

OCCASIONAL PAPERS
OF THE
California Academy of Sciences

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(ORTHOPTERA: ACRIDIDAE)

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SAN FRANCISCO
PUBLISHED BY THE ACADEMY
1966

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Hebard (1920) proposed the genus *Esselenia* to include one species, *vanduzeei*, which he described on the basis of four adult females taken by E. P. Van Duzee at Bryson, Monterey County, California. To this date no major work has been done concerning the genus although Hebard (1926) included it in his key to genera and Linsley (1936) and Linsley and Usinger (1936) recorded *Esselenia vanduzeei* as host of *Aulicus terrestris* Linsley, a clerid beetle.

Examination of rather large series of specimens indicates the presence of a second subspecies more common in general collections, but overlooked as being new because the male of the nominate subspecies had never been described. Included in this paper are: notes on preparation of specimens, a re-description of the genus, a description of the new subspecies, a key to the two forms, and biological notes.

ACKNOWLEDGMENTS

The author would like to thank Dr. Harold J. Grant and the late Mr. James A. G. Rehn of the Academy of Natural Sciences of Philadelphia for suggestions

during the preparation of this manuscript. Dr. Ashley B. Gurney of the U. S. Department of Agriculture has been particularly helpful to the author on many occasions and has given many helpful suggestions concerning this study. Mr. George M. Buxton and Mr. Hartford H. Keifer of the California State Department of Agriculture have made available many specimens and have taken time to see that material of this genus was collected by their field men. Dr. C. Don MacNeill, formerly with the California Academy of Sciences now with the Oakland Museum, has graciously helped the author many times during the course of this study. A travel grant made available by the California Academy of Sciences in cooperation with the American Association for the Advancement of Science enabled the author to visit many localities and establish many new records for the genus. The author wishes to thank the authorities of the California Academy of Sciences and all others who have helped with the project.

PREPARATION OF SPECIMENS

Owing to the large and soft abdomens of females it was found that the best museum specimens were obtained by eviscerating, stuffing, and "quick-drying" the prepared specimens under a low-wattage light bulb. Shrinkage and rotting were thus eliminated and colors were retained much better than by merely pinning freshly collected specimens. It was found that the latter method was sufficient to preserve much of the color and form of male specimens.

Determination of females can readily be made by examination of living specimens. The color of the hind tibiae, which is an important distinguishing characteristic, fades soon after death. The importance of examination of living Orthoptera has been recently demonstrated by Thomas and Alexander (1962, pages 4-5).

DISCUSSION

Records suggest that *Esselenia* is found only in the San Joaquin Valley and the adjacent mountains of California. The north slopes of Mt. Diablo are the northernmost known localities for the genus while material from Santa Barbara and Los Angeles counties provides the southernmost records.

Esselenia is very uncommon in general collections owing to the early occurrence of adult forms. Eggs hatch in late winter and adults appear in late winter and adults appear in late March. Rather severely hot weather usually occurs by late May and early June and adults gradually die out at this time. Both species occur in the upper Sonoran life zone in areas where annual rainfall is relatively little. Specimens are found in grass among digger pines and oaks. *Esselenia v. vanduzeei* has been found in more hilly areas whereas the new subspecies occurs in more open situations, away from dense brush and trees.

GENERIC DESCRIPTION

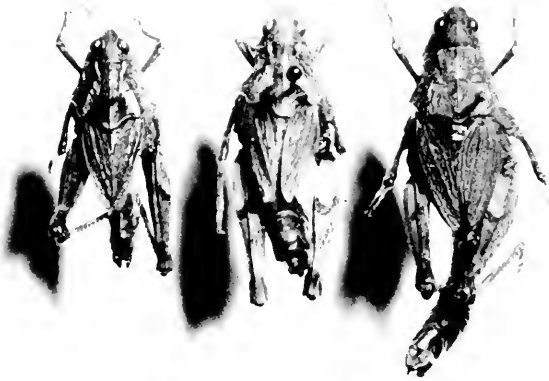
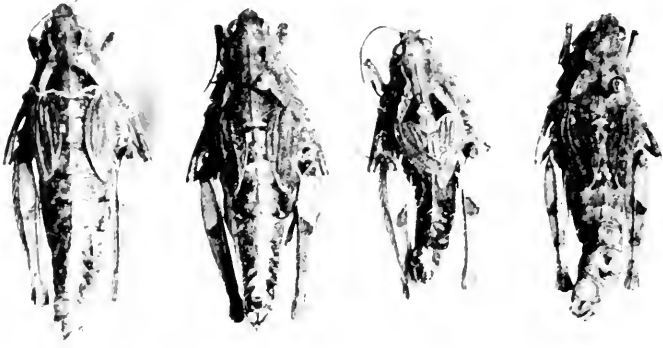
Type of the genus: *Esselenia vanduzeei* Hebard, 1920 (by monotypy).

Size medium small; form robust, especially so in females. Head large; face vertical in females, slightly slanted in males; vertex wide in both sexes, surface concave, frequently with an obsolete median longitudinal carinula; lateral carinae of vertex strongly concave in females, slightly so in males, diverging from apex; lateral foveolae not visible from above in either sex; frontal costa very decidedly concave in both sexes between the strong lateral carinae. Eye rounded in females but more elongate dorsoventrally in males. Antennae flattened, especially so in female where their length is less than that of the head and pronotum combined. Pronotum with a distinct precurent medio longitudinal carina in both sexes, cut by one to three sulci or entire; disk bounded laterally by distinct but irregular carinae which are weakly convex-convergent to first sulcus, then straight and strongly divergent. Caudal margin of lateral lobes of pronotum and of each half of the disk broadly concave so that the pronotum is roundly produced at each shoulder. Cephalic margin of pronotum either weakly convex or nearly straight. Surface of pronotum wrinkled, especially near sulci. Anterior margin of lateral lobes of the pronotum weakly convex ventrally, slightly concave dorsally; ventral margin broadly rounded, rectangulate, ventrocaudal angle; caudal margin broadly concave from shoulder of pronotum to ventral posterior corner of pronotum; sulci very deeply impressed on lateral lobes of pronotum. Tegmina represented by large, heavily veined, elongate pads never extending to end of abdomen; pads with apices pointed, more so in males; length variable. Caudal femora heavy, ventral, and in particular dorsal portions evenly and broadly lamellate; external pagina with herring-bone cross hatching. Dorsal surface of caudal tibiae with from eight to twelve external spines becoming larger in size apically; internal spurs of caudal tibiae heavy, ventral spur being slightly longer than the dorsal one. Ovipositor short, apices pointed upward. Supra-anal plate of male broad, cerci elongate, three to five times longer than broad. Color patterns of individual specimens variable, see figure 1.

KEY TO SUBSPECIES

(Utilized best with living specimens)

1. Hind tibiae and sides of abdomen brilliant orange in life (male), legs of female lighter orange, abdomen yellow. Dorsal ovipositor valves less elongate when viewed from above. (Distribution, figure 2) *Esselenia vanduzeei violae*
2. Hind tibiae of male specimens black. Sides of abdomen yellowish, never orange. Hind tibiae of female also black. Dorsal ovipositor valves elongate when viewed from above. (Distribution, figure 2) *Esselenia vanduzeei vanduzeei*



Esselenia vanduzeei Hebard.

(Figures 1, 2, and table 1)

Esselenia vanduzeei HEBARD, 1920, Proc. Acad. Nat. Sci. Philadelphia, vol. 10, pp. 71-75. Female holotype and three paratypes from Bryson, Monterey County, California. Type in the collection of the California Academy of Sciences.

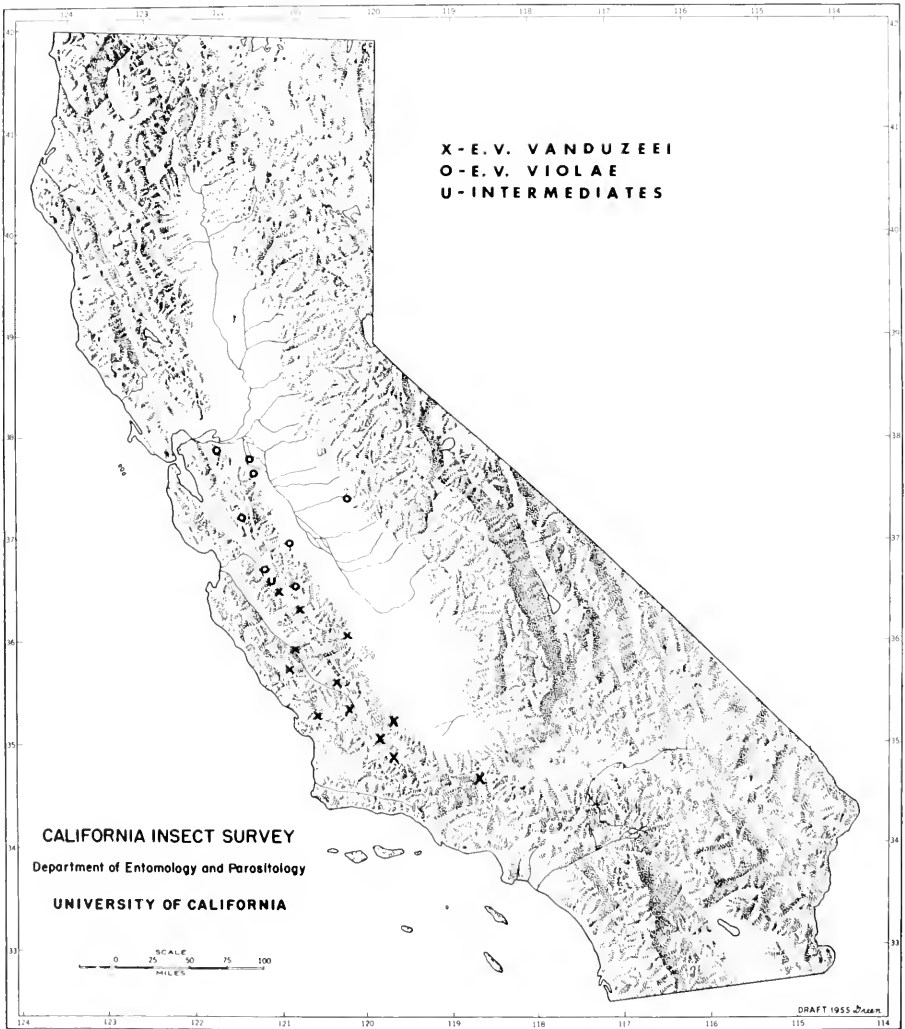
MALE (Plesiotype). Size much smaller than female. More slant faced than is the female when viewed laterally. Cephalic margin of pronotum weakly convex but slightly produced at extremities of median and lateral carinae. Dorsum of pronotum wrinkled, cut in half by a transverse suture. Greatest depth of lateral lobes equal to the dorsal length; cephalic margin of lateral lobes slightly convex ventrally; angle of anterior ventral lobe of pronotum broad, of posterior lobe acute. Supra-anal plate broad and rounded apically. Cerci slender, five times longer than the basal width. General coloration of this specimen of the more common type encountered in general collecting and generally the same as described by Hebard for the pale paratype of the original series with the exception that the hind tibiae are dark black.

DISCUSSION. This subspecies has the more southern distribution of the two as can be seen in figure 2. It was after collecting a specimen near Pinnacles National Monument, San Benito County, in 1958, and comparing it with specimens collected at Mt. Diablo, that the possibility of two similar but different forms occurring in California was brought to light. *Esselenia v. vanduzeei* in living specimens has black hind tibiae and no reddish markings on the sides of the abdomen as is the case with *E. v. violae*. This character is seen much better on male specimens and frequently cannot accurately be distinguished on females. When Hebard described the species he had neither males nor well preserved females and could not recognize the valuable color characters. Specimens collected at San Ardo, California, not far from the type locality, indicate that the black-legged form occurs in the area. That fact, in addition to the light blackish tibiae of the original specimens described and the characters of the ovipositor valves, proves that *E. v. vanduzeei* is the black-legged form. Table 1 shows measurements for eleven specimens. These measurements can be compared with those in table 2 and show that on the average the two subspecies are rather similar in size, the nominate form being slightly smaller.

The author made a trip to the type locality of *E. v. vanduzeei* in early April, 1963. Weather was inclement and because of this factor and the very heavy overgrazing of the land by sheep, no specimens were found.

Figure 1. First two rows females and males respectively of *Esselenia vanduzeei violae* Rentz, new subspecies, showing pattern variation and size range. Third and fourth rows same, of *Esselenia vanduzeei vanduzeei* Hebard.

This subspecies is more commonly found in the dry areas of the Upper Sonoran life zone. The author has collected most of his specimens in exposed areas usually surrounded by brush and trees. Trampling through dense brush and kicking up the dead leaves is the best method to use to collect specimens. Females of both subspecies are more apt to be found on the exposed soft dirt found near the entrance borrows of rodents. Oviposition has never been observed but it is thought that the soft dirt around the burrows might be utilized by the grasshoppers for this purpose.



As previously noted coloration is quite variable. Color range from one locality can vary from uniform gray to tan, with lighter areas of the pronotum bright chartreuse.

At present the two subspecies herein described and discussed have not been collected together. Specimens collected in San Benito County, 3 air-line miles south of Paicines, have reddish abdomens and reddish hind tibiae, but the distal half of the hind tibiae of males is quite blackish, indicating an intermediate condition. Until more specimens are collected from many localities, I believe it best to assign a subspecific status to the two forms on the basis of studies of the specimens now at hand.

SPECIMENS STUDIED: All from California. Female holotype, Monterey County, Bryson, 27 April 1917 (E. P. Van Duzee), California Academy of Sciences, type number 736. Male pleisotype, San Benito County, 2 miles north of Pinnacles National Monument entrance (D. C. Rentz), deposited in California Academy of Sciences. **FRESNO COUNTY:** Coalinga 1 female, 1 immature specimen, 7 March 1958 (H. L. Wilson); 1 immature male, 1 February 1964 (D. C. Rentz). **KERN COUNTY:** Antelope, 10 April 1931, 1 male 2 females (A. C. Browne); McKittrick, 1 male, 3 May 1941 (K. Frick). **LOS ANGELES COUNTY:** Gorman, 1 female, 13 April 1960 (G. Berry). **MADERA COUNTY:** no specific locality, 1 female, June 1, 1955 (R. M. Thompson). **MONTEREY COUNTY:** Bryson, 1 female paratype, May 18, 1920 (E. P. Van Duzee); San Ardo, 10 females, 5 April 1961, (O. Schwab). **SAN BENITO COUNTY:** Vicinity of Pinnacles National Monument, 9 males, 2 females, 9 April 1960; 1 male, 28 May 1960; and two immature specimens of each sex, 31 March 1962, all collected by D. C. Rentz; 1 mile north of entrance Pinnacles National Monument, 5 males, 8 April 1961 (D. C. Rentz); 2 miles north of entrance of Pinnacles National Monument, 17 males, 3 females, and 3 immature specimens; 9 miles north of Pinnacles National Monument, 18 males, 3 females, and 1 immature specimen, 15 April 1960 (D. C. Rentz); 15 miles east of Gonzales, 11 males, 7 females, and 3 immatures, 15 April 1960; and 4 males, 12 May 1962 (D. C. Rentz); 1 male from latter locality 19 May 1962 (C. D. MacNeill); Hernandez Valley, 1 male and 1 female, 28 May 1960 (D. C. Rentz). **SAN LUIS OBISPO COUNTY:** Cholame, 2 females, 10 April 1960 (H. M. Armitage); and 1 female, 18 May 1955 (R. M. Drake); Greston, 10 miles south, 1 male, 1 May 1962 (J. A. Powell); San Luis Obispo, 3 females, 28 March 1936, and 1 male and 1 female, 18 April 1939, collected by C. C. Wilson; 5 miles northeast of Santa Margarita, May 1962 (C. A. Toschi); 10 miles west of Simmler, 1 female (J. A. Powell) and 1 male and 3 females (R. W. Thorp) and 1 female (J. K. Drew), all collected on 3 May 1962. **SANTA BARBARA COUNTY:** Cuyama, 6 females, all immature, 9 April 1949 (J. S. Rowell),

Figure 2. Distribution of *Esselesia vanduzeei*.

and 1 male from the same locality 22 March 1961 (Gallion and Tabor); Cuyama Valley, 1 female, 5 April 1961 (T. Gallion).

SAN BENITO COUNTY (*intermediates between the two subspecies*): 2 miles west of the junction of Cienaga and Lime Kiln Roads, 8 males and 9 females, 30 March 1963 (D. C. Rentz and K. A. Hale); 3 air-line miles southwest of Paicines, 38 males and 8 females, 12 May 1962 (D. C. Rentz and C. D. Mac Neill).

TABLE 1. *Measurement of eleven specimens of Esselenia vanduzeei vanduzeei with an ocular micrometer, in millimeters.*

LOCALITY	SEX	MEDIAN LENGTH OF PRONOTUM	WIDTH OF PRONOTUM AT WIDEST	LENGTH OF LEFT TEGMEN	LENGTH CAUDAL FEMUR	WIDTH OF CAUDAL FEMUR
2 mi. north Pinnacles (Plesiotype)	male	3	2.5	4	8.1	2.4
Pinnacles	male	2.8	2.25	3.4	7.5	2.5
15 miles E. of Gonzales	male	3.2	2.4	4.5	8.4	2.6
1 mile N. of Pinnacles	male	2.5	2.2	3.5	6.8	2.1
San Ardo	male	3.6	3	5.5	9.75	2.8
Simmler	male	2.8	2.25	4.75	8.25	2.6
Bryson (Holotype)	female	5.25	4.25	8.1	12	3.25
Bryson (Paratype)	female	5.75	4.75	7.6	12	3.6
Pinacles	female	4.9	4.1	7.25	10.5	3
9 mi. W. of Pinnacles	female	5.25	4.5	8	11	3.4
Cholame	female	6	5	10	13	3.6

Esselenia vanduzeei violae Rentz, new subspecies

(Figures 1, 2, and table 2)

MALE, holotype. Length of body 16 mm. Similar to the description of the plesiotype of *Esselenia vanduzeei vanduzeei* except in the following: sides of abdomen and hind tibiae bright orange in life, of somewhat lesser intensity on the dead specimen.

FEMALE, allotype. Length of body (abdomen stuffed) 26 mm. Quite similar to the description of the holotype of *Esselenia vanduzeei vanduzeei* de-

scribed by Hebard, but differing in the following: wings shorter in proportion to the pronotum and not overlapping. Dorsal ovipositor valves not as elongate as in *E. v. vanduzeei* and with the tips greatly upturned. Hind tibiae orange in life, but in the dried specimen rather faded.

DISCUSSION. In the majority of cases this subspecies seems to have shorter wings in proportion to the pronotum, and the wings have not been seen to overlap. As previously mentioned this subspecies is more common in open areas, and usually where it is quite grassy. Once the author came upon several females congregated on a gopher mound sitting in a semicircle around a single male. This is unusual in that one is more likely to encounter many male grasshoppers around a single female. In this case the male was quite active, touching several females with his antennae. At no time was he seen to stridulate. Stridulation was only observed once during the course of this entire study. *Esselenia* is definitely not as prolific a stridulator as are many other members of the subfamily Acridinae. It is also of note that females tend to seek cover when approached, scrambling under leaves and grass. Males jump actively and are capable of leaping unusually great distances. It is not uncommon to observe a male leaping six feet.

I take great pleasure in naming this subspecies in honor of my grandmother, whom I consider to have fostered my interest in natural history.

SPECIMENS STUDIED. Holotype, male; allotype, female, both from Russelmann Park, northeast slope of Mt. Diablo, Contra Costa County, California, 7 May 1960 (D. C. Rentz). Types deposited in the California Academy of Sciences, number 8904. Paratypes: CONTRA COSTA COUNTY: Russelmann Park, east slope of Mt. Diablo, 36 females and one male, 24 April 1932 (Van Dyke); same as above, 1 female, 30 April 1932 (Van Dyke); Russelmann Park, Mt. Diablo, 1 female, 12 May 1962 (C. O'Brien); vicinity of Clayton, 1 female, 24 May 1958 (W. E. Simonds); 16 males and 21 females with the same data as for the holotype and allotype. The area represented by the above localities is located on the northeast slope of Mt. Diablo. Other specimens representing this subspecies but not designated as paratypes: FRESNO COUNTY: Panoche Canyon, 2 females, 29 April 1922 (E. C. Van Dyke). MERCED COUNTY: Merced Falls, 1 female, 6 May 1940 (C. C. Wilson); 9 miles west of Los Banos, 1 male and one female, 23 April 1956 (F. L. Blanc). SAN BENITO COUNTY: 5 miles east of Paicines, 18 males and 5 females, 30 April 1960; same locality, 3 males, 8 immature specimens, 8 April 1961; same locality, 2 males, 13 May 1961, all collected by D. C. Rentz. SAN JOAQUIN COUNTY: Tracy, 3 males and 5 females, 15 April 1931 (C. C. Wilson); Coral Hollow, 2 males, 3 April 1960 (D. C. Rentz); Hospital Canyon, 2 males and 1 female, 7 April 1931 (S. Lockwood). SANTA CLARA COUNTY: Mt. Hamilton, 1 female, 25 May 1922 (E. O. Essig); same locality, 3 females, 9 June 1922 (E. O. Essig); same locality, 1 male, 27 May 1961 (D. C. Rentz).

TABLE 2. *Measurement of the holotype and allotype and eight paratypes of Esselenia vanduzeei violae with an ocular micrometer, in millimeters.*

SPECIMEN	SEX	MEDIAN LENGTH OF PRONOTUM	WIDTH OF PRONOTUM AT WIDEST	LENGTH OF LEFT TEGMEN	LENGTH CAUDAL FEMUR	WIDTH OF CAUDAL FEMUR
Holotype	male	3.75	2.75	5	10	2.75
Paratype	male	3.5	2.4	5	10	2.75
Paratype	male	3.75	2.5	5	9.75	2.8
Paratype	male	3.6	2.5	4.6	9.8	2.75
Paratype	male	3.5	2.5	5	10	2.8
Allotype	female	5.5	4.75	7.5	12.75	3.5
Paratype	female	6.25	5	6.75	12.75	3.5
Paratype	female	6.2	5	6	13	3.5
Paratype	female	6.5	4.75	6.5	12	3.5
Paratype	female	5.25	4.5	6.75	12	3.6

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