two weeks before *G. veletis* sings in Indiana. However, in 1960, Alexander & Bigelow christened the latter the northern spring field cricket, now simply called the spring field cricket by Walker (2019).

G. vernalis occurs in many localities with either *G. fultoni* and *G. veletis.* With enough searching, we predict that one should find all three taxa sympatric. At such a locality, one could stand and hear and discriminate the three by song and microhabitat as follows: With an air temperature between 18-25° C, i.e. warm enough for males to sing, *G. vernalis* more likely into deeper woods where its individual three pulses/chirp can be counted. *G. fultoni* can be along the forest—adjacent grassland border area where its three pulses/chirp can't be counted because the PR is too high. *G. veletis* would be in the adjacent grassland only and although its pulses are too close together to be counted, one can hear that each chirp contains more than three pulses because of the chirp's longer duration. It is easier to appreciate the differences between *G. fultoni* and *G. vernalis*' pulse rates when the two species are heard singing together.

Near the type locality (S03-62) of *G. vernalis* in Indiana, both *G. vernalis* and *G. fultoni* occurred at high densities within an open area of dense forest that was clear-cut for electrical power lines. The songs of *G. vernalis* were softer than those of *G. fultoni,* not surprising given the shorter tegmina in *G. vernalis*. Many individuals of both sexes of both species were walking on the surface amid various limestone rocks and organic debris.

Jang & Gerhardt (2006a, b; 2007) and Jang *et al*. (2007) document calling song character displacement where *G. vernalis* and *G. fultoni* are sympatric; and aggressiveness related to habitat (Jang *et al.* 2008).

***Gryllus fultoni* (Alexander)**

Southern Wood Cricket

Figs 57, 113–115, 122–126, Table 1

1957 *Acheta fultoni.* Alexander (1957). Holotype male (Fig. 123, courtesy of M. O'Brien): Ohio, Hocking Co., Goodhope Township. Deposited at UMMZ. Types also photographed on OSF.

1964. *Gryllus fultoni*. Randell (1964).

'Gryllus #28' of DBW notebooks.

Distribution. East of 98° longitude in southern and central US, to the Atlantic coast and south into Florida.

Recognition characters and song. Small to medium sized cricket, always short hind wings, usually with contrasting yellow cerci when alive, head usually narrower that pronotum (Fig. 124). *Song* (Fig. 125) of 3p/c delivered at 250 to 360 c/m., PR 35–55. Usually lives in woods or on their edges but sometimes in short to long roadside grasses. Some males climb several feet into bushes and tree trunks to sing. One "effective" generation/year (see below under *Life cycle*). Differs from sympatric *G. vernalis* in not being a forest obligate, being slightly larger (Fig. 120), tegmina brown and black with tegminal bar vs. solid black in *G. vernalis*, no overlap in teeth/mm (Table 1, p. 18), PR faster (can hear difference in field when both species singing at same temperature), and yellow cerci common in live individuals (rare in *G. vernalis*). Differs from sympatric *G. veletis* in microhabitat (woods vs. grassland), *G. fultoni* frequently having the head narrower than pronotum, longer cerci that are usually yellow, smaller size, fewer p/c, and faster PR and CR. Differs from sympatric *G. veintinueve* in *G. fultoni* usually having yellow cerci when alive, head narrower than pronotum, faster CR and fewer file teeth, no overlap in its faster PR and different DNA (Fig. 6, p. 28; Gray *et al.* 2019).

Derivation of name. Named, by Alexander, in honor of B. B. Fulton who was the first to recognize this species as distinct.

Geographic range. (Fig. 126). From eastern Texas, Oklahoma, and Kansas through the central US to the Atlantic coast and south into Florida (see maps in Walker 2019; Jang & Gerhardt 2006a, b).

Habitat. Usually in woods or along their borders where they live in leaf litter and can be difficult to collect. Never in open fields. Also in holes in the ground under trees where they are easily flushed with water. Occasionally in short roadside grasses (Kansas, S87-69 & 70) with an open tree cover. In eastern Oklahoma males climb into bushes and trees to sing—we collected males singing 1.5–2m above ground on the side of a tree at Keystone State Park (S88-42) and in Tulsa (S07-22).

Life cycle and seasonal occurrence. No egg diapause (checked from Kansas, S87-70; Oklahoma, S88-42; and Missouri, S00-16), with first field adults in mid-late May. Walker (1974) notes that northern Florida can have second generation *G. fultoni* adults, similar to the situation seen in *G. veletisoides* in California (see p. 195), *G. veletis* in Mich-

igan (Alexander 1957, p. 592), and *G. firmus* in Florida (Walker 1980). The functionality of this second generation in Florida is unknown but apparently non-contributory to the gene pool (T.J. Walker pers. comm. to DBW, 2011).

FIGURE 123. Holotype male (upper) *G. fultoni* and allotype female (bottom), with labels.

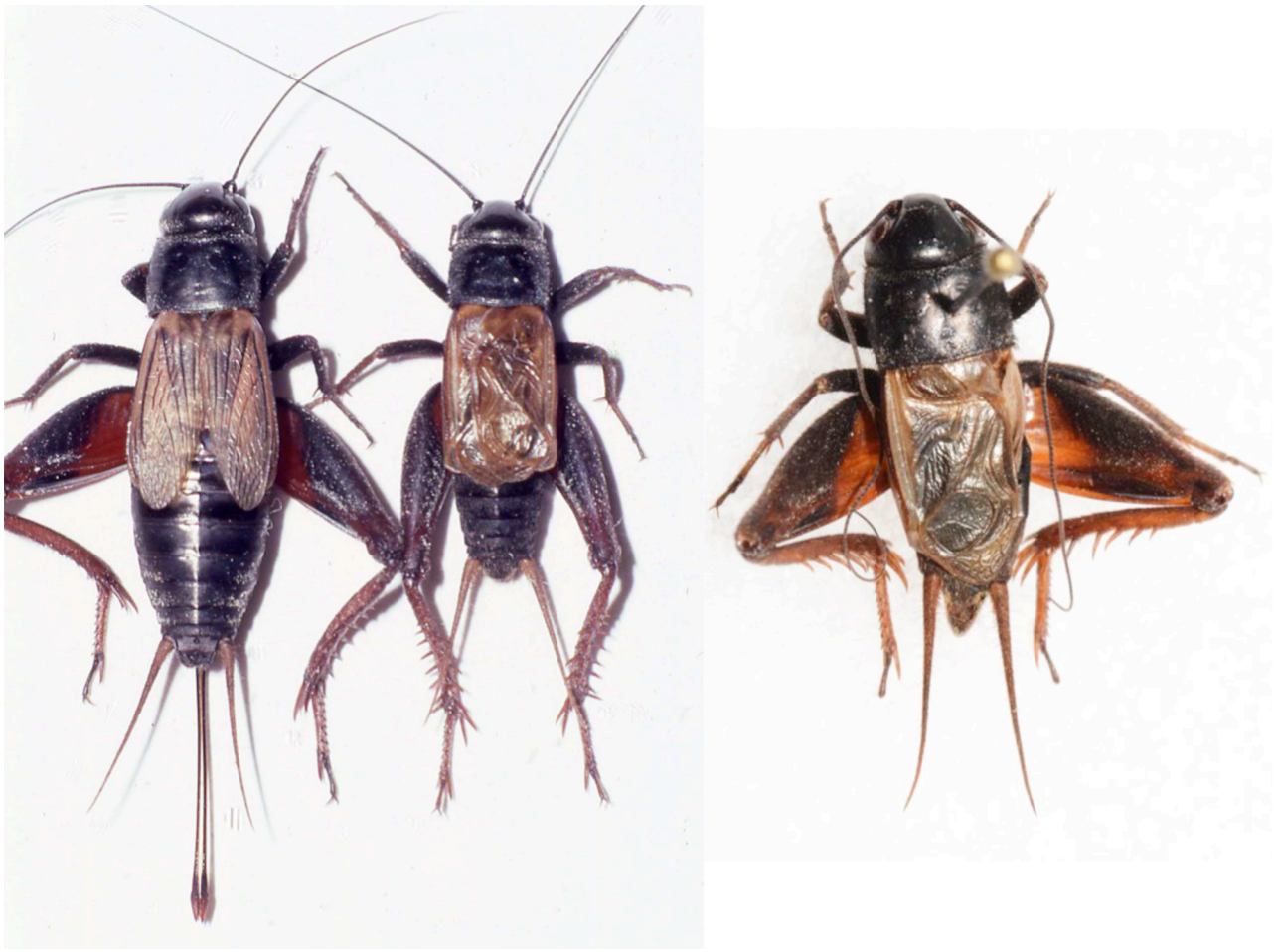

FIGURE 124. Color variation in *G. fultoni*: female (left) and both males (middle and right), all three from Crawford Co., IN (S03-62). Note narrow heads, especially in male on right, and separation of female tegmina.

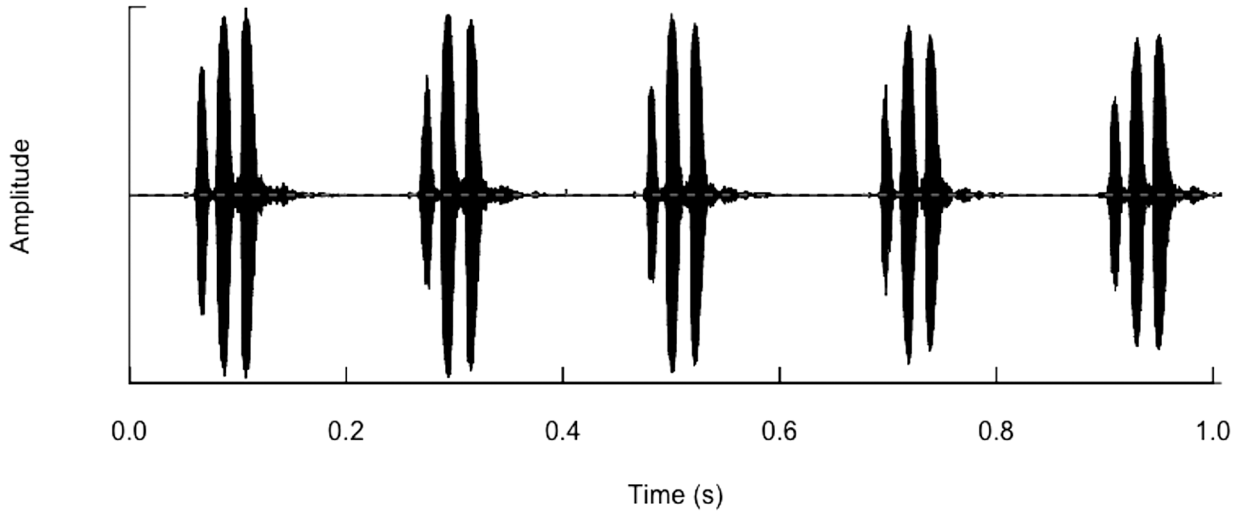

FIGURE 125. Calling song (R03-86) of *G. fultoni* from Hocking Co., Ohio (S03-64), recorded at 25°C.

Variation. **Color:** See Fig. 124 above. **Head width:** 28 of 36 males with head narrower than pronotum while 29 of 31 females with head narrower than pronotum. **Size:** Florida specimens are larger than more northern ones.

Specimens examined. **Arkansas:** *Garland Co.,* Lake Ouachita State Park, 16-vi-1995, T.J. Walker. **Indiana:** *Crawford Co*., Hwy 62 11.6 m W intersection with Hwy 135, 750', 4-vi-2003 (S03-62). **Kansas:** *Barber Co.,* 1 m

W Medicine Lodge on Hwy 160, 23-vi-1987 (S87-69). 27 m W Medicine Lodge on Hwy 160, 1750' 23-vi-1987 (S87-70). **Missouri:** *Hickory Co*., Pomme de Terre State Park, 1000', 20-vii-1993 (S93-49). *Jefferson* Co., Edmond A. Babler State Park, 750' 2-vi-2003 (S03-56). *Stone Co.,* Table Rock Dam Visitor Center, 31-v-2000 (S00-16) T.J. Walker. **Ohio:** *Hocking Co.* (near type locality), Hwy 33 9 m S Lanchester, 750', 5-vi-2003 (S03-64). **Oklahoma:** *Ataka Co.,* Jack Fork Mts. 3 m SW Daisy on Hwy 43, 750', 1-v-1988 (S88-46). *Osage Co.,* near Walnut Creek State Park, 600' 15-vi-1988 (S88-43). *Tulsa Co.,* Keystone State Park, 600', 15-vi-1988 (S88-42); Lake Keystone Dam Area 650', 27-v-2001 (S01-47); Tulsa, at intersection I44 and Hwy 244, 680', 9-vi-2007 (S07-22); near Tulsa, Exit 238 off I44 2 m E Tulsa city limit, 796', 15-vii-2013 (S13-68), 36° 09' 37.4 -95° 47' 33.1". **Texas:** *Bastrop Co.,* Bastrop State Park, 700' 31-v-1991 (S91-23). *Marion Co.,* Caddo Lake State Park, 300', 18-vi-1993 (S93-42).

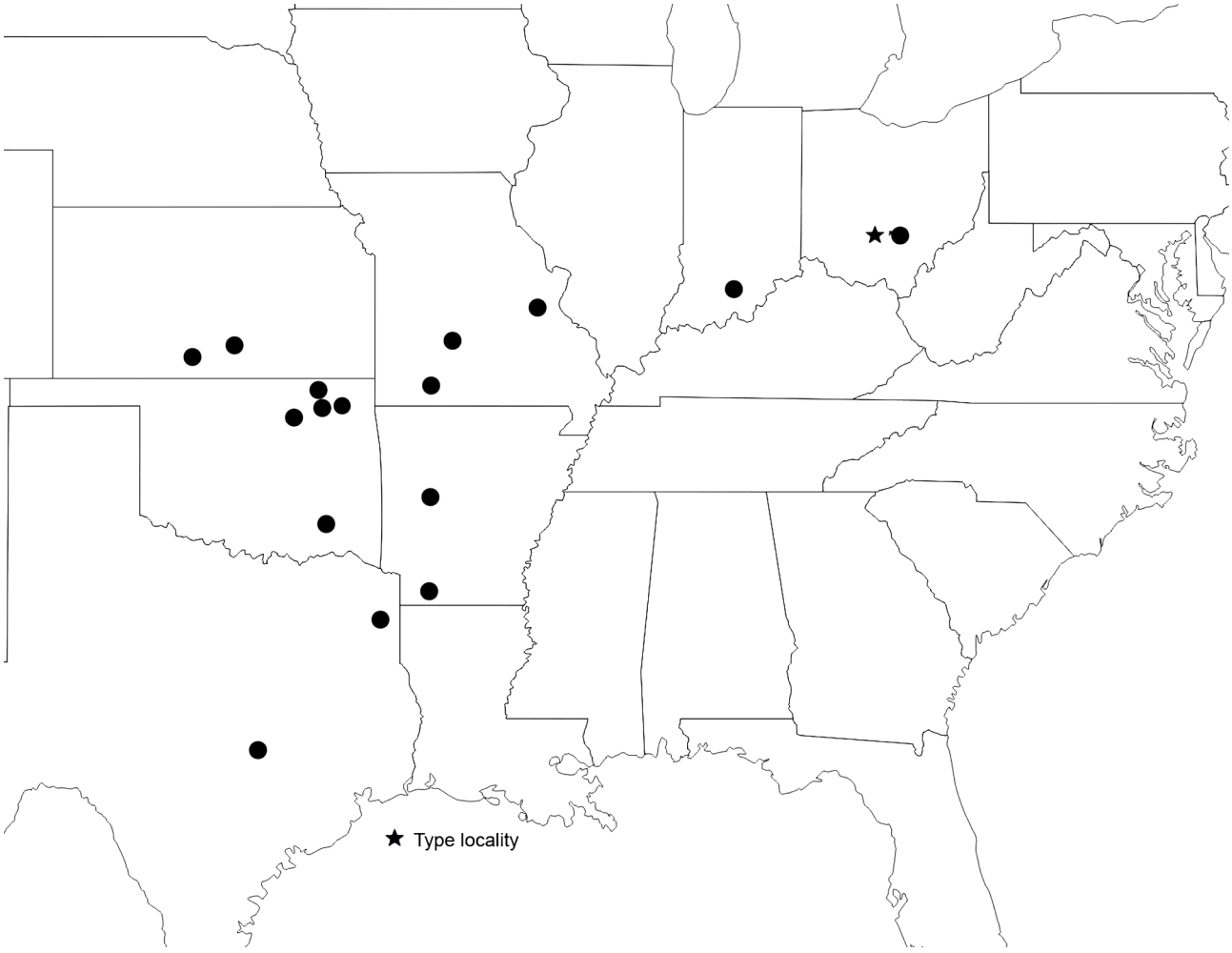

FIGURE 126. Populations of *G. fultoni* that we studied. See Walker (2019) for more eastern localities.

DNA. Multilocus G34 (Indiana, S03-62) sister species with *G. vernalis* and *G. cayensis* (Gray *et al.* 2019). ITS2 shows clear and complete separation between *G. fultoni* and *G. vernalis* (Fig. 115, p. 121), whereas two *G. fultoni* (Fig. 122, p. 125) from Missouri (G38 and G1703, both S03-56) have 16S sequences identical to microsympatric *G. vernalis,* suggesting the possibility of past hybridization.

Discussion. G. fultoni occurs microsympatric in Missouri (S03-56), Indiana (S03-62), and Ohio (S03-64) with *G. vernalis;* in Oklahoma (S88-42, S01-47 and S13-68) with *G. veintinueve*; and in Oklahoma (S13-68) with *G. veletis.* Thus, at the latter Oklahoma locality just east of Tulsa (S13-68), there are 3 *Gryllus* taxa synchronic and microsympatric that can have 3p/c with different PR and CR. Apparently females can discriminate between such small differences in songs.

Although called the southern wood cricket, the distribution of *G. fultoni* extends north of the northern wood cricket, *G. vernalis* (see Fig. 126 and Jang & Gerhardt 2006a, b).

Those males singing in woodlands and grassy areas can be difficult to catch because they sing from under dry

leaves and other vegetation. Those males singing in bushes and on tree trucks may jump on approach and get lost in the forest duff. A large butterfly net positioned beneath the male can help in these situations. Aggressiveness in this taxon studied by Jang *et al*. (2008).

***Gryllus cayensis* Walker**
Keys Wood Cricket
Figs 127–129

2001 *Gryllus cayensis* Walker 2001. Florida Ent. 84: 700. Holotype male (Fig. 127); allotype female (Fig. 128) (all courtesy Kyle Schnepp): Florida, Monroe Co., Key Largo. Deposited in FSCA Florida State Collection.

FIGURE 127. Holotype male of *G. cayensis*, with labels.

Distribution. Known only from southern Florida (Walker, 2019), and probably extirpated from the Florida Keys by past mosquito spraying that started in 1972 (Walker 2001).

Recognition characters and song. No calling song. Only woodland inhabiting *Gryllus* species there although *G. assimilis, G. firmus*, and *G. rubens* also occur in southern Florida (Capinera *et al*. 2004).

DNA. Multilocus 2018-002, Florida, Monroe Co., Everglades National Park, Long Pine Key, 14-v-2018. 25.401352° -80.660966°. Closest (Gray *et al.* 2019) to sister species *G. fultoni* and *G. vernalis*.

Discussion. The reader is referred to Walker (2001, 2019) for further information, since our exposure is limited. When DAG looked for them in Everglades National Park, in May, 2018, he was rained out on 3 consecutive nights and felt lucky to get 1 adult female to an oatmeal trail (Fig. 129). At least some individuals survived the area's 2017 flooding from Hurricane Irma.