THESIS

A REVIEW OF THE BROAD NOSED WEEVIL GENUS *THECESTERNUS* SAY FOUND IN THE CONTINENTAL UNITED STATES (COLEOPTERA: CURCULIONIDAE: ENTIMINAE)

Submitted by

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ABSTRACT

A REVIEW OF THE BROAD NOSED WEEVIL GENUS *THECESTERNUS* SAY FOUND IN THE CONTINENTAL UNITED STATES (COLEOPTERA: CURCULIONIDAE: ENTIMINAE)

The taxonomy and nomenclature of the North American weevil genus *Thecesternus* Say was reviewed. Five previously described species are recognized as valid: *affinis, foveolatus, hirsutus, humeralis*, and *maculosus*. One new species, *tumulosus*, from Texas is described as new. The following new synonymy is proposed: *longior* LeConte 1856 (= *affinis* LeConte 1856) and *albidus* Pierce 1909 (= *maculosus* Pierce 1909). A neotype is designated for *T. humeralis* (Say). A key to identify the species is provided, with various illustrations of key morphological features characterizing these species. Additionally, distribution maps, species descriptions, and species differentiation for each species is provided. A cladistic hypothesis of the included species is presented.

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INTRODUCTION

The Curculionidae are a vast and diverse group of beetles. There are currently over 60,000 different described species known worldwide within the family Curculionidae (Anderson 2002). In North America there are approximately 2,800 currently recognized species in the family Curculionidae including the Scolytinae and Platypodinae (Poole and Gentili 1996; O'Brien 1997). The subfamily Entiminae Schoenherr 1823, the broad-nosed weevils, is the most diverse subfamily of weevils in North America containing 23 tribes and 124 genera (Anderson 2002).

This revision treats the Nearctic representatives of the tribe Thecesternini in North America. There is one recognized genus in this tribe within North America, *Thecesternus* Say (1831). This genus is named for the deep excavation in the prosternum for the reception of the rostrum. It is distinguished from other Curculionidae by the presence of a triangular plate in front of the fore coxae, which is a unique modification of the prosternum (Fig. 1). Three other genera in this tribe occur elsewhere. *Arodenius* Heller (1921-32) is reported from South America and includes two species (Wibmer and O'Brien 1986). An additional genus, *Herpes* Bedel (1874) includes three species, which occur in the Palearctic region; throughout Bulgaria, Rumania, South Russia and Turkey (O'Brien 1997; Alonso-Zarazaga and Lyal 1999). The remaining genus, *Cyphomastax*

Marshall (1929) is monotypic and reported from New Caledonia (O'Brien 1997; Alonso-Zarazaga and Lyal 1999). *Thecesternus* historically included seven species occurring primarily in the grasslands of the Great Plains physiographic province of North America (O'Brien 1997). Pierce (1909) provided the most recent treatment of the genus, but determinations remained difficult because of the lack of useful specific characters.

The American naturalist, Thomas Say (1826) described the first species from North America, *humeralis,* and placed this species in the genus *Brachycerus*. In 1831 Say transferred this species into the monotypic genus *Thecesternus*. LeConte (1856) described a number of additional species in the genus *Lithodus*, family Byrsopidae, that are now included in *Thecesternus*, i.e. *Lithodus erosus*, *L. morbillosus*, *L. rectus*, *L. affinis*, *L. longior* and *L. rudis*. LeConte (1876) remarked that his previously described species *L. affinis, L. rectus, L. rudis, L. erosus, L. longior*, and *L. morbillosus* were synonyms of Say's *humeralis* (Blatchley and Leng 1916). LeConte (1876) considered *Thecesternus,* "a genus in which the originally distinct species are becoming effaced by mixture". With the examination of more material, he justified his decision by concluding that there were gradations of the elytral humeral process (LeConte 1876; Blatchley and Leng 1916). Finally, there was an unjustified emendation for the generic name *Thecesternus* in 1871 by Gemminger and Harold where it was a case of misspelling (Gemminger and Harold 1871; O'Brien and Wibmer 1982; Bright and Bouchard 2008). In 1909 Pierce revised the genus and added four more species including *T. albidus*, *T. foveolatus*, *T. hirsutus*, and *T. maculosus*.

The current recognition of species in *Thecesternus* is difficult because of population variability within the taxa. Pierce (1909) hesitantly described his new species realizing that he may have described forms that are synonymous with LeConte species since many specimens he examined were in poor condition (Pierce 1909). For instance, he considered *L. rectus* to be a synonym of *T. humeralis* while *L. rudis* and *L. erosus* were possibly variations of *T. affinis* (Pierce 1909). This conclusion was in disagreement with O'Brien and Wibmer's (1982) later observations. These authors believed that *L. rectus* (LeConte) and *L. morbillosus* (LeConte) were synonyms of *T. affinis* rather than *T. humeralis*. In addition, Pierce (1909) described *T. maculosus* from a single specimen within a genus that exhibits considerable variability. Blatchley and Leng (1916) also stated that the extent of variation within certain species is ever greater resulting in the recognition of fewer valid names. Overall, it may be that "Populations could be identified as species, subspecies, races or ecotypes" (O'Brien 1997).

The biology of *Thecesternus* is nearly unknown and poorly understood. Most adults are collected from under rocks and piles of dry cow or buffalo dung (Blatchley and Leng 1916) and are flightless (Anderson 2002). Host plant information is not well known although many specimens have been collected from various Asteraceae. Most references of the biology within this genus are typically extrapolated from research conducted on *T. hirsutus* in Mexico (McClay and Anderson 1985), which presented larval morphology and biology. It is thought that many adults may be nocturnal in nature, explaining their scarcity in collections (O'Brien 1997).

The objective of this study is to revise the genus *Thecesternus* of North America, north of Mexico. Diagnostic species descriptions, a key, figures, and a phylogenetic hypothesis are presented.

MATERIALS AND METHODS

Approximately 900 specimens of *Thecesternus* were studied. The following codens are used to refer to collections in the text:

BFLC	Brackenridge Field Laboratory, University of Texas, Austin, Texas, USA
BYUC	Monte L. Bean Life Sciences Museum, Brigham Young University, Provo, Utah, USA
CMNC	Canadian Museum of Nature, Ottawa, Ontario, Canada
CSUC	C.P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins, Colorado, USA
CWOB	Charles W. O'Brien Collection, Green Valley, Arizona, USA
EGRC	Edward G. Riley Collection, Texas A & M University, College Station, Texas, USA
EMEC	Essig Museum of Entomology, University of California, Berkeley, California, USA
MCZC	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA
MJPC	M.J. Paulsen Collection, University of Nebraska, Lincoln, Nebraska, USA

MTEC	Montana Entomology Collection, Montana State University, Bozeman, Montana, USA
SEMC	Snow Entomology Museum Collection, University of Kansas, Lawrence, Kansas, USA
TAMU	Texas A&M University Insect Collection, Texas A&M University, College Station, Texas, USA
TORC	Thomas O. Robbins Collection, Temple, Texas, USA
UNSM	University of Nebraska State Museum, University of Nebraska, Lincoln, Nebraska, USA
USNM	U. S. National Museum of Natural History, Smithsonian Institution, Washington D.C., USA

The species are arranged in alphabetical order within the text. In the lists of synonymy, the names are arranged chronologically, each with subsequently used generic combinations subordinate and accompanied by the reference, in which it was used first. Author and date are given for each original and subsequent name. Temporal occurrence data indicates specimens only when the number is greater than one specimen from each location and date in parentheses. The type locality is given only for the valid name of each species. All type specimens were examined.

Measurements and observations were taken with a Wild M5A Stereomicroscope. Measurements of length and width were taken with an ocular micrometer in the aforementioned stereomicroscope to the nearest quarter-millimeter. Before

measurements were taken, the cross-section hairs in the micrometer were aligned with the medial elytral suture and the suture between pronotum and elytra. Measurements were taken as follows: total length from anterior margin of head to abdominal apex from the dorsal view; standard length, from anterior margin of pronotum to abdominal apex in dorsal view; total length of pronotum from anterior margin to posterior scales on pronotum; total width of pronotum from apex of each lateral margin from dorsal view; total length of elytra from anterior margin of elytra, without regard of the medial tubercles or humeri, to abdominal apex from a dorsal view; total width of elytra from apices of lateral margins from a dorsal view; total length of humeral angles from the apex of the elytra, without regard to two tubercles medially, to apical region of the humeral angle (Bright and Bouchard 2008; Prena 2009). Ratios were constructed from the measurements listed above and utilized in morphometric analysis. Results of these measurements are mentioned in the species descriptions as general trends in size and shape.

Images were taken with Canon 40D 10.2 MP camera with studio flash head lighting. The camera equipment was on a modified infinite K2 Long distance microscope with a CF-3 or CF-4 lens. It utilized a visionary digital P-51 CamLift system with V2.1.8 software. The software used was Adobe Photoshop Lightroom 2 version 2.5, which allows processing of a raw image into a .jpeg file. The composition software used was Helicon Focus version 4.80.3 X64. This photomontage system is at the CPHST laboratory for the USDA-APHIS-PPQ located at 2301 Research Boulevard, Suite 108, Fort Collins, Colorado, 80526-1825. Maps of distribution were generated using ARCGis, Level III

eco-regions (Bailey 1995), and state boundaries. County boundaries are listed when there is only a single state provided.

Phylogenetic analysis utilized PAUP 4.0 software. The criterion used in PAUP was parsimony, with a heuristic bootstrap approach using 1000 replications. Nine unordered morphological characters were given equal weight. All characters were parsimony informative and accelerated transformation was used for character state optimization. Trees were obtained using stepwise addition with tree-bisection-reconnection (TBR). Only one unrooted tree was kept for each step during stepwise addition. To detect possible homoplasy MacClade 4: Analysis of Phylogeny and Character Evolution (Version 4.08) was utilized. The same character matrix used for Paup was used with MacClade. Unordered characters were used in a heuristic search for the most parsimonious tree and statistics. Tracing of the characters upon the most parsimonious tree was used to evaluate homoplasy.

Pits are defined as having a single seta arise from the center of the depression (Fig. 2). Punctures are minute depressions (Fig. 3). Metathoracic sidepieces follow the terminology and description provided by Pierce (1908). Erect clusters of setae, as described herein, do not resemble fascicles as seen on some Curculionidae specimens, such as species of *Cryptorhynchus* Illiger or *Episcirrus* Kuschel. Fascicles are dense clusters of erect scales or setae and are usually obvious. The clusters of erect scales described within this text are not pronounced and maintain a similar appearance to semi-erect scales around the clusters (Fig. 4).

RESULTS

PAUP

Character Matrix:

1. Prothorax shape: (0) wider than long, (1) length is subequal to width.
2. Pattern: (0) cryptic blotch pattern, (1) cryptic without pattern, (2) black V at base of prothorax.
3. Black erect scales: (0) present, (1) absent.
4. Setae: (0) semierect and of varying length but not long, (1) nearly erect and long.
5. Humeral angles: (0) nearly absent, (1) moderate, (2) pronounced, at least 1/5 length of prothorax.
6. Elytral tubercles shape: (0) quadrate, (1) oblong.
7. Elytral tubercles placement throughout dorsum: (0) irregular, (1) regular.
8. Depressions on Prothorax: (0) lacking or nearly so, (1) regularly surround prothoracic disk, (2) enhanced by pronounced ridges.
9. Metaepisternum: (0) anterior prolonged, (1) causing an emargination of the elytra.

Table 1. Character Matrix Code

Characters	1	2	3	4	5	6	7	8	9
T. humeralis	0	1	0	0	2	1	0	1	0
T. affinis	0	1	0	0	1	1	0	1	0
T. foveolatus	1	0	1	0	0	0	1	0	1
T. hirsutus	1	0	1	1	0	0	1	0	1
T. maculosus	0	2	0	0	1	1	0	1	1
T. tumulosus	0	1	0	1	0	0	1	2	1

Parenthetical Tree Description:

(*T. affinis, T. humeralis* (*T. maculosus* ((*T. foveolatus, T. hirsutus*) *T. tumulosus*)))

The unrooted tree shown (Fig. 7) is the result from the morphological analysis using parsimony on a 50% majority rule consensus tree. The two most similar species, *T. hirsutus* and *T. foveolatus* are closely related with a bootstrap support value of 85 on this tree. *Thecesternus tumulosus* was consistently sister to the *T. hirsutus – T. foveolatus* clade on all trees with the highest bootstrap support of 98. This clade, (*T. tumulosus* (*T. hirsutus*, *T. foveolatus*) was sister to *T. maculosus* with a bootstrap support of 66. The tree's total length was 13, the consistency index [CI] equaled 0.9231, the homoplasy index [HI] equaled 0.0769, the retention index [RI] equals 0.9091, and the rescaled consistency index [RC] equals 0.8392. Combining the phylogeny given with the information on distributional ranges it demonstrates that these species are closely related, yet have concise resolution.

MacClade Analysis was utilized to address concerns of homoplasy. There was only one most parsimonious rooted tree, which had a tree length of 13, a CI of 0.92, a RI of 0.91, a RC of 0.84 with the summary minimum number of changes 12 and the maximum 23. All

characters were traced on the most parsimonious tree using fast acceleration (ACCTRAN), giving 9 detailed trees of potential evolution (Figs. 8 - 16). Only the setal character, character number 4, seems to demonstrate possible homoplasy or convergence (Fig. 11). It is possible that long setal hairs are adaptations to desert climes where longer setae help protect many insect species from arid environments. *Thecesternus foveolatus* shares a similar character state, semi-erect setae of varying length without being long, to *T. humeralis*, *T. affinis*, and *T. maculosus*. However, it is possible that the setal character is an ancestral trait that is highly conserved with the exception of *T. hirsutus* and *T. tumulosus* species. If setal length is an adaptation rather than a conserved trait, then the setal character demonstrates homoplasy and is not effective to define species. Overall, the characters used for each species have high statistical potential in delimiting each species as a unique group. This provides greater confidence when identifying these species.

DISCUSSION

The species of *Thecesternus* are variable, resulting in difficulty of past identifications. This problem is frequently made more difficult by denuded specimens. Determining color and patterns is often misleading when inspecting denuded specimens because the individuals may initially appear to possess a pattern, but because of missing setae or scales there is no observable pattern, especially when the prothoracic tubercles are rubbed and missing pubescence. Frequently the rubbed tubercles can mimic the arrowhead pattern of *T. maculosus,* regardless of the actual species. Therefore care must be given when ascertaining general patterning on all specimens. In addition, both *T. affinis* and *T. humeralis* often possessed a "crust" of material that frequently obscures characters. The origin of this crust is unknown but is speculated (O'Brien, personal communication) to be either secreted by the weevils or is debris from the environment adhering to the integument, potentially used as crypsis. It is very difficult to remove the crust using ultrasonic cleaning techniques, particularly with older specimens. *Thecesternus affinis* and *T. humeralis* possesses variable depressions in shape and depth on the pronotum. *Thecesternus humeralis* also appears to have variability in pitting and tuberculation. On *T. maculosus* the apex of the sulcus possesses a depression in some populations, which is unlike other populations and species. More variation occurs when attempting to classify

overall coloration and patterns. *Thecesternus hirsutus* may have lateral maculae across the head, but this is not the equivalent of the lateral dots present in some species. *Thecesternus hirsutus* populations appear in sandy colors and symmetrical spotting while others, more rarely, appear to have black and white spots. These observations are only qualitative since quantitative and detailed population examination was not a feasible process for this study. Detailed study of individual populations would be beneficial to determine if there are isolated populations or if there are clines between these differences. Lastly, there are few differences in gender within this group. One small difference observed is sterna I and II more depressed in males and more convex in females. Frequently, but not always, males are the smaller of the two sexes. However, these characters are not sufficiently objective to separate gender on a regular basis.

Biology

The biology of most species of weevils is either poorly documented or generally unknown. Only 256 species of the 2,500 in North America have been studied in detail, only encompassing 123 of 390 genera (Bright and Bouchard, 2008). Even many economic pests are insufficiently understood (Bright and Bouchard 2008).

Relatively little is known on the general biology of *Thecesternus* species. Only one paper published (McClay and Anderson 1985) examines biology of a single species, *T. hirsutus*, within this genus. McClay and Anderson (1985) provide the only known

feeding preference information for *Thecesternus* and they include larval characters for all instars.

Although *T. hirsutus* is the only species for which there is host plant information, there is information from various labels to help elucidate potential host plants for other species of *Thecesternus*. It is suspected by Dr. Charles O' Brien that *Thecesternus* uses composites as host species (personal communication). There is also evidence that thistles are adequate hosts since several specimens have been found on or near these composites. In particular, *Cirsium canescens* (Nutt.), is a suspected host plant for another *Thecesternus* species. Several specimens were found on this plant in Nebraska, where the weevil was suspected to be feeding on or hiding under rosettes. Separately, further specimens have been found on various other unidentified thistle species in the Great Plains complex. Additionally, some specimens have been collected on *Helianthus* spp. *Parthenium* spp. is the only known host (Figs. 17, 18). These plants are all contained within the Asteraceae, which is a large and complex group of plants that produce terpenoids. It may be that *Thecesternus* has evolved to tolerate or use these secondary metabolites. However, utilization of secondary metabolites is merely speculation based on the evidence provided in McClay and Anderson (1985), notes on collected specimens, and other speculation. Furthermore, in arid regions of the Great Plains complex, it is also common to find *Thecesternus* species amongst cacti and yucca species.

With very little known information pertaining to *Thecesternus* biology, there truly is a vast amount of work yet to be completed elucidating life history, biology and host plant

information. Once this information becomes available it will further deliminate species to appropriate status and relationships. Without this information and laboratory experiments demonstrating reproductive isolation, speciation within this group is primarily still an educated guess based on morphological traits. The phylogenetic and evolutionary placement of *Thecesternus* requires resolution in future treatises of the Curculionidae.

Thecesternus Say

Thecesternus Say, 1831:8. Type species: *Brachycerus humeralis* Say (monotypy).

Lithodus Germar, 1834:420. Synonym. Type species: *Brachycerus humeralis* Say (monotypy).

Thecosternus Gemminger, 1871:2342 (unjustified emendation). Type species: *Brachycerus humeralis* Say.

General. Standard length, 5.2 mm – 11 mm; robust, roughly sculptured, medium-sized, apterous weevils; males usually smaller than females; variable in shape, size, and coloration but typically setae and scales matching in patterning; always cryptic.

Head. Frons deeply sulcate (Fig. 1), strongly convex above eye and onto vertex; rostrum very short and wide, narrowing toward apex (Fig. 1), shorter than head, not sexually dimorphic, transversely impressed above epistoma, with a short, deep, median, longitudinal groove, scrobe deeply impressed, curved below eyes; mandibles not bearing deciduous cusp or mandibular scar. Antennae geniculate, short, weakly elbowed, attached laterally with scape mostly fitting into scrobe (Fig. 1), often difficult to see when head in repose because antennae hidden in prosternal excavation with sparse, fine setae along scape and funicle, with denser, longer, fine setae on club; funicle with 6 antennomeres; club conical with 3 large and one smaller antennomeres.

Pronotum. Variable in shape and roughly sculptured; lateral-anterior margin with a distinct postocular lobe.

Elytra. Sculpturing and pubescence diverse; fused, basal, lateral margin frequently with pronounced humeri (Figs. 19, 21, 23, 25, 26, 28, 30), humeral angles covering basal angles of prothorax; disk convex, elongate-oblong, roughly sculptured and punctured with base of sutural interstriae weakly to strongly elevated at scutellar notch; 10 striae and corresponding interstriae, sculpture and pubescence various, along lateral and posterior margins more abbreviated and appear to "merge", often possessing clusters of small erect scales (Fig. 4); apex completely covering pygidium.

Venter. Coarsely and sparsely punctured with large pits and setae, usually covered in white or beige pubescence; prosternum consisting of a large, triangular plate in front of procoxae; abdominal sterna I and II of males often impressed, convex in females.

Legs. Densely covered with scales and moderately covered with setae; inner apex of tibia with two small, hook-like spines and clump of large, waxy setae producing appearance of multispinate condition; corbel area ovate at distal end of tibia, surrounded with fringe of stiff bristles; specimens in good condition bear two rows of thick, waxy setae on fore tibia near apices; tarsal segments cylindrical, bearing stout, waxy setae laterally; claws simple, free.

Genitalia. The internal structures have two apodemes acting to exert the aedeagus and a tegmen around the aedeagus.

KEY TO THE SPECIES OF *THECESTERNUS* IN NORTH AMERICA, NORTH OF MEXICO

1. Small, erect, black or brown scales present (Figs. 4, 19, 25, 28, 30)…….……..3

- Small, erect, black or brown scales absent (Figs. 21, 23)..….....……...….2

2. Prothorax densely, deeply, irregularly punctured, interpuncture spaces acutely elevated, often punctures appear to coalesce (Fig. 21); .....***foveolatus*** **(Pierce)**

- Prothorax with deep depressions and irregular elevations, inter-puncture spaces irregularly elevated (Fig. 23); punctures indistinct, surrounding disk without deep and irregular puncturing (Fig. 23) .....***hirsutus*** **(Pierce)**

3. Elytral humeri strongly pronounced, projecting forward or forward and outward; humeral projections cover basal fifth of prothorax (Figs. 25, 26)..…***humeralis*** **(Say)**

- Elytral humeri pronounced, or not, never projecting forward and outward; humeral angles cover prothoracic posterio-lateral angles but never covering basal fifth of prothorax…….....……4

4. Metaepisternum anteriorly prolonged, no emargination of the elytra (Fig. 5) .....……***affinis*** **(LeConte)**

- Metaepisternum anteriorly prolonged and cause an emargination of the elytra Fig. 6) 5

5. Pronotum with color pattern resembling an arrowhead (Fig. 28); elytra with thick clusters of black, erect scales (Fig. 4) and moderately long, semi-erect setae; throughout southern Great Plains (Maps 9, 10) ……...……..…***maculosus*** **(Pierce)**

- Pronotum with variegated, cryptic color pattern, never an arrowhead pattern (Fig. 30); elytra with small clusters of black, erect, scales and long, erect, setae; Texas along coastal plains (Figs. 30, 31; Maps 11, 12); .....……***tumulosus,*** **new species**

Thecesternus affinis (LeConte)

(Figures 19, 20, 32; Maps 1, 2)

Lithodus affinis LeConte, 1856:18. Type locality: Probably Nebraska "Valley of the Platte R." Type depository: MCZC. Type examined.

Lithodus rudis LeConte 1856:18. Synonymy by LeConte 1876:12. Type examined.

Lithodus erosus LeConte 1856:18. Synonymy by LeConte 1876:12. Type examined.

Lithodus morbillosus LeConte 1856:19. Synonymy by LeConte 1876:12. Type examined.

Lithodus longior LeConte 1856:19. Synonymy by LeConte 1876:12. Reinstated by Pierce 1909:334. Type examined. NEW SYNONYMY.

Description:

Standard Length. 7.0 mm to 14.5 mm

Head. Frons convex; brown and white setae recumbent, radiate from apex of frons; white, tan and brown scales present; frons clothed with white scales and interspersed brown and white setae; white medial stripe on vertex with two lateral dots, these may not always appear present; surface with fine punctures throughout and small uniform pits.

Prothorax. In dorsal view, overall shape roundly triangular, with pronounced lateral lobes, similar appearance to pit viper's head, wider than long, although often may appear nearly as wide as long; pronotal disc with four, shallow, variable depressions near pronotal disk; two depressions appear apically to disk, two appear in the posterior-lateral region of prothoracic disk; pitting on prothorax irregular along prothoracic disk and along

medial line, beyond those margins pitting becomes smaller and regular; white setae typically recumbent, frequently lay facing center of prothoracic disk (Fig. 19).

Elytra. Dorsally, outline ovoid except for apical edge abruptly buttressing prothorax in straight line (Fig. 19); small medial tubercles only marginally larger than other tubercles along apical edge of elytra; humeri vary, never reach one-fifth of overall prothoracic length, only marginally cover the posterior edge of the prothorax, never protrude outwards, may appear absent (Figs. 19, 20); puncturing small, moderately shallow, evenly distributed; tuberculation small, round, evenly spread over dorsum; strial rows evenly distributed across dorsum, near lateral margins interstitial spaces merge with striae (Fig. 19); white, brown and tan semierect setae and scales present in varying composition and patterning; scales recumbent, semi-erect clusters of small, erect black or brown scales present; dorsum may be covered in crust which obscures most pubescence and integument, setae and erect scales may appear through top of crust layer.

Genitalia. The endophallic region of the aedeagus for *T. affinis* resembles figure 32 a.

Diagnosis. *Thecesternus affinis* and *T. humeralis* are similar in general appearance and are sympatric with overlapping geographic distributions (Maps 1, 2, 7, 8). The presence of small humeri (Fig. 19) is the key character for this species to differentiate it from *T. humeralis* (Figs. 25, 26). Additionally, it can be difficult to differentiate *T. affinis* from denuded specimens of *T. maculosus*. The sinuation of the metaepisternum on *T. affinis* (Fig. 5) versus the emargination of the elytra by the metaepisternum on *T. maculosus* (Fig. 6) is the most consistent character to differentiate between denuded specimens of these species. The presence of a crust on *T. affinis* and their respective distributions (limited sympatry) may assist in delineating this species from denuded specimens of *T.*

maculosus. The general outline, or sinuation of the insect in a dorsal view from the apices of the head to the posterior region of the elytra, is also useful when comparing these two species. The outline of *T. affinis* appears more convex (Fig. 19) than the outline of *T. maculosus* (Fig. 28).

Distribution. *Thecesternus affinis* appears to be one of the more commonly collected species of this genus. The distribution of *T. affinis* ranges from southern British Columbia and Alberta Canada, south to Arizona, through the Great Plains complex to Louisiana, and northeast to Kentucky, and Tennessee (Map 1). Specimens have been collected in Abbeville County, South Carolina but were not examined (Ciegler 2010). Specimens examined from ecoregions (Map 2): Arkansas Valley section, Blackland Prairies section, Boston Mountains section, Central Dissected Till Plains section, Central Gulf Prairies and Marshes section, Central High Plains section, Central High Tablelands section, Central Loess Plains section, Oak-Hickory section of the Central Till Plains, Cross timbers and Prairie section, Eastern Gulf Prairies and Marshes section, Flint Hills section, Shawnee Hills of the Interior Low Plateau section, Western of Mid-Coastal Plains section, Nebraska Sand Hills section, North-Central Great Plains section, Northwestern Great Plains section, Oak Woods and Prairies section, Osage Plains section, Ouachita Mountains section, Ozark Highlands section, South-Central Great Plains section, and Southern High Plains section (Bailey 1995).

Hosts. Specimens were collected in Arkansas on peach, in Iowa on *Andropogon* L., in Kansas from *Petalostemon* Michx. and *Opuntia* Mill., in Kentucky from tobacco beds, in Missouri from wheat stubble and tomatoes, and on both *Solanum lycopersicum* L. and *Cirsium* Miller in South Carolina. Feeding preferences are unknown.

Comments. The holotype of *T. longior* falls in the range of variation for *T. affinis* and is considered a synonym.

Material Examined.

Type specimens: *T. affinis*, Lec., Type 280, (2); *T. erosus,* Lec., Type 282, (2); *T. longior,* Lec., Type 283; *L. morbillosus,* Lec., Type 284, (2); *T. rectus,* Lec., Type 285; and *T. rudis,* Lec., Type 281, (4).

Additional Specimens: CANADA: Alberta: Edmonton, June 1930, E.S. Carr, L.W. Saylor Collection, USNM; Medicine Hat, May 2, 1925, E.S. Carr, A. Nicolay Collection, USNM; Medicine Hat, November 10, 1926, O. Bryant, BYUC; Medicine Hat, August 21, 1927, Shoemaker 1956 Collection, USNM; Medicine Hat, June 5, 1932, E.S. Carr, UNSM; Medicine Hat, April, 21, 1928, Shoemaker 1956 Collection, (2), USNM; Medicine Hat, April 1, 1934, O. Bryant, Owen Bryant Collection 1956, BYUC; Medicine Hat, April 10, 1934, J. Carr, Owen Bryant Collection 1956, USNM; Medicine Hat, April 15, 1934, J. Carr, Owen Bryant Collection 1956, USNM; Medicine Hat, April 16, 1934, J. Carr, Owen Bryant Collection 1956, USNM; Medicine Hat, April 20, 1934, J. Carr, Owen Bryant Collection 1956, USNM; Medicine Hat, June 24, 1934, J. Carr, Owen Bryant Collection 1956, USNM; Medicine Hat, E.S. Carr, (2), BYUC; Muriel Lake, tp. 2, rge. 5, W. 4, May 18, 1975, Lot 4, B.F. and J.L. Carr, CMNC. **British Columbia**: Mount Assiniboine Provincial Park, Howard and Schwarz Collection, USNM. **UNITED STATES OF AMERICA: Arkansas**: State record only, (2), BYUC; Benton Co., Siloam Springs, peach, April, 4, 1908, E.L. Jenne, (2), USNM; Marion Co., June 27, F.M. McE, UNSM. **Arizona**: Pima Co., Tucson June 4, 1949, L. Chandler, J.M. Kinsgsolver 1963 Collection, USNM. **Colorado**: State record only, CSUC; Baca Co.,

junction of road 36 and road M, 15 miles S. Villas, July 5, 1995, E.G. Riley, EGRC; Baca Co., Comanche National Grasslands, August 15, 1999, shortgrass, L. Nadeau, CSUC; Baca Co., Comanche National Grasslands, September 18, 1999, shortgrass, L. Nadeau, CSUC; Baca Co., Comanche National Grasslands, October 15, 1999, Carrizo Creak, L. Nadeau and M.A. Burtner, CSUC; Douglas Co., Castlewood Canyons, S. of Franktown, May 7, 1999, I.S. Winkler, BYUC; Larimer Co., Fort Collins, April 20, 1900, CSUC; Larimer Co., Fort Collins, April 9, 1905, MTEC; Larimer Co., Fort Collins, April 22, 1905, MTEC; Larimer Co., Fort Collins, May 11, 1905, MTEC; Larimer Co., Fort Collins, October 18, 1970, Bal Stacl, CSUC; Larimer Co., June 26, 1976, CSUC; Larimer Co., Fort Collins, September 22, 1988, G.A. Surrez, CSUC; Larimer Co., North Grant Pine Ridge Open Space, September 12, 2000, CSUC; Mesa Co., Grand Junction, UNSM; Weld Co., 8 miles S.W. Wiggins, May 23, 1986, sand dunes, P.A. Opler, (6), EMEC; Weld Co., Pawnee National Grassland, LTER Prairie Dog Sites, July 25-29, 1997, J. Junell, (2); Weld Co., Pawnee National Grasslands, LTER Prairie Dog Sites, August 16, 1997, J. Junell, CSUC; Weld Co., Pawnee National Grassland, LTER Prairie Dog Sites, September 12, 1997, J. Junell, (2), CSUC. **Iowa**: Audubon Co., Audubon, May 1907, Wickham Collection 1933, USNM; Keokuk Co., Iowa State University, Agriculture Experiment Station, pr. no. 420, sample 790, December 1935, B. Blue stem (*Andropogon* L.), BYUC; Lucas Co., Iowa State University, Agriculture Experiment Station, pr. no. 420, 1930's, BYUC; Lyons Co., June 1897, USNM; Marion Co., Iowa State University, Agriculture Experiment Station, pr. no. 420, sample 1028, February 1936, B. Blue stem (*Andropogon* L.), BYUC; Polk Co., W. Saylorville Lake, May 27 - June 2, 1985, R. Schieferstein, Satterthwaite and Painter Collection, USNM; Ringgold Co., Iowa State

University, Agriculture Experiment Station, pr. no. 420, sample 980, January 1936, B. Blue stem (*Andropogon* L.), BYUC; Warren Co., Iowa State University, Agriculture Experiment Station, pr. no. 420, sample 428, December 1935, B. Blue stem (*Andropogon* L.), BYUC; Warren Co., Iowa State University, Agriculture Experiment Station, pr. no. 420, sample 1379, February 1936, L. Blue stem (*Andropogon* L.), BYUC. **Illinois:** Champaign Co., 1 mile S. Seymour, June 22, 1958, J.M. Kingsolver, edge of a cornfield, J.M. Kingsolver Collection, USNM; Will Co., Wilmington, May 15, 1930, Frison and Ross, USNM. **Kansas:** State record only, (2), CSUC; Kansas, F.C. Bowditch Collection, CWOB; Kansas, J.B. Smith Collection, USNM; W. Kansas, Hubbard & Schwarz Collection, USNM; Barber Co., May 17, 1991, G.A. Salsbury, ground litter, SEMC; Barber Co., Hardtner, October 19, 2001, B. & J. Smith, CWOB; Barber Co., 2 miles W. Hardtner, April 1, 2006, B. & J. Smith, under debris in pasture, CMNC; Barber Co., 3 miles W. Hardtner, March 23, 2008, B. & J. Smith, under debris in pasture, CWOB; Clark Co., May 10, 1988, G.A. Salsbury, SEMC; Douglas Co., Baldwin, May 9, 1953, Lugthart-Spangler, P.J. Spangler Collection 1958, USNM; Finney Co., June 23, 1987, G.A. Salsbury, *Petalostemon* spp. Michx., SEMC; Gove Co., Monument Rocks, September 14, 1988, G.A. Salsbury, (6), SEMC; Gove Co., Monument Rocks, May 8, 1992, G.A. Salsbury, (2), SEMC; Kiowa Co., June 5, 1980, G.A. Salsbury, rangeland, CWOB; Kiowa Co., 10 miles N.W. Mullinville, April 10, 1998, G.A. Salsbury, prairie dog burrow, SEMC; Meade Co., July 30, 1986, G.A. Salsbury, under cow dung, (5), SEMC; Meade Co., July 30, 1986, G.A. Salsbury, under cow dung, (3), CWOB; Meade Co., July 24, 1987, G.A. Salsbury, under *Opuntia* Mill., (2), SEMC; Meade Co., August 6, 1987, G.A. Salsbury, under *Opuntia* Mill., (3), SEMC; Sedgwick Co., Mt. Hope, May

2, Wickham Collection 1933, USNM; Shawnee Co., Topeka, Popenoe, USNM. **Kentucky:** State record only, Hubbard and Schwarz Collection, (2), USNM; Kentucky, July 19, 1906, (3), USNM; Clinton Co., Albany, April 24, 1954, tobacco bed, (2), USNM; Fulton Co., Fulton, W.J. Phillips, USNM. **Louisiana**: Cameron Co., Cameron Farm, USNM. **Missouri:** State record only, (3), USNM; Missouri, Chittenden, (2), USNM; Bollinger Co., Lutesville, April 29, 1918, in copula, (2), USNM; Bollinger Co., April 29, 1918, wheat stubs, bottomland, Satterthwaite Collection, USNM; Boone Co., Columbia, University of Missouri., S. Farms. Agriculture Experimental Station, June 21, 1966, F.D., USNM; Laclede Co., Atoka, (2), USNM; Laclede Co., Atoka, "said to damage tomatoes," USNM; Montgomery Co., A.D. Bishops Fenceline, April 4, 1922, A.C. Burrill, (2), USNM; Randolph Co., 1 mile E. Moberly, May 11, 1972 E.G. Riley, EGRC; Randolph Co., Rudolf Bennitt Wildlife Area, March 19, 1978, (3), TAMU; Randolph Co., Rudolf Bennitt Wildlife Area, April 2, 1976, E.G. Riley, (5), EGRC; Randolph Co., Rudolf Bennitt Wildlife Area, May 21, 1976, E.G. Riley, EGRC; Randolph Co., Rudolf Bennitt Wildlife Area, April 22, 1980, E.G. Riley, (4), CWOB; Randolph Co., Rudolf Bennitt Wildlife Area, March 28, 1981, E.G. Riley, CMNC; Randolph Co., Rudolf Bennitt Wildlife Area, March 28, 1981, E.G. Riley, CWOB; Sainte Genevieve Co., Hawn State Park, May 30, 1988, T.C. MacRae, SEMC; Scott Co., Caney Creek, August 21, 1918, Satterthwaite, USNM; St. Louis Co., St. Louis, M. Schuster, (2), USNM; St. Louis Co., St. Louis, 10/15, H. Soltau Collection, USNM; St. Louis Co., Valley Park, May 8, 1922, Satterthwaite, in copula, (2), USNM; Taney Co., Hercules Glades, May 23, 1987, T.C. MacRae, SEMC; Texas Co., Licking, U.S. Forest Service Nursery, September 10, 1936, D.H. Latham, USNM; Washington Co., Cadet, 1977,

USNM; Wright Co., Mt. Grove, July 1, 1903, F.H., E.P. Taylor Collection, CSUC; Wright Co., Mt. Grove, April 10, 1914, M.P. Somes, USNM; Wright Co., Mt. Grove, November 19, 1919, H.R. Painter, wheat stubble, USNM. **Montana:** State record only, USNM; Fergus Co., 16.5 miles N.E. Winifred, May 13, 1983, Endrin-Lorsban Study, O. Bain, pitfall trap, (2), MTEC; Gallatin Co., Montana State University Agriculture Experiment Station, Bozeman, April 22, 1912, MTEC; Gallatin Co., Bozeman, May 19, 1926, USNM; Gallatin Co., April 19, 1953, student collector, Montana State University; MTEC; Teton Co., 4 miles N. Chouteau, June 20, 1955, R.C. Froeschner, MTEC; North Dakota: Richland Co., June 22, 1962, BYUC; Richland Co., Blackmer, June 8, 1915, (3), USNM. **Nebraska:** Brown Co., Niobrara Valley Preserve (Island), 42˚45'N, 100˚00'W, May 2, 1996, S. Louda, CWOB; Greeley Co., 10 miles N. of Greeley, W. of highway junction 281 & 91, 41.697˚N, 98.542˚W, April 24, 2005, M.J. Paulsen, false burrow pitfall trap, MJPC; Lancaster Co., Lincoln, March, UNSM; Lancaster Co., Lincoln, June, UNSM; Lancaster Co., Lincoln, August 16, 1914, E.M. Partridge, UNSM; Lancaster Co., Lincoln, May 9, 1908, altitude 1150 feet, UNSM; Lincoln Co., Brady Island, UNSM; McPherson Co., Sandhills Agriculture Laboratory, July 8-14, 1973, UNSM; Sioux Co., Monroe Canyon, June 28, R.H. Wolcott, UNSM. **Oklahoma:** Beaver Co., 4 miles W. of Slapout, July 21, 1971, D.C. Arnold, sweeping pasture, TAMU; Choctaw Co., Ft. Towson, October 31, 1031, E. Hixson, BYUC; Cimarron Co., Boise City, July 15, 1933, E.E. Ivy, BYUC; Comanche Co., Ft. Sill, E. range, tall grass prairie, April 24-28, 2002, B. Kondratieff, J. Schmidt, & P. Pineada, CSUC; Comanche Co., Ft. Sill, W. range, short grass prairie, June 11, 2002, B. Kondratieff, J. Schmidt, & D. Leatherman, CSUC; Ellis Co., Lake Vincent, October 14, 1967, D.C. Arnold, overflow area, TAMU; Latimer Co.,

July 1983, Karl Stephan, TAMU; Latimer Co., August 1983, Karl Stephan, TAMU; Latimer Co., October 1984, K. Stephan, TAMU; Latimer Co., March 1987, Karl Stephan, TAMU; Latimer Co., 5 miles W. Red Oak, June 16, 1977, K. Stephan, TAMU; Latimer Co., 5 miles W. Red Oak, May 1980, Karl H. Stephan, TAMU; Latimer Co., 5 miles W. Red Oak, August 1986, K. Stephan, TAMU; Payne Co., December 14, 1924, W.J. Brown, BYUC; Payne Co., March 15, 1925, W.J. Brown, BYUC; Payne Co., Stillwater, April 7, 1931, C.C.D., BYUC; Payne Co., Stillwater, April 22, 1931, C.C. Deonier, BYUC; Payne Co., Stillwater, April 8, 1932, Oren Eastep, BYUC; Payne Co., Stillwater, February 26, 1936, Myron Maxwell, BYUC; Payne Co., Stillwater, June 1, 1936, P.T. Valvuena, BYUC; Payne Co., Stillwater, August 12, 1963, fungus, E. Cochrane, TAMU; Payne Co., Perkins, May 6, 1964, riverbank, D.C. Arnold, (2), TAMU; Woodward Co., Fort Supply, 20.10, BYUC; South Dakota: July 17, 1935, K. Cooper Collection, USNM. **Tennessee:** Davidson Co., Nashville, August 4-15, 1897 Wickham, USNM. **Texas:** Texas, May 13, 1931, Krass, TAMU; Texas, C.V. Riley Collection, (2), USNM; Bailey Co., Muleshoe, February 13, 1921, Wickham Collection 1933, USNM; Bexar Co., Fort Sam Houston, October 21, 1984, R. Turnbow, CWOB; Brown Co., Bangs, February 16, 1939, soil and soil surface, USNM; Brown Co., Bangs, May 28, 1941, O.H. Graham, orchard cover, (2), USNM; Carson Co., Pantex plant site, 10 miles W. edge of Playa 2, October 4-18, 2001, D. Sisson and S. Cox, pitfall trap, EMEC; Comal Co., New Braunfels, from Collection of Chas Schaeffer, (2), BYUC; Dallas Co., Dallas, May 17, 1950, Ed Gillbert & Eham Springs, EMEC; Fannin Co., Bonham, June 6, 1922, E. & G. Wheeler, USNM; Howard Co., Big Spring, Wickham, USNM; Howard Co., Big Spring, BYUC; Jeff Davis Co., Valentine, E.G. Linsley, Collection of E.C. Zimmerman 1941,

USNM; McLennan Co., Bufo Delta (a triangle sign), (2), USNM; McLennan Co., Waco, June 8, 1948, collected on S.C.S. weeds, Opp. W5-11, P.A. Glick, USNM; Potter Co., Amarillo, August, Wickham Collection 1933, (2), USNM; Smith Co., Flint, June 2, 1951, TAMU; Sutton Co., Sonara, February 31, 1932, S.E. Jones, prickly pear cactus (*Opuntia* Mill.), TAMU; Travis Co., 8 miles N.W. Austin, November 2, 1903, C.O. Martin, TAMU. **Wyoming:** Platte Co., Laramie River, Wheatland, September 9, 1974, R. Kumar, USNM; Platte Co., Camp Guernsey, Gray Rock Ranch, 42.1912˚N., 104.8169˚W., June 25, 2008, B. Kondratieff &B. Heinhold, CSUC.

Thecesternus foveolatus Pierce

(Figures 21, 22, 32; Maps 3, 4)

Thecesternus foveolatus Pierce, 1909:335. Type Locality: Marfa, Texas. Type depository: USNM. Type examined.

Description:

Standard Length. 10.5 mm to 15.25 mm

Head. Setae recumbent, densely white, sparsely tan and dark brown, point towards apex of frons and radiate outwards across head; frons clothed in dense white scales with sparse dark brown scales on venter; no other pattern present; regular, fine punctures cover integument; irregular, quadrate, small to medium pits present.

Prothorax. Nearly equal in length and width, less than 1 mm in difference, may sometimes appear longer than wide; lateral lobes do not protrude greatly, outline roughly round/oblong (Fig. 21); irregular, deep pits, frequently connected in a maze-like or coalescing appearance (Fig. 21); depressions around prothoracic disc not pronounced; tubercles small, arranged around pits; soil particulate matter often captured in pits and among setae; diverse variety of color and patterns, range from dominantly dark brown or black to sandy shades of white or tan; most common pattern of stripes or maculae of darker setae on dense, white or tan scales and setae (Figs. 21, 22).

Elytra. Robust; convex overall shape for first ¾ of the elytra from broadly rounded apex, outline abruptly narrows at posterior end of elytra, no distinct markings to denote alteration of outline (Fig. 21); topography coarse and irregular in general appearance with

little pattern; assisted by conglomeration of soil particulate matter; humeri not pronounced, typically quite small, does not wrap around posterior margin of prothorax, ends abruptly, giving a "squared-off" appearance in apical region of elytra (Fig. 21); metaepisternum anteriorly prolonged with a deep emargination of elytra, sometimes extends over elytral margins (Fig. 22); tubercles more pronounced on elytra than prothorax, irregular, variable size, arranged around pitting rather than interstitial rows; irregular pitting, frequently connected, depth may vary but always irregular in shape; alternating odd interspaces wider than the even series, with double rows of small tubercles, most noticeable in first, third and fifth interspaces; striae wider than intervals (Fig. 21); setae densely white with sparse, varying shades of brown or tan; diverse patterning, commonly appear plain, with coarse patches of opposing color; cryptic appearance.

Genitalia. The endophallic region of the aedeagus for *T. foveolatus* resembles figure 32 b.

Diagnosis. *Thecesternus foveolatus* and *T. hirsutus* are easy to confuse as they both lack small, erect black and/or brown setae on the dorsum (Fig. 4). Size, distribution (Maps 3, 4) and the general characteristic of deep, large, irregular pits that frequently coalesce allow separation of this species from others (Fig. 21). *Thecesternus foveolatus* also possesses deep, irregular pitting on the prothorax (Figs. 21, 22), whereas *T. hirsutus* has regular pitting on the elytra (Figs. 23, 24). The pitting present on *T. foveolatus* is unique and this is the most distinctive character.

Distribution. In its range *T. foveolatus* is relatively common but not frequently collected. In the U.S.A. *T. foveolatus* has only been collected in Texas (Map 3), but

specimens have also been collected in Mexico. Specimens were examined from these ecoregions (Map 4): Basin and Range section, Edwards Plateau section, Western section of Mid-Coastal Plains, Oak Woods and Prairies section, Rio Grande Plain section, Rolling Plains section, Stockton Plateau section and Texas High Plains section (Bailey 1995). Specimens collected from locations in Mexico as well.

Host. Collected from *Selaginella* P. Beauv. and cactus roots in Nuevo Leon, Mexico; and from *Yucca treculiana* Carr in Starr County, Texas, USA. Feeding preferences are unknown.

Material Examined.

Type specimen: *T. foveolatus* Type Pierce, Cotype No. 12590, E.A. Schwarz Collection, USNM; Presidio Co., Marfa, June 6, 1908, R.A.C., J.D.M., USNM, cotype 12590, (2); Potter Co., Amarillo, August, Wickham Collection 1933, USNM, paratypes.

Additional Specimens: MEXICO: Nuevo Leon, Villaldama, February 2, 1953, from *Selaginella* P. Beauv., USNM; Nuevo Leon, Monterrey, April 1, 1970, G.E. Reuthinger , cactus roots, USNM; Nuevo Leon, en fridol, Apodaca, September 22, 1987, D. Enkerlin, USNM. **UNITED STATES OF AMERICA: Texas:** Bailey Co., Muleshoe, March 29, 1971, G.B. Marshall, pitfall trap, female, CWOB; Bailey Co., Muleshoe, April 13, 1971, G.B. Marshall, pitfall trap, male, CWOB; Culberson Co., 4 miles S.W. Pine Springs, April 15, 1972, C.W. O'Brien & Marshall, CWOB; Dickens Co., 9 miles S.E. Dickens, July 6, 1970, C.W. O'Brien, night, male, CWOB; Hall Co., 6 miles S.E. Turkey, June 4, 1970, C.W. O'Brien, Temik Project, pitfall trap, male, CWOB; Hall Co., 6 miles S.E. Turkey, June 11, 1970, C.W. O'Brien, Temik Project, pitfall trap, male, CWOB; Hall Co., 6 miles S.E. Turkey, June 11, 1970, C.W. O'Brien, Temik Project, pitfall trap,

female, CWOB; Howard Co., 4 miles S. Big Spring, May 16, 1971, O'Brien & Marshall, night, female, CWOB; Howard Co., 5 miles S. Big Spring, May 16, 1971, O'Brien & Marshall, pitfall trap, TAMU; Howard Co., 4 miles S. Big Spring, June 5, 1971, C.W. O'Brien, under stones, (2), CWOB; Howard Co., 4 miles S. Big Spring on highway 87, October 14, 1971, C.W. O'Brien & Marshall, CWOB; Howard Co., 4 miles S. Big Spring, June 3, 1972, C.W. O'Brien, CWOB; Kleberg Co., Kingsville, June 29, 1957, W.D.E., TAMU; Starr Co., July 5, 1947, George B. Vogt, beaten from yucca cut 17 months ago, *Yucca treculiana* Carr, USNM; Starr Co., July 5, 1947, George B. Vogt, under yucca cut 17 months ago, sandy soil, *Yucca treculiana* Carr, USNM; Val Verde Co., on highway 90, N.W. of Langtry, October 1, 1976, R. Turnbow, female, CWOB.

Thecesternus hirsutus Pierce

(Figures 23, 24, 32; Map 5, 6)

Thecesternus hirsutus Pierce, 1909:336. Type Locality: San Diego, Texas. Type depository: USNM. Type examined.

Description:

Length. 9.5 mm to 14.5 mm

Head. Clothed in dense white scales and setae, sparse tan and dark brown scales, white pubescence interspersed with recumbent setae which radiate from apex of frons; fine punctures; ovoid, regular pits ranging from small to medium-sized, uncommonly ovoid pits may appear irregular in shape.

Prothorax. Slightly wider than long, less than 1 mm in difference; outline nearly rhomboid or oval in shape, lateral lobes present, not prominent (Fig. 23); suture between prothorax and elytra straight; depressions surrounding prothoracic disk not pronounced, may appear absent in well-clothed specimens (Fig. 23); pronounced tubercles on prothorax, tubercles may appear raised and denuded; tubercles quadrate, irregular, never large; deep, irregular and medium-sized pits, touch infrequently, never coalesce together (Figs. 23, 24); minute and small punctures present, noticeable on denuded specimens; setae semierect, sparsely tan or brown, densely clothed in white setae; densely clothed in white and tan scales; indistinct, cryptic patterning (Figs. 23, 24).

Elytra. Elongate, convex outline with abrupt declivity on posterior fourth, projects into broad, rounded, and nearly spatulate outline at posterior margins (Fig. 23);

metaepisternum causing a rounded emargination of elytra (Fig. 24); humeri small, enclose prothoracic posterior margins (Figs. 23, 24); tubercles rounded, irregular, always arise along striae; deep, small to medium-sized, regular pits; long, erect setae; densely clothed in light setae and scales with cryptic patterns in darker pubescence; dark brown or black erect scales always absent (Figs. 23, 24).

Genitalia. The endophallic region of the aedeagus for *T. hirsutus* resembles figure 32 c.

Diagnosis. Some specimens of *T. hirsutus* can appear similar to *T. foveolatus* in general sculpturing and shape. The overall size and shape are different between *T. hirsutus* (Fig. 23) and *T. foveolatus* (Fig. 21) despite the similar sculpturing that is found with *T. foveolatus.* *Thecesternus hirsutus* is less oblong, nor as strongly convex, in general appearance compared to *T. foveolatus*. In addition, the pits and tuberculation on the elytra of *T. hirsutus* appears in regular and consistent intervals (Figs. 23, 24), while the pits and tubercles on the dorsum of *T. foveolatus* are strongly irregular (Figs. 21, 22). Coalescing pits (Fig. 21) on *T. foveolatus* are the most distinct character by which to separate *T. hirsutus* from *T. foveolatus*. Secondly, due to long hairs, there may be specimens of *T. tumulosus*, n.sp., that may resemble *T. hirsutus*. *Thecesternus hirsutus* can be distinguished from *T. tumulosus*, n. sp., by the lack of erect black/ brown scales on the elytra (Figs. 23, 24); that are always present on *T. tumulosus* n. sp. (Figs. 30, 31).

Distribution. This species is uncommonly collected in the United States, albeit it is more commonly collected in Mexico. *Thecesternus hirsutus* has only been collected in New Mexico and Texas within the U.S.A. (Map 5). Specimens were examined from these ecoregions (Map 6): Edwards Plateau section, Rio Grande Plain section, Rolling Plains section and Texas High Plains section (Bailey 1995).

Hosts. *Parthenium* spp. is the only known host plant, see McClay and Anderson (1985). Specimens have been collected from *Mammillaria* Haw., *Celtis laevigata* Wild., *Yucca treculiana* Carr, and *Opuntia lindheimeri* Engeim. from Texas, USA.

Material Examined.

Type specimens: *T. hirsutus* Type Pierce; Cotype No. 12591, E.A. Schwarz Collection, USNM; Duval Co., San Diego, Texas 12.6, Cotype, USNM; Duval Co., San Diego, 23.4 E.A. Schwarz Collection, Cotype No. 12591, USNM.

Additional Specimens: **MEXICO:** Nuevo Leon, March 1, 1979, G.E. Reuthinger, cactus roots, USNM; Nuevo Leon, April 1, 1970, G.E. Reuthinger, cactus roots, USNM; Nuevo Leon, October 30, 1970, H. Perales & Dr. Gonzalez as larvae on *Parthenium hysterophorus* L. roots, (3), USNM; Tamaulipas, 103 kilometers E. cd. Victoria, August 16, 1973, Gaumer & Clark, TAMU. **UNITED STATES OF AMERICA: New Mexico:** Eddy Co., 5 miles N. Carlsbad, September 21, 1956, J.W. MacSwain, EMEC. **Texas:** Cameron Co., Brownsville, September 4, 1962, Jackson, *Mammillaria* Haw., USNM; Hidalgo Co., January 17, 1946, George B. Vogt, under bark of *Celtis laevigata* Wild., USNM; Starr Co., July 5, 1947, collected under yucca cut 17 months ago, *Yucca treculiana* Carr, sandy soil, (2), USNM; Starr Co., September 20, 1947, George B. Vogt, *Opuntia lindheimeri* Engeim., under cactus joints on ground, dead, USNM.

Thecesternus humeralis (Say)

(Figures 25, 26, 27, 32; Maps 7, 8)

Thecesternus humeralis (Say), 1826:254. (*Brachycerus*). Type Locality: Colorado, "Headwaters of Arkansas River". Type depository: holotype destroyed. Neotype herein designated: Nebraska, Douglas Co., Omaha; August 24, 1913. Type depository: UNSM.

Lithodus rectus LeConte 1856:18. Synonymy by LeConte 1876:12. Type examined.

Description:

Standard Length. 5.75 mm to 10.0 mm

Head. Recumbent brown and white setae, radiate from apex of frons; white, tan and brown scales present; frons densely clothed in white scales, brown and white setae sparsely interspersed among scales; white medial stripe present from frons to venter; two white dots, lateral to medial line, above frons; fine punctures; small, uniform pits; single seta arises from each pit, present across integument.

Prothorax. Outline varies; always wider than long, but not over 1 mm in difference; depressions always present, diverse placement and depth (Figs. 25, 26).

Elytra. Outline varies; humeri pronounced, enclose posterior 1/5 of prothorax, project with outward angle or straight forward, causes sinuation of lateral margins (Figs. 25, 26, 27); tubercles and pits consistent from dorsum to lateral margins (Figs. 25, 26); densely clothed in semierect scales and setae of brown, tan and white, brown/ black erect scales present; crust may cover integument and pubescence, scales and setae may appear

through crust, particularly on third interspace; cryptic pattern present, may appear similar to dung (Figs. 25, 26, 27).

Genitalia. The endophallic region of the aedeagus for *T. humeralis* resembles figure 32 d.

Diagnosis. *Thecesternus humeralis* is readily distinguished by prominent, protuberant humeri (Figs. 25, 26, 27). *Thecesternus humeralis* could be confused for *T. affinis* if there is damage or sediment on the specimen where the humeral angles are obscured. If the humeral angles are obscured it is suggested to ultrasonically clean the specimen. When specimens are damaged or covered with heavy sediment, separation between *T. humeralis* and *T. affinis* is difficult.

Distribution. Common throughout the Great Plains complex. The distribution of *T. humeralis* ranges from South Dakota, west to Nevada, as far south as southern Arizona, and through the Great Plains complex to Ohio and Tennessee (Map 7). Specimens were examined from these ecoregions (Map 8): Arkansas Tablelands section, Arkansas Valley section, Basin and Range section, Blackland Prairies section, Boston Mountains section, Central Dissected Till Plains section, Central Gulf Prairies and Marshes section, Central High Plains section, Central High Tablelands section, Central Loess Plains section, Cross Timbers and Prairie section, Eastern Gulf Prairies and Marshes section, Edwards Plateau section, Flint Hills section, Western Mid-Coastal Plains section, Nebraska Sand Hills section, North-Central Glaciated Plains section, North-Central Highlands section, Northern Canyon Lands section, Northern Parks and Ranges section, Northern Rio Grande Intermontane section, Northwestern Great Plains section, Oak Woods and Prairies section, Osage Plains section, Ouachita Mountains section, Pecos Valley section,

Redbed Plains section, Rio Grande Plain section, Rolling Plains section, Sacramento-Monzano Mountain section, South-Central Great Plains section, Southern Gulf Prairies and Marshes section, Southern High Plains section, Southern Parks and Ranges section, Stockton Plateau section, Texas High Plains section, and Upper Rio Grande Basin section (Bailey 1995).

Hosts. Collected from Broomsedge or big and little blue stem (*Andropogon virginicus* L.). Feeding preferences are unknown.

Comments. After examining the type material, I am in agreement to Pierce's (1909) observations that *L. rectus* is a synonym of *T. humeralis*.

Material Examined.

Type Specimen: Destroyed, not examined (Lindroth and Freitag, 1969).

Additional Specimens: Arizona: Santa Cruz Co., Nogales, July 17, 1902, BYUC.

Colorado: State record only, (3), CSUC; Arapahoe Co., Cherry Creek Reservoir near Dixon Grove, April 21, 1990, M. Kippenhan, CSUC; Baca Co., Picture Canyon, April 10, 1993, B. Kondratieff, Fitgerald, DeJong & Al Ayedh, CSUC; Boulder Co., Boulder, April 16, 1913, M.D.E, USNM; Boulder Co., Owen Lake, Boulder, May 21, 1927, S.A. Gale, BYUC; Denver Co., Denver, H. Soltau Collection, USNM; El Paso Co., Colorado Springs, H. Soltau Collection, USNM; El Paso Co., Colorado Springs, June 15-30, 1896, 6000-7000 feet altitude, H.F. Wickham, MTEC; Fremont Co., Cañon City, Wickham, BYUC; Fremont Co., Cañon City, 564 Ag. Col. 4-416, Wickham, CSUC; Jefferson Co., Morrison, April 19, 1952, R.S. Beal, (2), EMEC; Larimer Co., Fort Collins, May 13, 1899, (2), CSUC; Larimer Co., Fort Collins, April 2, 1900, CSUC; Larimer Co., Fort Collins, April 7, 1901, CSUC; Larimer Co., Fort Collins, May 9, 1901, Leng's Catalog

Number 18002, CSUC; Larimer Co., Fort Collins, April 11, 1903, CSUC; Larimer Co., Fort Collins, April 24, 1903, (3), CSUC; Larimer Co., Fort Collins, May 22, 1903, CSUC; Larimer Co., Fort Collins, April 9, 1905, USNM; Larimer Co., Fort Collins, April 30, 1905, USNM; Larimer Co., Fort Collins, August 1919, CSUC; Larimer Co., Fort Collins, May 2, 1905, MTEC; Larimer Co., Fort Collins, September 20, 1941, CMNC; Larimer Co., Horsetooth Ridge, September 5, 1985, D. Leatherman, CSU; Park Co., South Park, August 29, 1905, BYUC; Pueblo Co., Pueblo, 12/4 H. Soltau Collection; USNM; Weld Co., Greeley, BYUC; Weld Co., Greeley, 1889, Dieti', BYUC; Weld Co., St. Vrain Nuclear Plant site, October 16, 1972, Wayne F. Brewer, pitfall trap, MTEC; Weld Co., 8 kilometers N. of Nunn, June 4, 1976, CSUC; Weld Co., 8 miles S.W. Wiggins, May 23, 1986, sand dunes, EMEC; Weld Co., 2 miles N. Roggen, on county road 386, June 5, 1993, B. Kondratieff, CSUC; Weld Co., 2 miles S.S.E. Roggen, June 5, 1993, P.A. Opler, (4), CSUC; Yuma Co., Wray, August 4, 1925, C.J. Drake, BYUC.

Iowa: Adams Co., December 1935, Iowa State University, Experiment Station, pr. no 420, sample 610, BYUC; Adams Co., December 1935, Iowa State University, Experiment Station, pr. no 420, sample 610, collected from L. Blue Stem (*Andropogon* L.), (3), BYUC; Dickinson Co., Lake Okoboji, July 13, 1916, L. Buchanan, USNM; Jasper Co., 1930's, Iowa State University, Experiment Station, pr. no 420, (3), BYUC; Plymouth Co., Stone Point, May 11, 1950, J.D. Lattin, EMEC; Polk Co., W. of Laylorville Lake, June 21-30, 1984, R.H. Schieferstein, USNM; Pottawatomie Co., January 1936, Iowa State University, Experiment Station, pr. no 420, sample 715, BYUC; Pottawatomie Co., January 1936, Iowa State University, Experiment Station, pr. no 420, sample 715, from B. Bluestem (*Andropogon* L.), BYUC; Pottawatomie Co.,

January 1936, Iowa State University, Experiment Station, pr. no 420, sample 718, short dead grass, BYUC; Illinois: Mason Co., Havana, March 14, 1941, W.H. Anderson, on ground, USNM; Will Co., Wilmington, May 12, 1935, Frison & Rose, USNM. **Kansas:** State record only, CSUC; Kansas, (2), USNM; Atchison Co., H. Soltau Collection, 22/5, USNM; Douglas Co., Lawrence, May, 900 feet altitude, E.S. Tucker, USNM; Douglas Co., Lawrence, April 2, 1978, D. Brzoska, SEMC; Kearney Co., July 29, 1987, P.E. Gansberger, rangeland, SEMC; Kiowa Co., Belurdere, June 8, 1924, Satterthwaite, USNM; Meade Co., May 5, 1986, G.A. Salsbury, rangeland, SEMC; Pottawatomie Co., May 28, 1955, McReynolds, TAMU; Pottawatomie Co., Tuttle Creek Reservoir area, March 26, 1968, Gary F. Hevel, USNM; Riley Co., R. Bassler, BYUC; Riley Co., Manhattan, August 19, 1932, R.C. Smith, CWOB; Wallace Co., 3440 feet altitude, F.X. Williams, BYUC. **Missouri:** Boone Co., Columbia, June 22, 1913, S.W. Bromley Collection 1955, USNM; Lincoln Co., Elsberry, November 17, 1920, collected A.C. Burrill from broomsedge (*Andropogon virginicus* L.), (2), USNM; Mississippi Co., Charleston, number 42J18, field 126, Satterthwaite and Painter Collection, CSUC; Mississippi Co., Charleston, June 11, 1917, Satterthwaite, USNM; Mississippi Co., Charleston, November 8 1919, H.R. Painter, J.M. Kingsolver Collection 1963, USNM; St. Louis Co., St. Louis, 10/5 H. Soltau Collection, USNM; St. Louis Co., Sherwood forest, Webster groves, May 3, 1914, Satterthwaite, USNM; St. Louis Co., Kirkwood, April 18, 1922, A.F. Satterthwaite, (2), USNM. **Nebraska**: Arthur Co., Arapaho Prairie, May 14, 2002, 41.49˚N., 101.86˚W., 1125 meters, M.J. Paulsen, MJPC; Cass Co., Plattsmouth, UNSM; Cherry Co., between Valgore & Nenzel on Niobrara River, May 9, 1987, UNSM; Cuming Co., West Point, April 1888, UNSM; Cuming Co., West Point,

July 1888, UNSM; Cuming Co., West Point, May 1924, UNSM; Cuming Co., West Point, May, 1924, BYUC; Custer Co., 17 miles E. Anselmo, June 7, 1989, M.L. Jameson, on floodplain with scrub vegetation, UNSM; Dawes Co., Marsland, June 10, 1934, L.W. Quate, UNSM; Dixon Co., Maskell, July 16, 1915, E.G. Anderson, UNSM; Douglas Co., Omaha, June 14, 1913, L.T. Williams, UNSM; Douglas Co., Omaha, August 3, 1913, L.T. Williams, UNSM; Douglas Co., Omaha, August 24, 1913, L.T. Williams, UNSM; Douglas Co., Omaha, Child's Point, October 17, 1923, Owen Bryant, Owen Bryant Collection 1956, (2), BYUC; Dundy Co., Haigler, May 21, 1914, L.M. Gates, UNSM; Fillmore Co., Fairmont, June 19, 1912, G.W. Deming, UNSM; Frontier Co., Curtis, July 7, 1915, C.E. Mickel, UNSM; Gage Co., Wymore, June 8, 1924, UNSM; Hall Co., September 25, 1981, H. Hansen, UNSM; Holt Co., O'Neil, May 24, 1923, E.J. Katlar, UNSM; Hooker Co., 1.5 miles N. Mullen, near Middle Loup River, July 2-4, 1983, Grissell & Menke, USNM; Keith Co., Lake McConaughy, Spring Creek Beach, April 27, 2004, CSUC; Keith Co., Lake McConaughy, Spring Park, 3 April, 2005, J. Owens & S. Anderson, (2), CSUC; Lancaster Co., Lincoln, BYUC; Lancaster Co., Lincoln, June, UNSM; Lancaster Co., Lincoln, March 15, 1914, clay bank, Shoemaker, Owen Bryant Collection 1956, BYUC; Lancaster Co., Lincoln, November 20, 1940, Bruce, CSUC; Lancaster Co., Lincoln, October 1, 1967, J. Baker, USNM; Lancaster Co., Malcolm, March 23, 1900, C.R. Oertel, BYUC; Lancaster Co., Malcolm, September 20, 1909, C.R. Oertel, UNSM; McPherson Co., Sandhills Agricultural Laboratory, August 8-14, 1973, (7), UNSM; Nemaha Co., Peru, May 5, 1906, R.H. Wolcott, UNSM; Saline Co., Crete, May 15, 1915, E.M. Partridge, UNSM; Saunders Co., Swedeburg, June 6, 1957, UNSM; Sheridan Co., Pine Ridge, July, UNSM; Sioux Co., UNSM; Sioux Co., May, UNSM;

Sioux Co., Warbonnet Canyon, R.H. Wolcott, UNSM; Thomas Co., Halsey, June, (2), UNSM; Colfax Co., 4 miles W., 3 miles S., of Schuyler, April 6, 1991, D. Schmidt, UNSM. **New Mexico**: Rio Arriba Co., 6 miles N. Espanola at Hernandez, May 22, 1991, J. Welch, R.F. Kirchner, & B. Kondratieff, (3), CSUC. **Nevada:** Carson City Co., Carson City, Collection of Chas W. Leng, (3), BYUC. **Ohio:** Ohio, Collection of Chas Schaeffer, BYUC. **Oklahoma:** Cimarron Co., Boise City, July 10, 1933, A.E. Pritchard, BYUC; Ellis Co., 6 miles S.E. of Arnett, May 22, 1967, D.C. Arnold, TAMU; Ellis Co., Lake Vincent, October 14, 1967, D.C. Arnold, overflow area, TAMU; Payne Co., Accession number 2, December 14, 1924, W.J. Brown, BYUC; Payne Co., Stillwater, May 3, 1931, J.L. Jones, BYUC; Payne Co., Cushing, June 15, 1932, W.D. Davis, BYUC. **South Dakota**: Bennett Co., La Creek NWR, 10 miles E. Martin, May 26/27, 1989, P.A. Opler, (5), CSUC; Lawrence Co., Savoy, L. Bruner, UNSM. **Tennessee:** Davidson Co., Nashville, August 4-15, 1897, Wickham, Wickham Collection 1933, USNM. **Texas:** Burleson Co., April 10, 1957, H.R. Burke, TAMU; Hale Co., Plainview, October 1, 1931, S.E. Jones, TAMU; Taylor Co., Camp Barkley, S.W. of Abilene, June 1943, Brainerd, EMEC. **Wyoming:** Converse Co., Glenrock, D. Johnston Pl. Station 13, August 18, 1973, R. Lavigne, USNM; Converse Co., Glenrock, D. Johnston Pl. 7, May 5, 1974, R. Lavigne, USNM; No location, July 1, 1903, R.H. Wolcott Collection, UNSM.

Thecesternus maculosus Pierce

(Figures 28, 29, 32; Maps 9, 10)

Thecesternus maculosus: Pierce, 1909:337. Type Locality: Marfa, Texas. Type Depository: USNM. Type examined.

Thecesternus albidus Pierce, 1909:338. Type locality: Albuquerque, New Mexico. Type depository: USNM. Type examined. New Synonymy.

Description:

Standard Length. 6.75 mm to 15.0 mm

Head. White, tan or dark brown setae present; white scales create medial line, from venter to apex of frons, two lateral spots alongside medial line, four pronounced, dark circles comprised of thick brown setae and scales between white spots; setae recumbent, lay toward apical region of frons and radiate outward; white, tan, ocherous, and dark brown scales; frons densely clothed in white or tan scales, other colored pubescence may be present; regularly dispersed, fine punctures; minute to medium sized, regular pits.

Prothorax. Always wider than long, usually, but not always, with pronounced lateral lobes (Fig. 28), often greater than 0.5 mm difference; apically to widest point prothoracic outline narrows and abruptly emarginated, causing pronounced depressions apically to the pronotal disk (Fig. 28); common pronotal pattern of dark triangle of varying size (Fig. 28), with scutellar spot pattern may form a black "Y", may elongate into arrowhead shape with stripes, lines on apical region may mimic an arrow shaft in appearance; may appear

as a round oval shape with apical stripes instead; ovoid, regular pits, sometimes irregular on pronotal disk, may merge into larger quadrate pits, but never wide (Fig. 28); sometimes raised areas on pronotal disk possess quadrate tubercles (Figs. 28, 29); densely clothed in white and tan scales around along lateral margins of pronotal disk, pattern comprised of brown scales; matching setae recumbent (Figs. 28, 29).

Elytra. Mostly convex and robust; elytral base broadly rounded, small triangular emargination at suture (Figs. 28, 29); humeri envelop lateral posterior margins of prothorax, not pronounced (Figs. 28, 29); tuberculation and pitting regular, deep and ovoid on denuded specimens, tuberculation or pitting appears quadrate to ovoid on clothed specimens; tuberculation near lateral margins more pronounced than on dorsum (Fig. 28); pitting moderate in depth, not greatly pronounced, nor obviously shallow; scales densely white or tan with nearly symmetrical blotches of brown, cryptic; setae generally, but not always, follow scale pattern in color, semi-erect (Figs. 28, 29); large masses of erect black scales on dorsum, frequently cover ¾ of elytral length, particularly on third interspace (Figs. 4, 28, 29); with denuded specimens these areas may appear relatively smooth with small punctures; alternating striae elevated (Fig. 28); metaepisternum cause an emargination of elytra (Fig. 6).

Genitalia. The endophallic region of the aedeagus for *T. maculosus* resembles figure 32 e.

Diagnosis. Many specimens of other species closely resemble *T. maculosus* especially *T. tumulosus*, *T. hirsutus,* and *T. affinis*. It is most difficult to separate *T. maculosus* from *T. tumulosus*. The prothorax of *T. maculosus* is noticeably wider than long (Fig. 28) and although depressions are present, it does not have the same pronounced “hilly”

appearance as *T. tumulosus* (Fig. 30, 31). The prothorax of *T. tumulosus* is longer than wide and has pronounced ridges and depressions (Figs. 30, 31). In regards to separating *T. maculosus* from *T. hirsutus*; the presence of erect black scales is the most efficient character to use. For differentiation, *T. maculosus* possesses erect brown or black scales (Fig. 4, 28, 29) while *T. hirsutus* does not possess this character (Fig. 23, 24). Additionally, it can be difficult to differentiate *T. maculosus* from denuded specimens of *T. affinis*. The sinuation of the metaepisternum on *T. maculosus* (Fig. 6) versus the emargination of the elytra by the metaepisternum on *T. affinis* (Fig. 5) is the most consistent character to differentiate between denuded specimens of these species. The lack of a crust on *T. maculosus* and their respective distributions (limited sympatry) may assist in delineating this species from denuded specimens of *T. affinis*. The general outline, or sinuation of the insect in a dorsal view from the apices of the head to the posterior region of the elytra, is also useful when comparing these two species. The outline of *T. maculosus* appears less convex (Fig. 28) than the outline of *T. affinis* (Fig. 19).

Distribution. *Thecesternus maculosus* is commonly collected for this genus in the southern states of the Great Plains complex. The distribution of *T. maculosus* ranges from New Mexico throughout Texas and Oklahoma and into Missouri. It occurs in Mexico as well (Map 9). Specimens examined from these ecoregions (Map 10): Blackland Prairies section, Edwards Plateau section, Flint Hills section, Marshes section, Northern Rio Grande Intermontane section, Oak Woods and Prairies section, Pecos Valley section, Rio Grande Plain section, Rolling Plains section, Sacramento-Monzano Mountain section, South-Central Great Plains section, Southern Gulf prairies, Southern

High Plains section, Texas High Plains section, and the White Mountain – San Francisco Peaks section (Bailey 1995).

Host. Commonly collected in pitfall traps in prairies throughout winter months. Collected under rosette leaves of *Ipomopsis ruba* (L.) Wherry, from the ground next to *Ratibida columnifera* (Nutt.) Woot. & Standl., under canopy of *Baccharis neglecta* Britt., *Coreopsis* L., *Helianthus annuus* L., *Aloysia gratissima* (Gillies & Hook.) Troncosa, and *Sorghum halepense* Pers. in Texas. Feeding preferences are unknown.

Comments. The examined holotype of *T. albidus* falls in the range of variation for *T. maculosus* and is considered a synonym.

Material Examined.

Type specimen: *T. maculosus* Type Pierce, Type No. 12592 USNM; Presidio Co., Marfa, Texas, June 6, 1908, Cushman and Mitchell. T. albidus Type Pierce Cotype No. 12593, Bernalillo Co., Albuquerque, New Mexico, H. Soltau Collection, USNM**.**

Additional Specimens: MEXICO: Coahuila, 25 miles N.E. Monclova, 1300 feet, August 21, 1971, C. O'Brien, L. O'Brien, & Marshall, (3), CWOB; Coahuila, 25 miles N.E. Monclova, 1300 feet, August 21, 1971, C. O'Brien, L. O'Brien, & Marshall, female, CWOB. **UNITED STATES OF AMERICA: Missouri:** Atoka Co., Atoka, USNM; Wright Co., Mt. Grove, May 16, 1914, M.P. Somes, Wickham Collection 1933, (2), USNM. **New Mexico:** State record only, USNM; Bernalillo Co., Albuquerque, March 12, 1899, H. Soltau Collection, (3), USNM; Bernalillo Co., Albuquerque, January 28, 1899, (2), USNM; Colfax Co., Koehler, V.L. Wildermuth, Wickham Collection 1933, (2), USNM; Colfax Co., Koehler, elevation 6000 feet, W.R. Walton, USNM; Colfax Co., Prairie near Koehler, August, H.F. Wickham, (2), USNM; Colfax Co., Prairie near

Koehler, H.F. Wickham, August, Wickham Collection 1933, (2), USNM; Colfax Co., Maxwell, USNM; Colfax Co., September 27, 1916, D.J. Caffrey, USNM; Eddy Co., 32˚19.7'N., 103˚46.9'W., Site 7, June 2, 1979, Burke, DeLorme, Carrola, Friedlander, Schaffner, TAMU; Lea Co., 15 miles E. Lovington, August 3, 1971, C.W. O'Brien & Marshall, CWOB; Lincoln Co., Glencoe, elevation 5800 feet, August 22, 1970, J.R. & M.H. Sweet, TAMU; San Miguel Co., Las Vegas, 15.8, USNM; Terrance Co., Willard, USNM. **Oklahoma:** Cimarron Co., Boise City, July 10, 1922, A.E. Pritchard, BYUC; Cimarron Co., 1.3 miles N. Felt, October 3, 1971, G-22, G.C. Gaumer, leg, TAMU; Comanche Co., Fort Sill, E. range, April 24, 2002, B. Kondratieff, J. Schmidt, & P. Pineda, CSUC; Comanche Co., Fort Sill, Quanah Range, 0.5 miles E. Falcon Gate, Jackson Hole, June 13, 2006, B. Kondratieff & R. Younghanz, CSUC; Latimer Co., June 1986, K. Stephan, TAMU; Noble Co., August 2, 1932, E.E. Ivy, BYUC; Pawnee Co., July 16, 1932, Pritchard & Deonier, BYUC; Payne Co., December 14, 1924, W.J. Brown, (2), BYUC; Payne Co., Stillwater, April 5, 1925, W.J. Brown, BYUC; Payne Co., Stillwater, May 3, 1931, J.L. Jones, BYUC; Payne Co., Stillwater, March 12, 1942, TAMU; Payne Co., Stillwater, October 19, 1970, A. Maxwell, BYUC; Pittsburg Co., Quinton, June 10, 1934, J. Stankavich, BYUC. **Texas:** State record only, (2), BYUC; State record, C.V. Riley Collection, (4), USNM; State record, Collection of Chas Schaeffer, (3), BYUC; State record, USNM; Anderson Co., Salmon, September 20 – October 4, 1974, H.R. Burke, TAMU; Armstrong Co., 14 miles S. Claude, April 10, 1971, C.W. O'Brien, CWOB; Atascosa Co., 8 miles N.W. Poteet, January 30 – March 28, 2000, Turnbow & Wappes, barrier pitfall trap, CWOB; Bailey Co., Muleshoe, October 5, 1970, G.B. Marshall, night, female, CWOB; Bastrop Co., Sayersville, May 31, 1989, A.

Hook, BFLC; Bastrop Co., Sayersville, May 30, 1990, A. Hook, BFLC; Bastrop Co., Sayersville, May 11, 1991, A. Hook, BFLC; Bastrop Co., ca. 2.5 miles E. highway junction on 21 from 95, March 6-12, 2000, C.M. & E.G. Riley, fluorescent yellow pitfall trap, EGRC; Bastrop Co., ca. 2.5 miles E. highway junction on 21 from 95, March 6-12, 2000, C.M. & E.G. Riley, pitfall trap, sandy soil, TAMU; Bastrop Co., Sim Gideon Power Station Road, March 6-12, 2000, C.M. & E.G. Riley, fluorescent pitfall trap, (2), EGRC; Bee Co., Beeville, 22.10, Howard & Schwarz Collection, USNM; Bell Co., Stillhouse Hollow Dam, March 4, 1985, T.O. Robbins, hiding under basal rosette leaves of *Ipomopsis ruba* (L.) Wherry, TORC; Bell Co., Stillhouse Hollow Dam, March 22, 1985, T.O. Robbins, on ground next to *Ratibida columnifera* (Nutt.) Woot. & Standl., under canopy of *Baccharis neglecta* Britt., (2), TORC; Bexar Co., May 28, 1963, J.F. Reinert, USNM; Bexar Co., Camp Bullis, July 20, 1951, E. Shepherd, BYUC; Bexar Co., Fort Sam Houston, June 18, 1952, B.J. Adelson, EMEC; Bexar Co., Salado Creek, July 1, 1952, B. Adelson, EMEC; Blanco Co., Pedernales Falls State Park, June 1, 1990, A. Hook, BFLC; Blanco Co., Pedernales Falls State Park, June 19, 1991, A. Hook, BFLC; Blanco Co., Pedernales Falls State Park, June 10, 1994, A.W. Hook, BFLC; Blanco Co., Pedenales Falls State Park falls area, June 25, 1998, M.J. Teasdale, C.R. Nelson & Field Ent. Class, BYUC; Brazoria Co., Brazoria, July 17, 1955, H.R. Burke, TAMU; Brazos Co., April 20, 1960, TAMU; Brazos Co., College Station, October 30, 1936, Student Collection, TAMU; Brazos Co., College Station, April 14, 1964, R.D. Barnes, (3), TAMU; Brewster Co., Alpine, May 20, 1972, E. Giesbert, EMEC; Brown Co., Bangs, July 6, 1939, *Coreopsis* L., female, USNM; Brown Co., Bangs, July 6, 1939, *Coreopsis* L., male, USNM; Burleson Co., April 10, 1957, H.R. Burke, TAMU; Burleson Co., 4

miles W. Cook's Point, October 2-4, 1978, J.W. Summerlin, ex. cone emergence traps over cow dung, TAMU; Burleson Co., 2.2 miles N. Caldwell, March 5-23, 1995, E.G. & C.M. Riley, propionic acid baited pitfall trap; EGRC; Burleson Co., 2.2 miles N. Caldwell, April 2, 1995, E.G. Riley, EGRC; Burleson Co., 2.3 miles N. highway junction 21 on highway 908, May 13, 1995, E.G. Riley, (2), EGRC; Burleson Co., 2 miles N. highway junction 21 on F.M. 908, February 27 – March 6, 2000, C.M. & E.G. Riley, fluorescent yellow pitfall trap in sandy area, (10), EGRC; Burleson Co., F.M. 908, 7 miles N.W. highway junction 21, April 18, 2003, E.G. Riley, CSUC; Burleson Co., F.M. 908, 3.3 miles N.W., highway junction 21, May 30, 2004, E.G. Riley, CSUC; Burnet Co., Inks Lake State Park, June 18, 1965, M.H. Sweet, (3), TAMU; Burnet Co., Inks Lake State Park, June 19, 1965, M.H. Sweet, (2), TAMU; Cameron Co., Brownsville, Esperanza Ranch, August 18, 1918, Brooklyn Museum Collection 1928, USNM; Cameron Co., October 15, 1959, TAMU; Cameron Co., August 8-10, 1961, R.B. Eads, CSUC; Cherokee Co., Jacksonville, October 12, 1905, W.D. Pierce, USNM; Colorado Co., Columbus, Hubbard & Schwarz Collection, USNM; Comal Co., BYUC, Comal Co., New Braunfels, Collection of Chas Schaeffer, BYUC; Culberson Co., 36 miles W. Orla, June 14, 1980, M.E. Rice, CWOB; Dallam Co., road 1879, 7.5 miles N. highway 87, April 14, 1990, D. Brzoska, SEMC; Dallas Co., Dallas, May 3, 1905, A.W. Morrill, at light, USNM; Dallas Co., Dallas, March 8, 1908, USNM; Dickens Co., 9 miles S.E. Dickens, September 25, 1970, C.W. O'Brien, CWOB; Dickens Co., 2 miles S.E. spur, February 26, 1971, C.W. O'Brien, pitfall trap, male, CWOB; Dickens Co., 2 miles S.W. Dickens, October 3, 1971, E. Zukauckas, pitfall trap, (3), CWOB; Dickens Co., 4 miles S.W. Dickens, October 3, 1971, E. Zukauckas, pitfall trap, CWOB; Dickens Co., 2 miles

S.W. Dickens, October 7, 1971, E. Zukauckas, pitfall trap, (4), CWOB; Dickens Co., 4 miles S.W. Dickens, October 7, 1971, E. Zukauckas, pitfall trap, (3), CWOB; Dickens Co., 4 miles S.W. Dickens, October 10, 1971, E. Zukauckas, pitfall trap, CWOB; Dickens Co., 2 miles S.W. Dickens, October 14, 1971, E. Zukauckas, pitfall trap, (6), CWOB; Dickens Co., 2 miles S.W. Dickens, October 17, 1971, E. Zukauckas, pitfall trap, (4), CWOB; Dickens Co., 4 miles S.W. Dickens, November 14, 1971, E. Zukauckas, pitfall trap, female, CWOB; Dickens Co., 4 miles S.W. Dickens, November 14, 1971, E. Zukauckas, pitfall trap, (2), CWOB; Dickens Co., 4 miles S.W. Dickens, November 28, 1971, E. Zukauckas, pitfall trap, (3), CWOB; Dickens Co., 2 miles S.W. Dickens, November 17, 1971, E. Zukauckas, pitfall trap, CWOB; Dickens Co., 4 miles S.W. Dickens, December 22, 1971, E. Zukauckas, CWOB; Dickens Co., 4 miles S.W. Dickens, December 30, 1971, E. Zukauckas, CWOB; Dickens Co., 4 miles S.W. Dickens, December 31, 1971, E. Zukauckas, (3), CWOB; Dickens Co., 4 miles S.W. Dickens, February 17, 1972, E. Zukauckas, pitfall trap, (3), CWOB; Dickens Co., 4 miles S.W. Dickens, February 26, 1972, E. Zukauckas, pitfall trap, (8), CWOB; Dickens Co., 4 miles S.W. Dickens, March 12, 1972, E. Zukauckas, pitfall trap, CWOB; Dickens Co., 4 miles S.W. Dickens, March 16, 1972, E. Zukauckas, pitfall trap, CWOB; Dimmit Co., Chaparral Wildlife Management Area, June 13-15, 1992, A. Hook & J. Neff, BFLC; Dimmit Co., Chaparral Wildlife Management Area, April 12-13, 2001, A. Hook & J. Neff, BFLC; Dimmit Co., Chaparral Wildlife Management Area, June 12-14, 2001, A. Hook, BFLC; Erath Co., Stephenville, September 29, 1955, L.P. Sanchez, TAMU; Fannin Co., Bonham, June 20, 1933, TAMU; Fannin Co., Fuller, Hubbard & Schwarz Collection, USNM; Freestone Co., near Donie, March 27, 1994, E.G. Riley, berlese

surface sand and litter, EGRC; Galveston Co., Dickinson, February 24, 1935, TAMU; Gillespie Co., June 1, 1958, TAMU; Gillespie Co., June 7, 1959, S.D. & H.R. Burke Collections, TAMU; Grayson Co., Sherman, February 7, 1922, E.E. Russell, hibernation, USNM; Hale Co., Plainview, October 1, 1931, (2), TAMU; Hall Co., 6 miles S.E. Turkey, May 6, 1970, C.W. O'Brien and E. Huddleson, Temik Project, pitfall trap, (3), CWOB; Hall Co., 6 miles S.E. Turkey, May 14, 1970, C.W. O'Brien, Temik Project, CWOB; Hall Co., May 21, 1970, C.W. O'Brien, Temik Project, pitfall trap, (2), CWOB; Hall Co., 6 miles S.E. Turkey, May 28, 1970, C.W. O'Brien, Temik Project, (2), CWOB; Hall Co., 6 miles S.E. Turkey, July 11, 1970, C.W. O'Brien, Temik Project, (5), CWOB; Hamilton Co., Ireland, November 14, 1965, student collection, D.J. Lovelace, TAMU; Harris Co., Houston, May 11, 1949, J.L. Ward, on wild sunflower, *Helianthus annuus* L., USNM; Harris Co., near W. Houston Airport, June 22, 1990, D.J. Heffern, (2), CMNC; Harris Co., near W. Houston Airport, June 22, 1990, D.J. Heffern, CSUC; Harris Co., by W. Houston Airport, June 23, 1991, D.J. Heffern, CMNC; Hidalgo Co., Weslaco, September 17, 1933, TAMU; Hidalgo Co., Donna, January 27, 1944, Harrison, on turnip foliage, USNM; Howard Co., Big Spring, BYUC, Howard Co., Big Spring, Collection of Chas Schaeffer, BYUC; Howard Co., Big Spring, Wickham, USNM; Howard Co., Higgins Ranch, 5 miles E. Big Spring, October 25, 2005, T.O. Robbins, TORC; Hudspeth Co., 8 miles E. of Hueco, July 13, 1977, E. Giesbert, EMEC; Hunt Co., Greenville, October 15, 1932, D.F. Cook, USNM; Jeff Davis Co., Valentine, May 23, 1932, E.G. Linaley, Zimmerman Collection 1941, USNM; Jeff Davis Co., Fort Davis, July 1935, J.L. Owen Jr., TAMU; Jeff Davis Co., road 118, 5 miles S. Kent, June 22, 1994, Kondratieff & Kippenhan, CSUC; Karnes Co. Ecleto Metz Ranch, March 19, 1997,

J.E. Wappes, CMNC; Karnes Co., Ecleto Metz Ranch, March 24, 1997, J.E. Wappes, flight intercept/ pitfall trap, USNM; Karnes Co., Ecleto Metz Ranch, April 28, 1997, J.E. Wappes, TAMU; Karnes Co., Ecleto Metz Ranch, May 4, 1997, J.E. Wappes, EMEC; Karnes Co., Ecleto Metz Ranch, May 13, 1997, J.E. Wappes, EMEC; Kaufman Co., Terrell, C.R. Jones, USNM; Kenedy Co., Risken Ranch, 27˚10'N., 97˚40'W., June 11, 1977, TAMU; Kenedy Co., Risken Ranch, 27˚10'N., 97˚40'W., July 10, 1977, Gene Fields, TAMU; Kenedy Co., Armstrong, March 27-31, 1986, E.G. Riley, human feces pitfall trap, CMNC; Kenedy Co., 16 miles N. Willacy county line on 77, October 20, 1988, R. Morris, (3), CMNC; Kenedy Co., 7 miles S. Sarita, March 16-19, 1995, E.G. Riley, EGRC; Kenedy Co., Kenedy Ranch, Jaboncillos Pasture, sand dunes area, 26˚58'38''N., 97˚40'59''W., April 20, 2001, E.G. Riley, TAMU; Kenedy Co., Kenedy Ranch, Jaboncillos Pasture, sand dune area, 26˚59'22''N., 97˚40'11''W., April 21, 2001, E.G. Riley, TAMU; Kenedy Co., 2.5 miles S. Sarita, September 18-20, 2002, B. Raber & E. Riley, pitfall trap in sand, TAMU; Kenedy Co., 2.5 miles S. Sarita, October 18-20, 2002, B. Raber & E. Riley, pitfall trap in sand, (3), TAMU; Kenedy Co., 6.2 miles S. Sarita, October 18-20, 2002, B. Raber & E. Riley, pitfall trap in sand, CSUC; Kenedy Co., 2.5 miles S. Sarita, October 19-20, 2002, B. Raber & E. Riley, pitfall trap in sand, CWOB; Kerr Co., Kerrville, November 11, 1968, W.F. Chamberlain, TAMU; Kerr Co., Kerrville, June 5, 1999, G.M. Chamberlain, TAMU; Kleberg Co., Kingsville, April 3, 1900, McMillian, USNM; Kleberg Co., Sarita, November 30, 1911, bare sand, (2), USNM; Kleberg Co., Kingsville, October 10, 1957, R.L.E., TAMU; Kleberg Co., Riviera, May 25, 1971, V.V. Board, TAMU; Kleberg Co., Kingsville, November 7, 1972, J.E. Gillaspy Collection, TAMU; Kleberg Co., Kingsville, October 18, 1975, Shu Wong,

TAMU; Kleberg Co., 10 miles S.W. of Kingsville, November 7, 1975, J.E. Gillaspy, (2), TAMU; Kleberg Co., Kingsville, November 10, 1975, Noel Barrera, TAMU; Kleberg Co., Site 55, November 13, 1975, Gillaspy and party, (2), TAMU; La Salle Co., Cotulla, May 12, Pratt & Crawford, (4), USNM; La Salle, Cotulla, May 12, 1906, Pratt, (3), USNM; La Salle Co., Chaparral Wildlife Management Area, 10.1 miles N.W. Artesia Wells, June 11-15, 2001, J.C. Abbott & Field Ent. Class, BFLC; La Salle Co., Chaparral Wildlife Management Area, pasture, September 11 – October 10, 2003, B. Raber, pitfall trap, area with whitebrush, *Aloysia gratissima* (Gillies & Hook.) Troncosa, (2), CSUC; Lee Co., Fedor, April 24, 1909, Wickham Collection 1933, USNM; Leon Co., 5 miles E. Centerville, 31˚15'N., 96˚52'W., September 4-13, 1996, J. Yantis, pitfall trap, (3), TAMU; Leon Co., 5 miles N. Flynn, June 3, 1995, E.G. Riley, EGRC; Limestone Co., 3.5 miles E. Kosse, March 20, 1971, ex. dry sandy creek, TAMU; Live Oak Co., 17 miles S.W. George, est., May 5, 1985, Dan Heffern, SEMC; Live Oak Co., 14 miles S.W. G., West, September 6, 1997, Wappes & Turnbow, CMNC; Llano Co., November 27, 1964, E.J. Gerbery, USNM; Llano Co., Enchanted Rock, June 15, 1968, TAMU; Lubbock Co., Lubbock, April 22, 1958, D.M. McLemen, TAMU; Lubbock Co., Lubbock, January 21, 1970, W.J. Fournier, pitfall trap, (3), CWOB; Lubbock Co., Lubbock, October 22, 1970, C.W. O'Brien, pitfall trap, CWOB; Lubbock Co., Lubbock, October 20, 1970, E. Huddleston, pitfall trap, male, CWOB; Lubbock Co., Lubbock, October 25, 1970, C.W. O'Brien, pitfall trap, female, CWOB; Lubbock Co., Lubbock, October 25, 1970, C.W. O'Brien, pitfall trap, male, (2), CWOB; Lubbock Co., Lubbock, October 27, 1970, C.W. O'Brien, pitfall trap, male, CWOB; Lubbock Co., Lubbock, October 29, 1970, C.W. O'Brien, pitfall trap, CWOB; Lubbock Co., Lubbock, November 1, 1970, P.M. Allen,

(2), CWOB; Lubbock Co., Lubbock, November 5, 1970, C.W. O'Brien, pitfall trap, (4), CWOB; Lubbock Co., Lubbock, November 10, 1970, Campbell & Allen, pitfall trap, CWOB; Lubbock Co., Lubbock, November 11, 1970, C.W. O'Brien, pitfall trap, CMNC; Lubbock Co., Lubbock, November 12, 1970, C.W. O'Brien, pitfall trap, CWOB; Lubbock Co., Lubbock, November 14, 1970, P.M. Allen, (3), CWOB; Lubbock Co., Lubbock, November 15, 1970, C.W. O'Brien, pitfall trap, CWOB; Lubbock Co., Lubbock, November 17, 1970, C.W. O'Brien, pitfall trap, (3), CWOB; Lubbock Co., Lubbock, November 22, 1970, C.W. O'Brien, pitfall trap, (4), CWOB; Lubbock Co., Lubbock, December 10, 1970, C.W. O'Brien, pitfall trap, (14), CWOB; Lubbock Co., Lubbock, January 2, 1971, W.J. Fournier, pitfall trap, CWOB; Lubbock Co., Lubbock, January 21, 1971, W.J. Fournier, pitfall trap, CWOB; Lubbock Co., Lubbock, February 2, 1971, C.W. O'Brien, pitfall trap, female, (2), CWOB; Lubbock Co., Lubbock, February 28, 1971, C.W. O'Brien, pitfall trap, (2), SEMC; Lubbock Co., Lubbock, March 14, 1971, C.W. O'Brien, pitfall trap, SEMC; Lubbock Co., Lubbock, March 14, 1971, C.W. O'Brien, pitfall trap, (4), CWOB; Lubbock Co., 1 mile W. Lubbock, March 28, 1971, G.D. Hays, pitfall trap, CWOB; Mason Co., 5 miles S.E. Fredonia, May 28, 1973, Gaumer & Clark, (2), TAMU; Matagorda Co., Buckeye, June 8, 1917, J.D. Mitchell, on flooded rice, (3), USNM; McLennan Co., July 2, 1933, H.B. Mills, TAMU; McLennan Co., July 18, 1933, W.B. Bills, TAMU; McLennan Co., Waco, June 8, 1948, P.A. Glick, S.C.S roadside, on Johnsongrass, *Sorghum halepense* Pers., Opp. IV9-1, USNM; McLennan Co., Waco, August 3, 1948, P.A. Glick, S.C.S., on weeds Opp., W7-17, USNM; McMullen Co., Daugherty Wildlife Area, N. & E. of Tilden, May 9, 1989, Sundberg & Hanselmann, CWOB; McMullen Co., highway 16 by Nueces Ranch, May 5,

1985, Dan Heffen, SEMC; Motley Co., Matador, June 15, 1933, H.G. Johnston, TAMU; Nacogdoches Co., Nacogdoches, April 25, 1968, B.R. English, swept from vegetation, TAMU; Nacogdoches Co., Nacogdoches, July 19, 1971, D. Starr, electric light, TAMU; Potter Co., Amarillo, August, Wickham Collection 1933, (3), USNM; Presidio Co., 10 miles S. Marfa, June 13, 1948, H.S. Barber, H.S. Barber Bequest 1950, USNM; Presidio Co., 10 miles S. Marfa, June 13, 1968, H.S. Barber, H.S. Barber Bequest 1950, USNM; San Patricio Co., Welder Wildlife Refuge, June 19, 1989, J.M. Mora, pitfall trap, sandy brush land, TAMU; San Patricio Co., Welder Wildlife Refuge, August 31, 1989, J.M. Mora, pitfall trap, sandy brush land, (2), TAMU; San Patricio Co., Welder Wildlife Refuge, August 31, 1989, J.M. Mora, pitfall trap, sandy brush land, CWOB; San Patricio Co., Welder Wildlife Refuge, October 10, 1989, J.M. Mora, pitfall trap, sandy brush land, TAMU; San Patricio Co., Welder Wildlife Refuge, October 19, 1989, J.M. Mora, pitfall trap, clay soil, brush land, (5), TAMU; San Patricio Co., Welder Wildlife Refuge, November 25, 1989, J.M. Mora, pitfall trap, clay soil, brush land, (13), TAMU; Starr Co., 1-10 miles E. El Sauz, May 10, 1986, D.J. Heffern, SEMC; Sutton Co., September 13, 1958, H.R. Burke, TAMU; Travis Co., 8 miles N.W. Austin, November 2, 1963, C. Martin, TAMU; Travis Co., 8 miles N.W. Austin, November 2, 1965, C.O. Martin, TAMU; Travis Co., Austin University of Texas - Brackenridge Field Laboratory, August 14, 1981, A. Hook, TAMU; Travis Co., Austin, Brackenridge Field Laboratory, October 23, 1985, A. Hook, (2), BFLC; Travis Co., Austin, Brackenridge Field Laboratory, November 6, 1985, A. Hook, (2), BFLC; Travis Co., Austin, University of Texas-Brackenridge Field Laboratory, July 25, 1987, A. Hook, (5), TAMU; Travis Co., Austin, University of Texas – Brackenridge Field Laboratory, October 7, 1987, A. Hook, BFLC;

Travis Co., Austin, Brackenridge Field Laboratory, May 13, 1989, A. Hook, BFLC; Travis Co., Austin, Brackenridge Field Laboratory, 550 feet elevation, May 10, 1991, C.R. Nelson, BYUC; Travis Co., Austin, Brackenridge Field Laboratory, 550 feet elevation, June 14, 1991, A.W. Hook & C.R. Nelson, (2), BYUC; Travis Co., Austin, Brackenridge Field Laboratory, 170 meters elevation, April 12, 1993, C.R. Nelson & G.I. Baird, (2), BYUC; Uvalde Co., Uvalde, November 25, 1987, T. vanNoman, wild turkey crops, (3), CMNC; Val Verde Co., Comstock, 1932, E.C. Zimmerman 1941 Collection, USNM; Val Verde Co., Comstock, May 17, 1932, Zimmerman Collection 1941, (5), USNM; Val Verde Co., 39 miles N.N.W. Comstock on Texas road 1024, May 12, 1997, Gillogly & Schaffner, TAMU; Victoria Co., Victoria, USNM; Victoria Co., Victoria, February 11, 1915, J.D. Mitchell, hibernating in sedge grass (*Carex* L.), (2), USNM; Waller Co., Hepstead, December 31, 1999 – January 16, 2000, E.G. Riley, fluorescent yellow pitfall trap, sandy area, TAMU; Wilson Co., ca. 2 miles S.W. La Vernia, May 3, 1992, E.G. Riley, EGRC; Wood Co., ca. 17 miles N. Hawkins, 32˚48’55’’N., 95˚10’00’’W., May 9, 1999, A. Gillogly, W. Godwin, & E. Riley, EGRC; Yoakum Co., Plains, C.R. Jones Collection, USNM.

Thecesternus tumulosus new species

(Figures 30, 31, 32; Maps 11, 12)

Thecesternus tumulosus: new species. Type Locality: Kenedy Co., Texas, 7 miles South of Sarita, October 17, 1985. Collected by J.E. Wappes. Type depository: USNM.

Naming: Tumulosus is loosely translated to "hilly" in English from Latin. This was chosen to depict the "rolling" sculpture of the prothorax; with it's pronounced ridges and depressions.

Description:

Standard Length. 9.75 mm to 13.5 mm.

Head. White, tan, and dark setae are usually, but not always, recumbent, radiate toward slightly above apex of frons, two dark triangles on apical-lateral margins of frons nearly meet in dark points near base of white medial line, triangles pronounced and composed of long, thickly clothed dark brown setae and scales; setae long and pronounced across margins of head; white, tan and brown scales densely clothe head; frons densely clothed with white or tan scales with sparse white, tan or dark brown setae interspersed, remaining margins usually clothed in darker scales; dominant color clothing frons is similar as medial line across dorsum; remaining margins across head usually clothed in darker scales than frons.

Pronotum. Angular; appears longer than wide, measures wider than long with prothoracic lobes (Fig. 30), less than 1 mm in difference between length and width; rough

sculpture with pronounced ridges present along margins and prothoracic disk (Figs. 30, 31); apical ridge abrupt, broad and thick; lateral protuberances pronounced and form from truncated cone (Figs. 30, 31); prothoracic disk with angulate raised sections; depressions intensified by ridges; anteriorly transverse impression, deep and pronounced, evident on sides and disk; depressions on disk and emarginations laterally impressed and apparent (Figs. 30, 31); ridges angular, give "squared off" appearance (Fig. 30); impression "hilly" from dorso-lateral view (Fig. 31); small tubercles, may appear absent on well-clothed specimens (Figs. 30, 31); deep, sometimes irregular pits (Figs. 30, 31); white, tan and brown setae, semi-erect, not recumbent, moderately long (Figs. 30, 31); white, tan and brown scales thick, not spongy, may be broad or narrow; cryptic, without overt patterning (Figs. 30, 31).

Elytra. Convex, broad posterior margins; humeri short, barely cover posterior angles (Fig. 30); metaepisternum causes emargination of elytra (Fig. 31); tubercles at apices of medial suture apparent, not engorged or enlarged (Fig. 30); tubercles along elytra tuberculate, regularly spaced along striae (Figs. 30, 31); pitting deep and regular; topography of tubercles and pits appears moderately sized, regularly spaced (Fig. 30); coloration varies in shades of white, tan or brown with few noticeable patterns (Figs. 30, 31); white, tan and brown setae long and semi-erect (Figs. 30, 31); scales follow suite in coloration, include small clusters of dark brown or black, erect scales (Figs. 30, 31); very cryptic patterns.

Genitalia. The endophallic region of the aedeagus for *T. tumulosus* resembles figure 32 f.

Diagnosis. Specimens of *T. tumulosus* most closely resemble *T. hirsutus* and *T. maculosus.* The presence of dark brown or black scales (Fig. 4) will differentiate *T. tumulosus* (Figs. 30, 31) from *T. hirsutus,* which lacks these scales (Figs. 23, 24). For denuded specimens the prothorax of *T. tumulosus* is wider than long, with prominent lateral lobes (Figs. 30, 31). The prothorax of *T. hirsutus* is subequal in length and width and does not have protuberant lateral lobes (Figs. 23, 24). The sculpturing of the prothorax on *T. tumulosus* is remarkably angulate with pronounced depressions and ridges, particularly the apical ridge (Figs. 30, 31), whereas *T. maculosus* also has prominent prothoracic depressions, but without pronounced and protruding ridges (Figs. 28, 29). In addition, the prothoracic ratio is generally much narrower in *T. tumulosus* than *T. maculosus*. Clustering of black or dark brown erect scales is not a dominant vestiture of *T. tumulosus* (Figs. 30, 31), where it is present only in small patches along the dorsum, however, it is a dominant vestiture on *T. maculosus* (Figs. 4, 28, 29). Lastly, the setae are longer and more erect on *T. tumulosus* (Figs. 30, 31) than *T. maculosus*, which has semi-erect and shorter setae (Figs. 28, 29).

Distribution. Primarily distributed in coastal plains of Texas (Maps 11, 12). Dominant populations reside in a small area, which is anticipated to be an artifact of collecting with a greater distribution utilized by this species, primarily along the coastline in Texas and Mexico. Specifically inhabits these ecoregions: Rio Grande Plain section and Southern Gulf Prairies and Marshes section (Bailey 1995).

Host. Collected from *Helianthus argophyllus* Torrey and Gray in Texas. Feeding preference information remains unavailable.

Material Examined.

Type Specimen: Holotype: Texas: Kenedy Co., 7 miles S. Sarita, October 17, 1985, collected by J.E. Wappes, USNM.

Additional Specimens: Texas: Brooks Co., Falfurrias, May 18, 1907, A.C. Morgan, USNM; Cameron Co., Brownsville, August 19, 1943, with truck bed 43-10623, USNM; Hidalgo Co., 26 miles N. Edinburg, July 16, 1964, H.R. Burke, (2), TAMU; Jim Wells Co., 8 miles W. Ben Bolt La Copita Research Station, May 20, 1987, J.B. Woolley, CSUC; Kenedy Co., 27˚10'N., 97˚40'W., April 4, 1976, Gillaspy & party, (2), TAMU; Kenedy Co., 25.3 miles S. Sarita, October 21, 1984, R. Turnbow, (2), CWOB; Kenedy Co., 25.3 miles S. Sarita, October 21, 1984, R. Turnbow on *Helianthus argophyllus* Torr & A. Gray, CWOB; Kenedy Co., 3 miles N. Norias, May 4, 1989, E.G. Riley, TAMU; Kenedy Co., 5 miles S. Sarita, April 8-10, 1994, E.G. Riley, (2), EGRC; Kenedy Co., 7 miles S. Sarita, March 16-19, 1995, E.G. Riley, ECRC; Kenedy Co., Kenedy Ranch, Jaboncillos Pasture, 26˚58'38''N., 97˚40'59''W., April 6-20, 2001, W. Godwin & E.G. Riley, sand dune area, pitfall trap, (3), TAMU; Kleberg Co., 3 miles S. Riveria, August 13, 1964, H.R. Burke & J. Apperson, TAMU; Kleberg Co., La Paloma Ranch, May 23, 1975, Joel Hallan, TAMU; Kleberg Co., 10 miles S.W. Kingsville, November 7, 1975, J.E. Gillaspy, TAMU; Kleberg Co., 10 miles S.W. Kingsville, November 8, 1975, J.E. Gillaspy, TAMU; Kleberg Co., 1 mile S. Riviera, October 25, 1986, Heffern & Brattain, CSUC.

ILLUSTRATIONS

Fig. 1. *Thecesternus* spp. prosternum indicating prosternal plate.

Fig. 2. Pitting on prothorax of *Thecesternus humeralis*.

Fig. 3. Punctures on prothorax of *Thecesternus humeralis*.

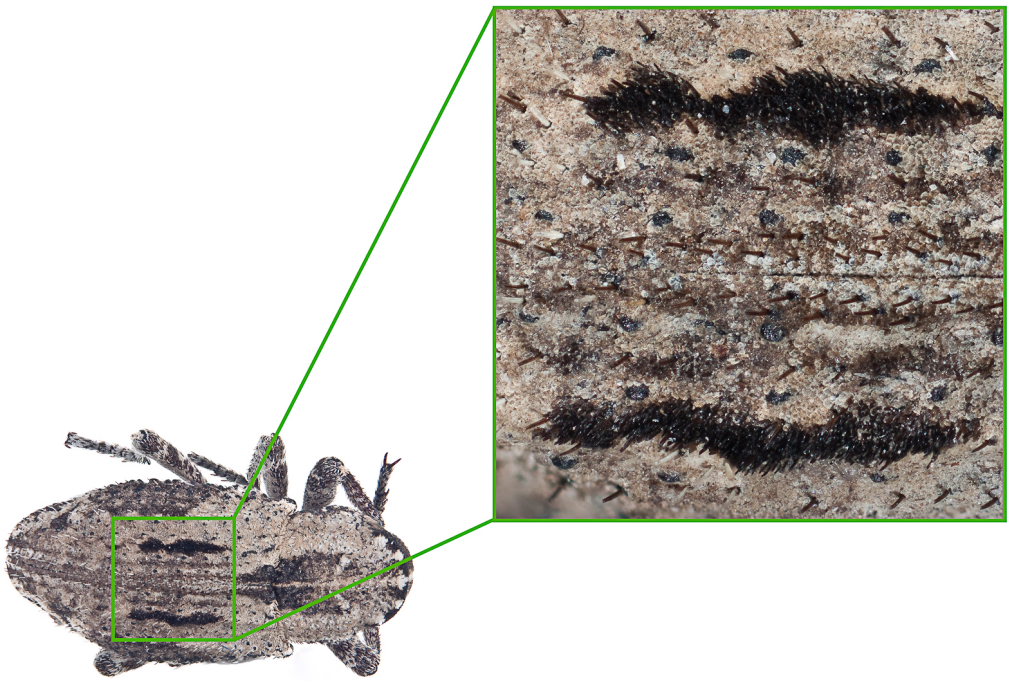


Fig. 4. Erect scale clusters, dorsal view of elytra on *Thecesternus maculosus*.

Fig. 5. Metaepisternum of *Thecesternus affinis*; anteriorly prolonged.

Fig. 6. Metaepisternum of *Thecesternus maculosus* showing emargination of elytra.

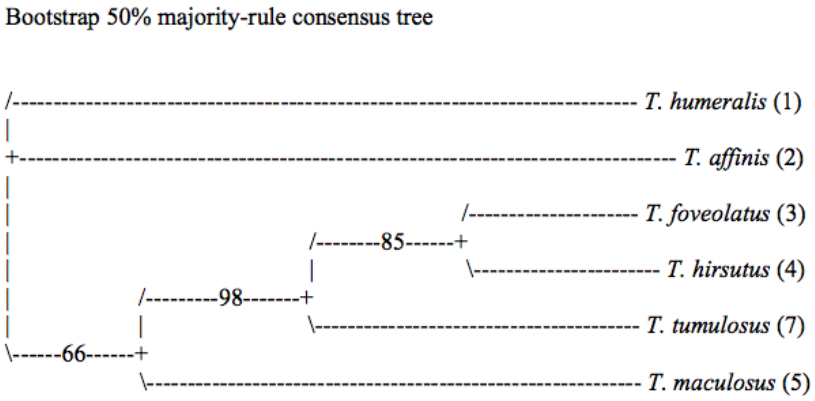


Fig. 7. Phylogenetic Tree provided from PAUP 4.0 using Parsimony.

Fig. 8.- Fig. 16. Most Parsimonious Tree Produced in MacClade with Character States Traced using ACCTRAN.

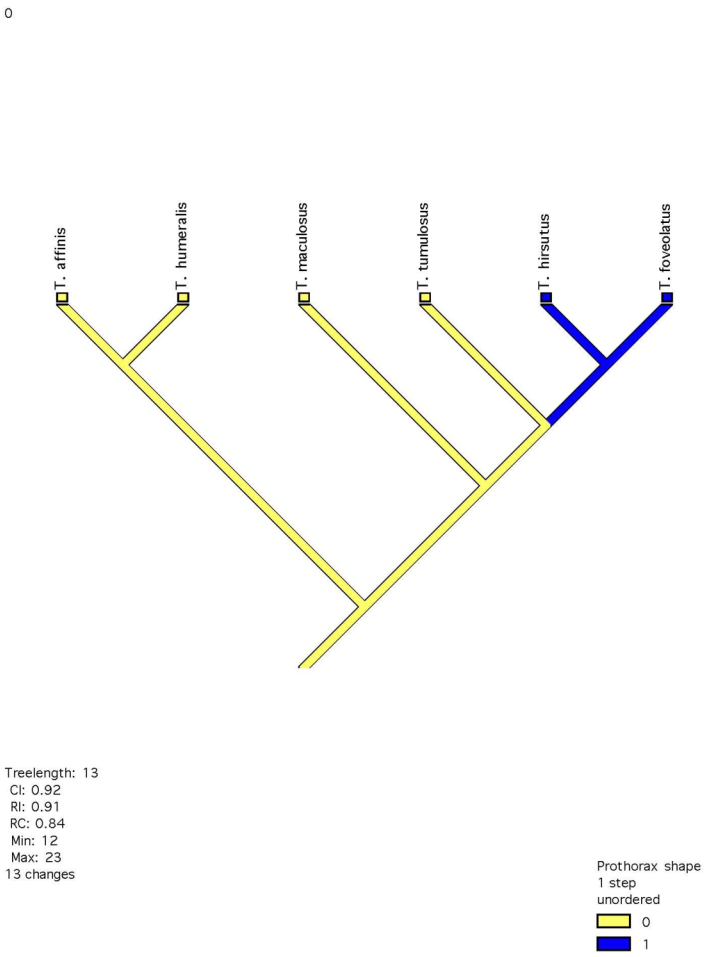


Fig. 8. Prothoracic shape character.

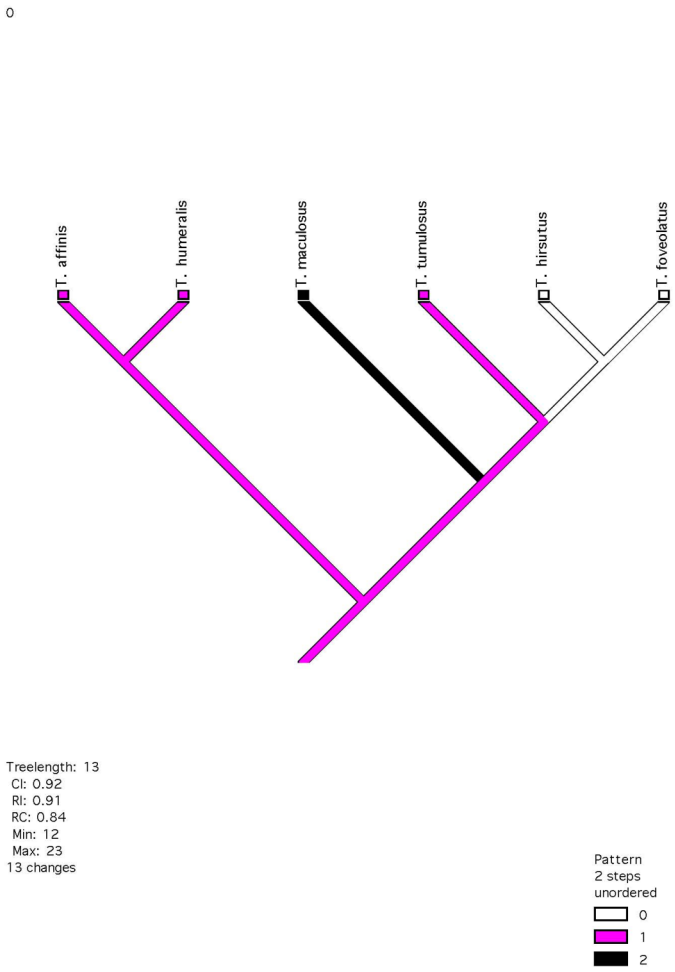


Fig. 9. Pattern character.

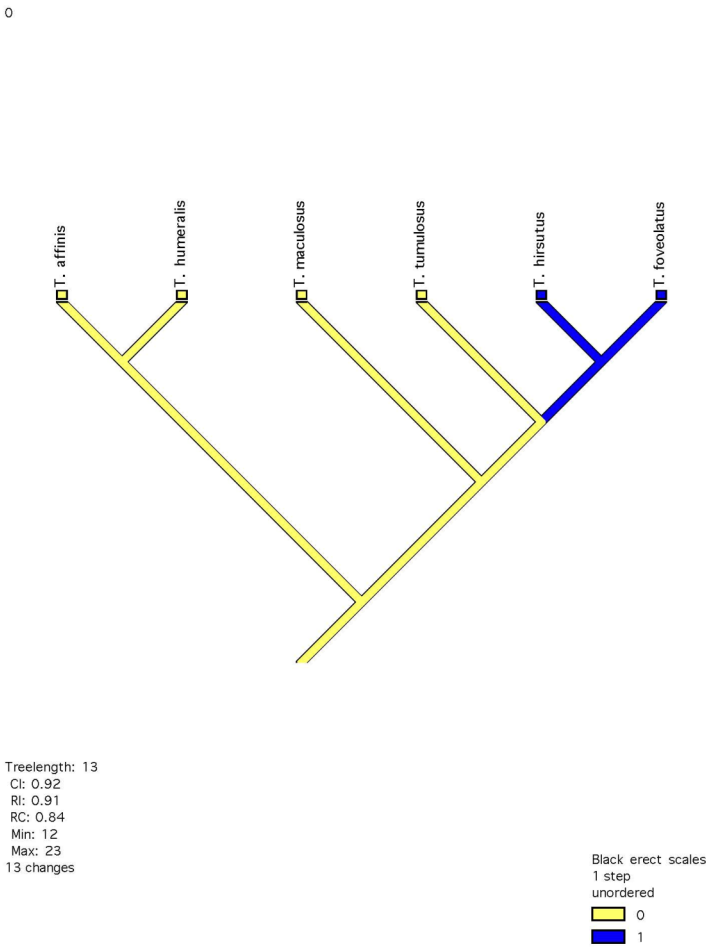


Fig. 10. Black erect scales character.

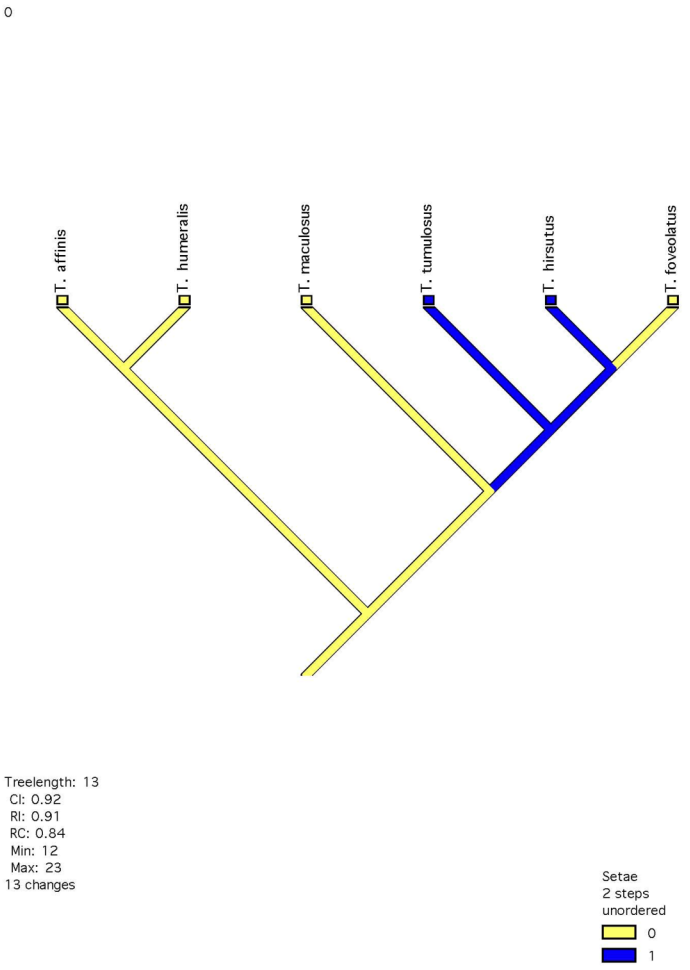


Fig. 11. Setae character.

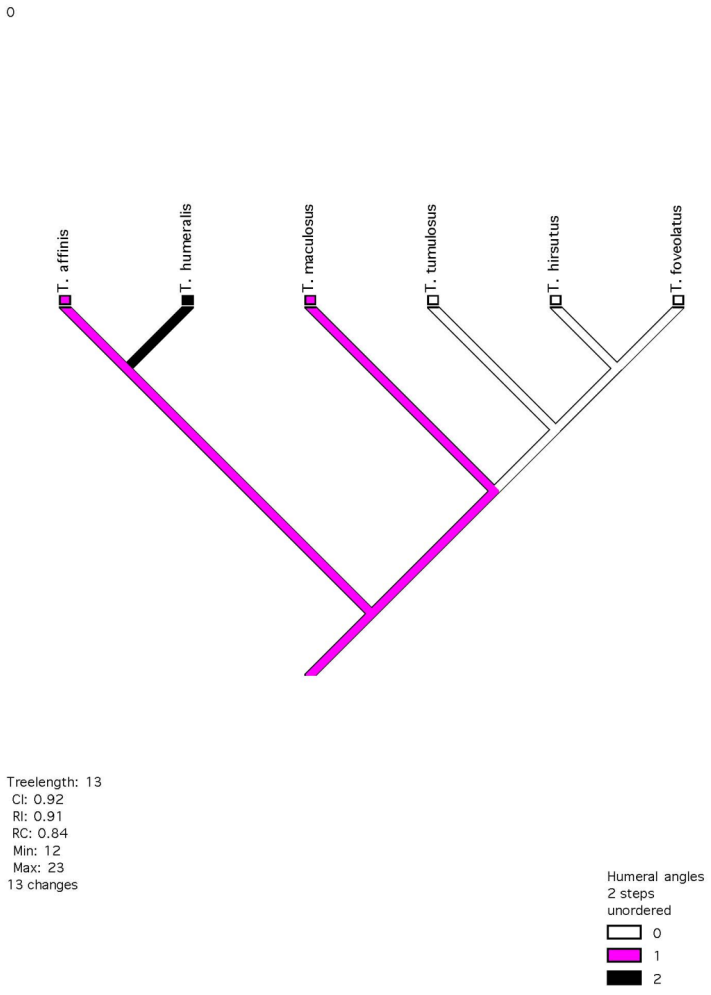


Fig. 12. Humeral angles character.

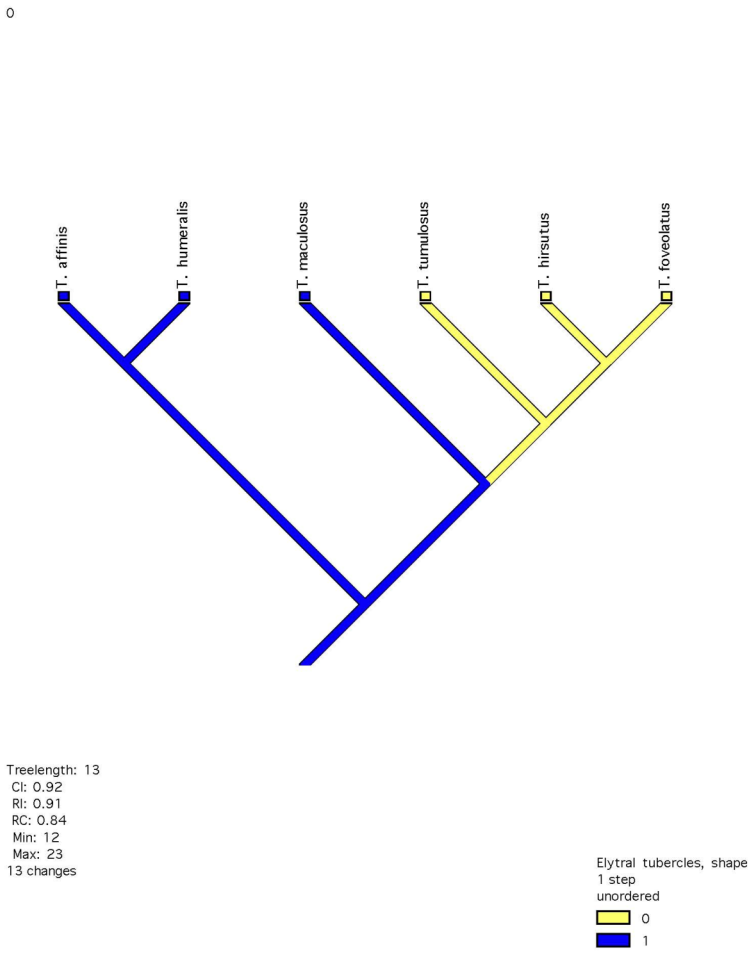


Fig. 13. Elytral tubercles, shape.

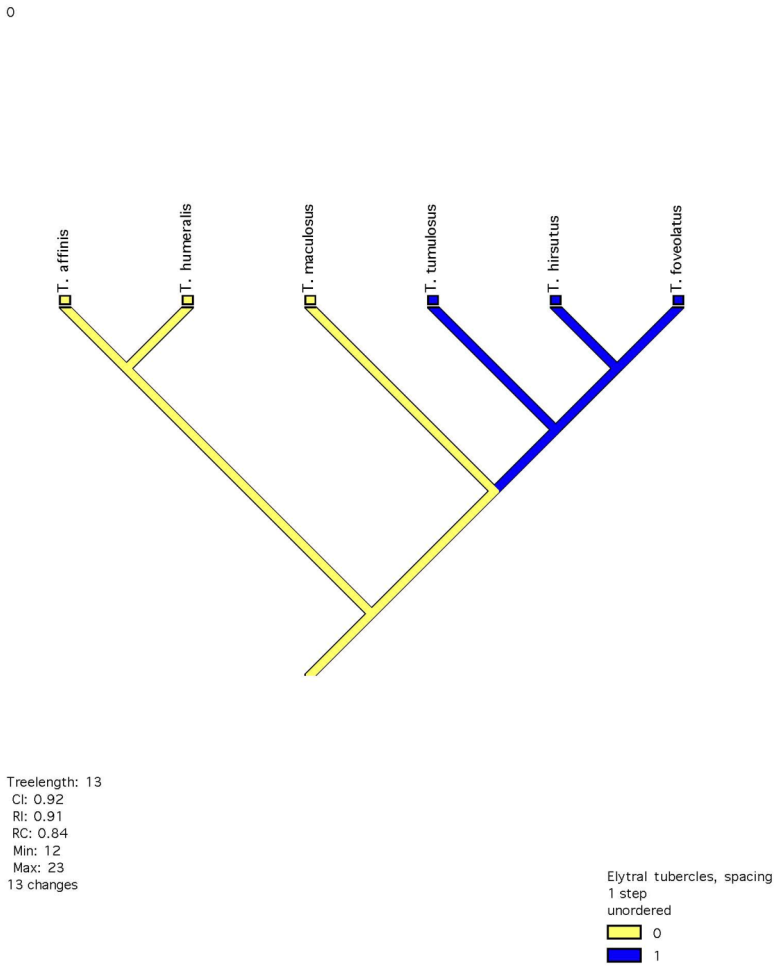


Fig. 14. Elytral tubercles, spacing.

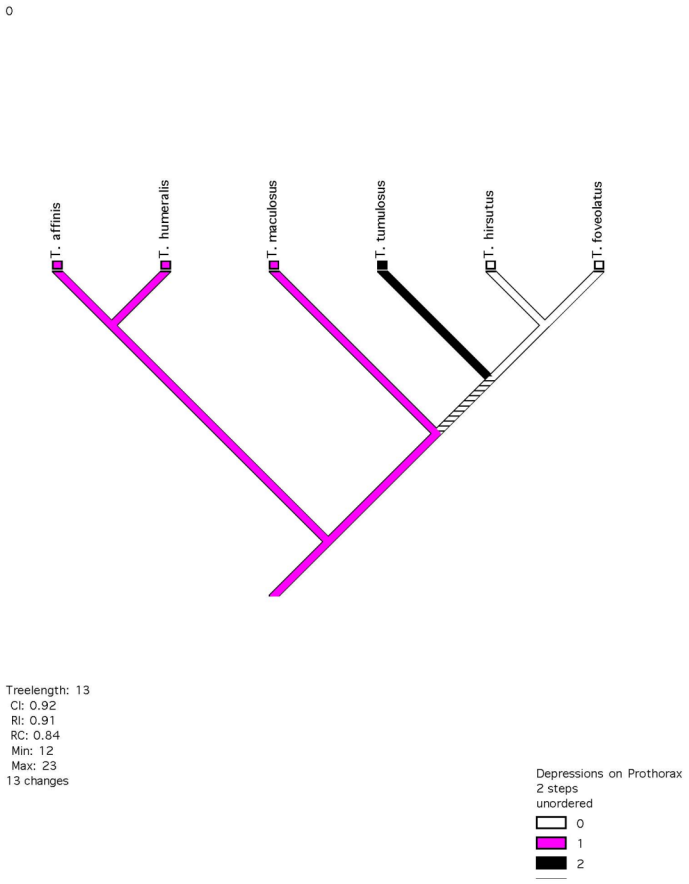


Fig. 15. Depression on prothorax character.

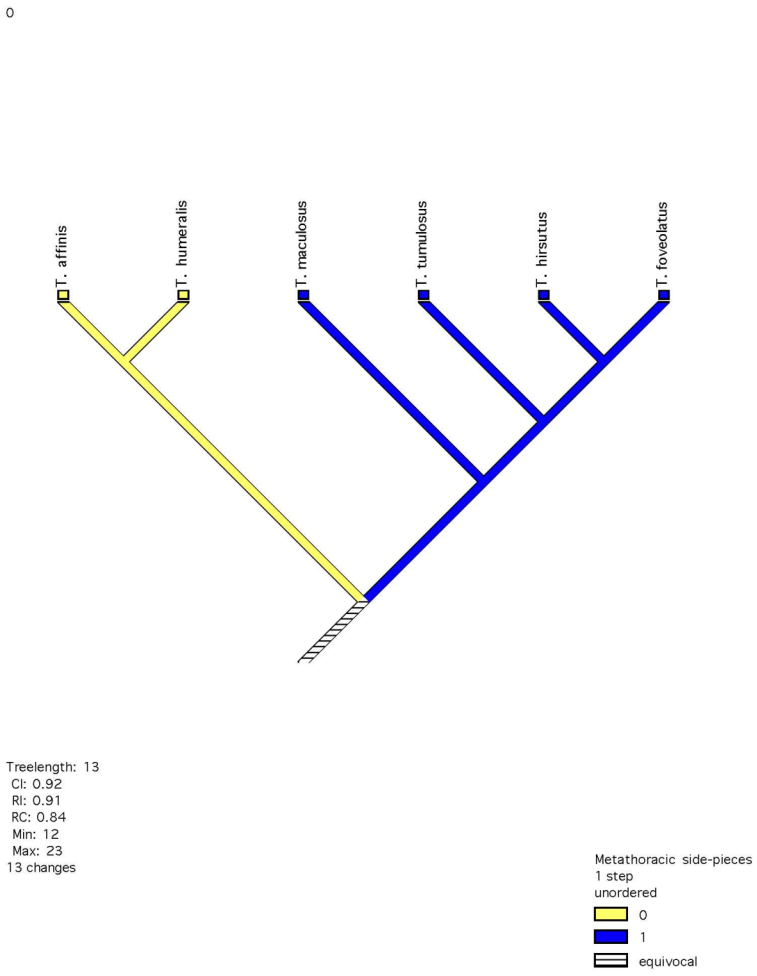


Fig. 16. Metathoracic side pieces character.

Fig. 17. *Parthenium hysterophorus.*[*]

Fig. 18. *Parthenium hysterophorus* infestation.[*]

[*] Images © The State of Queensland, Australia (2000); used by permission.

Fig. 19. *Thecesternus affinis*, dorsal.

Fig. 20. *Thecesternus affinis*, lateral.

Fig. 21. *Thecesternus foveolatus*, dorsal.

Fig. 22. *Thecesternus foveolatus*, lateral.

Fig. 23. *Thecesternus hirsutus*, dorsal.

Fig. 24. *Thecesternus hirsutus,* lateral.

Fig. 25. *Thecesternus humeralis*, dorsal.

Fig. 26. *Thecesternus humeralis*, dorsal.

Fig. 27. *Thecesternus humeralis*, lateral.

Fig. 28. *Thecesternus maculosus*, dorsal.

Fig. 29. *Thecesternus maculosus*, lateral.

Fig. 30. *Thecesternus tumulosus*, dorsal.

Fig. 31. *Thecesternus tumulosus*, lateral.

Fig. 32 a. Aedeagus for *Thecesternus affinis*

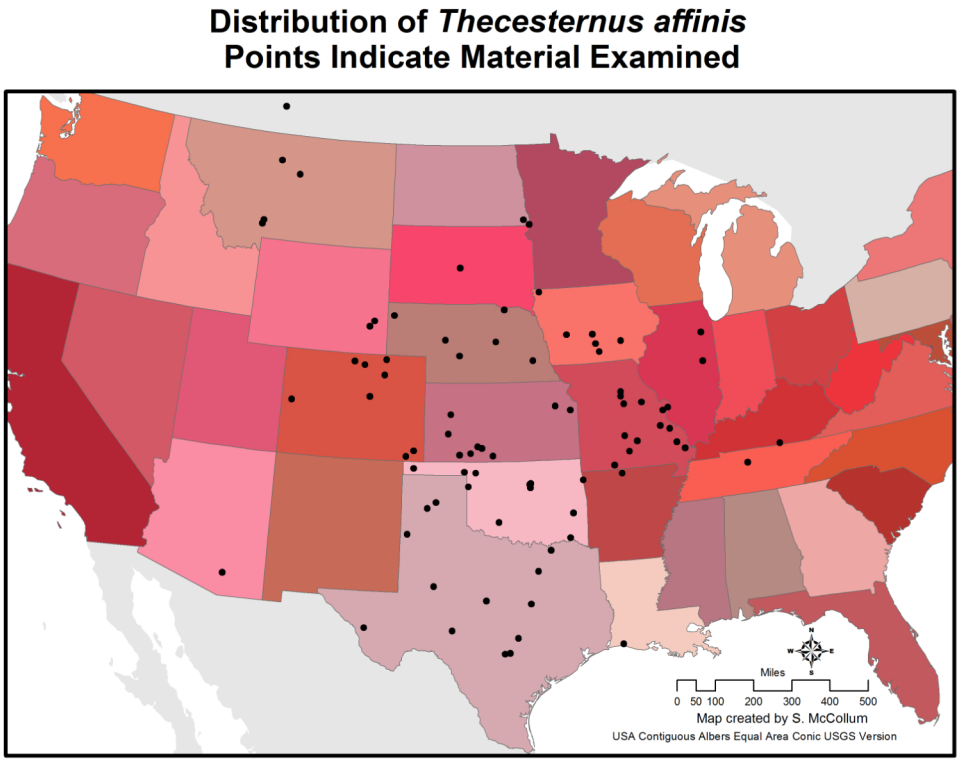
Fig. 32 b. Aedeagus for *Thecesternus foveolatus*

Fig. 32 c. Aedeagus for *Thecesternus hirsutus*

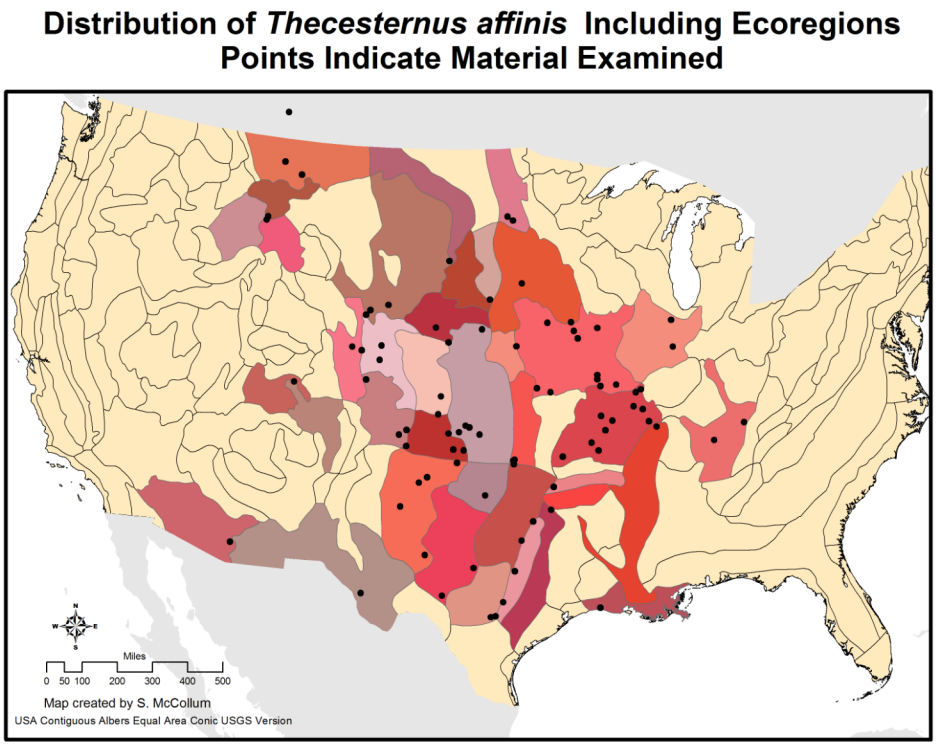
Fig. 32 d. Aedeagus for *Thecesternus humeralis*

Fig. 32 e. Aedeagus for *Thecesternus maculosus*

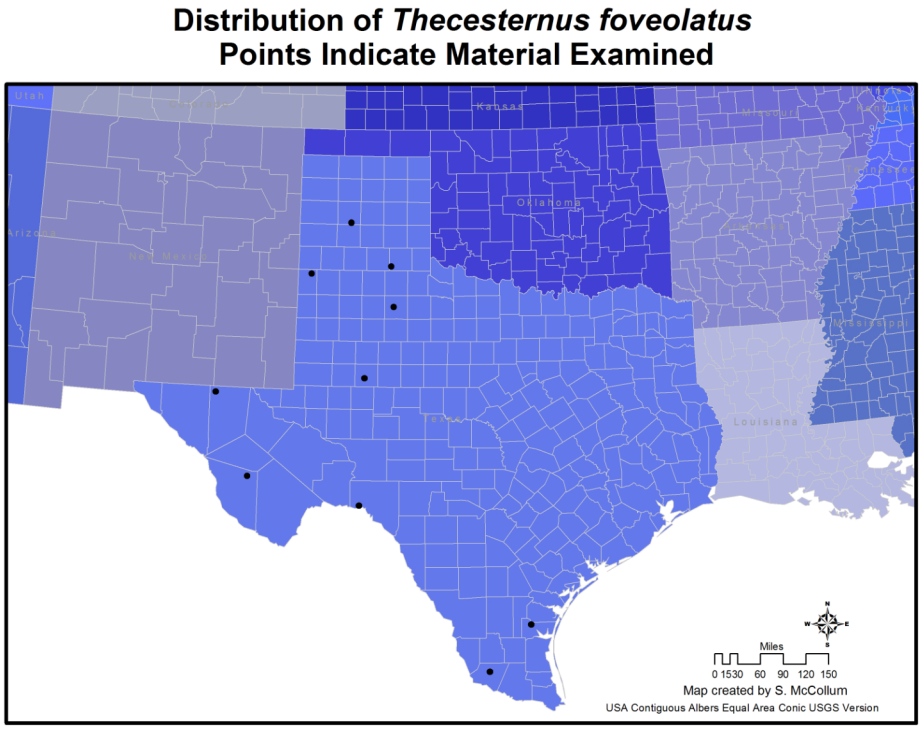
Fig. 32 f. Aedeagus for *Thecesternus tumulosus*



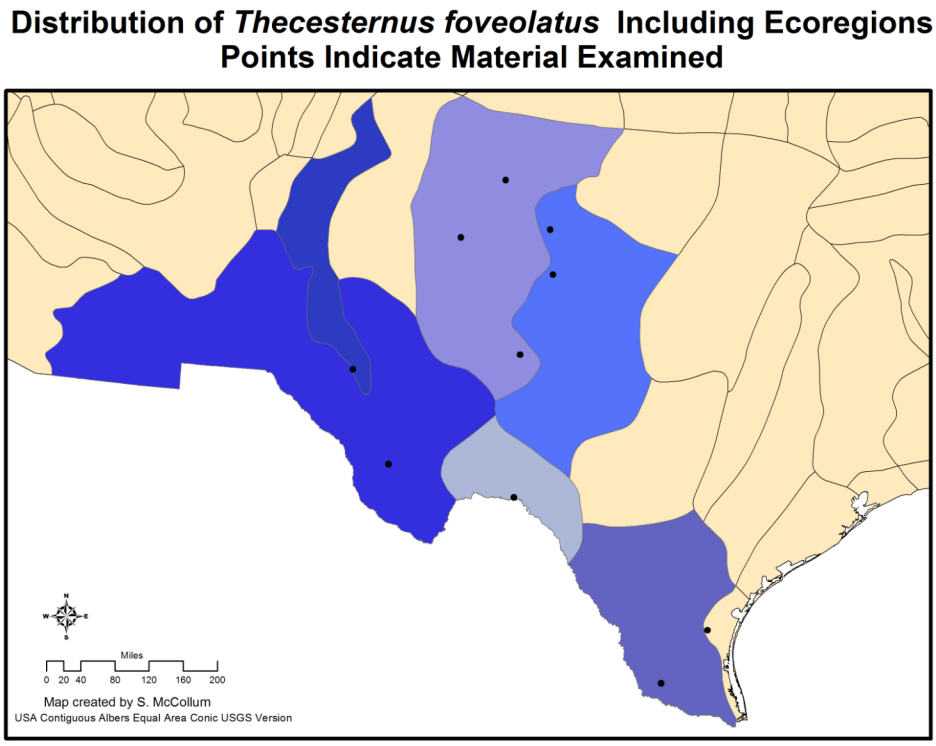
Map 1. Distribution of *Thecesternus affinis.*



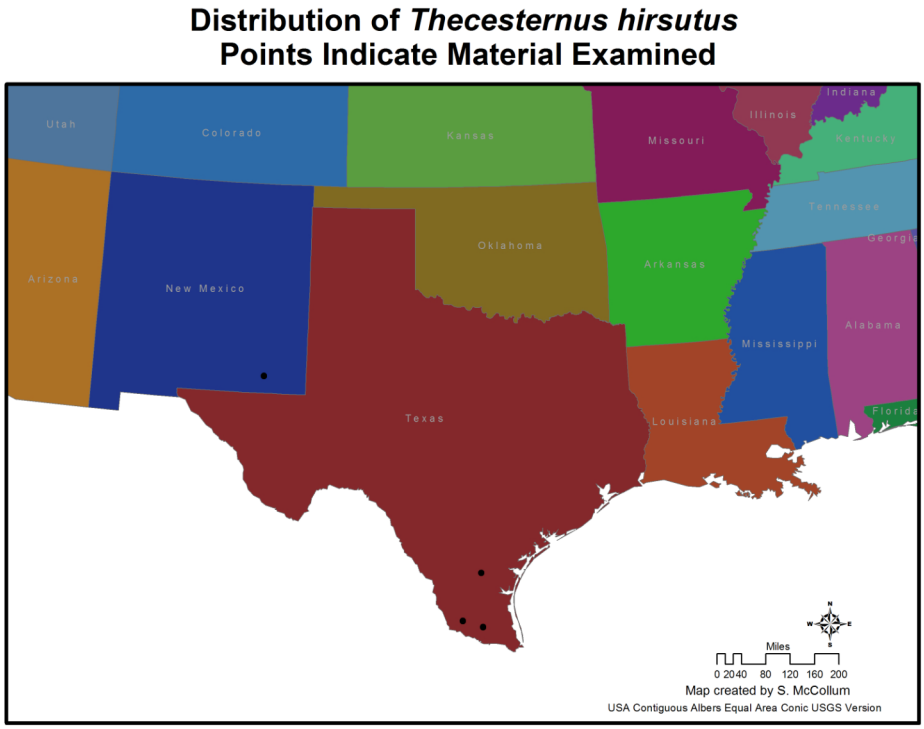
Map 2. Distribution of *Thecesternus affinis*, including ecoregions.



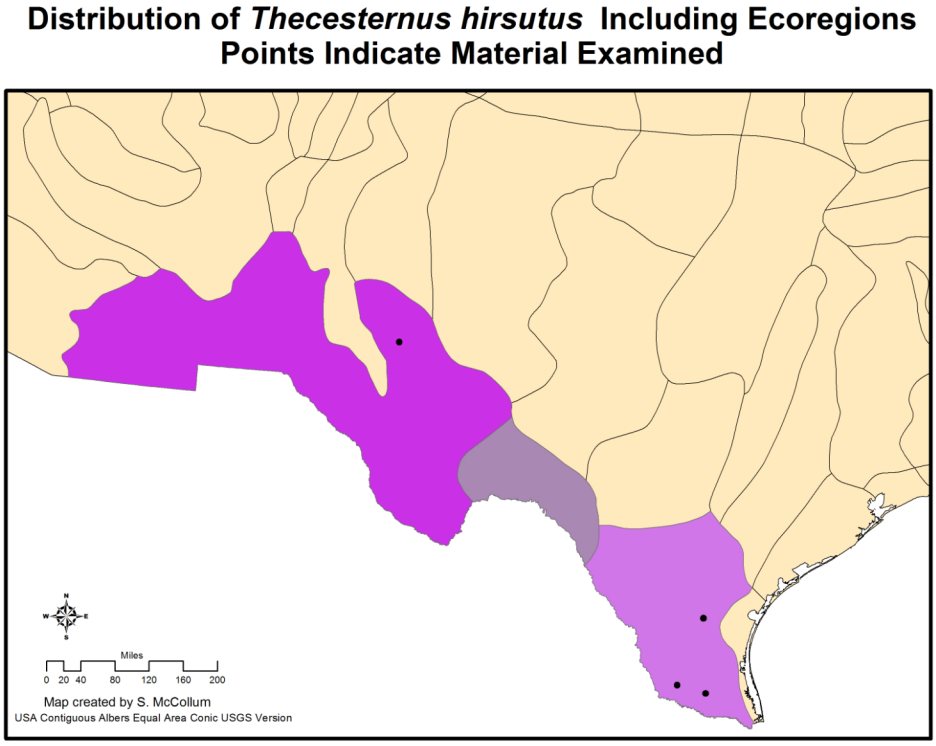
Map 3. Distribution of *Thecesternus foveolatus*.



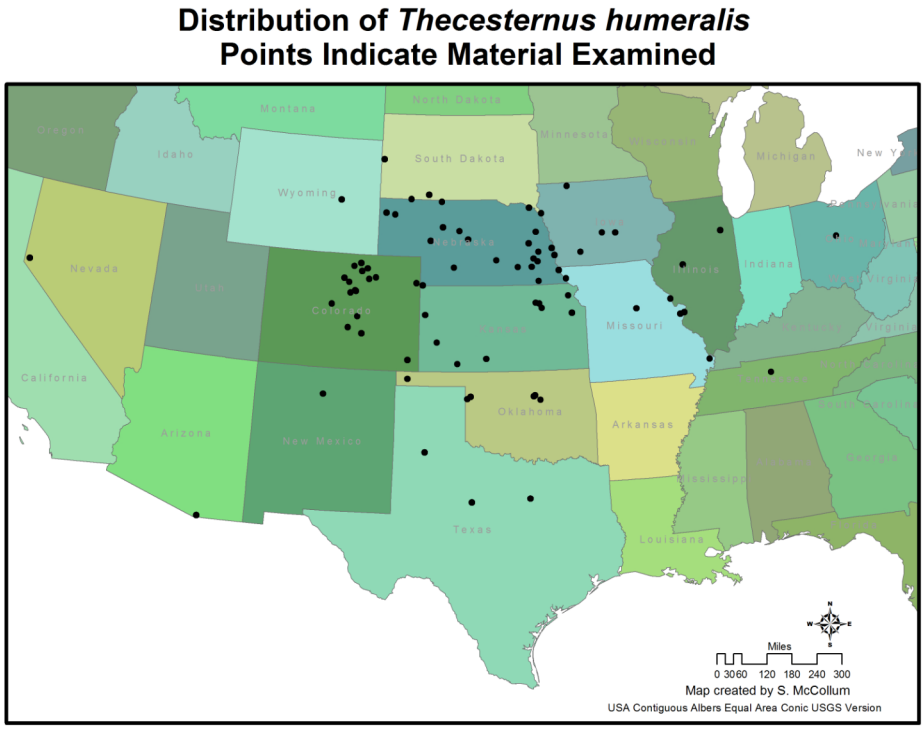
Map 4. Distribution of *Thecesternus foveolatus,* including ecoregions.



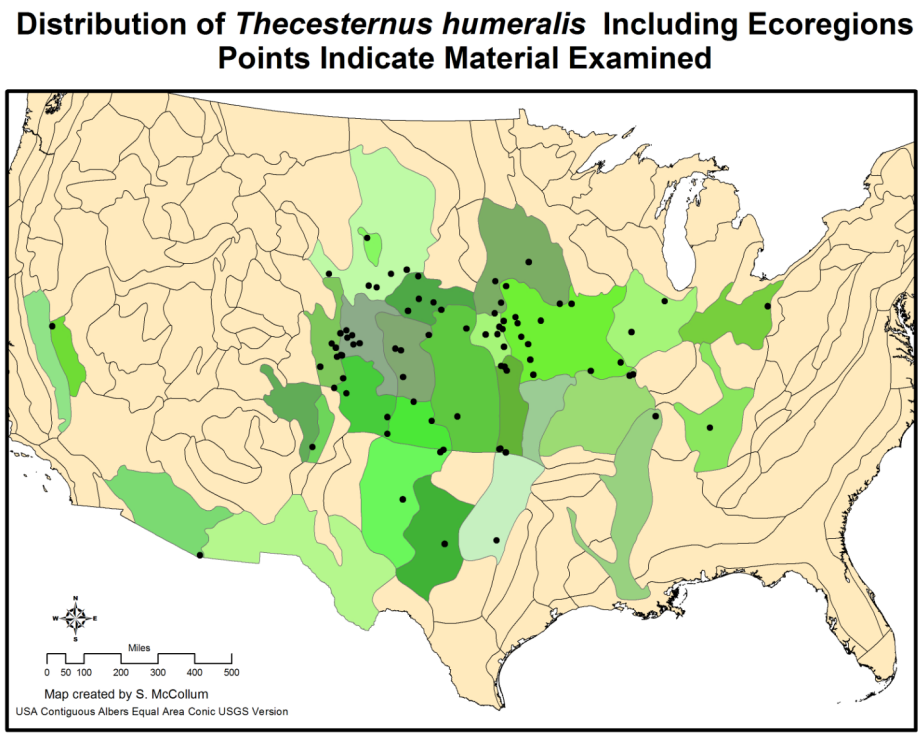
Map 5. Distribution of *Thecesternus hirsutus*.



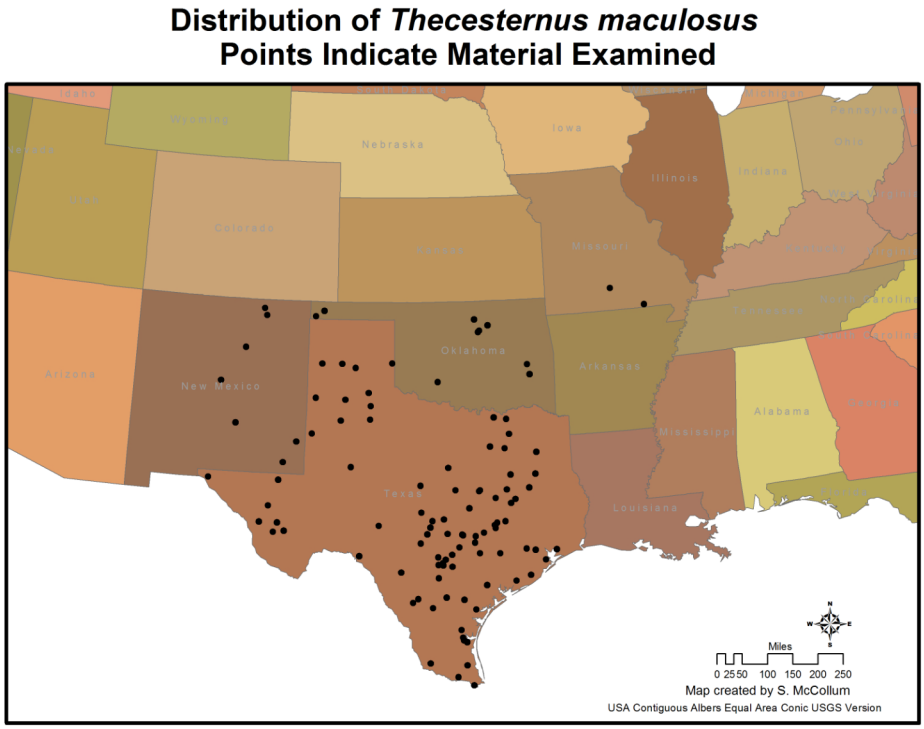
Map 6. Distribution of *Thecesternus hirsutus,* including ecoregions.



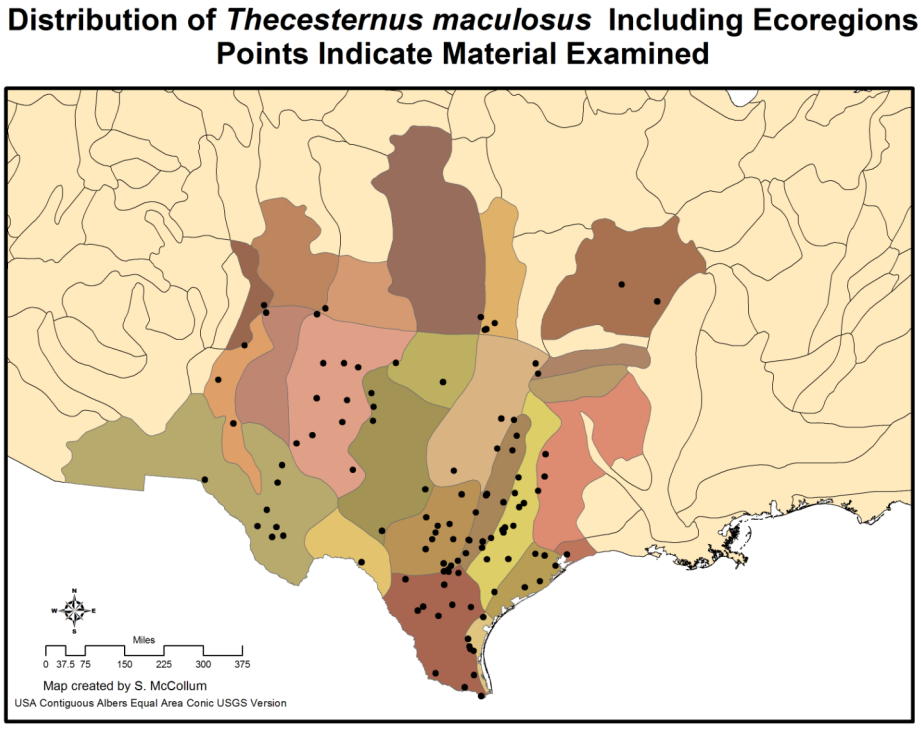
Map 7. Distribution of *Thecesternus humeralis*.



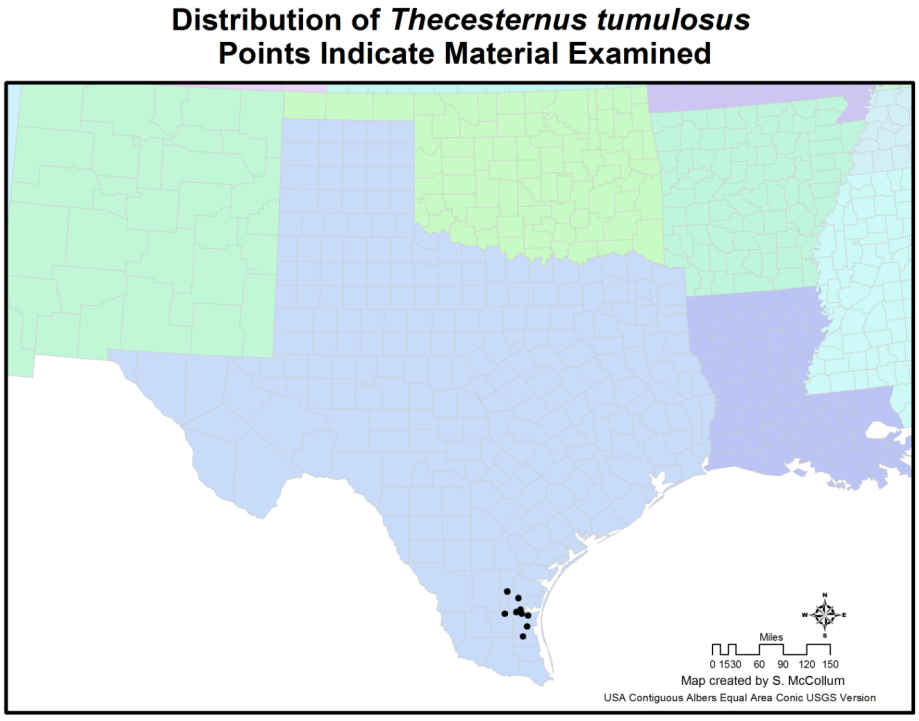
Map 8. Distribution of *Thecesternus humeralis,* including ecoregions.



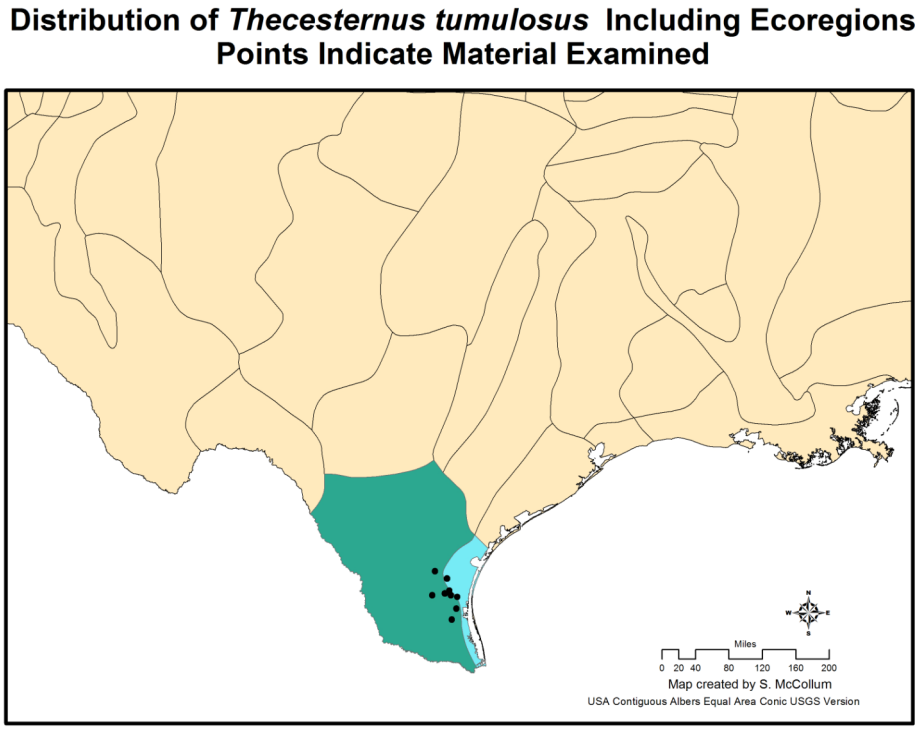
Map 9. Distribution of *Thecesternus maculosus*.



Map 10. Distribution of *Thecesternus maculosus*, including ecoregions.



Map 11. Distribution of *Thecesternus tumulosus*.



Map 12. Distribution of *Thecesternus tumulosus*, including ecoregions.

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