

Two Introduced Field Crickets New to Eastern United States (Orthoptera: Gryllidae)¹

RICHARD D. ALEXANDER² AND THOMAS J. WALKER³

ABSTRACT

The Jamaican field cricket *Gryllus assimilis* (Fabricius), widely distributed in the West Indies and in South and Central American countries bordering the Caribbean, appears to be established in south Florida. A Japanese burrowing cricket, *Scapsipedus micado* Sausure, was found in Huntsville, Alabama, in August 1959. Distinguishing characters and song descriptions are given

for both species. Their manner and time of introduction are not known: *assimilis* has been abundant from the Miami area south since 1958, but five pinned specimens dated 1941, 1954, and 1956 have been seen. The Gryllinae of the eastern United States are listed, common names are suggested, and the probable effect of shipping various kinds of crickets for bait purposes is discussed.

The following species of Gryllinae, or house and field crickets, are presently known from the eastern United States:

- Acheta domesticus* (Linnaeus). The House Cricket (introduced)
- Gryllus vernalis* Blatchley.⁴ The Northern Wood Cricket
- Gryllus fultoni* (Alexander). The Southern Wood Cricket
- Gryllus veletis* (Alexander and Bigelow). The Spring Field Cricket
- Gryllus pennsylvanicus* Burmeister. The Fall Field Cricket
- Gryllus rubens* Scudder. The Southern Field Cricket
- Gryllus firmus* Scudder. The Sand Cricket
- Miogryllus verticalis* (Serville). The Little Field Cricket
- Anurogryllus muticus* (De Geer). The Short-Tailed Cricket
- Grylloides sigillatus* Walker. The Decorated Cricket (introduced)

In this paper we add two species that have apparently been introduced.

Gryllus assimilis (Fabricius), 1775, p. 280

THE JAMAICAN FIELD CRICKET

This cricket is widely distributed in the West Indies and in South and Central American countries bordering on the Caribbean. It was described from Montego Bay, Jamaica, and no other *Gryllus* species has been clearly distinguished on Jamaica. Prior to 1958 this cricket had not been identified from the United States, although its name (the oldest for American field crickets) was unfortunately used many years for all American field crickets as a result of Rehn and Hebard's (1915) synonymizing of American *Gryllus* species. It is now clear, in spite of Rehn's (1958) remarks to the contrary (p. 287), that there are many native American field crickets that can be distinguished easily, especially by biologists who do not rely solely upon structural characteristics of preserved specimens. In fact, no species has yet been found that cannot also be distinguished by combinations of morphological characteristics.

In 1956 Alexander determined from preserved specimens in various collections that Jamaican field crickets are different from North American species and concluded (Alexander 1957) that the name *assimilis* was not appropriate for any native United States field cricket. In January 1958, Dr. Thomas Farr, entomologist at the Institute of Jamaica, Kingston, kindly collected and shipped living Jamaican field crickets to Alexander, and their distinctiveness was further confirmed when these matured and sang. Five individual pair-matings with United States field crickets—two with *G. firmus* and three with three different western United States species that are still undescribed—all failed to produce offspring, and no copulations were seen. Through mass-stress matings Bigelow (1958, 1960a) has produced hybrids between Jamaican and North American field crickets, and between North American species. All of these hybrids are unusual and are definitely not found in nature. They have been produced in mating situations that probably cannot occur in the field, and they do not bear directly on the question of specific distinctness when sympatric populations are involved, except that the lowered breeding success and the nature of the hybrids confirm that speciation is complete.

¹ Accepted for publication April 24, 1961.

² Museum of Zoology and Department of Zoology, The University of Michigan, Ann Arbor.

³ Department of Entomology, University of Florida, Gainesville.

⁴ In spite of the rash of publications dealing with the generic status of the 200 or so cricket species across the world that have at various times and by various authors been placed in the genera *Gryllus* Linnaeus and *Acheta* Fabricius (cf. Gurney 1951, Chopard 1955, Cousin 1956, 1958, Jobin and Bigelow 1961), the problem has not yet been completely solved. One thing, however, is clear: native American field crickets are more closely allied to the European field cricket, *Gryllus campestris* Linnaeus (type of *Gryllus*), than they are to *Acheta domesticus* (Linnaeus) (type of *Acheta*). The published evidence is as follows: (1) males of American and European field crickets possess an epiphallal hook that is absent in males of both *Acheta* and *Grylloides* (compare Berlese's 1880 drawings of *G. campestris* with Rehn and Hebard's 1915 drawings of *A. domesticus* and an American field cricket, probably *G. pennsylvanicus*, and with Snodgrass' 1937 drawings of an American field cricket, probably *G. pennsylvanicus*, and of *Grylloides sigillatus*); (2) the spermatophore of *A. domesticus* (cf. Lespes 1855, Khalifa 1949) lacks the paired, recurved hooks or lobes present on the distal end of the spermatophore plate in *G. campestris* (Lespes 1855) and American field crickets (Snodgrass 1937, Jensen 1911); (3) Cousin (op. cit. found that American and European field crickets are interfertile, but none of them crosses with *A. domesticus*); (4) Alexander (1961) found that a *G. veletis* male could not grasp the subgenital plate of a female of *A. domesticus*, although both individuals actively assumed the copulatory position repeatedly and for extended periods; (5) the postcopulatory behavior of *G. campestris* and *G. bimaculatus* (Hormann-Heck 1957) is very similar to that of *G. veletis*, *G. pennsylvanicus*, and *G. rubens* (Alexander 1961) but differs from that of *A. domesticus* (Khalifa 1950); and (6) the entire sound repertoire of *G. campestris* is practically identical to that of *G. pennsylvanicus* and *G. veletis* (Huber 1955, Alexander and Bigelow 1960, Alexander 1961).

In August 1958, from the grassy median of U. S. Route 1 in Miami, Florida, Walker heard and collected an unfamiliar species of field cricket. Within the next few days he collected the same species about a fish market at Homestead and about a parking lot in Everglades National Park. The loud, characteristic stridulation of the species was heard nowhere in the Florida Keys or in many other localities in south Florida where Orthoptera were collected during the same trip. Since this cricket was not among the species discussed by Alexander in his 1957 revision, Walker sent specimens and tape recordings to Alexander, who identified it as *Gryllus assimilis* (Fabricius).

Although pinned specimens of *assimilis* are easily recognized by their particular combination of coloration, body shape and size, and pubescence, it is difficult to make an objective translation of these characters. This species is perhaps the *brownest* of all American field crickets—it is really black only on the visible portions of the abdomen and the front of the head. All other eastern North American field crickets have glossy black or largely glossy black heads and pronota. Part of the difference in effect is due to a consistently dense pubescence on *assimilis*, especially on the pronotum, which prevents the head and pronotum from giving a glossy appearance even when they are largely black. This pubescence is characteristic of South and Central American *assimilis* as well as of specimens from the West Indies and Florida.

The lighter coloration of *assimilis* is buff or tan rather than reddish as is most frequent in native United States *Gryllus* species. The species is usually macropterous, probably in higher proportion than any other American field cricket, and the ovipositor of the female is invariably shorter than the body.

The number of teeth in the stridulatory file effectively distinguishes males of *assimilis* from those of most other North American field crickets. Rakshpal (1960) found that 50 *assimilis* males (from Jamaica) had 115-130 teeth, while 50 *rubens* males had 82-111 teeth, and 50 *pennsylvanicus* and 50 *veletis* males had 130-174 teeth. We find 105-124 teeth on six *assimilis* males (from Florida), 93-101 teeth on three *rubens* males, 100-122 teeth on three *fultoni* males, 190-197 teeth on three *firmus* males, and 120-125 teeth on a single *vernalis* male. We note that this character also distinguishes males of *rubens* from those of *pennsylvanicus*, *veletis*, and *firmus*, separations that are otherwise difficult to make. Alexander (1957) details other morphological differences among North American *Gryllus* species.

The calling, courtship, and aggressive sounds of the Jamaican field cricket have been illustrated by Alexander (1961). The calling song is a succession of loud chirps and is easily distinguishable from those of all other North American species by the high pulse rate (about 90 per second at 80° F.) and very slow chirp rate (about one per second). The frequency is about four kilocycles per second, and

each chirp contains eight or nine pulses. Among eastern United States species, only the house cricket and the little field cricket have comparable chirp rates. However, the rather weak chirp of *A. domesticus* has only two or three pulses delivered at about 15 per second at 80° F., and the chirp of *M. vernalis* is high-pitched (about 7 kilocycles per second) and buzzy.

Since the initial discovery of *assimilis* in south Florida, Walker has found five specimens in the collection of the Division of Plant Industry, Florida Department of Agriculture, taken at lights as follows: Goulds, 24 January 1941 (2 ♀ ♀); Key Largo, 29 October 1954 (1 ♂), 25 February 1956 (1 ♂, 1 ♀). We have also added several field records. In late January 1959, on a brief trip to south Florida, Walker heard and collected several specimens along the highway through South Bay and in a mowed area at the University of Florida Sub-Tropical Experiment Station at Homestead. On Key Largo and Plantation Key he found *assimilis* in large numbers along roadsides and on lawns. In April 1960, Dudley A. Palmer collected specimens of *assimilis* from lawns in Miami and brought them to Walker. In August 1960, Palmer reported that adults of *assimilis* had been present in Miami continuously at least since April. In June 1960, Alexander found *assimilis* abundant under mulch piles at the Sub-Tropical Experiment Station, Homestead; in lawns and around lights in Miami; and at automobile service stations along U. S. Route 1 between Miami and Homestead. On the night of 12 August 1960, while driving south from Ocala, Florida, on U. S. Route 27, Walker attempted to determine the northern limits of *assimilis* by listening for its song. The species was first heard at Moore Haven, where it was abundant about lights and along the highway. It was also heard at Clewiston, where the night's trip ended. Two nights later Walker drove south on U. S. Route 1 from West Palm Beach to North Miami Beach. The species was noted in the following towns: Lake Worth, Deerfield Beach, Oakland Park, Fort Lauderdale, Hollywood, Hallendale, North Miami Beach. It was not heard in the other towns along the way, but where it did occur it was usually abundant. On 15 August 1960, *assimilis* was heard in Homestead. On 16 August, on a drive at night from Big Pine Key to Key West and back, Walker heard no *assimilis*, and the only other record on this trip to south Florida was along the road a few miles north of Flamingo in Everglades National Park.

There are some problems regarding the distribution and abundance of *assimilis* in south Florida. Prior to location of the 1941, 1954, and 1956 specimens, we had interpreted the apparent spread in distribution and rise in abundance between 1958 and 1960 as evidence for a recent introduction, perhaps as a result of use as fish bait. Thus, Walker found *assimilis* in small numbers in August 1958, but during 4-6 May 1957 and 10-14 June 1958, Alexander col-

lected in south Florida, especially in the Miami and Homestead areas, and failed to find it. Yet during 23-27 June 1960, Alexander stayed at the same residence in south Miami as in 1958, and within 5 minutes after arriving recognized the song of *assimilis* in a lawn across the street. Singing males were heard in at least a dozen different locations where they had not been heard in 1958, and adults were collected several times without the use of song, sometimes in great abundance. On each subsequent visit to south Florida, Walker has found *assimilis* in new locations. He has noted that *assimilis* is much more spottily distributed than *firmus* and *rubens*, yet where *assimilis* occurs it is usually more abundant than the other two species.

The Jamaican field cricket may have been present in Florida a long time before 1941, and it may have been introduced either through human activities or in some other way. But its general absence from collections suggests that it has not previously been very abundant in Florida. For example, there are no specimens in the extensive University of Michigan Museum of Zoology collection of Florida Orthoptera; none occur among the Florida field crickets in the Blatchley collection at Purdue or in the Museum of Comparative Zoology at Harvard; and Alexander did not recognize any *assimilis* specimens among Florida crickets at the Philadelphia Academy of Science or the United States National Museum when he examined these collections in 1956 and 1958, respectively. If this cricket has been re-introduced recently, or if it is for some reason undergoing a rapid increase in abundance and a spread in distribution from an early introduction, then it may spread north from south Florida during the next few years. However, it is not a diapausing cricket; consequently it cannot be expected to survive long or severe winters, and it should not penetrate inland from the Florida peninsula. We have no information that would indicate whether or not it could become a significant pest. It can become extremely abundant, as was demonstrated in June 1960 at a service station along U. S. Route 1, north of Homestead, where hundreds of crickets were still in evidence at noon, running, hopping, and flying about after having accumulated under the lights during the previous night. Neither of us has seen any other field cricket so abundant.

Scapsipedus micado Saussure, 1877, p. 415

THE JAPANESE BURROWING CRICKET

In August 1959, while driving through Huntsville, Alabama, late at night, Alexander heard a cricket song that he had not heard before in eastern United States coming from the grassy median of U. S. Route 231. Several individuals were collected, and a colony was maintained through one complete generation in the laboratory. This proved to be a species of the African and Asian genus *Scapsipedus*. Specific identification of such material is exceedingly

difficult, and not likely to be finally correct because there has been little biological work on crickets from these parts of the world. It is obvious from the work that has been done that the systematic problems are similar to those in North America; closely related species are difficult to distinguish morphologically until ecological and behavioral work initially separates groups of specimens for comparison. The crickets involved here fit Saussure's (1877) description of *S. micado*, and they do not fit any other species described by him. Dr. Lucien Chopard of the Museum d'Histoire Naturelle, Paris, has concurred in this tentative identification.

Unfortunately, we have no information as to where, how, or when this cricket entered the country, or where it actually came from.⁵ House crickets are sold in several Huntsville bait stores, and the largest population of *S. micado* occurred almost directly across the street from one of these stores. The possibility that this cricket was unsuccessfully tried for bait rearing could not be eliminated; local bait store proprietors would scarcely discuss the matter, perhaps fearful that someone might get into trouble if information of any kind was revealed.

This cricket can be distinguished rather easily from other North American crickets. First, there are four, longitudinal, pale, ragged stripes on the head and a narrow, pale, transverse stripe above the antennae between the compound eyes. The pronotum is speckled with pale coloration, and the palpi are white. These characteristics alone distinguish it from all North American Gryllinae. Males in the genus *Scapsipedus* also have a slightly elongate and dished face that is different from North American crickets. *S. micado* is about the size of North American *Gryllus*, but as with many Asian crickets, its lighter coloration tends to be grayish rather than reddish as in North American Gryllinae.

S. micado has a chirping song, delivering about three, six-pulse chirps per second. The pulse rate within the chirps is about 45 per second at 80° F. The three basic sounds of the species are illustrated by Alexander (1961). The calling song is so similar to those of other chirping field crickets in eastern North America that only an expert who recognizes the particular combination of pulse rate, chirp rate, chirp length, and frequency (pitch) could be expected to notice its distinctiveness. However, the courtship song is quite unlike those of *Acheta*, *Gryllus*, and *Gryllodes* species. It is made up of short, clear trills that begin abruptly, sometimes with a "catch" or vibrato, and then drop off slightly in intensity and slow in pulse rate.

With the exception of *Anurogryllus muticus*, *S. micado* seems to be a more extensively burrowing cricket than our other Gryllinae. Alexander (1961) illustrates a unique "hood" or "awning" that the male constructs out of substrate particles over the mouth

⁵ Jobin and Bigelow (1961) mention that a cricket probably belonging to *Scapsipedus* was collected by Bigelow in 1958 in North Carolina, but we have not seen the specimen.

of his burrow while excavating. This cricket's potentialities as a pest, as well as its chances of succeeding in the United States, are completely unknown. In June 1960, too early for adults, Alexander searched intensively in Huntsville without locating any juveniles. The area has been changed considerably by construction, but it is unlikely that a successful colony could have been eliminated by this activity. In 1959, singing males were heard sporadically from the southern part of Huntsville to several miles north of town, suggesting that the colony was more than a year old. This is apparently an egg-diapausing species, for the eggs laid in the laboratory hatched only after being subjected to temperatures below freezing, following a delay of several months without hatching. Eggs kept at room temperature did not hatch. With respect to diapause, at least, this species seems adapted to survive in northern climates. We wonder if some of the Huntsville crickets were not the result of someone throwing out in disgust a batch of unhatched eggs, perhaps during late fall or early winter.

DISCUSSION

Nearly every field and house cricket in eastern North America has been tried at one time or another in the expanding business of fish bait rearing, but practically all have proved unsuitable because they have obligate diapauses, either as eggs or as late juveniles. These diapauses can be by-passed only if the crickets are kept at very high temperatures continuously, or if they are passed through a cold spell; even after such special treatment, developmental rates are usually slower and more erratic than in non-diapausing crickets. For some unknown reason, colonies of diapausing crickets become progressively weaker with each generation. The result is that practically every bait house in the United States now rears the house cricket. This cricket is already widely distributed across North America, and rarely if ever has it become more than a simple nuisance, even to those totally unappreciative of its pleasant, persistent chirp. The decorated cricket can also be reared without difficulty, but the only bait house known to us to have used it has changed back to house crickets for unknown reasons. Outdoors, the decorated cricket is rather strictly tropical, and because it does not seem so successful as the house cricket in invading heated buildings, its distribution is not likely to expand significantly in the United States. Presently it is known outside greenhouses and other heated buildings along the Gulf Coast from Florida to southern Texas. These two introduced crickets can probably be shipped freely in the United States without danger. The limited distributions of the native American field crickets, together with their obvious failure to become established in unusual locations as a result of repeated use in bait shipments, indicate that there is no reason for restricting the shipment of eastern crickets around eastern United States. For the same reasons, *G. assimilis*, likely

eventually to be picked up by bait houses because they are always on the lookout for a new and unusual cricket, will probably never become established outside locations that it can enter on its own. The potential results of shipments involving western crickets, southeast-southwest transports, and introduced diapausing crickets such as *S. micado* are more uncertain.

The colloquial names used in this paper have either been coined by us (where none existed previously) or else shortened and otherwise altered from those suggested by Alexander (1957), partly in the light of appropriate names for western field crickets yet to be described and distinguished, and partly because of changes in known distribution (*firmus*) or in classification (*pennsylvanicus* and *veletis*) (cf. Alexander and Bigelow 1960). These names have been suggested for inclusion in the Entomological Society of America's list of common names of insects.

The reference list below includes all the papers dealing with North American field crickets since Fulton's (1952) work restimulated interest in this group.

REFERENCES CITED

- Alexander, R. D. 1957. The taxonomy of the field crickets of the eastern United States (Orthoptera: Gryllidae: *Acheta*). Ann. Ent. Soc. Amer. 50(6): 584-602, 19 figs., 1 table.
1961. Aggressiveness, territoriality, and sexual behaviour in field crickets. Behaviour [Leiden], 27 (2-3): 130-223, 63 figs., 31 tables.
- Alexander, R. D., and R. S. Bigelow. 1960. Allochronic speciation in field crickets, and a new species, *Acheta veletis*. Evolution 14(3): 334-46, 5 figs.
- Berlese, A. 1880. Osservazioni sulla anatomia descrittiva del *Gryllus campestris* L. Atti Soc. Veneto-Trentina 1880: 200-98, 4 pls.
- Bigelow, R. S. 1958. Evolution in the field cricket, *Acheta assimilis* Fab. Canadian Jour. Zool. 36(1): 139-51, 3 tables.
- 1960a. Interspecific hybrids and speciation in the genus *Acheta* (Orthoptera, Gryllidae). Canadian Jour. Zool. 38(3): 509-24, 2 figs., 4 tables.
- 1960b. Developmental rates and diapause in *Acheta pennsylvanicus* (Burmeister) and *Acheta veletis* Alexander and Bigelow (Orthoptera: Gryllidae). Canadian Jour. Zool. 38(5): 973-88, 9 figs., 2 tables.
- Chopard, L. 1955. Note sur un grillon gynandromorph provenant du Congo Belge. Mém. Soc. Ent. Belgique 27: 153-7, 2 figs.
- Cousin, G. 1956. Biométrie et définitions de morphologie quantitative des espèces et de leurs hybrides. Bull. Soc. Zool. France 81(4): 247-89, 29 figs.
1958. Hybridisations interspécifiques entre Gryllides et considérations sur l'évolution du groupe. Proc. 10th Internat. Congr. Ent., Montreal 1956, 2: 881-97, 14 figs. 1 table.
- Fulton, B. B. 1952. Speciation in the field cricket. Evolution 6(3): 283-95, 4 figs.
- Gurney, A. B. 1951. The names of the field and house crickets. Jour. Econ. Ent. 44(4): 611.
- Hörmann-Heck, S. 1957. Untersuchungen über den Erbgang einiger Verhaltensweisen bei Grillenbastarden (*Gryllus campestris* L. x *Gryllus bimaculatus* De-Geer). Zeitschr. Tierpsychol. 14(2): 137-83, 18 figs., 31 tables.
- Huber, F. 1955. Sitz und Bedeutung nervöser Zentren für Instinkthandlungen beim Männchen von *Gryllus*

- campestris* L. Zeitschr. Tierpsychol. 12(1): 12-48, 26 figs., 14 tables.
- Jensen, J. P.** 1911. The structure and systematic importance of the spermatophores of crickets. Ann. Ent. Soc. Amer. 4(1): 63-66, 4 figs.
- Jobin, L. J., and R. S. Bigelow.** 1961. An Old World field cricket species in America (Orthoptera: Gryllidae: *Scapsipedus*). Canadian Ent. 93(4): 313-19, 8 figs.
- Khalifa, A.** 1949. The mechanism of insemination and the mode of action of the spermatophore in *Gryllus domesticus*. Quart. Jour. Microsc. Sci. 90(3): 281-92, 7 figs.
1950. Sexual behaviour in *Gryllus domesticus* L. Behaviour [Leiden] 2(4): 264-74, 2 figs., 3 tables.
- Lespes, C.** 1855. Mémoire sur les spermatophores des grillons. Ann. Sci. Nat. [Paris], Zool. 3(4): 366-77, 14 figs.
- Rakshpal, R.** 1960. Sound-producing organs and mechanisms of song production in field crickets of the genus *Acheta* Fabricius (Orthoptera, Gryllidae). Canadian Jour. Zool. 38(3): 499-507, 3 figs.
- Rehn, J. A. G.** 1958. The origin and affinities of the Dermaptera and Orthoptera of western North America. In: Zoogeography (Hubbs, ed.). Amer. Assoc. Adv. Sci. Publ. 51: 253-98.
- Rehn, J. A. G., and M. Hebard.** 1915. The genus *Gryllus* (Orthoptera) as found in America. Proc. Acad. Nat. Sci. Philadelphia 67: 292-322, 12 figs.
- Saussure, H. de.** 1877. Mélanges orthoptérologiques. 5^e fascicule. Mém. Soc. Phys. Hist. Nat. Genève 25(1): 1-352.
- Snodgrass, R. E.** 1937. The male genitalia of orthopteroid insects. Smithsonian Misc. Coll. 96(5): 1-107, 42 figs.

Reprinted from the

ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA

Volume 55, Number 1, pp. 90-94 January, 1962