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SEEDLING SURVIVORSHIP IN NATURAL POPULATIONS OF NINE PERENNIAL CHALK GRASSLAND PLANTS

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SUMMARY

Seedling survivorship in cohorts of nine perennial species of chalk grassland is reported. Heavy (> 80%) mortality in the first year occurred in six of the species with still higher values of mortality expected before any individuals in a cohort flowered. The observations are compared with the results of previous studies.

INTRODUCTION

Plant demography is fundamental to an understanding of both the ecological forces which shape plant population structure (Harper, 1977) and the evolutionary forces which shape life history characteristics (Schaffer and Gadgil, 1975). The seedling and juvenile phases are of particular importance because the heavy mortality which is often observed in these phases may represent a major component of the selection operating in the plant life cycle. Despite these important considerations relatively few demographic studies of perennial plants have been carried out (reviewed by Sarukhan and Harper, 1973; Harper and White, 1974; Harper, 1977; Cook, 1979; Solbrig, 1980). In this communication we report observations on seedling survivorship in natural populations of nine species of chalk grassland habitats in Britain. Only one of these species (*Athyllis vulneraria*‡) has been the subject of a published demographic study before (Sterk, 1975).

MATERIALS AND METHODS

Seedling cohorts of *Pimpinella saxifraga* and *Centaurea scabiosa* growing in chalk grassland dominated by *Zerna erecta* were located and individually marked with plastic rings shortly after emergence in spring 1975 at the Devils Ditch, Cambridgeshire (TL 582647). A population of seedlings of *Zerna erecta* found at the same site and presumed to have germinated in the autumn of 1974 was also counted at this time. The number of individuals remaining in these three cohorts was recorded at intervals through to July 1976. Cohorts of *Helianthemum chamaecistus* and *Poterium sanguisorba* germinating in the same spring in chalk

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‡ Botanical nomenclature follows Clapham, Tutin and Warburg (1962).

grassland at Church Hill Hertfordshire (TL 332396) were followed by the same procedure (Dickie, 1977). *Anthyllis vulneraria*, *Reseda lutea*, *Galium mollugo* and *Scabiosa columbaria* occurring at a third chalk grassland site, Castle Hill National Nature Reserve, Sussex (TQ 365072) were marked in a similar way and their survivorship followed for a period of 12 to 14 months from the date of emergence (Fig. 1).

RESULTS AND DISCUSSION

Survivorship curves for the nine populations studied are shown in Figure 1. All species showed a tendency towards Deevey type II or type III survivorship with the possible exceptions of *Galium mollugo* and *Scabiosa columbaria* whose populations occurred at low density. Half-lives calculated over the period of observation for each cohort are given in Table 1. No individuals reached the flowering stage in any of the populations under observation and most cohorts

Table 1. *Half-lives of seedling cohorts and the percentage mortality observed during observation of nine populations of chalk grassland perennial plants*

Species	Initial size of cohort	Half-life (years)	Length of observation (years)	Percentage mortality observed
Devil's Ditch				
<i>Centaurea scabiosa</i>	18	0.38	1.3	89
<i>Pimpinella saxifraga</i>	58	0.43	1.0	100
<i>Zerna erecta</i>	134	0.28	0.5	66
Church Hill				
<i>Helianthemum chamaecystis</i>	19	0.45	1.2	89
<i>Poterium sanguisorba</i>	80	0.33	1.2	97
Castle Hill				
<i>Anthyllis vulneraria</i>	340	0.21	1.0	94
<i>Galium mollugo</i>	58	0.83	1.2	67
<i>Reseda lutea</i>	273	0.14	0.9	98
<i>Scabiosa columbaria</i>	18	1.17	1.3	50

experienced over 80% mortality in their first year. These observations provide a minimum estimate of pre-reproductive mortality which agrees well with that observed in other herbaceous perennials (e.g. Thomas and Dale, 1975; Hawthorne and Cavers, 1976; Symonides, 1977; Bishop, Davy and Jeffries, 1978). Sterk (1975) observed pre-reproductive mortality of 64 to 82% in coastal populations of *Anthyllis vulneraria* in the Netherlands. Some of our data in 1976 were collected during an exceptionally severe summer drought, but substantial mortality occurred in our populations before its onset (Fig. 1).

Plants surviving to the end of the observation period were in many cases (*Reseda lutea*, *Galium mollugo*, *Scabiosa columbaria*), still very small (two to three leaves) and unlikely to flower soon after observations ended, if at all. Recruitment of seedlings to the adult populations of these plants is probably a rare event though the absence of vegetative organs of propagation in all the species studied implies that it must occur.

The chalk grassland habitat in Britain is typically species rich (Ratcliffe, 1977) and it has been suggested (Grubb, 1977; Silvertown, 1979, 1980) that differences in the regeneration requirements of species may account for their coexistence at

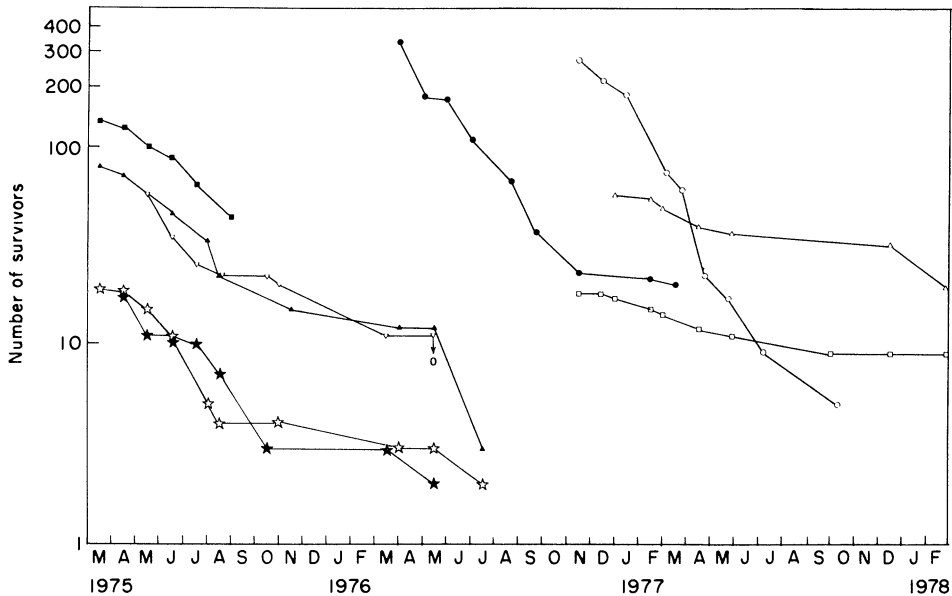


Fig. 1. Survivorship curves for seedling cohorts of nine species of chalk grassland perennials. ☆, *Helianthemum*; ★, *Centaurea*; ▲, *Poterium*; ▽, *Pimpinella*; ■, *Zerna*; ●, *Anthyllis*; □, *Scabiosa*; △, *Galium*; ○, *Reseda*.

high density. Attempts to relate the mortality observed in seedling populations to specific micro-environmental conditions and heterogeneity in the habitat (Silver-town, 1981) should result in a more detailed analysis of plant demography and a better understanding of plant population dynamics.

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