

with the situation along the east coast of Mexico where *G. assimilis* is more common. For unknown reasons, collecting in coastal Texas in 2013 uncovered several dense populations and much wider distributions than in previous years. This cricket is loud and singing males are not easily overlooked. Perhaps because of its adaptation to lowland, cool coastal habitats, *G. assimilis* males still sing well at 04:00 when most other *Gryllus* species have long ceased singing.

Bertram & Rook (2011a, b) have studied calling songs and biological aspects in this species from the Austin, Texas area, while Pollack & Kim (2013) and Vedenina & Pollack (2012) studied female phonotaxis and variable courtship song in long-term laboratory cultures. Sturm (2014) and Villarreal *et al.* (2018) examined aspects of mating strategies. Weissman *et al.* (2012) documented efforts by US and European cricket farms to utilize another *Gryllus* species, *G. locorojo*, misidentified as *G. assimilis*, to replace virus-infected *Acheta domesticus* as the preferred pet-feeder cricket.

S.M. Bertram notes (pers. comm. to T.J. Walker, March, 2015) that she and her group have encountered thousands of flying individuals at lights in the fall around Smithville, Bastrop Co., TX, in 2007, 2008 or 2009, and 2014. This situation seems similar to those outbreaks described by Alexander & Walker (1962) in Florida.

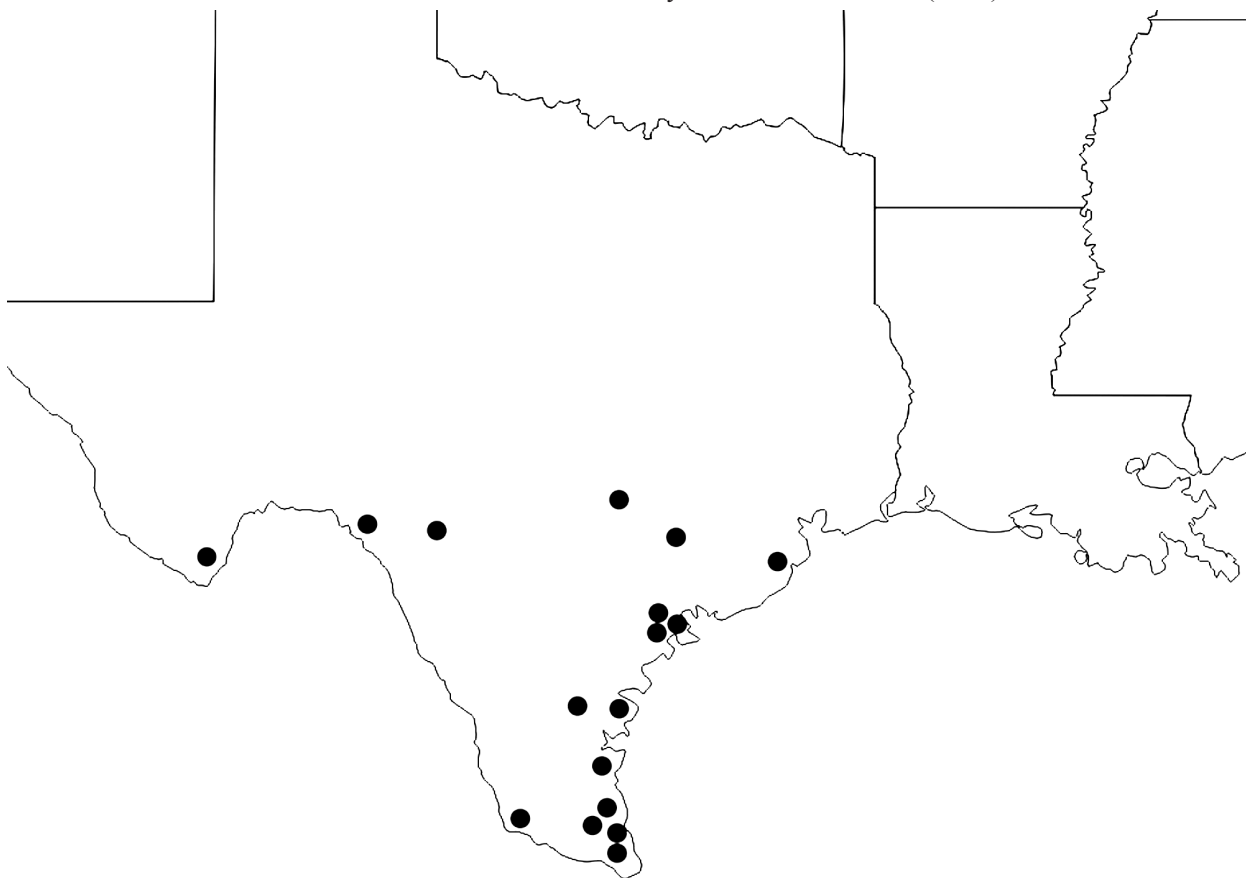


FIGURE 66. Known US distribution, *G. assimilis* within native range (also found introduced in south Florida, see SINA: <https://sina.orthsoc.org/>).

***Gryllus multipulsator* Weissman**

Long-Chirp Field Cricket

Figs 54, 60–62, 67–70, Table 1

2009 *Gryllus multipulsator* Weissman *et al.* 2009, p. 375. Holotype male (Fig. 67): Alpine, San Diego Co., California. Deposited in CAS, Entomology type #18174.

1980 *Gryllus assimilis* Weissman *et al.* 1980.

1981 ‘*Gryllus* I’ Rentz & Weissman 1981.

‘*Gryllus* #1’ in DBW notebooks.

Distribution. Known from southern California, southern Nevada, and southwestern-central Arizona.

Recognition characters and song. Always macropterous (Figs 67, 68), medium to large crickets, head usually narrower than pronotum, pronotum covered with fine hairs resulting in dull appearance. *Song* (Fig. 69; R15-325) loud, unique in US with 11–17 p/c and usually <2 c/s. Individual chirps demonstrate how pulse duration increases during a chirp while pulse rate simultaneously decreases (Fig. 71, and Weissman *et al.* 2009). Body measurements as in Table 1, p. 18. Most similar US song is *G. assimilis* but latter with fewer p/c and found considerably east in Texas.

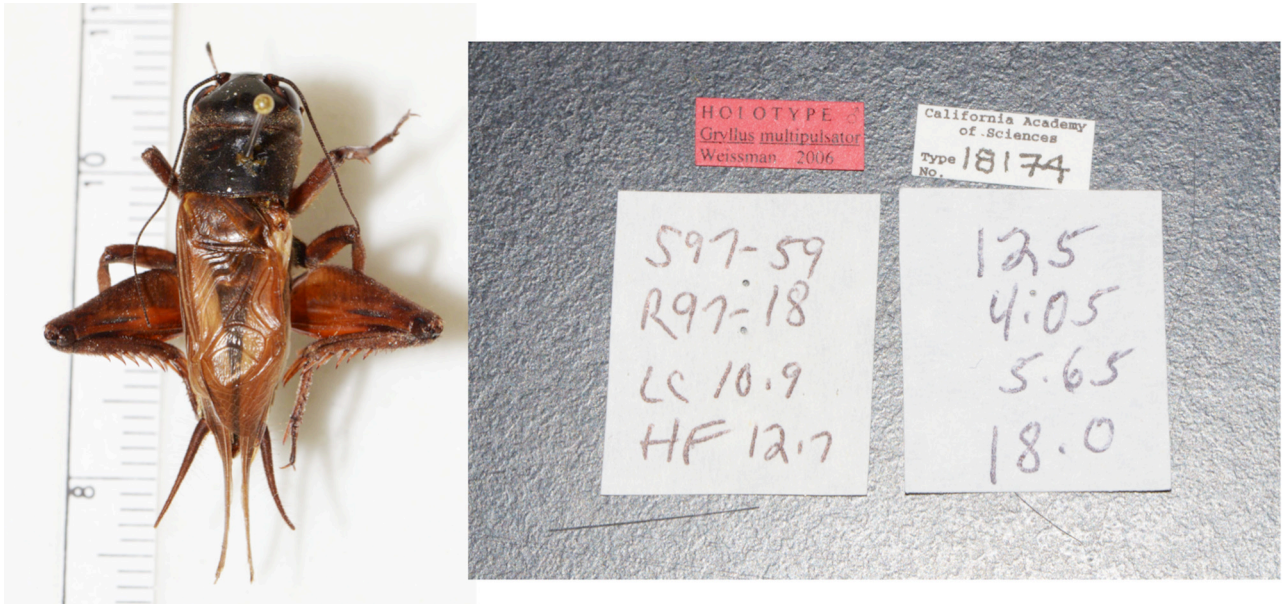


FIGURE 67. Holotype male, *Gryllus multipulsator*; specimen and labels.



FIGURE 68. Color variation in *G. multipulsator*; from reddish male (left, Riverside Co., CA, S03-41); brown female (middle, Santa Cruz Island, CA, S04-65); black male (right, Riverside Co., CA, S03-41).

Derivation of name. Reflecting the high number of pulses in each chirp.

Geographic range. Southern California, far southern Nevada, and southwestern Arizona (Fig. 70), including on the Channel Islands of Santa Cruz and Santa Catalina. Also extends into Mexico west of the Continental Divide (Weissman *et al.* 2009) and throughout much of Baja California, Mexico (Weissman *et al.* 1980).

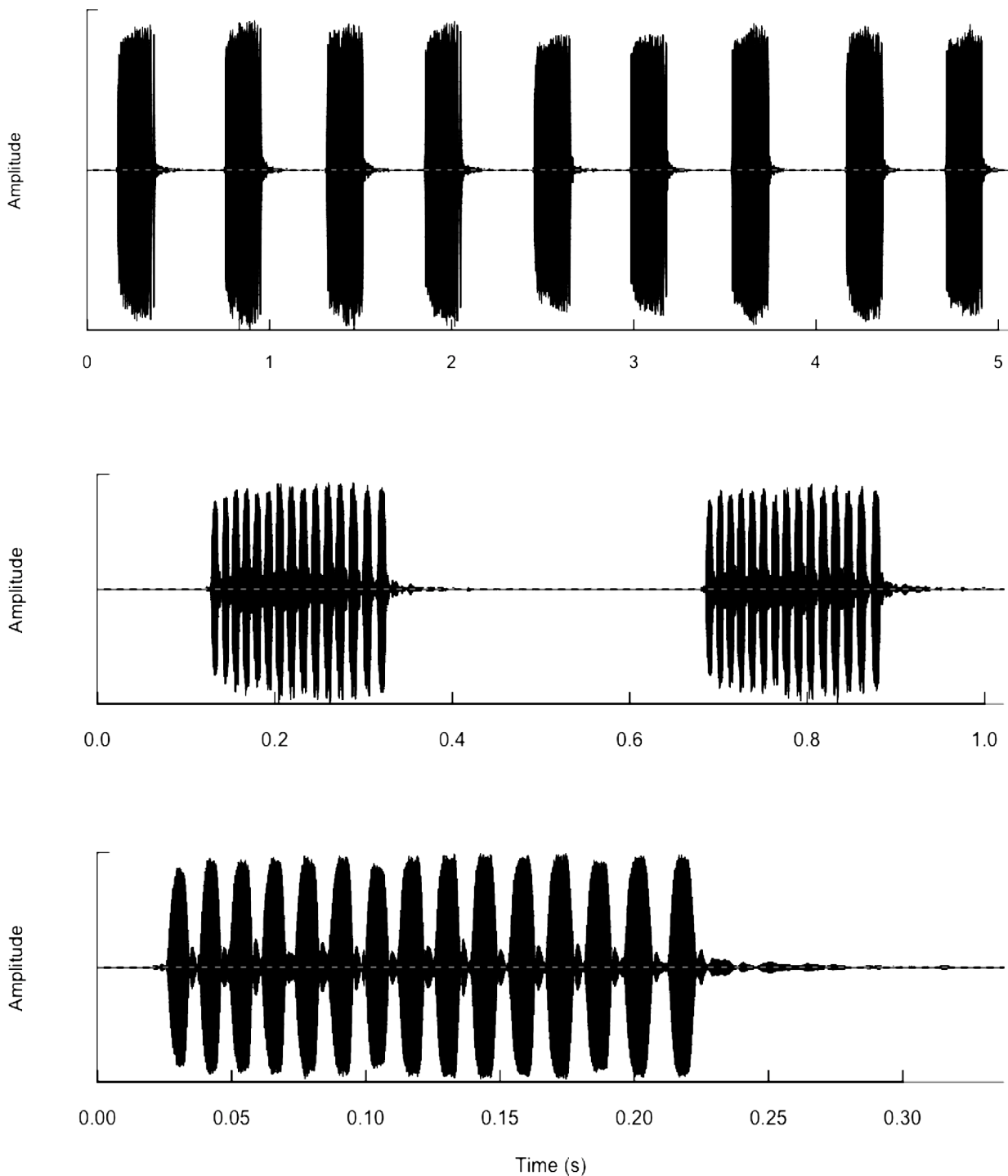


FIGURE 69. Top: Five second waveform of calling song of *G. multipulsator* (R15-325) Pima Co., AZ (S15-108), at 25.4°C; Middle: One second waveform of same song showing individual pulses; Bottom: Expansion of an individual chirp showing decreasing pulse rate towards end of chirp.

Habitat. Almost always associated with people and their watered environs such as lawns, golf courses, schools, around towns but also from salt and fresh water marsh areas. Usually singing from under dense vegetation. Most common in low elevation areas under coastal weather influences but also up to 1700 m at Sky Forest, San Bernardino Co., California.

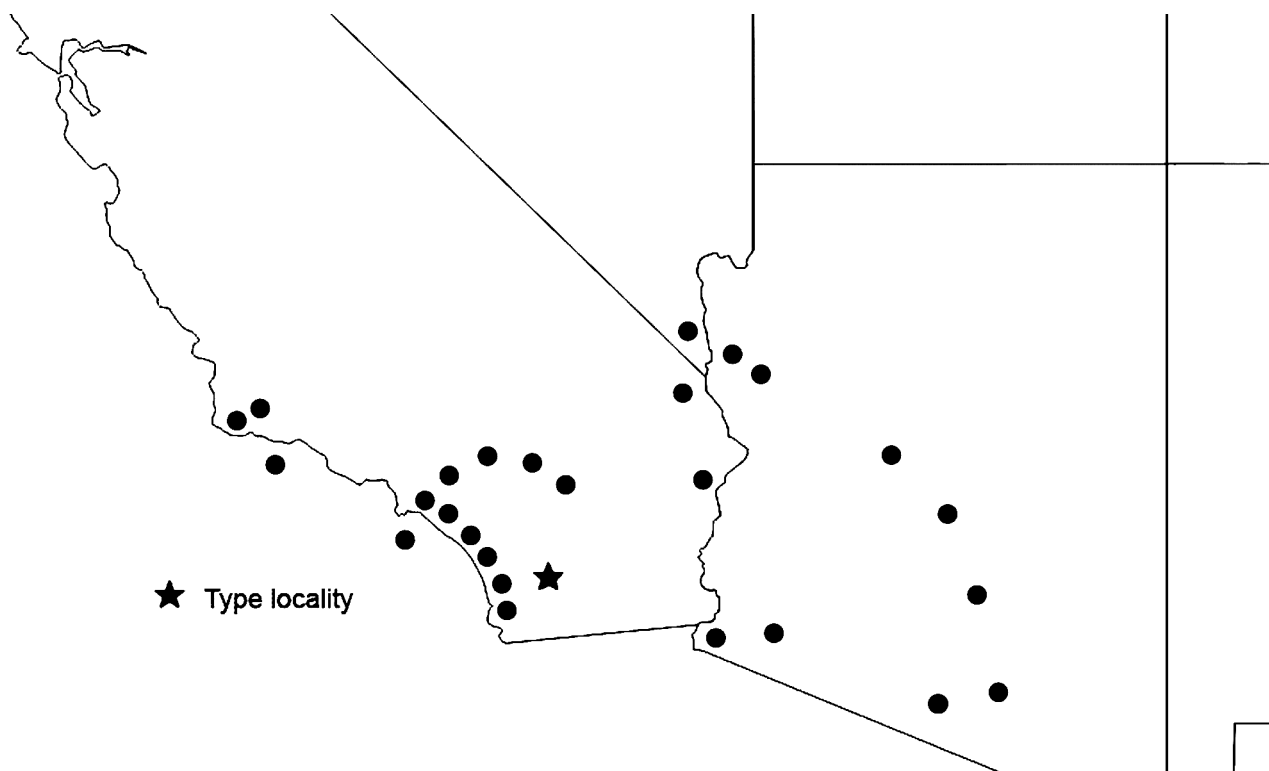


FIGURE 70. Known US distribution, *G. multipulsator*.

Life cycle and seasonal occurrence. No diapause at any stage. Continuous generations with two or three generations/year with adult males heard singing in coastal southern California even in the middle of winter.

Variation. Color: Individuals vary from almost entire body solid black (Fig. 68) to those with tan or reddish body parts. In the latter, the head may have distinctive longitudinal stripes. Tegmina also vary from tan to black, the latter especially common in cooler, moister habitats. Adult females with dark tegmina frequently have a light stripe (tegminial bar) along the forewing angle. It is unknown if colors change with generation and/or time of year maturing.

Specimens examined. **ARIZONA.** *Gila Co.*, Globe, 3544' 25-viii-1982 (S82-103). *Maricopa Co.*, Buckeye, 840' 18-ix-2011 (S11-102). Hwy 85 just E Goodyear, 980' 31-vii-1981 (S81-46). Phoenix, 1140' 16-v-1999 (S99-25). Scottsdale, 22-iv-1985 (S85-41). *Mohave Co.*, Davis Dam, 900' 14-vi-1990 (S90-46). Kingman, 3600' 19-vi-1990 (S90-58). *Pima Co.*, Ajo, 1720' 20-viii-1998 (S98-72). Gila Bend, 1700' 1-viii-2009 (S09-103). Saguaro Rd near Tucson, 2400' 28-vii-1981 (S81-35). Hwy 86 just W Sells, 2276', 29-vii-2015, 31° 57' 25.4" -111° 56' 46.4" (S15-108) 2♂. *Yuma Co.*, Telegraph Pass, 676' 15-ix-2011 (S11-92). Yuma, Western College, 300' 10-viii-1988 (S88-89). Yuma, 156', 1-xi-2003, 32.63011 -114.59740 (2003-333 and 2003-334) A. Izzo. **CALIFORNIA.** *Los Angeles Co.*, Santa Catalina Island, Middle Ranch, 28-iv-1970, 15-vi-1971; 2-vii-1972. Santa Catalina Island, Isthmus, 4-Vvii-1973. Santa Monica Mts., Trancas Reservoir, 18-viii-1973. *Orange Co.*, Newport Beach, Backbay Dr., 7-vii-1976. Irvine, on UC Irvine Campus, 7-vii-1976. *Riverside Co.*, Banning, 2400' 22-viii-2006 (S06-88). Blythe, 400' 26-vi-1980 (S80-47). Indio, 6-viii-1988 (S88-74). Palm Springs, 2-iv-1989 (S89-8); 6-iv-1991 (S91-14). Rancho Mirage, 850' 30-ix-2006 (S06-114). Riverside near UC Riverside Campus, 6-vi-2003 (S03-41). *San Diego Co.*, Alpine, 1900' 5-vi-1997 (S97-59). Borrego Springs, 8-viii-1988 (S88-83.) Camp Pendleton, 10 & 11-vii-1976. Cardiff by the Sea, sea level, 12 and 13-vii-1976; 27-vi-1980 (S80-48). La Jolla, near Prospect and Beach Blvd., sea level, 11-vii-1976. San Diego, Mission Bay, sea level, 18-vi-1994 (S94-34). *San Bernardino Co.*, Essex, 2000' 22-vii-1990 (S90-69). 3 m N Essex, 1680' 21-viii-1998 (S98-75). Mentone, 2000' 25-vii-1981 (S81-28). San Bernardino Mts., Sky Forest, 5600' 17-viii-1982 (S82-64). *Santa Barbara Co.*, Gaviota State Park 14-vii-1976. Santa Cruz Island, Prisoner's Harbor, sea level 11-vii-2004 (S04-65). Santa Ynez Mts., Lake Cachuma, 600' 24-vii-1981 (S81-20). **NEVADA.** *Clark Co.*, Cottonwood Cove, 800' 14-vi-1990 (S90-44).

DNA. Multilocus species tree G1414 (S09-103, Gila Bend) *G. multipulsator* is a sister species of *G. assimilis*—see DNA comparisons in Weissman *et al.* (2009) and in Gray *et al.* (2019). Also, closely related to *G. locorojo* and *G. veintinueve* (Fig. 6, p. 28).

Discussion. When we described this taxon in 2009, it was thought to have the highest number of p/c of any *Gryllus*. Otte (1987) described *G. mzimba* from Malawi with 17p/c and Martins (2009) discussed an undescribed *Gryllus* from southern Brazil (his *G. n. sp. 2*) that has from 13-21 p/c. Because *G. multipulsator*'s distribution ends in central Mexico (Weissman *et al.* 2009), Martins' undescribed cricket will be the new record holder for p/c once published.

Tachinid *Ormia ochracea* emerged from 2 males collected in Yuma, AZ (2003-333 and 334).

The Rubens Group

G. rubens Scudder; *G. texensis* Cade & Otte; *G. regularis* Weissman & Gray, n. sp.

Sister species of trilling field crickets distributed from south-central Arizona into far western Texas (*G. regularis*), from western Texas and the southern Great Plains eastwards to western Florida (*G. texensis*), and from eastern Texas eastwards to Florida and the southeastern Atlantic states (*G. rubens*). The only regular trilling species of *Gryllus* in the US (*G. cohni* is more of an irregular triller), differing from each other most notably in pulse rate (Figs 71 & 72) with *G. regularis* 30-50; *G. rubens* 45-65; and *G. texensis* 62-91. Geography, female morphology, and genetics also useful (Fig. 73, and Gray *et al.* 2019).

Gryllus rubens Scudder

Southeastern Field Cricket

Figs 71–82, 85, 86, 90, Table 1

1902 *Gryllus rubens* Scudder. Psyche 9: p. 295. Holotype female, Auburn, Alabama. Type in ANSP, photos (Fig. 74) courtesy of J.D. Weintraub, ANSP. Plotting Scudder's female holotype measurements of pronotal width of 6 mm and ovipositor length of 16 mm (Scudder 1902) falls within *G. rubens* measurement cluster (Fig. 75).

1957 *Acheta rubens* (Scudder). Alexander, 1957. p. 586.

1964 *Gryllus rubens* Scudder. Randell 1964.

Distribution. One (Fig. 71, R13-220) of only two trilling US *Gryllus* found between 99° longitude (central Texas) and the Atlantic coast. See Walker (2019) and Gray (2011) for additional eastern localities.

Recognition characters and song. Medium sized, short or long hind winged crickets with an average PR of ~55 at 25°. Distinguished from morphologically similar and trilling, sometimes sympatric, *G. texensis* in that the latter has an average PR of ~80 at 25° (Figs 71, 84), more teeth in the file (Figs 78, 79), a shorter ovipositor (Gray *et al.* 2001), and frequently, but not always, shorter bursts of pulses. Pulse rate at a given temperature faster, but with greater separation from *G. texensis*, in the late summer/fall generation than in the spring generation (Walker 1998).

Along coastal Texas, in 2013, we found no overlap in dominant frequency, in many males, which was <5000 Hz in *G. rubens* but >5000 HZ in *G. texensis*. Yet around Tulsa, Oklahoma (S13-68), there is overlap and we wonder if this might reflect hybridization, environmental effects during development, or both. Additionally, Blankers (pers. comm.) stated that dominant frequency values that he used in Blankers *et al.* (2015) had a range of 4.18–5.88 KHz in *G. rubens* and 4.66–5.56 KHz in *G. texensis*. Unfortunately, these measured males were all from laboratory generations with unknown effects on the song.

Derivation of name. “rubens” apparently for the general reddish and rufo-testaceous markings on Scudder's unique, long tegmina female specimen.

Geographic range. (Fig. 76.) Most of our collection localities are near the western and northwestern boundaries of *G. rubens*' distribution. See Gray (2011) and Walker (2019) for more complete eastern US distribution maps. Our most western locality is Bastrop State Park (S91-23), Texas, where *G. rubens* occurred with *G. texensis*. There we collected one male *G. rubens* (R91-39) with a PR of 53 at 25°C and with 100 file teeth and three *G. texensis*