Notes and records

Fire-induced reproduction of *Festuca pilgeri* in the subalpine zone of Mount Kenya

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Introduction

Plant species in fire-dominated habitats are characterized by a variety of evolutionary adaptations to fire (reviewed in Gill, 1981; Bond & van Wilgen, 1996). These include thick bark, the ability to coppice, and protected meristems, such as those in tussock grasses. The reproductive opportunities created by fire favour adaptations such as fire-induced reproduction (Gill & Ingwersen, 1976; Le Maitre & Brown, 1992; Verboom, Stock & Linder, 2002) and dormancy that is broken by smoke (Keely, 1993) or intense heat.

Fire appears to be common in the sub-alpine shrublands and grasslands of the tropics (Hedberg, 1964; Beck, Scheibe & Schulze, 1986; Lægaard, 1992; Young, 1996). On East African mountains, as elsewhere in the tropics, the sub-alpine zone is characterized by ericaceous vegetation floristically and physiognomically similar to fire-prone chaparral biomes (Young, 1991, 1996; Safford, 2001). The woody species there readily coppice after fire (T. Young, pers. obs.; Hemp & Beck, 2001). The ericaceous zone of Mount Kenya burned several times between 1970 and 1990 at different sites (Young, 1996; Phil Snyder, Bill Woodley & Bongo Woodley, pers. comm.). Each of these fires covered several hundred hectares. As yet we have no data on return intervals but many of these fires are suspected to be human-caused by honey hunters (Phil Snyder & Bill Woodley, pers. comm.).

*Festuca pilgeri* St-Yves is the dominant grass in the alpine zone of Mount Kenya, forming nearly monospecific stands in some areas (Hedberg, 1964, Young & Peacock 1992). It forms dense tussocks up to 50 cm in diameter. It occurs in both reproductive and mostly sterile populations on Mount Kenya, with the latter predominating at lower elevations in the subalpine zone (Young & Peacock, 1992).

Study site and methods

This research was carried out in June 1980 on the north-western slopes of Mount Kenya at an elevation of 3300 m, along the Timau Track, an unimproved vehicle track. A fire had occurred at the site 6 months previously (January/February; Phil Snyder, pers. comm.). and the track had served as a firebreak. The area north of the road had burned, and the area south of the road had not.

On 29 June, I carried out a survey of tussock density and reproduction in *F. pilgeri* at this site. I laid out six paired 30 x 2 m line transects, three on the burned side of the road, and three on the unburned side. Along each transect, I counted the total number of *F. pilgeri* tussocks, and the number of these that had reproductive culms. I surveyed a total of 668 individuals. The densities of tussocks and the per cent reproductive tussocks in the burnt and unburnt areas were compared in simple *t*-tests, with a sample size of three.

Results and discussion

The average density of *F. pilgeri* tussocks was similar in the burned and unburned areas (mean number per m$^2$ ± 1 SE: 1.84 ± 0.07 versus 1.87 ± 0.04. $t = 0.32, P = 0.77$). In the three transects in the unburned area, only one tussock of 336 was reproductive. In the three transects in the burned area, 92% of the tussocks were reproductive (306 of 332). This difference was statistically significant ($t = 62.01, P < 0.0001$).

The similar densities of *F. pilgeri* tussocks in the burned and unburned areas suggest that this species suffered essentially no adult mortality in the fire, and is fire-tolerant (see also Hedberg, 1964, Fig. 22). The virtual absence of reproduction in unburned areas, contrasted with over 90% flowering in the burned areas, suggests that some populations of *F. pilgeri* may be dependent on fire for recruitment. Together, these results suggest a long evolutionary exposure of this species to fire. To our knowledge, this is

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the first demonstration of fire-induced reproduction from a tropical alpine ecosystem.

Fire-induced reproduction appears to be more common in nutrient-poor habitats, and it has been suggested that the effects of fire are limited to the release of limiting nutrients (Verboom et al., 2002). However, the nutrient-rich volcanic soils of Mount Kenya (Young, 1984) imply other proximate cues, such as increased light or soil moisture availability. A likely evolutionary reason for this fire-induced reproduction may be the opening of rare sites for seedlings after a fire.

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References


