MOLE RATS – UNDERGROUND EVOLUTION IN ISRAEL

Exploitation of the underground environment has many advantages for small to medium sized mammals. It is not surprising, therefore, that complex adaptations to a completely subterranean existence have evolved independently more than once (an example of convergent evolution).

Species from four orders; insectivores, marsupials, edentates and rodents, have all made the transition from surface dwelling to an almost entirely underground way of life. One of the most fascinating groups are the mole rats, *Rodentia*, of which the best studied 'species' is *Spalax ehrenbergi*.

Spalax ehrenbergi is really a complex of species inhabiting the eastern Mediterranean and semi-arid to arid zones of Israel and north Africa. As a result of the work of Professor Eviatar Nevo, of the Institute of Evolution, University of Haifa, and his colleagues, we know an enormous amount about the adaptations of mole rats to their fossorial existence, and about the probable course of their evolution.

In Israel, the complex is represented by four chromosomal species distributed in definite and virtually non-overlapping areas (figure 1). These areas correspond to four climatic regimes: cool and humid (2n=52), cool and dry (2n=54), warm and humid (2n=58) and warm and dry (2n=60). [2n refers to the total number of chromosomes in all cells apart from eggs and sperm].

It is thought that these species have evolved, by chromosomal changes, since the early Middle Pleistocene as the climate of Israel greatly diversified. The latest addition to the group seems to be the species with the highest chromosome number, adapted to the hottest and most arid regions of southern Israel. Although there is some hybridisation between species where their distributions abut, hybrids are less viable and less fertile, and species show a marked preference to mate with their own kind.

Israeli mole rats have bodies, cylindrical in section, covered with short fur. The species differ slightly in size but typically have head + body lengths a few centimetres larger than our own (insectivore) mole, and weigh about one and a half times more. They are almost completely blind, live in tunnels and push up spoil as 'mole' hills. Unlike most other mammals that have adopted an underground lifestyle, mole rats do not dig with flattened forepaws, but with their teeth. They literally gnaw their way through the soil.

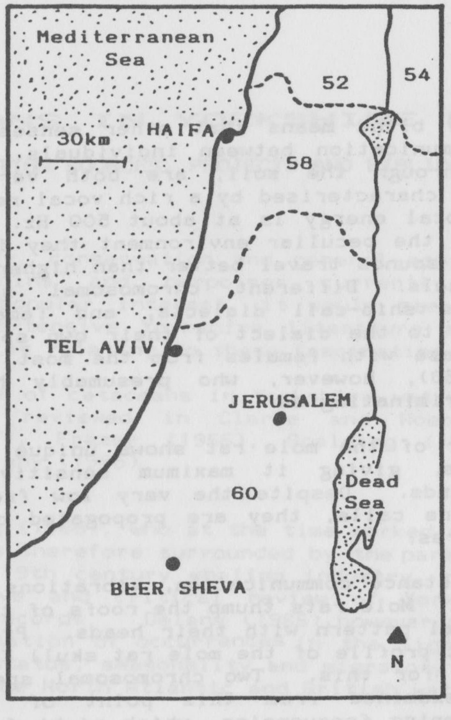

Figure 1

Map of Israel showing the distributions of species in the *Spalax ehrenbergi* complex. Numbers indicate chromosome complements of the four species ansd dashed lines delimit their boundaries.

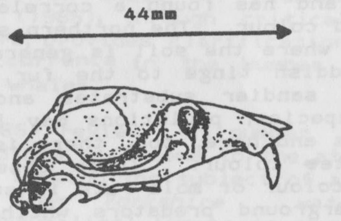

Figure 2

Side view of a skull of *Spalax* showing the very flattened upper surface.