

A MORPHOLOGICAL MEANS OF DISTINGUISHING FEMALES
OF THE CRYPTIC FIELD CRICKET SPECIES, *GRYLLUS RUBENS*
AND *G. TEXENSIS* (ORTHOPTERA: GRYLLIDAE)

DAVID A. GRAY^{1,4}, THOMAS J. WALKER², BRENDA E. CONLEY¹ AND WILLIAM H. CADE^{1,3}

¹Department of Biological Sciences, Brock University, St. Catharines, Ontario, L2S 3A1, Canada

²Department of Entomology and Nematology, University of Florida, Gainesville, FL, 32611-0620, USA

³Present Address: The President's Office, The University of Lethbridge, Lethbridge, Alberta, T1K 3M4, Canada

⁴Present Address: Department of Biology, The University of Lethbridge, Lethbridge, Alberta, T1K 3M4, Canada

The field crickets *Gryllus rubens* Scudder and *G. texensis* Cade and Otte (previously *G. integer* from Texas, see Cade & Otte (2000)) are the most commonly collected crickets throughout the southeastern United States from North Carolina to Texas. The two species are sympatric from western Florida to eastern Texas (Walker 1998). These two species are the only known trilling field crickets in the southeastern US, and are currently separated by song differences alone. Male *G. rubens* produce trilled calling song with pulse rates averaging ca. 55 pulses per second (p/s) at 25°C, whereas *G. texensis* produce trills with pulse rates averaging about 80 p/s at 25°C (Souroukis et al. 1992, Walker 1998, 2000 Martin *et al.* 2000). The pulse rates of the two species become more similar at lower temperatures, but provided that the temperature is above approximately 20°C, males can unambiguously be identified to species by song (Walker 1998; Gray & Cade 2000). No morphological means of distinguishing either males or females has previously been reported (see Nickle & Walker (1975) for other species of the southern United States). Here we report that most females of the two species can be separated on the basis of body-size relative ovipositor length: *G. rubens* have longer ovipositors relative to body size than do *G. texensis*.

We compared the ovipositor lengths and the pronotal widths of 122 females from several localities across the species' geographic ranges. Females were either laboratory reared from field-caught nymphs, laboratory reared offspring of field-caught field-inseminated females, or were field caught females. Females from allopatric sites were identified to species on the basis of col-

lection locality alone (*G. rubens*: Gainesville, FL (n = 15); *G. texensis*: Austin, TX (n = 14), Dallas, TX (n = 6)) or based on the songs of their brothers (*G. texensis*: Uvalde, TX (n = 2), Austin, TX (n = 1)). Females from sympatric sites (*G. rubens*: Milton, FL (n = 8), Marianna, FL (n = 12), Pensacola, FL (n = 5), Mobile, AL (n = 1), Decatur, AL (n = 1); *G. texensis*: Milton, FL (n = 32), Starkville, MS (n = 9), Tuscaloosa, AL (n = 4), Pensacola, FL (n = 4), Mobile, AL (n = 2), Carrollton, GA (n = 6)) were identified to species based on the songs of their brothers.

The crickets were measured as two replicates; replicates 1 and 2 represent crickets in the collections of DAG and the Florida State Collection of Arthropods, Gainesville, respectively. The data are presented together in Figure 1 and both separately and pooled in Table 1. We found that female *G. rubens* have ovipositors ca. 2.5 to 3 mm longer relative to their body size than do female *G. texensis*. For the pooled data, we tested the effect of species with pronotal width as a covariate using an ANCOVA. The model r^2 was 0.88 (i.e., 88% of the variation in ovipositor length was accounted for). Both species ($F_{(1,119)} = 170.96, P < 0.0001$) and pronotal width ($F_{(1,119)} = 440.93, P < 0.0001$) were significant predictors. A comparison of the slopes of ovipositor length on pronotal width was made by testing for a species x pronotal width interaction in a separate ANCOVA. The slopes did not differ (*G. rubens*, slope = 2.285, *G. texensis*, slope = 2.374; $F_{(1,118)} = 0.10, P < 0.7507$). The intercepts of the lines were 1.34 mm for *G. rubens* and -1.31 mm for *G. texensis*. Thus it should be possible to separate accurately most females of these two species.

TABLE 1. MEAN \pm SD OVIPOSITOR LENGTHS (MM) OF *G. RUBENS* AND *G. TEXENSIS*.

Replicate	<i>G. rubens</i>	<i>G. texensis</i>	$t_{(df)}$	P-value
1	14.42 \pm 0.79 (n = 24)	11.46 \pm 0.77 (n = 31)	$t_{(53)} = 13.91$	<0.0001
2	14.7 \pm 2.0 (n = 18)	11.2 \pm 2.4 (n = 49)	$t_{(65)} = 5.53$	<0.0001
Combined data	14.53 \pm 1.44 (n = 42)	11.30 \pm 1.91 (n = 80)	$t_{(120)} = 9.60$	<0.0001

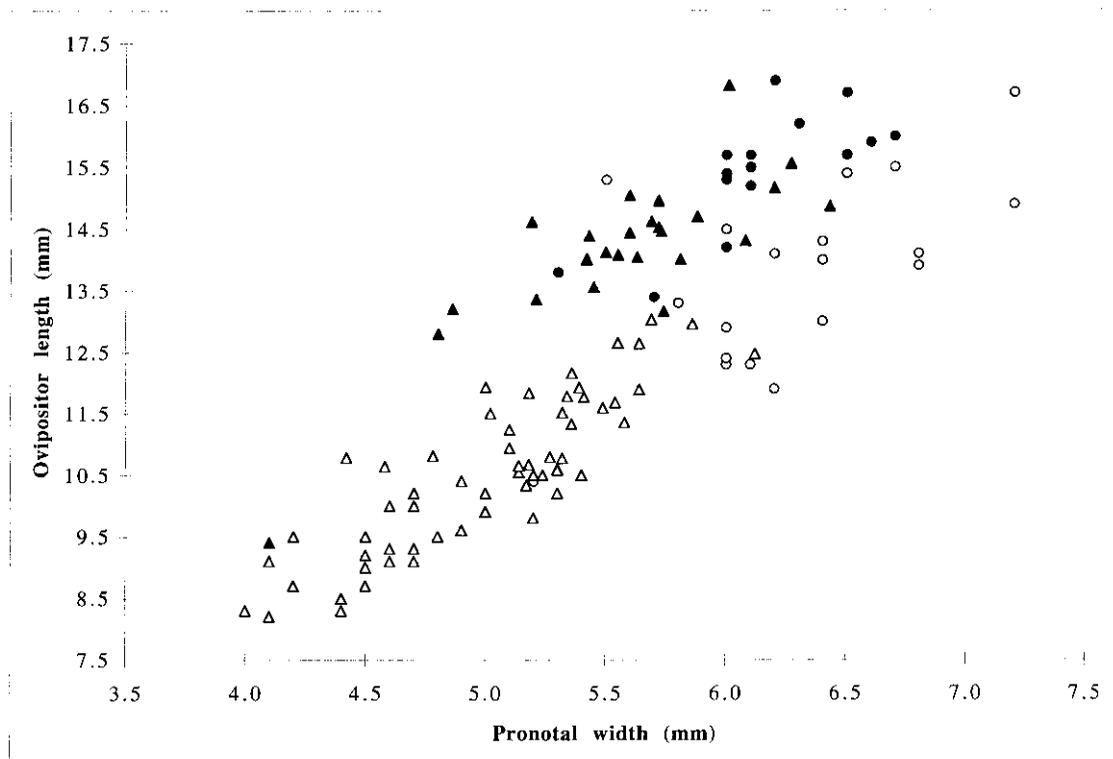


Fig. 1. Ovipositor length as a function of body size (pronotal width) in *Gryllus rubens* (filled symbols) and *G. texensis* (open symbols). Triangles represent individuals identified to species based on the songs of their brothers, whereas circles represent individuals identified to species based on locality alone. *G. rubens* have longer ovipositors than *G. texensis*.

SUMMARY

Females of the field crickets *Gryllus rubens* and *G. texensis* can generally be distinguished on the basis of their ovipositor length relative to body size. *G. rubens* females have longer ovipositors than do *G. texensis*.

REFERENCES CITED

- CADE, W. H., AND D. OTTE. 2000. *Gryllus texensis* n. sp.: A widely studied field cricket (Orthoptera; Gryllidae) from the southern United States. *Trans. Am. Entomol. Soc.* 126: 117-123.
- GRAY, D. A., AND W. H. CADE. 2000. Sexual selection and speciation in field crickets. *Proc. Natl. Acad. Sci. USA.* 97: 14449-14454.
- MARTIN, S. D., D. A. GRAY, AND W. H. CADE. 2000. Fine-scale temperature effects on cricket calling song. *Can. J. Zool.* 78: 706-712.
- NICKLE, D. A., AND T. J. WALKER. 1975. A morphological key to field crickets of Southeastern United States (Orthoptera: Gryllidae: *Gryllus*). *Florida Entomol.* 57: 8-12.
- SOUROUKIS, K., W. H. CADE, AND G. ROWELL. 1992. Factors that possibly influence variation in the calling song of field crickets: temperature, time, and male size, age, and wing morphology. *Can. J. Zool.* 70: 950-955.
- WALKER, T. J. 1998. Trilling field crickets in a zone of overlap (Orthoptera: Gryllidae: *Gryllus*). *Ann. Entomol. Soc. Am.* 91: 175-184.
- WALKER, T. J. 2000. Pulse rates in the songs of trilling field crickets (Orthoptera: Gryllidae: *Gryllus*). *Ann. Entomol. Soc. Am.* 93: 565-572.