The Great Basin Naturalist

VOLUME XXII, 1962

EDITOR: VASCO M. TANNER
ASSISTANT EDITOR: STEPHEN L. WOOD
ASSISTANT EDITOR: WILMER W. TANNER

PUBLISHED AT PROVO, UTAH, BY
BRIGHAM YOUNG UNIVERSITY

TABLE OF CONTENTS

VOLUME XXII

NUMBERS 1-3 — OCTOBER 15, 1962

NUMBER 4 — DECEMBER 31, 1962

The Great Basin NATURALIST

Volume XXII **October 15, 1962** **Nos. 1-3**

TABLE OF CONTENTS

PUBLISHED BY
BRIGHAM YOUNG UNIVERSITY

The Great Basin Naturalist

A journal published from one to four times a year by Brigham Young University, Provo, Utah.

MANUSCRIPTS: Only original unpublished manuscripts, pertaining to the Great Basin and the Western United States in the main, will be accepted. Manuscripts are subject to the approval of the editor.

ILLUSTRATIONS: All illustrations should be made with a view to having then appear within the limits of the printed page. The illustrations that form a part of an article should accompany the manuscript. All half-tones or zinc etchings to appear in this journal are to be made under the supervision of the editor, and the cost of the cuts is to be borne by the contributor.

REPRINTS: No reprints are furnished free of charge. A price list for reprints and an order form is sent with the proof.

SUBSCRIPTIONS: The annual subscription is $2.50, (outside the United States $3.25). Single number, 80 cents.

All correspondence dealing with manuscripts, subscriptions, reprints and other business matters should be addressed to the Editor, Vasco M. Tanner, Great Basin Naturalist, Brigham Young University, Provo, Utah.

REPRINTS SCHEDULE OF THE GREAT BASIN NATURALIST

	2 pp.	4 pp.	6 pp.	8 pp.	10 pp.	12 pp.	Each Additional 2 pp.
50 copies	$6.00	$7.00	$8.00	$9.00	$10.00	$11.00	$2.00
100 copies	7.00	8.00	9.00	10.00	11.00	12.00	
200 copies	8.00	9.00	10.00	11.00	12.00	13.00	
300 copies	9.00	10.00	11.00	12.00	13.00	14.00	

COVERS: $10.00 for first 100 copies, $4.00 for additional 100 copies.

The Great Basin Naturalist

Published at Provo, Utah by
Brigham Young University

Volume XXII | October 15, 1962 | Nos. 1-3

UNDESCRIBED SPECIES OF NEARCTIC TIPULIDAE (DIPTERA). II.

Charles P. Alexander[1]

At this time I am describing certain novelties from the eastern United States, collected in Tennessee by Dr. Inez W. Williams and in Illinois by Dr. Jane C. Dirks Edmunds, and from the western United States, chiefly captured in California by Dr. Dennis Hynes and in Nevada by Dr. Mont A. Cazier. I am greatly indebted to all of these students for the privilege of retaining the type specimens in my personal collection of these flies.

Tipula (*Trichotipula*) *dis*, n. sp.

Size medium (wing of male 10 mm.); antennae relatively long; mesonotal praescutum with a broad central gray stripe, lateral margins and a median stripe on posterior notal sclerites yellow; femoral obscure yellow, tips very narrowly dark brown, claws very small; wings slightly darkened, cell *Sc* and stigma still darker brown; sparse macrotrichia in outer ends of cells R_5 and M_1; male hypopygium with beak of inner dististyle a long slender blade; eighth sternite with posterior border truncate.

Male.— Length about 12 mm.; wing 10 mm.; antenna about 4.4 mm.

Frontal prolongation of head above, including the long nasus, yellow, sides dark brown; palpi brownish black, terminal segment paling into obscure orange. Antennae elongate, scape and pedicel light yellow, flagellum black; flagellar segments much exceeding their verticils, basal enlargements small. Head light yellow, whitened anteriorly, sides of posterior vertex with a brown spot, lower genae paler brown; vertical tubercle very low to virtually lacking.

Pronotum yellow, sides darkened. Mesonotal praescutum with a broad central gray stripe, lateral stripes narrow and less distinct, lateral praescutal borders light yellow, interspaces dark brown; posterior sclerites of notum with a continuous light yellow central stripe, scutal lobes gray, the areas ringed with brown; parascutella and sides of mediotergite brown, pleurotergite more yellowed. Pleura reddish brown, variegated by yellowed areas on dorsal sternopleurite,

1. Amherst, Massachusetts.

posterior sclerites and dorsopleural region. Halteres with stem yellowed, brighter at base, knob infuscated. Legs with coxae brown, middle pair slightly paler; trochanters yellow; femora obscure yellow, tips very narrowly dark brown; tibiae and basitarsi obscure yellow, remainder of tarsi brownish black; claws very small, simple. Wings slightly darkened, cell *Sc* and stigma darker brown; pale areas before and beyond stigma and more narrowly across cell *1st* M_2; narrow indistinct whitened longitudinal streaks in cells beyond cord, outer ends of cells *R* and *M* and in cell *1st A*; veins light brown. Beyond cord veins R_{1+2}, R_3, R_{4+5}, M_{1+2}, outer end of M_3 and *Cu* with macrotrichia, these lacking on M_4; basad of cord lacking on *Rs*, *M* and *1st A*, present on outer half of *2nd A*; outer half of cell R_5 and distal end of cell M_1 with macrotrichia. Venation: Petiole of cell M_1 about one-half *m*.

Abdomen basally reddish brown, darker outwardly; eighth sternite paler medially and at base, with a darkened spot on either side. Male hypopygium with posterior border of tergite broadly notched, the base of the emargination obtusely rounded; margins of lobes with relatively few slender black spines, those near apex sparse and much smaller. Outer dististyle pale, relatively broad, margins with abundant very long black setae; inner style with beak long and slender, bladelike; outer basal lobe small, appearing triangular in profile. Eighth sternite with posterior border truncate to gently convex, unmodified.

HABITAT.— Nevada (Nye County).

HOLOTYPE, ♂, Oak Spring, Belted Range, May 26, 1940 (Mont A. Cazier and associates).

Tipula (*Trichotipula*) *dis* is most similar to species such as *T.* (*T.*) *cazieri* Alexander and *T.* (*T.*) *dorsolineata* Doane, differing especially in the hypopygial structure, particularly the inner dististyle. It may be noted that *dorsolineata* lacks the macrotrichia in the outer wing cells.

Tipula (*Platytipula*) *paterifera*, n. sp.

Belongs to the *cunctans* group; mesonotal praescutum gray with four pale brown stripes that are insensibly bordered by darker brown; posterior sclerites of notum with a narrow brown central line; flagellar segments strongly incised, the basal ones weakly bicolored; femora brownish yellow, tips brownish black; wings brownish yellow, cells *C* and *Sc* dark brown; abdomen yellow, tergites very narrowly trivittate with brown; male hypopygium with dorsal tergal plate very narrowly and deeply notched, lower plate entire, its posterior border strongly concave, the lateral angles produced; outer dististyle longer than the inner style, the latter unusually simple in structure, produced into a slender smooth beak.

MALE.— Length about 15-16 mm.; wing 15-16 mm.; antenna about 4.7-4.8 mm.

FEMALE.— Length about 16 mm.; wing 12.5 mm.

Frontal prolongation of head yellow, dorsal surface light gray; nasus elongate; basal segments of palpi brown, terminal segment darker. Antennae with three basal segments yellow, scape slightly pruinose; basal flagellar segments weakly bicolored, strongly incised, basal swellings dark brown, paler outwardly, apex dilated, segments longer than their verticils. Head above brownish yellow with a darker brown central line, orbits clearer gray, occiput narrowly yellowed; vertical tubercle small.

Pronotum brownish gray. Mesonotal praescutum gray with four pale brown stripes that are insensibly bordered by darker brown; posterior sclerites of notum light gray, scutal lobes slightly darker; a vague pale brown interrupted central line from suture to base of abdomen, pleurotergite pale gray, more yellowed above. Pleura clear light gray; dorsopleural membrane light yellow. Halteres with stem pale yellow, knob infuscated. Legs with coxae pale gray; trochanters yellow; femora brownish yellow, tips passing into brownish black; tibiae and tarsi light brown, outer tarsal segments still darker; claws simple. Wings brownish yellow, cells *C* and *Sc* dark brown, stigma more brownish yellow; pale brown clouds in outer ends of cells *M* and *1st A*, less evident in other cells; veins brown. Veins beyond cord with sparse long trichia, lacking on the veins comprising cell *1st* M_2; basad of cord with trichia on *Sc* and *Rs*, most of Cu_1 and *2nd A* and extensively on *M*, lacking on *1st A*. Venation: *Rs* variable in length, from being subequal to nearly twice *m-cu*; cell *1st* M_2 long, narrowed outwardly, M_{3+4} relatively short, from about two-thirds to subequal to *m*.

Abdomen yellow, tergites very narrowly trivittate with brown, sternites with posterior borders narrowly darkened, the pattern continued throughout the length of the abdomen. Male hypopygium with dorsal plate of tergite deeply and narrowly notched medially, forming broad lateral lobes, their margins subtruncate to feebly concave, weakly crenulate; lower tergal plate entire, its posterior border strongly concave, blackened, lateral angles produced into conspicuous smooth lobes, their tips obtuse. Outer dististyle long and slender, broadest at near midlength; inner style unusually simple in structure, shorter than the outer style, narrow, produced into a slender smooth beak; no lower beak or outer basal lobe developed. Lobes of ninth sternite of moderate length.

HABITAT.— Tennessee (Sevier County).

HOLOTYPE, ♂, Sevierville, October 23, 1938 (Inez W. Williams). *Allotopotype*, ♀, pinned with type. *Paratopotype*, 1 ♂, with the type.

The most similar species is *Tipula* (*Platytipula*) *cunctans* Say, the economically important 'Smoky Crane-fly,' which differs evidently in the structure of the male hypopygium, particularly the tergite and inner dististyle. The species of this group have long been referred to the typical subgenus but it now seems desirable to remove them to *Platytipula* Matsumura, 1916, type *moiwana* Matsumura of Japan, a course followed by Savtshenko, 1961, in his outstanding

treatment of the Tipulinae of the U.S.S.R. Other Nearctic species include *T.* (*P.*) *carinata* Doane, *T.* (*P.*) *maritima* Alexander, *T.* (*P.*) *nebulinervis* Alexander, *T.* (*P.*) *pendulifera* Alexander, *T.* (*P.*) *spenceriana* Alexander, *T.* (*P.*) *tennessa* Alexander and *T.* (*P.*) *ultima* Alexander. It is of interest to note that the known range of *pendulifera* and *spenceriana*, hitherto recorded as being northwestern species, has been extended to Newfoundland.

Tipula (*Lunatipula*) *triplex integra*, n. subsp.

Male.— Length about 17-18 mm.; wing 16.5-17 mm.; antenna about 6 mm.

Antennae relatively long, flagellum bicolored, with only the outer two or three segments more uniformly darkened. Wings relatively narrow; *m-cu* shortly before fork of M_{3+4}. Male hypopygium with the median tergal lobe very slender, entire, provided with long conspicuous setae to the apex; lateral lobes much stouter but only a trifle longer than the median lobe. Eighth sternite with the submedian lobe broad at base, slightly narrowed to the obtuse tip, surface with microscopic striae.

I am placing this fly as a race of *triplex* Walker chiefly on the conspicuous difference in structure of the median lobe of the ninth tergite as described. There is no trace of an apical split such as occurs in all other races and allied species. All specimens of the type series are identical in this character.

Habitat.— Illinois (Piatt County).

Holotype, ♂, White Heath, along the Sangamon River, May 29, 1938 (Jane C. Dirks Edmunds). *Paratopotypes*, 2 ♂♂, May 15-29, 1938.

Tipula (*Hesperotipula*) *linsdalei obispoensis*, n. subsp.

Male.— Length about 16 mm.; wing 14 mm.; antenna about 4 mm.

Differs from typical *linsdalei* chiefly in hypopygial characters. Ninth tergite with the major emargination much deeper, lateral lobes conspicuous, median notch linear, shorter. Inner dististyle with posterior lobe smaller, the outer basal lobe narrow. Setae of the sternal lobes elongate, as in the typical race, quite different from the short dense plushlike setae found in *micheneri* Alexander and some allied species.

Typical *linsdalei* Alexander was described from the Hastings Reservation, Monterey Co., California, May 6-June 1, 1943, taken by Dr. Jean M. Linsdale (Bull. Brooklyn Ent. Soc., 46:85-86; 1951).

Habitat.— California (San Luis Obispo County).

Holotype, ♂, San Luis Obispo, April 27. 1961 (Dennis Hynes).

Cryptolabis (*Cryptolabis*) *magnistyla*, n. sp.

General coloration of mesonotum brown, sparsely pruinose, pleura more variegated by yellow; femora obscure yellow, tips narrowly brownish black; male hypopygium with the tergite emargi-

nate, lateral lobes provided with relatively few moderately long setae; dististyle appearing terminal, large, bidentate, the lower blade very large; aedeagus elongate.

MALE.— Length about 4 mm.; wing 4.4 mm.

Rostrum and palpi dark brown. Antennae black; flagellar segments a little shorter than their verticils. Head dark.

Pronotum light yellow. Mesonotal praescutum brown, with three confluent gray stripes, more blackened in front, scutal lobes similarly blackish gray; scutellum blackened, pruinose; postnotum black, pruinose, variegated by whitened areas on anterior lateral margins of mediotergite and across the pleurotergite. Pleura dark brown, variegated by yellow on dorsal sternopleurite, posterior sclerites and the dorsopleural membrane. Halteres with stem yellow, knob weakly infuscated. Legs with coxae brownish yellow; trochanters yellow; femora and tibiae obscure yellow, tips narrowly brownish black; tarsi brownish yellow basally, outer segments darker. Wings whitish subhyaline, base clearer white; cord and vein *Cu* in cell *M* narrowly and vaguely darker; veins brown, whitened in the prearcular field. Macrotrichia in centers of cells R_3 through M_3. Venation: *Rs* oblique, gently arculated, forming a V with R_{2+3+4}; R_{2+3} about twice R_2; *m-cu* at near midlength of M_{3+4}.

Abdomen dark brown. Male hypopygium with the tergite broadly emarginate, setae of lateral lobes moderately long, not retrorse. Basistyle with inner apical lobe with long setae from strong tubercles. Dististyle appearing terminal in position, large, bidentate, the lower blade narrowing to an acute point, the outer marginal tooth much shorter. Aedeagus elongate, as in *bidenticulata*.

HABITAT.— California (Monterey County).

HOLOTYPE, ♂, Salmon Creek, June 25, 1961 (Dennis Hynes).

Cryptolabis (*Cryptolabis*) *magnistyla* is most similar to *C.* (*C.*) *bidenticulata* Alexander, differing evidently in the proportions of the teeth of the dististyle. In the latter species, the hypopygium as mounted on slides, appears to be subterminal in position but this may be caused by the method of mounting. In *bidenticulata* what appear to be the lateral tergal lobes are large oval structures provided with very long yellow setae, the more basal ones retrorse, the smaller inner ventral lobes separate.

Ormosia (*Ormosia*) *hynesi*, n. sp.

General coloration of head and thorax almost uniformly gray; femora and tibiae obscure yellow; wings light brown, stigma barely indicated, R_2 at fork of R_{2+3+4}; male hypopygium with tergal lobe widened outwardly, apex weakly bilobed; dististyles terminal, both irregular in outline, provided with spinous points or teeth, the inner style at apex further produced into a curved flattened appendage; gonapophysis a blackened rod, at base with a small slender straight spine.

Male.— Length about 4.5 mm.; wing 5 mm.; antenna about 1.1 mm.

Rostrum brown; palpi brownish black. Antennae of medium length; scape and pedicel dark brown, basal flagellar segments testaceous, outer ones passing into brownish black; flagellar segments long-oval, shorter than their verticils, with a further dense white pubescence. Head dark gray.

Pronotal scutum brownish gray, scutellum and pretergites yellowed. Mesonotum almost uniformly gray, praescutal stripes scarcely evident; pseudosutural foveae and tuberculate pits black; sides of scutellum, parascutella and pleurotergite more reddish brown. Pleura gray, dorsopleural membrane buffy. Halteres with stem yellow, knob very weakly darkened. Legs with coxae pale brown; trochanters yellow; femora and tibiae obscure yellow, the tibial tips and the tarsi darker. Wings light brown, base slightly more yellowed, stigma barely indicated; veins brown. Venation: Sc_1 ending just beyond R_2, the latter at fork of R_{2+3+4}; cell *2nd* M_2 nearly three times its petiole; *m-cu* perpendicular, just before fork of *M*.

Abdomen brown. Male hypopygium with tergal lobe widened outwardly, its apex weakly bilobed. Both dististyles terminal, very irregular in outline, subequal in size; outer style with two acute divergent spines, the apex farther extended into a narrow blade; inner style narrowed beyond base, dilated into a flattened blade that terminates in a curved flattened appendage, the outer margin of blade with two acute teeth and a broader obtuse lobe. Gonapophysis a blackened rod, its expanded base with a small slender straight spine.

Habitat.— California (San Luis Obispo County).

Holotype, ♂, Cerro Alto, February 16, 1958 (Dennis Hynes).

I take great pleasure in dedicating this distinct crane-fly to Dr. Dennis Hynes who has added greatly to our knowledge of Nearctic Tipulidae. The most similar regional species include *Ormosia* (*Ormosia*) *cornuta* (Doane), *O.* (*O.*) *curvata* Alexander, and some others, all readily distinguished among themselves in the hypopygial structure, particularly the dististyles.

Molophilus (*Molophilus*) *aspersulus*, n. sp.

Belongs to the *gracilis* group, *pubipennis* subgroup, allied to *gracilipes;* antennal scape and pedicel brownish yellow, tips narrowly darker brown; male hypopygium with the inner dististyle widened at near midlength, bent at almost a right angle.

Male.— Length about 4.5 mm.; wing 5.1-5.2 mm.; antenna about 1.1 mm.

Rostrum dark brown; palpi black. Antennae with scape and pedicel brownish yellow, flagellum dark brown; terminal segment shorter and smaller than the penultimate; in *gracilipes*, longer than the penultimate. Head gray.

Pronotum and pretergites light yellow. Mesonotal praescutum light brown, the humeri pale yellow; pseudosutural foveae reddish

brown; scutum light brown, scutellum more yellowed; postnotum dark brown, more yellowed at the interpostnotal suture. Pleura medium brown, variegated with yellow, especially on the dorsal sternopleurite and dorsopleural region. Halteres light yellow. Legs with coxae obscure yellow; trochanters yellow; femora brownish yellow, tips narrowly darker brown; tibiae and tarsi brown, outer segments darker brown; legs, especially the posterior pair, long and slender, as in *gracilipes;* posterior legs with femora and tibiae virtually as in *gracilipes*, the basitarsi evidently longer (in *aspersulus*, tibia, 4.25 mm.; basitarsus, 1.75 mm.; in *gracilipes*, tibia, 4.2 mm.; basitarsus, 1.35 mm.). Wings narrower than in *gracilipes;* prearcular and costal fields somewhat clearer yellow than remainder; veins brownish yellow, macrotrichia long and conspicuous, brown. Venation: R_2 slightly before level of *r-m*; petiole of cell M_3 slightly more than twice *m-cu*.

Abdomen brown, hypopygium slightly more yellowed. Male hypopygium most as in *gracilipes*, differing in details of structure. Outer dististyle a little broader, outer margin with appressed spinules, those of lower edge stout, erect, conspicuous, sides of style unarmed; in *gracilipes*, the spinules more generally distributed over the surface; inner style beyond midlength bent almost at a right angle, extended into an acute point; outer margin with relatively few but long delicate setae.

HABITAT.— California (San Luis Obispo County).

HOLOTYPE. ♂, Dune Lake, May 2, 1958 (Dennis Hynes).

PARATYPE. ♂, R. 27 W, T 11 N, S 31, April 28, 1958 (Dennis Hynes).

The chief differences from *Molophilus* (*Molophilus*) *gracilipes* Alexander (Sonora Pass, California, 8,600 feet) are indicated throughout the above description.

A NEW MYRMECOPHILOUS LACEBUG FROM PANAMA (HEMIPTERA: TINGIDAE)

Carl J. Drake[1] and Richard C. Froeschner[2]

Among miscellaneous hemipterons in the United States National Museum, the authors found two specimens of an undescribed species of a myrmecophilous tingid belonging to the subfamily Vianaidinae. These specimens were obtained in Panama by the late James Zetek, who collected many rare and curious insects of various orders in the American tropics.

The four members of the vianaidines, including the new species described herein, are indigenous to and known only from the Neotropical region. The literature contains scant information relative to their natural history and coexistence with ants in subterranean ant nests. One species, *Anommatocoris coleopteratus* (Kormilev) (1945), was found in the nests of a leaf-cutting ant (*Acromyrmex lundi* Guérin) in Argentina. According to M. J. Viana, who collected the type series and subsequent specimens, adults and nymphs alike feed on the sap sucked from the fine rootlets of the introduced honey locust, *Gleditsia triacanthos*, growing in the ant nests.

In a recent paper on the higher classification and morphology of Tingidae, Drake and Davis (1960) included an illustrated monograph of the subfamily Vianaidinae. Certain features of the vianaidines, which have not shared similar development in the other two subfamilies, set them apart as a subfamilial taxon. These structures are: 1) Inordinate development of tht ostiole and furcate ostiolar channel with the backward branch forming a somewhat Y-shaped sulcus (fig. 2); 2) an unusually large evaporatorium that covers the entire metapleuron, hind part of mesopleuron and then extends downward on the respective thoracic sterna to the laminae of rostral sulcus; 3) vestigal compound eyes with only a small number of poorly developed, usually irregularly distributed ommatidia in each eye; and 4) punctate elytra without the characteristic lacy network present in the other subfamilies. The macropterous form is unknown.

Anommatocoris zeteki, n. sp.

Figures 1 and 2

Brachypterous form. Small, polished, elongate-ovate, widest across middle of elytra, there width less than half of median length; elytra distinctly transversely depressed near base, meeting behind apex of scutellum in a straight commissural line, convexly deflexed laterally so as to cover sides and apex of abdomen. Length ♂ 1.88 mm., ♀ 2.02 mm., width (widest part of elytra) ♂ 0.88 mm. and ♀ 1.00 mm.

1. Smithsonian Institution, Washington, D. C.
2. Entomology Research Division, ARS, U. S. Department of Agriculture, Washington, D. C.

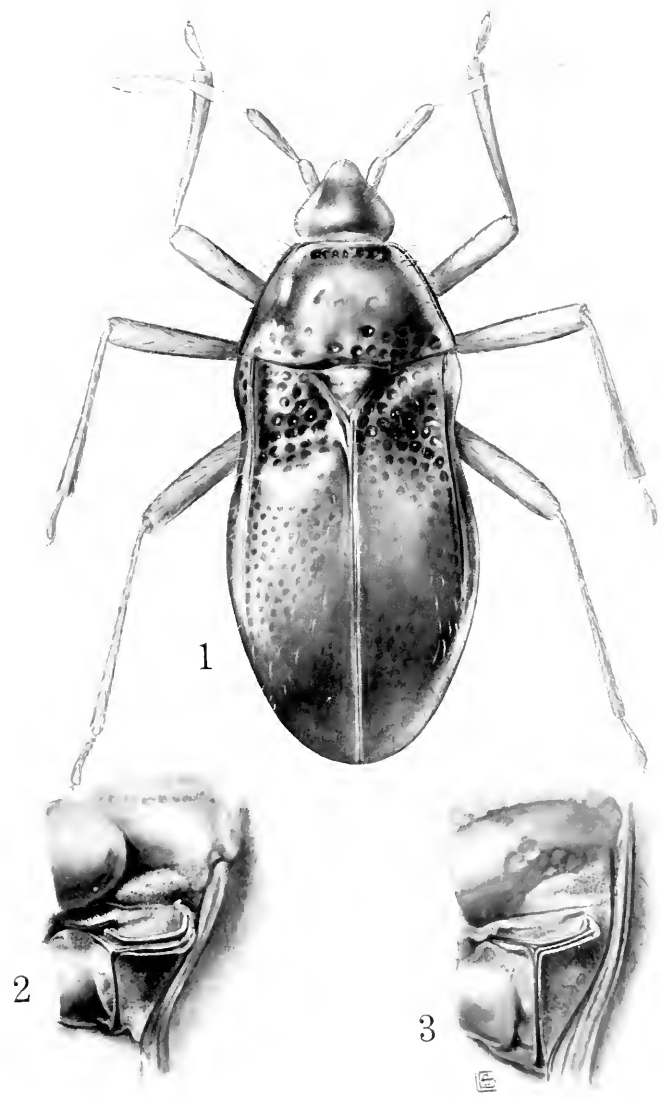


Fig. 1. Anommatocoris zeteki, n. sp., dorsal aspect (type ♂).

Fig. 2. *Anommatocoris zeteki*, n. sp., profile of meso- and metapleura showing evaporatorium; furcate ostiolar canal on metapleuron.

Fig. 3. *Anommatocoris minutissimus* China, profile of meso- and metapleura showing evaporatorium; furcate ostiolar canal on metapleuron.

Color. Reddish brown, slightly shiny, sparsely clothed with fine, erect, yellowish hairs; beneath reddish brown, scarcely shiny, clothed with thinly dispersed, short, yellowish hairs. Head with clypeus paler than vertex; compound eyes vestigial, each represented by a large pale subreniform spot bearing several scattered, poorly formed, hardly discernible ommatidia. Labium pale testaceous long, extending on fourth abdominal sternite. Legs yellowish brown, sparsely clothed with short, pale, setalike hairs. Antennae yellowish brown.

Head. Fairly long, convex above, subporrect; tylus wider and slightly higher than either jugum, together with their apices jointly rounded; compound eyes sparsely clothed with short pale hairs, each eye bearing 10-12 irregularily scattered ommatidia, each with a rounded instead of an hexagonal facet. Bucculae foliaceous, open in front, not extending backwards beyond base of head, with inferior margin convex. Antennal segment I not attaining apex of clypeus, measurements: I, 0.11 mm.; II, 0.20 mm.; other segments missing.

Pronotum. Subdepressed, without discal carinae, median length slightly more than half of basal width (0.38 mm.:0.66 mm.), lateral margins slightly sinuately narrowed anteriorly, each margined above with a narrow, dark fuscous, carinal ridge; posterior border slightly convex, nearly rectate in front of scutellum; anterior lobe very large, impunctate, except for transverse row of punctures at base of narrow collar; posterior lobe much shorter, coarsely punctate. Scutellum small, impunctate, triangular. Ostiole furcate and ostiolar sulcus as shown in illustration (fig. 2).

Elytra. Strongly convex, slightly surpassing apex of abdomen, strongly deflexed on sides so as to conceal abdomen from lateral aspect, coarsely punctate in depressed basal part, impunctate dorsally on convex apical two-thirds; costal area absent; corium not divided into the usual divisions, but with a distinct ridgelike carina or perhaps vein running straight backwards for nearly half its length (fig. 1); hypocostal ridge (often mistaken for costal area) very narrow, feebly wider at base, composed of a single row of minute punctures. Sexes very similar in general aspect, distinguishable by genital segments.

Types. Holotype ♂ and allotype ♀, Barro Colorado Island, Panama Canal Zone, Panama, vii-viii.1942, collected by James Zetek, in whose honor the species is named (U. S. National Museum, Type No. 65840).

The holotype was illustrated by Caroline B. Lutz, Arlington, Virginia. This species can be separated easily from other members of the genus by the backward projecting branch of the ostiolar canal which divides the part of the metapleural evapatorium behind the transverse channel into two quite unequal divisions as shown in the illustration (fig. 2). In *A. minutissimus* China (1955) and *A. coleopteratus*, the backward branch of the transverse ostiolar sulcus divides the hind part of the evaporating area of the metapleuron into

two almost equal divisions as depicted in the illustration (fig. 3). And the ommatidia of *zeteki* are not as numerous as in *minutissimus* nor closely clustered as in *coleopteratus*.

Literature Cited

China, William E. 1945. A completely blind bug of the family Lygaeidae (Hemiptera: Heteroptera). Proc. Roy. Soc. London, vol. 14, nos., 9-10, pp. 126-128, 1 fig.

Kormilev, Nicolas A. 1955. A new Myrmecophyl family of Hemiptera from the delta of Rio Paraná, Argentina. Rev. Ecuat. Ent. Paras., vol. 2, nos. 3-4, pp. 465-477, 1 pl.

Drake, Carl J. and Norman T. Davis. 1960. The Morphology Phylogeny, and Higher Classification of the family Tingidae, including the description of a new genus and species of the subfamily Vianaidinae (Hemiptera-Heteroptera). Entomologica Americana, vol. 39, pp. 1-100, 75 figs. (Subfamily Vianaidinae, new status, pp. 84-100, 4 figs.)

STUDIES IN NEARCTIC DESERT SAND DUNE ORTHOPTERA, PART V

A New Genus and Two New Species of Giant Sand Treader Camel Crickets with Keys and Notes

Ernest R. Tinkham[1]

This is a continuation of the author's studies on Desert Sand Dune Biotae conducted under grant from the National Science Foundation during the summers of 1957-1960 inclusive.

The discovery, in July of 1960, of a new genus and three new species, one of gigantic size for a sand treader, came as a distinct surprise. The Utah species herein described was discovered in 1958, but additional material obtained in Western Utah, in 1960, indicated its affinity to the new genus and not to *Ammobaenetes* Hubbell as originally believed.

Provisional Key to the Sand Treader Camel Crickets and Their Allies

1. Mesotibiae with 3 to 5 pairs of dorsal spines (sometimes irregular) exclusive of the calcars 3

   Mesotibiae with 2 pairs of dorsal spines (sometimes only 3 spines) exclusive of the calcars 2

2. Sand basket present and formed by the crowding together apically of long aciculate spurs. Ovipositor short, approximating the length of the pronotum ..... *Rhachocnemis* Caudell

   Sand basket absent. *Ceuthophilus*, *Pristoceuthophilus*, *Udeopsylla*, *Styracosceles*, *Phrixocnemis*.

3. Sand basket formed of 4 to 6 pairs of long, moveable, aciculate, dorsal spurs, somewhat flattened on their inner faces and crowded apically on the caudal tibiae, their length greater than the tibial depth 5

   Sand basket absent. Caudal tibial spurs with length about equal to tibial depth 4

4. Segments of caudal tarsi- 3, their distoventral angle well rounded. Ovipositor 1.5 to 2.0 times the pronotal length ..... *Daihinia* Haldeman

   Segments of caudal tibiae- 4, their distoventral angle strongly acute or spinose. Ovipositor length about equal pronotal length ..... *Daihiniodes* Hebard

5. Size medium to very large. Externo-inferior keel of caudal femora armed with several large median teeth or spines in addition

1. Indio, California.

to smaller teeth. Tarsal segment ratio -3-4-4 with distoventral angles acute. Ovipositor short and stout, its length about equal to pronotal length ..... *Daihinibaenetes* n. genus

Size small. Externo-inferior keel of caudal femora either nondentate or armed with very small teeth. Ovipositor approx. 1.5 to 2.0 times the pronotal length 6

6. Tarsal segment ratio -3-4-4 with distoventral angles well rounded. Externo-inferior keel dentate ..... *Daihiniella* Hubbell

Tarsal segment ratio -3-4-3 with distoventral angles acutely produced or spinose. Externo-inferior keel unarmed ..... *Ammobaenetes* Hubbell

Daihinibaenetes, n. genus

This new genus has much the appearance of *Daihinia* Haldeman and *Daihiniodes* Hebard, in size, and general features but is separable from these two genera by possession of the diacritical "sand basket" as typically observed in *Ammobaenetes* Hubbell. This sand basket is formed by the grouping or crowding together apically on the distal third of the caudal tibiae of 5 to 6 pairs of long, aciculate, dorsal spurs, their length considerably greater than the tarsal depth. The name proposed for the new genus indicates its apparent generic affinity with *Daihinia*, *Daihiniodes* and *Ammobaenetes*.

Closest relationship appears with *Daihiniodes* which has the same tarsal segment ratio of 3-4-4 for pro-, meso-, and metatarsi and both *Daihiniodes* and the new genus have the distoventral angle or apices of these segments acuminately acute, acute or spinose. The spination on the externo-inferior keels of the caudal femora is also closely similar in that they bear several large, centrally-placed spines followed by a row of small dark teeth in both genera; the interno-inferior keel is more heavily toothed in the new genus.*Daihiniodes*, however, lacks the sand basket and the external dorsal spurs of the caudal tibiae, with their length about equal to the tibial depth, are more widely spaced in the apical half with 1 to 2 smaller teeth interspersed except at the extreme apex. In the new genus 5 to 6 pairs of long, aciculate, dorsal spurs, somewhat flattened on their internal faces and with length greater than tibial depth occupy the apical third of the caudal tibiae to form the sand basket and this character is considered of major generic importance. *Daihinia* has a tarsomere ratio of 3-4-3 compared to 3-4-4 in the new genus and the distoventral angles are well rounded in *Daihinia* distinguishing it from the spinose angles of the tarsomeres in the new genus and *Daihiniodes*. As in *Daihiniodes* and *Daihinia* the dorsal spurs on the mesotibiae are the same, namely four pairs.

The short ovipositor of *Daihinibaenetes* n. g., about equal to the pronotal length, indicates closer relationship to *Daihiniodes* where the length is similar, than to *Daihinia* where the length is about twice the pronotal length and more slender.

Daihinibaenetes, as now understood, is restricted to sand dune areas in southern Colorado at high elevations, dune areas in northeastern Arizona and western Utah, but up until the present it has not been found in the San Rafael Desert of southeastern Utah.

DESCRIPTION: Size very large with the typical form of a heavy bodied Rhaphidophorid. Head, thorax and abdomen typical, the chief diagnostic features existing in the spination of the legs.

Leg spination as follows: Forelegs with externo-inferior keel unspined, interno-inferior keel with 1 to 4 minute teeth and occasionally a larger, pale, apical spur; protibiae dorsally with a pair of apical calcars or spurs, the ventral surface bearing 3 pairs of large, aciculate spurs plus the apical ones; protarsus 3-segmented, the first two segments extremely short and with their distoventral angles spinose or acuminately acute, the third segment almost one-third the length of the protibia with its distoventral angle acute. Middle legs with mesofemora unspined dorsally; ventrally with 3-4 pairs of small spines in addition to the apical ones. Mesotibiae with 4 pairs of large, dorsal, acuminate spines, usually paired but sometimes irregularly spaced, plus the apical calcars; ventrally with 3 pairs of long, acuminate spurs, one pair centrally, two pairs apically, plus a larger pair of calcars. Mesotarsus 4-segmented, the first about half the length of the fourth, the second and third segments very short, the first three segments with their distoventral angle spinose, of which segment 2 is largest; fourth and apical segment with the distroventral angle acute only.

Hind legs with internal dorsal ridge of caudal femora bearing a row of small sharp teeth and with a few scattered teeth externad of this row. Externo-inferior keel with 2 to 4 very large spines located about centrally, followed caudally by a row of closely spaced smaller spines or teeth; the interno-inferior keel with a row of numerous closely, or more-widely spaced teeth for its entire length. Caudal femora in the female with the same dorsal teeth, the spines and teeth of the externo-inferior keel much smaller than in the male; teeth of the interno-inferior keel less reduced. Caudal tibiae in the male with 5 to 7 pairs of long, aciculate, dorsal spurs in the apical half, sometimes the first 2 or 3 pairs nearest the middle with a single small tooth between the longer spurs; the basal half usual with two pairs of spurs, the first two pairs preceded by a series of 4 teeth each, with 2 teeth usually separating the second and third pairs of long spurs. Caudal tarsus 4-segmented, the first segment longer than the fourth, the second and third very short; the first to the third with their distoventral apices acuminately produced into long spinose spurs of which that of segment 2 is largest; segment 4 with its distoventral angle acute. Ventral surface of male caudal tibiae often asperate with small appressed teeth terminating with the tibial subapical tooth found in most Rhaphidophorids. Spination of caudal tibiae and tarsi in the female closely similar to that described for male. Ovipositor short and stout with abruptly truncate apex, its length about the pronotal length.

TYPE SPECIES: *Daihinibaenetes giganteus*, new species.

Key to the Species of *Daihinibaenetes*

1. Size very large. Median spines of external inferior keel of caudal femora very large. Teeth of internal inferior keel of caudal femora in single row. Ventral ridge of caudal tibiae asperate with short, heavy, appressed teeth. Forcipate arms of male subgenital plate long. Ovipositor short with abruptly truncate apex ..... *giganteus* n. sp.

   Size medium. Median spines of caudal femora smaller. Teeth of internal inferior keel of caudal femora in several rows at base. Ventral ridge of caudal tibiae relatively smooth 2

2. Forcipate arms of male subgenital plate long. Dorsal teeth of caudal tibiae normal in size. Five spurs in the sand basket with or without teeth between the fifth and sixth spurs. Ovipositor short, abruptly truncate at apex .... *arizonensis* (Tink)

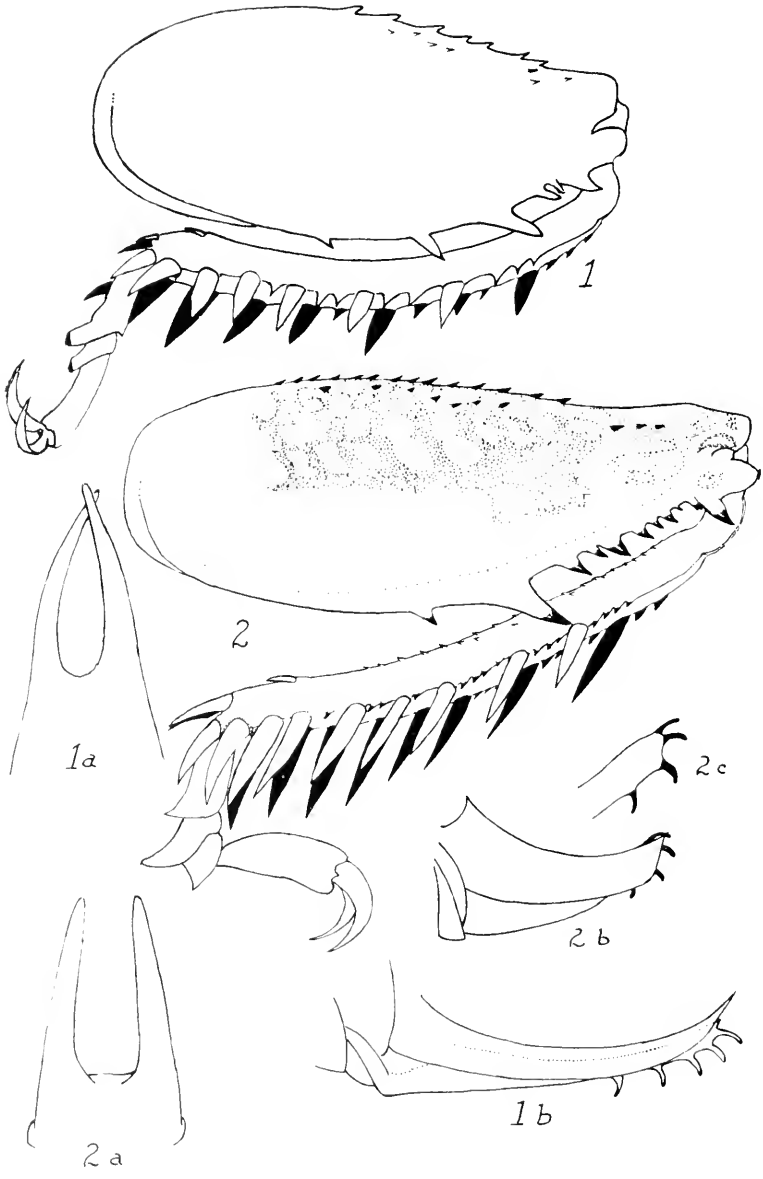
   Forcipate arms shorter. Dorsal teeth of caudal tibiate heavy and triangulate. Six spurs in the sand basket closely spaced. Ovipositor short, abruptly but roundly truncate .... *tanneri* n. sp.

Daihinibaebetes giganteus, n. sp.

The new species closely resembles *Daihinia brevipes* Haldeman in size and general features but the coloration is much paler and the caudal femora less massive and more elongate; the huge spines of the external inferior keel more centrally located than in *Daihinia*. The new species also differs distinctly by possession of the sand basket of much longer aciculate spurs crowded together into the apical third of the caudal tibiae and the tarsomere ratio is 3-4-4 and not 3-4-3 as in *Daihinia brevipes* with their distoventral angles spinose and not rounded as in *D. brevipes*. From *Daihiniodes hastiferum* (Rehn) it differs chiefly in the conformation of the external ventral spines of the caudal femora and by possession of the sand basket; the tarsomere ratio and the spination of the distoventral angles of the tarsomeres being similar in the two genera. The same differences hold between *Daihinibaenetes giganteus* and *Daihiniodes larvale* Strohecker of the White Sands National Monument in New Mexico.

MALE.— Size very large with heavy body typical of certain Rhaphidophorids. Head, thorax and abdomen of typical form.

Leg spination as follows: forelegs with profemora without dorsal spination; anterio-ventral keel armed for most of its length with a row of 4-5 black minute teeth with the apical one much larger and which may be indicative of maturity in the male. Protibiae unarmed dorsally except for a pair of calcars; ventral keels with 3 medium sized spurs in the apical two-thirds plus a large apical calcar and 3 much larger spines and one apical calcar on the posterior ventral keel. Protarsus 3-segmented, the first two segments very short, all with distoventral angles acuminately produced.



EXPLANATION OF PLATE 1

Daihinia brepes Haldeman. 1. Left hind leg of male specimen from Cherokee, Oklahoma. 1a. Subgenital plate of same. 1b. Subgenital plate of female from Boise City, Cimarro County, Oklahoma.

Daihinibaenetes giganteus. 2. Left hind leg of Type Male from Great Sand Dunes National Monument, Colorado. 2a. Subgenital plate of Type Male. 1b. Subgenital plate of Allotype Female, Great Sand Dune Natl. Mont. 2c. Enlarged view of apical teeth of ventral valvula of Allotype Female.

Middle legs with mesofemora unarmed dorsally, the anterior ventral keel with usually 3 black teeth plus a longer subapical spur; the posterior ventral keel with usually 2-3 teeth beyond the middle and with an apical longer spur. Mesotibiae dorsally with 4 pairs of spurs plus the apical pair of calcars; ventral with 3 pairs of spurs, the proximal pair almost central, the two other pairs subapical plus a larger pair of calcars. Mesotarsus 4-segmented, segments 2 and 3 very short, segment 1 about half the length of segment 4, the first three with the distoventral angle acuminately produced into long spurs, the fourth segment with the angle acute.

Hind legs with the caudal femora rather short and deep with the internodorsal keel lined in its central portions by an irregularly or double-appearing row of black, semi-appressed teeth with some scattered teeth exteriorad of this row. Inferior external keel with one huge tooth about the apical two-thirds, preceded by a smaller but large tooth and followed caudadly with about ten black teeth of irregular size with a large tooth at the genicular angle. Internoinferior keel lined its entire length with a single row scattered black teeth, in its basal half these teeth are interspersed with minute teeth; internal genicular lobe also toothed. Caudal tibiae on its dorsal surface armed with 8 large pairs of aciculate spurs, convex on their outer surface, somewhat angulately flattened within, the apical 6 pairs beyond the middle forming the sand basket in which area the tibiae is visibly broadened, the three basal pairs of spurs preceded by 1 to 4 small black teeth and pairs 4 to 6 preceded by one smooth black tooth, followed by two subapical spurs and the apical and smaller calcars. Ventral surface of caudal tibiae with several irregular rows or small, heavy, dark appressed teeth occupying the median area from near the base to the subapical, semi-appressed conical larger spur just ahead of which are a pair of small slender calcars. Caudal tarsus 4-segmented, segments 2 and 3 very short; segment 1 much larger and only slightly longer than the fourth segment. Distoventral angles of first three segments acuminately produced, that of the fourth segment only acute.

Abdomen with penultimate tergite sinuate with a slight median convexity. Supra-anal plate somewhat triangulate. Cerci very long, acuminate and hirsute. Subgenital plate with straight forcipate arms.

Living Coloration: Pale with more tan along the dorsum of the entire body with dark brownish gray markings as follows: an open "X" or hour glass-shaped marking on the dorsum of the pronatum; mesa and metanota and first two segments of the abdomen with their posterior margins heavily bordered with brownish gray, the remaining abdominal segments with posterior margins more finely margined. Legs pale flesh-colored with the dorsal areas in the apical two-thirds of the caudal femora with a netting effect of dark brownish gray. The eyes are black and the head concolorus with the body.

Male Holotype: Great Sand Dune National Monument, 33 miles NE Alamosa, Colorado, July 11, 1960, on cold wet sand after

heavy rain, elevation 8200 ft., E. R. Tinkham. Caliper measurements in mms.: body length 21.9; total length to apex of hind femora 26.8; pronotum 6.6 hind femora 16.9; hind tibiae 15.5 mms. Holotype Male deposited in the Tinkham Eremological Collection.

FEMALE: closely similar in size and characteristics to the Type and differing only in the degree of dentition and spination of the hind legs as follows: caudal femora with teeth of dorsal ridge greatly reduced in size; external inferior keel with teeth much reduced and fewer in number as are also those of the inferior internal keel. Rows of heavy short, appressed teeth on the ventral ridge of caudal tibiae almost evanescent in the female; small dorsal teeth preceding the first three pairs of long spurs in basal half of caudal tibiae reduced in number although spurs and teeth in apical half closely similar to the male. Subgenital plate a shallow sector with basal margin straight and posterior margin circular. Ovipositor approximately the length of the pronotum, heavy, the dorsal valvulae abruptly and rather squarely truncate with apices acute, the ventral valvulae armed apically with 4 pairs of uncinate hooks with blunt apices, the basal pair the smallest (see figs. 2b and 2 c, Plate).

FEMALE ALLOTYPE: Same data as the Holotype Male. Glogau caliper measurements for alcoholic preserved female which is close to living size: body length 28.0; caudal femora 13.8; caudal tibiae 11.2; ovipositor 4.6 mm. Type in the Tinkham Eremological Collection.

MALE PARATYPE: 27, same data as type. Range in millimeters for dried specimens first preserved in 10 to 80 per cent alcohol: body length 16.8-22.7; hind femora 11.5-16.0; caudal tibiae 10.0-12.7; pronotum 4.2-5.4 mm. Paratypes identical to the Male Type except for size range.

FEMALE PARATYPE: 27, same data as the Allotype. Range in mms, preservation as in Male Paratypes: body length 16.8-22.5; caudal femora 11.5-13.4; caudal tibiae 9.8-10.5; pronotum 4.5-5.2; ovipositor 4.9-5.0. Paratypes to be deposited in the major Orthopterological Museums.

ECOLOGY: a cold storm front, moving north from northern New Mexico and which had deluged rain and snow on my car, also greeted my arrival at the Great Sand Dunes National Monument, 33 miles north and east of Alamosa, Colorado, in San Luis Valley, with similar flood. It seemed bitterly cold in the late evening at the camp grounds lying on the edge of the great sahara of sand at an elevation of 8300 feet. The dunes themselves lie at the northwestern base of that lofty range known as the Sangre del Christo.

I expected to find nothing out on those cold barren sands the night of July 10, 1960. The only vegetation in sparse scattered patches was the scurf pea *Psoralea lanceolata* and dune grass *Oryzapsis hymenoides;* but most of the sand areas were completely bare. The camp ground in heavy vegetation marked the fringe of the dunes and due to the heavy precipitation a shallow stream 15 to 20

feet across flowed across the edge of the dunes—a rather strange phenomenon.

At 9:30 p.m. it was dark enough to start out with 2 Coleman lanterns and collecting equipment. The air temperature had warmed to 13.5° C (56.3° F), the sand was 14.5° C. Within 200 yards of camp I shortly found the first Giant Sand Treader lying stretched out on the wet sand drinking and soaking up the moisture which was most welcome to its body after a considerable drowth. For several hours all sand treaders were found immobile and in similar position, the temperature and the moisture making them still. Just before midnight I found several males crawling about high up on the slopes of the main sand mountain but by then the temperatures had risen to 15.0° C for air and 13.5° C for the sand surface. The series was taken over approximately a square mile area. Some females were left to carry on the race.

Biology: Most of the adults seemed freshly teneral; some late stadia nymphs were taken and these later matured by feeding lettuce. On the low sand flats nearer camp and at the south base of the great sand ridge practically all specimens were females and largely confined to bare sand ridges or low sand crests. Most of the males were found later that night on the lower flanks of the great sand ridge, but higher up still no specimens were found due to the barrenness of the environment.

Food: My field notes state "one female on a ridge crest had gnawed into a few wet blades of dead dune gress. Another had eaten a cutworm moth and left the dark wings on the sand. Still another specimen was found devouring the head end of a living pupa of a large scarab that appeared to be a *Phyllophaga* sp. which the rain had apparently brought to the sand surface." All other specimens of the big series lay prostrate on the wet sand drinking up the moisture.

Enemies: Only one specimen was found recently killed, its anterior end chewed off. I looked up and ten feet away spied a Great Basin Spadefoot (*Scaphiopus intermontanus*) sitting under a small scurf pea plant. As this was the only other signs of life observed that night, I am certain the toad had tried to eat the sand treader but found her spiny legs unpalatable.

Orthopteran Associates: No other nocturnal associates were found. Next morning out in the hot humid sand flats I found in the scurf pea areas 1 female *Cammula pellucida* and 1 *Craytypedes neglectus* after diligent searching. At 11 a.m. the air temperature was 23° C, the sand 30.0° C. Also taken were several tiny speckled acridid nymphs resembling *Coniana snowi*. These were placed in half-pint ice cream cartons and by feeding produced in August typical *Trimerotropis agrestis*.

Daihinibaenetes arizonensis (Tinkham), n. comb.

Ammobaenetes arizonensis Tinkham, 1947, Amer. Midland Nat. 38(1):130-133, pl. 1, figs. 1, 3, pl. 2, figs. 1, 2.

In 1936, Dr. Theodore H. Hubbell in his monumental work on "A Monographic Revision of the Genus *Ceuthophilus*" created the genus *Ammobaenetes* by key description and designated *Daihinia phrixonemoides* Caudell as the genotype.

At the time of the description of *Ammobaenetes arizonensis* in 1947, no additional species of this genus had been described, although unknowingly to the author, that same year Dr. Strohecker named *A. lariversi* from the Sand Springs dunes in western Nevada. In 1947, it was perfectly natural to consider any sand treader an *Ammobaenetes* and any male and female from the same dunes as undoubtedly of the same species. Fortunately or unfortunately, the assumed pair of *A. arizonensis*, collected on small sand dunes near the headquarters of the Petrified Forest in July of 1940, were not both described as in keeping the pair some days alive for photography and observation, the female destroyed part of the male's genitalia making it unfit for description. The male, however, was a true *Ammobaenetes*, the female referable to the new genus *Daihinibae* herein described, and this accident leaves the *Ammobaenetes* of this sand area undescribed. Unknown too, in 1940, but now not uncommon, is to find three different genera and species of Rhaphidophirids on the same sand dunes. In July, 1960, at these dunes at the Petrified Forest, I took the new *Daihinibaenetes*, the new *Ammobaenetes* and a *Ceuthophilus* sp. all in the same evening on a small patch of sand.

The species, *Daihinibaentes arizonensis* (Tinkham) differs from *D. giganteus* by its smaller size, the smaller large teeth on the externo-inferior keel of the caudal femora, the much heavier small dentition on the dorsal keels of the caudal tibiae, the form of the male pseudosclerite, the lack of the dark "X" on the pronotum as well as other minor features.

Male Type: a large heavy bodied Rhaphidophorid with short and unusually deep caudal femora with the teeth on the basal half of the caudal tibiae unusually large and heavy; foremargin of the pronotum with a slight angular emargination. The chief characters lie in the spination or dentition of the legs. The attachment of the hind legs is well back of the middle portions of the body.

Leg spination as follows: forelegs with a forward projecting spine on the forecoxae; forefemora with dorsum unspined, externo-inferior keels with 1 to 2 small, dark, medium teeth, interno-inferior keels with 4 to 5 dark, well-spaced teeth in the middle areas. Foretibiae unspined dorsally with a pair of apical calcars of which the external ones are much the largest; inferior keels with 3 pairs of acuminate spurs, those on the outer keels the largest, plus a pair of apical calcars. Foretarsi 3-segmented, short, the first two segments extremely short with their distoventral apices acuminately produced or spines, the third segment with this angle acute.

Middle legs with the mesocoxae unarmed; mesofemora unarmed dorsally, the externo-inferior keel with 5 to 6 small teeth and 2 to 3 additional, interspersed, minute teeth plus one small apical calcar;

the interno-inferior keel with 3 to 5 large teeth plus a larger acuminate calcar; mesotibiae with 4 pairs (sometimes on 3 and ½ pairs) of long acuminate spurs plus a similar pair of calcars, ventrally with the externo-inferior keels with 3 pairs of small teeth, one median and the other 2 apical plus a larger pair of calcars; mesotarsi 4-segmented, segments 2 and 3 very short, segments 1 and 4 short but much longer, the distoventral angles of segments 1 to 3 spined, that of segment 4 acute.

Hind legs, short and heavy, the caudal femora with depth slightly greater than one-third the length; the interno-dorsal ridge lined with a row of short, heavy, semi-appressed teeth from one-quarter the distance from the base to almost the geniculi with scattered similar teeth exteriorad of these; externo inferior keel with 3 to 4 large widely spaced teeth in the middle areas of the caudal femora, these teeth preceded by 2 to 3 much smalled teeth and followed caudally by a row of minute and larger teeth (the size of those on the interno-dorsal ridge) plus a larger tooth on the lower genicular lobe; interno-inferior keel lined its entire length with semi-appressed teeth, the size of those on the interno-dorsal ridge, those teeth nearest the base smaller and forming a double row, plus 1 to 2 teeth on the lower genicular lobe. Caudal tibiae about 5/6ths the length of the caudal femora, of heavy build with apical third somewhat reflexed; ventral surface with one minute, central, subapical tooth plus a pair of larger slender calcars. Externo-dorsal keels with 8 very large aciculate spurs, two in the basal two-thirds and 6 in the apical third which form the outer edge of the sand basket, plus an apical calcar; the first basal spur preceded by 3 to 5 short heavy teeth and the spurs of the sand basket preceded by 4-6 heavy teeth. Interno-dorsal keel with 8 large aciculate spurs plus the apical calcar, the first at the extreme base, the second about the basal third, with 6 very large aciculate spurs forming the inner edge of the sand basket. First basal spur preceded by one short heavy tooth, the second by 5 to 6 teeth increasing gradually in size distally, the third preceded by 3 to 4 regularly increasing larger teeth and one tooth separating spurs 3 and 4 of the sand basket. Caudal tarsi 4-segmented, segments 2 and 3 very short, segments 1 and 4 much longer and equal and about three times those of the second and third; the distoventral angles of the first three segments spined, that of segemnt 2 the longest and segment 4 with the distoventral angle acute.

GENITALIA: with penultimate tergite arcuately sinuate, supra-anal plate a broad arcuate lobe, cerci very long, acuminate, hirsute; subgenital plate with two long straight, tapering forcipate arms; pseudosclerite black, semi"X"-shaped.

COLORATION: uniformly pale with rich golden tan on the dorsal areas of the entire body, the posterior dorsal margin of each thoracic and abdominal segment lightly infuscated with brown. The dorsal apical two-thirds of the caudal femora infuscated with a network of broad lines.

TYPE MALE: Low semistabilized sand areas along the west bank of a wash tributary to Cottonwood Wash, one quarter mile ESE of the Petrified Forest Headquarters and just north of the bridge on Highway 260, July 8, 1960, Ernest R. Tinkham, night collecting (this is the same type locality as for the Female Type). Caliper measurements in millimeters: body length 21.7; pronotum 4.5 in dorsal median length, caudal femur 13.5 x 5.5 in depth; caudal tibiae 11.1 mms. Type in the Tinkham Eremological Collection.

PARATYPE MALES: 3, same data as the Type Male. Range in millimeters: body length 19.0-24.6; pronotum 4.6-4.6; caudal femora 14.1-14.5; caudal tibiae 10.5-10.8 mms. Paratypes in Tinkham and University of Michigan Clns.

Paratypes closely similar to the Type Male, the chief difference being in the dentition of the externo-inferior keel of the caudal femora. Here the long teeth may range from 2 to 4 in number, preceded by 2 to 4 small teeth and followed caudadly by 10 to 14 small and larger teeth plus a large and small tooth on the lower genicular lobe.

TYPE FEMALE: The description of the Type Female was quite adequately portrayed in my 1947 publication.

PARATOTYPES: 3 females, same type locality but collected July 8, 1960 with the Type and Paratype Males. Range in millimeters: body length 21.5-24.0; pronotum 4.2-4.4; caudal femora 11.6 x 4.3—11.7 x 4.3; caudal tibiae 9.1-9.3; ovipositor 4.2—4.2 mms. Paratype distribution the same as noted above.

Paratypes closely similar to the Type Female. Foretibiae (missing in the Type Female) without dorsal spines except for two apical calcars, the outermost of which is much the larger. Inferior keels with 3 pairs of long acuminate spines in the apical half plus one pair of calcars, those on the exterior keel much the largest. Foretarsi 3-segmented, segments 1 and 2 very short, segment 3 much longer, the distoventral angle of segments 1 and 2 spined, of segment 3 acute.

FIELD NOTES: The genus *Daihinbaenetes* makes a peculiar and characteristic trail in the sand, quite distinct from that of *Ammobaenetes*. Once recognized it is not easily forgotten. The trail of *Ammobaenetes* is that made of numerous tarsal claw-points in the sand, whereas that of *Daihinbaenetes* not only leaves the claw-points but draws or pushes its body along across the sands. In so doing the trail appears as if made up of alternately placed pieces of pie or sectors of one-eighth size, these sectors formed when the short and powerful hind legs push the body forward first one side then the other. Specimens in the field were found by recognizing the trail and following it until the specimen was found, or the trail lost in the dune grass and vegetation or tracked to the burrow which was excavated into the rather hard packed sand for 18 inches or more and at about a 45 degree angle.

At 9:30 p.m. July 8, 1960 the air temperature was 22.0° C., the sand temperature 21.0° C. At this time I discovered one of the

female *D. arizonensis* (Tinkham) ovipositing in the sand a few inches from the mouth of her burrow in the sand. At 9:45 p.m. I found the first male by excavating it out of its burrow which was about 18 inches long with the resting chamber 9 to 10 inches below the level of the sand. At the resting chamber sand temperature was a warm 28.0° C. At 11 p.m. the air was 20.0, the sand 18.5° C and it was at this time that the first *Ammobaenetes* were found as well as the single mature *Ceuthophilus* sp. of small size.

ORTHOPTERAN ASSOCIATES: The nocturnal orthopteran fauna consisted of *Daihinibaenetes arizonensis* (Tinkham) which was rare, the rarer *Ammobaenetes* n. sp. which appeared about midnight on these rather small and limited dunes, and a *Ceuthophilus* sp. which was rarer yet. In the *Atriplex confertifolia*, *Plagiostira albonotata* males were softly stridulating with their rapidly produced "zee-zee-zeeezees' that continued on for minutes at a time. The phasmid *Parabacillus coloradus* was also very rare. Diurnal orthopteran associates were *Xanthippus montanus*, *Eremiacris virgata* on the dune grass and *Trimerotropis bilobata* on the sand. More extensive day collecting would yield one or two others.

DUNE FLORA: these low, semistabilized dunes, 30 to 40 feet wide and about 600 feet long, were covered with a considerable variety of vegetation chief of which was *Atriplex confertifolia*, Silver sagebrush *Artemesia filifolia*, Dune Grass *Oryzopsis hymenoides*, Dune Broom *Parryella filifolia*, Scurf pea *Psoralea lanceolata*, Spectacle Pod *Diathyrea wislizeni*, Buckwheat *Eriogonum subreniforme* and *E. divaricata*, Sand Verbena *Abronia fragrens* and *A. elliptica*. Ragweed *Ambrosia psilostachys*, Sacaton *Sporobolus Wrightii*, and less common plants such as *Yucca angustissima*, flax *Linum aristatum*, Snake weed *Gutierrezia microcephala*, Bastard Toad Flax *Comandra pallida*, *Solanum* sp., *Sphaeralcea incana*, *Muhlenbergia pungens* *Orobranche multiflora*, *Stephanomeria exigua* and still others. Along the wash proper and below the level of the low dunes grew the giant Sand Reed *Calemovilfa gigantea*. I am indebted to Mr. E. Neil Stephenson, Park Naturalist, for the identification of the plants.

Daihinibaenetes tanneri, n. sp.

Differs from *D. gigantea* by the much smaller size and from *D. arizonensis* by the slightly smaller proportions. The male of *D. tanneri* is distinguished from the larger males of the two other species by the short forcipate arms of the subgenital plate which are very long in the two species previously described above; dentition on the interno-dorsal ridge of the caudal femora much more reduced than in the other two species of *Daihinibaenetes* and the reduced dentition at the base of the interno-ventral keel of the caudal femora, these and the reduced dentition on the inferior keels of the fore and middle legs will furnish ample means of separation. The female of *D. tanneri* is distinguished from the other two larger species of the new genus by smaller size and by the much reduced dentition on the inferior keels of all femora; from *D. gigan-*

teus by the deeper and more triangular subgenital plate and from *D. arizonensis* by the reduction of the dentition on the inferior keels of the caudal femora. The rounded nature of the truncate apex of the ovipositor is also distinctive.

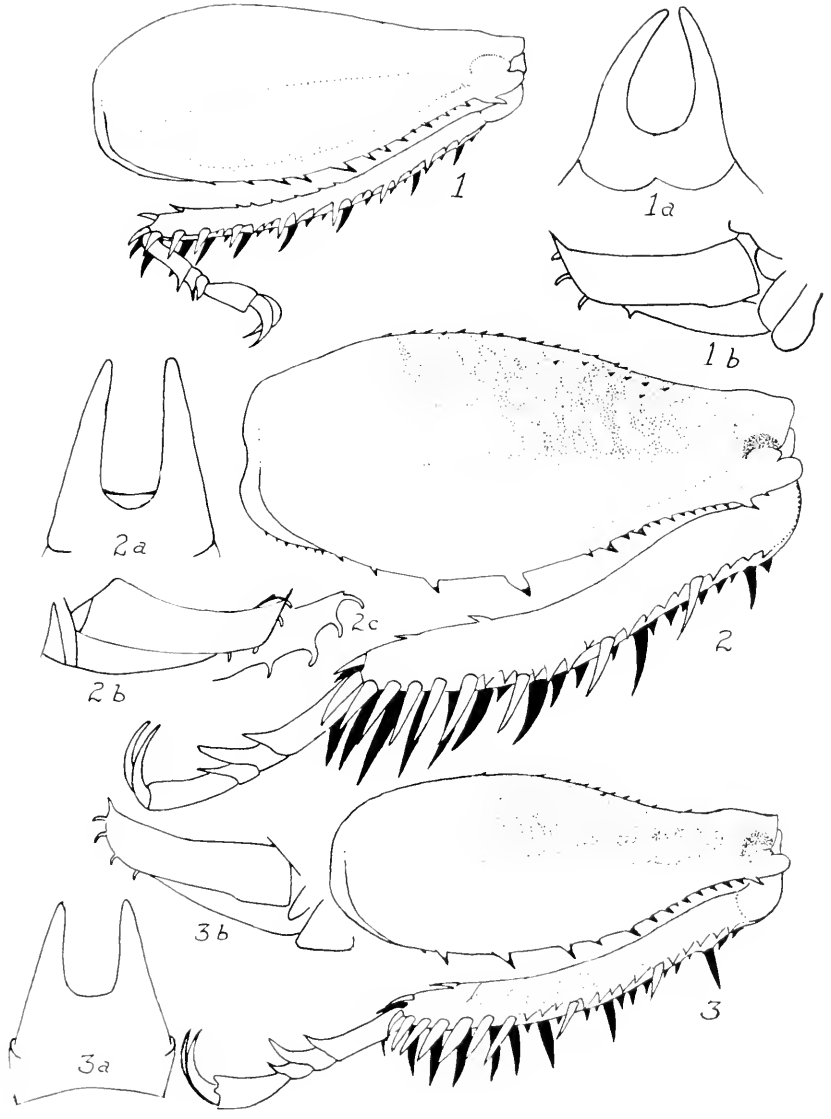
Male: size medium and of rather heavy build with powerful and heavy hind legs. Form typical of the genus with the foremargin of the pronotum bearing a slight arcuate emargination. The chief distinguishing features exist in the dentition of the legs.

Leg Spination as follows: Forelegs with the forecoxae bearing a small toothlike projection on the anterior vertical keel; forefemora unspined above, the interno-inferior keel bearing in its apical half 4 small black teeth of irregular size with sometimes a similar tooth in the basal half. Foretibiae unspined above but with a pair of large apical calcars; that externad being the largest; ventrally with 3 pairs of long tapering spurs, plus an apical pair of calcars, those spurs on the externo-inferior keel the largest. Foretarsi 3-segmented, the first 2 segments very short, the third segment short but about three times the length of the first segment; the distoventral angles of the first two segments spined and that of the third segment acute.

Middle legs with mesofemora unspined dorsally; ventrally with 4 to 5 small teeth on the interno-inferior keel (leg in same position as the forelegs) and the externo-inferior keels bearing 4 to 5 small irregular teeth plus larger apical calcars. Mesotibiae dorsally with 4 pairs of large sharp spurs plus a pair of similar calcars; ventrally with 3 pairs of smaller spined spurs plus similar apical calcars. Mesotarsi 4-segmented, segments 2-3 very short, 1 and 4 short but three times as long as 2 or 3, distoventral angles of segments 1 to 3 spined, of segment 4 acute.

Hind legs with caudal femora heavy and short, their depth slightly greater than one-third their length; interno-dorsal ridge with 10 black, sparsely spaced, teeth in the apical two-thirds with 2 to 3 teeth externad of this row. External inferior keels of caudal femora with 4 to 5 large teeth in the middle sections, preceded by 1 to 3 small black teeth and followed caudally by a row of 8 to 10 larger, black teeth(smaller than the 4 to 5 large teeth) plus a large tooth on the lower genicular lobe; interno-inferior keel with an entire row from base to apex of small, black, irregularly-sized and spaced, teeth plus one large and sometimes several small teeth on the genicular lobe.

Caudal tibiae ventrally with 1-2 small subapical teeth plus a pair of larger calcars; dorsal surface with externo-dorsal keel bearing 8 long aciculate spurs plus one smaller apical calcar, 6 (spurs 3-8) in the apical third and forming the outer row of the sand basket, one at the basal quarter, the second in the center; spur 1 preceded by 4 to 5 heavy, dark, short teeth, spur 2 by 4 to 5 similar teeth and spur 3 (first of sand basket) by 3 similar teeth. Interno-dorsal keel bearing 8 long aciculate spurs plus smaller apical calcar, the first spur basal, the second not quite at the middle, the remaining spurs 3 to 8 forming the inner row of the sand basket; spur 1



EXPLANATION OF PLATE 2

Daihiniodes larvale Strohecker, from White Sands: 1. Left hind leg of Paratype Male. 1a. Subgenital plate of Male (alcoholic specimen). 1b. Subgenital plate of Female (alcoholic specimen).

Daihinibaenetes arizonensis (Tinkham): 2. Left hind leg of Male Type. 2a. Subgenital plate of Type Male. 2b. Subgenital plate of Female Paratopotype. 2c. Same showing enlargement of apical teeth of ventral valvula.

Daihinibaenetes tanneri: 3. Left hind leg of Male Type. 3a. Subgenital plate of Male Type. 3b. Subgenital plate of Female Allotype.

preceded by 2-3 teeth (similar to those on outer keel), spur 2 by 5 to 6 teeth, spur 3 by 4 irregular teeth and spur 4 by a single tooth.

Caudal tarsi 4-segmented, segments 2 and 3 very short, segments 1 and 4 about three to four times as long as 2 and 3 and equal in length; segments 1 to 3 with the distoventral angles spined, that of segment 2 the largest, and the distoventral angle of segment 4 acute. Genitalia: with penultimate tergite very gently arcuate; supraanal plate triangulate with the apex deflexed at a right angle; cerci very long, acuminate, sparsely hirsute with long hairs; pseudosclerite a strongly arcuate lobe; subgenital plate with rather short, parallel forcipate arms, much shorter than in the other two larger species of *Daihinibaenetes*.

Male Holotype: Oak City Dunes, about 3 miles WSW of Oak City, Millard County, Utah, on Utah Highway #125, night collecting, June 15, 1958, Ernest R. Tinkham. Caliper measurements in millimeters: body length 21.0; pronotum 4.2, caudal femora 13.2, caudal tibiae 10.3; antennae 35 mms. Type in the Tinkham Eremological Collection.

Female: Identical in size to the Holotype Male; pronotum as in the male.

Leg spination as follows: Forelegs with the forecoxae bearing a small toothlike tubercle on the anterior vertical keel; fore femora unspined above; external and internal keels with 1 to 2 minute teeth subapically; foretibiae unspined dorsally but with a pair of apical calcars of which the external one is twice the size of the internal one; ventral keels with 3 pairs long tapering spurs plus a pair of apical calcars, the external spurs twice the size of the internal ones. Foretarsi 3-segmented, segments 1 and 2 very short, segment 3 twice the combined length of segments 1 and 2; the distoventral angles of segments 1 and 2 spined, of segment 3 acute.

Middle legs with mesofemora unspined dorsally, ventrally, the keels with 1 to 2 minute teeth; mesotibiae with 4 pairs of long tapering dorsal spurs plus 1 pair of apical calcars; the ventral keels with 3 pairs of medium-sized acuminate spurs plus a pair of large calcars. Mesotarsi 4-segmented, segments 2 and 3 very short, segments 1 and 4 similar in size and about twice the combined length of segments 2 and 3; distoventral angles of segments 1 to 3 spined, of segment 4 acute.

Hind legs with 5 to 6 very minute teeth on the internal dorsal ridge; externo-inferior keels with 10 small scattered teeth, mostly apical, including one on the genicular angle or lobe; interno-inferior keels with 10 to 15 minute teeth most of which are crowded subapically with 2 on the inner lower genicular lobe. Caudal tibiae, ventrally, with one median, small, subapical tooth and a pair of larger calcars; external dorsal keels with 8 long aciculate spurs plus the apical calcar, the first spur about the basal quarter, the second about central on the keel and 6 spurs crowded in the apical half and forming the outer edge of the sand basket, spur 1 preceded by 3 to 4

small teeth (much more slender than in the male), spur 2 preceded by 3 to 4 similar teeth, spur 3 preceded by 3 similar teeth; internal dorsal keels with 8 long aciculate spurs plus the apical calcars, the first basal, the second spur about the apical third and spurs 3 to 8 in the apical half and forming the inner tines of the sand basket; spur 1 preceded by 2 to 3 small teeth, spur 2 preceded by 4 to 5 larger teeth; spur 3 by 3 to 4 similar teeth; spur 4 by 0 to 1 teeth. the remaining spurs of the sand basket without intervening teeth. Tarsomeres as in the Male Type. Ovipositor short and stout, its length about equal the pronotal length; apex of dorsal valvula somewhat roundly and abruptly truncate; apex of ventral valvula with four uncinate hooks, their apices blunt.

Female Allotype: same data as the Male Type. Measurements as follows: body length 21.8; pronotum 4.2; caudal femur 11.0; caudal tibia 9.5; ovipositor 4.6 mms. for alcoholic specimen). Allotype in the Tinkham collection.

Male Paratypes: 10 ♂ same data as the Type Male. 4 ♂ Lynndyl Dunes, 10 miles north of Lynndyl, Millard County, Utah. June 21, 1958. 10 ♂, Hawbush Dunes, 10 miles north Flowell and 8 miles west Holden, Millard County, June 14, 1958. 4 ♂, Hawbush Dunes, same location, July 25, 1960. Range in measurements: Oak City dune series: body length 19.2-23.6; pronotum 3.9-4.2; caudal femur 11.8-12.8; caudal tibiae 9.9-10.0 mms. Lynndyl series: body length 16.0-18.9, pronotum 3.8-3.6, caudal femur 11.0-11.3, caudal tibia 9.2-9.0 mms. Hawbush series: body length 18.5-18.8; pronotum 3.8-4.2; caudal femur 10.8-12.7; caudal tibiae 9.0-9.2 mms. Paratypes closely similar to the Male Type with slight variations in the leg spination as follows: caudal tibiae, external dorsal keel with usually 4-5, sometimes, 2, 3 or 6 teeth preceding the basal or spur 1; usually 4-5, sometimes 3, 2 or 6 teeth preceding spur 2; usually 2 or 3, sometimes 4 or 1 preceding spur 3; usually 0-1 teeth preceding spur 4; remainder of spurs of sand basket without intervening teeth. Internal dorsal keel with usually 2-3 sometimes 4 teeth preceding spur 1; usually 4-5 sometimes 6 teeth preceding spur 2, usually 2-4 teeth preceding spur 3, usually 1 sometimes no teeth preceding spur 4, rest of sand basket entire.

Female Paratypes: 6 ♀ same data as Allotype. 4 ♀ Lynndyl dunes June 21, 1958; 7 ♀ Hawbush dunes June 14, 1958; 3 ♀ Hawbush dunes July 25, 1960. Range in millimeters: Oak City series body length 21.2-23.4; pronotum 3.8-4.2; caudal femur 11.7-11.6 caudal tibia 8.8-9.4; ovipositor 4.7-4.5 mms. Hawbush series: body length 15.3-20.3; pronotum 3.8-3.8; caudal femur 9.9-9.9; caudal tibia 7.4-7.8; ovipositor 4.2-4.0 mms. Lynndyl series: body length 17.3-22.3; pronotum 3.8-4.0; caudal femur 9.5-10.8; caudal tibia 7.8-9.0; ovipositor 4.4-4.1 mms. Leg spination range as follows: caudal tibiae, external dorsal keel with usually 4 sometimes 5, rarely 3 or 1 teeth preceding spur 1; usually 4-5, sometimes 3 or 6 teeth preceding spur 2; usually 2-4, sometimes 1 or 6 teeth preceding spur 3; usually 1 or no teeth preceding spur 4; rest of sand basket

entire. Internal dorsal keel with usually 2 sometimes 1, 3 or 4 teeth preceding spur 1; usually 4-5, sometimes 6 teeth preceding spur 2; usually 3-4 sometimes 2 teeth preceding spur 3, one or no teeth preceding spur 4, rest of sand basket entire.

Paratypes will be deposited in the major orthopterological museums of the country.

This interesting sand treader is named with pleasure after Dr. Vasco M. Tanner, Chief of the Department of Entomology, Brigham Young University and Editor of the Great Basin Naturalist; a scientist who has greatly advanced our knowledge of the fauna of the Great Basin Desert.

Ecology: The Oak City Dunes where crossed by Highway #125 are in places quite blackish hued due to the generous admixture of fragmentized pumice or lava from the lava bed areas west of Flowell. In more stabilized areas immediately west of these blackish drift dunes, the sand is finer and lighter in color with scurf pea (*Psoralea* sp.) in places and such areas are the habitat of the recently described *Trimerotropis agrestis barnumi* and other acridids. The blackish dune areas are usually very dry and barren, margined by a heavy fringe of dead Russian thistle with *Artemesia tridentata* and *Sarcobatus vermiculatus* in surrounding sand flats. The thistle fringe provides protection for the Utah Giant Sand Treader herein described. These dunes running northeast—southwest also meet the gravel road some 6-7 miles northeast running from Oak City to Lynndyl. Attempts to collect in this latter area where the dunes encroached on Junipers were impossible due to the attacking swarms of mosquitoes.

The Lynndyl dunes occupy a tremendous area of approximately 100 square miles of very fine whitish sand forming a billowy sea of dunes up to 25 feet high formed on the north lea of a ridge of mountains (axis East-west) about five miles north of Lynndyl, with a long arm of dunes extending north towards Jericho, Utah. The collecting area was found by crossing the UP railroad tracks on a small road, 10 miles northeast of Lynndyl, from Highway 50 and 6, thence continuing northwest to the end of the road by some big Junipers on the edge of the dunes. From here, a hike of several miles northwest brought the collector to the northern fringe of dunes which were encroaching and destroying a sparse Juniper forest. The dunes here, 25 feet high encircled dead and living trees. The sand here was so fine it formed "rubber sand" and would not break through when tread upon. Here too, Russian thistle formed dense fringes to the dunes and this fringe provided protection for the sand treaders. At 7:30 p.m. June 20, 1958, an hour before sundown, the air temperature was 85° F.; at 8:30 p.m. when night collecting began with lantern sand was 71 and air 74° F. and by midnight the air was 62-63 and the sand 60° F.

The Hawbush Dunes, north of Flowell and west of Holden, lie in an area of dense and varied vegetation with ponds fringed by cattails and juncus meadows on the north and old stabilized sand

ridges bearing aged *Artemesia tridendata*, rabbit brush (*Chrysothamnus* spp.) and other types of bushes in very dense formation on the west. The flora of this area is very rich and the area should be created into a State Park.

The Giant Utah Sand Treaders in their polished reddish brown coats were found at the damp base of long, bare, parallel sand ridges, often 30 feet high, which rested on a rather bare and wet sand substrata or sand flats. At 10:45 p.m. June 14, 1958, the sand and air was 60° Fahrenheit. The tracks made were typical of the new genus being a broad trail of roundly triangular abdominal sternite marks fringed laterally by the pinpoints of the tarsal joints that pushed the heavy bodied creature along over the sands. Once recognized the tracks will reveal the presence of this new genus. In other places scurf pea formed loose coverage over low sand areas, but to adequately describe this area would take pages of report.

Orthopteran Associates. At the Oak City Dunes there were no other nocturnal associates; the diurnal associates were *Trimerotropis strenua*, rare on the barren drift dunes, and *T. a. barnumi* and *T. p. pallidipennis* as well as *Melanoplus pachardi* on the scurf pea areas.

At the Lynndyl dunes a very small mature *Ceuthophilus* sp. was the only nocturnal associate. At the Hawbush dunes the only nocturnal associate was a *Plagiostira* sp. on the dense *Artemesia* ridges. The diurnal orthopterans were *T. a. barnumi*, *T. bilobata*, *Conozoa wallula*, *Hesperotettix* sp., *Melanoplus* sp., and *M. pachardi*, the latter three on Rabbit brush and Northern sagebrush.

Bibliography

Hubbell, T. H. 1936. A Monographic Revision of the genus Ceuthophilus (Orth., Gryllacrididae, Rhaphidophorinae). Univ. Florida Public. vol. 2(1):1-551, 38 plates.

Rehn, James, A. G. 1902. Two new species of North American Stenopelmatinae. Entt. News, 13:240-241.

Strohecker, H. F. 1947. Some southwestern Gryllacrididae (Orthoptera). Anns. Ent. Soc. Amer., 40(2):241-246, 5 figs.

Tinkham, Ernest R. 1947. New species, Records and Faunistic notes Concerning Orthoptera in Arizona. Amer. Midland Nat., 38(1):127-149, 4 pls. with 32 figs.

———. 1960. Studies in Nearctic Desert Sand Dune Orthoptera. Part II. Two new grasshoppers of the genus *Trimerotropis* from the Utah Deserts. Great Basin Nat., 20(3 & 4):49-58, 6 figs.

WINTERING HABITS OF SOME BIRDS AT THE NEVADA ATOMIC TEST SITE

Gerald Richards[1]

In the fall of 1959, Brigham Young University began studies to determine the ecology of native animals in undisturbed and atomically disturbed areas at the Atomic Energy Commission test site in Nye County, Nevada. During the winter of 1960-1961, daily visits were made to feeding grounds and other areas of concentration of wintering species of birds. As a result of the nuclear weapons testing during the last eight years, native vegetation has essentially been destroyed in the vicinity of ground zeros, resulting in areas dominated primarily by *Salsola kali L.* These areas were used as feeding grounds by large flocks of horned larks and house finches. Flocks of these two species in these areas have been numbered as high as 5,000 birds. Flocks occurring in neighboring undisturbed areas were much smaller. Presumably, *Salsola* produced large amounts of seed that attracted large numbers of birds into these areas.

Eremophila alpestris (Linnaeus) . . . Horned Lark

The horned lark was the most common species wintering at the test site. Flocks in nuclear disturbed areas were estimated frequently at 2,500 birds. Smaller flocks of about 300 birds were observed throughout the test site. Horned larks were the only birds frequently observed inhabiting the playas which were void of vegetation.

Horned larks were seen in large flocks during the day, but there was no indication that they remained so while roosting at night. In the early morning in the *Atriplex confertifolia* (Torr & Frem.) and *Kochia americana* Wats. plant community, docile larks that were reluctant to fly were observed singly. Their inactivity probably was due to the cold, as they evidently preferred warmer temperatures before becoming active. It was not until about 10:00 a.m. that sizeable flocks were observed.

Carpodacus mexicanus (Muller) . . . House Finch

House finches wintered at the test site in large concentrations where they were restricted almost entirely to the nuclear disturbed areas. Flocks often were estimated in excess of 2,500 birds. Elsewhere house finches were observed in sizeable flocks only at Yucca Reservoir where flocks of about 300 birds were seen flying between the reservoir and the feeding grounds throughout the day.

---

1. Undergraduate Student, Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

Amphispiza belli (Cassin) . . . Sage Sparrow

Unlike the two species discussed previously, sage sparrows avoided nuclear disturbed areas. They seemed to prefer the desert shrubs and only infrquently visited the fringes of disturbed areas. Flocks were small, usually fewer than ten birds, and were distributed widely over the test site. At Yucca Reservoir, however, thirty sparrows occasionally were seen together.

Sturnus vulgaris (Linnaeus) . . . Starling

During the winter the starling population was small. Usually only three or four birds were seen at irregular intervals. At times, however, there were striking increases in the starling population, which seemed related to the occurrence of precipitation. During December, 1960, and February, 1961, there was no rainfall and, consequently, few starlings. In November, 1960, and January, 1961, there was considerable precipitation, and for a short period after each storm, flocks of thirty to forty birds were observed.

Falco mexicanus Schlegel . . . Prairie Falcon

During early winter, prairie falcons were the most common hawks. Five prairie falcons were recorded at one time in December, 1960. Their dominance in numbers was lost during late winter, when the rough-legged hawk became more abundant. Prairie falcons were observed preying on small rodents, but were more frequently seen pursuing flocks of horned larks. On one occasion one was observed to prey on starlings.

Falco sparverius Linnaeus . . . Sparrow Hawk

Sparrow hawks were common on the test site, but seemed to be most numerous in Yucca Flat. They were usually seen perched on utility poles or atop Joshua trees (*Yucca brevifolia* Engelm). An examination indicated that their pellets consisted largely of remains of tenebrionid beetles. The stomach of one bird contained the remains of three side-blotched lizards, *Uta stansburiana* Baird and Girard. The remaining contents were entirely of tenebrionid beetles.

Buteo lagopus (Pontoppidan) . . . Rough-legged Hawk

The rough-legged hawk was the most common hawk on the test site regularly after January, 1961. It was not uncommon to see two or three of these hawks every morning perched on utility poles in Yucca Flat. Pellet examination showed that they had fed on insects as well as rodents, for the bulk of the material was exoskeletons of Jerusalem crickets (*Stenopelmatus fuscus* Halderman).

ACKNOWLEDGMENTS

This work was supported (in part) by Atomic Energy Commission Contract AT(11-1)786. Special thanks go to Clive Jorgensen who not only helped considerably in the preparation of the manuscript, but also contributed much of the data.

BIBLIOGRAPHY OF UTAH AQUATIC BIOLOGY, NO. II

Earl M. Christensen[1]

In 1956, a bibliography containing 243 references to Utah aquatic biology was compiled by the author (Christensen 1956). This is the second bibliography dealing with Utah aquatic biology and it supplements the 1956 bibliography. This second bibliography contains 390 references dated prior to December 31, 1961. Most of these references are to papers written since 1956. The total number of citations to Utah aquatic biology in these two bibliographies is 633. Twenty-seven unsigned articles are cited.

The publications of aquatic biological investigations in Utah are scattered in many journals, some of which have limited circulation. A large number of the references are to theses and processed papers. Most of the papers are brief. Reports and abstracts are common. Some semi-popular articles are included. A few papers dealing with some aspects of mosquito control and disease transmittion by vectors are not included.

Corrections of errors in the 1956 biblography are listed at the end of this paper.

Adams, Willard Newton. 1953. Study of the bactericidal effect of chlorinated reservoir waters from the Salt Lake City water supply. M.S. Thesis. Univ. Utah, Salt Lake City

Allee, W. C. 1926. Some interesting animal communities of northern Utah. Sci. Monthly, 23:481-495.

Anderson, Russell Daniel. 1960. Taxonomy, distribution, and biology of the Dytiscidae of Utah. Ph.D. Thesis. Univ. Utah, Salt Lake City.

Andriano, Don. 1958. Winter fishing—why, where and how. Utah Fish and Game Mag., 14(2-3):14-15.

Andriano, Donald. 1958. Strawberry fish trap. Utah Fish and Game Bull., 14(4):17.

Andriano, Don. 1958. Fish for your creel. Utah Fish and Game Mag., 14(5):11-23.

Andriano, Don. 1960. The paradoxical brown trout. Utah Fish and Game Mag., 16(8):8-9.

Angelovic, Joseph W. 1960. The effects of temperature on the incidence of fluorosis in rainbow trout. M.S. Thesis. Utah State Univ., Logan.

Angelovic, J. W., W. F. Sigler, and J. M. Neuhold. 1960. The efects of temperature on the incidence of fluorosis in rainbow trout. Presented at the 15th Annual Purdue Industrial Waste Conf. 11 pp. Mimeog.

1. Department of Botany, Brigham Young University, Provo, Utah.

Angelovic, J. W., W. F. Sigler and J. M. Neuhold. 1961. Temperatures and fluorosis in rainbow trout. Jour. Water Pollution Control Fed., 33(4):371-381.

Arnold, Bill B. 1959. Walleyes in Utah Lake. Utah Fish and Game Mag., 15(4):21.

Arnold, Billy B. 1960. Life history study on the walleye, Stizostedion *vitreum vitreum* (Mitchell) in a turbid waters, Utah Lake. Utah. M.S. Thesis. Utah State Univ., Logan.

Arnold, Billy. 1960. Central region: Fishing tips. Utah Fish and Game Mag., 16(6):9.

Bangerter, Arnold. 1960. Eastern region: Fishing prospects. Utah Fish and Game Mag., 16(6):10.

Bangerter, Arnold. 1961. Lake with the limits [Utah Lake]. Utah Fish and Game Mag., 17(6):14-15.

Bangerter, Arnold. 1961. Return of the native. Utah Fish and Game Mag., 17(7):20-21.

Bangerter, Arnold and Rodello Hunter. 1957. The brook trout. Utah Fish and Game Mag., 13(12):12.

Beck, D Elden. 1942. Life history notes on the California gull, No. 1. Great Basin Nat., 3:91-108.

Beck, D Elden. 1960. Mosquito survey of central Utah Valley, Utah. Proc. Utah Mosquito Abatement Assoc., 13:18-23.

Beck, D Elden. 1961. Central Utah County, Utah, mosquito survey studies. Mosquito News, 21(1): 6-11.

Beck, James Stephen. 1960. Conservation class field trips for Utah. M.S. Thesis. Univ. Utah. Salt Lake City.

Behle, William H. 1955. The birds of the Deep Creek Mountains of central western Utah. Univ. Utah Biol. Ser., 11(4):1-34.

Behle, William H. 1958. The bird life of Great Salt Lake. Univ. Utah Press, Salt Lake City. 203 pp.

Behle, William H., John B. Bushman, and Clifton M. Greenhalgh. 1958. Birds of the Kanab area and adjacent high plateaus of southern Utah. Univ. Utah Biol. Ser., 11(7):1-92.

Berry, Elmer G. 1931. Mollusca of Lamb's Canyon, Utah. Naut., 44(2):113-114.

Berryman, Jack H. 1961. What price pollution? Utah Fish and Game Mag., 17(2):20-21.

Bessey, Gerald E. 1960. Aquatic plants of central Utah and their distribution. M.S. Thesis, Brigham Young Univ., Provo, Utah.

Blair, Albert P. 1955. Distribution, variation, and hybridization in a relict toad (*Bufo scaphus*) in southwestern Utah. Amer. Mus. Novitates, 1722:1-38.

Blair, W. Frank. 1957. Structure of the call and relationships of *Bufo microscophus* Cope. Copeia, 1957:208-212.

Bown, Casey. 1956. The good old days. Utah Fish and Game Bull., 12(6):3,9.

Bown, Casey. 1958. My favorite fishing spots. Utah Fish and Game Mag., 14(7):12-13.

Bronson, Clark. 1961. Utah trout. [Illus.]. Utah Fish and Game Mag., 17(6):12-13.

Bronson, Clark. 1961. Utah Game Fish [Illus.]. Utah Fish and Game Mag., 17(7):12-13.

Brooks, Gerald Dean. 1955. The Chironomidae of the Provo River, Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Brooks, S. T. 1936. Some molluscs from Utah. Naut., 50(1):13-14.

Bulkley, Ross V. 1958. The food of adult Fish Lake trout and its relation to forage abundance Proc. Utah Acad. Sci., Arts, and Letters, 35:85-89.

Bulkley, Ross V. 1960. The use of branchiostegal rays to determine age of lake trout, *Salvelinus namaycush* (Walbaum). Amer. Fish. Soc. Trans., 89(4):344-350.

Bullock, Howard R. 1952. Culicoid gnats of Salt Lake County. M.S. Thesis. Univ. Utah, Salt Lake City.

Chamberlain, Norman. 1960. Pollution in Utah Lake. Utah Fish and Game Mag., 16(8):10-11.

Chamberlin, Ralph V. 1933. Observations on *Stagnicola kingi* (Meek), living and extinct. Naut., 46:97-100.

Chamberlin, Ralph V. and David T. Jones. 1929. A bibliography of recent Utah Mollusca. *In* A descriptive catalog of the Mollusca of Utah. Bull. Univ. Utah, 19(4), Biol. Ser. 1(1). pp. 185-190.

Chamberlin, Ralph V. and E. G. Berry. 1930. Mollusca from the Henry Mountains and some neighboring points in Utah. Bull. Univ. Utah, 21(2); Biol. Ser. 1(3):1-7.

Chamberlin, Ralph V. and Don M. Rees. 1935. Accomplishments in mosquito control in Utah. Proc. New Jersey Mosquito Extermin Assoc., 22:93-98.

Chamberlin, Ralph V. and Ernest J. Roscoe. 1948. Check list of recent Utah Mollusca. Bull. Univ. Utah, 39(2); Biol Ser. 11(1):1-16.

Chatwin, Sterling Larry. 1956. The vertical distribution of phytoplankton of Deer Creek Reservoir, Wasatch Co., Utah. M.A. Thesis. Univ. Utah, Salt Lake City.

Christensen, Dale Clair. 1938. The feeding value of certain duck food plants of the Bear River Migratory Bird Refuge as determined by chemical analysis. M.S. Thesis. Utah State Univ., Logan.

Christensen, Earl M. 1956. Bibliography of Utah aquatic biology. Proc. Utah Acad. Sci., Arts, and Letters, 33:91-100.

Christensen, Earl M. and B. F. Harrison. 1961. Ecological study area at Lily Lake in the Uinta Mountains. Utah. Proc. Utah Acad. Sci., Arts, and Letters, 38:36-49.

Chura, Nicholas. 1961. Food availability and preferences of ju-

Chura, Nicholas J. 1961. Selective food utilization by juvenile mallards. Proc. Annual Conf. W. Assoc. State Game and Fish Comm., 41:176-180.

venile mallards. Trans. North Amer. Wildlife Conf., 26:121-134.

Chura, Nicholas J. and Jessop B. Low. 1961. Food availability and utilization of juvenile mallards. Proc. Utah Acad. Sci., Arts, and Letters. 38:113-114.

Clark, William J. 1956. An evaluation of methods of concentrating and counting the phytoplankton of Bear Lake, Utah—Idaho. M.S. Thesis. Utah State Univ., Logan.

Clark, William J. 1958. The phytoplankton of the Logan River, Utah, a mountain stream. Ph.D. Thesis. Utah State Univ., Logan.

Clover, Elzada U. and Lois Jotter. 1944. Floristic studies in the canyon of the Colorado and tributaries. Amer. Midl. Nat., 32:591-642.

Collett, Glen. 1951. On the biology of *Aedes niphadopsis* Dyar and Knab. M.S. Thesis. Univ. Utah, Salt Lake City.

Collett, Glen C. 1960. Recent changes in *Aedes nigromaculis* (Ludlow) populations in the Salt Lake City Mosquito Abatement District. Proc. and Papers 29th Ann. Conf. Calif. Mosq. Control Assoc.

Collett, Glen C. and Don M. Rees. 1959. Mosquito abatement programs in Utah in 1958. Proc. New Jersey Mosquito Extermin. Assoc., 46:61-63.

Cottam, Walter P. 1930. Some unusual floristic features of the Uintah Mountains, Utah. Proc. Utah Acad. Sco., 7:48-49.

Crismon, Lester C. 1933. A determination of the known Utah mosquitoes. M.A. Thesis. Univ. Utah, Salt Lake City.

Daines, Lyman Luther. 1910. Physiological experiments on some algae of Great Salt Lake. M.A. Thesis. Univ. Utah, Salt Lake City.

DeFoliart, G. R. and B. V. Peterson. 1960. New North American Simuliidae of the genus *Cnephia* Enderlein (Diptera). Ann. Ent. Soc. Amer., 53:213-219.

de Roos, Carolyn Clapp. 1958. The effects of sodium fluoride on the weight gain and gills of the common goldfish. M.S. Thesis. Utah State Univ., Logan.

Dotson, Phil A. 1960. Green River clean up. Utah Fish and Game Mag., 16(10):14-15.

Dotson, Phil A. 1961. Rainbow range. Utah Fish and Game Mag., 17(2):12-13.

Dotson, Phil A. 1961. Fish facts. Utah Fish and Game Mag., 17(4):14-15.

Dotson, Phil A. 1961. Color by crustacean. Utah Fish and Game Mag., 17(8):6-7.

Dotson, Phil A. 1961. Vanishing lady [grayling]. Utah Fish and Game Mag., 17(7):8-9.

Dotson, Phil A. 1961. Giant of the Colorado. Utah Fish and Game Mag., 17(9):6-7.

Dufphey, Dan. 1959. Glen Canyon . . . boom or bust. Utah Fish and Game Mag., 15(4):8-11.

Dufphey, Dan. 1959. Flaming Gorge Project: a wildlife "Jekyll and Hyde." Utah Fish and Game Mag., 15(11):6-9.

Dumas, Mary Elizabeth. 1956. A study of the Hydra of Salem Pond. M.A. Thesis. Brigham Young Univ., Provo, Utah.

Eaton, Theodore H., Jr. 1935. Amphibians and reptiles of the Navaho Country. Copeia, 1935(3):150-151.

Eberhardt, Robert L. 1950. The food of three centrarchids and an ameiurid in northern Utah during 1949 and 1950. M.S. Thesis. Utah State Univ., Logan.

Edmunds, George F., Jr. 1954. The use of granular larvicides in mosquito control. Abstrs. and Proc. Utah Mosquito Abatement Assoc., 7:26-27.

Edmunds, George F., Jr. 1957. The predaceous mayfly nymphs of North America. Proc. Utah Acad. Sci., Arts, and Letters, 34:23-24.

Edmunds, George F., Jr. 1957. On the life history of *Parameletus columbiae* McDunnough (Ephemeroptera). Proc. Utah Acad. Sci., Arts, and Letters, 34:25-26.

Edmunds, George F., Jr. 1958. Ecological checklist, Ephemeroptera. *In* Preliminary report on the biological resources of the Glen Canyon Reservoir. Univ. Utah Anthropological Papers, 31:134-137.

Edmunds, George F. 1959. The mayflies of the Glen Canyon Dam Area, Colorado River, Utah. Proc. Utah Acad. Sci., Arts, and Letters, 36:79-80.

Edmunds, George F., Jr. 1960. The food habits of the nymph of the mayfly *Siphlonurus occidentalis*. Proc. Utah Acad. Sci., Arts, and Letters, 37:73-74.

Edmunds, George F., Jr. and Guy G. Musser. 1960. The mayfly fauna of Green River in the Flaming Gorge Reservoir Basin, Wyoming and Utah. *In* Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming. Univ. Utah Anthropological Papers, 48:111-123.

Edmunds, G. F., Jr., L. T. Nielsen, and J. R. Larsen. 1956. The life history of *Ephoron album* (Say) (Ephemeroptera: Polymitarcidae). Wasmann Jour. Biol., 14(1):145-153.

Engelhardt, George P. 1918. Batrachians from southwestern Utah. Copeia, 60:77-80.

Evans, Frederick R. 1960. Laboratory culture of Protozoa from Great Salt Lake. Proc. Utah Acad. Sci., Arts, and Letters, 37:150-151.

Federal Security Agency, Public Health Service. 1951. Report on water pollution control, Great Salt Lake Basin, Great Basin drainage basin. Public Health Service Publ. No. 139; Water Pollution Series No. 29. 26 pp. Illus. Processed.

Ferriss, James H. 1910. A collecting excursion north of the Grand Canyon of the Colorado. Naut., 23:109-112.

Flannery, John. 1956. The shock treatment. Utah Fish and Game Bull., 12(2):6-7.

Flowers, Seville. 1959. Vegetation of Glen Canyon. *In* Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropological Papers. 40:21-61.

Flowers, Seville. 1959. Algae collected in Glen Canyon. *In* Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropological Papers, 40:203-206.

Flowers, Seville. 1960. Vegetation of Flaming Gorge Reservoir Basin. *In* Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming. Univ. Utah Anthropological Papers, 48:1-48.

Flowers, Seville. 1961. The Hepaticae of Utah. Univ. Utah Biol. Ser., 12(2):1-89.

Flowers, Seville, n.d. The blue-green algae of Utah. Univ. Utah, Department of Botany. Processed 69 pp.

Foote, Benjamin A. 1961. The marsh flies of Idaho and adjoining areas (Diptera: Sciomyzidae). Amer. Midl. Nat., 65:144-167.

Foster, Harris Norman. 1960. An ecological study of a warm sulphur spring in Salt Lake Valley, Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Francy, David Bruce. 1961. A study of the identification and distribution of the eggs of *Aedes* mosquitoes in valleys in Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Frandsen, John Christian. 1956. Survey of the parasites of some Amphibia of Salt Lake County, Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Fraser, Russell Simon. 1953. A comparison of methods for differentiating sources of fecal pollution of water. M.S. Thesis. Utah State Univ., Logan.

Fuller, Robert Weeks. 1953. Studies in the life history and ecology of the American pintail (*Anas acuta tzitzihoa* Vieillot) in Utah. M.S. Thesis. Utah State Univ., Logan.

Garrett, Verl B. 1960. A study of hatching of *Artemia salina* of Great Salt Lake. M.S. Thesis. Univ. Utah, Salt Lake City.

Gates, John M. 1957. Autumn food habits of the gadwall in northern Utah. Proc. Utah Acad. Sci., Arts, and Letters, 34: 69-71.

Gaufin, Arden R. 1951. Production of bottom fauna in the Provo River, Utah. Ph.D. Thesis. Iowa State College, Ames.

Gaufin, Arden R. 1957. Limnological analyses of Jordan, Price, Provo, and Weber Rivers by Arden R. Gaufin. Univ. Utah and Utah State Water Pollution Control Board. Salt Lake City.

Gaufin, Arden R. 1958. Report on limnological and sanitary characteristics of Jordan, Price, Provo and Weber Rivers for 1957-58. Univ. Utah and Utah State Water Pollution Control Board, Salt Lake City.

Gaufin, Arden R. 1958. Check list of fishes. *In* Preliminary report on the biological resources of the Glen Canyon Reservoir. Univ. Utah Anthropological Papers, 31:174-175.

Gaufin, Arden R. 1960. The effects of insecticides on aquatic life. Proc. Utah Mosquito Abatement Assoc., 13:16-18.

Gaufin, Arden R., Gerald R. Smith, and Phil Dotson. 1960. Aquatic survey of Green River and tributaries within the Flaming Gorge Reservoir Basin. *In* Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming. Univ. Utah Anthropological Papers, 48:139-175.

Gaufin, Richard F. and Arden R. Gaufin. 1961. The effect of low oxygen concentrations on stoneflies. Proc. Utah Acad. Sci., Arts, and Letters, 38:57-64.

Gill, Theodore Nicholas. 1876. Report on ichthyology. *In* Simpson, Capt. J. H. Report of explorations across the Great Basin of the Territory of Utah . . . in 1859. U. S. Army. Engineer Dept. Gov't. Printing Office, Washington, D. C. pp. 383-431.

Graham, Edward H. 1937. Botanical studies in the Uinta Basin of Utah and Colorado. Annals Carnegie Museum (Pittsburgh), 26. 432 pp.

Graham, Edward H. 1937. Notes on some mosses from the Uinta Basin, Utah. Bryologist, 40:40-45.

Graham, Jay E. 1950. A preliminary study of the gnats or midges of the tribe Tendipedini in northern Utah. M.S. Thesis Univ. Utah, Salt Lake City.

Graham, Jay E. 1959. Creation of an aquatic wildlife habitat by mosquito source reduction. Proc. Utah Acad. Sci., Arts, and Letters, 36:81-82.

Graham, Jay E. 1959. The current status of *Aedes nigromaculis* (Ludlow) in Utah. Proc. and Papers Calif. Mosquito Control Assoc., 27:77-78.

Graham, Jay E. 1959. The relation of detailed larval surveys to control efficiency in Salt Lake County. Proc. New Jersey Mosquito Extermin. Assoc., 46:119-121.

Graham, Jay E. 1960. Economic poisons and mosquito control. Proc. Utah Mosquito Abatement Assoc., 13:27.

Graham, Jay E., Don M. Rees, and George F. Edmunds, Jr. 1954. A season of mosquito control with heptachlor. Proc. and Papers Calif. Mosquito Control Assoc., 22:21-22.

Graham, Jay E., Don M. Rees, and Lewis T. Nielsen. 1958. Trends in mosquito populations in Salt Lake County. Mosquito News, 18:98-100.

Graham, Jay E. and Glen C. Collett. 1961. The effects of precipitation and irrigation on larval populations of *Aedes dorsalis* (Meigen) in Salt Lake County, Utah. Proc. Utah Acad. Sci., Arts, and Letters, 38:65-67.

Graham, Jay E., Iver E. Bradley and Glen C. Collett. 1960. Some factors influencing larval populations of *Culex tarsalis* and western *equine* encephalitis in Utah. Mosquito News, 20: 100-103.

Graham, Jay E. and Russell D. Anderson. 1957. Treatment of a trout pond with heptachlor for the control of *Anopheles free-*

borni Aitken larvae. Proc. Utah Acad. Sci., Arts, and Letters, 34:81-82.

Graham, Jay E. and Russell D. Anderson. 1958. The effects of mosquito larviciding on other organisms in Salt Lake County. Proc. Utah Acad. Sci., Arts, and Letters. 35:43-48.

Gregg, Wendell O. 1940. Mollusca of Zion National Park, Utah. Naut., 54(1):30-32.

Gregg, Wendell O. 1941. Mollusca of Cedar Breaks National Monument, Utah. Naut., 54(4):116-118.

Gregg, Wendell O. 1942. Additional Utah records [Mollusca]. Naut., 55(4):143-144.

Griffin, Gerald D. 1956. An investigation of *Anabaena unispora* Gardner and other blue-green algae as a possible mosquito control factor in Salt Lake County, Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Griffin, Gerald D. and Don M. Rees. 1956. *Anabaena unispora* Gardner and other blue-green algae as possible mosquito control factors in Salt Lake County, Utah. Proc. Utah Acad. Sci., Arts, and Letters, 33:101-103.

Grundmann, Albert W. 1958. Ecological checklist: Mollusks *In* Preliminary report on biological resources of the Glen Canyon Reservoir. Univ. Utah Anthropological Papers. 31:126-129.

Gumtow, Ronald E. 1960. Southern region: the '60 outlook. Utah Fish and Game Mag., 16(6):7-8.

Haas, Phillips. 1943. A study of beaver populations of some Utah streams. M.S. Thesis. Utah State Univ., Logan.

Hales, Donald C. 1955. Evaluation of stream bottom fauna sampling techniques as used in the Logan River. M.S. Thesis. Utah State Univ., Logan.

Hales, Don C. 1957. The Utah chub. Utah Fish and Game Bull., 13(9):8.

Hales, Don. 1958. Winter kill. Utat Fish and Game Bull., 14 (2-3):22.

Hales, Don. 1958. The black bullhead. Utah Fish and Game Bull., 14(4):16.

Hales, Donald C. 1958. Year-'round fishing. Utah Fish and Game Mag., 14(12): 14-15.

Hales, Donald C. 1960. Rape of the rivers. Utah Fish and Game Mag., 16(2):3-4.

Hales, Don. 1960. Northern region: Improved waters. Utah Fish and Game Mag., 16(6):11.

Hales, Don. 1960. Kokanee salmon. Utah Fish and Game Mag., 16(11):6-7.

Hall, Heber H. and Gerald T. Groves. 1960. Annotated list of plants found in Flaming Gorge Reservoir Basin. 1959. *In* Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming. Univ. Utah Anthropological Papers. 48:49-98.

Hantush, Iqbal Al-Husaini. 1954. The biology of *Cletocamptus albuquerquensis* of Hobo Springs in Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Hassler, Thomas J. 1960. Relationships of certain environmental factors to benthic fish densities in Bear Lake, Idaho-Utah. M.S. Thesis. Utah State Univ., Logan.

Havertz, David S. and Jay E. Graham. 1961. A comparison of mosquito larval populations and emerging adult populations. Proc. Utah Acad. Sci., Arts, and Letters, 38:121-122.

Hayward, C. Lynn. 1945. Biotic communities of the southern Wasatch and Uinta Mountains, Utah. Great Basin Nat., 6:1-124.

Hayward, C. Lynn. 1952. Alpine biotic communities of the Uinta Mountains, Utah. Ecol. Monogr., 22:93-120.

Hayward, C. Lynn, D Elden Beck, and Wilmer W. Tanner. 1958. Zoology of the Upper Colorado River Basin. Brigham Young Univ. Sci. Bull., Biol. Series, 1(3):1-74.

Henderson, Junius. 1924. Mollusca of Colorado, Utah, Montana, Idaho, and Wyoming. Univ. Colo. Studies, 13(2):65-223.

Henderson, Junius. 1931. The problem of the Mollusca of Bear Lake and Utah Lake, Idaho-Utah. Naut., 44(4):109-113.

Henderson, Junius. 1936. Mollusca of Colorado, Utah, Montana, Idaho, and Wyoming - Supplement. Univ. Colo. Studies, 23(2): 81-145.

Henderson, Junius and L. E. Daniels. 1916. Hunting Mollusca in Utah and Idaho. Proc. Acad. Nat. Sci. Phila., 68:315-339.

Henderson, Junius and L. E. Daniels. 1917. Hunting Mollusca in Utah and Idaho in 1916. Proc. Acad. Nat. Sci. Phila., 69:48-81.

Herrington, H. B. and E. J. Roscoe. 1953. Some Sphaeriidae of Utah. Naut., 66(3):97-98.

Hervey, Ralph J. 1947. Studies on the toxicity of algae for animals. Proc. Utah Acad. Sci., Arts, and Letters, 24:49-50.

Huff, Clarion L. 1961. Fishing Cache. Utah Fish and Game Mag., 17(5):18-19.

Jensen, Bruce. 1961. Duchesne whitefish. Utah Fish and Game Mag., 17(2):23.

Jensen, G. H. 1940. The relation of some physical and chemical factors of the soil to the productivity and distribution of certain waterfowl food plants at Bear River Refuge. M.S. Thesis. Utah State Univ., Logan.

Johnson, Clark. 1952. Life history and ecology of the mallard duck (*Anas platyrhynchos platyrhynchos* L.) in Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Johnson, Clark D. 1961. Muskrat: Marsh maverick. Utah Fish and Game Mag., 17(5):14-15.

Jones, David T. 1935. Mollusks from Weber Canyon. Utah. Proc. Utah Acad. Sci., Arts., and Letters, 12:227-228.

Jones, David T. 1940. Mollusks of the Qquirrh and Stansbury Mountains in Utah. Naut., 54(1):27-29.

Jones, David T. 1940. Recent collections of Utah Mollusca, with extralimital records from certain Utah cabinets. Proc. Utah Acad. Sci., Arts, and Letters, 17:33-45.

Jones, Kenneth L. 1960. A study of the parasites from rainbow trout of a commercial fish farm in Cache Valley, Utah. M.S. Thesis, Utah State Univ., Logan.

Jones, Kenneth L. and Datus M. Hammond. 1960. A study of the parasites from rainbow trout of a commercial fish farm in Cache Valley, Utah. Proc. Utah Acad. Sci., Arts, and Letters. 37:157-158.

Jordan, David Starr. 1889. Report of explorations in Colorado and Utah during the summer of 1889. U. S. Bureau of Fisheries, Vol. 9:24-40.

Jorgenson, Edsel G. 1956. Ephydridae of Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Kay, Lee. 1957. Lake of water and fish. Utah Fish and Game Bull., 13(6):5.

Kay, Lee. 1958. So you want to know. Utah Fish and Game Mag., 14(2-3):10-11.

Kay, Lee. 1959. Fishlake. Utah Fish and Game Mag., 15(8):8-9.

Kay, Lee. 1959. Utah's fish story. Utah State Dept. Fish and Game, Public Relations and Education, Salt Lake City, Utah. 5 pp. Processed.

Kimerer, Keith. 1919. Presence of bacteria in water. M.A. Thesis. Univ. Utah, Salt Lake City.

Lacy, Charles H. 1959. Artificial pothole and level ditch development as a means of increasing waterfowl production. M.S. Thesis. Utah State Univ., Logan.

Lawler, Robert E. 1959. Channel Catfish in Utah. Utah Fish and Game Mag., 15(4):20.

Lawler, Robert E. 1960. Observations on the life history of channel catfish (*Ictalurus punctatus*) in Utah Lake, Utah County, Utah. M.S. Thesis. Utah State Univ., Logan.

Lawler, Robert E. 1960. X-section of a catfish spine. Utah Fish and Game Mag., 16(1):6-7.

Lawler, Robert E. 1961. Central Utah Project: Fisherman's finish? Utah Fish and Game Mag., 17(2):10-11.

Legler, John M. 1960. Amphibians and reptiles of Flaming Gorge. *In* Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming. Univ. Utah Anthropological Papers, 48:177-183.

Lemke, Armond Edwin. 1954. A pollutional survey of Mill Creek, Salt Lake County, Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Lepak, Joseph W. 1960. Incidence and transmission of animal parasites in sewage and culinary water. Ph.D. Thesis. Univ. Utah, Salt Lake City.

Lepak, Joseph W. and Albert W. Grundmann. 1959. Application of membrane filter for recovery of animal parasites from culi-

nary water supplies. Proc. Utah Acad. Sci., Arts, and Letters, 36:71-72.

Lewis, Mont E. 1958. Carex—Its distribution and importance in Utah. Brigham Young Univ. Sci. Bull., Biol. Ser. 1(2). 43 pp.

Lindsay, Delbert W. 1959. Vascular plants collected in Glen Canyon, 1958. *In* Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropological Papers, 40:63-72.

Loo, Stan K. Y. 1960. Distribution and movement of some fishes in Bear Lake, Utah-Idaho, 1958-59. M.S. Thesis. Utah State Univ., Logan.

Lowrance, Edward. 1934. Observations on the early development of *Stagnicola kingi* (Meek), the Utah ribbed snail. Bull. Univ. Utah, 24(5); Biol. Ser., 2(5):1-21.

McCloy, James S. 1950. A preliminary study of the Choaborinae of Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

McConnell, W. J. 1953. Why age carp? Farm and Home Science, 14:6-7, 23.

McConnell, William J. 1958. Chlorophyll and productivity in a Mountain River. Ph.D. Thesis. Utah State Univ., Logan.

McConnell, William J., William J. Clark, and William F. Sigler. 1957. Bear Lake, its fish and fishing. Utah State Dept. of Fish and Game, Idaho Dept. of Fish and Game, and Wildlife Dept., Utah State Univ. 76 pp.

McConnell, W. J. and W. F. Sigler. 1959. Chlorophyll and productivity in a mountain river. Limnology and Oceanography, 4(3):335-351.

McCullough, Robert A. 1951. Some studies of the ecology and management of the muskrat on the Locomotive Springs Migratory Waterfowl Refuge, Box Elder County, Utah. M.S. Thesis. Utah State Univ., Logan.

McDonald, Donald B. 1956. The effects of pollution on Great Salt Lake, Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

McDonald, Donald B. 1959. Fish stomach contents from samples taken during Colorado River Expedition, 1958.*In* Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropological Papers, 40:201-202.

McDonald, Donald and Frederick R. Evans. 1956. A progress report on Protozoa from caves. Proc. Utah Acad. Sci., Arts, and Letters. 33: 180-181.

McDonald, Donald B. and Phil A. Dotson. 1960. Fishery investigations of the Glen Canyon and Flaming Gorge impoundment areas. Utah State Fish and Game Dept. Infor. Bull., 60-3. 70 pp.

McDonald, Donald and Phil Dotson. n.d. Preimpoundment investigations on the Green River and Colorado River Developments. Utah State Dept. Fish and Game, Salt Lake City. Mimeog

Madsen, Clyde R. 1937. A study of the fish foods of Fish Lake, Utah. B.S. Thesis. Utah State Univ., Logan.

Madsen, M. J. 1954. Fish killed by tiny organism in Utah hatchery. Utah Fish and Game Bull., 10(8):7.

Madsen, Marion J. n.d. General survey of water pollution in Utah. Utah State Dept. Fish and Game, Salt Lake City. Mimeog.

Martin, Thomas L. and Owen M. Davis. 1932. A preliminary study of blue sac disease of fishes at the federal hatchery at Springville, Utah. Proc. Utah Acad. Sci., Arts, and Letters, 9:29-30.

Miller, Grant Leslie. 1959. An investigation of pollution in the Price River, Carbon County, Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Miller, Hack. 1946. Net result: cast and catch. Utah Mag., 8(4): 16-17, 42-44.

Moffett, J. W. 1936. A quantitative study of the bottom fauna in some Utah streams variously affected by erosion. Bull. Univ. Utah, 26(9); Biol. Ser. 3(3):1-32.

Morgan, Dale L. 1947. The Great Salt Lake. Bobbs-Merrill Co., Indianapolis. 432 pp.

Mulaik, Stanley B. 1958. Ecological checklists: Crustacea *In* Preliminary report on the biological resources of the Glen Canyon Reservoir. Univ. Utah Anthropological Papers, 31:130.

Murphy, Joseph R. 1951. Ecology of passerine birds wintering at Utah Lake. M.A. Thesis. Brigham Young Univ., Provo, Utah.

Musser, Guy G. 1959. Annotated check list of aquatic insects of Glen Canyon. *In* Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropological Papers, 40:207-221.

Musser, R. Jean. 1960. Dragonflies (Odonata: Anisoptera) from Green River in the Flaming Gorge Reservoir Basin, Wyoming and Utah. *In* Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming. Univ. Utah Anthropological Papers, 48:125-137.

Musser, Jean. 1961. Dragonfly nymphs of Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Musser, R. Jean. 1961. Some noteworthy dragonfly records from Utah (Odonata: Anisoptera). Ent. News, 72:53-54.

Mutlag, Daood Salman. 1954. A study of aquatic insects of Logan River, Utah. M.S. Thesis. Utah State Univ., Logan.

Nave, Robert Harry. 1960. A limnological study of Clover Creek, Tooele County, Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Nelson, Noland F. 1949. Marshes prove worth. Utah Fish and Game Bull. 7(1):8.

Nelson, Noland F. 1953. Marsh development and management on artificial impoundments in Utah Proc. 32nd Annual Conf. West. Assoc. State Game and Fish Comm., Glacier Nat. Park, Montana, June 15-17. pp. 207-209.

Nelson, Noland F. 1954. Factors in the development and restoration of waterfowl habitat at Ogden Bay Refuge, Weber County, Utah. Utah State Fish and Game Dept. Publ. No. 6. Salt Lake City, Utah. 87 pp.

Nelson, Thomas Edward. 1960. The use of caddisflies and stoneflies in bioassays. M.S. Thesis. Univ. Utah. Salt Lake City.

Neuhold, John M. 1955. Age and growth of the Utah chub, *Gila atraria* (Girard), in Panguitch Lake and Navajo Leke, Utah, from scales and opercular bones. Amer. Fish. Soc. Trans., 85:217-233.

Neuhold, John M. 1958. The effects of sodium fluoride on carp and rainbow trout. Ph.D. Thesis. Utah State Univ., Logan.

Neuhold, John M. and William F. Sigler. 1960. The effects of sodium fluoride on carp and rainbow trout. Amer. Fish. Soc. Trans., 89(4):358-370.

Nielsen, Lewis T. 1947. On the biology of *Aedes dorsalis* (Meigen). M.A. Thesis Univ. Utah, Salt Lake City.

Nielsen, Lewis T. 1955. The taxonomy, biology, and control of Rocky Mountain Aedes mosquito species. Ph.D. Thesis. Univ. Utah, Salt Lake City.

Nielsen, Lewis T. 1959. Seasonal distribution and longevity of Rocky Mountain snow mosquitoes of the genus *Aedes*. Proc. Utah Acad. Sci., Arts, and Letters, 36:83-87.

Nielsen, Lewis T. and Don M. Rees. 1959. The mosquitoes of Utah —a revised list. Mosquito News, 19:45-47.

Nielsen, Lewis T. and Don M. Rees. 1961. An identification guide to the mosquitoes of Utah. Univ. Utah Biol. Ser., 12(3):1-58.

Noble, Ralph, Don Deming, and John Flannery. 1957. Fish drop. Utah Fish and Game Mag., 8:2-3.

Norrington, A. 1925. Phycological study of the Wasatch and Uinta Ranges in Utah. Ph.D. Thesis. Univ. Chicago, Chicago, Illinois.

North, Max. 1955. Malachite green to the rescue. Utah Fish and Game Bull., 11(12):1,2.

Oborn, Eugene Timbrell. 1938. Comparison of methods of collect-storing, and germinating "seeds" of waterfowl food and cover plants. M.S. Thesis. Utah State Univ., Logan.

Olson, Harold F. 1957. Age and growth of the Utah chub, *Gila atraria* (Girard), in Fish Lake, Utah. Proc. Acad. Sci., Arts, and Letters, 34:83-85.,

Olson, Harold F. 1959. The biology of the Utah chub, *Gila atraria* (Girard) of Scofield Reservoir, Utah. M.S. Thesis. Utah State Univ., Logan.

Packard, A. S., Jr. 1873. Insects inhabiting Great Salt Lake and other saline or alkaline lakes in the west. *In* Hayden, F. V. Sixth Annual Report of the United States Geological Survey. Gov't. Printing Office, Washington. pp. 743-746.

Packer, Paul E. 1957. Management of forest watershed and improvement of fish habitat. Amer. Fish. Soc. Trans., 87:392-397.

Parkinson, Ernest W. 1933. Bird studies of the Bear River marshes. M.S. Thesis. Utah State Univ., Logan.

Peterson, B. V. 1956. Observations on the biology of Utah black flies (Diptera: Simuliidae). Can. Ent., 88:496-507.

Peterson, B. V. 1958. The taxonomy and biology of Utah species of black flies (Diptera: Simuliidae). Ph.D. Thesis. Univ. Utah, Salt Lake City.

Peterson, B. V. 1958. A redescription of the female and first descriptions of the male, pupa and larva of *Prosimulium flavianteunus* (S. and K.) with notes on the biology and distribution. Can Ent., 90:469-473.

Peterson, B. V. 1959. Observations on mating, feeding, and oviposition of some Utah species of black flies (Diptera: Simuliidae). Can Ent., 91: 147-155.

Peterson, B. V. 1959. Notes on the biology of some species of Utah blackflies (Diptera: Simuliidae). Mosquito News, 19:86-90.

Peterson, B.V. 1959. Three new black fly records from Utah (Diptera: Simuliidae). Proc. Ent. Soc. Wash., 61:21.

Peterson, B. V. 1960. Notes on some natural enemies of Utah black flies (Diptera: Simuliidae). Can. Ent., 92:266-274.

Peterson, B. V. 1960. The Simuliidae (Diptera) of Utah. Part I. Keys, original citations, types and distribution. Great Basin Nat., 20 (3&4):81-104.

Peterson, B. V. and G. R. DeFoliart. 1960. Four new species of *Prosimulium* (Diptera: Simuliidae) from western United States. Can Ent., 92:85-102.

Peterson, Hal W. 1956. Why a creel census? Utah Fish and Game Bull., 12(4):8.

Peterson, Hal W. and Robert L. Lee. 1956. Rainbow vs. brown. Utah Fish and Game Bull., 12(3):2.

Platts, William S. 1957. The cutthroat trout. Utah Fish and Game Bull., 13(10): 4, 10.

Platts, William S. 1958. The natural reproduction of the cutthroat trout, *Salmo clarki* Richardson, in Strawberry Reservoir, Utah. M.S. Thesis. Utah State Univ., Logan.

Platts, William S. 1958. Age and growth of the cutthroat trout in Strawberry Reservoir, Utah. Proc. Utah Acad. Sci., Arts, and Letters, 35:101-103.

Platts, William S. 1959. Food habits of the cutthroat trout in Strawberry Reservoir, Utah. Proc. Utah Acad. Sci., Arts, and Letters, 36:119-121.

Platts, William S. 1960. Fishing Strawberry. Utah Fish and Game Mag., 16(4):12-14.

Pratt, Gene A. 1957. Studies on the periodicity of certain plankton species of Salem Lake. M.S. Thesis. Brigham Young Univ., Provo, Utah.

Pratt, Gene A. and Kent H. McKnight. 1957. Plankton periodicity in Salem Pond. Proc. Utah Acad. Sci., Arts, and Letters, 34:153.

Quinn, Barry George. 1958. The effects of sugar beet wastes upon the periphyton of the Jordan River. M.A. Thesis. Univ. Utah. Salt Lake City.

Rawley, Edwin V. 1954. Utah beaver transplanting manual. Utah State Dept. Fish and Game. Dept. Infor. Bull., 12. 15 pp.

Rees, Don M. 1942. Work of mosquito control in Salt Lake City. Proc. New Jersey Mosquito Extermin. Assoc., 29:103-106.

Rees, Don M. 1944. Progress in mosquito control in Utah. Mosquito News, 4(3):78-79.

Rees, Don M. 1948. Mosquito abatement in Utah during 1947. Proc. and Papers Calif. Mosquito Control Assoc., 16:46-47.

Rees, D. M. 1949. Report from the Utah Mosquito Abatement Association. Proc. and Papers Calif. Mosquito Control Assoc., 17: 36-38.

Rees, Don M. Advances in mosquito work in Utah in 1948. Proc. New Jersey Mosquito Extermin. Assoc., 36:58-59.

Rees, Don M. 1952. The effectiveness of mosquito control in Salt Lake City, Utah, as determined by light trap collections. Proc. New Jersey Mosquito Extermin. Assoc., 39:105-109.

Rees, Don M. 1954. The Utah Mosquito Abatement Association in 1953. Proc. and Papers Calif. Mosquito Control Assoc., 22: 2-3.

Rees, Don M. 1956. Water management for mosquito abatement on waterfowl marshes in Utah near the Great Salt Lake. Proc. Utah Mosquito Assoc., 9:21-22.

Rees, Don M. 1960. The Utah Mosquito Abatement Association; objectives and accomplishments Proc. Utah Mosquito Abatement Assoc., 13:1-2.

Rees, Don M. and Glen C. Collett. 1954. The biology of *Aedes niphadopsis* Dyar and Knab. (Diptera, Culicidae). Proc. Ent. Soc. Wash., 56:207-214.

Rees, Don M., George F. Edmunds, Jr., and Lewis T. Nielsen. 1954. Additional uses of granular larvicides in mosquito abatement. Proc. and Papers Calif. Mosquito Control Assoc., 22:20-21.

Rees, Don M. and Jay E. Graham. 1953. 1952 field test of heptachlor for mosquito control. Proc. and Papers Calif. Mosquito Control Assoc., 21:6-7.

Rees, Don M. and Beng. C. Ho. 1960. Arthropods found in Flaming Gorge Reservoir Basin, 1959. General lists. *In* Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin. Utah and Wyoming. Univ. Utah Anthropological Papers, 48: 100-110.

Rees, Don M. and Lewis T. Nielsen. 1952. Control of *Aedes* mosquitoes in two recreational areas in the mountains of Utah. Mosquito News. 12:43-49.

Rees, D. M. and L. T. Nielsen. 1955. Additional mosquito records from Utah. Pan-Pacific Entom., 31:31-33.

Rees, Don M., L. J. Ogden, G. C. Collett, and J. E. Graham. 1959. The 1958 encephalitis outbreak in northern Utah. 3. Mosquito populations in relation to the outbreak. Mosquito News. 19: 227-231.

Regenthal, Albert F. 1958. Scofield rehabilitation program scheduled. Utah Fish and Game Bull., 14(9):19.

Reid, Mervin R. 1957. Comparison of mosquito larval resistance to DDT and heptachlor in treated and untreated areas in Utah. M.S. Thesis, Univ. Utah, Salt Lake City.

Reynolds, Temple A., Jr. 1958. The chemical treatment of Scofield Reservoir. Utah Fish and Game Mag., 14(11): 12-15.

Reynolds, Temple A., Jr. 1959. Fishin' and facts. Utah Fish and Game Mag., 15(5):18-19.

Rich, Royal A. 1960. Limnological studies on Hyrum Reservoir in northern Utah. M.S. Thesis, Utah State Univ., Logan.

Rich, Royal A. 1960. Hyrum reservoir. Utah Fish and Game Mag., 16(6):12-13.

Richards, C. S., L. T. Nielsen, and D. M. Rees. 1956. Mosquito records from the Great Basin and drainage of the lower Colorado River. Mosquito News, 16:10-17.

Robel, Robert J. 1961. Water depth and turbidity in relation to growth of sago pondweed. Jour. Wildlife Mgt., 25:436-438.

Robel, Robert J. 1961. The influence of carp on the production of sago pondweed. Proc. Utah Acad. Sci., Arts, and Letters, 38:119.

Robel, Robert J. 1961. The effects of carp populations on the production of waterfowl food plants on a western waterfowl marsh. Trans. North Amer. Wildlife Conf., 26:147-159.

Roscoe, Ernest J. 1948. *Radix auricularia* (L.) in Utah. Proc. Utah Acad. Sci., Arts, and Letters, 25:168-169.

Roscoe, Ernest J. 1948. Some Mollusca collected in the vicinity of Kanab, Kane County, Utah. Proc. Utah Acad. Sci., Arts, and Letters, 25:169-171.

Roscoe, Ernest J. 1954. Mollusks as fish food. Utah Fish and Game Bull., 10(12):3.

Roscoe, Ernest J. and Lottie O. Roscoe. 1955. Gastropods of the Brighton area, Wasatch Mountains, Utah. Naut., 68(4):127-131.

Ryder, Ronald A. 1957. Coot-waterfowl relations on some northern Utah marshes. Proc. Utah Acad. Sci., Arts, and Letters, 34: 65-68.

Ryder, Ronald A. 1958. Coot-waterfowl relationships in northern Utah. Ph.D. Thesis, Utah State Univ., Logan.

Ryder, Ronald A. 1961. Coot and duck productivity in northern Utah. Trans. North Amer. Wildlife Conf., 26:134-147.

Salt Lake City Mosquito Abatement District. Annual reports beginning in 1930.

Saunders, Edward V. 1951. Reaction of the Rocky Mountain muskrat *Ondatra zibethica osoyoosensis* (Lord) to drought conditions at Ogden Bay Migratory Waterfowl Refuge. M.S. Thesis, Utah State Univ., Logan.

Schoenfeld, T. A. 1957. Report of the Utah Mosquito Abatement Association 1957. Mosquito News, 17: 163-164.

Sessions, Joann. 1960. A study of the stoneflies of the Provo River, Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Shaw, Samuel P. and C. Gordon Fredine. 1956. Wetlands of the United States. U. S. Dept. Int., Fish and Wildlife Serv. Circ. 39, 67 pp.

Sherwood, Glen Allan. 1959. The whistling swan in the Great Salt Lake Valley of Utah. M.S. Thesis. Utah State Univ., Logan.

Sigler, William F. 1957-59. Fish life history series. Utah Fish and Game Mag. Vol. 13, 4: 2, 7 (mountain whitefish); 5: 3, 12 (carp); 6: 4, 12 (rainbow trout); 7: 10 (lake trout); 8: 5 channel catfish); 11: 10-11 (walleye). Vol. 14, 1: 22-23 (brown trout); 2-3: 16-17 (grayling); 6: 20-21 (yellow perch); 7: 20-21 (kokanee); 8: 20-21 (largemouth bass); 9: 20-21 (green sunfish); 10: 20-21 (bluegill); 11: 20-21 (black crappie); 12: 20-21 (white fishes of Bear Lake); Vol. 15(1):20-21 (white bass).

Sigler, William F. 1958. The ecology and use of carp in Utah. Utah Agr. Expt. Sta. Bull 405. 63 pp.

Sigler, William F. 1959. What should we do with Utah's carp? Farm and Home Science, 20:8-9, 25-26.

Sigler, William F. 1959. The taxonomy and life history of some fresh-water fish. Utah State Univ., Logan. Dept. Wildlife Management. Processed.

Skousen, Don B. 1952. A taxonomic survey of the eggs and larvae of some species of Utah Amphibia. M.A. Thesis. Brigham Young Univ., Provo, Utah.

Smart, Earl W. 1958. An ecological study of the bottom fauna of Bear Lake, Idaho and Utah. Ph.D. Thesis. Utah State Univ., Logan.

Smith, Donald O. 1955. An economic evaluation of selected treatments for avian botulism in waterfowl of Utah marshes. M.S. Thesis. Utah State Univ., Logan.

Smith, Gerald R. 1959. Effects of pollution on the Weber River, Utah. M.S. Thesis. Univ. Utah, Salt Lake City.

Smith, Gerald R. 1959. Annotated check list of fishes of Glen Canyon. *In* Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropological Papers, 40:195-199

Smith, Gerald, Guy Musser and Donald B. McDonald. 1959. Aquatic survey of Glen Canyon. *In* Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropological Papers, 40:177-194.

Snow, Edna. 1931. A preliminary study of the Algae of Utah Lake. M.S. Thesis. Brigham Young Univ., Provo, Utah.

Sorenson, W. C. 1956. What we accomplished at Fish Lake. Utah Fish and Game Bull., 12(9):2.

Spencer, Howard E., Jr. 1953. The cinnamon teal (*Anas cyanoptera* Vieillot): Its life history, ecology, and management. M.S. Thesis. Utah State Univ., Logan.

Standing, Keith M. 1954. A critical study of the genus Pantosteus (Catostomidae). M.S. Thesis. Brigham Young Univ., Provo, Utah.

Stone, A. and B. V. Peterson. 1958. *Simulium defoliarti*, a new black fly from the western United States (Diptera, Simuliidae). Bull. Brooklyn Ent. Soc., 53:1-6.

Stone, A. and G. R. DeFoliart. 1959. Two new black flies from the western United States (Diptera: Simuliidae). Ann. Ent. Soc. Amer., 52:394-400.

Tanner, Vasco M. 1927. An ecological study of Utah Amphibia. Proc. Utah Acad. Sci., Arts, and Letters, 5:6-7.

Tanner, Vasco M. 1927. Distributional list of the amphibians and reptiles of Utah. Copeia, No. 163:54-58.

Tanner, Vasco M. 1928. Distributional list of amphibians and reptiles of Utah, No. 2. Copeia, No. 166: 23-28.

Tanner, Vasco M. 1929. A distributional list of amphibians and reptiles of Utah, No. 3. Copeia, No. 171:1-6.

Tanner, Vasco M. 1930. The amphibians and reptiles of Bryce Canyon National Park, Utah. Copeia, 1930(2):41-43.

Tanner, Vasco M. and C. Lynn Hayward. 1934. A biological study of the La Sal Mountains, Utah. Report No. 1 (Ecology). Proc. Utah Acad. Sci., Arts, and Letters. 11:209-235.

Taylor, Glenn North. 1955. Galvanotaxic response of fish to pulsating direct curent. M.S. Thesis. Utah State Univ., Logan.

Taylor, Stanley K. 1959. Bionomics of *Culex tarsalis* Conquillet in Utah County. M.A. Thesis. Brigham Young Univ., Provo, Utah.

Thomas, Chet. 1958. Why not apply "Multiple Use" to our water? Utah Fish and Game Mag., 14(2-3):6-7.

Thomas, Leo A. and J. V. Smith. 1959. The 1958 encephalitis outbreak in northern Utah. 2. Infection rates in birds, mammals, and mosquitoes. Mosquito News, 19:223-226.

Thomas, LeVon. 1961. Cisco season. Utah Fish and Game Mag., 17(12):14-15.

Tuttle, Jerry. 1960. The role of the Utah State Engineer in the elimination of waste water as a means of mosquito abatement. Proc. Utah Mosquito Abatement Assoc., 13:7-10.

U. S. Dept. Int., Fish and Wildlife Service. 1955. Wetlands inventory, Utah. Fish and Wildlife Service Region 2. Albuquerque, New Mexico. 14 pp. Processed.

Utah Mosquito Abatement Association. Proceedings of Annual Meetings. Salt Lake City, Utah.

Utah State Department Fish and Game. 1952-61. Utah Furbearers, management recommendations and harvest reports. Dept. Infor. Bulls.

Utah State Fish and Game Comm. Biennial Reports. Utah Dept. Fish and Game, Salt Lake City, Utah.

Walker, Vance Demont, Jr. 1953. Factors affecting the establishment and spread of the bullfrog *Rana catesbeiana* Shaw in Utah and southern Idaho. M.S. Thesis. Utah State Univ., Logan.

Walker, Demont. 1954. The bullfrog is a potential game species in Utah. Utah Fish and Game Bull., 11(1): 5, 6, 8.

Wardle, William Duane. 1953. An ecological study of a farm fish pond. M.S. Thesis. Univ. Utah, Salt Lake City.

Weber County Mosquito Abatement District Annual Reports (beginning in 1947). Ogden, Utah. Processed.

Weller, Milton W., Billy H. Wingfield and Jessop B. Low. 1958. Effects of habitat deterioration on bird population of a small Utah marsh. The Condor, 60(4):220-226.

Welsh, Stanley L. 1957. An ecological survey of the vegetation of of the Dinosaur National Monument, Utah. M.S. Thesis. Brigham Young Univ., Provo, Utah.

West, Nolan and D. I. Rasmussen. 1947. Utah beaver study. Utah Fish and Game Comm., Salt Lake City. 37 pp.

Wetmore, A. 1917. On the fauna of Great Salt Lake. Amer. Nat., 51:753-755.

Wetmore, A. 1921. Wild ducks and duck foods of the Bear River Marshes, Utah. U. S. Dept. Agr. Bull. 936. 20 pp.

White, Clayton M. and William H. Behle. 1960. Birds of Flaming Gorge Reservoir Basin. *In* Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming. Univ. Utah Anthropological Papers. 48:185-208.

Wilkinson, Finley, 1960. Mosquitoes and Davis County. Proc. Utah Mosquito Abatement Assoc., 13:12-14.

Williams, Cecil S. 1945. Bear River Waterfowl Refuge. Utah Fish and Game Bull., 2(10):1-4.

Williams, C. S. and W. H. Marshall. 1938. Duck nesting studies. Bear River Migratory Refuge, Utah, 1937. Jour. Wildlife Mgt., 2:29-48.

Williams, C. S. and W. H. Marshall. 1938. Evaluation of nesting cover for waterfowl on Bear River Refuge. Trans. North Amer. Wildlife Conf., 3:640-646.

Wingfield, Billy H. 1951. A waterfowl productivity study in Knudson Marsh, Salt Lake Valley, Utah. M.S. Thesis. Utah State Univ., Logan.

Wingfield, Billy and Jessop B. Low. 1955. Waterfowl productivity in Knudson Marsh, Salt Lake Valley, Utah. Proc. Utah Acad. Sci., Arts, and Letters. 32:45-49.

Wolf, Kenneth E. 1952. Some effects on fluctuating and falling water levels on waterfowl production. M.S. Thesis. Utah State Univ., Logan.

Wolf, Kenneth E. 1956. The cause and control of blue-sac disease. Ph.D. Thesis. Utah State Univ., Logan.

Woodbury, Angus M. 1929. The snails of Zion National Park. Naut., 43(2):54-61.

Woodbury, Angus M. 1931. A descriptive catalog of the reptiles of Utah. Bull. Univ. Utah 21(5); Biol. Ser. 1(4):1-129. Genus *Thamnophis* Fitzinger, pp. 98-104.

Woodbury, Angus M. (with others). 1958. Preliminary report on the biological resources of the Glen Canyon Reservoir. Univ. Utah Anthropological Papers, 31:1-219.

Woodbury, Angus M. 1959. Amphibians and reptiles of Glen Canyon: Amphibians. *In* Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropological Papers, 40: 138-140.

Woodbury, Angus M. 1959. An ecological study of the Colorado River in Glen Canyon. *In* Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropological Papers, 40:149-176.

Woodbury, Angus M., Biol. Editor. 1960. Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming. Univ. Utah Anthropological Papers, 48:1-243.

Woodbury, Angus M., Stephen D. Durrant, and Seville Flowers. 1959. Survey of vegetation in the Glen Canyon Reservoir Basin. Univ. Utah Anthropological Papers, No. 36:1-53.

Woodbury, Angus M., Stephen D. Durrant, and Seville Flowers. 1960. A survey of the vegetation in the Flaming Gorge Reservoir Basin. Univ. Utah Anthropological Papers, 45:1-121.

Woolstenhulme, Jack. 1942. Uinta Mountain mollusks. Naut., 56(2):50-55.

Woolstenhulme, Jack P. 1942. New records of Mollusca. Bull Univ. Utah, 32(11); Biol. Ser., 6(9):1-11.

Workman, Gar W. 1959. Lethal concentrations and detoxification time of toxaphene for goldfish, Gambusia, and rainbow trout. M.S. Thesis, Utah State Univ., Logan.

Some Selected Unsigned Articles

Utah Fish and Game Bulletin

1945. Utah's man-made marshes (from information gathered by Marcus Nelson).

Locomotive springs is sportsmen's paradise. Vol. 2(5): 1-5.

Utah public shooting grounds. Vol. 2(6):1-8.

Ideal habitat at Clearlake. Vol. 2(7):1, 3-9.

Farmington Bay Waterfowl Project. Vol. 2(8):1-5.

1946. Buriston Pond gets face lifted. Vol. 3(2):7-8.

1946. Fish suffocation at Fairview Lake. Vol. 3(3):5-6.

1946. Provo River fishing hurt by river changes. Vol. 3(5):6-7.

1947. Utah's oldest man-made marsh. Vol. 4(2):3, 6-7.

1947. Striking back at poor fishing. Vol. 4(3):1-3.

1948. Reclamation on the Provo River. Vol. 5(9):2-3.

1948. Early day leaders introduced unusual species of game. Vol. 5(12):5.

1949. Trash fish utilization in Utah. Vol. 7(6):1, 4-5.
1949. A report on Ogden Bay Refuge. Vol. 7(9):3-5.
1950. Unwise use of soils and water challenges fish production. Vol. 7(12):1, 6-7.
1953. There's gold in that thar river. Vol. 10(1):2.
1953. Utah's best fishing season. Vol. 10(2):1-2.
1953. German carp invade Utah's greatest fishing mecca. Vol. 10(3):8-9.
1953. Permanent improvement program improves fish and game resources. Vol. 10(4):1, 2.
1953. Small reservoirs prove worth in fish production. Vol. 10(6): 1-2.
1954. Water pollution affects wildlife. Vol. 10(8): 1, 2, 3.
1954. Water won't wash itself. Vol. 10(9): 1, 4, 5.
1954. Fish suffocate in Pine Lake. Vol. 10(10):3.
1955. Is Great Salt Lake just coming to life? Vol. 11(4): 1, 2, 6, 7.
1955. White bass reach Utah waters. Vol. 11(11):4.
1956. Can mosquito abatement work and waterfowl management be compatible? Vol. 12(4): 1, 3.
1956. Brine shrimp, miracle feed or practical flop? Vol. 12(8): 1, 4.

UTAH FISH AND GAME MAGAZINE

1961. Oh, that Strawberry groan [Strawberry Reservoir]. Vol. 17(12):4-5.

CORRECTIONS FOR "BIBLIOGRAPHY OF UTAH AQUATIC BIOLOGY" (CHRISTENSEN - 1956)

The following names of authors were misspelled or incorrectly listed in the 1956 bibliography. The correct names are listed first and the incorrect ones are given in parentheses.

Dunstan, William Albert (Dustans, William Albert)
Frederick, Elfriede (Frederick, Elfrside)
McConnell, William Johnston (McCornell, William Johnston)
Nielsen, Lewis T. (Nielson, Lewis T.)
Sigler, William F. 1955. (Sigler, William F. and J. B. Low)

The following scientific names were spelled incorrectly in the 1956 bibliography. The authors' names and dates of publication are given with the corrected names.

Carbine, William Fenton. 1936. *Tigoma atraria*
Cope, E. D. 1874. Plagopterhines (Plagopterhinidae).
Leichty, W. R. 1952. Carex.
Neubold, John Mathew. 1954. *Gila atraria.*
Rees, Don M. 1934. *Gambusia affinis.*
Rees, Don M. 1954. *Aedes nigromaculis.*

Sargent, David L. 1927. *Gammarus limnaeus.*
Tanner, Vasco M. 1932. *Notolepidomyzon utahensis;* catostomid.

The following theses which were listed in the 1956 bibliography as M.S. theses are M.A. theses.

Flowers, Seville. 1926.
Merkley, Don R. 1948.
Rees, Bryant E. 1936.

The following thesis which was listed in the 1956 bibliography as an M.A. thesis is an M.S. thesis.

Kirkpatrick, Ruth. 1934.

The dates were incorrectly listed for the following in the 1956 bibliography. The authors and correct dates are given first followed by the incorrect dates in parentheses.

Alexander, Charles P. 1948 (1848)
Cope, E. D. 1876(1874) On the Plagopterinae. . .
Madsen, Marion J. 1931 (1935)
Tanner, Mathias Charles. 1941 (1942)
Rockwood, A. P. 1873 (1874)

The pages were incorrectly listed for the following in the 1956 bibliography. The correct page citations follow the authors and dates of publication. The incorrect citations are given in parentheses.

Knowlton, G. F. and L. E. Fronk. 1950. 369:5-6 (369:56).
Marsh, C. D. 1929. 75(14):1-27 (75:1-27).
Nelson, Noland F. 1955. 32:37-40 (32:37-44).
Pack, Dean A. 1919. 36:273-282. (pages not given).
Tanner, Vasco M. 1942. 3:27-32 (3:27-30).

The following are corrected titles:

Madsen, Vaughn D. 1942. Investigation of the fishery of Fish Lake, Utah.
Merkley, Don R. 1948. The adult caddis flies of the Provo River.
Daines, L. L. 1917. On the flora of the Great Salt Lake.

THE DYTISCIDAE (COLEOPTERA) OF UTAH: KEYS, ORIGINAL CITATION, TYPES AND UTAH DISTRIBUTION

Russell D. Anderson[1]

A review of the voluminous literature dealing with the family Dytiscidae reveals that very little has been published about the Utah dytiscid fauna. The principal studies are the unpublished master's theses of Chandler (1941) and Todd (1952). Chandler (*op. cit.*) prepared the most extensive list which includes 63 species; however, two these *Hydroporus vilis* LeConte and *Hydroporus tristis* Paykull were included on the basis of their known distribution and not on locally collected specimens. Four other species *Hydroporus sinuatipes* Fall, *Hydroporus hardyi* Sharp, *Cybister fimbriolatus* (Say) and *Agabinus sculpturellus* Zimmerman, have been deleted as mis-identifications. Todd's (*op. cit.*) study was on the adult dyticids of the Provo River and didn't include any new records. Beck (1954) included 29 dytiscid species in his study of the plateau region and surrounding portions of Wayne. Kane and Garfield Counties. Leech (1938) and Tanner (1928, 1934, 1940) also noted the occurrence of limited numbers of dytiscid species in Utah. Musser (1959) reported on 9 dytiscid genera including 5 specific determinations from the Glen Canyon portion of the Colorado River. Putnam (1876) reported on 12 species collected in Utah county; the specimens were determined by Henry Ulke. Two of these, *Bidessus cinctellus* (LeConte) and *Agabus fimbriatus* (LeConte), have never been collected again from the area and as the original specimens were unavailable for study they have not been included in the present list.

In the present paper an attempt has been made to present workable keys to the genera and species of adult dytiscids of Utah; provide an annotated check list of the species in Utah including original citations, type repository, type locality, and Utah distribution. In the interest of space the distribution is by county except in the case of those species with only a few locality records. There are also at least two undescribed dytiscid species known to occur in Utah. I plan to describe these in the future.

Key to the Genera of Adult Utah Dytiscidae

1. Mesoscutellum covered by hind margin of pronotum; protarsi and mesotarsi 4-segmented or 5-segmented with the 4th usually much shorter than the 3rd (except in *Laccophilus*) 2

1. Assistant Professor, The Church College of Hawaii, Laie, Oahu, Hawaii. This is a portion of a thesis completed in partial fulfillment of the requirements for the Degree of Doctor of Philosophy at the University of Utah, Salt Lake City.

Mesoscutellum entirely visible; protarsi and mesotarsi 5-segmented with the 4th approximately as long as the 3rd 8

2. Base of prosternum and its postcoxal process in the same plane; protarsi and mesotarsi distinctly 5-segmented; metatarsi with a single straight claw ..... *Laccophilus*

Base of prosternum and its postcoxal process not in the same plane; protarsi and mesotarsi having 4th segment hidden between lobes of 3rd segment 3

3. Broad apex of metacoxal processes divided into 3 parts, 2 widely separated narrow lateral lobes and a broad depressed middle region, triangular at its tip ..... *Hydrovatus*

Metacoxal processes not divided into 3 parts as described above; but either without lobes or with these lobes covering base of trochanters 4

4. Metacoxal processes without lateral lobes, bases of metathoracic trochanters entirely free; metatibia slightly arcuate; epipleura without a diagonal carina near base ..... *Bidessus*

Metacoxal processes with lateral lobes covering at least in part the bases of metathoracic trochanters; metatibia straight; epipleura with or without diagonal carina near base 5

5. A diagonal carina crossing epipleura near base; protarsi and mesotarsi 4-segmented; epipleura of elytra with basal excavation ..... *Hygrotus*

Without diagonal carina on epipleura; protarsi and mesotarsi 5-segmented, 4th partly hidden; epipleura of elytra without basal excavation 6

6. Mesial line between metacoxal processes never abbreviated; posterior margins of metacoxal processes (best viewed with head of insect toward observer) virtually straight across or sinuate or obtusely angulate ..... *Hydroporus*

Mesial line between metacoxal processes more or less abbreviated behind; posterior margins of metacoxal processes slightly to deeply incised at middle 7

7. Ventral surface of body subgranulate to densely micro-punctate, lacking scattered large punctures; pronotum without longitudinal sublateral plica; metafemora densely punctate over entire surface ..... *Deronectes*

Ventral surface of body more or less finely punctate with scattered coarser punctures; pronotum with longitudinal sublateral plica; metafemora with a median line of setiferous punctures, otherwise sparsely punctate ..... *Oreodytes*

8. Eyes emarginate above bases of antennae; first 3 segments of protarsi of male widened but never forming a round plate 9

Eyes not emarginate above bases of antennae; first 3 segments of protarsi of male greatly widened, forming a nearly round or oval plate with adhesion discs 14

9. Metafemora with a linear group of cilia near the posteriodistal angle 10
   Metafemora without such a group of cilia 12
10. Metacoxal processes parallel sided, lateral margins straight to apices ..... *Agabinus*
    Metacoxal processes in form of rounded lobes 11
11. Metatarsal claws equal in length; female genital valves simple ..... *Agabus*
    Metatarsal claws obviously unequal, outer one of each pair much shorter than inner claw; female genital valves sawlike and laterally compressed ..... *Ilybius*
12. Metatarsal claws virtually equal in length; terminal segment of labial palpi emarginate at apex; smaller species, less than 9 mm. long ..... *Coptotomus*
    Metatarsal claws obviously unequal, outer ones shorter than inner; terminal segment of labial palpi simple at apex; larger species, great than 9 mm. long 13
13. Metatasternum between mesocoxae deeply, triangularly, split to receive tip of prosternal process; pronotum margined; elytral reticulation lightly impressed, meshes of unequal size and shape ..... *Rhantus*
    Metasternum between mesocoxae with a shallow depression, never a sharply outlined, triangular excavation; pronotum not margined; elytral sculpture consisting of numerous parallel transverse grooves ..... *Colymbetes*
14. Inferior spur at apex of metatibiae dilated, much broader than the other spur; first 3 segments of protarsi of male forming a transversely oval adhesion disc, with 3 or 4 transverse rows of petiolate adhesive plates ..... *Cybister*
    Inferior spur not or but little broader than the other spur; first 3 segments of protarsi of male forming a nearly round adhesion disc 15
15. Distal margins of first 4 metatarsal segments bare; large beetles, greater than 20 mm. long ..... *Dytiscus*
    Distal margins of first 4 metatarsal segments beset with a fringe of flat golden setae; smaller beetles less than 19 mm. long 16
16. Prosternal process sharply pointed; pronotum margined laterally; lateral edge of elytron from behind middle to about apical 5th margined with short spines ..... *Eretes*
    Prosternal process rounded; pronotum not margined laterally; elytra without spines on lateral edge 17
17. Outer metatibial spur acute; outer margin of metasternal wing straight ..... *Hydaticus*
    Outer metatibial spur blunt, more or less emarginate; outer margin of metatasternal wing arcuate 18

18. Ventral and dorsal surface coarsely punctate; elytra usually fluted and hairy in female; protarsal adhesion disc of male with one large basal, and two small median suction cups ..... *Acilius*

Ventral and dorsal surface almost smooth, with micropunctation; elytra not fluted or hairy in female; protarsal adhesion disc of male with 4 to 6 large and many smaller suction cups 19

19. Elytral ground color yellow, uniformly speckled or vermiculate with black; hind margin of mesofemora with a series of stiff setae which are only about half as long as femora are wide ..... *Graphoderus*

Elytral ground color black with yellow maculae or transverse bands, or yellow with black spots, or irrorate; hind margin of mesofemora with a series of stiff setae which are as long or longer than the femora are wide (often broken off) ..... *Thermonectus*

Species Keys, and Accounts

Laccophilus Leach 1817

1. Metasternum and metacoxal plates black, abdominal sterna black with posterior margin broadly piceous; elytra nearly uniformly irrorated with brown, vaguely paler laterally ..... *atristernalis* Crotch

Metasternum, metacoxal plates and abdominal sterna yellow to testaceous; elytra irrorated with brown, but with definite clear yellow spots, the more constant ones located in a subbasal transverse series, a series in the apical three-fourths, a subapical transverse series, a median lateral and a postmedian sutural spot ..... *decipiens* LeConte

Laccophilus decipiens LeConte, 1852, Ann. Lyceum Nat. Hist., N. Y. 5:205. *maculosus* Walker, *truncatus* Mannerheim, *californicus* Motschulsky, *fusculus* Sharp.

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: In California, et in Territorio Orgonensi abundat.

Utah Distribution: Box Elder, Cache, Rich, Weber, Morgan, Davis, Summit, Daggett, Tooele, Salt Lake, Utah, Wasatch, Duchesne, Uintah, Juab, Sanpete, Carbon, Grand, Millard, Beaver, Sevier, Wayne, Garfield, Piute, Emery, Washington, Kane and San Juan Counties.

Laccophilus atristernalis Crotch, 1873, Trans. Amer. Ent. Soc., 4:400.

Type Repository: British Museum (Nat. Hist.), London.

Type Locality: California.

Utah Distribution: Box Elder, Davis, Tooele, Salt Lake, Juab, Utah, Wasatch, Millard, Washington, Kane, and San Juan Counties.

Hydrovotus Motschulsky 1855

Hydrovatus brevipes Sharp, 1882, Sci. Trans. Royal Dublin Soc., 2(2):324.

Type Repository: British Museum (Nat. Hist.), London.

Type Locality: California.
Utah Distribution: Washington County, St. George (Chandler 1941).

Bidessus Sharp 1882

1. Elytra with distinct sutural striae; elytra dark with pale post-humeral, post-medial and pre-apical color pattern ..... *subtilis* (LeConte)
   Elytra without sutural striae or at best very obscure; elytra dark with pale color pattern typically longitudinal or transverse 2
2. Elytra occasionally with obscure sutural striae; elytral markings of large transverse pale areas ..... *amandus* (LeConte)
   Elytra lacking sutural striae; elytral markings of longitudinal pale areas ..... *affinis* (Say)

Bidessus affinis (Say), 1823. Trans. Amer. Phil. Soc., 2:24, 104. *nanus Aubé*, *nigrinus* Casey, var. *macularis* LeConte, var. *obscurellus* LeConte, var. *erythrostomus* Mannerheim.
Type Repository: Say's types are considered lost.
Type Locality: Not stated by author.
Utah Distribution: Box Elder, Cache, Rich, Morgan, Salt Lake, Summit, Daggett, Tooele, Utah, Wasatch, Duchesne, Uintah, Juab, Sanpete, Millard, Sevier, Iron, Garfield, Washington, Kane, and San Juan Counties.

Bidessus subtilis (LeConte), 1852, Ann. Lyceum Nat. Hist., N. Y., 5:206.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: "Sta Isabel," California.
Utah Distribution: Emery, Garfield, Washington, and San Juan Counties.

Bidessus amandus (LeConte), 1852, Ann. Lyceum Nat. Hist., N. Y., 5:207.
Type Repository: Museum of Comparative Zoology, Harvary University, Cambridge, Massachusetts.
Type Locality: Gila River, Arizona.
Utah Distribution: Utah (Leech, 1948).

Hygrotus Stephens 1828

1. Clypeus with marginal bead anteriorly 2
   Clypeus lacking marginal bead anteriorly 3
2. Under surface black; male protarsal claws laminiform, anterior one a little shorter and less acute; elytra vittate; length 4-5 mm. ..... *masculinus* (Crotch)
   Under surface rufous or rufo-testaceous; male protarsal claws unmodified; disc of elytra with large, deep punctures, length less than 4 mm. ..... *sayi* Balfour-Browne
3. Last abdominal sternite of the male with a prominent oblique tumidity on either side, often obscure in female ..... *tumidiventris* (Fall)
   Last abdominal sternite without tumidity 4

4. Elytral punctation (excluding serial punctures) obviously dual in size; elytra flavo-to rufo-testaceous in color, generally with vitiform markings 5

Elytral punctation (excluding serial punctures) not dual in size; elytral color highly variable, never vittate, generally with nebulose markings 6

5. Elytral punctures coarse and intermixed with fine punctures between serial punctures; impressed lines of serial punctures variable in development, ventral surfaces shagreened; anterior protarsal claw simple ..... *impressopunctatus* (Schaller)

Elytral punctures fine, dispartity evident but not as distinct as above, impressed lines of serial punctures lacking, ventral surface alutaceous; anterior protarsal claw short and stout ..... *unguicularis* (Crotch)

6. Protarsi of male broadly dilated, nearly or quite as wide as the apical width of the tibia ..... *patruelis* (LeConte)

Protarsi of male at most only slightly dilated 7

7. Color above testaceous with elytral cloud extending nearly to base; elytral markings highly variable sometimes almost absent ..... *medialis* (LeConte)

Color above testaceous with a faint posterior elytral cloud ..... *virgo* (Fall)

Hygrotus sayi Balfour-Browne, 1944. Ann. Mag. Nat. Hist. 11:347-384. *punctatus* Say (nec Marsh).

Type Repository: Type is considered lost.

Type Locality: "Northwest Territory" (Wisconsin and Minnesota).

Utah Distribution: Cache, Weber, Summit, Salt Lake, Utah, Wasatch, Duchesne, Juab, Sanpete, Millard, Sevier, Garfield and Kane Counties.

Hygrotus medialis (LeConte), 1852. Ann. Lyceum Nat. Hist., N. Y., 5:209. *infacetus* (Clark).

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: San Diego.

Utah Distribution: Box Elder, Cache, Rich, Weber, Davis, Summit, Daggett, Salt Lake, Tooele, Utah, Wasatch, Duchesne, Uintah, Juab, Millard, Sevier, Grand, Beaver, Garfield, Kane, and San Juan Counties.

Hygrotus virgo (Fall), 1919. N. Am. Sp. of Coelambus, J. D. Sherman Jr. Publ..: pp. 12 and 13.

Type Repository: American Museum of Natural History.

Type Locality: Virgin River, Utah.

Utah Distribution: Washington, Sevier, and Garfield Counties.

Hygrotus patruelis (LeConte), 1855, Proc. Acad. Nat. Sci. 7:298. *medialis* Sharp, *discoideus* LeConte.

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: Fort Laramie, "Nebraska" (Wyoming).

Utah Distribution: Cache, Summit, Daggett, Salt Lake, Utah, Wasatch, Duchesne, Uintah, Sanpete, Sevier, Garfield, and San Juan Counties.

Hygrotus tumidiventris (Fall), 1919, N. Am. Sp. Coelambus J. D. Sherman Jr. publ.,: 16.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Stony Mountain, Manitoba.
Utah Distribution: Box Elder, Cache, Rich, Davis, Daggett, Salt Lake, Tooele, Utah, Duchesne, Carbon, Sevier, Beaver, Iron, and Garfield Counties.

Hygrotus masculinus (Crotch), 1874, Trans. Amer. Ent. Soc., 5:74.
Type Repository: British Museum (Nat. Hist.), London.
Type Locality: "Lake Labache" (Lac La Hache, British Columbia).
Utah Distribution: Box Elder County, Muddy Reservoir, 17 miles west of Rosette and Utah County, Utah Lake.

Hygrotus unguicularis (Crotch), 1874, Trans. Amer. Ent. Soc., 5:73, 74.
Type Repository: British Museum (Nat Hist.), London.
Type Locality: British Columbia.
Utah Distribution: Daggett, Sanpete, Sevier, Beaver, Iron, Garfield, and Kane Counties.

Hygrotus impressopunctatus (Schaller), 1783, Abhandlungen der Hallischen Naturforschenden Gessellschaft. Dissau u. Leipzig., :312. *picipes* Fabricius, *flavicans* Müller, *lineatus* Müller, *ovalis* Thunberg, *punctatus* Marsham, *porosus* Gebler, *similis* Kirby, *alternatus* Huryl, *decemlineatus* Mannerheim, *picatus* Kirby, *alternans* Kunze, *lineelus* Gyllenhal.
Type Repository: Type is considered lost.
Type Locality: Unkonwn to author.
Utah Distribution: Box Elder, Davis, Salt Lake, Utah, Juab, Duchesne, Uintah, Sevier, Beaver, Piute, Wayne, Iron, and Garfield Counties.

Deronectes Shaper 1882

1. Elytral margin with small subapical tooth; outline of prothorax and elytra strongly discontinuous ..... *elegans* (Panzer)
   Elytral margin lacking subapical tooth; outline of prothorax and elytra continuous 2
2. Elytra with more than two distinct longitudinal, discal striae, the first no further from the sutural series than the sutural series is from the suture ..... *striatellus* (LeConte)
   Elytra with only two longitudinal discal striae, often indistinct, the first twice as far from the sutural series as the sutural series is from the suture 3
3. Longitudinal elytral striae of impressed punctures distinct; form broader, less than twice as long as wide; body outline discontinuous; pronotal lateral marginal bead increasing in width posteriorly ..... *aequinoctialis* (Clark)
   Longitudinal elytral striae of impressed punctures scarcely impressed; form narrower, twice as long as wide, continuous body outline; pronotal lateral marginal bead narrow but constant in width for entire length 4

4. Color pattern of distinct, separate vittae, united only in two discal and three sublateral spots; smaller sized beetles .... *coloradensis* (Fall)

Color pattern of indistinct vittae with considerable transverse coalescence; larger sized beetles .... *griseostriatus* (DeGreer)

Deronectes elegans (Panzer), 1794, Fn. Germ., 24:5. *brevis* Sturm, *rotundatus* LeConte, *depressus* Stephens.

Type Repository: Type is considered lost.

Type Locality: Unknown to author.

Utah Distribution: Daggett County, Green River, and Salt Lake County, Mountain Dell Reservoir.

Deronectes griseostriatus (DeGreer), 1774. Mémoires pour servir à l'histoire des Insectes, Stockholm, 4:403. *halensis* Paykull, *parallelus* Say, *interruptus* Say, *suffusus* Sharp, *prosternalis* Sharp, var. *catascopium* Say.

Type Repository: Naturhist. Riksmus, Stockholm.

Type Locality: Sweden.

Utah Distribution: Cache, Rich, Summit, Daggett, Utah, Wasatch, Duchesne, Uintah, Millard, Sanpete, Sevier, Washington, Kane, and San Juan Counties.

Deronectes striatellus (LeConte), 1852, Ann. Lyceum Nat. Hist., N. Y., 5:207. *infaustus* Clark, *pulcher* Motschulsky, *corvinus* Needham and Christenson.

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: San Francisco et San Diego, California.

Utah Distribution: Box Elder, Cache, Weber, Summit, Daggett, Salt Lake, Utah, Wasatch, Duchesne, Uintah, Juab, Sanpete, Carbon, Sevier, Emery, Grand, Beaver, Garfield, Washington, Kane, and San Juan Counties.

Deronectes aequinoctialis (Clark), 1862, Ann. Mag. Nat. Hist., 3:178. *nudatus* (Say).

Type Repository: British Museum (Nat. Hist.), London.

Type Locality: Mexico.

Utah Distribution: Washington County, St. George.

Deronectes coloradensis (Fall), 1923, Revision N. Am. Sp. *Hydroporus* and *Agaporus*.: 108, 109.

Type Repository: Museum of Camparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: "Copeland, Res." Boulder County, Colorado.

Utah Distribution: Cache, Summit, Duchesne Counties.

Hydroporus Clariville 1806

1. Posterior line of metacoxal processes sinuate to slightly angulate medially; meta-trochanters elongate, posterior margins more nearly in line with the posterior margin of the metafemora and approximately $\frac{1}{2}$ the length of the metafemora; metacoxal processes glabrous 2

Posterior line of metacoxal processes truncate or very nearly so; meta-trochanters not elongate, posterior margins not in line with the posterior margin of the metafemora and only about $\frac{1}{4}$ the length of the metafemora; metacoxal processes with pubescence 3

2. Form subovate, width greater than twice the length, moderately convex; pronotum piceous to black; elytra yellowish-brown to reddish-brown ..... *vilis* LeConte

   Form narrower, width less than twice the length, more parallel sided, depressed; pronotum and elytra more nearly yellowish-brown to reddish-brown ..... *planiusculis* Fall

3. Elytral punctures faint and minute; ovate beetles of larger size (4.5-6 mm. long) 4

   Eltral punctures distinct and moderately coarse; oval beetles of smaller size (3-4.5 mm. long) 7

4. Basal segments of male protarsi very large, wider than following segments ..... *notabilis* LeConte

   Basal segments of male protarsi no wider than the following segments 5

5. Elytral punctures arranged in transversely elongate rows; fourth segment of protarsi of female reduced, third segment deeply bilobed ..... *transpunctatus* Chandler

   Elytral punctures in no distinct order; protarsi of female unmodified 6

6. Abdominal sterna with dense, coarse punctures, most notable on last sternite; male anterior protarsal claws short, arcuate internally and bluntly pointed ..... *axillaris* LeConte

   Abdominal sterna with sparse, finer punctures, no notable difference on last sternite; male anterior protarsal claws short, sinuate internally and acuminate ..... *? niger* Say

7. Size moderate (3.5-4.5 mm.) 8

   Size small (less than 3.5 mm.) 10

8. Third segment of male protarsi broadly dilated, slightly wider than first and second segments ..... *tenebrosus* LeConte

   Third segment of male protarsi narrowly dilated, never wider than first and second segments 9

9. Anterior protarsal claws of male shorter than their fellows ..... *pervicinus* Fall

   Protarsal claws of male equal ..... *despectus* Sharp

0. Ventral sclerites alutaceous or shagreened between punctures ..... *occidentialis* Sharp

   Ventral sclerites polished or shining between punctures ..... *fuscipennis* Schaum

Hydroporus occidentalis Sharp, 1882, Sci. Trans. Royal Dublin Soc., (2) 2:456.
Type Repository: British Museum (Nat. Hist.), London.
Type Locality: "Lake Labache" (Lac La Hache, British Columbia).
Utah Distribution: Box Elder, Cache, Utah, Duchesne, Summit, and Uintah Counties.

Hydroporus vilis LeConte, 1852, Ann. Lyceum, Nat. Hist., N. Y., 5:208.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: San Jose et San Diego.
Utah Distribution: Duchesne, Uintah, Washington, and San Juan Counties.

Hydroporus planiusculus Fall, 1923, Revision H. Am. Sp. *Hydroporus* and *Agaporus*, 58.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Mt. Adams, White Mountains, New Hampshire.
Utah Distribution: Duchesne and Garfield Counties.

Hydroporus tenebrosus LeConte, 1850. Agassiz Lake Superior, 4:215. *rusticus* Sharp, *luridipennis* LeConte
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Lake Superior.
Utah Distribution: Sevier County, 1 mi. N. of Fish Lake and 18 mi. above Salina Reservoir.

Hydroporus despectus Sharp, 1882, Sci. Trans. Royal Dublin Soc., (2)2:466-467.
Type Repository: British Museum (Nat. Hist.), London.
Type Locality: Canada.
Utah Distribution: Utah County, Provo and Goshen.

Hydroporus fuscipennis Schaum, 1868, Ins. Deutsch., 2:64. *puberulus* Mannerheim.
Type Repository: Zoological Museum of the Bavarian State, Munich, Germany.
Type Locality: Unknown to author.
Utah Distribution: Duchesne County, Farmers Lake Group.

Hydroporus axillaris LeConte, 1853, Cat. of the Desc. Col. of the U. S. by F. E. Melsheimer, revised by Haldeman and LeConte, :32. *humeralis* LeConte.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Colorado River.
Utah Distribution: Washington County, St. George.

Hydroporus niger Say, 1823, Trans. Amer. Phil. Soc., 2:103. *modestus* Aubé, *punctatissimus* Aubé, *latifrons* Sharp.
Type Repository: Type is considered lost.
Type Locality: Not stated in original description.
Utah Distribution: Cache County, Canteen Springs, Logan Canyon.

Hydroporus notabilis LeConte, 1850, Agassiz Lake Superior, 4:216.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Black Bay, Lake Superior.
Utah Distribution: Box Elder, Salt Lake, and Utah Counties.

Hydroporus pervicinus Fall, 1923, Revision N. Am. Sp. *Hydroporus* and *Agaporus*: 84.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Lake Tahoe, California.
Utah Distribution: Summit, Utah, Duchesne, Uintah, and Sanpete Counties.

Hydroporus transpunctatus Chandler, 1941, Great Basin Nat., 2:103.
Type Repository, Brigham Young University, Provo, Utah.
Type Locality: Salamander Lake (pond), Mt. Timpanogos, Utah County, Utah.
Utah Distribution: Cache and Utah Counties.

Oreodytes Seidlitz 1886

1. Epipleura not impressed at humeral angles for reception of mesofemora; metafemora strongly curved at attachment to trochanters; elytra of female with an angular tooth laterally near the apex; elytra lackly impressed longitudinal series of discal punctures; larger (over 4 mm. long) ..... semiclarus (Fall)

   Epipleura impressed at humeral angles for reception of mesofemora; metafemora not strongly curved at attachment to trochanters; elytra of female lacking angular tooth laterally near apex; elytra with impressed longitudinal series of discal punctures; smaller (less than 4 mm. long) 2

2. Body outline discontinuous, form elongate oval 3
   Body outline continuous, form broadly oval 4

3. Epipleura black or slightly paler along lateral margin; scattered punctures of elytra evident; discal series of punctures moderately impressed ..... *scitulus* (LeConte)

   Epipleura pale or slightly darker along lateral margin; scattered punctures of elytra indistinct; discal series of punctures distinctly impressed ..... *septentrionalis* (Gyllenhal)

4. Metacoxal plates with scattered large punctures; scattered elytral punctures distinct ..... *crassulus* (Fall)

   Metacoxal plates with scattered small punctures, scattered elytral punctures reduced or lacking 5

5. Elytra with faint, occasional punctures between discal and subhumeral longitudinally impressed series; elytra nigrolineate ..... *obesus* (LeConte)

   Elytra impunctate between discal and sub-humeral longitudinally impressed series; elytra indistinctly nigrolineate, considerable coalescence forming a transverse cloud ..... *congruus* (LeConte)

Oreodytes obesus (LeConte), 1866, Proc. Acad. Nat. Sci., Philadelphia, 5:365.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: California.
Utah Distribution: Cache County, Logan.

Oreodytes congruus (LeConte), 1878, Bul. U. S. Geol. Surv., 4:452.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Florissant, Colorado, (8,000 ft.).
Utah Distribution: Box Elder, Summit, Daggett, and Wasatch Counties.

Oreodytes scitulus (LeConte), 1855, Proc. Acad. Nat. Sci., Philadelphia, 7:295. *septentrionis* auct (*nec* Gyll.).
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Eagle Harbor, Lake Superior.
Utah Distribution: Weber County, Uintah on the Weber River.

Oreodytes semiclarus (Fall), 1923, Revision N. Am. Sp. *Hydroporus* and *Agaporus*; :113, 114.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Georgetown, Colorado.
Utah Distribution: Cache County, Logan.

Oreodytes crassulus (Fall), 1923, Revision N. Am. Sp. *Hydroporus* and *Agaporus*, :119.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Western Montana.
Utah Distribution: Cache, Weber, Morgan, Daggett, Utah, and Wasatch Counties.

Oreodytes septentrionalis (Gyllenhal), 1827, Insecta Suecica, 4:385.
Type Repository: Zoological Museum, Uppsala, Sweden.
Type Locality: Unknown to author.
Utah Distribution: Duchesne County, Miners Gulch on Rock Creek.

Agabinus Crotch 1873

Agabinus glabrellus (Motschulsky), 1859, Bul. Soc. Imp. Nat. Moscou, 32:184.
Type Repository: Zoological Museum, University of Moscow, Russia.
Type Locality: California.
Utah Distribution: Washington County, St. George, and Zion National Park.

Agabus Leach 1817

1. Antennal segment 7 to 11 of male dilated, segments 8 to 10 broader than long; metasternal wings very narrow, elongate and tongue like ..... *antennatus* Leech

   Antennal segments of male not dilated; segments never broader than long; metasternal wings broad or narrow, never elongate or tongue like 2

2. Outline of body clearly discontinuous; pronotum subcordate .. 3

   Outline of body not or very slightly discontinuous; posterior margin of pronotum wider than the middle of the pronotum 4

3. Posterior margin of pronotum 6/7 as wide as base of elytra; lateral margin of pronotum slightly sinuate; black; appendages obscurely rufous; 9-10.8 mm. in length ..... *bjorkmanae* Hatch

   Posterior margin of pronotum 9/10 as wide as base of elytra; lateral margin of pronotum subparallel before curving out strongly; piceous to rufous; feebly aenescent; 8.7-9.2 mm. in length ..... *cordatus* (LeConte)

4. Elytra testaceous with four black vittae often more or less confluent so that elytra are almost black; meshes of elytral reticulations small, unequal ..... *disintegratus* (Crotch)

   Elytra color various, never vittate; meshes of elytral reticulations various 5

5. Spinous punctures along posterior margin of lower surface of metatibiae so closely set as to form an almost continuous groove from base nearly to apex 6

   Spinous punctures along posterior margin of lower surface of metatibiae well separated or lacking except in basal ⅓. 7

6. Male anterior protarsal claw with basal tooth; elytra coarsely reticulate, alveoli large; metafemora strongly obliquely strigate ..... *tristis* Aubé

   Male anterior protarsal claw not toothed, slightly sinuate or dilated medially along inner margin; elytra finely reticulate; strongly convex when viewed laterally .... *minnesotensis* Wallis

7. Prosternal process rather broad, slightly convex, never with a median carina 8

   Prosternal process narrower, moderately convex to acutely longitudinally carinate 11

8. Prosternal process broad and flat, sides broadly margined behind the procoxal cavity; protarsi with only small apical area of basal joint clothed with small pallettes, metatibiae without row of spinous punctures .... *semivittatus* LeConte

   Prosternal process broad, slightly convex, never broadly margined behind procoxal cavities, protarsi variable, metatibiae with a row of spinous punctures along posterior lower margin 9

9. Fine punctures of elytra occurring at intersections of the reticulations; pronotal bead very narrow; prosternal process bluntly pointed ..... *hypomelas hypomelas* Mannerheim

   Fine punctures of elytra occurring within meshes of reticulations; pronotal bead moderately wide; prosternal process sharply pointed 10

10. Metasternal wings narrow, least distance from mesocoxae to metacoxal plate less than ½ width of the latter; elytral reticulations lightly impressed; elytra unicolor .... *seriatus intersectus* (Crotch)

    Metasternal wings broad, least distance from mesocoxae to metacoxal plate more than ½ the width of the latter; reticulations more deeply impressed; elytra generally with small sublateral yellow spot behing middle .... *lugens* LeConte

11. Elytral reticulations forming large meshes in both sexes, deeply impressed 12

    Elytral reticulations forming small meshes in male; slightly coarser in females of some species 13

12. Head, pronotum and elytra reddish-brown, ventral surface blackish; prosternal process without pubescence; epipleura pale ..... *austini* Sharp

Head and pronotum black, elytra fuscous often paler at humeral angle; prosternal process finely pubescent; epipleura dark ..... *strigulosus* Crotch

13. Anterior protarsal claws of male toothed medially or subapically along inner margin, posterior claw short and curved 14

Anterior protarsal claws of male not toothed, posterior claw long and slender, only slightly curved 15

14. Anterior protarsal claws of male subapically toothed, appearing bifid; male pro-and mesotarsi broad, glandular hairs forming pallettes; size over 7 mm. length ..... *griseipennis* LeConte

Anterior protarsal claws of male toothed near apex, not bifid; male pro- and mesotarsi narrowed, glandular hairs not forming pallettes; surface distinctly aeneous; size less than 7 mm. length ..... *punctulatus* Aubé

15. Glandular hairs of male protarsal and mesotarsal pads fine not dilated apically 16

Glandular hairs of male protarsal and mesotarsal pads, at least of third segment, enlarged into pallettes 17

16. Pronotal bead wide; metacoxal wing narrow, least distance from mesocoxal to metacoxal plate less than ½ the width of the latter; size less than 6.5 mm. long ..... *kenaiensis* Fall

Pronotal bead narrow, metacoxal wing wide, least distance from mesocoxal to metacoxal plate more than ½ the width of the latter; size larger than 6.5 mm. long ..... *verisimilis* Brown

17. Anterior protarsi of male feebly dilated; 3rd segment scarcely wider than 4th ..... *approximatus* Fall

Anterior protarsi of male rather strongly dilated; 3rd segment wider than 4th 18

18. Prosternal process narrow, lanceolate carina of prosternum continuing into prosternal process but not pronounced ..... *obliteratus* LeConte

Prosternal process broad, acutely carinate 19

19. Meshes of elytral reticulation very small, rounded and subequal; male protarsal claw-bearing segment dentate beneath ..... *ajax* Fall

Meshes of elytral reticulation larger, irregular and unequal, showing secondary reticulations; male protarsal claw-bearing segment not dentate beneath 20

20. Protarsi and mesotarsi of male with extremely large circular pallettes; anterior angles of pronotum normal; metasternal groove prominent ..... *anthracinus* Mannerhheim

Protarsi and mesotarsi of male with small though distinct pallettes; anterior angles of pronotum turned outward, away

from head; metasternal groove rudimentary .... *erichsoni* G. & H.

Agabus cordatus (LeConte). 1853, Proc. Acad. Nat. Sci., Philadelphia, 6:226. *cordata* LeConte.

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: Santa Fe, New Mexico.

Utah Distribution: Tooele, Salt Lake, Summit, Duchesne, Juab, Utah, Wayne, Grand, Millard, Garfield, Washington, Kane, and San Juan Counties.

Agabus bjorkmanae Hatch, 1939, Ent. News, 50:104. *rectus* (LeConte).

Type Repository: University of Washington, Seattle, Washington.

Type Locality: Vancouver Island, British Columbia.

Utah Distribution: Tooele County, Ibapah Pass.

Agabus semivittatus LeConte, 1852. Ann. Lyceum Nat. Hist., N. Y., 5:204, texanus Sharp.

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: Colorado desert of California.

Utah Distribution: San Juan, Kane, and Washington Counties.

Agabus hypomelas hypomelas Mannerheim, 1834, Bul. Soc. Imp. Nat Moscou, 16:221. *irregularis* Mannerheim.

Type Repository: Zoological Museum, Helsingfors, Finland.

Type Locality: "Habitat in insula Sitkha D. Eschscholtz" (Alaska).

Utah Distribution: Summit County, Diamond Lake (Chandler 1941).

Agabus seriatus intersectus (Crotch) (new combination by Leech, 1942) Canad. Entomol., 74:126-136.

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: California (lectotype designated by Leech 1942).

Utah Distribution: Box Elder, Cache, Weber, Davis, Summit, Daggett, Salt Lake, Tooele, Utah, Duchesne, Sanpete, Millard, Grand, Beaver, Garfield, Washington, and Kane Counties.

Agabus lugens LeConte, 1852, Ann. Lyc. Nat. Hist., N. Y., 5:203, 204. *perplexus* Sharp, *suturalis* Crotch.

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: San Diego, California. (Colorado desert of California also listed).

Utah Distribution: Summit, Salt Lake, Grand, Wayne, Garfield, Washington, Kane, and San Juan Counties.

Agabus punctulatus Aubé, 1838, Sp. gen. des Hydroc., 6:332. *aeneolus* Crotch.

Type Repository: Institut des Sciences Naturelles, Brussels, Belgium.

Type Locality: "L'Amerique du Nord."

Utah Distribution: Daggett and Cache Counties (Chandler 1941).

Agabus disintegratus (Crotch), 1873, Trans. Amer. Ent. Soc., 4:416.

Type Repository: Original series in British Museum (Nat. Hist.), London.

Type Locality: Not designated by author, original distribution given as Kansas, Arizona, Pennsylvania, Nebraska, and Canada.

Utah Distribution: Weber, Davis, Salt Lake, Utah, Sanpete, Millard, Garfield, Grand, Washington, and Kane Counties.

Agabus austini Sharp, 1882, Sci. Trans. Royal Dublin Soc., (2)2:516.
Type Repository: British Museum (Nat. Hist.), London.
Type Locality: British Columbia.
Utah Distribution: Weber, Summit, Salt Lake, Utah, Wasatch, Duchesne, and Millard Counties.

Agabus strigulosus (Crotch), 1873, Trans. Amer. Ent. Soc., 4:422. *nanus* (LeConte.).
Type Repository: British Museum (Nat. Hist.), London.
Type Locality: Lake Tahoe, California.
Utah Distribution: Summit, Wasatch, Duchesne, and Uintah Counties.

Agabus griseipennis LeConte, 1859, Smithsonian Contrib. Knowledge, 11:5.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Fort Laramie, Wyoming.
Utah Distribution: Weber, Salt Lake, Daggett, Utah, Sanpete, Grand, Kane, and San Juan Counties.

Agabus obliteratus LeConte, 1859, Smithsonian Contrib. Knowledge, 11:5.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Fort Laramie, Wyoming.
Utah Distribution: Box Elder, Rich, Weber, Summit, Daggett, Salt Lake, Utah, Duchesne, Sanpete, Sevier, Wayne, Garfield, and Washington Counties.

Agabus approximatus Fall, 1922, Review N. Am. Sp. *Agabus*, J. D. Sherman, Jr., Publ., :26.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Horsefly Pk. Divide, Placerville Rd., San Miguel County, Colorado.
Utah Distribution: Salt Lake, Utah, Wasatch, Duchesne, Millard, Sanpete, Sevier, Iron, Washington, and San Juan Counties.

Agabus ajax Fall, 1922, Review N. Am. Sp. *Agabus*, J. D. Sherman, Jr., Publ., :30, 31.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Waghorn, Alberta, Canada.
Utah Distribution: Duchesne County, Farmers Lake Group; Garfield County, Cyclone Lake and Beaver County, Tushar Mts.

Agabus anthracinus Mannerheim, 1852, Bul. Soc. Imp. Nat. Moscou, 25(2):304. *scapularis* Mann.
Type Repository: Zoological Museum, Helsingfors, Finland.
Type Locality: Sitka, Alaksa.
Utah Distribution: Reported by Leech - "Utah" (1938).

Agabus erichsoni Gemminger and Harold, 1868, Cat. Coleopt., 2:454. *nigroaeneus* Erickson, 1873, (*nec* Marsham, 1802).
Type Repository: Zoological Museum of Humboldt University, Berlin, Germany.
Type Locality: Berlin, Brandenburg, Germany.
Utah Distribution: Summit County, Trial Lake and Duchesne County, Mirror Lake.

Agabus tristis Aubé, 1838, Sp. gen. des Hydroc., 6:356, 357. *dubius* Mannerheim.
Type Repository, Musée Royal des Sciences Naturellas, Brussels, Belgium.
Type Locality: "L'Amerique septentrionale" (North America).

Utah Distribution: Cache, Weber, Salt Lake, Summit, Utah, Wasatch, Duchesne, Uintah, Sanpete, Millard, Washington, and San Juan Counties.

Agabus antennatus Leech, 1939, Canad. Entomol. 71:217-218. *clavatus* LeConte 1859 (*nec* Latreille 1804).
Type Repository: Loup Fork of the Platte River, Nebraska.
Type Locality: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Utah Distribution: Garfield County (Beck, 1954).

Agabus verisimilis Brown, 1932, Canad. Entomol. 64:4, 5.
Type Repository: Canadian National Collection, Ottawa, Canada.
Type Locality: Creston, British Columbia.
Utah Distribution: Salt Lake County, Willow Creek Pond.

Agabus minnesotensis Wallis, 1933, Canad. Entomol., 65:268.
Type Repository: University of Minnesota.
Type Locality: Minnesota, Hennepin County (apparently an erroneous locality label).
Utah Distribution: Washington County (Tanner 1939).

Agabus kenaiensis Fall, 1926, Pan-Pacific Ent., 2:141, 142.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Anchorage, Alaska.
Utah Distribution: Summit County (Chandler 1941).

Ilybius Erichson 1832

1. Metatarsi of male not margined externally above; large setiferous punctures on ventral surface of metatibiae confined to anterior and posterior margin, sometimes with a few at base ..... *fraterculus* (LeConte)

   Metatarsi of male margined externally above; metatibiae with strong setiferous punctures over most of their under surface 2

2. Last Sternite of male with an acute median carina, strigate laterally; metasternal wings narrow, mesocoxae and metacoxal plates separated by more than ⅓ the width of the latter, measured along the same line; secondary elytral reticulation present ..... *angustior* (Gyllenhal)

   Last sternite of male lacking carina; strigate at sides in both sexes; metasternal wings broad; mesocoxae and metacoxal plates separated by about ⅓ the width of the latter, measured along the same line; secondary elytral reticulations lacking ..... *subaeneus* Erichson

Ilybius subaeneus Erichson, 1839, Die Kafer Mark Brandenberg, 1 (vol. 1):156. *viridiaeneus* Crotch.
Type Repository: Zoological Museum of Humboldt University, Berlin, Germany.
Type Locality: Berlin, Brandenburg, Germany.
Utah Distribution: Daggett, Summit, and Duchesne Counties.

Ilybius angustior (Gyllenhal), 1808, Ins. Suecica. 1:500. *picipes* Kirby.
Type Repository: Zoological Museum, Uppsala, Sweden.

Type Locality: Unknown to author.
Utah Distribution: Summit, Duchesne, and Garfield Counties.

Ilybius fraterculus (LeConte), 1862, Proc. Acad. Nat. Sci. Philadelphia, 14:521.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: North Red River.
Utah Distribution: Cache, Summit, Salt Lake, Utah, Duchesne, Sanpete, Garfield, Washington, and San Juan Counties.

Coptotomus Say 1834

Coptotomus longulus LeConte, 1852, Ann. Lyceum Nat. Hist., 5:205.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Laramie, "Territorio Missouriensi" (Wyoming).
Utah Distribution: Cache County, Logan and Daggett County, Green River.

Rhantus Dejean 1833

1. Pronotal disc with single transverse spot, not bilobed; metacoxal processes pale; prosternum pale; male anterior protarsal claws long, sinuate, dilated; posterior protarsal claws 5/9 length of anterior claws ..... *frontalis* (Marsham)

   Pronotal disc bimaculate or with single bilobed spot; only posterior tips of metacoxal processes pale, if at all; male anterior protarsal claws long or short, sinuate or straight not dilated, posterior protarsal claws almost as long as anterior claws 2

2. Anterior protarsal claws ⅓ longer than fellows and longer than claw bearing segment; female with elongate-oval roughened area on each elytron; prosternal process (carina) usually black ..... *anisonychus* Crotch

   Anterior protarsal claws only slightly longer than fellows, not as long as claw bearing segment; female without roughened area on elytron; prosternal process (carina) usually pale 3

3. Elytra solid black except for yellowish-brown irrorate apex, lateral, basal and scutellar margin .... *mexicanus* (Laporte)

   Elytra yellowish, irrorated with black 4

4. Anterior and posterior protarsal claws of male straight, sinuate along inner margin ..... *binotatus* (Harris)

   Anterior protarsal claws of male evenly, slightly curved, posterior claws arcuate 5

5. Anterior protarsal claws of male not broader at middle than at base; aedeagus with apical quarter thicker, less strongly twisted to one side; eyltral reticulations deeply impressed, elongated slightly longitudinally ..... *gutticollis* (Say)

Anterior protarsal claws of male broader at middle than at base, strongly arcuate; aedeagus with apical quarter thinner, more strongly twisted to one side; black dots of elytra vermiform, elytral reticulations lightly impressed .... *hoppingi* Wallis

Rhantus binotatus (Harris), 1828, New Eng. Farmer, 7:164. *divisus* (Aubé), *longipes* Sharp, *assimilis* Kirby, *maculicollis* (Aubé), *plebejus* Sharp, *flavogriseus* Crotch.

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: Not stated by author; original distribution given as Mexico, Guatemala, and Western United States.

Utah Distribution: Box Elder, Cache, Rich, Davis, Summit, Daggett, Tooele, Salt Lake, Utah, Wasatch, Duchesne, Uintah, Juab, Sanpete, Iron, and Washington Counties.

Rhantus gutticollis (Say), 1834, Trans. Amer. Phil. Soc., 4:442.443.

Type Repository: Type is considered lost.

Type Locality: "River beyond Vera Cruz."

Utah Distribution: Emery, Grand, Iron, Garfield, Washington, Kane, and San Juan Counties.

Rhantus mexicanus (Laporte), 1835, Etudes Ent., :101.

Type Repository: Type is considered lost.

Type Locality: Mexico.

Utah Distributions: Emery, Garfield, and Grand Counties.

Rhantus hoppingi (Wallis), 1933, Canad. Entomol., 35:272. *longipes* Hatch.

Type Repository: Canadian National Collection, Ottawa, Canada.

Type Locality: Trinity Valley, B. C.

Utah Distribution: Box Elder, Weber, Summit, Salt Lake, and Utah Counties.

Rhantus anisonychus Crotch, 1873, Trans. Amer. Ent. Soc., 4:409.

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: Not stated in original description. Leech (1948) remarks that Darlington, of the Museum of Comparative Zoology at Harvard University, feels that Crotch's probable type in the LeConte collection is labeled S. Fr. standing probably for San Francisco.

Utah Distribution: Washington County (Tanner 1934).

Rhantus frontalis (Marsham), 1802, Ent. Brit., 1:425. *notatus* Fabricius, *punctatus* Hoppe, *flavicollis* Eschscholtz, *suturalis* Boisduval and Lacordaire, *Gyllenhallii* Castelnau, *sericans* Sharp.

Type Repository: Type is considered lost.

Type Locality: Unknown to author.

Utah Distribution: Daggett County; Garfield County, Aquarious Plateau and Sevier County, 1 Mile North of Fish Lake, and 1 Mile North of Jct. Hwy. 24 on Hwy. 25.

Colymbetes Clairville 1806

Colymbetes sculptilis sculptilis (Harris), 1829, New Eng. Farmer, 8:1.

Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Type Locality: Ipswich, Massachusetts.

Utah Distribution: Rich, Davis, Summit, Daggett, Salt Lake, Wasatch, Duchesne, Sanpete, and Iron Counties.

Dytiscus Linnaeus 1758

1. Metacoxal processes bluntly pointed apically; adhesive pads on 2nd and 3rd mesotarsal segments of male longitudinally divided by a bare space; elytra of male and female smooth ..... *marginicollis* LeConte

   Metacoxal processes sharply pointed apically; adhesive pads of 2nd and 3rd mesotarsal segments of male not longitudinally divided; elytra of male smooth and of female smooth or sulcate 2

2. Dorsum of head adjacent to eye yellow along inner margin; size larger, over 30 mm. long ..... *dauricus* Gebler

   Dorsum of head adjacent to eye not at all yellow, or very faintly yellow, size smaller, under 30 mm. long ..... *ooligbukii* Kirby

Dytiscus marginicollis LeConte, 1844, Proc. Boston Soc. Nat. Hist., 1:201.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: "In Flumine Missouri" (Missouri River).
Utah Distribution: Cache, Salt Lake, Summit, Daggett, Utah, and Sanpete Counties.

Dytiscus dauricus Gebler, 1832, Nouv. Mem. Soc. Imp. Nat. Moscou, 2:39. *confluens* Say, *diffinis* LeConte.
Type Repository: Unknown to the author.
Type Locality: Unknown to the author.
Utah Distribution: Summit, Salt Lake, Wasatch, Duchesne, Uintah, Sanpete, Sevier, Wayne, and Garfield Counties.

Dytiscus ooligbukii Kirby, 1837, Fn. Boreali Americana, 4:74, 75. *parvulus* Mannerheim, *alaskanus* Balfour-Browne.
Type Repository: British Museum (Nat. Hist.), London.
Type Locality: Great Bear Lake River.
Utah Distribution: Summit County, Lilly Lake and Duchesne County, Rock Sea Pass.

Hydaticus Leach 1817

Hydaticus modestus Sharp, 1882, Sci. Trans. Royal Dublin Soc., (2)2:650. *americanus* Sharp
Type Repository: British Museum (Nat. Hist.), London.
Type Locality: Not mentioned by author, but distribution given as North America.
Utah Distribution: Salt Lake and Juab Counties.

Acilius Leach 1817

Acilius semisulcatus abbreviatus Mannerheim, 1843, Bul. Soc. Imp. Nat. Moscou, 16:219. (New combination Hatch 1953).
Type Repository: Musée Royal des Sciences Naturelles, Brussels, Belgium.
Type Locality: "Habitat in insula Sitkha" (Alaska).
Utah Distribution: Box Elder, Weber, Summit, Salt Lake, Utah, Wasatch, Duchesne, Sanpete, Beaver, and San Juan Counties.

Thermonectus Dejean 1833

1. Elytra black, conspicuously marked with numerous yellow spots, considerable coalescence may be observed with the pale lateral margins ..... *marmoratus* (Hope)

Elytra black, lateral margins with variable yellow vitta, may be interrupted ..... *basillaris* (Harris)

Thermonectus basillaris (Harris), 1829, New England Farmer, 8:1. *incisus* Aubé, *cinctatus* Aubé, *laticinctus* LeConte, *nimbatus* Melsheimer.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: Not given by original author.
Utah Distribution: Salt Lake, Weber, Tooele, Utah, and Juab Counties.

Thermonectus marmoratus (Hope), 1832, in: Cuvier, Animal Kingdom, 1:284, and pl. 32, fig. 1. *flavomaculatus* Chevrolat, *maculatus* LeConte.
Type Repository: Paris Museum (Nat. Hist.)
Type Locality: Mexico.
Utah Distribution: Grand, Garfield, Kane, and San Juan Counties.

Graphoderus Dejean 1833

1. Pronotum with transverse anterior and posterior fascia attaining margins; male protarsi dilated, clothed beneath with 14 or 15 pallettes; male mesotarsi not dilated and without pallettes ..... *occidentalis* Horn

Pronotum with transverse anterior and posterior fascia not attaining margins; male protarsi dilated, clothed beneath with three large and numerous smaller pallettes; male mesotarsi with pallettes ..... *perplexus* Sharp

Graphoderus perplexus Sharp, 1882, Sci. Trans. Royal Dublin Soc., (2)2:695. *elatus* Sharp, *zonatus* auct. Walker (*nec* Hoppe).
Type Repository: British Museum (Nat. Hist.), London.
Type Locality: United States.
Utah Distribution: Wasatch County, 3 mi. East of Guardsman's Pass; Garfield County, Aquarius Plateau.

Graphoderus occidentalis Horn, 1883, Trans. Amer. Ent. Soc., 10:281.
Type Repository: Academy of Sciences, Philadelphia, Pennsylvania.
Type Locality: No type was designated, but California and Washington territory were listed as the distribution in the original description.
Utah Distribution: Salt Lake, Duchesne, and Grand Counties.

Eretes Laporte 1833

Eretes sticticus (Linnaeus), 1767, Systema Nat., ed. 12:666. *conicollis* Wollaston, *occidentalis* Erichson, *punctatus* Zoubkoff, *subcoriaceus* Wollaston, *subdiaphanus* Wollaston, *plicipennis* Motschulsky.
Type Repository: British Museum (Nat. Hist.), London.
Type Locality: "Barbarie."
Utah Distribution: Box Elder County, Muddy Reservoir, 17 mi. West of Rosette; Washington County, St. George.

Cybister Curtis 1827

Cybister explanatus LeConte, 1852, Ann. Lyceum Nat. Hist., N. Y., 5:202.
Type Repository: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
Type Locality: "Ad San Diego," Colorado, et Sacramento minus frequens, given as original distribution.
Utah Distribution: Salt Lake, Tooele, Utah, and Washington Counties.

Acknowledgments

I wish to express my thanks to Dr. George F. Edmunds, Department of Zoology, University of Utah, for his guidance and assistance during this study and for his reading of this manuscript. I am extremely grateful to Mr. Hugh B. Leech, California Academy of Sciences, San Francisco, California, and Mr. J. Balfour-Browne, British Museum (Natural History), London, England, for reading and criticizing the manuscript and/or for their aid in the identification of certain species, loan of specimens and comparison of material with types. For the loan of specimens in their charge I am indebted to Dr. Vasco M. Tanner, Brigham Young University, Provo, Utah; Dr. Donald W. Davis, Utah State University, Logan, Utah; and Dr. Frank N. Young, Indiana University, Bloomington, Indiana.

Literature Cited

Beck, D E. 1954. Distributional records of some aquatic Coleoptera in Utah. Proc. Utah Acad. Sci., Arts, and Letters 31:52-56.

Chandler, H. P. 1941. Study of the aquatic and semi-aquatic Coleoptera in the state of Utah. Unpublished master's thesis. Provo, Utah, Brigham Young University Library.

Leech, H. B. 1938. A study of the Pacific Coast species of *Agabus* Leach, with a key to the nearctic species. Unpublished master's thesis, Berkeley, California, Berkeley Library.

———. 1948. Contributions toward a Knowledge of the Insect Fauna of Lower California No. 11. Coleoptera: Haliplidae, Dytiscidae, Gyrinidae, Hydrophilidae, Limnebiidae. Proc. Calif. Acad. of Sci. 25(11):348-420.

Musser, G. D. 1959. Annotated check list of aquatic insects of Glen Canyon. *In* Dibble's *Anthropological Papers* No. 40 Series 7. Salt Lake City (University of Utah Press) 207-221.

Putman, J. D. 1876. Report on the insects collected in the vicinity of Spring Lake Villa, Utah Co., Utah, during the summer of 1875. Proc. Davenport Acad. Nat. Sci., 1:193-207.

Tanner, V. M. 1928. The Coleoptera of Zion National Park, Utah. Ann. Ent. Soc. Amer. (2):269-281.

———. 1934. Coleoptera of Zion National Park, Utah. Ann. Ent. Soc. Amer., 27(11):43-49.

——— 1940. A biotic study of Kaiparowits Region of Utah. Great Basin Naturalist. 1:97-126.

Todd, G. K. 1952. The adult water beetles of the Provo River. Unpublished master's thesis, Salt Lake City, Utah, University of Utah Library.

MISCELLANEOUS TAXONOMIC NOTES ON SCOLYTIDAE (COLEOPTERA)

Stephen L. Wood[1]

While reviewing references for a study of bark beetle (Scolytidae) genera, a number of generic homonyms were discovered. Because six of them are preoccupied and have no subgeneric or synonymous names available for use, new names are proposed below. In addition, new synonymy involving twelve species and the descriptions of three species new to science are included. The new species include: *Scolytus obelus* from the western United States; and *Conophthorus mexicanus* and *Pityophthorus islasi* from Mexico. The two Mexican species are included here in order to make names available for the research of Sr. Federico Islas.

Cryptulocleptus, new name

It has been noted that the genus *Cryptocleptes* Blackman (1920, Mississippi Agric. Expt. Sta. Tech. Bull. 9:51) is a junior homonym of *Cryptocleptes* Simon (1884, Les Arachnides de France 5(2):352). It is, therefore, necessary to replace Blackman's name. The new name, *Cryptulocleptus* is proposed as a replacement for Blackman's genus. The type species of the genus is *Cryptocleptes dislocatus* Blackman as designated in the original diagnosis.

Dryotomicus, new name

The generic name *Dryotomus* Chapuis (1869, Synopsis des Scolytides, p. 46, preprint of 1873, Mem. Soc. Roy Sci. Liége (2)3:254) is a junior homonym of *Dryotomus* Swainson (1831, *in* Richardson, Fauna Boreali Americana 2:301, 304, 308), a bird. Since no synonyms or subgenera of this genus are known, the new name *Dryotomicus* is proposed as a replacement for *Dryotomus* Chapuis. The type species of this monobasic genus is *Dryotomus puberulus* Chapuis.

Gnathophthorus, new name

The name *Gnathophorus* Schedl (1935, Rev. Ent. Rio de Jan. 5:342) is a junior homonym of the generic name *Gnathophorus* Kirby (1837, *in* Richardson, Fauna Boreali Americana 4:166), a Cerambycidae. It is proposed that the new name *Gnathophthorus* be used as a replacement, since no synonyms or subgenera of Schedl's genus are known. The type species of this monobasic genus is *Gnathophorus sparsepilosus* Schedl.

Pityotrichus, new name

The generic name *Pityophilus* Blackman (1928, New York St. Coll. For., Syracuse Univ. Tech. Pub. 25:147) is preoccupied by the

1. Contribution no. 180, Department of Zoology and Entomology, Brigham Young University, Provo, Utah. Scolytoidea contribution no. 25.

older name *Pityophilus* Brullé (1884, Hist. Nat. Ins., Coleopt. 6(1): 75), a Staphylinidae. Since synonyms are unknown for this genus, the new name *Pityotrichus* is proposed as a replacement for Blackman's genus. The type species of this monobasic genus is *Pityophilus barbatus* Blackman.

Styracoptinus, new name

Because the generic name *Styracopterus* Blandford (1896, Ann. Mag. Nat. Hist., ser. 6, 17:323) is a junior homonym of *Styracapterus* Traquair (1890, Ann. Mag. Nat. Hist., ser. 6, 6:492), a fossil fish, it must be replaced. The new name *Styracoptinus* is proposed as a replacement for Blandford's genus. The type species of this monobasic genus is *Styracopterus murex* Blandford.

Toxophthorus, new name

The name *Toxophorus* Eggers (1920, Ent. Blätter 16:119) is a junior homonym of the genus *Toxophorus* Schoenherr (1836, Genera et Species Curculionidum 3(1):371), a Curculionidae. The new name *Toxophthorus* is proposed as a replacement for Eggers' genus. The type species of this monobasic genus is *Toxophorus africanus* Eggers.

Pteleobius Bedel

Schedl (1959, Ent. Blätter 55:41) placed *Pteleobius* Bedel (1888, Ann. Soc. Ent. France, hors ser., 6:392, 393, 411) in synonymy under the older name *Acrantus* Broun (1882, Ann. Mag. Nat. Hist., ser. 5, 9:409). He did not note, however, that *Acrantus* Broun is a junior homonym of *Acrantus* Wagler (1830, Natürliches System der Amphibien, p. 154), a reptile. If the synomymy proposed by Schedl is correct, the name *Pteleobius* Bedel automatically becomes the valid name for this genus. However, since basic differences exist between the European *Pteleobius* and the New Zealand *Acrantus* the synonymy cannot be recognized and it is necessary to find another name for Broun's genus.

Dendrotrupes Broun

As indicated above, the name *Acrantus* is pre-occupied. *Acrantus* was a replacement for the monobasic homonym *Homarus* Broun; it included one New Zealand species, *mundulus* Broun. In 1895, Broun described a second species, *opacus*, in this genus. Broun (1881, Man. New Zealand Coleopt., p. 741) also described the genus *Dendrotrupes* with the New Zealand species *costiceps* Broun as the type species (Hopkins, 1915, Proc. U. S. Natl. Mus. 48:120). Since specimens of *Acrantus opacus* and of *Dendrotrupes costiceps* received from the British Museum unquestionably are congeneric, and assuming that Broun was correct in placing *opacus* and the type species *mundulus* in the same genus, *Acrantus* and *Dendrotrupes* are synonymous. In view of the unavailability of *Acrantus*, *Dendrotrupes* is the valid name for this genus. This genus differs from *Pteleobius* by the absence of pronotal asperities in both sexes, by the

rather deeply excavated male frons, and by a number of less obvious characters.

Cryptocarenus heveae (Hagedorn)

Authentic specimens of this species (Hagedorn, 1912, Rev. Zool. Africaine 1:338), from Africa, in the Eggers collection at the U. S. National Museum, were compared to the type of *Tachyderes parvus* Blackman (1943, Jour. Washington Acad. Sci. 33:36). These specimens undoubtedly belong to the same species.

Hypothenemus beameri Wood

The type of *Stephanoderes gossyppi* Hopkins 1915, U. S. Dept. Agric. Sec. Rept. 99:25) was examined and compared to paratypes of *Hypothenemus beameri* Wood (1954, Univ. Kansas Sci. Bull. 36:1056). The specimens were identical in all respects. Since the name *Hypothenemus gossyppi* Sampson (? nomen nudum) appears in the literature, my name is used provisionally.

Loganius ficus Schwarz

The types of *Loganius ficus* Schwarz (1895, Proc. Ent. Soc. Washington 3:44) and of *Ceratolepsis nubilus* Blackman (1943, Proc. U. S. Nat. Mus. 94:380) were examined and found to represent the same species. Blackman's name should be placed in synonymy.

Stephonoderes congonus Hagedorn

The type of *Stephanoderes africanus* Hopkins (*op. cit.*, p. 30) was compared to Eggers' homotype of *Stephanoderes congonus* Hagedorn (1912, Rev. Zool. Africaine 1(3):337) that was lebeled "D. O. Afr., Amani, Eichelbaum lg. 1:03, Coll. Hagedorn 1915." These specimens were found to be identical. If the comparisons of Hagedorn and of Eggers are correct, these species are synonymous.

Stephanoderes differens Hopkins

The type of *Stephanoderes differens* Hopkins (*op. cit.*, p. 25) and specimens in the U. S. National Museum labeled "type" and "cotype" of *Stephanoderes amazonicus Eggers* (1934, Ent. Blätter 30:78) were compared and found to represent the same species .

Stephanoderes ferrugineus Hopkins

The types of *Stephanoderes ferrugineus* Hopkins (*op. cit.*, p. 29) and of *Stephanoderes fiebrigi* Hopkins (*op. cit.*, p. 27) were compared directly and found to be synonymous. The option available to me as the first revisor in selecting a name for this species is here exercised in favor of *ferrugineus*, although *fiebrigi* has page priority.

Stephonoderes liberiensis Hopkins

The type of *Stephanoderes liberiensis* Hopkins (*op. cit.*, p. 31) was compared to a cotype of *Stephanoderes theobromae* Eggers (1932, Rev. Zool. Bot. Afr. 22(3):32) and found to be identical.

Stephanoderes setosus Eichoff

A specimen of *Stephanoderes setosus* Eichhoff (1867, Berliner Ent. Zeitschr., p. 391), in the Eggers collection at the U. S. National Museum that was compared to the type by Eggers, was compared directly to cotypes of *Stephanoderes javanus* Eggers (1908, Ent. Blätter 4:215), of *Stephanoderes banensis Eggers* (1922, Ent. Blätter 18:167), and of *Stephanoderes subagnatus* Eggers (1940, Rev. Zool. Bot. Afr. 33:101). All four were found to represent the same species.

Xyleborus howardi Hopkins

The type of *Xyleborus howardi* Hopkins (*op. cit.*, p. 65) and *Xyleborus fitchi* Hopkins (*op. cit.*, p. 66) were compared directly and were found to be identical in all essential characters.

Xyleborus saxeseni (Ratzeburg)

Representatives of several series of this species (Ratzeburg, 1837, Die Forst-Insekten 1:67) from Europe and North America were compared to the types of *Xyleborus quercus* Hopkins, *pecanis* Hopkins and *floridensis* Hopkins (*op. cit.*, p. 63). All three of Hopkins' specimens unquestionably belong to *saxeseni*.

Xyleborus sharpae Hopkins

The type of *Xyleborus sharpae* Hopkins (*op. cit.*, p. 63) and a cotype of *Xyleborus schreineri* Eggers (1920, Ent. Blätter 16:115) were compared and found to synonymous.

Xyleborus theobromae (Hopkins)

The type of *Theoborus theobromae* Hopkins (*op. cit.*, p. 57) was compared to a cotype of *Xyleborus pseudococcotrypes* Eggers (1941, Arb. Morph. Tax. Ent. Berlin 8:105). Only one species is represented by these specimens.

Xylosandrus zimmermanni (Hopkins)

The species, described as *Anisandrus zimmermanni* Hopkins (*op. cit.*, p. 68) should be transferred to *Xylosandrus*. This species has been taken at Sebring, Florida, from *Ardesia* sp. and *Ocotea catesbiana* since its description.

Conophthorus mexicanus, n. sp.

This species is very closely allied to *ponderosae* Hopkins, but is larger and has the elytral declivity much more strongly impressed.

Male.— Length 3.7 mm. (paratypes 3.4 - 4.2), 2.3 times as long as wide; body color very dark brown.

Frons convex, feebly, transversely impressed near upper level of eyes; a broad, weak median carina on lower half; surface almost smooth, finely, rather sparsely punctured. Antennal club 1.2 times as long as wide, the sutures about as in *ponderosae*.

Pronotum slightly wider than long (1.06 times), the outline as in *ponderosae*; summit on basal third, finely asperate from anterior

margin to summit on disc and to base laterally; basal area of disc rather coarsely, closely punctured.

Elytra 1.6 times as long as wide, the sides very slightly arcute, rather broadly rounded behind; only the first striae weakly impressed, the punctures small, confused with the equally large interstrial punctures; surface smooth, shining. Declivity moderately steep, deeply bisculcate; sutural interstriae moderately, rather sharply elevated and bearing a row of rather coarse, close tubercles; interspace two strongly impressed, smooth, shining, impunctate; interspace three very strongly elevated, the elevation much higher than that of sutural interspace, bearing a row of about eight rather coarse teeth; the sulcus considerably deeper than in previously known *Conophthorus species;* strial punctures obsolete on declivity. Vestiture of fine, moderately long hair; slightly longer and more abundant on sides.

FEMALE.— Larger (4.2 mm.), the pronotum a little more coarsely sculptured, and the declivity more shallow and more finely sculptured, otherwise similar to male.

TYPE LOCALITY.— Necaxa, Puebla, Mexico.

HOST.— *Pinus* sp.

TYPE MATERIAL.— The male holotype, female allotype and four paratypes were taken at the type locality on March 17, 1960, by J. Carrillo, from pine cones. The holotype, allotype and one paratype are in my collection; two paratypes are in the U. S. National Museum, and one paratype is in the collection of Federico Islas.

Pityophthorus islasi, n. sp.

Evidently the only previously described species in this section of Blackman's Group V is *auctor* Blackman. This species, however, is larger and has different declivital sculpture.

FEMALE.— Length 2.44 mm. (paratypes 2.5 - 2.7), 2.3 times as long as wide; body color dark brown, the elytra usually reddish brown.

Frons weakly convex over a broad area, shallowly, broadly, transversely impressed between upper margins of eyes; surface smooth, brightly shining, with numerous fine, deep, rather close punctures; vestiture fine, inconspicuous, moderately long, a few hairs a little longer near periphery. Antennal club longer than wide, the sutures moderately arcuate.

Pronotum equal in length and width, widest at base; weakly arcuate and converging anteriorly to well developed lateral constriction just behind anterior margin; summit about one-third from base, indefinite; asperities confused, moderately narrow on anterior half, gradually decreasing posteriorly to punctured area behind summit, the punctures moderately fine, deep, rather close, the surface between punctures subreticulate with minute points visible; a broad, indistinct median ridge visible behind summit; vestiture hairlike, scanty, limited to sides.

Elytra 1.5 times as long as wide, the sides almost straight and subparallel on basal three-fourths then very broadly rounded behind; striae and interstriae indistinguishable on anterior half, the punctures distinct, moderately large, confused, the surface between punctures smooth, shining, with numerous minute points. Declivity steep, convex; punctures of striae one and two in rows, one slightly impressed, the punctures rather deep, all at least half as large as those on disc; sutural interspace abruptly, weakly, broadly elevated; interspace two flat, wide above, rather strongly tapered, narrow below, the surface impunctate except near upper and lower margins of declivity, bearing numerous minute points; interspace three very slightly raised on its lateral half, the punctures feebly to not at all subgranulate. Vestiture moderately abundant, hairlike, each seta slightly longer than the distance between rows of setae.

Male.— Similar to female except frons deeply excavated from eye to eye from upper level of eyes almost to epistomal margin, the excavation divided by a median carina that ends tooth-like on epistomal margin, the surface punctures rather coarse.

Type Locality.— Temascaltepec, Mexico, Mexico.

Host.— Pinus oocarpa.

Type Material.— The female holotype, male allotype and three paratypes were collected at the type locality on August 17, 1960. The species is named for its collector Sr. Federico Islas. The holotype, allotype and one paratype are in my collection; one paratype is in the U. S. National Museum, and one is in the collection of Federico Islas.

Scolytus obelus, n. sp.

This species appears to be more closely allied to *subscaber* Leconte and *ventralis* Leconte than to other known species. It differs, however, by the smaller size, by the more strongly convex male frons, and by the very different spine on the second abdominal segment of the male.

Male.— Length 2.1 mm. (paratypes 2.0 - 2.4), 2.1 times as long as wide; body color very dark brown.

Frons strongly convex between upper level of eyes and above, flattened on a rather limited area below; surface convergently punctate-aciculate; vestiture sparse, rather short. Eye and antenna as in allied species.

Pronotum 1.1 times as wide as long; general outline as in *robustus* Blackman; surface smooth and shining except for a few minute points, with rather sparse, moderately small oval punctures, the punctures very slightly larger and deeper laterally; vestiture consisting of a few hairs on anterior and lateral margins.

Elytra 1.1 times as long as wide, 1.3 times as long as pronotum; sides straight and subparallel on basal three-fourths, then very broadly rounded behind (almost straight), with a slight dehiscence

at suture; posterior margin irregular but not definitely serrate or tuberculate; strial and interstrial punctures in rather definite rows, small, shallow, those of striae slightly larger. Second abdominal sternum vertical, the anterior margin elevated and produced posteriorly, similar to but a little less strongly produecd than in *robustus*, the posterior margin bearing an acute, slender, median spine; the spine with point of greatest height on posterior margin of second sternum, the height almost equal in distance to length of third segment; all sterna opaque.

FEMALE.— Similar to male except frons more strongly convex; second abdominal sternum with anterior margin much less strongly raised (intermediate between females of *robustus* and *ventralis*); and devoid of the abdominal spine.

TYPE LOCALITY.— Payson Canyon, Utah.

HOST.— *Abies concolor*.

TYPE MATERIAL.— The male holotype and six male paratypes were taken at the type locality on May 14, 1960, by S. L. Wood, from the limbs of white fir. The female allotype and three paratypes were taken at the same locality, host and collector on July 25, 1962; four other paratypes were taken at Beaver, Utah, on April 22., 1950, by S. L. Wood, from limbs of white fir.

The holotype, allotype and some paratypes are in my collection; other paratypes are in the U. S. National Museum.

DISTURBANCE OF MAMMAL TRAPS BY JACK RABBITS[1]

Clive D. Jorgensen[2]

During studies of rodent populations at the Atomic Test Site, Mercury, Nevada, considerable disturbance of Young-type mammal traps occurred. After several months of trapping for three consecutive nights each month in a *Grayia spinosa* (Hooker) Moq. and *Lycium andersonii* Gray plant community, it was evident that the trap disturbance was somewhat systematic. On the basis of tracks, fecal droppings, and observance of the implicated animals, the disturbance was attributed to activities of black-tailed jack rabbits, *Lepus californicus deserticola* Mearns. The trapping design of 144 traps spaced at 75 foot intervals over a 15.6 acre grid, was for a study of rodents. When disturbance by the hares became a serious threat to the collection of rodents data, the trapping pattern was altered to determine their reactions and behavior as a prerequisite to their removal from the study area. Study plots in other plant communities were trapped in the same manner at similar times, but none was so heavily disturbed.

Procedures and Results

Initially, many traps were sprung but not overturned. Assuming that hares were trying to enter the traps to obtain the oatmeal bait, all traps were closed and baited. The baited, closed traps were disturbed as frequently as those which were baited and left open. By the end of six consecutive nights of baiting, disturbance had increased considerably.

Source of stimulation for the disturbance was investigated by offering the hares both unbaited and baited traps. Relatively few of the unbaited traps were disturbed.

Bait was moistened, formed into small balls, dried, and placed in alternate traps. The bait balls could not pass through the screen of overturned traps, but were accesible to visual and olfactory senses. Other traps were baited with oatmeal flakes as usual. Relatively few of the traps with bait balls were disturbed.

Thirty-six baited traps were displaced 10 feet from their original positions and the traps around the perimeter of the study area next to established trails were baited. Another 36 traps were left in position beside the trails and made by us as we repeatedly walked through the quadrat. Both displaced and regularly placed traps were disturbed, although more of those by trails were disturbed than those away from trails.

In order to determine if the hares followed the straight lines of traps, 10 traps selected at random in the interior of the quadrat and all the perimeter traps were baited. Relatively more of the perimeter

1. This study was supported in part by Atomic Energy Commission Contract AT(11-1)-780.

2. Brigham Young University, Radiation Ecology Project, Mercury, Nevada.

traps were disturbed than those randomly selected in the interior of the quadrat.

Table I. Disturbance of traps by jack rabbits in a 15.6 acre quadrat of 144 traps spaced at 75 foot intervals.

	Trapping and baiting plan	Condition of bait and traps	Average percentage of traps disturbed	Date (1961 unless indicated otherwise)
1.	All baited	flakes - traps open	41	Sept.-Mar. (1960-61)
2.	All baited	" " closed	43	Jan. & Mar.
3.	None baited	" "	5	Jan.
4.	72 alternates baited	" " "	83	Jan. & Feb.
	72 alternates not baited	" "	2	
5.	72 alternates baited	" " "	91	Feb.
	72 alternates baited	balls " "	22	
6.	36 displaced baited	flakes " "	32	Feb.
	36 in place baited	" " "	59	
	72 in place not baited	" "	0	
7.	44 perimeter baited	" " "	86	Feb.
	100 interior not baited	" "	0	
8.	44 perimeter baited	" " "	92	Feb.
	10 displaced baited	" " "	46	
	90 interior not baited	" "	2	

Time of activity was investigated by observing for trap disturbance immediately before sunrise and after sunset. No disturbance occussed during the daytime, but 69 per cent of the traps were disturbed during the night. Hares were observed morning and evening lying in hollows underneath the foliage of shrubs. At night they were seen moving within the quadrat. On one occasion, a hare was feeding on oatmeal next to an over-turned trap. During these observation periods of clear, calm weather conditions, their feeding activities apparently were strictly nocturnal.

Discussion

Life history and population fluctuations of jack rabbits have been studied by Vorhies (1933), Philip *et al.* (1955), Woodbury (1955) Lechleitner (1958a), Adams and Adams (1959), and Bronson and Tiemeier (1959). Little has been published which adds to an understanding of their behavior. Lewis (1946) demonstrated the effectiveness of a strip of rye in affecting a barrier, and Bronson and Tiemeier (*op. cit.*) studied the relationship of precipitation to population response. Lecheitner (1958a and 1958b) studied habitat and environmental effects, alternation in home range, feeding preferences, and means of detecting food.

It is not known how the trap disturbance behavior was initiated in our study or why it became so extensive in such a limited area. Inasmuch as the disturbance did not begin until 24 days after the first traps were baited, it is possible that the hares learned the behavior during this interum of repeated trapping. Similar traps disturbances occurred in other study areas, but to a much less degree. The high incidence of disturbance in this one area may have been due to a high population of hares, but this does not explain the lack of disturbance in other areas where populations of hares were equally high. Seasonal cycles may have an influence. During the season of our study, there may have been greater competition for food because of population increase resulting from the birth of young. However, during July and August when hare numbers were seemingly as high in other study areas, there was little trap disturbance.

Spatial distribution of hares was difficult to determine because we could not differentiate between individual hares, and usually only one was seen at a time. Although nine hares were eventually removed from the quadrat, at least one remained, resulting in no less than 10 in this single 15.6 acre plot. When little disturbance occurred, it was usually localized, suggesting activity of only one or two individuals.

Lechleitner (1958b) suggested that the sense of smell seemed to be used for identification of food. In our study, when inaccessible bait only was used, only a few traps were disturbed. This suggests an ability to differentiate between accessible and inaccessible bait. Disturbance of unbaited traps may have been due to odors from previous baitings or animal inhabitants.

With reference to trail influence, Lechleitner (1958b) stated that jack rabbits not only make trails, but follow those made by man's activities. In our studies, apparently a stimulus resulted from contact with trails, although traps placed away from trails were disturbed. Apparently the hares sought traps randomly, but if a distinct trail were found, it was followed in locating traps.

Conclusions

Following this sequence of experiments, the following theories are presented. (1) The hares responded to the bait inside the trap rather than the trap itself. (2) Their visual senses enabled them to detect traps with accessible bait and avoid traps with inaccessible bait. (3) Searching was not systematic until trails were approached, at which time they followed them in their search. (4) Their behavior was suggestive of a learning process. (5) Their activity was primarily nocturnal.

References

Adams, L. and H. B. Adams. 1959. Black-tailed jack rabbit carcasses on highways in Nevada, Idaho and California. Ecology 40:717-719.

Bronson, F. H. and O. W. Tiemeier. 1959. The relationship of precipitation and black-tailed jack rabbit populations in Kansas. Ecology 40:194-198.

Lewis, J. G. 1946. Planting practice to reduce crop damage by jack rabbits. Wildlife Management 10:277.

Lechleitner, R. R. 1958a. Movements, density, and mortality in a black-tailed jack rabbit population. Wildlife Management 22: 371-384.

Lechleitner, R. R. 1958b. Certain aspects of behavior of the black-tailed jack rabbit. American Midland Naturalist 60:145-155.

Philip, C. B., F. J. Bell, and C. L. Larson. 1955. Evidence of infectious diseases and parasites in a peak population of black-tailed jack rabbits in Nevada. Wildlife Management 19:225-233.

Vorhies, C. T. 1933. The life histories and ecology of jack rabbits, *Lepus alleni* and *Lepus californicus* ssp., in relation to grazing in Arizona. Univ. Arizona Coll. Agric., Agric. Expt. Sta. Tech. Bull. 49:467-587.

Woodbury, A. M. 1955. Ecology of the Great Salt Lake Desert. I. An annual cycle of the desert jack rabbit. Ecology 36:353-356.

ESCALANTE AND THE RECOGNITION OF ANCIENT LAKES IN THE GREAT BASIN

Ernest J. Roscoe[1]

In the fall of 1776 the Franciscan Padre Silvestre Valez de Escalante, traversing the region between the Sevier Lake and the Beaver (Cricket) Mountains in what is now Millard County, Utah, wrote under date of October 2 (Auerbach, 1943:75):

> This place, which we named Llano Salado, because we found some thin white shells there, seems to have had a much larger lake than the present one.

On the strength of this single statement Ives (1948) maintained that to Escalante should go the credit for being the first to recognize and record evidence of former "high lake levels" in the Great Basin; moreover, that Escalante's statement "strongly suggests that Stansbury's [1852] discovery was anticipated by nearly three-quarters of a century." Recently Schwarzback (1961:277) has repeated this contention as established fact. To avert further confusion, particularly among those who do not have the Auerbach translation at hand, I believe it is time for a belated re-examination of Ives's postulates. This will involve several bits of admittedly negative evidence, but evidence which Ives totally ignored.

1. As pointed out long ago by Gilbert (1890:224), Escalante did not personally inspect Sevier Lake, relying upon report of the natives as to its existence (cf. Escalante journal, Auerbach translation, p. 74). Could it have been more than a lucky guess that the white shells at Llano Salado represented a former high level of the Sevier? If so, how high a level? There is nothing in the entire Escalante journal to indicate that he had the slightest conception of a lake of the magnitude of the "vast inland sea" of which Stansbury (1852:105) spoke. I use the word 'lucky' in a previous sentence advisedly; some of Escalante's other geographical postulates were less fortunate guesses. It is an interesting postscript to note that it has been suggested (Feth, 1961:110) that the Escalante arm of Lake Bonneville be deleted from maps of the pluvial lakes of the Great Basin.

2. Why is there not the slightest reference in the fairly lengthy Escalante account of Utah valley (Auerbach, 1943:69-71) to the most striking piece of evidence of former high lake levels—the abandoned strand lines on the adjacent Wasatch Mountains? Is it not reasonable to conclude that Escalante either failed to observe the obvious, or having observed the strand lines failed to grasp their significance?

1. Chicago Natural History Museum, Chicago, Illinois.

3. While in Utah valley Escalante had been informed by the natives of the existence of a large salt lake to the north. Is it not incongruous that a man with the scientific perspicacity with which Ives's would endow him would fail to make the slightest attempt to travel the few leagues (Spanish league = 2.53 miles) to the divide between Utah and Jordan valleys, from which point a clear view of the Great Salt Lake could have been obtained?

Until satisfactory answers to these puzzling questions are forthcoming. I must take the stand that any attempt to suggest that Escalane's remarks forestall the clear-cut, unequivocal statements of Stansbury rests on very shaky foundations. But, as A. N. Whitehead once remarked, "Everything of importance has already been said by someone who did not discover it."

References Cited

Auerbach, H. S. 1943. Father Escalante's Journal with related documents and maps. Utah State Historical Soc. Quarterly, vol. 11.

Feth, J. H. 1961. A new map of western conterminous United States showing the maximum known or inferred extent of Pleistocene lakes.U. S. Geol. Surv., Prof. Paper 424-B, p. 110-112.

Gilbert, G. K. 1890. Lake Bonneville. U. S. Geol. Surv., Monograph 1.

Ives, R. L. 1948. An early report of ancient lakes in the Bonneville Basin. Jour. Geol., v. 56, p. 79-80.

Schwarzback, M. 1961. Palaeoclimates of Europe and North America, in: A. E. M. Nairn, Descriptive Palaeoclimatology. Interscience Bubl. Inc., N. Y., p. 255-291.

Stansbury, H. 1852. Exploration and Survey of the Valley of the Great Salt Lake. Lippincott, Gambo & Co., Phila.

A NEW SPECIES OF EREMAEUS FROM THE WESTERN UNITED STATES (ACARINA: ORIBATEI, EREMAEIDAE)[1]

HAROLD G. HIGGINS[2]

Preliminary studies on the genus *Eremaeus* of North America have shown that this group of mites has a wide ecological range with many species. A rather robust species with deep pits which appear spotted under low magnification, has been found in mountainous areas of Western United States. A description of this new species follows.

Eremaeus stiktos, n. sp.

DIAGNOSIS: Color deep reddish-brown; body and legs more deeply pitted than any known species; pseudostigmatic organs shorter than distance between pseudostigmata; body hairs short and weak; femus of all legs with a double, ventral keel.

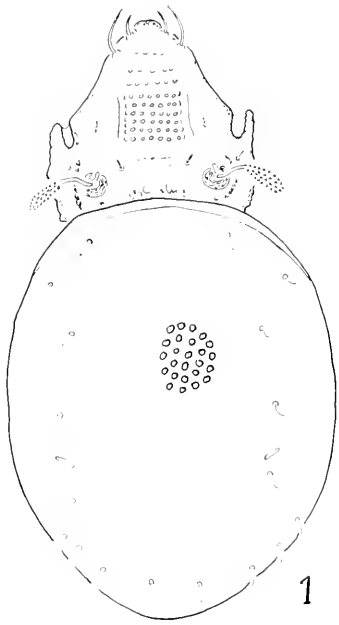
DESCRIPTION: Color deep reddish-brown; propodosoma slightly wider than long, about one-third as long as hysterosoma; rostrum rounded; rostral hairs short and projected anteriorly for about one-half their length over the rostrum; lamellae short, rather smooth with roughened medial borders, separated from each other a distance equivalent to their lengths, usually with about six longitudinal rows of large pits between lamellae; lamellar hairs located on antero-lateral margins of propodosoma and extended down over rostrum by about one-third their lengths; interlamellar hairs extremely short, about one-third as long as distance across pseudostigmata, insertions prominent, located posterior to lamellae at level of pseudostigmata; pseudostigmata heavy, cup-shaped, directed antero-laterally; pseudostigmatic organs short, slightly longer than lamellae, with short, rounded setose head and short pedicle as shown in figures 1 and 3; tectopedia I long, directed anteriorly, with roughened edges; tectopedia II shorter than tectopedia I and directed antero-laterally; exobothridial hair slender and located antero-laterally to pseudostigmata.

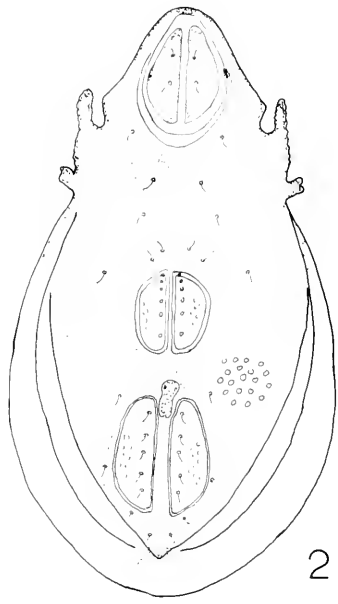
Hysterosoma oval and slightly vaulted; dorsal hairs short, weak and often hidden by the deep, oval pits that cover the body. Hysterosoma and dorsal hairs as seen in figure 1, nine pairs visible in holotype specimen.

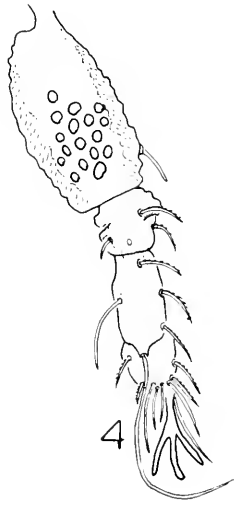
Camerostome egg-shaped in outline with two pairs of medially placed hairs; apodemata I a short transverse bar with lateral extensions divided; the anterior part arching in front of tectopedia II; apodemata III weak, not extending to middle line; apodemata IV coalesced with sclerotized margin of genital aperature; ventral plate

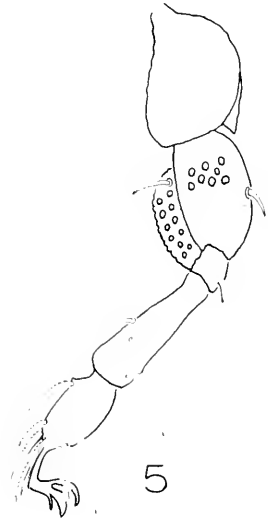
1. Research supported by National Science Foundation.

2. Department of Zoology, University of Utah, Salt Lake City









Figs. 1-5. *Eremaeus stiktos*: 1, dorsal aspect; 2, ventral aspect; 3, pseudostigmata and pseudostigmatic organ; 4, leg I from dorsal aspect; 5, leg IV, from lateral aspect.

structures and setae as shown in figure 2; genital aperture oval in outline, surrounded by a sclerotized ring formed by apodermata IV; each genital cover with six unequally placed setae along its median edge; anal opening egg-shaped and separated from genital opening by less than one-half length of genital cover, a sclerotized ring surrounding anal covers which terminates in a point at posterior end, each anal cover with five sub-equally spaced setae along median edge; preanal piece large and extended about one-half the distance to genital opening; four pairs of adanal setae, ad_1 and ad_2 posterior to anal covers, ad_3 at postero-lateral edge of anal plate, and ad_4 near anterior level of anal opening. Entire ventral surface and legs deeply pitted.

Leg I longer than leg II, but shorter than leg IV; all tarsi shorter than their tibia; femur of leg I extending forward to end of rostrum; legs heterotridactylous, middle claw being the largest; the femur of all legs with a heavy, roughened, double, ventral keel. Leg I shown in figure 4; leg IV shown in figure 5.

Total length, 636 μ, hysterosoma, 450 μ; width of hysterosoma, 360 μ.

The holotype and six paratypes are from Farmington Canyon, Davis County, Utah, 2 August 1956 by J. R. Higgins. Additional specimens are as follows:

UTAH: 1 specimen from Lambs Canyon, Salt Lake County, 3 October 1954 by S. Mulaik; 1 specimen from Spruces Recreational Area, Salt Lake County, 5 June 1957, and 1 specimen from the same area 11 July 1957 by H. Higgins; 1 specimen from Diamond Fork Canyon, Utah County, 17 June 1956 by H. Higgins.

WASHINGTON: 2 specimens from Cle Elum, 19 August 1956 by H. and M. Higgins; 1 specimen from lichens at Neah Bay, 22 August 1956, by H. and M. Higgins.

REMARKS: This species of mite is more deeply pitted than any known species of *Eremaeus*. It appears to live in a large variety of habitats in a wide range of elevations. Specimens from Farmington Canyon and the Spruces Recreational Area were taken from litter under a mixed conifer-aspen association at elevations above 7,000 feet. The specimens from Cle Elum were taken from a moss covered log under Douglas fir while the specimen from Neah Bay was found in lichens on a standing tree at sea level.

REFERENCES

Banks, N. 1896. New North American Spiders and Mites. Trans. Amer. Ent. Soc. 23:57-77.

———. 1947. On Some Acarina from North Carolina. Psyche 54(2):110-141.

Ewing, H. E. 1909. The Oribatoidea of Illinois. Bull. Ill. State Lab. Nat. Hist. 7(10):337-389.

Forsslund, K.-H. 1957. Schwedische Oribatei (Acari). III. Ent. Ts. Arg. 77(2-4): 210-218.

Hammer, M. 1952. Investigations of the Microfauna of Northern Canada, Part I, Oribatoidea. Acta Arctica 4(1):1-108.

Kunst, M. 1957. Bulgarische Oribatiden (Acarina) I. Univ. Carolina. Biologica 3(2):133-165.

Mihelcic, F. 1955. Oribatiden der Iberischen Halbinsel II. Zool. Anz. 155:306-309.

Winkler, J. R. 1956. Beitrag zur Kenntnis der Gattung *Eremaeus* Koch. (Acari: Oribatoidea). Zool. Anz(9/10): 201-210.

Woolley, T. A. 1957. Redescriptions of Ewing's Oribatid Mites, III—Family Eremaedidae (Acarina: Oribatei). Ent. News 58(6): 147-156.

The Great Basin NATURALIST

Volume XXII December 31, 1962 No. 4

TABLE OF CONTENTS

PUBLISHED BY
BRIGHAM YOUNG UNIVERSITY

The Great Basin Naturalist

A journal published from one to four times a year by Brigham Young University, Provo, Utah.

MANUSCRIPTS: Only original unpublished manuscripts, pertaining to the Great Basin and the Western United States in the main, will be accepted. Manuscripts are subject to the approval of the editor.

ILLUSTRATIONS: All illustrations should be made with a view to having then appear within the limits of the printed page. The illustrations that form a part of an article should accompany the manuscript. All half-tones or zinc etchings to appear in this journal are to be made under the supervision of the editor, and the cost of the cuts is to be borne by the contributor.

REPRINTS: No reprints are furnished free of charge. A price list for reprints and an order form is sent with the proof.

SUBSCRIPTIONS: The annual subscription is $2.50, (outside the United States $3.25). Single number, 80 cents.

All correspondence dealing with manuscripts, subscriptions, reprints and other business matters should be addressed to the Editor, Vasco M. Tanner, Great Basin Naturalist, Brigham Young University, Provo, Utah.

REPRINTS SCHEDULE OF THE GREAT BASIN NATURALIST

	2 pp.	4 pp.	6 pp.	8 pp.	10 pp.	12 pp.	Each Additional 2 pp.
50 copies	$6.00	$7.00	$8.00	$9.00	$10.00	$11.00	$2.00
100 copies	7.00	8.00	9.00	10.00	11.00	12.00	
200 copies	8.00	9.00	10.00	11.00	12.00	13.00	
300 copies	9.00	10.00	11.00	12.00	13.00	14.00	

COVERS: $10.00 for first 100 copies, $4.00 for additional 100 copies.

The Great Basin Naturalist

Published at Provo, Utah by
Brigham Young University

Volume XXII December 31, 1962 No. 4

A NEW SPECIES OF *PASSALOZETES* FROM UTAH WITH NOTES ON THE GENUS. (ACARINA: ORIBATEI)[1]

Harold G. Higgins[2] and Tyler A. Woolley[3]

Among specimens of mites collected by the University of Utah Ecological Research Unit from wood rat (*Neotoma*) nests in Tooele County, Utah are examples of the genus *Passalozetes* Grandjean, 1932. These specimens represent a new species and a new geographic record of the genus. This is the first species of *Passalozetes* recorded from the United States; all others are European, according to Balogh (1961).

Passalozetes linearis, n. sp.

(Figs. 1, 2, 3, 4)

Diagnosis: This species is readily separated from other known species of the genus by the fine-lined, dorsal and ventral integument and by the flattened, densely setose pseudostigmatic organs (Fig. 3).

Description: Yellowish in color; propodosoma about as long as wide, rostrum blunt, rounded; rostral hairs simple, inserted in small lateral projections, curved medially toward tip of rostrum, decurved; lamellae absent; lamellar hairs small, short, inserted near faint transverse line which transects dorsum of propodosoma nearly midway between anterior top and level of tectopedia I; interlamellar hairs not present in type specimen, insertions of hairs antero-mediad of pseudostigmata, adjacent to coalesced medial section of dorsosejugal suture; propodosoma broken in type specimen anterior to interlamellar hairs; pseudostigmata cup-like, separated from each other by a little more than the length of pseudostigmatic organ; pseudostigmatic organ with a narrow pedicel and with an expanded, densely setose head as shown in figure 3.

Hysterosoma oval, anterior margin extended forward, coalesced medially with dorsum of propodosoma at level of interlamellar hairs; dorsosejugal suture interrupted by this medial projection; lenticulus clear, circular, surrounded by lines; dorsum with 8 pairs

1. Research sponsored by National Science Foundation.

2. University of Utah, Salt Lake City, Utah
3. Colorado State University, Fort Collins, Colorado.

of simple hairs as shown in figure 1; integument with many fine lines (similar to the reticulations of a human fingerprint); two pairs of areae porosae and a glandular fissure as seen in figure 1.

Camerostome rectangular, general sclerotization as seen in figure 2; apodemata as seen in figure 2; ventral plate broken in type specimen; apodemata III darkly sclerotized, medially encircling genital aperture in a perigenital ring; genital aperture at level of apodemata IV, genital covers each with four pairs of genital setae, g:1 and g:2 inserted diagonally in anterior end of cover, g:3 posterior to g:1 near middle of cover, g:4 in medial-posterior corner of cover; aggenital setae inserted about twice their lengths postero-laterad of genital aperture; anal aperture nearly one-third larger than genital opening, in posterior end of ventral plate, aperture broken in type specimen; anal covers rectangular, separated in type specimen, each with two setae; adanal setae as in figure 2, ad:1 and ad:2 close together at lateral margin of anal aperture, ad:3 nearly halfway between anal and genital aperture, directly posterior to aggenital setae.

Tarsus of leg I as shown in figure 4; all tarsi heterobidactylous; heavier of the two claws toothed.

Length 366 μ, hysterosoma 246 μ; width 186 μ.

Specimens of this species were collected as follows: 35 specimens from the Woodrat Nest Survey, South end Cedar Mountains, Tooele County, Utah, 8 July 1954, by J. Roscoe; 3 specimens from nest of *Neotoma lepida*, Cedar Mountains, Tooele County, Utah, 9 February 1953 by B. Thomas; 2 specimens from *Neotoma* nests, Cedar Mountains, Tooele County, Utah, 22 June 1953 by W. Thomas. Specimen No. 1326:055 is designated as type and will be deposited in the U.S. National Museum.

Key to the Known Species of *Passalozetes*

1. Legs with three (3) claws 2
   Legs with two (2) claws 4

2. Area between pseudostigmata smooth, without lines or sculpturing (Fig. 5) ..... *P. hispanicus* Mihelcic.
   Area between pseudostigmata with transverse lines or sculpturing 3

3. Tip of rostrum with large irregular markings; pseudostigmatic organ plumose (Fig. 6, 6a) .... *P. inlenticulatus* Mihelcic.
   Tip of rostrum with fine hair-like reticulations; pseudostigmatic organ serrate (Figs. 11, 11a) ..... *P. africanus* Grandjean

4. Sculpturing of hysterosoma consisting of both oblong or line-like markings and granules 5
   Sculpturing of hysterosoma not consisting of both oblong or line-like markings and granules 7

5. Sculpturing of both dorsal and ventral surfaces of hysterosoma similar ..... *P. reticulatus* Mihelcic
Sculpturing of dorsal surface different from markings on ventral surface 6

6. With heavy transverse ridges between and slightly anterior to pseudostigmata (Figs. 10, 10a, 10b) .... *P. vicinus* Mihelcic
Without heavy transverse ridges between the pseudostigmata (Figs. 16, 16a, 16b, 16c, 16d, 16e) ..... *P. variatepictus* Mihelcic

7. Dorsal pattern consisting of roughened stars interspersed with small granules (Fig. 12) ..... *P. bidactylus* (Coggi)
Dorsal pattern not consisting of roughened stars 8

8. Dorsal pattern of hysterosoma consisting of line-like markings (Figs. 1, 13) 9
Dorsal pattern of hysterosoma not consisting of line-like markings 10

9. Dorsal hysterosomal pattern of lines separated by rows of granules; pseudostigmatic organ not setose. (Fig. 13) ..... *P. striatus* Mihelcic.
Dorsal hysterosomal pattern of lines not separated by rows of granules; pseudostigmatic organ with setose head. (Figs. 1, 3) ..... *P. linearis* n. sp.

10. Middle part of dorsal hysterosomal pattern consisting of single granules or strings of broken bead-like granules 11
Middle part of dorsal hysterosomal pattern with a heavy bone-shaped design. (Figs. 14, 14a) .... *P. intermedius* Mihelcic

11. Middle part of dorsal pattern consisting of strings of broken bead-like granules. (Figs. 9, 9a) ..... *P. permixus* Mihelcic
Middle part of dorsal pattern consisting of mainly single granules 12

12. Propodosoma with a heavy lateral keel. (Fig. 8) ..... *P. granulatus* Mihelcic
Propodosoma without a heavy lateral keel 13

13. Exobothridial setae posterior to pseudostigmata; ventral pattern of irregular rectangular markings. (Fig. 15) ..... *P. perforatus* (Berlese).
Exobothridial setae antero-lateral to pseudostigmata; ventral pattern of fine broken lines (Fig. 7) ..... *P. propinquus* Mihelcic

Literature Cited

Balogh, J. 1961. Identification keys of World Oribatid (Acari) Families and Genera. Acta Zool. 7(3-4):243-344.

Grandjean, F. 1932 Observations sur les Oribates (3° serie). Bull. Mus. Paris 2(4): 292-306.

Mihelcic. F. 1954 Beitrag zur Geographie und Ökologie des Genus *Passalozetes* Grdj. Zool. Anz. 153 (7-8): 168-170.

———. 1955 Beitrag zur Kenntnis des Genus *Passalozetes* Grdj. Zool. Anz. 155(7-8): 195-202.

———. 1956 Oribatiden Südeuropas III. Zool. Anz. 156: 9-29.

———. 1957 Zur Systematic und Okologie der Gattung *Passalozetes* Grandjean. Zool. Anz. 158 (1-2): 24-26.

———. 1957a Milben (Acarina) aus Tirol und Vorarlberg. Veroft. Mus. Ferd. 37: 99-120.

———. 1958 Oribatiden Südeuropas VII. Zool. Anz. 159: 44-68.

———. 1959 Zur Kenntnis der Miben (Acarina) aus Südkärnten und Osttirol. Zool. Anz. 162 (11-12): 362-371.

Strenzke, K. 1953 *Passalozetes bidactylus* und *P. perforatus* von den Schleswigholsteinischen Kusten (Acarina: Oribatei). Keiler Meeresforchungen 9(2): 231-234.

Explanation of Figures

Fig. 1. *Passalozetes linearis*, n. sp. from dorsal aspect, legs omitted.

Fig. 2. *Passalozetes linearis*, n. sp. from ventral aspect, legs omitted.

Fig. 3. Pseudostigmatic organ of *P. linearis* n. sp.

Fig. 4. Leg 1 of *P. linearis*, n. sp.

Fig. 5. Dorsal view of propodosoma of *P. hispanicus* Mihelcic, 1955, (After Michelcic, 1955).

Fig. 5a. Detail of dorsum of *P. hispanicus* Mihelcic, 1955, (After Mihelcic, 1955).

Fig. 6. Dorsal view of propodosoma of *P. inlenticulatus* Mihelcic, 1959, (After Mihelcic, 1959).

Fig. 6a. Pseudostigmatic organ of *P. inlenticulatus* Mihelcic, 1959.

Fig. 7. Dorsal view of propodosoma of *P. propinquus* Mihelcic, 1956, (After Mihelcic, 1956).

Fig. 7a. Pseudostigmatic organ of *P. propinquus* Mihelcic, 1956.

Fig. 8. Dorsal view of propodosoma of *P. granulatus* Mihelcic, 1955, (After Mihelcic, 1955).

Fig. 8a. Enlargement of dorsal sculpturing of *P. granulatus* Mihelcic, 1955.

Fig. 9. Dorsal view of propodosoma of *P. permixtus* Mihelcic, 1957a, (After Mihelcic, 1957a).

Fig. 9a. Enlargement of hysterosomal sculpturing of *P. permixtus* Mihelcic, 1957a.

Fig. 9b. Enlargement of propodosomal sculpturing of *P. permixtus* Mihelcic, 1957a.

Fig. 10. Dorsal view of propodosoma of *P. vicinus* Mihelcic, 1958. (After Mihelcic, 1957).

Fig. 10a. and Fig. 10b. Enlargement of hysterosomal sculpturing of *P. vicinus* Mihelcic, 1958.

Fig. 11. Dorsal view of propodosoma of *P. africanus* Grandjean, 1932. (After Grandjean, 1932).

Fig. 11a. Pseudostigmatic organ of *P. africanus* Grandjean, 1932.

Fig. 12. Dorsal view of propodosoma of *P. bidactylus* (Coggi) 1900. (After Strenzke, 1953.)

Fig. 13. Dorsal view of propodosoma of *P. striatus* Mihelcic, 1955. (After Mihelcic, 1955).

Fig. 13a. Enlargement of sculpturing of *P. striatus* Mihelcic. 1955.

Fig. 14. Dorsal view of propodosoma of *P. intermedius* Mihelcic, 1954. (After Mihelcic, 1954).

Fig. 14a. Enlargement of dorsal sculpturing of *P. intermedius* Mihelcic, 1954.

Fig. 15. Dorsal view of propodosoma of *P. perforatus* (Berlese), 1910, (After Strenzke, 1953).

Fig. 16. Dorsal view of propodosoma of *P. variatepictus* Mihelcic, 1956. (After Mihelcic, 1956).

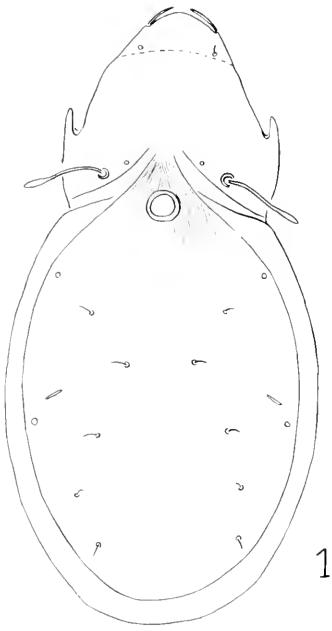
Fig. 16a. Enlargement of sculpturing of the middle part of propodosoma of *P variatepictus* Mihelcic, 1956.

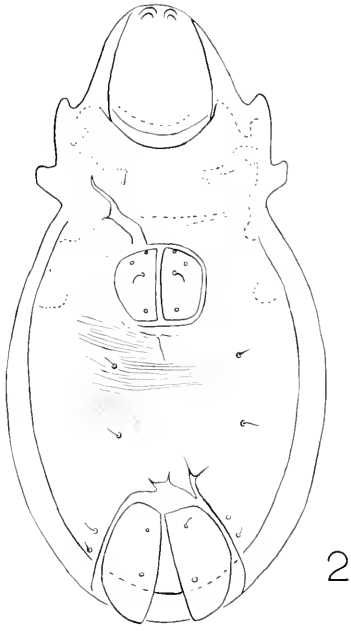
Fig. 16b. Enlargement of sculpturing of dorsal edge of hysterosoma of *P. variatepictus* Mihelcic , 1956.

Fig. 16c. Pseudostigmatic organ of *P. variatepictus* Mihelcic, 1956.

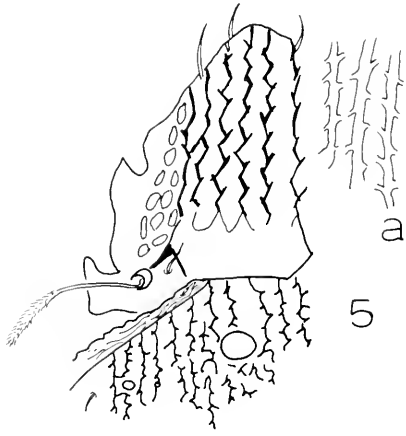
Fig. 16d. Enlargement of sculpturing of middle of hysterosoma of *P. variatepictus* Mihelcic, 1956.

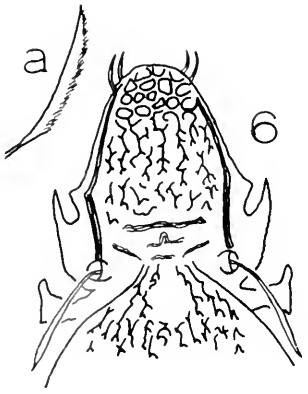
Fig. 16e. Enlargement of sculpturing around dorsal fissure of *P. variatepictus* Mihelcic. 1956.

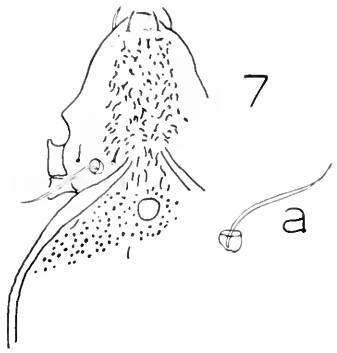

1

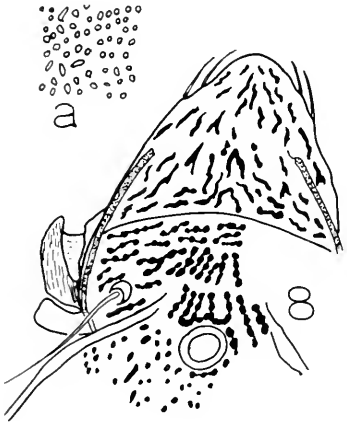

2

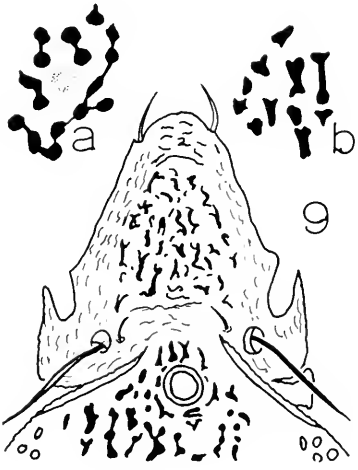

3
4

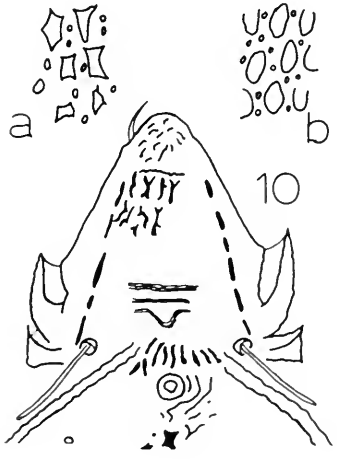

a
5

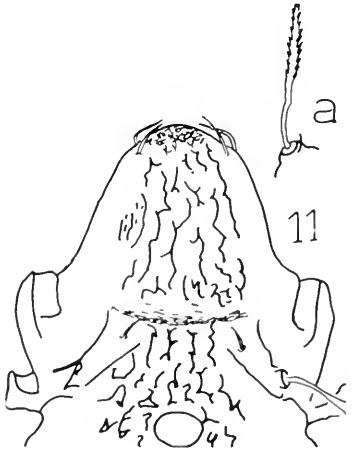

a
6

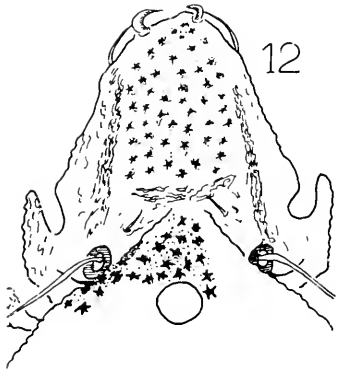

7
a

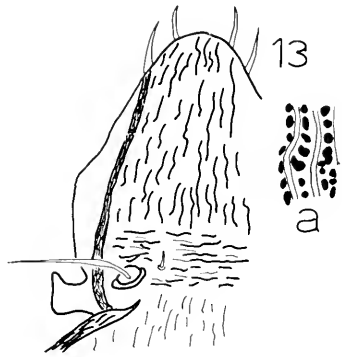

a
8


a
b
9

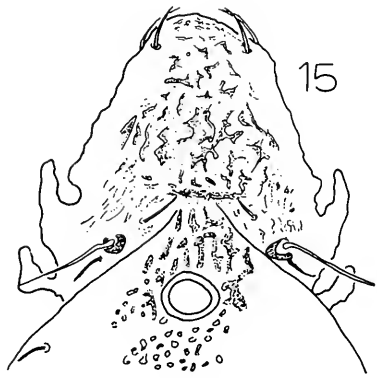

a
b
10


a
11

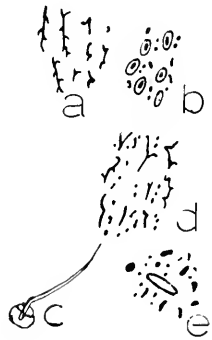

12


13
a


a
14


15


16


a
b
d
c
e

MITES ON GRASSHOPPER MICE AT THE NEVADA ATOMIC TEST SITE[1]

Dorald M. Allred[2]

This is the third of a series dealing with the mite fauna at the nuclear testing site near Mercury, Nevada (Allred and Beck, 1962; Allred, 1962). These studies are part of a broad ecological survey of which the objectives and a description of the biotic communities are given by Allred, Beck, and Jorgensen (1963).

Between August, 1959, and August, 1962, 84 grasshopper mice, *Onychomys torridus longicaudus* Merriam, were examined for ectoparasites. Mites were found on 51 mice. Approximately the same percentage of mice was infested in one community as in another. About equal numbers of male and female mice were infested, although males had an average of twice as many mites as females. The maximum number of mites found on a male mouse was 128 (*Euschöngastia criceticola*) in December and on a female, 65 (*Ischyropoda armatus*) in August. Relatively more mice were infested during June and October than in other months, although the average numbers of mites found on the mice were highest in August and December. The peak in December was due to heavy infestations of chiggers, and to mesostigmatids in August.

Haemolaelaps glasgowi (Ewing)

This cosmopolitan species is known from a variety of hosts including *Onychomys leucogaster* (Strandtmann and Wharton, 1958), but apparently has not heretofore been reported from *O. torridus*. At the test site it was found on 25% of the grasshopper mice, with male and female mice equally infested. It apparently is not an abundant symbiont of the mice, for in most instances only one mite per host was found. The greatest number found on a mouse was 10. Half of the times it was found, it was the only species on its host. Most of its mite associates were other mesostigmatids; it was found only once with chigger mites. Its seasonal records at the test site are: Jan., 1 dny, 2♂, 9♀; Mar., 1 dny, 1♀; April, 8♀; June, 6♀; Sept., 1♂, 5♀; Oct., 1 dny, 9♀; Nov., 3♀; Dec., 4♀.

Hirstionyssus triacanthus (Jameson)

Only two mice were found infested with mites of this species, each with only one female mite. These infestations in June likely were accidental inasmuch as this mite is typically associated with kangaroo rats (Strandtmann and Wharton, 1958).

1. This research was supported in part by contract AT-11-1-780 between the United States Atomic Energy Commission and Brigham Young University.

2. Department of Zoology and Entomology, Brigham Young University, Provo Utah

Hypoaspis leviculus (Eads)

Mites of this species have been reported from *Onychomys leucogaster* and rodents of several other species (Allred, 1958). Apparently its most commonly known host is the grasshopper mouse. At the test site this species was found on only 12% of the *O. torridus* examined. It was not as frequent in its occurrence on this host as were other mites. In most of its collections, less than four mites of this species were found on a host. The greatest number found on a mouse was five. Two of the 10 times it was collected it was the only mite species on its host. At other times it was associated only with mesostigmatid mites. Its seasonal records are: June, 8 ♀; July, 1 ♂; Sept., 8 ♀; Oct., 8 ♀.

Ischyropoda armatus Keegan

This species is known to occur in southwestern United States on a variety of rodents including *Onychomys leucogaster* (Allred, 1957). Twenty-three percent of the grasshopper mice examined at the test site were infested with it. Most infested animals possessed two or more mites, and as many as 65 were found on a single host. Eight of the 19 times it was collected it was the only mite species on its host. In one collection it was associated with chigger mites, and at other times with mesostigmatids. Seasonally it was collected as follows: Jan., 1 dny, 5 ♂; April, 1 ♀; May, 1 dny, 1 ♀; June, 3 dny, 9 ♂, 5 ♀; July, 2 ♀; Aug., 1 ♂, 69 ♀; Oct., 1 dny, 2 ♂, 4 ♀.

Kleemania sp.

Relatively little is known of the taxonomy and ecology of these mites. They were found on 15% of the mice examined. Most infested animals possessed three or less mites, but as many as 13 were found on a single host. Two of the 13 times it was collected it was the only mite species on its host. In one collection it was associated with chigger mites, and at other times with mesostigmatids. Its seasonal records are: April, 1 ♂, 12 ♀; June, 7 ♀; Sept., 1 ny, 14 ♀; Oct., 1 ♂, 16 ♀; Dec., 1 ♀.

Odontacarus linsdalei (Brennan and Jones)

This species has been reported from rodents of several species from California and Utah, but has not heretofore been known from grasshopper mice (Brennan and Beck, 1955). This species was the most frequent in occurrence of all the chigger mites collected from this host at the test site, although it was found on only 10% of the mice examined. In numbers of individuals it was not abundant on these mice. Usually less than 10 mites were found on a mouse, but in two instances 39 and 44, respectively, were found. Twice in the nine times that it was collected it was the only mite species on its host. At other times it was associated with another species of chigger mite, and only twice was it associated with mesostigmatid

mites. Its seasonal records are: June, 32 la; Aug., 87 la; Oct., 8 la; Dec., 1 la.

Euschöngastia criceticola Brennan

Four mice from the *Coleogyne ramosissima* plant community were infested with mites of this species. Whenever they were found, these mites were the predominant species. They were associated twice with *Odontacarus linsdalei*, once with a mesostigmatid protonymph, and once with *O. linsdalei*, *Haemolaelaps glasgowi*, and *Kleemania* sp. Their seasonal records are: Oct., 29 la; Mar., 28 la; Dec., 128 la.

Trombicula arenicola Loomis

A single larva of this species was collected in September, and 13 larvae in June.

Leeuwenhoekiinae sp. "B" Brennan

One mouse from a *Larrea divaricata* plant community and two from a Mixed community were infested with mites belonging to an undescribed genus and species. In the three collections these mites were predominant in numbers over their mite associates. This species was found associated three times with *Odontacarus linsdalei* and once with *Ischyropoda armatus*. Mites of this undescribed species were found attached side by side with *O. linsdalei*. A total of 160 larvae was collected in August.

Other Mites

Thirteen mites belonging to an unidentified species of the family Ameroseiidae were found on eight mice in Jan., April, July, Sept., and Oct. These were usually found in association with other mesostigmatids. Three protonymphs and three deutonymphs of an unidentified family were found on five mice in March and October.

Discussion

Little has been published on the mite fauna of *Onychomys torridus*, especially with reference to year round examinations of the host species. Of the 12 species of mites found on this mouse at the Nevada Test Site, *Haemolaelaps glasgowi* and *Ischyropoda armatus* were most frequent in occurrence. Greatest numbers of individuals belonged to *I. armatus*, *Odontacarus linsdalei*, *Euschöngastia criceticola*, and an undescribed genus of chigger mite. Considering both frequency and population, *I. armatus* is considered the most common mite associate of *Onychomys torridus* at the test site. As far as is known, the host and distribution records reported here for Nevada are new.

Literature Cited

Allred, D. M. 1957. Mites found on mice of the genus *Peromys-*

cus in Utah. II. Family Haemogamasidae. Proc. Entomol. Soc. Washington, 59:31-39.

———. 1958. Mites found on mice of the genus *Peromyscus* in Utah. IV. Families Laelaptidae and Phytoseiidae. Pan-Pacific Entomol., 34:17-32.

———. 1963. Mites on squirrels at the Nevada atomic test site. J. Parasitol., 48:817.

Allred, D. M., and D E. Beck. 1962. Ecological distribution of mites on lizards at the Nevada atomic test site. Herpetologica, 18:47-51.

Allred, D. M., D E. Beck. and C. D. Jorgensen. 1963. Biotic Communities of the Nevada Test Site. Brigham Young University Science Bulletin, Biological Series, Vol. 2, No. 2.

Brennan, J. M., and D E. Beck. 1955. The Chiggers of Utah. The Great Basin Nat., 15:1-26.

Strandtmann, R. W., and G. W. Wharton. 1958. A Manual of Mesostigmatid Mites Parasitic on Vertebrates. Contrib. No. 4, The Institute of Acarology, University of Maryland, College Park. 399 pp.

STUDIES IN NEARCTIC DESERT SAND DUNE ORTHOPTERA

Part VII. A new dwarf race of *Plagiostira gillettei* from a Utah Dune, with generic key[1]

Ernest R. Tinkham[2]

In Part I of this series of studies, I reported a dwarf male of *Plagiostira gillettei* taken on the Coral Pink Dunes of southwestern Utah the night of August 3-4, 1958. Additional material of this form taken by Jacques Helfer of Mendocino, California, in the summer of 1960 is now available and indicates that this small race dwelling in sage brush on the Coral Pink Dunes at the considerable elevation of 6500 feet in the Pine Zone is worthy of racial recognition.

Plagiostira gillettei utahensis, n. subsp.

Considerably smaller than typical *P. gillettei* Caudell; differing from Utah specimens of *gillettei* by the presence of four nacreous spots on the prozona of the pronotum and by the broad nacreous border margining the lower edge of the lateral lobes of the pronotum, as well as by the more strongly flanged anterodorsal margin of the pronotum; from Nevada specimens of *gillettei* chiefly in its smaller size and more strongly flanged fore margin of the pronotum, the more rectangular dorsum of the pronotum, as well as by the parallel lateral carinae of the pronotum. From *P. albonotata* Scudder, with which it was associated, by its slightly larger size, the lustrous enamelling of head, pronotum and thorax and by the heavier pair of uncinate hooks on the internal subapical portion of each of the cerci. Other features include the pronotum which is broader and shorter, the anterior margin much more strongly flanged or reflexed dorsally, the strongly humped median section of the posterior margin, as well as the much more crenulately thickened lateral carinae of the pronotum. The dorsum of the metazona lacks the parallel dashes of dull Chinese white so characteristic of *albonotata*.

Coloration.—The general ground color of head and thorax is a lustrous viridian, the head liberally lightened with satiny white on face and genae, the pronotum with the typical spots on the prozona and the lateral lobes of the pronotum with the lower margin broadly edged with nacreous. The mes- and meta-epimeron and episterna are luctrous viridian lightened by two diffused bands of nacreous. The abdominal segments are dark foliage green dorsally with irregular dorso-lateral and lateral stripes of satiny white;

1. National Science Foundation Grantee No. 11261

2. Indio, California

the posterior margin of each segment bearing a row of separated, rusty brown, spots.

Type.—Male. Coral Pink Dunes, 13 miles South of Mt. Carmel Junction, Kane County. Utah, elev. 6500 feet, Jacques Helfer. Calliper measurements: body length 21.8, pronotum, length 9.8 x 5.8 width; hind femur 19.5 mms. Type deposited in the California Academy of Sciences.

Paratypes.—5 males. 4 males same as type; 1 male, same data but collected August 5, 1958, by Ernest R. Tinkham. Range in measurements: body length 18.5- 23.0; pronotum 8.3-9.2 x 5.2-5.3; hind femora 17.5-18.7 mms. Paratypes similar to the Type in every respect and deposited in the collections of the California Academy of Sciences, Helfer nad Tinkham Collections.

Host.—The new race of *Plagiostira* was collected on the ridge of a steep slope of red sand, about 15 feet high, which was occupied by *Artemesia tridentata*, a little *A. filifolia* (Silver Sage) and some rabbit brush (*Chrysothamnus* sp.) Here also was found more commonly *Plagiostira albonotata.*

Orthopteran Associates.—In the sage brush *P. g. utahensis* was associated with *P. albonotata* and a *Melanoplus* sp. near *pachardi.* On the dunes themselves atypical *Trimerotropis agrestis gracewileyae* was abundant in communities of Scurf Pea *Psoralea stenostachys*, and on the dune margins was the newly discovered *Trimerotropis arenacea* Rehn, a new record for Utah.

Key to the genus *Plagiostira* Scudder

1. Size large to medium, pronotum squarish or squarish-rectangular. No nacreous markings on the metazona. Subgenital plate from above rather broad and projecting only slightly beyond the apices of the cerci 2

   Size medium large to small. Pronotum narrowly rectangular. Nacreous markings present on both prozona and metazona of the pronotum. Subgenital plate narrow and projecting well beyond the apices of the cerci 3

2. Size large, crenulated lateral margins of the pronotum broadest about the middle . . . San Raphael and Lahontan Deserts .....*g. gillettei* Caud.

   Size medium. crenulated lateral margins of the pronotum practically parallel. Coral Pink Dunes: Pine Zone .....*gillettei utahensis* Tinkham

3. Size medium-large. Pronotum in profile distinctly subsellate. Nacreous markings on the prozona consisting of two short parallel streaks and with two long parallel streaks on the

metazona, the cephalic apices of which flare outwardly. eastern New Mexico; Mescalero sands
.....*mescaleroensis* Tinkham

Size small. Pronotum in profile almost flat. Pronotal length more than twice the pronotal breadth. Prozona with two pairs of nacreous spots and metazona with an inverted, white, straight-bottomed "U"-shaped design. Northern Arizona and southern Utah east to the Rio Grande in New Mexico .....*albonotata* Scudder

References

Tinkham, Ernest R. 1959. Notes on the Self-burial Habits of two Nearctic Sand Dune Acridids (Orthoptera). The Entomologist, 92(1156):185-188, 1 text photo.

——— 1960. Studies in Nearctic Sand Dune Orthoptera. Part I. A new species of *Plagiostira* from eastern New Mexico with key and notes. Great Basin Naturalist, 20(1 & 2):39-48, 10 text figs.

———. 1960. Studies in Nearctic Desert Sand Dune Orthoptera. Part II. Two new Grasshoppers of the genus *Trimerotropis* from the Utah Deserts. Great Basin Naturalist, 20(3 & 4):49-58, 6 text figs.

STUDIES IN NEARCTIC DESERT SAND DUNE ORTHOPTERA

Part VIII. A Grasshopper New to the Utah List[1]

Ernest R. Tinkham[2]

On the morning of July 25, 1960, after having collected by lantern light the night before on the Coral Pink Dunes 3 miles southeast and ten miles southwest of Mt. Carmel Junction, Utah, I was preparing to leave the small parking area when I decided to obtain a small sample of red sand for study. In so doing I had to follow a path traversing a habitat of tall Sage Brush (*Artemesia tridentata*) to the nearest bank some one hundred feet away. I had crossed this area several times previously that morning but as temperatures were warming up, insect activity was also increasing. This time I heard the buzz of a grasshopper along the path that sounded new to me. Getting my net, I soon had the specimen. Intensive search over the small area of sage brush netted an additional three males in half an hour. The coarse humus layer, typical of an *Artemesia* habitat, was covered with a fine topping of sand from the dunes close by, producing a habitat favorable to this species. Later, while determining the specimens, I had occasion to compare the reddish colored males with grayish colored males of *Trimerotopic arenacea* Rehn collected in similar environment on low dunes semistabilized with *Artemesia tridentata*, 3 miles west of Winnemucca, Nevada. Although very slightly more slender with the wing discs more brightly yellow, the Utah specimens were otherwise very closely similar to the Winnemucca males of *T. arenacea*. The Winnemucca specimens were captured, August 11, 1948, on my Great Basin Desert Expedition, but search in the same area on September 17, 1958, proved it barren of all forms of Orthopteran life.

T. arenacea was described from Springfield, Bingham County, Idaho, about 18 miles NW of Pocatello, and this record extends its distribution southward at least 400 miles. This capture adds another species to the imposing list of *Trimerotropis* for Utah, which Barnum (1954) listed as twenty, including *T. agrestis*. Typical *T. agrestis* does not occur in Utah but in 1960, I named two new races, namely; *T. agrestis gracewileyae* from the dunes of Emery County of the San Rafael Desert and *T. a. barnumi* from dunes of the Great Salt Lake Desert. These additions bring the list to 22 species for the genus which appears to be a North American State Record.

References

Barnum, Andrew. 1954. The Taxonomy of Utah Orthoptera.

1. National Science Foundation Grantee No. 11261

2. Indio, California.

Great Basin Naturalist, 14(3 & 4):39-60, pls I-V with many illustrations.

Tinkham, Ernest R. 1947. New Species, Records and Faunistic Notes Concerning Orthoptera in Arizona. American Midland Naturalist, 38(1): 127-149, pls I-IV with many illustrations.

———. 1960. Studies in Nearctic Desert Sand Dune Orthoptera. Part II. Two new grasshoppers of the genus *Trimerotropis* from the Utah Deserts. Great Basin Naturalist, 20(3 & 4):49-58, 6 text figs.

PELECYPHORUS SEMILAEVIS (HORN) (COLEOPTERA: TENEBRIONIDAE)[1]

Vasco M. Tanner[2] and Willis A. Packham[3]

In 1870 Dr. George H. Horn described, from a unique, a species of Tenebrionidae which was collected by William M. Gabb in western Nevada. He named it *semilaevis* assigning it to the genus *Asida*. In the Henshaw "List of Coleoptera of America, North of Mexico," 1885, there are thirty-eight species referred to this genus. Horn recognized that the species of this genus represented a heterogeneous complex but failed to correct the situation. In 1912 Colonel Casey revised the tribe Asidini dispersing species found in *Asida* between ten genera, eight of which he proposed as new. The genus *Asida* of Latreille he considered as foreign to America. It appears from a study of many of Casey's genera of the Asidini that some of them should be synonymized.

As he proceeded with his study, some of the previously described species did not fall into his revisional pattern. One of these was *Asida semilaevis* Horn. He did not have a specimen of the species so had to depend upon Horn's description of the unique which is in the Academy of Natural Sciences of Philadelphia.

Casey was in doubt as to the generic placement of *semilaevis*, so he tentatively placed it in *Trichiasida* Csy. He observed that "the arrangement of the elytral costae is exactly that characterizing this genus, but the sinuation of the sides of the prothorax toward base is a character quite at variance with anything hitherto observed, and the author makes no reference to pubescence of any kind, this being present, at least in some form, in all other species." (1912—p. 182).

Fortunately, many specimens of *semilaevis* were recently collected at the Mercury Test Site in western Nevada. They were collected in sunken open cans which served as night traps.

The drawing, figure 1, of a representative specimen from Mercury fits so well Horn's description and remarks that we are convinced that the series before us are representative of the species *semilaevis*. To further substantiate our belief, Mr. Leech, Curator of Entomology at the California Academy of Science, kindly furnished us with a specimen from the Blaisdell collection which consisted of the "elytra, most abdominal sternites and the mesa and meta sterna" labeled "Brown's Nev. fragment, 4-11-1907. F. H. S." determined as *semilaevis* by F. E. Blaisdell and placed in the genus *Pelecyphorus*. We also wish to thank Dr. James A. G. Rehn of the Academy of Natural Sciences of Philadelphia for time spent in ex-

1. Contribution No. 181 from the Dept. of Zoology and Entomology, Brigham Young University.
2. Professor of Zoology and Entomology.
3. Graduats student in Entomology, and field research assistant, Atomic Test Site, Mercury, Nevada.

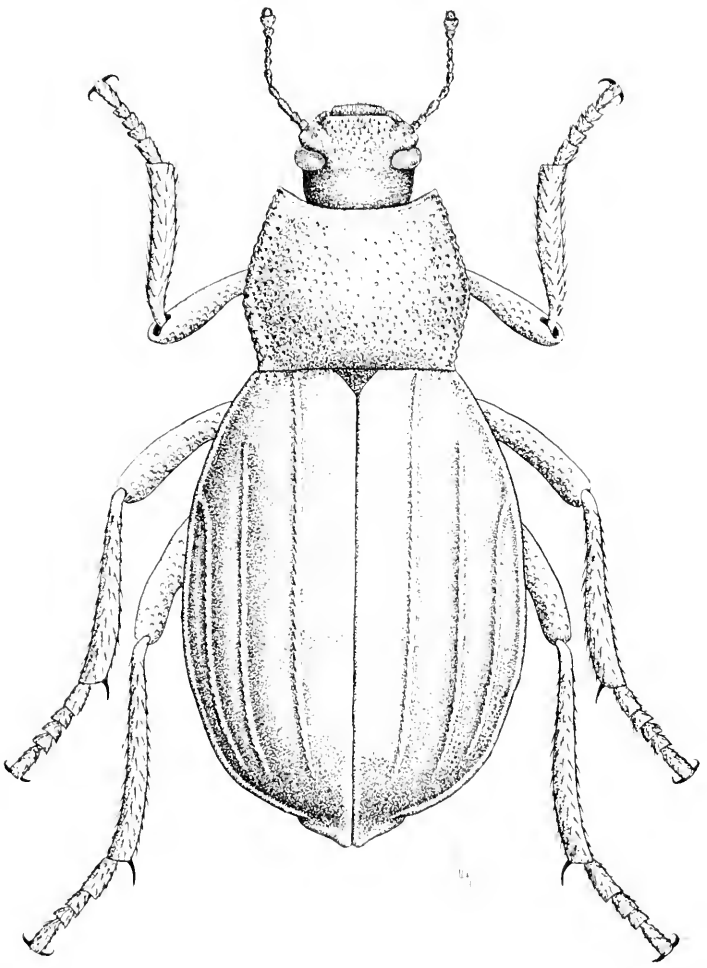


Fig. 1. *Pelecyphorus semilaevis* (Horn).

amining and reporting on questions concerning the type specimen of *semilaevis* in the Academy collection.

We are not in agreement with Casey's placing *semilaevis* in his new genus *Trichiasida*. We believe it is a *Pelecyphorus* since it does not agree with *T. acerba* Horn and other species placed in the genus, in possessing a pubescent integument, a small transverse mentum, pale slender antennae with the tenth joint abruptly wider, and devoid of cariniform costae.

The following are some of the salient characteristics of Solier's genus *Pelecyphorus*: terminal joint of the maxillary palpi large and scalene; wide buccal space between the mentum and the man-

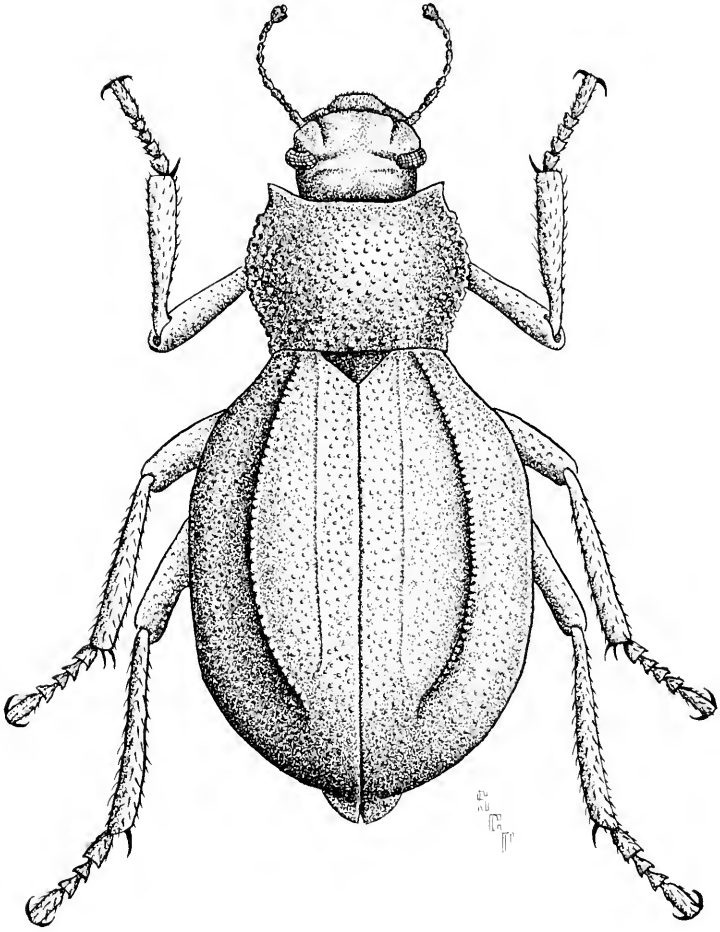


Fig. 2. *Pelecyphorus pantex* Casey.

dibles; antennae with sparse short black setae, the ninth and tenth joints wider, the tenth emarginate for the reception of the small eleventh joint; anterior body parts smaller when compared with the posterior body; the prosternum between the coxae is longitudinally impressed along the median line.

Col. Casey separated the species of *Pelecyphorus* into three groups. The species upon which this study is based belong to his group III: "Body very variable in form and sculpture but with the pronotum never carinate and the elytra never transversely rugose, rather convex as in group II."

In his key to the species of *Pelecyphorus*, *semilaevis* runs to *P. opimus*, but is different in many respects. We have not seen a

specimen of *opimus* so must rely upon Col. Casey's description. Our specimens do not agree with *opimus*.

Horn's description describes the specimens so well. We have chosen to reproduce it:

"*Semilaevis*, black opaque, elongate oval. Head coarsely and sparsely punctured. Thorax sub-quadrate, moderately convex, coarsely, sparsely and unevenly punctured, sides moderately rounded, posteriorly feebly sinuate, anteriorly emarginate, angles not prominent, base truncate, angles rectangular, elytra elongate oval, convex, with a distinct marginal costa, base truncate, angles distinct, disc with six parallel moderately elevated costae, surface between suture and first costa shining, between first costa and margin opaque. Beneath opaque, coarsely and sparsely punctured. Length .90 inch."

At the conclusion of the above description. Horn made the following significant remarks: "The arrangement of the costae of this species is very peculiar. They are moderately elevated, perfectly parallel to the suture and extend three-fourths of the length of the elytra. The first costa arises from the base slightly within the angles of the thorax; the second on a line of the humeri of the elytra, but at some little distance from it; the third arises from the marginal costa at about one-fifth from the humeral angle. This species commences the divergence from the robust form resembling somewhat that of *confluens* (infra)."

Along with a representative series of *semilaevis*, we have the following species of this genus from Southern Utah and Nevada: *P. pantex* Csy. Fig. II, collected at Mercury Nev.; Trout Creek, Juab Co., Ut.; and *P. haruspex* Csy. Alamo, Lincoln Co., Nev.; Hurricane, Wash. Co., Ut.; Parowan, Iron Co., Ut.; Fredonia, Ariz. *P. pantex* Csy. has a crenulate prothorax with a granulate disc; elytra finely granulate, with outer beaded strong costae inner costae almost obsolete.

In this study we have established *semilaevis* as a species of *Pelecyphorus* and illustrated its similarity to *pantex* with which it may have been mistaken. This tribe should be reviewed and new species described now that rather sizable collections have recently been made.

References

Casey, Thomas L. 1912. Memoirs on the Coleoptera. A Revision of the American Genera of the Tenebrionid Tribe Asidini, pp. 70-212.

Horn, George H. 1870. On the Revision of the Tenebrionidae of America, North of Mexico, p. 284. Trans. Am. Phil. Soc. Vol. 14, Part II.

THE ROOT SYSTEM OF BIGTOOTH MAPLE

Earl M. Christensen[1]

Root systems of several common Utah mountain brush species have been studied and illustrated (Baker and Korstian 1931, Cline 1960), but the root system of the common bigtooth maple, *Acer saccharum* Marsh. ssp. *grandidentatum* (Nutt. ex T. & G.) Desmarias, has not been described.

The root system of a 16 year old plant that was 3 feet. 7 inches high is illustrated in Figure 1. The plant was growing at 5100 feet on a north-facing slope in lower Provo Canyon, Utah in a community dominated by Gambel oak (*Quercus gambelii* Nutt.) and bigtooth maple. The excavation of the root system was made along the contour of the slope. The profile illustrated has a width of 2½ feet. Three soil horizons could be distinguished. The A horizon was 9 inches thick and gravelly. The B horizon was 18 inches thick and rocky. The C horizon was composed of hard clay and large rocks.

The root system of bigtooth maple is characterized by having a layer of superficial roots located mostly in the A horizon. A smaller number of roots extend vertically downward into the parent material. The root system of bigtooth maple is somewhat similar to that of Gambel oak, although Gambel oak is a rhizomatous species (Baker and Korstian 1931).

The plant chosen for study had not reproduced vegetatively by layering, a characteristic that is typical of older individuals of bigtooth maple. Layering is an effective type of reproduction in bigtooth maple, and in older plants the root system is extended radially as the lower branches layer in the litter.

References

Baker, F. S. and Clarence F. Korstian. 1931. Suitability of brush lands in the Intermountain Region for the growth of natural or planted western yellow pine forests. U.S. Dept. Agr. Tech. Bul. 256. 82 pp.

Cline. Morris G. 1960. A comparison of the root systems of bitterbrush and cliffrose. Master's thesis, Brigham Young University, Provo, Utah.

---

1. Department of Botany, Brigham Young University, Provo, Utah.

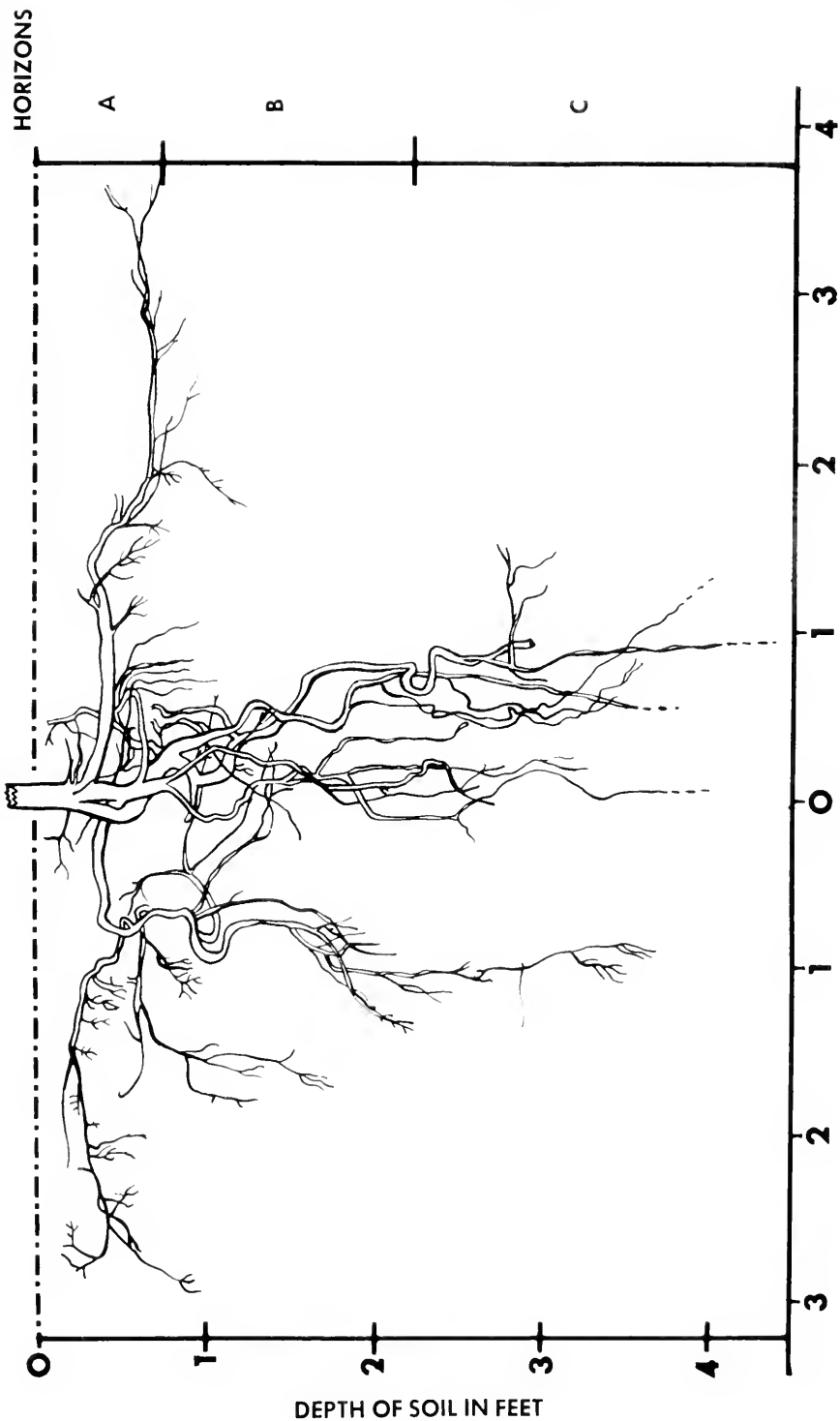


Fig. 1. Root system of bigtooth maple.

THE DISTRIBUTION OF *TANTILLA UTAHENSIS* BLANCHARD[1]

Wilmer W. Tanner[2] and Benjamin H. Banta[3]

Tantilla utahensis was originally described by Blanchard (1938: 372-3), based on a few specimens from southwestern Utah and east central California. Since then there has been uncertainty as to its distributional limits. The occurrence of known populations in Utah and California with no authentic records from Nevada left a hiatus in the distribution which seemed artificial. Recent field work in the Nevada Atomic Test Site as well as in California and Utah has not only extended the range of *T. utahensis* in California and Utah, but has also provided specimens from southern Nevada, thus bridging the widely separated populations in Utah and California.

The first record of this species was published by Van Denburgh (1922:880), who listed it as *Tantilla nigriceps*, based upon a specimen in the collection of the California Academy of Sciences taken by V. M. Tanner at Saint George, Washington County, Utah. This specimen became the holotype for *T. utahensis* (Blanchard, *loc. cit.*; Slevin and Leviton, 1956:549). V. M. Tanner (1927:57) and Woodbury (1928:21 and 1931:107-8) listed a *Tantilla* for southwestern Utah, but also referred it to *Tantilla nigriceps*.

More recently Tanner (1954:92-4) extended the range in Utah (to central Kane County) and reported a record for nothern Arizona. Since this report *T. utahensis* has been found at Star Spring, on the southeast slope of Mount Hilliar (elevation 6,000 feet), Garfield County, Utah. This record extends the range approximately 100 miles to the northeast.

Banta (1960:11) reported a second specimen of *T. utahensis* from Inyo County, California (Saline Valley), extending the range slightly to the north in California, and indicating a wider distribution in the state of California.

During the years 1959-1962, the Ecological Field Studies conducted at the Nevada Atomic Test Site,[4] Nye County, Nevada, have secured in buried-can pitfall traps two specimens of *Tantilla utahensis* from the western edge of Yucca Flat. These specimens (BYU 17922-3), plus the report by Stebbins (1958:2) of the species' occurrence in the Charleston Mountains, Clark County, definitely establishes the presence of this species in Nevada. These records also indicate that the range of *T. utahensis* is widespread (Fig. 1) and not divided into small widely-separated population pockets as suggested by Stebbins (1954:504).

1. This work was partially supported by a grant-in-aid from the Society of the Sigma Xi and the Research Society of America.
2. Department of Zoology and Entomology, Brigham Young University, Provo, Utah.
3. California Academy of Sciences, San Francisco 18, California.
4. We are very grateful to Dr. Dorald M. Allred, Department of Zoology, Brigham Young University, for the opportunity to examine and report upon specimens of *T. utahensis* from the United States Atomic Energy Commission Test Area, Nevada.

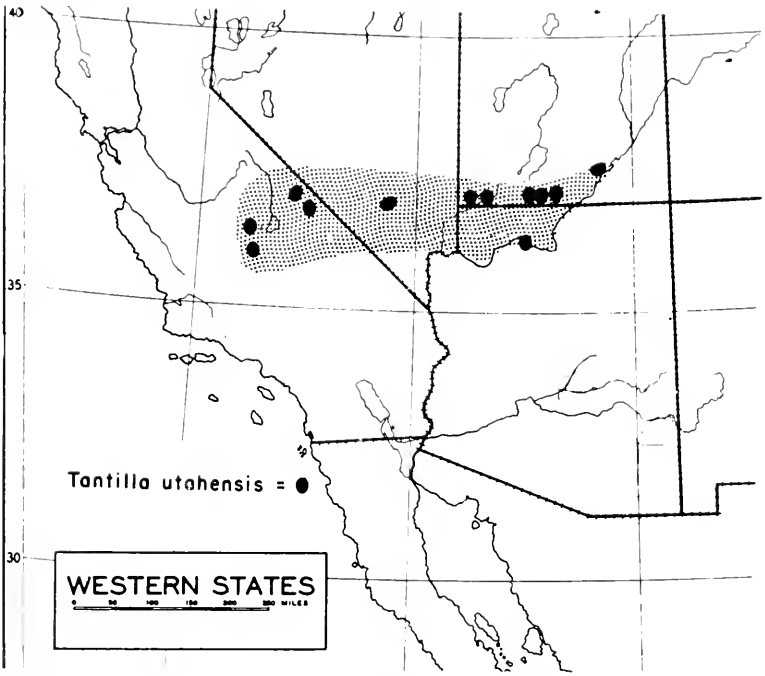


Fig. 1. Distribution of *Tantilla utahensis* in California, Nevada, Utah and Arizona.

Previous concepts generally implied that this species was restricted to the Lower Sonoran life zone (Tanner 1935:267); however, this is now obviously not the case. Elevation records are now known to range from approximately 2,500 feet in the southern part of its range to 6,000 feet in south-central Utah. Data available suggest that distribution is perhaps more dependent upon food (availability of small arthropods) and soil conditions (rocky foot hills and rocky alluvial fans) than on a restricted elevation or a specific plant community.

We have seen 41 specimens of *utahensis*, a series many times larger than others previously examined. In both scalation and color they are uniform. In only the ventrals and caudals are there noticable variations beyond the limits set in the original description. These are as follows: ventrals, males 153-160, females 162-174; caudals, males 62-70, females 57-64.

Attention should also be called to the narrow light nape band which is visible in some specimens of *utahensis*. It is more clearly seen in live snakes as a narrow band (about one-half scale wide) along the posterior edge of the black head and nape spot. In many specimens the body color and light nape band are so well blended that magnification is needed to indicate the presence of the narrow light band.

The two key characters (number of ventrals and amount of

black cap extending onto dorsals) used for separating *utahensis* from the two allopatric species (*atriceps* in Arizona, and *eiseni* in California) are actually close in these three species, and although we have not seen sufficient material to justify a conclusion, we suspect that there is a closer affinity between these three species (*atriceps*, *eiseni*, and *utahensis*) than has previously been suggested. This is indicated in Table 1.

Table 1. Comparison of Key Characters in Three Allopatric Species of *Tantilla*.

		utahensis			*eiseni**			*atriceps**		
Character	Sex	No.	Range	Mean	No.	Range	Mean	No.	Range	Mean
Ventrals	M	16	153-160	156.7	19	164-175	169	30	130-147	142
	F	21	162-174	166.2	16	169-182	178	12	145-157	150
Caudals	M	13	62-70	66.0	19	58-69	66	30	54-70	63
	F	18	57-64	60.16	17	53-67	60	12	51-64	57

*Includes the data presented by Blanchard (1938:376) and Klauber (1943:73).

Literature Cited

Banta, Benjamin Harrison. 1960. Another record of *Tantilla utahensis* from Inyo County, California. Herpetologica, 16:11.

Blanchard, Frank Nelson. 1938. Snakes of the genus *Tantilla* in the United States. Zoological Series, Field Museum of Natural History, 20 (28):369-376.

Klauber, Laurence Monroe. 1943. A desert subspecies of the snake *Tantilla eiseni*. Trans., San Diego Society of Natural History, 10(5):71-74.

Slevin, Joseph Richard, and Alan Edward Leviton. 1956. Holotype specimens of reptiles and amphibians in the collection of the California Academy of Sciences. Proc., California Academy of Sciences, series 4, 28(14):529-560.

Stebbins, Robert Cyril. 1954. Amphibians and reptiles of Western North America. New York: McGraw-Hill Book Co., Inc., xxii-528 pp. 104 pls.

———. 1958. A new alligator lizard from the Panamint Mountains, Inyo County, California. American Museum Novitates, 1883:1-27.

Tanner, Vasco Myron. 1927. Distributional list of the amphibians and reptiles of Utah. Copeia, 163:54-58.

———. 1935. Western Worm-Snake, *Siagonodon humilis* (Baird and Girard) found in Utah. Proc., Utah Academy of Sciences, Arts and Letters, 12:267-270.

Tanner, Wilmer W. 1954. Herpetological notes concerning some reptiles of Utah and Arizona. Herpetologica, 10:92-96.

Van Denburgh, John. 1922. The reptiles of Western North America. Vol. 2. Snakes and turtles. Occasional Papers, California Academy of Sciences, no. 10, pp. 617-1028.

Woodbury, Angus Munn. 1931. A descriptive catalog of the reptiles of Utah. Bull., University of Utah, 21(5): x, 1-129.

INDEX TO VOLUME XXII

The new genera and species described in this volume appear in bold type in this index.