

Although not known from the United States, this cricket is endemic to the Bahama Islands, which are less than 80 km away from the closest US location along the Florida coast. Since our earlier publication (Weissman *et al.* 2019), we have documented this cricket on a third island in the Bahamas: San Salvador, 24.122279° -74.45678°, 23-i-2019, 1♂, N. Lee, deposited CAS.

**Recognition characters and song.** Known only from 3 islands in the Bahamas. Body color as in Fig. 22. *Song* (Fig. 22) at 25°C typically with widely spaced single pulses delivered at 7–15/10 seconds at a pulse rate of 0.8–2.1.

**DNA.** GBM05, from Andros Island, multilocus appears (Fig. 6, p. 28) to be one of several *Gryllus* near the base of a continental North American species group, distinct from the Afro-Eurasian *G. bimaculatus* and *G. campestris* Linnaeus. We interpret this result cautiously, however, as we lack DNA samples for other geographically nearby species *G. jamaicensis* Walker, *G. mandevillus* Otte & Perez-Gelabert, and *G. bermudensis* Caudell (probably most closely related to *G. firmus* [Kevan 1980]).

## The Ovisopis Group

*Gryllus ovisopis* Walker and *Gryllus thinos* Weissman and Gray, n. sp.

These two species are distributed in far allopatry on opposite sides of the Gulf of Mexico: *G. ovisopis* in Florida, Georgia, and South Carolina, and *G. thinos* in coastal Texas. They differ in several major ways: *G. ovisopis* is a wood cricket, with an obligate egg diapause, and lacks a functional calling song. In contrast, *G. thinos* is a beach cricket without an obligate egg diapause and has a 4–7 pulse chirp calling song. Nonetheless, multilocus DNA places them as sister species.

### *Gryllus ovisopis* Walker, 1974

Taciturn Wood Cricket

Fig. 23

*Gryllus ovisopis* Walker, 1974 Florida Entomologist 57:13. Holotype male, Florida, Alachua County, deposited in USNM, type #72970. Holotype male and allotype female both listed on USNM type webpage and specimens located and photographed by Floyd Shockley and Kayla Kramer (Fig. 23).

**Recognition characters and song.** This species is an egg overwintering, obligate egg diapausing, fall maturing species where adults first appear in September, and whose documented US distribution includes 3 states (Florida, Georgia, and South Carolina) but may include as many as 6 southeastern states: Florida, Georgia, South Carolina, Alabama, Mississippi, and Louisiana (Capinera *et al.* 2004, Walker 2019). Head is narrower than pronotum. Males produce no calling song, but do naturally produce both aggressive and courtship songs, and can be chemically induced to produce a feeble 3–5 pulse chirp structurally similar to *G. pennsylvanicus* and *G. firmus* songs (Gray *et al.* 2018).

**DNA.** Multilocus 2018-001 and 2016-035, courtesy of Kevin Judge's cultures, from samples originally from the type locality of Gainesville, FL., show (Gray *et al.* 2019) that nearest multilocus relative is non-taciturn, non-egg diapausing *G. thinos*, the latter known only from coastal Texas. In the absence of genetic sequencing data, Walker (1974) believed *G. fultoni*, and perhaps *G. firmus*, to be the nearest relatives. Harrison & Bogdanowicz (1995) showed a single clade of *G. ovisopis*, *G. pennsylvanicus*, and *G. firmus* with 1.3% separation for the whole group; Huang *et al.* (2000) found similar results.

**Discussion.** With the exception of a single male nymph caught 22-vii-2002 (DAG FLA02-311) in Yulee, Nassua Co., FL, we have no field experience with this species. Therefore, the interested reader is referred to Walker (1974, 2019) and Capinera *et al.* (2004).

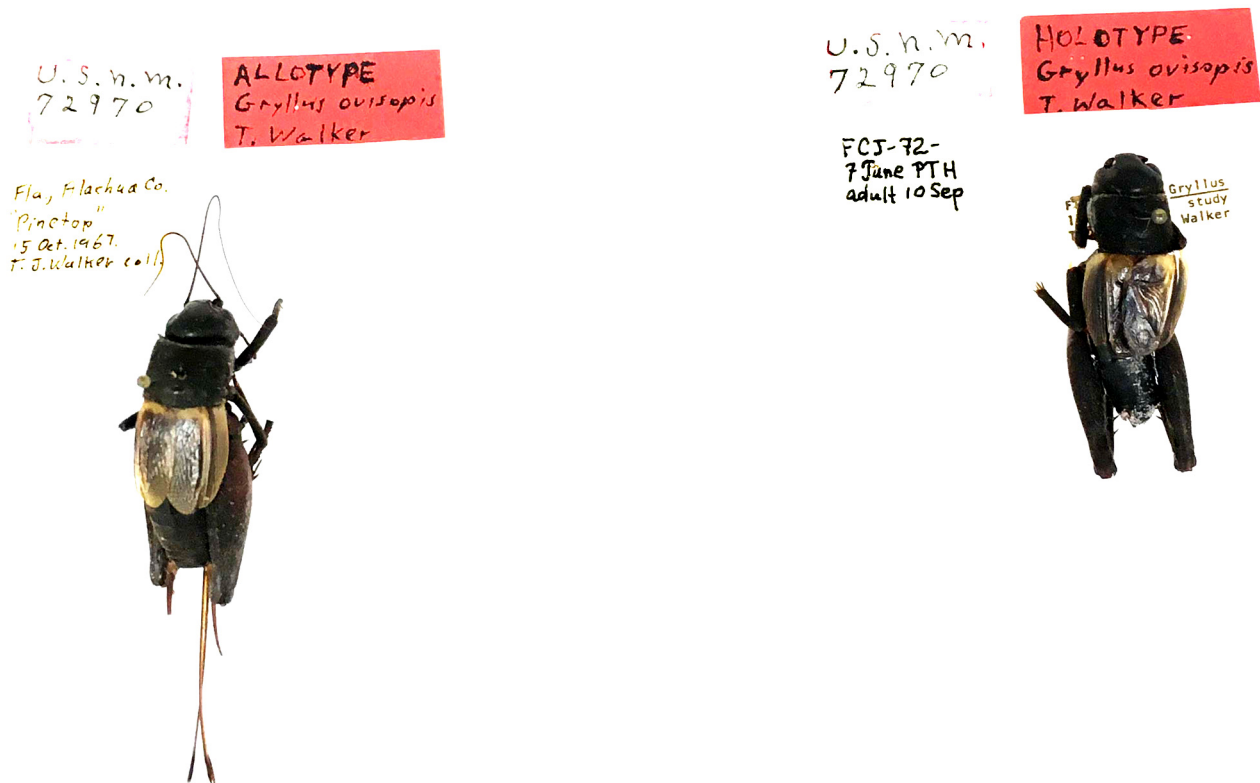


FIGURE 23. Male holotype (right) and female allotype (left) *G. ovisopis*.

***Gryllus thinos* Weissman & Gray, n. sp.**

Texas Beach Field Cricket

Figs 24–27, Table 1

‘Gryllus #21’ and ‘near #21’ of DBW notebooks.

*Distribution.* Texas—restricted to Texas Gulf coast and up to 8 km inland.

*Recognition characters and song.* Small to medium sized (Fig. 24), always short hind wings, medium length cerci, almost always in sandy habitats, males frequently sing from up in vegetation. *Song* (Fig. 25; R07-125) a slow chirp, CR usually < 90, 4–7 p/c, PR 20–35. Can be distinguished from only other Texas Gulf coast, sandy-environment field cricket, *G. firmus* (Texas), by DNA, non-overlapping file teeth, teeth/mm and a generally lower PR (Table 1, p. 18). Singing males of *G. thinos* also easier to approach than singing, microsympatric *G. firmus*. Females of the two taxa can be difficult to separate although *G. firmus* ovipositor length is generally longer in that larger species (see Table 1).

*Holotype.* Male (Fig. 24). USA, Texas, Kleberg Co., Padre Island National Seashore around Malaquite Visitor Center, 11-vi-2011, 15° 27' 25" 23.2" -97° 18' 07.7". D.B. Weissman. S11-35, R11-8, DNA sample G2018. 16S GenBank accession #MK446632. BL 17.28, HF11.53, LC 10.76. Right tegmen removed: 119 teeth, file length 3.1, TL 10.0, TW 4.6. Type deposited in CAS, Entomology Type #19274.

*Paratypes.* (Total: 67♂ 14♀) **Texas.** *Aransas Co.*, Business 35 near Rockport, 10', 12-vii-2013, 27° 57' 32.7" -97° 06' 14.4" (S13-55) 1♂. Texas 188 0.2 m SE Hwy 35, 19', 12-vii-2013, 27° 57' 56.1" -97° 07' 13.7" (S13-54) 2♂. *Cameron Co.*, Boca Chica State Park, 10', 25° 59.827" -97° 09.146" 3-vi-1991 (S91-36) 5♂ 1♀; 10-vi-2007 (S07-25) 6♂ 4♀. South Padre Island, Isla Blanca Park, 5', 10-vii-2013, 26° 04' 09.3" -97° 09' 41.7" (S13-41) 3♂. *Kleberg Co.*, Padre Island National Seashore, near Park entrance, 11-vi-2011, 27° 28' 39.9" -97° 16' 28.7" (S11-34) 1♂. Malaquite Visitor Center, 11-vi-2011 (S11-35) 2♂ 3♀; 3 m N Malaquite Visitor Center, 2-vi-1991 (S91-33) 11♂ 5♀; South Beach, 2-vi-1991 (S91-34) 2♂. *Matagorda Co.*, Hog Island, 21', 13-vii-2013, 28° 36' 17.4" -95°

57° 34.8" (S13-60) 4♂. Nueces Co., Corpus Christi near 10421 S. Padre Island Dr., 27° 40' 02.5" -97° 16' 54.4", 29-vi-1986 (S86-57) 20♂ 1♀; 12-vii-2013 (S13-53) 1♂. Mustang Island State Park, 5', 12-vii-2013, 27° 40' 25.9" -97° 10' 30.1" (S13-51) 7♂. Hwy 361 2 m S Port Aransas, 12-vii-2013, 15' (S13-52) 2♂.



**FIGURE 24.** Holotype male (left), *G. thinos*. Female (right) from type locality showing typical, linear head stripes.

*Derivation of name.* “thinós” is Greek for beach, shore, or strand in recognition of where this cricket occurs.

*Geographical range.* Fig. 26. Known only from coastal and barrier island areas of Texas and inland for no more than 8 km. May get into adjacent coastal Mexico but areas not checked due to limited access. We did find suitable sandy areas just south of Tampico, Mexico, and around Galveston, Texas, but no *G. thinos* at either site.

*Habitat.* Almost always on sandy substrate in open, low rolling coastal dunes. In Corpus Christi (S86-57 and S13-53), somewhat sandy-substrate vacant field with grasses, forbs, and small shrubs (all three vegetation types from 10 to 40 cm tall), males almost always singing from vegetation (but never at top of plants) and initially visible on triangulating but quickly climbed (not jumped) down. Also heard throughout town of Corpus Christi in 1986 in road median areas, mowed lawns, etc. At Padre Island National Seashore (S91-33), common, with some in plants, but many just along mowed edges of road in vegetation 5 cm tall and singing with females also walking around. At Padre Island National Seashore (S11-34), nymphs and one adult male collected under boards just above high tide line. At Mustang Island State Park (S13-51), several reddish/pale mid instar nymphs under boards on low rolling dunes during daytime. At night at Mustang Island, all 7 singing males 15 to 46 cm up in grass, dead twigs, and *Yucca* spp. Two of those males quickly climbed down and retreated into nearby holes in the sand and were easily flushed with water.

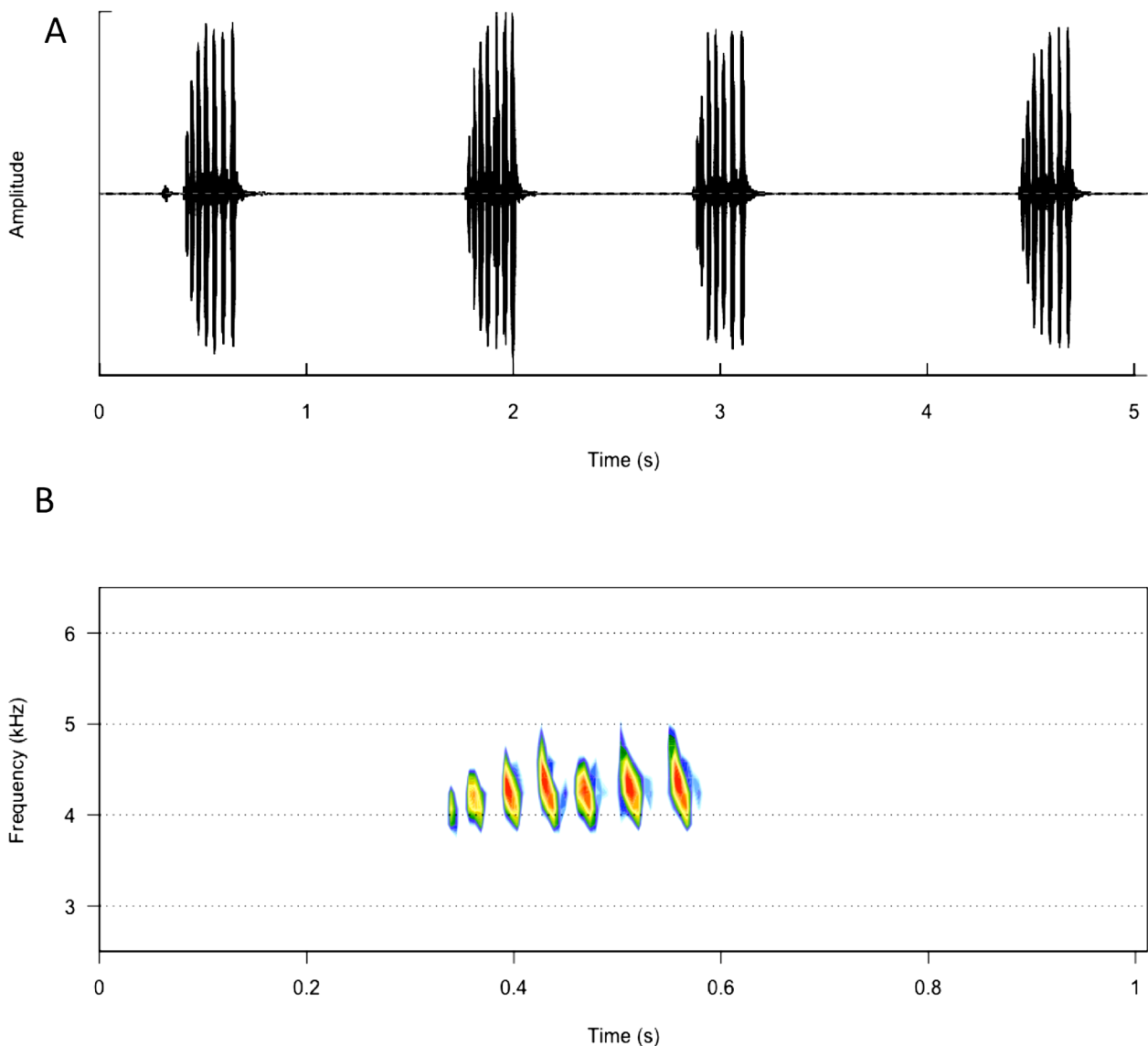
*Life cycle and seasonal occurrence.* No egg diapause: Corpus Christi (S86-57). Probably one generation/year but many late spring and early summer mid-instar nymphs, at Padre Island National Seashore (S91-33) and Mustang Island State Park (S13-51), either represent a second generation or, more likely, show that maturation occurs over several months. Mid instar nymphs from those two localities molted to adults in August.

*Variation. Color:* tegmina almost equally divided between brown and black. Rear leg femur and tibia usually tan/orange but also black. **Head:** 13 adult males (out of 67) and 3 adult females (out of 14) with defined linear head stripes (Fig. 24), a character also seen in some late instars.

*DNA.* Multilocus G1209 (Boca Chica State Park, TX, S07-25) maps (Gray *et al.* 2019) with 2 males from Cor-

pus Christi, TX (G2018, G2022 from S11-35). Surprisingly, the single, fall generation, egg diapausing *G. ovisopis* appears to be the sister species.

Much DNA variation between habitats although no morphologically corresponding characters. When South Padre Island specimens (S11-35) were genetically compared with those from Boca Chica (S07-25), less than 200 km south and in a similar habitat, we found, for CO1, 17 fixed nucleotide differences in 700+ base pairs; and for 16S, 6 fixed nucleotide differences in 500+ base pairs. We are concerned, however, that the COI variation might be an artifact of pseudogenes (see general DNA discussion, pages 16 & 17). ITS2 also shows very slight separation within *G. thinos* from these localities (Fig. 27). Further analysis might support species status for these genetically very different populations but in a comparison of their morphological characters (see Table 1, p. 18), nothing stands out. Plus, all 3 individuals are each other's nearest neighbor in multilocus tree. The Boca Chica habitat, while appearing very similar to Padre Island, is somehow ecologically different in that the former locality is also inhabited by microsympatric *G. firmus*, while no other *Gryllus* species occurs on Padre Island.



**FIGURE 25.** Calling song of *G. thinos* (R07-125) Cameron Co., TX (S07-25), at 25°C: (A) five second waveform, (B) one second spectrogram.

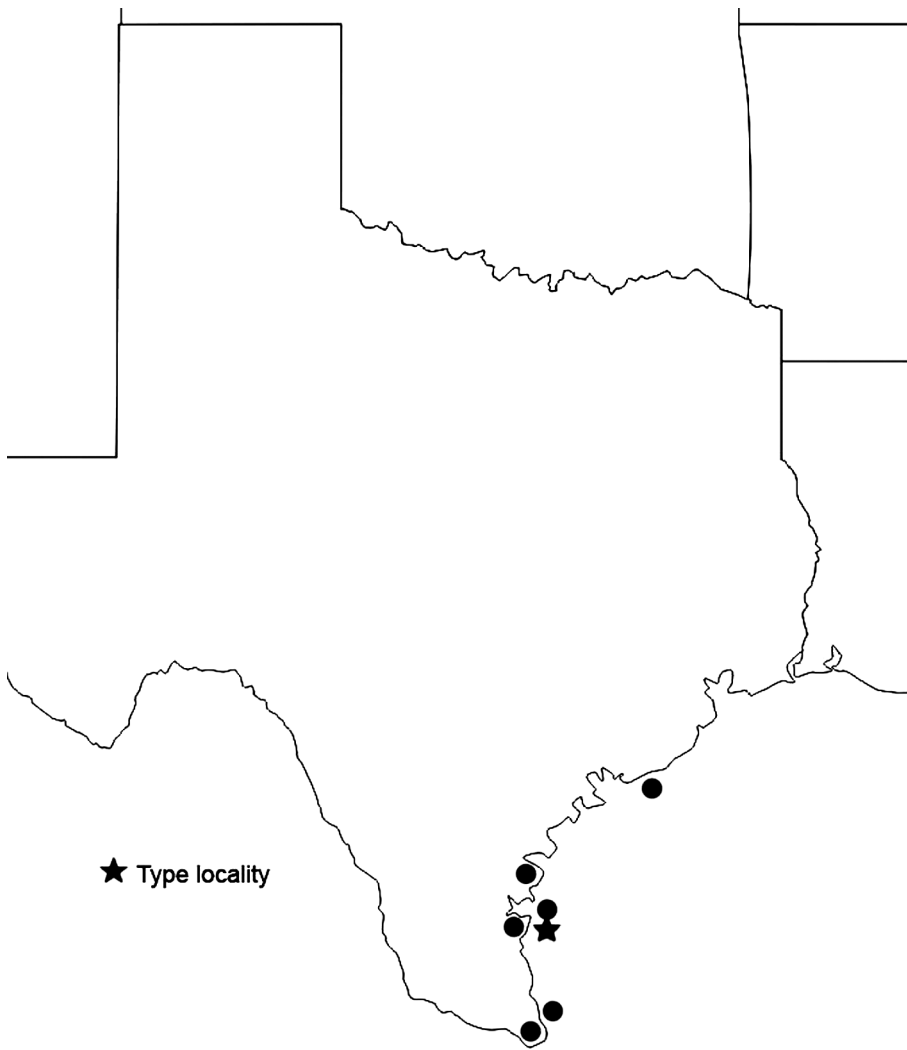


FIGURE 26. Known distribution of *G. thinos*.

Tree scale: 0.001 |——|

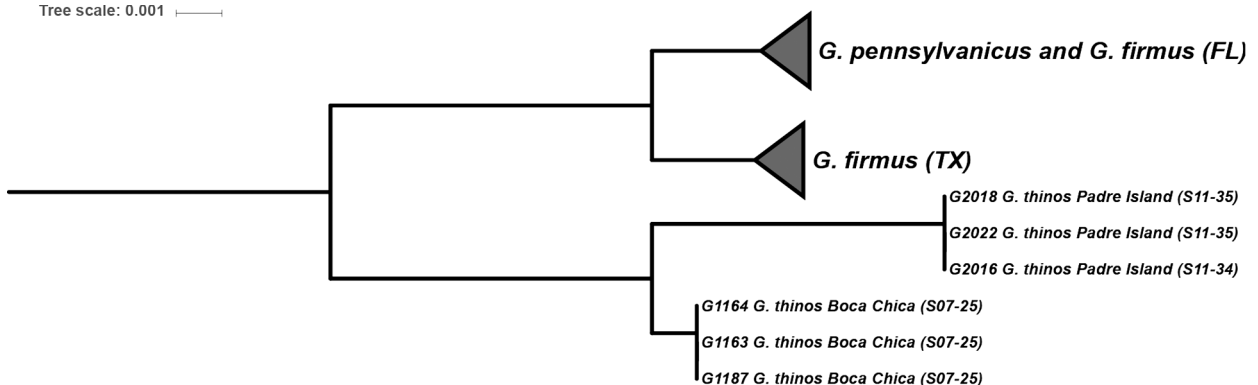


FIGURE 27. ITS2 gene tree showing some separation between Padre Island and Boca Chica samples of *G. thinos*.

The Texas beach inhabiting crickets, *G. thinos* and *G. firmus* (Texas), are clearly genetically distinct: Tamura-Nei genetic distance within *G. thinos* ITS2 samples is low ( $N = 6$ , mean  $\pm$  SD,  $0.0044 \pm 0.0037$ ), similar to variation within *G. firmus* (Texas) samples ( $N = 12$ , mean  $\pm$  SD,  $0.0034 \pm 0.0040$ ), but an order of magnitude greater between *G. thinos* and *G. firmus* (Texas) ( $0.0240 \pm 0.0027$  mean  $\pm$  SD).

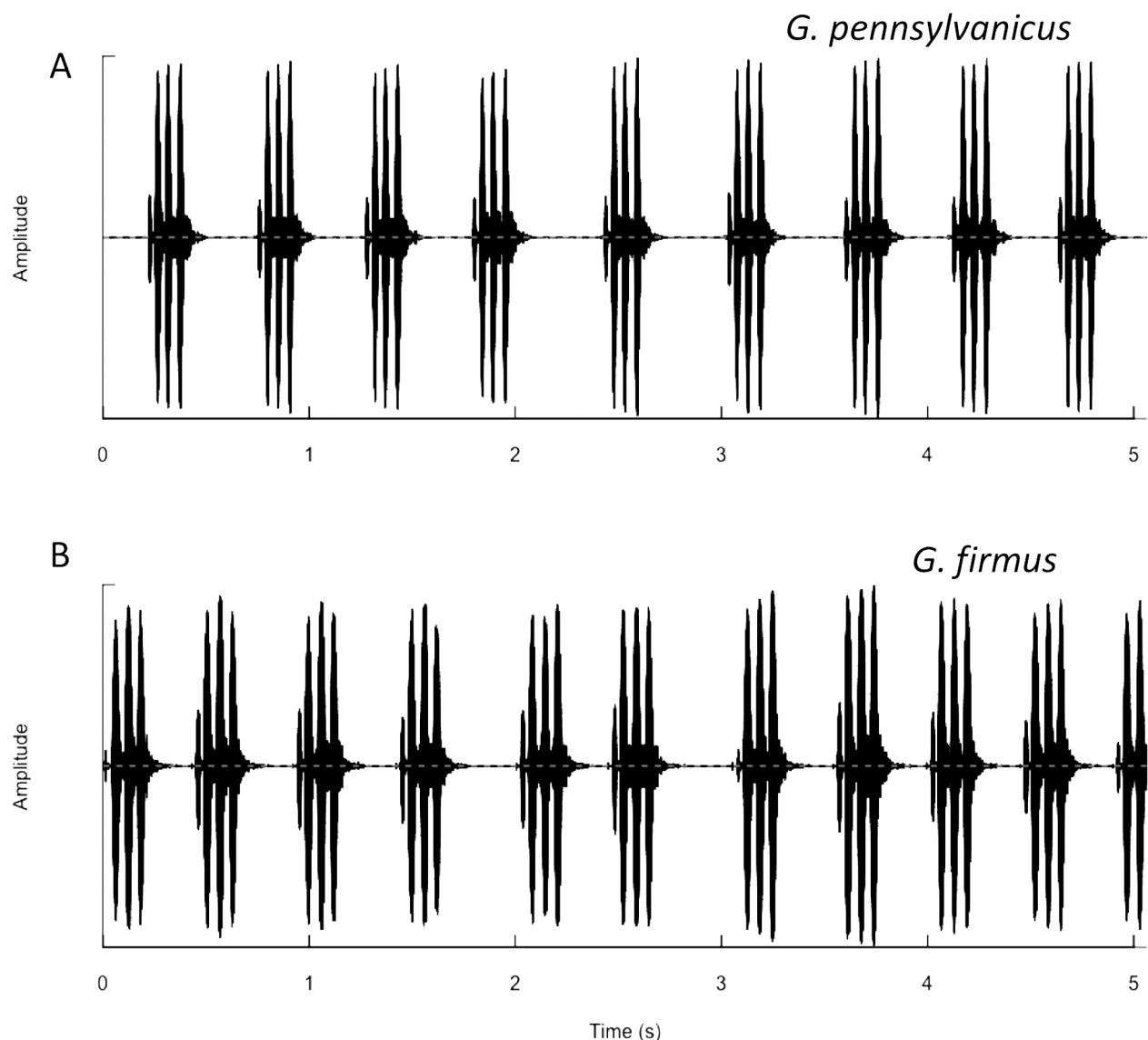
*Discussion.* Singing males easy to approach. On 10-vi-2007, males not singing well until 21:45, considerably after sunset, and without a significant moon. Oatmeal trails in dunes helped to attract wandering individuals.

Besides finding *G. thinos* microsympatric with *G. firmus* at Boca Chica, we also found them together near Port Aransas (S13-52), and Mustang Island State Park (S13-51). Singing males of the two species are easily separated in the field by the slower pulse rate in *G. firmus*.

### The Pennsylvanicus Group

*Gryllus pennsylvanicus* Burmeister and *Gryllus firmus* Scudder.

Sister species of 3–5 pulse chirping field crickets (Figs 28, 29). *G. pennsylvanicus* widespread distribution throughout the colder more northern US and into Canada; *G. firmus* coastal Texas and southeastern US (including Atlantic seaboard) inland for variable distances. With post-mating, but pre-zygotic, genetic incompatibility in hybrid crosses of *G. firmus* females with *G. pennsylvanicus* males (Larson *et al.* 2012), but nonetheless difficult to separate morphologically. Both ITS2 (Fig. 30) and multilocus analyses (Gray *et al.* 2019) suggest that Texas and Florida populations of *G. firmus* are distinct.



**FIGURE 28.** Five second waveforms of calling songs of (A) *G. pennsylvanicus* and (B) *G. firmus*. *G. pennsylvanicus* (R04-110) Whatcom Co., WA (S04-91), at 25°C. *G. firmus*: (R03-255) Gainesville, FL (S03-85), at 25°C.