Short Communications

More winged females of the cricket *Gryllodes supplicans* (Walker)

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The cosmotropical cricket *Gryllodes supplicans* occurs in two forms, a common micropterous form and a rare macropterous form. The unusual macropterous form occurs naturally in Sri Lanka and Bermuda, but has also been produced by laboratory manipulation of environmental conditions. This article is a preliminary report on a successful independent repetition of the breeding of macropterous females from micropterous stock, collected in Pretoria. Although it has been argued that these two forms represent two different species, the fact that macropterous individuals can be produced from micropterous parents can only be accommodated by regarding them as two forms of one species.

Die kosmotropiese kriek *Gryllodes supplicans* kom voor in twee vorms, 'n volop kortvlerkige en 'n skaars langvlerkige vorm. Die ongewone, langvlerkige vorm kom wild voor in Sri Lanka en Bermuda, maar is ook voortgebring deur die manipulasie van omgewingstoestande in die laboratorium. Hierdie artikel is 'n voorlopige verslag oor 'n suksesvolle, onafhanklike herhaling van die teling van langvlerkige wyfies van 'n kortvlerkige bevolking, versamel in Pretoria. Alhoewel daar geargumenteer is dat hierdie vorms twee verskillende spesies verteenwoordig, kan die voortbring van langvlerkige individue uit kortvlerkige ouers slegs verklaar word indien hul as verskillende vorms van een spesie beskou word.

The crack or crevice inhabiting cosmotropical cricket, *Gryllodes supplicans*, has a wide distribution, having been shipped all over the world in crates. The common female form (form *sigillatus*) is micropterous, with minute tegminal pads (Figure 1), while the common male form has brachypterous tegmina, which are used for sound production during stridulation. In the rare winged form (form *supplicans*), both sexes have fully developed tegmina and wings (Kevan 1980). The occurrence of two forms of the same species is common in crickets and locusts, but also occurs in many other orders of insects (Jago 1985; Masaki & Walker 1987; Roff 1990). In several of these cases, including the one under discussion, the two forms were originally described in different genera. One of the most important reasons for regarding the two forms of *G. supplicans* as one species is the fact that winged forms have been produced from wingless forms in controlled laboratory conditions (Ghouri & McFarlane 1958). The appearance of fully winged forms obviously depends on the presence of appropriate genetic material, but can be induced by a combination of factors such as crowded conditions, a high protein diet, high temperatures, relatively high humidity and high day to night ratios (Masaki & Oyama 1963; McFarlane 1964; Mathad & McFarlane 1968).

Gryllodes supplicans and *G. sigillatus* were originally regarded as two species. They were synonymized by Chopard in 1967. In 1980 Kevan pointed out that *G. supplicans* had priority over *G. sigillatus* and discussed the problem in more detail. However, the synonymy of these two species was not universally accepted, and Otte (1987) argued that they were two separate species. Unfortunately the two syntypes of *supplicans* are missing, so there was little hope of resolving the taxonomic problem with reference to type material. With only limited evidence available, there were few ways in which progress could be made. One way of obtaining additional information was to attempt to induce the development of the winged form in an independent repetition of McFarlane's experiments.

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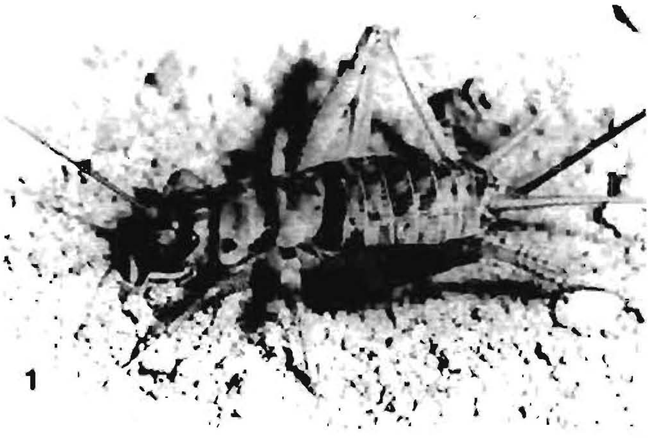

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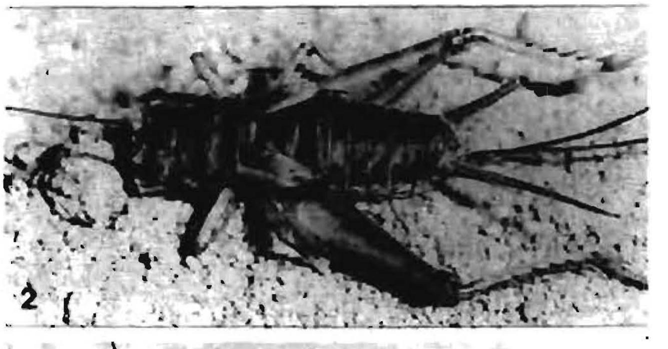

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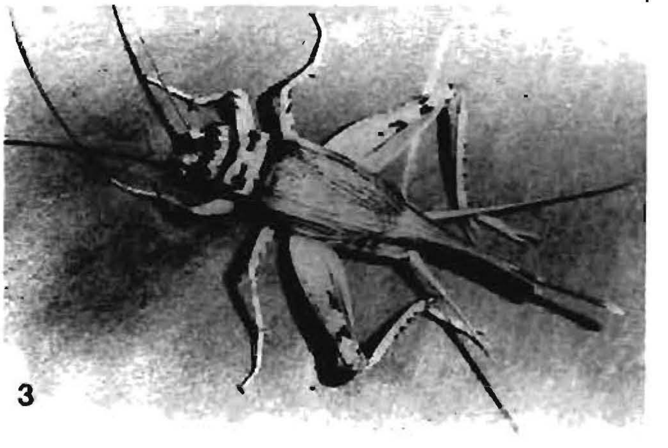

Figures 1–3 Different forms of the cricket *Gryllodes supplicans*. **1** Common micropterous form (form *sigillatus*). **2** An unusual brachypterous female form with developed tegmina and hind wings. **3** Macropterous female reared in this study (form *supplicans*).

The current culture was started in February 1991. Crickets were collected at two localities in Pretoria. Plastic jars 19 cm high with a diameter of 12 cm were used as cages. To provide ventilation, fine stainless-steel gauze was inserted in an 8 cm diameter hole in the lid. After experimenting briefly with different foods such as cat pellets, Pro-Nutro and Silgro chicken starter-mash, it was found that the crickets preferred the starter-mash and other food types were discontinued. The bases of the jars were covered with a 3-cm layer of vermiculite and sand (1 : 1) which was kept moist to provide drinking water and a suitable substrate for oviposition. After the emergence of juveniles, crowded conditions were maintained until the selection of breeding stock for the next generation had been completed. The crickets were kept in a room which was maintained between 25° and 30°C with a Capil thermostatically controlled heater. The day : night ratio was 8 : 16. Cycles were controlled with a time plug which switched a 250-W globe.

The first notable success occurred in December 1991, when a brachypterous female was found in one of the containers (Figure 2). This female was isolated with a male with normal tegmina. On 7 May 1992 one of the daughters of this female was seen to have well developed hind wings, but a relatively short ovipositor, suggesting that she was not fully mature. On 11 May 1992 this female underwent her final moult and became a macropterous adult female (Figure 3). Two days later a second fully winged individual emerged from its final moult, but this individual was the daughter of a micropterous female.

The independent production of a winged female, using South African examples of this species, suggests that the reversion from one form to the other is not particularly difficult to achieve. Since the genetic potential to transform was present in the small sample we used, it is highly probable that the winged form occurs naturally. This would be most likely to occur in a warm, humid part of the world like Sri Lanka, the type locality for *G. supplicans* form *supplicans*.

It is noteworthy that fully winged individuals were produced in spite of sub-optimal (8 : 16) day : night ratios used during our first efforts to manipulate phenotype using environmental conditions. According to Mathad & McFarlane (1968) a 14-h photoperiod is optimal for this species. The fact that macropterous forms were produced means that it is not essential to have such long photoperiods, provided that other conditions are appropriate.

Are *supplicans* and *sigillatus* different species?

Otte (1987) cited three reasons for regarding *Gryllodes supplicans* and *G. sigillatus* as different species. 'Because the type of *supplicans* is a female from Ceylon while that of *sigillatus* is a female from Swan River, Western Australia, and because one species is macropterous while the other is micropterous it is probable that they belong to two different species.'(*ibid.*) The only remaining evidence that *sigillatus* and *supplicans* are different species concerns the drawings of male genitalia by Chopard (1969, Figures 65 and 66, p. 87). According to Otte (1987), 'expert and novice alike will agree that these cannot belong to the same species'.

The fact that the two types come from different localities, in Sri Lanka and Australia, is meaningless when one looks at the cosmotropical distribution of this species, and the way it can be moved around in crates. I have found this species in every town or city in South Africa and every restcamp in the Kruger National Park. Otte's second reason for regarding *supplicans* and *sigillatus* as two different species was the different lengths of their wings. However, the fact that wing length can be altered in laboratory manipulations makes this an inconsequential difference, and Chopard (1969) maintained that if winged forms from laboratory manipulations were similar to *supplicans* that these should be regarded as one species.

As far as the genitalia are concerned, in contrast to Otte's statement above, Chopard (1969) maintained that the genitalia are only slightly different. Unfortunately, it is not known where the specimens which Chopard illustrated come from. My own examination of genitalia of micropterous males from Pretoria suggests that the genitalia of this species resemble Chopard's *supplicans* more when they are tilted forward, and *sigillatus* when they are tilted backward (Figure 4). Nothing is known of the intraspecific variation in genitalia and no study on the genitalia of macropterous forms produced in the laboratory has been published. There is no evidence that *supplicans* and *sigillatus* are different species. Available evidence does not resolve the taxonomic problem, but the fact that macropterous forms can be produced from micropterous parents must be accommodated, and is only accommodated by regarding these as forms of one species. Detailed examination of macropterous specimens from laboratory cultures, Bermuda and Sri Lanka, with special reference to intraspecific variation in genitalia, should provide sufficient evidence to resolve this problem.

Phase dimorphism and communication

Experimental animals with two different forms are of great potential value in helping us to understand phase dimorphism and related phenomena. Thus crickets with different forms might help us to understand the evolution of phase dimorphism in locusts, which might help in our efforts to control them. Another possible use for these insects is in the study of the evolution of communication, since a correlation

Figure 4 Photograph of genitalia of a micropterous male from Pretoria.

exists between the presence and absence of wings and ears in crickets. In the common form of this species, anterior tympana are missing. If there is a genetic link between the presence and absence of wings and ears, as suggested by Otte (1990), we might expect the ears and wings to always appear or disappear together. In fact, neither of the first two form *supplicans* females which developed in our laboratory have anterior tympana. However, if the presence or absence of wings and ears are both under developmental control (Toms 1992), the reappearance of organs would require the genetic potential to produce the organ, and the correct environmental conditions. When the genetic potential to produce ears or wings is missing, environmental conditions would not be capable of producing both. Also, if the genetic potential is present, fully developed wings and ears may never develop unless the environmental conditions are suitable.

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On the misidentification of a common sandy beach crab belonging to the genus *Ovalipes* Rathbun, 1898

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The three-spot swimming crab, a common intertidal resident of sandy beaches in southern Africa, has previously been misidentified as *Ovalipes punctatus* (De Haan, 1833). Inspection of local specimens indicates that the valid name for this species is *O. trimaculatus* (De Haan, 1833).

Die driekolswemkrap, 'n bekende intergetybewoner van sanderige strande in suider Afrika, is vantevore verkeerd as *Ovalipes punctatus* (De Haan, 1833) geïdentifiseer. Nadat plaaslike monsters ondersoek is, blyk dit dat hierdie spesie *O. trimaculatus* (De Haan, 1833) is.

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One of the most common crabs inhabiting intertidal and sub-tidal zones of southern African sandy beaches is the three-spot swimming crab, a member of the genus *Ovalipes* Rathbun, 1898. Members of this genus are common in coastal and estuarine waters of temperate oceans and are especially associated with sandy and muddy sediments (Caine 1974; Du Preez 1984; Davidson 1986). With the exception of *O. molleri*, which occurs in relatively deep (300–450 m) oceanic waters off eastern Australasia (Dawson & Yaldwyn 1974) and *O. iridescens*, an Indo-West-Pacific species, all *Ovalipes* species are limited to fairly shallow waters (Stephenson & Rees 1968).

Until the late 1960s only five *Ovalipes* species were commonly recognized, among them *O. punctatus* (De Haan, 1833), the species to which the southern African three-spot swimming crab was assigned by Barnard (1950). However, in their review of the genus, Stephenson & Rees (1968) realized that at least five species had regularly been confused under this name: *O. punctatus* (De Haan, 1833); *O. trimaculatus* (De Haan, 1833); *O. catharus* (White, 1843); *O. australiensis* Stephenson, 1968 and *O. elongatus* Stephenson, 1968. This high degree of synonymy was explained on the basis of species groups and sub-groups. It was proposed that extremely close phylogenetic relationships between members within each sub-group of *Ovalipes* species were responsible for their remarkable degree of morphological similarity (Stephenson & Rees 1968).

Stephenson & Rees (1968) suggested that the distribution of *O. punctatus* was limited to the coastal waters of China and Japan, where commercial fishing pressure has recently prompted some preliminary investigation into its reproductive biology (Sasaki & Kawasaki 1980). By comparison, the sole *Ovalipes* species positively identified by Stephenson &