

Gryllus cohni Weissman

Irregular-Trilling Field Cricket

Figs 155–157, 164–169, Table 1

1980 *Gryllus cohni* Weissman, Transactions of the American Entomological Society 106: 339. Holotype male (Fig. 164): Mexico, Baja California Sur, 0.5 km W Hwy 1 km 8 sign W La Paz, 16-vii-1978. S78-59, R78-90. Type in CAS, Entomology type # 13220.

'*Gryllus irregularis*', G. #20 of DBW notebooks.
Arizona stutter triller of Sakaguchi & Gray (2011).



FIGURE 164. Holotype male of *G. cohni*, with labels.

Distribution. Known from south-central Arizona and Mexican states of Sonora, Sinaloa, Nayarit, Jalisco and the Cape Area of Baja California Sur.

Recognition characters and song. Small to medium sized, small headed, usually long hind winged, pronotum moderately hirsute and slightly dull (Figs 164, 165). *Song* variable, which can make for difficult identification, but usually an irregular “trill” (Fig. 166, 2003-295, R15-289) with groupings of 1 to 13 pulses and a PR between 22 and 41 at 25°C. Some males (Fig. 167, R14-36) with much longer, uninterrupted trills. Some individuals, mainly from central Arizona, with sections where their pulses clustered in threes (see Fig. 167, recording 2006-260), resembling the song of morphologically indistinguishable sister species *G. vocalis*. Nevertheless, songs of *G. cohni* can be distinguished from those of *G. vocalis* since the latter produces long uninterrupted bouts of 3 pulse chirps, with little or no variation in pulse number, and pulses never grouped into trills as seen in other sections of recording 2006-260. The two-sister species are also usually separated ecologically with *G. vocalis* around moist environs and *G. cohni* in drier, more open desert situations. Both taxa were found microsympatric at only one location—a semi-garden area in Ajo, AZ (S98-72), although several subsequent visits to both Ajo and Why failed to yield more specimens

of either. Additionally, *G. vocalis* usually with short hind wings and a shiny pronotum and frequently at high densities in riparian corridors (see under *G. vocalis*) while *G. cohni* rarely common anywhere. *G. cohni* distinguished from other western US trilling *Gryllus* species as follows: From Arizona *G. regularis*, which is a larger, broader cricket with a shiny pronotum and short hind wings whose pulses are uniformly spaced and not grouped; females somewhat separable by ovipositor length relative to pronotal width (Fig. 168). From Arizona *G. staccato*, a larger cricket whose calling song can vary from an irregular trill with a faster pulse rate of 70-110, variable pulses/chirp, and different DNA. From Texas and eastward medium to large *G. rubens*, which has long series (> one second) of regularly-spaced trills delivered with a PR less than 60. From larger eastern New Mexico and eastward *G. texensis* that has regularly-spaced trills delivered with a PR >70. Rare western *G. integer* trill but with PR >70. Lastly, at very warm (>35°C) nighttime summer temperatures (easily reached in Ajo and Why, AZ) *G. cohni* males, when mainly singing with 3-4 p/c, can sound like *G. armatus*. They can be easily separated by recordings made closer to 25°C with differences in pulse rate and chirp rate diagnostic. Where they occur with *G. multipulsator* and *G. staccato* (e.g. near Mazatlán, S14-53), females too similar to separate except by DNA.



FIGURE 165. Female *G. cohni* from Pima Co, AZ (S98-71).

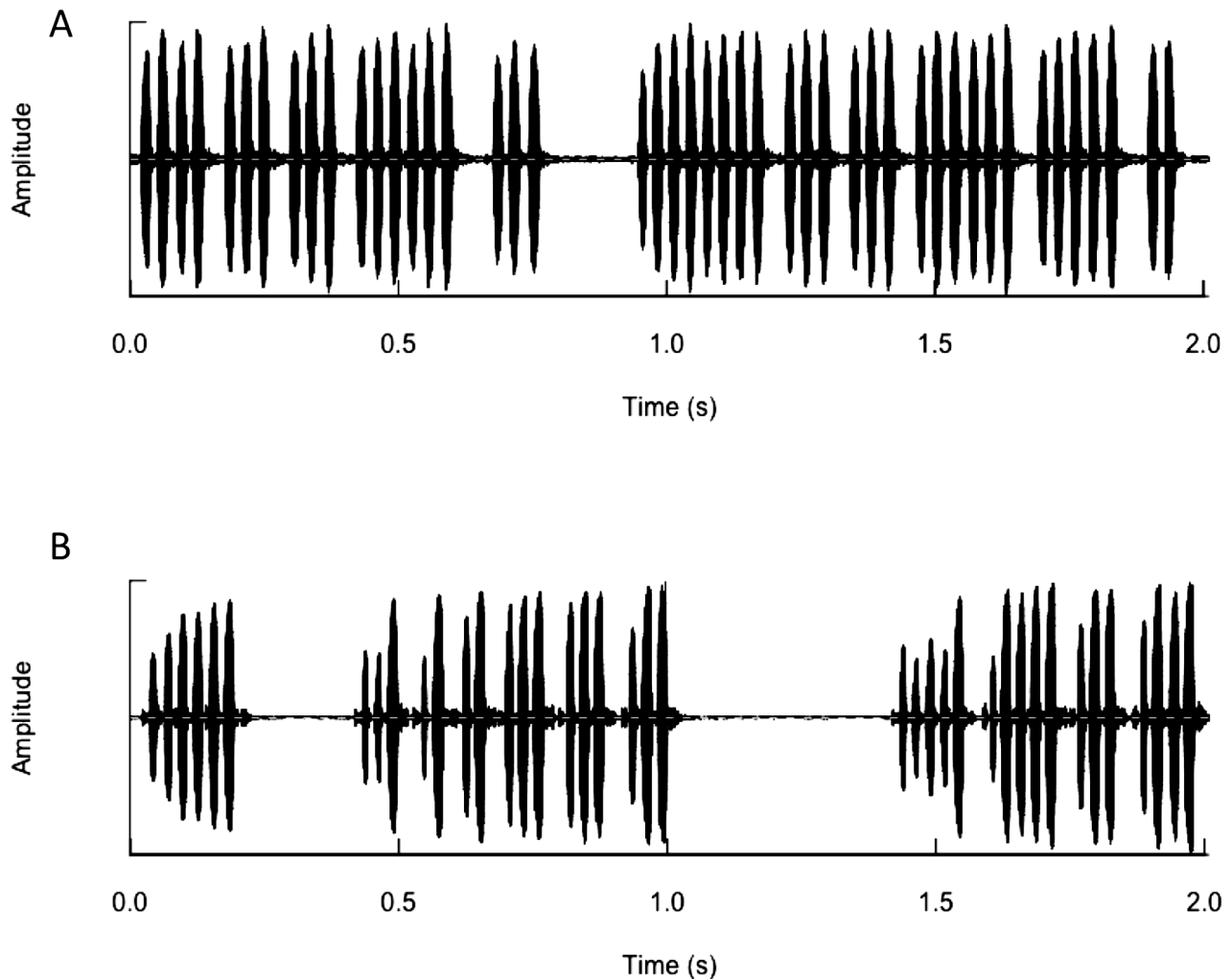


FIGURE 166. ‘Typical’ songs of *G. coхни* illustrating the extreme variability in pulse numbers both within and among individuals. (A) 2003-295 Cordes Junction, Yavapai Co., AZ, at 22.0°C. (B) R15-289 Pima Co., AZ (S15-108), at 25.3°C.

Specimens examined. (Total: 64♂ 27♀). **MEXICO.** *Baja California Sur*, 0.5 km W Hwy 1 km 8 sign W La Paz, 16-vii-1978 (S78-59) 3♂ (including holotype) 7♀; 31-xii-1978 (S79-16) 2♂; 21-iv-1979 (S79-84) 1♂; 25-viii-1995 (S95-81) 2♂. First wash along road to Miraflores, off Hwy 1, 24-iv-1979 (S79-95) 1♂. *Jalisco*, Club Med Playa Blanca, Rincon de Careyes ~55 road km N Manzanillo, 29-xii-1984 (S85-1) 13♂ 4♀. Puerto Vallarta, 29-iii-1983 (S83-13) 2♂. *Nayarit*, Hwy 200 1.6 km NE turnoff for Alta Vista, km post 78.3, 26-vi-2011, 320', 21° 07' 57.4" -105° 10' 01.3" (S11-50) 1♂. *Sinaloa*, Mazatlán, 11-viii-1999 (S99-87) 1♂. ~20 km S Mazatlán, 23-vii-2014, 110', 23° 11' 49.4" -106° 11' 37.7" (S14-53) 6♂ 1♀. Hwy 40 2 km NE Hwy 15, 11-viii-1999 (S99-86) 2♂. *Sonora*, Alamos, 18-vii-2006, 390m, 27.0257338° -108.9403527° (DAG 2006-215) 2♂. Hermosillo, 24-vii-1990 (S90-77) 1♂. San Carlos Bay, Club Med, 22-29-iii-1986 (S86-15) 6♂. 12 km W San Carlos, 25-vii-1990 (S90-78) 2♂. **USA.** *Arizona.* *Pima Co.*, Ajo, north end town, 520m, 20-viii-1998 (S98-74) 6♂. Ajo, plaza area, 520m, 20-viii-1998 (S98-72) 2♂. Sells, 29-vii-2015 (S15-107) 1♂. Why, 530m, 20-viii-1998 (S98-71) 1♂ 6♀. Hwy 86 4.4 m NW Sells, 31° 57' 25.4" -111° 56' 46.4" 2276', 29-vii-2015 (S15-108) 1♂. *Yavapai Co.*, Agua Fria National Monument, Perry Mesa near intersection Bloody Basin Rd and Pueblo La Plata Rd, 3657', 34° 14' 8.56" -112° 01' 45.34", 16-viii-2006, DAG 2006-243, 4♂, 1 last instar male and 1 last instar female; 11-ix-2007, 1♂ 1♀; 11-ix-2012 6♀. Forest Service Road 525 west of Sedona, 4507', 16-viii-2004, 34.91855° -111.91090° 2♀, I17 near Cordes Junction, gas station, 6-viii-2003, 34° 19' 41.6" -112° 07' 8.3" (DAG 2003-294, 2003-295) 3♂.

Song records only. **MEXICO.** *Sinaloa*, Concordia, 320', 11-viii-1999 (S99-85) 2♂. El Fuerte, 23-vii-2006, 800', 26.42099° -108.61774° (2006-224) 1♂.

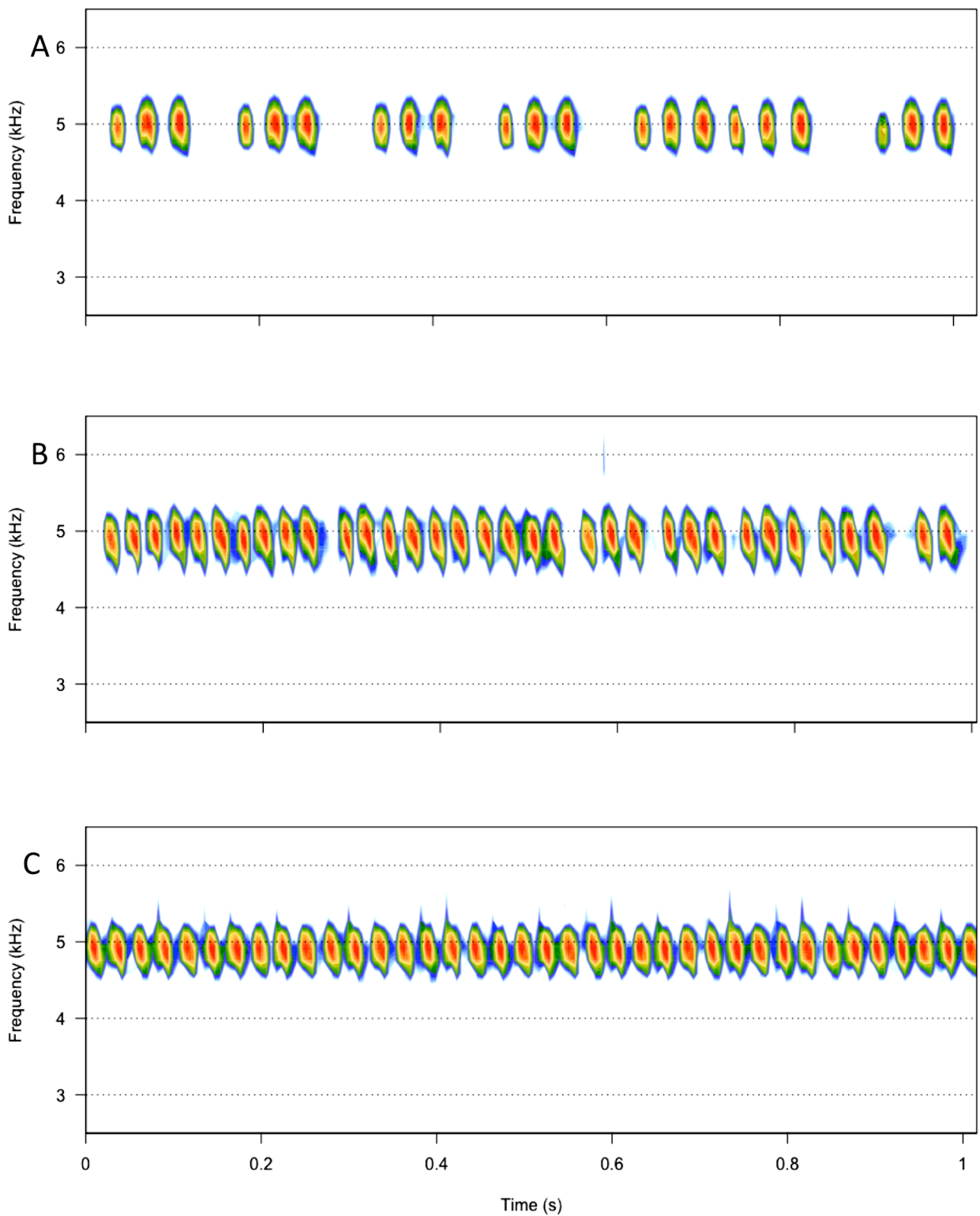


FIGURE 167. One second spectrograms of *G. coxni* showing atypical calling songs. (A) Agua Fria, AZ (2006-260), showing pulses grouped into 3s, at 22.8°C. (B) near Mazatlán, Mexico (R14-30, S14-53), showing an irregular trilling pattern, at 26°C. (C) near Mazatlán, Mexico (R14-36, S14-53), showing an almost uninterrupted trill, at 25.7°C.

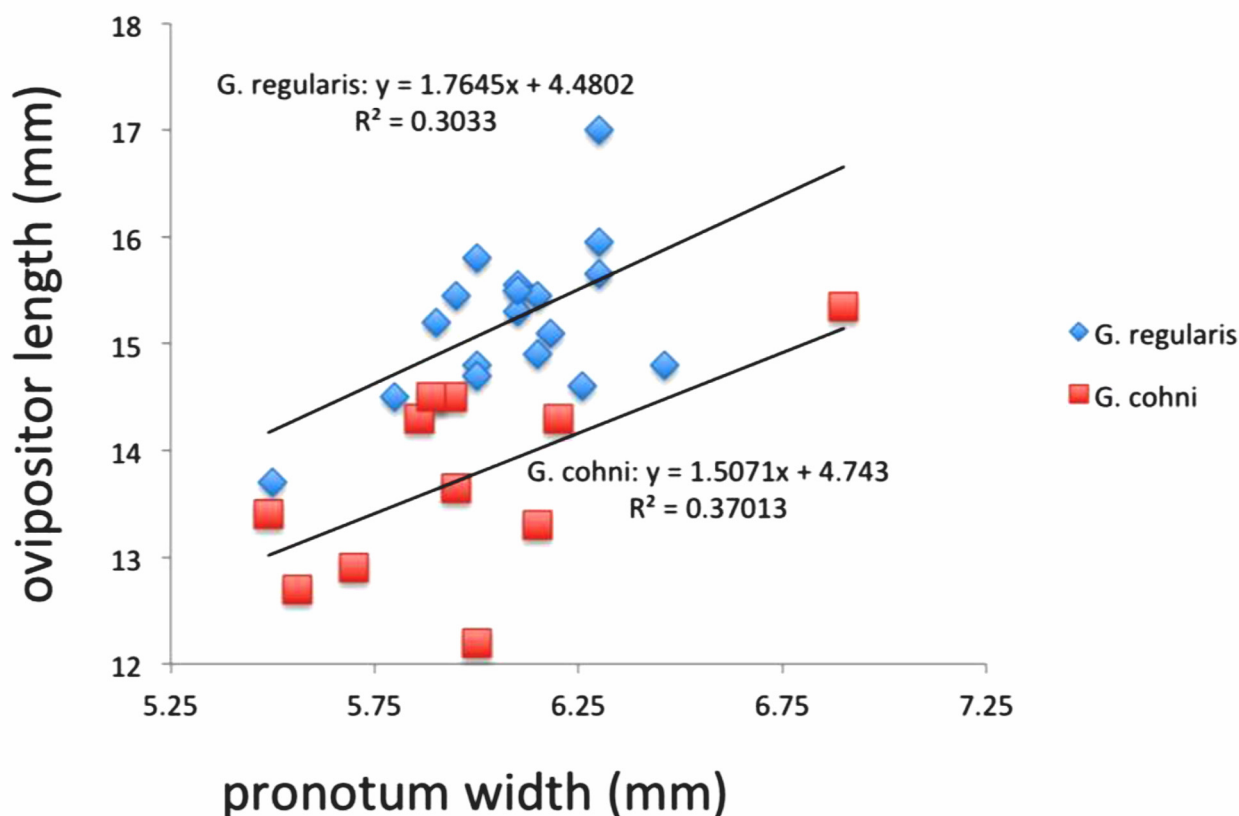


FIGURE 168. In sympatry in central Arizona, female *G. cohni* and *G. regularis* differ in relative ovipositor length, however not diagnostically so. All females are from Agua Fria National Monument, with species ID via song of lab reared sons.

Uncertain placement. Arizona: Pima Co., Ajo, plaza area, 520m, 20-viii-1998 (S98-72) 1♂ (R98-28). This long hind winged male has 3p/c delivered evenly and probably represents *G. vocalis*. If true, this site would represent the only locality where *G. cohni* and *G. vocalis* occur microsympatrically. Hwy 86 4.4 m NW Sells, 31° 57' 25.4" -111° 56' 46.4", 12276', 29-vii-2015 (S15-108) 1♂ (R15-289, G3217). This long hind winged specimen, the only male heard here, from open Sonora Desert, sang with 3 (5) p/c. His 16S DNA mapped in the tree where *G. vocalis* and *G. cohni* are intermixed. His ITS2 gene mapped (see Fig. 157) with other *G. cohni* and separate from *G. vocalis*. Such a dry habitat is usually associated with *G. cohni* although 3 males of the more mesic associated, always long hind winged *G. multipulsator* were also collected there. Perhaps these individuals all flew here after a localized monsoon rain?

Derivation of name. This cricket was originally named in appreciation of Theodore J. Cohn.

Geographic range. Fig. 169.

Habitat. From 520-1152m. The type locality is a wooded, thickly vegetated area subject to periodic flooding, where adult males did little singing and were most easily collected by an oatmeal trail. Found in both dry (open Sonoran Desert) and wet areas of human habitation, sometimes around lawns (San Carlos Bay, S86-15), at base of planted palm trees, irrigated garden areas, etc. Also at gas stations (Mazatlán, S99-87), cracks in structures and sidewalks and in deep, dry soil cracks (the latter away from human habitation at Agua Fria).

Life cycle and seasonal occurrence. Egg diapause absent (Agua Fria). Unsure if 1 or 2 generations/year and may vary between years depending on rainfall. Adults known from late March (San Carlos Bay, S86-15) through August. Nymphs collected at Agua Fria 16-viii-2006 (2006-257 & 2006-260). We have collected the Ajo-Why area on other occasions (16-v-1999 and 17-ix-2011) besides those listed under "Specimens examined" and not heard any *G. cohni* singing. Likewise collecting the Yavapai Co. localities of Agua Fria and Cordes Junction on 18-ix-2011, 12-vi-2012, 21-viii-2012, and 31-v-2013 yielded no singing males. There appears to be some unexamined interaction between monsoon rainfall and which *Gryllus* species are present, and when, in many areas of south-central

Arizona. Despite collecting 6 *G. cohni* males, flushed with water from a grassy area, none were heard singing at 20 km S Mazatlán (S14-53) when we arrived at 11:20 PM with temperatures at 31°C.

One question stands out: how long are *Gryllus* eggs viable in the soil, especially during periods of below average summer monsoon and winter rainfall?

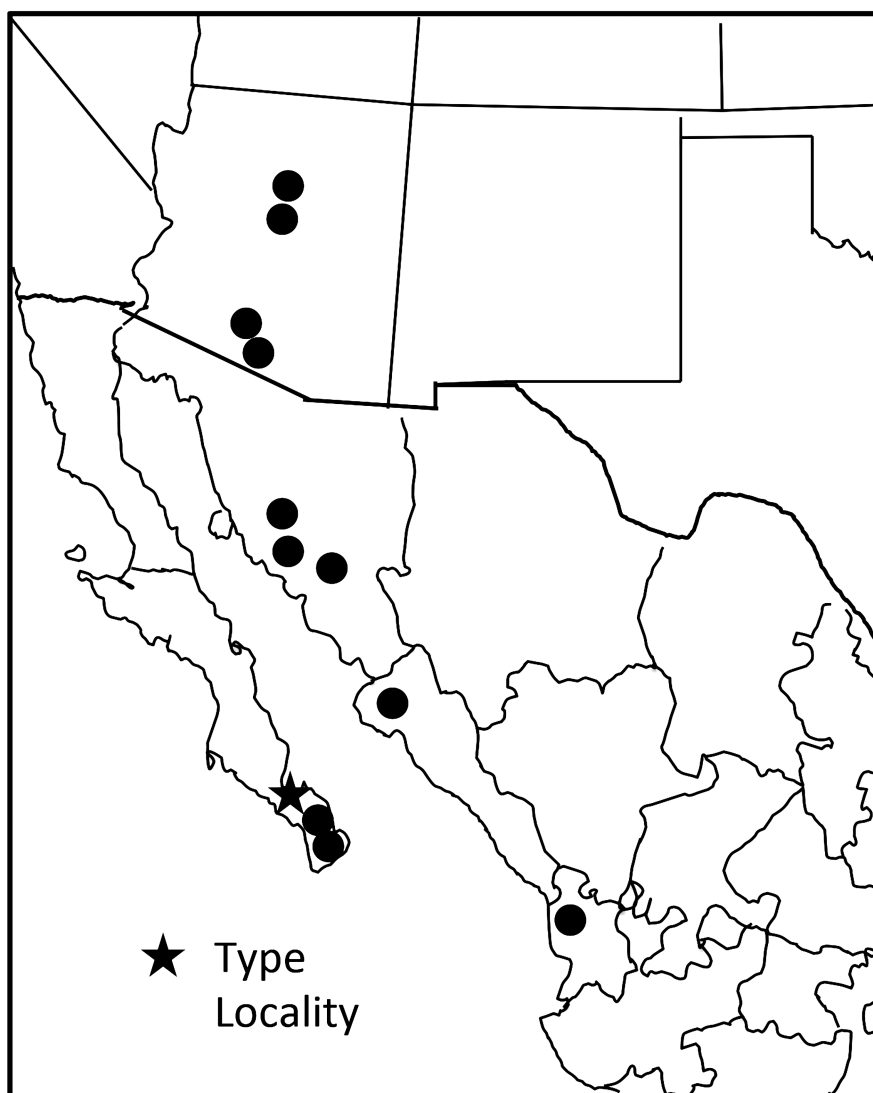


FIGURE 169. Known distribution of *G. cohni*.

Variation. Head width: All Mexican specimens from Playa Blanca (S85-1) and Puerto Vallarta (S83-13) with head narrower than pronotum, a condition infrequently seen in US specimens. **Hind wing length:** Of 39 individuals of *G. cohni* from Mexico, 37 have long hind wings and 2 males are dealate. In southern Arizona (Ajo and Why), all 13 collected individuals were long winged. In contrast, of the 7♂ and 8♀ from the Agua Fria National Monument area in north/central Arizona, 14 had short hind wings. **Body size:** Males from Agua Fria as small as 15.8 mm body length. In our small sample from Baja California Sur, Mexico, (Weissman *et al.* 1980), females were consistently larger than males, a characteristic also seen in those individuals from the Agua Fria area. **Song:** Number of p/c characteristically variable. Of 18 recorded males, 15 had an irregular trill with the exceptions being the single Nayarit (S11-50) specimen and 2 of 6 males from Mazatlán (S14-53). The Nayarit male was recorded twice: he had a short introductory trill and then groupings of 3-6 p/c at 27°C on 5-vii-2011, and no introductory trill with 3 or 4 p/c at 26° on 9-vii-2011. His DNA (G2074) mapped with that of other *G. cohni*. Of the 6 Mazatlán males (S14-53), 4 had an irregular trilling pattern (Fig. 167, R14-30) and 2 trilled more regularly (Fig. 167, R14-36). In southern Arizona (Ajo and Why), all 6 recorded males produced an irregular trill. Songs from Agua Fria were different from the general pattern seen in Mexico and southern Arizona in that some had significant stretches of 3p/c (Fig. 155, R15-289)

in addition to periods of irregular trills. Our documentation (Weissman *et al.* 1980, Fig 10a, b) in Baja California, where calling songs at higher temperatures tended to go from discrete bursts to longer trains of trills, has not been seen in populations elsewhere.

DNA. Multilocus G101, Baja California, type locality (S95-81); G2776 Mazatlán, Mexico (S14-53); and 2016-041 Agua Fria National Monument are all sisters to 2016-036, Los Angeles Co., type locality of *G. vocalis*; G3335, Albuquerque, NM, type locality of *G. alogus*; and G3227 from Gila Bend, AZ (S15-111), locality of ‘*G. arizonensis*’ (Gray *et al.* 2019) (and see under *G. vocalis* for discussion of *G. alogus* and ‘*G. arizonensis*’). We caution that type locality leg G101, used in both 16S and multilocus sequencing, was removed in 2003 from a pinned specimen, eight years after collection. In both sequences, the leg mapped consistent with other *G. cohni* and sister species *G. vocalis* specimens.

Discussion. Of the US species discussed in this paper, *G. cohni* is the only one whose type locality is in Mexico. Because of its disjunct distribution (Fig. 169), we were initially uncertain if we were dealing with one taxon. But we were unable to separate, morphologically and song-wise, those from the Cape Area of Baja California Sur from those on the adjacent Mexican mainland and those from Arizona. Most importantly, 3 geographically separated samples of *G. cohni* (from Baja Sur, Sinaloa, and Arizona) map together and are well supported for both ITS2 (Fig. 157, p. 155) and in the multilocus genetic analysis (Gray *et al.* 2019). Also, 3 geographically separated, and well supported samples of *G. vocalis* (from Los Angeles, Albuquerque, and Arizona) map together (Fig. 157) and separate from sister species *G. cohni*.

We wonder if some variation on this possible historic narrative might have occurred in central Arizona to explain the complicated situation re hind wing length and songs containing 3 pulses/chirp: long hind winged (and probably able to fly), irregular trilling *G. cohni* typically is a cricket of dry habitats (before the summer monsoon rains come) and would not normally occur microsympatrically with usually short hind winged, 3p/c *G. vocalis*, since the latter prefers riparian areas in the Southwest. The spread of human habitation and the formation of cities like Ajo and Why, AZ, subsequently brought these two environments into proximity, which brought these two-sister species together and possibly facilitated hybridization and introgression. Thus, we find around central Arizona, short hind winged crickets that sing like *G. cohni* but also have periods of 3p/c in their calling songs as seen in *G. vocalis*. Consistent with this narrative is the fact that no *G. vocalis* are known along northern Sea of Cortez mainland Mexico and, hence, the widespread absence there of *G. cohni* with 3p/c song-periods. We have no data to support this scenario, but it is in principle easily testable using modern genomics.

Likewise, in this general Arizona geographical area, we find (normally rare elsewhere) long hind winged *G. vocalis* at Cottonwood Cove, NV (S81-31); Goodyear (S81-46), Buckeye (S11-102), and Gila Bend (S09-103), AZ; and Havasu Lake, CA (S83-62), although none have periods of trilling, regular or irregular song.

Given the variation in song produced by males in the same population, this species would be ideal for studies on female song preferences.

One male each from S86-15 (San Carlos Bay) and 2006-243 (Agua Fria) parasitized by tachinid *Ormia ochracea*. At the first locality, all 3 *Gryllus* species there (*multipulsator*, *staccato*, and *cohni*) were parasitized by this tachinid species.

The Lineaticeps Group

G. lineaticeps Stål, *G. personatus* Uhler, and *G. staccato* Weissman & Gray, n. sp.

Sister species of chirping field crickets with typically 6-9 pulses per chirp (Figs 170, 171). Separated from each other by geography (Fig. 172), song (Fig. 173), and DNA (Fig. 174).

Gryllus lineaticeps Stål

Variable Field Cricket

Figs 170–178, Table 1

1860 *Gryllus lineaticeps* Stål, 1861 [1860]. Kongliga Svenska fregatten Eugenie's Resa omkring jorden under befäl af C.A. Virgin åren 1851–1853. Zoologi 1. p. 314.