

POPULATION ECOLOGY OF *PHALERIA ACUMINATA* (COLEOPTERA: TENEBRIONIDAE) FROM SANDY BEACHES IN THE MALTESE ISLANDS

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Abstract

Populations of the beetle *Phaleria acuminata* from four beaches on the Maltese Islands were sampled for six consecutive seasons to investigate changes in population size, sex ratio, reproductive state and distribution on the shore. The populations on all the beaches showed a small decrease in numbers from spring to summer and a pronounced drop from summer to autumn, with a dramatic increase between winter and spring. Male to female sex ratio varied between 1:1 and 1:1.5. Females of all reproductive stages occurred throughout the year. There were little seasonal differences in distribution of beetles in the wet and dry zones.

Keywords: Phaleria acuminata, population dynamics, sex ratio, sandy shores

Few studies on the population ecology of shore-dwelling tenebrionids have been made. Two species of *Phaleria* (*P. acuminata* and *P. bimaculata*) occur in the Maltese Islands (1), and on some beaches may account for up to 54% of all individuals of macro-invertebrates collected. We investigated aspects of the population ecology of the commonest species *Phaleria acuminata* on four beaches: White Tower Bay and Golden Bay on Malta, and Ramla l-Hamra and Xatt l-Ahmar on Gozo. *Phaleria acuminata* were sampled over six different seasons between October 2001 and March 2003 using a constellation of pitfall traps in the wet and dry zones of the beaches. Sex was determined by dissection and the reproductive state of females was determined by examining the state of the *bursa copulatrix*.

A total of 8842 individuals were collected from the four beaches over the study period. On all the beaches, more individuals were collected in spring and summer than in autumn and winter. The population size on each of the four beaches showed an almost identical pattern with a small decrease in numbers from spring to summer and then a sudden drop from summer to autumn. The second set of autumn and winter samples showed a similar phenology as the first set, although a lower number of beetles were collected. The population increased dramatically during spring especially at Ramla l-Hamra and Xatt l-Ahmar. This contrasts with the results obtained by Carpaneto and Fattorini (2) who found that the Italian *Phaleria acuminata* population they studied had the largest drop in abundance from spring to summer; Aldryhim *et al.* (3) describe a similar pattern in Saudi Arabia.

The sex ratio did not vary much at Golden Bay and Ramla l-Hamra; however, at White Tower Bay and Xatt l-Ahmar there were large seasonal variations. In general, more females than males were collected, with a few exceptions: the spring sample from White Tower Bay, the first autumn sample from Golden Bay, and the spring and summer samples from Xatt l-Ahmar, when males outnumbered females. However, there was no significant seasonal variation in sex ratio on any of the beaches (Kruskall-Wallis test). At Xatt l-Ahmar, the overall sex ratio was very close to 1:1 whereas on the other beaches it was approximately 1.5 females for every male. Sex ratio may give an indication of how stressed a population is; the greater the stress, the greater the deviation from a 1:1 ratio, as the population tends to produce more individuals of the energetically economical

sex. In this regard it is worth noting that Xatt l-Ahmar is an isolated beach with a low number of visitors whereas the other beaches are very popular recreational resorts especially during summer.

In general, females of all reproductive stages occurred throughout the year, showing that a percentage of the population is reproductive at all times. However, in spring and summer there was an increase in the percentage of females of low reproductive potential, probably representing newly emerged, unmated adults. This correlates well with the increase in numbers of individuals trapped during these seasons, suggesting a peak in emergence during the warmer part of the year.

Krosnov and Shenbrot (4) found that shore-dwelling tenebrionids on Israeli beaches occupied the wet zone in the warmer months and moved upshore towards the dunes during the colder months. In the present study, there was no clear seasonal pattern for either sex in the occurrence of the beetles in the wet and dry zones of the beaches studied. Although more beetles occurred in the wet zone during the warmer months of the year, the difference was not statistically significant.

References

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