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Source: Journal of Orthoptera Research, 21(1) : 51-56

Published By: Orthopterists' Society

URL: <https://doi.org/10.1665/034.021.0104>

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## *Oecanthus walkeri*: a new species of tree cricket from Texas

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### Abstract

A new species of *Oecanthus* Serville, 1831 is described from Texas. *Oecanthus walkeri* n. sp. Collins & Symes occurs in southern Texas on Seep Willow (*Baccharis salicipholia*), Tepejuage (*Leucaena iveruienta*) and Sugar Hackberry (*Celtis laevigata*) trees. *O. walkeri* is currently known only from the Rio Grande Valley. Song analysis revealed a pulse pattern of constant trilling, similar to other constant trillers of the *O. nigricornis* species group, although the early evening calling pattern shows characteristics of the *O. niveus* group. This species was only found in trees, which is uncommon for the *O. nigricornis* group. The antennal markings are consistent with the *O. nigricornis* group; however, this is the first species of that group to have a pale abdomen, pedicel and scape, while also having black flagellae. Notes are provided on physical morphology, phenology, habitat and song pulse rates at given temperatures.

### Key words

new species, Oecanthinae, *Oecanthus*, Seep Willow, Tepejuage, Thomas J. Walker, tree cricket

### Introduction

As listed in the Orthoptera Species File (OSF) online (Eades *et al.* 2012), the genus *Oecanthus* is comprised of 62 species. OSF is an Orthoptera database which provides multiple references for each species, including descriptive articles when available. Walker & Collins (2010) divide North American *Oecanthus* into four main groups: *nigricornis*, *niveus*, *rileyi* and *varicornis*. These groups can be distinguished by characteristics including: coloration of the head, pronotum and abdomen; antennae color; antennal markings on the pedicel and scape; tegminal morphology; song character (chirping *vs* trilling and continuous *vs* intermittent); and song pulse rate at given temperatures. Seven species from the *O. nigricornis* group of *Oecanthus* occur in the USA: *O. argentinus*, *O. celerinctus*, *O. forbesi*, *O. laricis*, *O. nigricornis*, *O. pini* and *O. quadripunctatus*.

A 2009 field trip to the Rio Grande Valley in southern Texas led to the discovery of a new *nigricornis*, group species. Individuals were located by following the singing of males in Seep Willow (*Baccharis salicipholia*), Tepejuage (*Leucaena iveruienta*) and Sugar Hackberry (*Celtis laevigata*) trees. The constant trilling song of this species can be heard both day and night, while a song pattern of intermittent bursts is heard only at dusk.

Song analysis, morphology and distribution were all instrumental in diagnosing this new Texas Oecanthine. Information on habitat and behavior is provided. DNA sequencing results and phylogenetic comparisons will be offered in a future paper by LS. Photographs and video of *O. walkeri* are in Supporting Material.

### Materials and methods

Photographs of the holotype and videos of paratypes will be made available for viewing at OSF, Macaulay Library, www.oecanthinae.com and Singing Insects of North America: crickets and katydids (SINA).

*Type verification.*—According to current listing on OSF, there are eight genera of Oecanthinae worldwide, but only two occur in the USA and Mexico — *Oecanthus* and *Neoxabea*. Genus level for these specimens was identified using the key from Walker (1967). The genus of *Oecanthus* was determined by the presence of spines on the hind tibiae, and lack of a tubercle on the distal border of the scape.

Species group was determined using the Key to Species Groups of *Oecanthus* found on the SINA website (Walker 2012). Members of the *O. nigricornis* group of *Oecanthus* have a continuous trilling song and 3 or 4 black marks on the scape and pedicel. The *O. varicornis* group also has a continuous trilling song, but wider tegmina than the *O. nigricornis* group, and only 2 marks on the scape and pedicel. The *O. niveus* group produces intermittent bursts of trilling, and has 2 black marks on the scape and pedicel. The *O. rileyi* group makes regularly spaced chirps and has 2 black marks on slightly raised ivory/white fields on the scape and pedicel.

Several characteristics are informative for identifying species of *Oecanthus*: 1) presence *vs* absence of markings on the front of the first and second antennal segments (the scape and the pedicel), which are generally similar in each group and often unique to each species. When present, these markings should be examined for number, size, shape, position and configuration. It should be noted that *nigricornis* species-group markings are sometimes similar enough to make species identification difficult. 2) Head color, or the shape, area and intensity of patches of color on the head. 3) The color(s) of the ventral abdomen: appearance is solid or patterned. 4) Tegminal size, shape and occasionally notable vein pattern differences. 5) Number of teeth on the file — usually located on the male's right tegmen. 6) Number of pulses per second in the song of a male at a given temperature. There is a linear relationship between ambient temperature and male pulse rate across the biologically relevant temperature range.

### Morphology

*Collection methods.*—Areas inhabited by oecanthines were determined by locating actively singing males. Inhabited trees were then searched for adults of both sexes and for instars. Most specimens were collected by shaking or by bending downward pliable branches; only the holotype and a female paratype were found at eye level.



**Fig. 1.** Dorsal view of antennal markings of *O. walkeri*. Two black marks on the pedicel tend to be in the shape of a V, barely meeting at the bottom, with the outer mark shorter than the inner mark. The two marks on the scape include a long black inner mark and a short upswinging outer mark. For color version see Plate II.

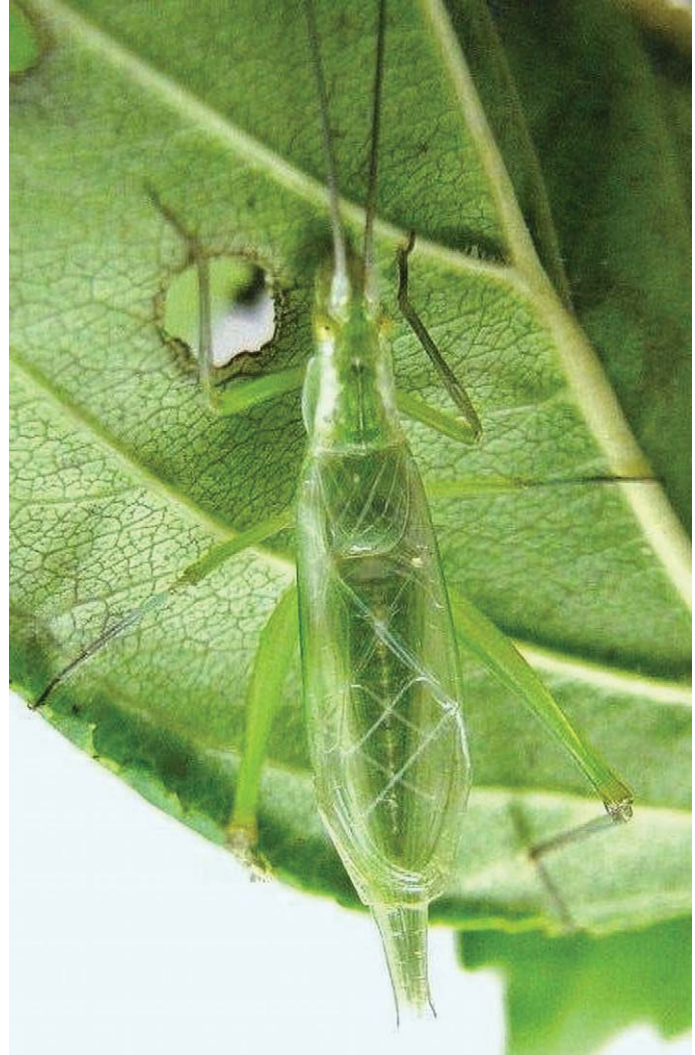
**Habitats.**—*O. walkeri* was found in Seep Willows (*Baccharis salicifolia*) at Resaca de La Palma State Park (RDLPS), Cameron County, Texas. At Bentsen-Rio Grande State Park (BRGVSP), Hidalgo County, Texas, *O. walkeri* was found in Sugar Hackberry trees (*Celtis laevigata*), Tepejuage trees (*Leucaena iveruienta*) and multiple groups of Seep Willows. Collection dates were May 2009 and June 2010 by NC and LS.

**Preservation of specimens.**—Males and females were collected and photographed; singing males were video recorded. Measurements and visual observations for morphological study were made after the specimens were euthanized using acetone. Specimens were preserved in alcohol or with anhydrous calcium sulfate drying crystals. Wings were removed from some specimens in order to photograph the teeth on the stridulatory file.

**Depositories.**—

FSCA - Florida State Collection of Arthropods - Gainesville, USA  
 UWM - University of Wisconsin-Madison, USA  
 DC - Dartmouth College, Hanover, New Hampshire, USA

**Morphological measurements.**—Dimensions in mm of holotype male. Total body length refers to the midline length from the fastigium to the apex of the subgenital plate—not including antennae, tegmina, limbs or cerci. Tegminal width is measured at the tegmina widest



**Fig. 2.** Adult male *O. walkeri*. Femurs milky green, tibiae tend to be dark gray. Lateral edges of pronotum and posterior pedicel and scape bright white, and eyes generally yellow.

section, while resting atop the abdomen of the male. Pronotal length was measured along the medial line of the pronotum.

**Antennal markings.**—The antennal markings found on the ventral surface of the pedicel and scape were photographed using a Canon PowerShot S5 IS digital camera.

**Song and temperature recordings.**—The digital camera was also used to record songs; it was set in video mode at 30 frames/sec, with the camera held as close to the singing tree cricket as possible. The sound track had a sample rate of 44100 Hz, with a 16-bit sample size. An avi-to-wav converter marketed online by 008soft.com was used to extract the sound track from the video file. AVS4YOU Audio Editor Software version 4.2 was used to analyze the sound tracks and to make images of their waveforms. Temperature was measured within 15 cm of actively singing males using a hand-held digital thermometer manufactured by LaCrosse Technology, model WS-9029U. Accuracy of the digital thermometer was confirmed by its immersion in a water bath, comparing its readings with those of a precision glass laboratory thermometer.



Fig. 3. Underside of adult male *O. walkeri* is light colored with no visible patterning. Hind wings are long, cerci long and green. For color version see Plate II.

## Results

### *Oecanthus walkeri* Collins & Symes, n. sp.

**Etymology.**—*Oecanthus walkeri* Collins & Symes n. sp. Named in honor of Thomas J. Walker, Professor Emeritus, University of Florida, Gainesville. Dr. Walker has studied orthopterans his entire career, has published a wealth of articles, and described many species, including 16 oecanthines. His first Oecanthinae description was with A. B. Gurney, of *Oecanthus allardi* in 1960; his most recent was *Oecanthus alexanderi* in 2010 with N.J. Collins.

**Holotype.**—Male (Fig. 2). Located on Seep Willow (*Baccharis salicifolia*), at Bentsen-Rio Grande Valley State Park, 7 Jun 2010, GPS - N 26° 11.127, W 98° 22.838; altitude 33.9m, N.J. Collins, collector; FSCA. Body length (mm) 16.0; tegminal length 12.0, tegminal width 4.3; pronotal length 2.9, rear pronotal width 2.8; hind femur length 9.0. Right tegminal stridulatory tooth total 47. Antennal markings on first two antennal segments as in Fig. 1. Song as in Fig. 6-8. Video and photograph of living holotype in Supporting Material.

**Paratypes.**—

- (1) Female: located on same branch as holotype. Deposited at FSCA.
- (1) Male: located at BRGVSP. Deposited at UWM.
- (1) Female: located at BRGVSP. Deposited at UWM.
- (1) Male: located at RDLSP. Deposited at DC.



Fig. 4. Adult female *O. walkeri*. Similar to males. Prominent white bordering dorsal sides of abdomen. Laticed vein pattern on translucent wings. For color version see Plate II.

**Description.**—Overall color of both sexes light green, often with small amount of yellow on head/face. Eye color yellow. Palpi pale brown or gray. Prominent areas of bright white color on borders of pronotal area. Ventral abdomen pale creamy white. Pedicel and scape pale anteriorly, pure white posteriorly. Antennal markings (Fig. 1): pedicel with two vertical black marks, scape with two black marks — inner is vertical and outer horizontal. Antennae dark, often deep black. Tympana on foretibiae light gray. Tarsi black, tibiae dark gray distally graduating to green proximally, femora translucent green. Yellow-brown at femoral-tibial joints. Cerci pale and long (extending to tip of ovipositor in female). Male (Figs 2, 3): hind wings extend beyond distal edge of tegmina. Inner area of metanotal gland appears dark tan; outer rim appears pale green. Female (Fig. 4): prominent white bordering dorsal sides of abdomen. Laticed vein pattern on translucent wings. Instar (Fig. 5): dorsal abdomen medium green with bright white at both outer edges. A thin white line bordered with dark green runs from head to distal tip of abdomen.

**Song Analysis.**—The pulse rates of the continuous trilling of *O. walkeri* at given temperatures (Fig. 8) fall midway between those of *O. argentinus* and *O. quadripunctatus* (Fig. 9), and therefore reinforce its placement as a member of the *O. nigricornis* group. The dominant frequency of the song of *O. walkeri* is 4.1kHz (Fig. 6, 7D) at 19.1° C. Videos can be viewed in Supporting Material.

## Discussion

Morphologically, oecanthines in the *O. nigricornis* species group are often difficult to distinguish based on antennal markings, since the intraspecific variation in markings often overlaps the interspecific differences. However two characters that do separate *O. walkeri* from other tree crickets in the *nigricornis* group are: 1) a white pedicel and scape with black flagellae, and 2) black flagellae in conjunction with a creamy white ventral abdomen.

Although *O. walkeri* could be confused with species in the *niveus* species group due to an interrupted trilling pattern earlier in the evening, its predominant call of continuous trilling matches those of other species in the *O. nigricornis* group. *O. walkeri* can generally be distinguished by song from *O. celerinictus* due to differences in pulse rate, especially under higher temperature conditions. The pulse



**Fig. 5.** Instar (4<sup>th</sup> stage) *O. walkeri*. Dorsal abdomen medium green with bright white at both outer edges. A thin white line bordered with dark green runs from the head to the distal tip of the abdomen. For color version see Plate II.

rate of *O. celerinictus* falls at the higher edge of the range of the *O. nigricornis* group, while that of *O. walkeri* falls toward the lower edge of this range. While its pulses per second rate is similar to two Texas co-occurring species in the *O. nigricornis* group, *O. quadripunctatus* and *O. argentinus*, a distinguishing character of *O. walkeri* is their habit of dwelling in trees, whereas the aforementioned two species occur on ground vegetation and shrubs.

This species is currently known only in extreme southern Texas and more investigation is needed to establish their geographic range, including Mexico. Given proximity to Mexico, the potential exists to find other new species along the Mexican-American border.

## Acknowledgements

We thank David Riskind, Texas Director of Natural Resources for permitting studies in state parks, and George Cortez, Park Superintendent at Bentsen-Rio Grande Valley State Park for granting permission to collect specimens of this new species. We are grateful to Katherine Miller, Resaca de La Palma State Park Natural Resource Specialist, and to Joshua Stuart Rose and Javier de Leon, Bentsen-Rio Grande Valley State Park Natural Resource Specialists, for their guidance and assistance.

We are eternally grateful to Dr. Thomas J. Walker for the wealth of knowledge he generously shares and for his kind guidance in expanding our knowledge of Oecanthinae, as well as furthering our pursuit of increasing public awareness of tree crickets.

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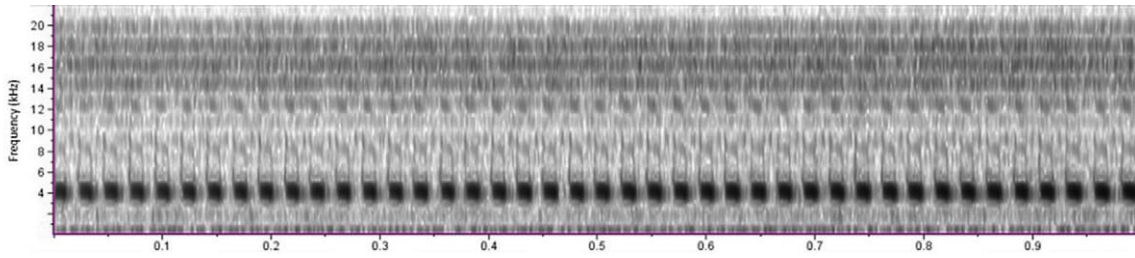


Fig. 6. The dominant frequency of song of male *O. walkeri* is 4.1kHz at 19.1 C.

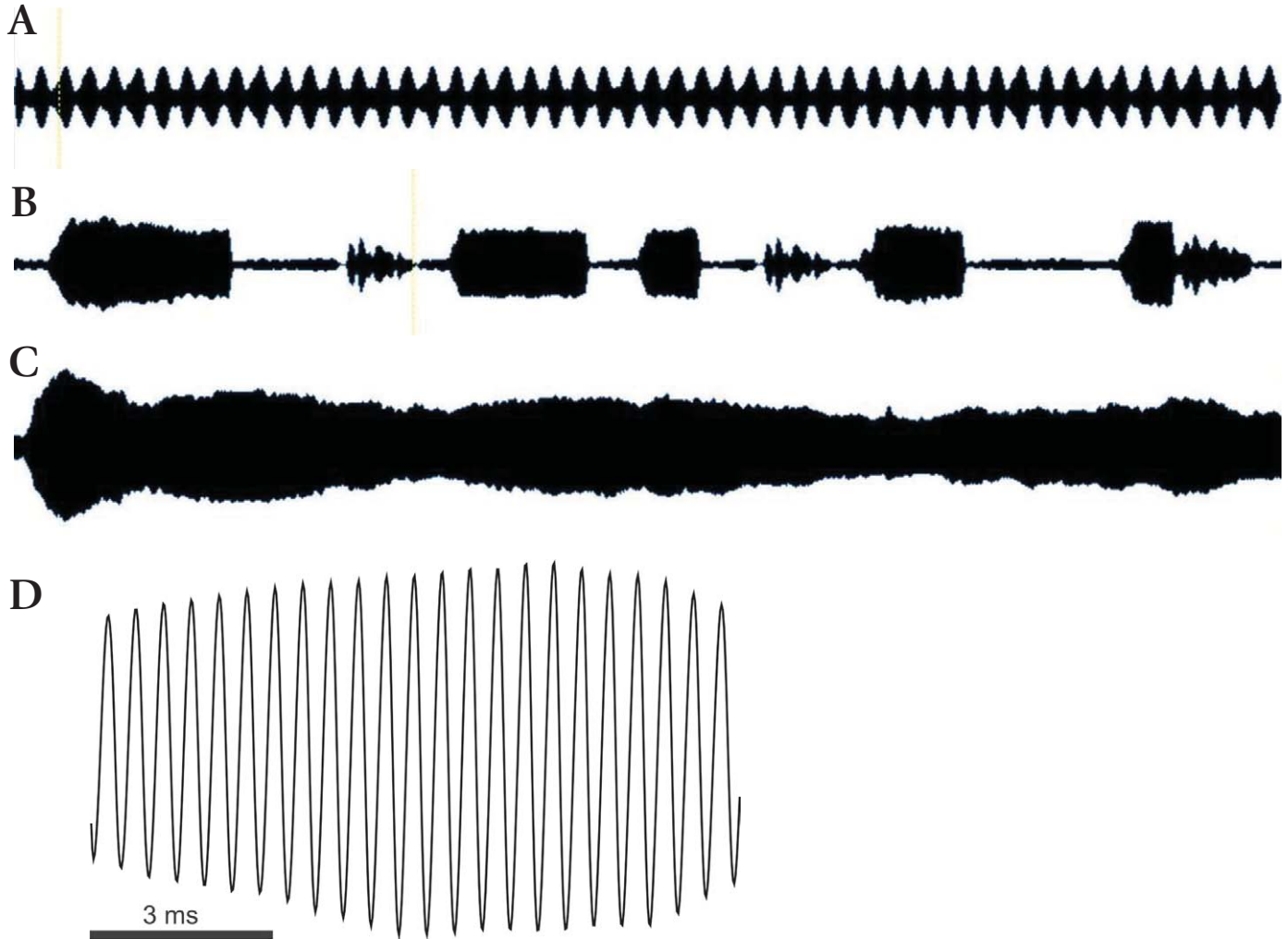


Fig. 7. Waveforms of the calling song of *O. walkeri*. A. 1 s of trilling at 19.1 C with 30 pulses. B. 30 s with bursts of trilling. (Heard at initiation of singing in early evening only.) C. 30 s of continuous trilling. D. Sinusoidal wave comprising part of a single pulse, low-pass filtered at 10kHz to remove high frequency noise.

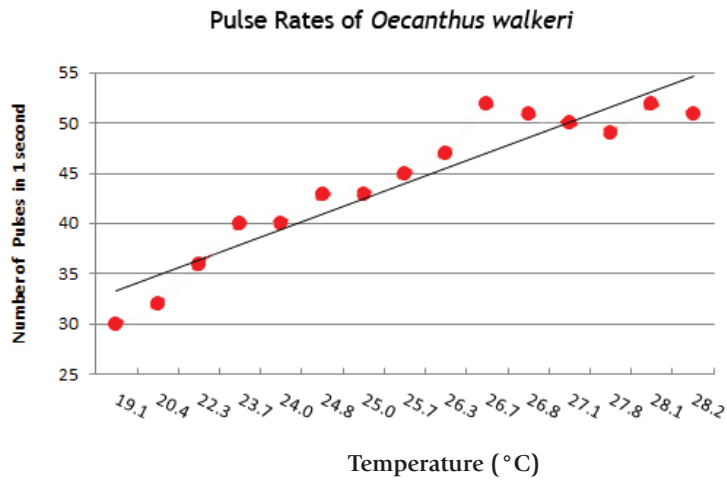


Fig. 8. Pulse rate changes linearly with temperature. Recordings were made both indoors and in a natural setting.

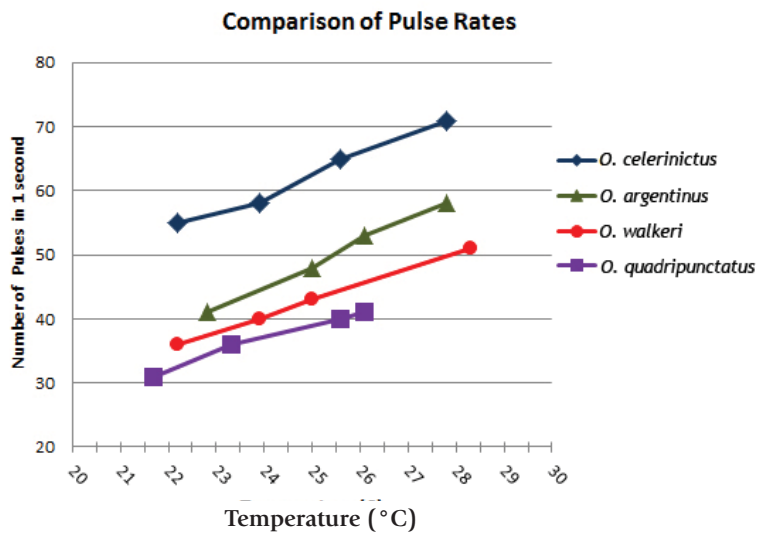


Fig. 9. Comparison of pulse rates of *O. walkeri* and three members of the *nigricornis* species group that co-occur in Texas. *O. celerinictus*, *O. argentinus* and *O. quadripunctatus*; sample values are taken from Walker (1963).