

NOTES ON THE IMPACT OF THE BLACK RAT (*RATTUS RATTUS* L.) ON THE FLORA AND FAUNA OF FUNGUS ROCK (MALTESE ISLANDS)

Arnold Sciberras¹ & Sdravko Vesselinov Lalov²

ABSTRACT

Recently the presence of the black rat *Rattus rattus* was reported from the island of Fungus Rock which houses a remarkable flora and fauna and has been a protected site for over 250 years. A preliminary account of the rat's impact on some Fungus Rock species is given and threats to the island's ecosystem are discussed.

Introduction:

In the early 18th century the Island of Fungus Rock was made a protected site by the knights of St. John in order to guard the economically important species *Cynomorium coccineum* L., the Maltese Fungus. As early as 1800 the British authorities reconfirmed its protected status (Lanfranco 1961). Today Fungus Rock is a strictly protected nature reserve under Government Notice No. 223 of 2005 and access is only permitted for scientific purposes. Because of that protection and since access is extremely difficult the site has remained quite undisturbed for centuries. Apart from its archaeological and historical value this island houses a number of important and rare species, one of them endemic to Fungus Rock and some endemic to the Maltese islands. Among the most important are the largest population of *Cynomorium coccineum* in the Maltese islands, a population of *Helichrysum melitense* (Pignatti) Brullo, Pavone & Ronsisvalle which is endemic to the Dwejra and Fungus Rock area, populations of the Maltese endemics *Cremonophyton lanfrancoi* Brullo & P. Pavone and *Darniella melitensis* (Botsch.) Brullo, *Podarcis filfolensis generalensis* Gulia which is endemic to Fungus Rock, the Maltese endemics *Muticaria macrostoma oscitans* Charpentier and *Trochoidea spratti* Pfeiffer and a breeding colony of *Calonectris diomedea* Scopoli (www.mepa.org.mt).

The presence of the Black rat *Rattus rattus* L. on Fungus Rock and some damage caused by the rats to the avifauna of the island and to *Cynomorium coccineum* were reported for the first time by Borg & Sultana in 2003. Various species of rats are known to be among the exotics most damaging to island flora and fauna. Since island communities often lack mammalian predators and grazers, island species may succumb rapidly once such exotic species are introduced (Primack 1998). Being aware of the exceptional value of Fungus Rock and of the threat originating from the rats the authors decided to publish their own observations on the rat's impact on the island.

Impact upon the flora:

During a floristic survey of Fungus Rock in June 2006 traces of nibbling caused by rats were recorded from six plant species (Table 1). No other animal on the island leaves similar tooth marks. Animal damage to two other species (unattached leaves and little twigs in *Darniella melitensis* and holes in a stalk of *Orobancha* sp. with missing inflorescence) was noted but could not be attributed with certainty to a particular animal.



Fig. 1: *C. coccineum* destroyed by rats (June 2006) © SVL



Fig. 2: *L. arborea* heavily damaged by rats (March 2007) © SVL

¹ 'Mariapoli' 131, Arcade Str, Paola, Malta. E-mail: bioislets@yahoo.co.uk

² Sauerbruchstr. 22, 67063 Ludwigshafen/ Rhein, Germany. E-mail: anwoda@pol.net

Table 1: Percentage of plants damaged and destroyed by rats on Fungus Rock (June 2006)

Species	% of plants affected	% of plants destroyed	affected parts
<i>Allium commutatum</i> Guss.	100	100	aboveground part completely consumed
<i>Cynomorium coccineum</i>	40	20	flowers/ fruit eaten
<i>Darniella melitensis</i>	5	0	unattached leaves/twigs
<i>Daucus</i> sp.	2	0	stems nibbled
<i>Lavatera arborea</i> L.	100	60	stems of medium age consumed
<i>Lotus cytisoides</i> L.	70	20	sometimes leaves, sometimes skin on stems eaten
<i>Matthiola incana</i> (L.) R. Br. ssp. <i>Melitensis</i> Brullo, Lanf., Pav. & Ronsisv.	1	0	leaves nibbled
<i>Orobancha</i> sp.	100	100	holes in stalk

In March 2007 animal damage caused by rats was recorded from 8 plant species (Table 2). Numerous holes in leaves of *Matthiola incana* ssp. *melitensis* and *Urginea pancraticion* Nym. were attributed to insects or snails. Also, a large number of dead *Matthiola incana* ssp. *melitensis* specimens was observed but could not be linked with the presence of rats on the island.

Table 2: Percentage of plants damaged and destroyed by rats on Fungus Rock (March 2007)

Species	% of plants affected	% of plants destroyed	affected parts
<i>Allium commutatum</i>	70	10	mostly leaves nibbled, in smaller plants often bulb consumed
<i>Cynomorium coccineum</i>	5	5	flowers/fruit eaten in two inflorescences which seem to have flowered out of season in autumn or winter, new inflorescences not affected
<i>Desmazeria pignattii</i> Brullo & Pavone	30	0	spikes removed and seeds extracted
<i>Lavatera arborea</i>	100	60	twigs of medium age eaten
<i>Linaria pseudolaxiflora</i> Lojac.	40	0	tips of stems and leaves eaten
<i>Lotus cytisoides</i>	30	0	sometimes all leaves of single branches eaten, sometimes indiscriminate foraging of exposed parts
<i>Sonchus oleraceus</i> L.	40	0	leaves and buds consumed
<i>Sonchus tenerrimus</i> L.	60	0	leaves and buds consumed

Impact upon the fauna:

During repeated faunistic surveys of the island no particular differences in populations or species numbers were noted. However, certain traces of nibbling on various specimens indicated the presence of rats. Traces of nibbling were recorded on species of Helicidae. While many empty shells from the latter were recorded in small pockets in the rock in an average of 50 specimens per pocket, only some of the shells that were found scattered contained bite marks of rats. From 14 pockets 37 shells were attacked. Five insect species were recorded with nibbling marks: Two specimens of *Anacridium aegyptium* L. contained teeth marks in the right side of the thorax, in the pronotum (the metazona area), near the wing attachment and the costal margin and in the first 3 segments of the abdomen while one hind leg was detached and the femur devoured. One specimen was still fresh when found. One fresh specimen of *Sphingonotus coeruleans* L. was found with a missing abdomen and left hind leg. Two specimens of *Blaps gigas* L., one of them still fresh were found with missing hind legs and the latter with clear bite marks on the wing case. One specimen of *Uthetheisa pulchella* L. and two specimens of *Vanessa cardui* L. were found without abdomen and these could also be linked with the predation of *Rattus rattus* from the bite marks they contained. Egg shells and bones of juvenile *Calonectris diomedea* Scopoli in the nesting holes also contained bite marks and the large amount of footprints and faeces indicates the presence of *Rattus rattus* around the nests.

The only natural predator of the mentioned species listed above excluding *Calonectris diomedea* and *Blaps gigas* on the island is *Podarcis filfolensis generalensis* Gulia whose population seems to be stable at present. The mode of feeding of the latter species differs completely from that of *Rattus rattus* because the leftovers of *Podarcis filfolensis generalensis* such as *Sphingonotus coerulans* wings are complete, not nibbled. Traces of Hymenoptera species were also found in rat faeces along with Coleoptera limbs possibly belonging to *Blaps gigas*. There is no indication of any impact of *Rattus rattus* on *Podarcis filfolensis generalensis* at present but past studies from nearby islands show that when the *Rattus rattus* population increases to a certain extent compared to the area of the island and possibly when other food sources are exhausted, *Rattus rattus* may have a devastating impact on the local herpetofauna.

Discussion:

The heavy impact upon the flora observed in 2006/7 is an argument against the theory of an early introduction of the rats on Fungus Rock. In our opinion the populations of *Cynomorium coccineum*, *Allium commutatum* and *Lavatera arborea* could not have sustained for a long period a damage to the extent observed without disappearing completely from the island.

From observations on Selmunett Island (Maltese islands) in a period of 10 years rats had a devastating effect on the population of the endemic *Podarcis filfolensis kieselbachi* Fejervary and also on other herpetofauna such as *Hemidactylus turcicus* L. While some species of flora were affected, too we are not in a position to estimate the extent of the damage since no such evaluation on Selmunett was ever taken.

Due to lack of a permit no survey of Fungus Rock could be undertaken in October 2006 and so the damage caused to perennial plant species during the summer could not be assessed. Such an assessment is particularly important in the case of *Cynomorium* since it is suspected that the rats destroy most of the *Cynomorium* inflorescences during summer. However, in March 2007 the *Cynomorium* inflorescences from spring 2006 were too decomposed to ascertain what percentage had been affected by rats.

While all *Allium* inflorescences and leaves were found destroyed in June 2006 thus preventing sexual reproduction of the species and accumulation of sufficient resources, the excavation of *Allium* bulbs observed in March 2007 demonstrates that even established *Allium* individuals are being destroyed.

Lavatera arborea was the species most severely affected. In June 2006 all *Lavatera* individuals on the island were heavily damaged but most still showed patches of live bark. In contrast, in March 2007 60% of the *Lavatera* plants on the island were found dead. Because the remaining stumps were bleached and in an advanced stage of decomposition it can be assumed that the plants died during summer 2006. While in June 2006 several *Lavatera* plants measuring 1-1.5 m were observed in sheltered places on Fungus Rock in March 2007 the typical size of the *Lavatera* individuals on the island was 20-40 cm and all of them featured a stunned bushy growth.

On Fungus Rock bushy growth and numerous severed branch tips due to foraging were also observed in *Lotus cytisoides* and to some extent in *Linaria pseudolaxiflora*, *Sonchus tenerrimus* and *Desmazeria pignatii*.

The South African invasive *Oxalis pes-caprae* L. which is the most common plant species in the Maltese islands could not be recorded on Fungus Rock. One possible reason is that the species which depends only on vegetative reproduction in the Mediterranean and thus on dispersal by humans was never introduced to the island. Or an existing population could have been eradicated by the rats which feed on the succulent tubers of *Oxalis* during summer months.

An open question is the possibly more vegetarian nature of *Rattus rattus* on Fungus Rock compared to the mainland. During a two hour survey of the Dweira coast close to Fungus Rock in June 2006 all plant species (except *Cynomorium* and *Linaria*) which were damaged by *Rattus rattus* on the island were encountered. During that survey several rats were seen but the plant species which were heavily damaged on Fungus Rock showed no damage which could be attributed to rats on the mainland. One *Daucus* plant on the mainland showed traces of nibbling but the plant was associated with numerous rabbit (*Oryctolagus cuniculus* L.) droppings so the damage was attributed to rabbits.

Even on Fungus Rock signs of different feeding habits for individual rats were encountered. While red rat droppings were always seen in the neighbourhood of nibbled *Cynomorium* which contains red pigments green ones were always associated with destroyed green *Lotus cytisoides* plants suggesting that some rats use to feed on one species, some on another.

From those preliminary results it is obvious that more research on Fungus Rock and a long-term monitoring program on the impact of *Rattus rattus* on its ecosystem are required. For that reason arrangements for further visits to the site have been made with MEPA. However, there is also an urgent need for immediate rat extermination measures on Fungus Rock. Without waiting for the results from long-term studies rat extermination on the island should begin provided that no other of the species found there will be affected.

ACKNOWLEDGEMENTS

The authors wish to thank Mr Mario Gauci for his help with accommodation, logistics, equipment and information during all visits to Fungus Rock and the Nature Protection Directorate of MEPA for the permission

to visit the island. Furthermore SVL wants to thank Dr Elena Yasnezskaya for enabling him to join her on several trips to the site and AS would like to thank Esther Schembri and Jeffrey Sciberras for their continuous assistance in the field visits.

REFERENCES

- Borg, J. J. & Sultana, J.** (2003) The presence of the black rat *Rattus rattus* on Fungus Rock (Maltese Islands). *The Central Mediterranean Naturalist* **4** (1): 105-106.
- Lanfranco, G.** (1961) *Cynomorum coccineum* Linn., a Maltese Historical Plant. *Melita Historica* **3**(1): 53-70
- Primack, R. B.** (1998) *Essentials of Conservation Biology*. Sunderland: Sinauer Associates, xii+660pp
- Sciberras, A. & Schembri, P. J.** (2003) Observations on the population of the Maltese Wall Lizard on Il-Gzejjer ta' Selmunett (*Podarcis filfolensis kieselbachi*). Unpublished MEPA Report.
- Sciberras A.** (2005) Observation on the endangered population of the Maltese wall lizard of Selmunett island (*Podarcis filfolensis kieselbachi*). Unpublished work, presented to the chamber of young scientists at 4- 10th April and to the Belgian Science expo on 26 April to 1 May.
- Sciberras A.** (2007) Lizards at Id-Dwejra. *Dwejra Heritage Park Gozo*. Dwejra Management Board: pp28-33
- Natura 2000 standard data form Dwejra-Qawra Area, inkluz Hagret il-General (http://www.mepa.org.mt/environment/index.htm?nature_protection/mainpage.htm&1) accessed 15-9-2007