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A NEW SHRUB-INHABITING SPECIES OF
SCHISTOCERCA FROM CENTRAL FLORIDA

(Orthoptera, Acrididae)

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The remarkable new species described below was discovered by the junior author near Orlando, Florida, during the summer of 1924. In view of its distinctive appearance and extraordinary habits the authors were at first of the opinion that it would be found to constitute a new genus closely allied to *Schistocerca* Stal. Messrs. Rehn and Hebard, however, have kindly compared specimens with material from Central America and the West Indies, and they inform us that some of the peculiar structural features are paralleled in other species of the genus. They point out, furthermore, that the differences separating such species as *Schistocerca americana* (Drury) and *S. damnifica* (Sauss.) are nearly as marked as those which set off this species from other members of the genus. The new form nevertheless constitutes a distinctive

¹ Contribution from the Department of Biology, University of Florida, and the Florida Agricultural Experiment Station, Gainesville, Florida.

group of the genus, characterized by the slender form, small size, very narrow tegmina and wings, as well as by its confinement to a single host plant, and its nocturnal habits.

Schistocerca ceratiola, new species

Size very small for the genus; form more slender than in any other known species. Eyes large and very prominent; front distinctly retreating; pronotum narrow, subsellate, dorsally rounded; tegmina and wings very narrow, elongate; caudal femora slender. General coloration olivaceous to gray-brown, the lighter areas thickly maculate with fuscous dots.

Description of holotypic male: Orlando, Orange County, Florida, August 28, 1924 (F. W. Walker). [On foliage of *Ceratiola ericoides* at night; in "sand scrub" area 5½ miles west of town, on Ocoee road.]

Head narrow, front retreating more decidedly than in any other species known to us; frontal costa reaching clypeal suture, distinctly sulcate to just below vertex, its sides subparallel except between vertex and median ocellus, where they are slightly expanded; vertex prominent, about as long as broad, distinctly sloping, its surface shallowly excavate; interocular space narrower than usual, about equal to breadth of frontal costa at vertex, and to breadth of proximal antennal joint. Eyes large, very prominent, distinctly longer than the infra-ocular portion of genae. Antennae elongate, more than half again as long as combined length of head and pronotum, reaching base of caudal femora. Pronotum deep, narrow, distinctly but not strongly subsellate; disk rounding into the lateral lobes with scarcely a trace of angulation on prozona, but with shoulders faintly indicated on posterior portions of metazona; median carina almost completely obsolete on prozona, very low but distinct on metazona; sulci strongly impressed and clear-cut. Prozona slightly longer than metazona, its dorsum with a more or less regular arrangement of low, rounded rugae bounding coarse, shallow impressions; disk of metazona nearly plane, faintly depressed

on each side of median carina, surface of disk and upper portions of lateral lobes closely and coarsely punctate. Cephalic margin of pronotum roundly produced upon occiput, to a distinctly greater degree than in *S. americana* or *S. alutacea*; caudal margin obtuse-angulate, the angle narrowly rounded. Prosternal spine distinctly retrorse, basally inflated, subconical, with narrowly rounded apex. Interspace between mesosternal lobes twice as broad cephalad as caudad, its sides distinctly concave mesad. Caudal femora very slender. Caudal tibiae with external spines (7-9) distinctly shorter than internal (11-11). Tegmina very narrow, elongate, faintly and evenly tapering almost to the narrowly rounded apex, except for the distinct post-humeral angulation, which falls just caudad of the base of the caudal femora with the tegmina closed; distal 1/7 of the closed tegmina gently upcurved. Length of tegmen approximately 9 times the middle breadth (in males of *americana* approx. 6.1, in *alutacea* approx. 6.3). Cerci of the laminate, subquadrate form usual in the genus, the sides faintly tapering toward the subtruncate, shallowly emarginate apex, the dorsal angle of which is slightly more prominent than the ventral; distal third of cercus thinning toward the distal margin. Subgenital plate subconical, the apical notch small, open, rounded V-shaped, about as broad as deep.

Description of allotypic female: Same data as male holotype. Agrees with the male except in the following features: Size much larger; form more robust (though slender for genus); interocular space broader; vertex distinctly shorter in proportion to breadth; caudal angle of pronotum the same as in the male; antennae shorter, not reaching the base of the caudal femora, but distinctly (approximately 1/6) longer than the combined length of head and pronotum; caudal tibial spines 9-10 (external) 11-12 (internal); ovipositor valves a little more slender than in any other North American species, their apices acute and slender, the scoop of the upper valve deeply hollowed, its basal ridges distinctly elevated, and the

shaft of the upper valves tapering proximad from the base of the scoop, instead of being subparallel.

Coloration: The following notes refer to dried material. In life the coloration is somewhat lighter, and the body has, to a greater or less degree, a general greenish or olive-drab tone which is largely lost in drying.

General impression of dorsal aspect approximately walnut brown. A rather inconspicuous medio-dorsal light stripe is usually present on head and prozona, and is fainter or obsolete on metazona and base of closed tegmina. Genae, lower portions of sides of thorax, a stripe along the ventro-lateral face of the caudal femora, the venter, and the abdomen are light yellowish or creamy white in color; all the light portions are profusely maculate with small fuscous dots.

Antennae deep brownish vinaceous, shading to wood-brown distad. Front walnut brown, maculate with fuscous dots along the frontal carinae. Genae, proximal antennal segment, ventral portion of lateral lobes of pronotum, and an irregular diagonal stripe on metapleurae cream-buff to cinnamon-buff, maculate with small fuscous dots, which on the genae form a vertical row ventrad of the eyes. Eyes russet to walnut brown, marked in life with narrow darker vertical bands. Vertex, broad meso-occipital band, and medio-dorsal band on prozona cinnamon-buff, bordered laterad with narrow stripes of fuscous, which are less distinct on the irregular surface of the prozona than on the head; light band more narrowly and faintly indicated on metazona and base of closed tegmina, or obsolete. Remaining portions of disk and dorsal portions of lateral lobes of pronotum approximately walnut brown, somewhat darker on metazona than on prozona; surface of prozona maculate with fuscous dots, which are often especially prominent along the margins of the disk, forming a distinct lateral stripe, and giving the prozona a longitudinally quadri-fasciate appearance. Midway down the lateral lobes of the pronotum is a narrow, more or less interrupted horizontal band of shining fuscous or blackish bister extending from the

cephalic margin to the principal sulcus; caudad of this it is represented by a group of heavy fuscous maculations on the metazona. Sternum of thorax and entire abdomen approximately yellow ochre; each tergite of the latter bears the usual dashes of fuscous or blackish bistre along the caudal margin, and in addition numerous irregularly scattered dots on the remaining portions. Cephalic and median femora varying from deep olive-buff to fawn-color, maculate with fuscous dots. Ventral half of external pagina of caudal femora whitish or ivory-yellow; proximo-internal portion pale yellowish; remaining portions darker, vinaceous-fawn to army brown, dorsal half of outer face occasionally washed with olive-buff or plumbeus. Dorsal face of caudal femora marked with a pair of moderately broad, faint blackish bands, nearly equidistant from the ends and a little closer to each other, the proximal much the plainer. Femora maculate with fuscous dots, especially on the dorsal half of the external pagina, the ventro-external carina and the external and internal dorsal carinae. Internal pagina with a medio-longitudinal row of very small fuscous dots. Genuiclar arc grayish olive, ventral portions of geniculae ivory. Caudal tibiae russet-vinaceous to livid brown, occasionally tinged with rose disto-internally; basal halves of spines ivory-yellow, distal halves black. Tegmina russet-vinaceous to cinnamon-drab, anal field ivory-yellow, nearly immaculate; basal third of tegmen largely suffused with dilute bistre, the distal two-thirds marked with small, irregularly spaced maculae of the same color. Wings subhyaline, faintly infumate except at the extreme base, which has a faint yellowish tinge; veins dark; a few small smoky spots at extreme apex of wing.

Variation: The large series at hand shows that variation in this species is slight. The measurements given below indicate approximately the extremes in size. In color there is some variability, apparently due for the most part to age; specimens which have only recently matured are usually lighter in hue than older ones, and the greenish colors are brighter.

The males are somewhat duller colored than the females, and the striping of the dorsum is usually more marked in the latter. In many of the females the longitudinal black bands of the pronotum are intensified, and a distinct light band is indicated on either side of the middle, in addition to the light median band. The degree of obtuseness of the caudal angle of the pronotum varies slightly in both sexes, and in the female the apex varies from sharply to rather broadly rounded.

MEASUREMENTS

	Length of body	Length of pro- notum	Length of meta- zona	Caudal breadth pronot. disk	Length of tegmen	Length of caudal femur
<i>Male</i>						
Orlando, Fla., holotype	24.4	5.0	2.3	2.7	21.6	12.7
Orlando, Fla., paratype*	25.6	5.2	2.4	3.0	23.0	13.5
Tavares, Fla., paratype	25.5	5.1	2.4	2.9	23.3	13.5
<i>Female</i>						
Orlando, Fla., allotype†	34.3	7.0	3.4	3.8	30.2	17.0
Orlando, Fla., paratype	32.8	6.6	3.2	3.7	29.8	16.3
Tavares, Fla., paratype	32.3	7.3	3.5	4.0	32.5	18.0
Apopka, Fla., paratype	36.0	7.2	3.5	3.8	30.4	17.3

* Breadth of tegmina at post-humeral enlargement 3.0; at middle 2.5, length of wing 21.5; breadth 8.1.

† Length of antenna 11.1; length of head and pronotum 9.6.

Material studied: In addition to the holotype and allotype, the following paratypic material is before us: Orlando, Orange Co., Fla., Aug. 28 to Sept. 20, 1924 (Walker & Hubbell), 371 males, 602 females; Sept. 5, 1925 (Hubbell), 2 males, 3 females; Apopka, Orange Co., Fla., Sept. 19-21, 1924 (Walker & Hubbell), 3 females; Tavares, Lake Co., Fla.,

Sept. 19, 1924 (Walker & Hubbell), 1 male, 4 females; Altamonte Springs, Seminole Co., Fla., Aug., 1924 (Walker), 1 female. In all, a total of 987 paratypes. The holotype, allotype, and the bulk of the paratypes are in the Museum of Zoology, University of Michigan; other paratypes are in the collections of F. W. Walker, Morgan Hebard, W. T. Davis, the United States National Museum, the Academy of Natural Sciences of Philadelphia, and the Museum of Comparative Zoology at Cambridge.

Habits and habitat: *Schistocerca ceratiola* has been found only on a single species of plant, growing in a peculiar environment, in portions of three adjacent counties in north-central Florida. The habitat in which it occurs is well marked and easily recognizable, going under the local name of "sand scrub"; it occupies moderately extensive areas in the region. The soil of these areas is so poor as to be practically worthless for agricultural purposes, as it consists of nearly pure white sand to an average depth of six or eight feet. The sand scrub plants are all xerophytes. On the higher portions the dominant vegetation is composed of clumps of scrubby dwarf oaks and other xerophytic shrubs, between which the loose sandy soil is largely exposed, except for a scanty cover of grasses, trailing vines, and a thin layer of dead leaves. Scattered among the bushes are a few sand pines (*Pinus clausa* Chapm.), turkey oaks (*Quercus catesbaei* Michx.), and an occasional twin live oak (*Q. geminata* Small).²

A characteristic and conspicuous shrub of the sand scrub is *Ceratiola ericoides* Michx., locally known as "rosemary"—a juniper-like bush from three to ten feet in height, with dark,

² Some of the typical plants of this habitat, determined by the Rev. Hugh O'Neil, are as follows: *Quercus minima* (Sarg.) Small, *Q. pumila* Walt., *Q. catesbaei* Michx., *Persicaria* sp., *Vaccinium* sp., probably *nitidum* Andr., *Xolisma fructicosa* (Michx.) Nash, *Pinus clausa* Chapm., *Persea humilis* Nash (?), *Chamaecrista brachiata* Pollard, *Gallactia elliotii* Nutt., *Siphonychia diffusa* Chapm., *Garberia fructicosa* Gray, *Yucca* sp., *Opuntia* sp., *Osmontha* sp. These were all collected in the type locality.

olive-green, needle-like foliage, and resinous aromatic sap, which belongs to the family Empetraceae. These shrubs are scattered throughout the sand scrub areas; but in places, usually on lower, somewhat moister ground, they become the dominant vegetation, and form thickets of considerable extent. Such a thicket occurs around and back of the margins of a shallow pond in the sand scrub area $5\frac{1}{2}$ miles west of Orlando, on the Ocoee road.

The writers had collected in this area on previous occasions, and found it rich in interesting Orthoptera; but casual beating of the *Ceratiola* bushes had revealed so little that they had not been thoroughly examined. However, on August 28, 1925, the junior author obtained a specimen of *Schistocerca ceratiola* while beating these shrubs. Realizing that he had found something of great interest, he continued to beat them, but in the course of a whole afternoon was able to secure only one or two more specimens. As it afterwards proved, he was fortunate to have found these first specimens at all; only where the species is abundant is there much chance of locating individuals during the day.

The writers had previously found that many of the less common Acridids of this region are more easily collected at night than during the day; using an electric headlight they may be found perched on the tops of tall weeds, and picked up with the fingers. The *Ceratiola* thicket was therefore again visited the same night, and the surprising fact discovered, that *S. ceratiola* not only was fairly common, but that it had nocturnal habits. Specimens were found moving about on the foliage, feeding, and copulating, on some of the very bushes which had been thoroughly beaten and examined without result that afternoon.

Further observations on the habits of this interesting Locustid were made by both the writers on succeeding visits to this and similar localities. Its structure, appearance and actions are all adapted to its mode of existence. The needle-like foliage of the *Ceratiola* bushes is crowded at the ends of

the twigs, forming a dense mass around the periphery, and making of the interior a shaded chamber traversed by the finely divided, radiating branches. The grasshoppers spend the day concealed in the interior of the bushes. They cling so closely to the twigs that they can scarcely be dislodged even by heavy beating, and their gray-brown and olivaceous mottled coloration harmonizes so closely with that of their surroundings that they escape all but the closest search. At the approach of evening they congregate on the exterior of the bushes, and during the early hours of the night may be found in numbers. As the air cools and the bushes become loaded with dew, the insects gradually withdraw within the foliage again, and comparatively few can be found later than midnight.

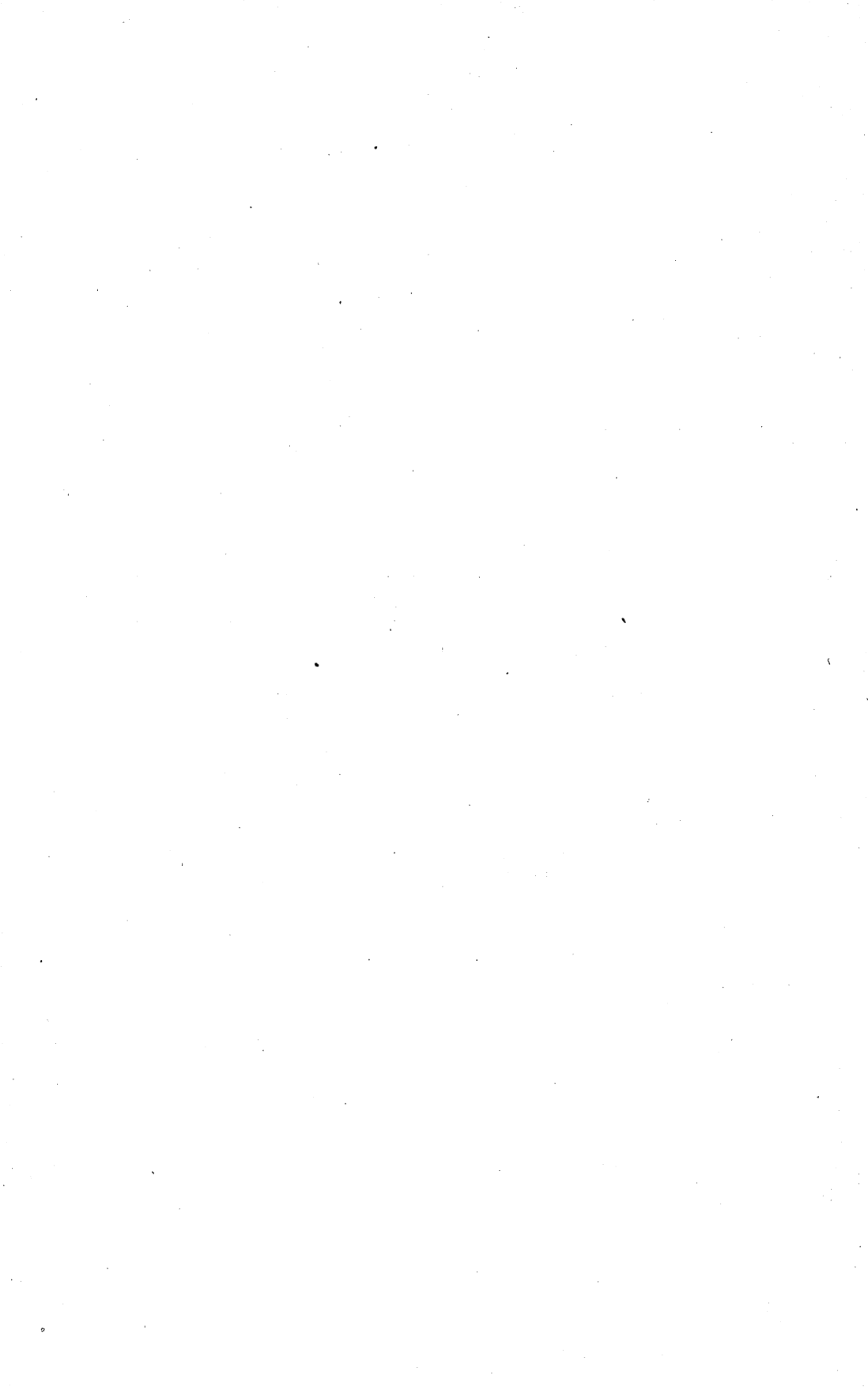
Nymphs and teneral individuals were found on all occasions when the species was collected, from late August to September 21st. The nymphs are light green or olive-green in color, heavily dotted with black, and closely resembling those of other species of *Schistocerca* in appearance and actions. Many more females than males were taken; this may probably be explained by the smaller size, somewhat duller coloration, and greater agility of the latter, which better enable them to escape observation.

It is evident that *S. ceratiola* is strictly confined to this single food-plant. Specimens were never taken on any other plant, nor would they leave the *Ceratiola* bushes if they could avoid doing so. They were seen feeding on the foliage on various occasions; and the liquid from the crop, which is regurgitated when they are handled, has the stickiness and resinous consistency of the *Ceratiola* sap, as well as its aromatic odor. Indeed, a faint trace of this aroma is retained by dried specimens, as if their bodies were impregnated by the resin. It is difficult to make *S. ceratiola* take flight, even when it is alarmed; its method of escape is to slip quickly into the interior of the bush upon which it is resting, and then to remain motionless, hidden among the mass of twigs

and foliage. However, specimens have been observed to make short flights from one bush to another.

Whether the distribution of *S. ceratiola* will be found to coincide with that of its host-plant (stated by Small to range from South Carolina to Florida and Alabama) can only be surmised. The species was not found by the writers in patches of *Ceratiola* bushes growing in sandy areas near Cedar Keys, Levy County, and near Archer, Alachua County, Florida; but this is not conclusive evidence that it is actually absent from these localities.

It seems probable that all of the most distinctive characters of this insect, such as its slender form, reduced powers of flight, cryptic coloration, and nocturnal habits, are adaptations which have followed its restriction to *Ceratiola ericoides* as its sole food-plant.



University of Michigan

PLATE I

Schistocerca ceratiola Hubbell and Walker

Upper row (left to right)

Paratypic male, Orlando, Florida.

Paratypic male, Orlando, Florida.

Holotypic male, Orlando, Florida.

Lower row (left to right)

Paratypic female, Orlando, Florida.

Paratypic female, Tavares, Florida.

Allotypic female, Orlando, Florida.

All figures $1\frac{1}{2}$ times natural size.

