New populations of *Brachytrupes megacephalus* (Lefevre, 1827) on mainland Malta and some notes on its adaptive capacity (Orthoptera: Gryllidae)

Louis F. CASSAR[1*] & Elisabeth CONRAD[1]

ABSTRACT. Until recent years, records of the indigenous gryllid species *Brachytrupes megacephalus* within the Maltese Islands were restricted to Għadira and Armier on Malta, and Ramla l-Ħamra on Gozo. Four newly recorded additional populations are discussed, taking into account the different characteristics of the habitat at the various sites, and associated adaptations of the species in relation to substrate within each site.

KEY WORDS. Malta, Orthoptera, *Brachytrupes megacephalus*.

INTRODUCTION

Research on the subterranean cricket, *Brachytrupes megacephalus* (Lefevre, 1827) in the Maltese Islands has been ongoing since the late 1970s. The first record of this cricket species was that by Guido Lanfranco, in 1955, at Ramla l-Ħamra in Gozo (Lanfranco, 1957). A second specimen, this time from Għadira (Malta), was found in 1977 by one of the authors, in coastal sands (Cassar, 1979). These two isolated occurrences did not, at the time, generate sufficient interest to investigate the status of this species further and existing populations within these localities remained overlooked. When, in 1979, a second specimen was discovered at Għadira, observations carried out systematically at this locality revealed an established population within the Għadira area (Cassar & Bonett, 1985) that has been monitored since. Subsequently, searches at the Ramla l-Ħamra site in 1990 (Cassar, 1990) yielded yet another specimen; further field observations during the following year at this dunal site in Gozo confirmed the presence of a seemingly small established population that extended, sporadically, from the consolidated dune area to the adjoining parcels of agricultural land further inland from the coastal dunes. Moreover, fresh burrow mounds were noted at Armier in 1995 (Cassar, 1996), and the presence of an established population at this third site was confirmed in 1996 (Cassar & Stevens, 2002).

METHODOLOGY

From 1983 onwards, observations of the species in its natural habitat were carried out during its stridulating season, generally between the last week of March and the first week of June. Counts were made of stridulating male specimens, commencing soon after nightfall (when stridulation begins), until the cessation of all stridulating activity. The latter occurs either due to a fall in air temperature and/or due to increases in wind velocity, or when a female of the species is attracted to the male's burrow.

[1] International Environment Institute, 3rd Floor, Chemistry Building, Room 311, University of Malta, Msida, Malta.
E-mail: louis.f.cassar@um.edu.mt
[*] Corresponding author

RESULTS

The presence of established populations at Ramla l-Ħamra in Gozo, and Għadira (Fig. 1, Site 1) and Armier (Fig. 1, Site 5) was re-confirmed. Additional populations were recorded at the following sites within the Marfa promontory (toponymy based on Camilleri (1996) and Camilleri, *pers. comm*., 2008):

- Rdum il-Griewi/Daħlet ix-Xilep (Fig. 1, Site 2);
- L-Aħrax tar-Ramel (Fig. 1, Site 3);
- Tax-Xmajjar (Fig. 1, Site 4);
- Ta' Damma, between Ramla tat-Torri region and the Armier complex (Fig. 1, Site 6).

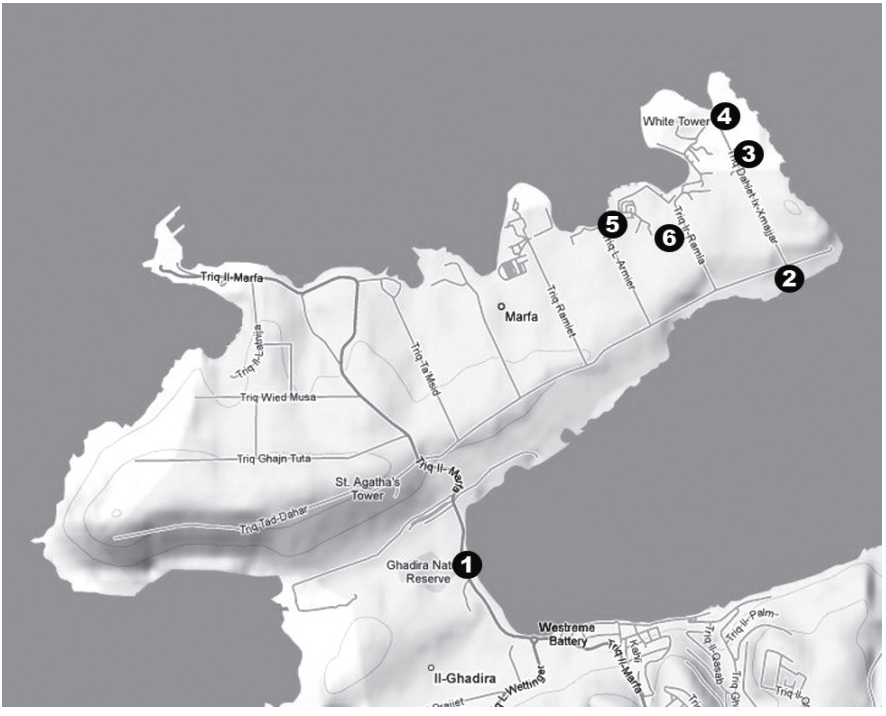

Figure 1 – Recorded populations of *Brachytrupes megacephalus* at Għadira and Marfa Ridge.

DISCUSSION

These newly-discovered populations provide insights into the habitat requirements of the species, which was previously thought to be localized and largely restricted to the complex and geomorphologically dynamic environment of the dune ecosystem (Cassar, 1990), such as occurs at Għadira, Ramla l-Ħamra and Armier. However, the population located within the Rdum il-Griewi and Daħlet ix-Xilep region establishes its burrows within a geological conglomerate (mainly

comprising Upper Coralline Limestone and other deposits resulting from complex processes involving slope failure, scarp fragmentation and colluvial formation), which has been rendered friable through boulder scree dynamics and mass movement, and is intermittently pocketed with Quaternary age and modern soil deposits. Unlike in other locations both in the Maltese Islands and across the Maghreb where the species is traditionally known to colonise sandy areas, both coastal and desert, the population of *B. megacephalus* at Rdum il-Griewi/Daħlet ix-Xilep exhibits an almost tenacious ability to burrow in a considerably harder substrate, in which ground armour and compacted rock materials are a dominant feature, within this sedimentary landscape.

The population at Tax-Xmajjar establishes burrows in a substrate of consolidated sandy soil, representing a complex derived from beach sand, valley sediment and imported soils. The karstic Aħrax tar-Ramel site is bordered by agricultural land, and comprises a naturally-occurring *terra rossa* soil mixed with traces of fine aeolian sand particles. Some specimens of the species at l-Aħrax tar-Ramel were noted on the verges of, and within, cultivated land, indicating that the species can successfully live within intensively used agricultural land. The population at Ta' Damma is in fact established almost entirely on cultivated agricultural land.

It remains to be seen whether the various spatially separated populations within the Marfa promontory and at Għadira function as a metapopulation. Given the proximity of the site at L-Aħrax tar-Ramel to that at Tax-Xmajjar, and on the basis of spatial observations of burrow mounds and stridulating male specimens, it can be reasonably assumed that there is some degree of exchange of individuals between these two populations. Similarly, there is likely to be interaction between the populations at Armier and Ta' Damma. Given the lie of the land between these aforementioned localities and the lack of abrupt topography that may act as a natural barrier to dispersal, it is plausible that the populations at Ta' Damma and L-Aħrax tar-Ramel also interact at some level. The remaining two populations (Għadira and Rdum il-Griewi/Daħlet ix-Xilep), on the other hand, appear, *prima facie*, to exist in isolation, and could possibly be vulnerable to the dynamics of small, isolated populations. Such dynamics include disproportionate exacerbated vulnerability to demographic and environmental stochasticity, and the genetic effects of inbreeding depression (Caughley, 1994). In the case of the Għadira population, apart from its physical distance from the other existing populations at L-Aħrax, a number of natural and anthropic barriers present may hinder the dispersal of crickets and their eventual interaction with neighbouring populations. In the case of the Rdum il-Griewi/Daħlet ix-Xilep population, inter-population migration to neighbouring sites may be physically obstructed by the rugged geomorphology of the scarpline and associated screes.

CONCLUSIONS

Observations on these new populations indicate that *Brachytrupes megacephalus* has behaviourally adapted to survive in environments other than the specialized and spatially restricted habitat of sand dunes, displaying an ability to survive on a variety of substrates and even within an anthropic terrain. This finding provides support and guidance for the establishment of a strategy of wildlife corridors to link the various populations at Marfa ridge and the one at Għadira, which is expected to enhance the long-term viability of these populations and which would provide safeguards for the maintenance of genetic diversity. Moreover, the species' adaptability to survive within coastal hinterland habitats beyond its preferred beach and sand dune environment augurs well in the event of coastal habitat degradation and modification and in the face of predicted threats from sea-level rise.

ACKNOWLEDGEMENTS

The input of Mr Matthew Borg Cardona is gratefully acknowledged, in that he noted burrow mounds on the sandy areas at the Rdum il-Griewi/Daħlet ix-Xilep site prior to any knowledge of a population of the cricket at this site, and passed on this information to the authors; detailed field investigation consequently showed that the species also colonized other areas, as described above, where a sandy substrate was not prevalent. Thanks are also due to Mr Guido Bonett, Mr Alex Casha, Mr Victor and Ms Desiree Falzon, Dott Elena Gagnarli, Mr Guido Lanfranco and Ms Miraine Rizzo, for assisting in field research and/or for passing on relevant information on the species. The authors are indebted to Mr Alex Camilleri for sharing with them his unpublished toponymic information of the Aħrax region.

REFERENCES

Camilleri, A. (1996) *L-Aħrax tal-Mellieħa. The basis for an action plan.* University of Malta: Unpublished dissertation published in part fulfillment of the requirements for the degree of MSc (Environmental Planning & Management). xiv + 165 pp. + appendices.

Cassar, L.F. (1979) Occurrence of *Brachytripes megacephalus* Lefevre in the Maltese Islands (Orthoptera Grylloidea). *The Central Mediterranean Naturalist*, **1** (1): 22-23.

Cassar, L.F. (1990) Notes on rare and infrequent Orthoptera of the Maltese Islands. *The Central Mediterranean Naturalist*, **2** (1): 1-4.

Cassar, L.F. (1996) *Coastal Dunes: Form and Process. Geomorphology, ecology and planning & management for conservation.* University of Malta: Unpublished dissertation published in part fulfillment of the requirements for the degree of MSc (Environmental Planning & Management). viii + 136 pp.

Cassar, L.F. & Bonett, G. (1985) Weitere Nachweise von *Brachytrupes megacephalus* Lefevre auf den Maltesischen Inseln (Orthopt.: Grillidae). *Neue Entomologishe Nachricten,* **14**: 27-29.

Cassar, L.F. & Stevens, D.T. (2002) *Coastal dunes under siege: a guide to conservation for environmental managers.* International Environment Institute, University of Malta. x + 194 pp.

Caughley, G. (1994) Directions in Conservation Biology. *Journal of Animal Ecology*, **63**: 215-240.

Lanfranco, G. (1957) Notes on the Orthoptera of the Maltese Islands. *The Entomologist*, **90**: 75-76.

ISSN : 2070-4526
Date of Publication : 31st August 2008

Received: June 5, 2008
Accepted: August 2, 2008