

## GEOCARPY AS AN ADAPTATION TO AFROALPINE SOLIFLUCTION SOILS

By

A. D. Q. AGNEW & O. HEDBERG

### INTRODUCTION

One of us (Hedberg, 1964) has given a comprehensive account of the ecology of Afroalpine plants, without any specific mention of geocarpy as an adaptation to the constant solifluction that may be experienced throughout the year in certain habitats. Since the publication of this account, the present two authors have revisited high altitude vegetation in East Africa and the purpose of this paper is to draw attention to the phenomenon and to remark on the species that show it and their ecology.

### GEOCARPY AS AN ADAPTATION

Hedberg (1964, pp. 29-33 and 64-70) has outlined the features of solifluction soils, and so it is unnecessary to say more here than that they are intermittently moist soils exposed to rapid changes between mild day- and low night-temperatures. The resultant ice formation, and frost-heaving of the soil surface, often occurring every 24 hours, renders the soil surface extremely mobile and unstable. The plants which can grow in such a habitat must be adapted to it, and the adaptations already noted include tough rhizomes and/or roots, the formation of a "bunch" (i.e. tussock or cushion) of strong stems at ground level and the bizarre "free-living" mosses and lichens which are not attached to the soil at all.

Clearly, establishment of seedlings must be extremely difficult in such a habitat, for before the young roots have penetrated the mobile surface layer of the soil and got anchored below it they are usually pulled out by frost-heaving. This then, is a critical phase in the life-history of these afroalpine plants and it is not surprising that many of them have developed *geocarpy* as a means of adapting to it. Geocarpy means burial of the fruit while still attached to the plant, and it is usually accomplished by bending the pedicel or peduncle down into the soil.

Geocarpic plants of solifluction soils are low, mostly perennial, with a rosette or creeping habit and tough roots. From our observations it seems that some species are strongly geocarpic, while others show this feature only weakly.

Strongly geocarpic afro-alpines so far noted are:

*Haplocarpha rueppellii* (Sch. Bip.) Beauv.  
*Haplosciadium abyssinicum* Hochst.  
*Limosella africana* Gluck  
*L. macrantha* R. E. Fr.  
*Ranunculus cryptanthus* Milne-Redhead & Turrill  
*R. oreophytus* Del.  
*R. stagnalis* A. Rich.

Several other species tend towards geocarpy in that their pedicels are often reflexed at maturity bringing the fruits into the region of the soil surface and often in contact with the latter, though they are not actively buried. According to a terminology coined by Hylander (1929 p. 211) these may be called *depositors*—their fruits are deposited on the soil surface. On active solifluction soil such fruits may sometimes get buried by soil movements before they are detached from the plant or the seeds are

released, so that the distinction between depositors and truly geocarpic plants may become vague in this case.

The following species have been found by us to behave usually as depositors:

*Alchemilla microbetula* Th. Fr. jr.  
*A. subnivalis* E. G. Bak.  
*Anagallis serpens* DC. ssp. *meyeri-johannis* (Engl.) P. Tayl.  
*Lobelia duriprati* Th. Fr. jr.  
*L. lindblomii* Mildbr.  
*L. minutula* Engl.  
*Oreophyton falcatum* (A. Rich.) O. E. Schulz  
*Ranunculus volkensis* Engl.  
*Trifolium acaule* A. Rich.  
*T. elgonense* Gillett  
*Uebelinia crassifolia* Th. Fr. jr.  
*Veronica gunae* Engl.

These are all plants of open soils, sometimes found at roadsides and in muddy hollows between tussocks at lower altitudes on the mountains, and occupying the solifluction soils where these exist. Other plants which grow in such soils are those with a densely tufted habit such as *Agrostis sclerophylla* C. E. Hubb., *Cotula cryptocephala* A. Rich., *Myosotis keniensis* Th. Fr. jr., *Sagina afroalpina* Hedb., and *Swertia subnivalis* Th. Fr. jr.

We still do not know how *Subularia monticola* Schweinf. subsists on its permanently moist localities with almost nightly frost-heaving (see Hedberg 1964, p. 66), with no fruit burial or other apparent adaptation.

The necessity of maintaining active growth under conditions of diurnal alternate freezing and thawing, throughout the year, is responsible for most of the special features of the Afroalpine vegetation. This short note merely records one more.

#### SUMMARY

A record is made of 7 strongly geocarpic herbs and of 12 other species which are weakly geocarpic, or depositors, all occurring on solifluction soils in the alpine belt of the high East African mountains. This adaptation to tropical high mountain solifluction has not been noted before.

#### REFERENCES

- HEDBERG, O., (1964). Features of Afroalpine plant ecology. *Acta Phytogeogr. Suecica* 49: 1-144.  
HYLANDER, N., (1929). Diasporenabtrennung und Diasporen-Transport. *Svensk bot. Tidskr.* 23: 184-218.

(Received 26th June, 1968)