DAVIS EXPEDITION FUND

REPORT ON EXPEDITION/PROJECT

Expedition/Project Title: The land snails of Tenerife..

Travel Dates: 1st April – 16th April 2003...

Location: Tenerife, Canary Islands..

Group Members: Alan Gray, Claire Pannell and Matthew Browne...

Aims: To quantify the community composition of land snails and investigate the responses of species and communities to vegetation and the abiotic environment in order to generate hypotheses that may be tested in further scientific investigations .

To quantify the inter and intra-relationships of the stable carbon and oxygen isotopes of the land snail shell carbonate and associated vegetation for Tenerifean species.

N.B. The Expedition did not raise the required funds for the original 6 members to go to Tenerife, therefore the original aims as detailed in the proposal had to be modified and scaled down. Also some of the data collection was compromised by the negligence of one member of the team.

OUTCOME (not less than 300 words):-
Wollaston described the land snails of Tenerife in 1873. His work contained some additional ecological information about some of the species. Work of a taxonomic nature has been published more recently in Spanish by biologists at the University of La Laguna in Tenerife, but rarely has work of this nature appeared in international publications. However, as is evident by Wollaston's early and forward thinking account, the combination of taxonomy with vital ecological information is invaluable, especially in our climate of declining biodiversity. To date no published research combining the essentials of a taxonomic study together with ecological factors such as altitude, soil pH, rainfall, and relative humidity has been conducted on terrestrial snails on Tenerife. Also the inter and intra-relationships of the stable carbon and oxygen isotopes of the land snail shell carbonate and associated vegetation have not been quantified for Tenerifean species.

Tenerife is situated in the Canarian archipelago; a chain of volcanic islands situated approximately 150 km off the West Coast of Africa. Tenerife is estimated to have emerged from the sea floor around 12.5 million years ago. Mount Teide is the third largest volcano in the world and the highest peak in Spain, at a height of 3718 meters above sea level. The North/North-Easterly trade winds in conjunction with the oceanic circulation result in a windward side to the island that is green and fertile and a leeward side that is dryer, even arid in the far south. The overall climate is Mediterranean and comprised of three subtypes: mesophytic mediterranean (dry and humid), xerophytic mediterranean (semiarid), and desertic mediterranean (arid). The vegetation of the Canaries displays adaptations to the variation in climate and a high degree of endemicity is present (80% of the communities and 26% of the flora are endemic to the islands). The three vegetation subtypes can be further subdivided into seven macro-series or communities according to characteristic vegetation assemblages (Rivas-Martínez *et al*, 1993).

Land snails are mainly herbivores, feeding on rotting vegetation, fungi, algae and lichens. Few are actively carnivorous. None are known to have a restricted diet and they exhibit no really narrow specialisation, although many species do exhibit habitat preferences. It is the habitat characteristics such as climate, structure and the soil conditions that are thought to dictate the distribution of gastropod species. The Gastropod families of the Canaries are allied to those of North Africa, but many endemics have evolved due to island isolation.

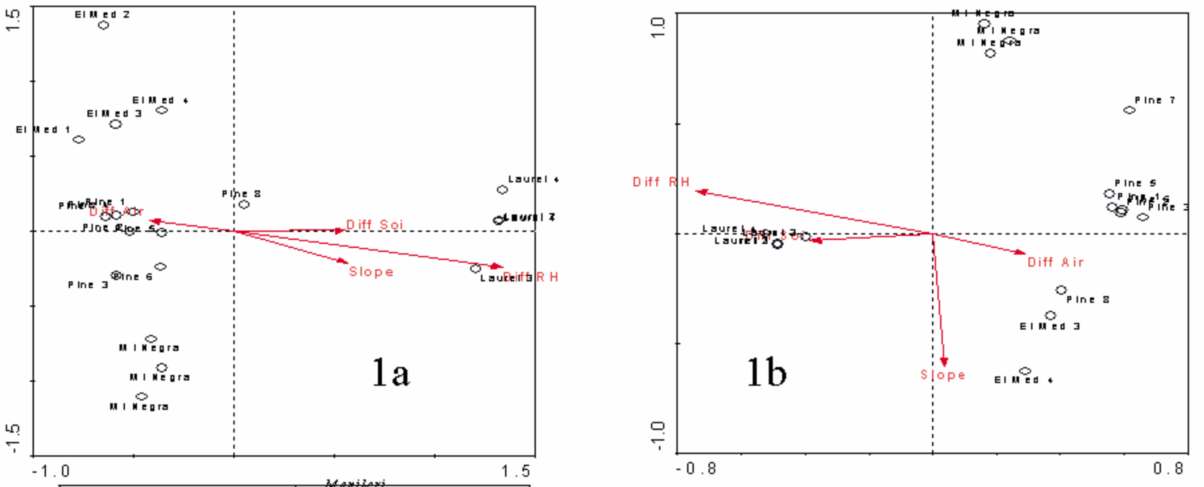
Methods

Stratified sampling was chosen according to three habitat zones coastal, pine and laurel with 6 sites, two in each habitat El Medano and Montagna Negra, a northern pine (above the Oratava Valley) and southern pine (above Guimar Valley), and a northern laurel, Anaga Mountains, and a western laurel, Teno region. Due to restrictions it was not possible to sample the Anaga Mountain site with quadrats. Four 5 m x 5 m quadrats within each site were sampled for soil pH, relative humidity, soil and air temperature, altitude, slope, percentage ground cover of soil, rocks, stones, boulders and vegetation. All relative humidity and air and soil temperature measurements were expressed in relation to a base station on the coast. Gastropod sampling used fixed time (15 minutes) searching followed by sieving of soils and leaf litter. All snails were collected, identified and counted.
The quadrat data were subjected to a redundancy analysis but were first analysed by detrended correspondence analysis to ensure that gradient lengths were appropriate.

Results and Discussion

Stable Isotopes of the vegetation and snails have yet to be quantified and results will appear at a later date.
A total of 123 species of plant including a few lichens and bryophytes were recorded during the expedition including 48 endemic species see appendix, and 18 snail species some of which are still to be determined to species level. Figure 1 shows the ordination diagrams relating to the redundancy analysis of the vegetation and snail quadrat data where altitude is taken out as a co-variable. Figure 1 a shows the vegetation samples, Figure 1b the snail samples, and Figure 1c the snail species. Figure 1 a indicates that environmental variables explain the variance in vegetation samples reasonably well. Axis 1 separates the laurel forest with the rest and then axis 2 separates the pine and coastal sites but not as clearly. Axis 1 correlates well with air temp and relative humidity but axis 2 is still unexplained. The sites, therefore, appear very different, and allow exploration of the idea that the snail species may respond to differing habitat conditions. This hypothesis is given some support from Figures 1b and 1c, snail samples are spread out in a similar manner to the vegetation samples indicating a response to similar environmental variables as the vegetation. Relative humidity and temperature appear to correlate well with axis 1 and slope appears to explain much of the variance in axis 2. Some of the snail species as shown in Figure 1c appear to have particular affinity to particular habitats and this merits further investigation.

The limited data here is not conclusive but does generate further questions such as:
Why do snails appear to have preferences for particular habitats?
Can habitat characteristics be used to predict snail distribution?
Can snail species be used to predict habitat types?
What is the role of disturbance?
What is the distribution of snails in intermediate habitats?



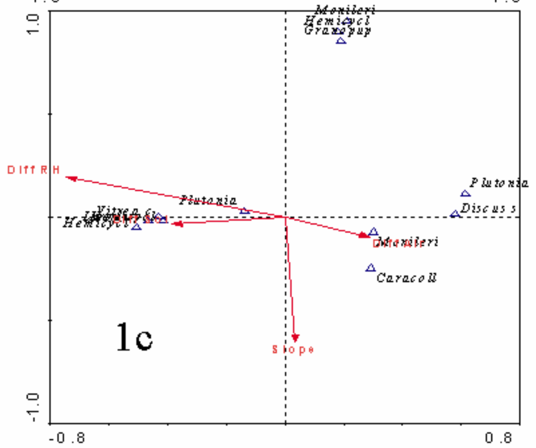


Figure 1 a, b and c: Ordination plots axes 1 and 2 from a Redundancy Analysis of snail and vegetation data from Tenerife, Canary Islands. 1a illustrates vegetation samples in relation to environmental variables, 1b demonstrates snail samples in relation to environmental variables and 1c shows snail species in relation to environmental variables

References

Rivas-Martínez S., Wildpret de la Torre W., Diaz Gonzalez T. E., Perez de Paz P. L., del Arco Aguilar M., Delgado O. R. 1993. Excursion guide. Outline vegetation of Tenerife Island. *Itinera Geobotanica* **7**: 5-167.

Wollaston T.V., (1878). Testacea Atlantica : or the land and freshwater shells of the Azores, Madeiras, Salvages, Canaries, Cape Verdes, and Saint Helena. London, 1878.

Appendix

Plant species recorded during Expedition

Species	**Family**	**Zone**	**Status**
Cryptograms			
Cladonia portentosa?	Lichen	Laurel	?
Lobularia sp	Lichen	Laurel	?
Peltigera sp	Lichen	Laurel	?
Usnea sp	Lichen	Pine	?
Bryophyta			
Dicranum sp?	Dicranaceae	Laurel	?
Leucobryum glaucum ?	Bryophyta	Laurel	?
Pteridophyta			
Asplenium adiantum nigrum	Aspleniaceae	Laurel	Native
Asplenium hemionitis	Aspleniaceae	Laurel	Native
Asplenium trichomanes	Aspleniaceae	Laurel	Natuve
Blechnum spicant	Blechnaceae	Laurel	Native
Culcita macrocarpa	Culcitaceae	Laurel	Native
Davallia canariensis	Davalliaceae	Laurel	Native

Diplazium caudatum	Woodsiaceae	Laurel	Native
Hymenophylum tunbrigense	Hymenophyllaceae	Laurel	Native
Polypodium macronesicum	Polypodiaceae	Laurel	Native
Pteridium aquilinum	Dennstaedtiaceae	Laurel	Native
Woodwardia radicans	Blechnaceae	Laurel	Native
Gymnospermae			
Pinus canariensis	Pinaceae	Coastal	Endemic
Angiospermae			
Magnoliopsida			
Adenocarpus foliolosus	Crassulaceae	Pine	Endemic
Aeonium sp1	Crassulaceae	Pine/Laurel	Endemic
Aeonium sp2	Crassulaceae	Pine/Laurel	Endemic
Aichryson punctatum	Crassulaceae	Pine/Laurel	Endemic
Aizooea canariensis	Aizoaceae	Coastal	Endemic
Anagallis arevensis	Primulaceae	Coastal	Native
Argyranthemum gracile	Asteraceae	Coastal	Endemic Tenerife
Artemesia reptans	Asteraceae	Coastal	?
Cakille martima	Brassicaceae	Coastal	Native
Canaria canariensis	Campanulaceae	Laurel	Endemic
Ceropegia fusca	Asclepiadaceae	Coastal	Endemic
Chamaecystis proliferus	Fabaceae	Pine	Endemic
Cistus monspeliensis	Cistaceae	Laurel	Native
Cistus symphytifoilius	Cistaceae	Laurel	Endemic
Convolvulus canariensis	Convolvulaceae	Laurel	Endemic
Crambe strigosa	Brassicaceae	Laurel	Endemic
Descaurinia lemsii	Brassicaceae	Pine	Endemic
Erica arborea	Ericaceae	Laurel	Native
Erodium cicutarium	Geraniaceae	Laurel	Possibly introduced
Erysmum scoparium	Brassicaceae	Pine	Endemic Tenerife
Euhorbia balsamifera	Euphorbiaceae	Coastal	Native
Euphorbia canariensis	Euphorbiaceae	Coastal	Endemic
Fagonia cretica	Caryophyllaceae	Coastal	?
Fallopia concolvulus	Polygonaceae	Coastal	Native
Ferula linkii	Apiaceae	Pine	Endemic
Frankenia laevis	Frankeniaceae	Coastal	Native