Survival of the Teesdale rarities

from Peter D. Moore
Plant Ecology Correspondent

RARITY is an attribute which makes an organism peculiarly attractive to mankind, even to biologists. When many rare organisms are gathered together in one place, it is inevitable that biological attention should be focused on that spot. In the British Isles there is no better example of this than the rare plants of Teesdale, especially since they have been threatened and partially obliterated by the development of the Cow Green Reservoir. One good result of this incident is the burst of research activity which it has stimulated, partly as a result of the finance generated by the setting up of the ICI Teesdale Trust Fund, a kind of sad consolation for depleted biological resources.

The major biological problem presented by Teesdale is a phytogeographical one, namely the explanation of the surprising distribution patterns of some of the rarities, such as *Gentiana verna, Minuartia stricta, Tofieldia pusilla* and *Kobresia simpliciuscula*. In 1956, Pigott (*J. Ecol.*, **44**, 545) presented a detailed survey of the plant communities in Teesdale and suggested possible explanations for the unusual assemblages of species found there. Following the arguments of Godwin (*J. Ecol.*, **37**, 140; 1949), he considered that these communities were relicts of late-glacial vegetation which had survived because of the poor growth of forest in the area during the postglacial climatic optimum. Factors such as severity of climate and instability of soil may have assisted such survival.

Direct evidence of postglacial survival has been found in the local peat deposits, where plant fragments and pollen grains are preserved (Squires, *Nature*, **229**, 43; 1971 and more recently Turner *et al.*, *Phil. Trans. R. Soc.*, **B265**, 327; 1973). Peat deposits, some dating back to the late-Devensian (last glacial) period, show that light demanding plant species have been present in some quantity throughout the Flandrian (postglacial) period. Woodland cover can never have been complete, therefore, and the refugium hypothesis of Pigott gains support. Furthermore, some of the rare and uncommon plants (such as *Gentiana verna, Dryas octopetala, Polemonium caeruleum* and *Polygonum viviparum*) have a fairly continuous pollen record, indicative of postglacial survival. Many of the other rare plants, however, cannot be identified to the level of species on the basis of their pollen so that evidence for them is still lacking.

An alternative approach to the problem is the study of the ecophysiology of the rare plants. Arnold (*New Phytol.*, **73**, 333; 1974) has examined the growth of seedlings of two Teesdale plants, *Kobresia simpliciuscula* and *Plantago maritima*. Seeds of these species were germinated at 18° C and the seedlings were grown at 10°, 14° and 18° C at a light intensity of 60 W m^{-2}. Records were kept of leaf length, width and number and net assimilation rate. Both species grew faster in all respects at higher temperatures but, in the case of *Kobresia*, there was a marked increase in growth at 18° C when compared with that at 14° C. Mean summer temperatures in Teesdale are between 10° C and 14° C; temperatures of 18° C were exceeded on only about 3% of summer days. Arnold remarks that *Kobresia* would be favoured by a warmer environment and she finds difficulty in explaining its occurrence at Teesdale in terms of its temperature response. The answer seems to be that temperature response is not an important parameter in this situation. The experiments demonstrate that these species are living suboptimally in Teesdale as far as temperature is concerned, but this is not surprising. The survival of such plants is due to their ability to maintain a positive growth rate where many other more robust species (including trees) fail to do so. The relevance of these temperature response data, if indeed they are relevant, will only be appreciated when further figures are available from the potential competitors of the Teesdale rarities.

Aerial view of Upper Teesdale (looking north-west) showing the Cow Green area before it was flooded for the reservoir built by the Tees Valley and Cleveland Water Board (Imperial Chemical Industries photograph).

Genes for N_2 fixation on the move again

from a Correspondent

Two years ago Dixon and Postgate reported (*Nature*, **237**, 102; 1972) their success in transferring nitrogen-fixing ability from a N_2-fixing strain of *Klebsiella pneumonia* to the common colon bacteria *Escherichia coli*. Greater complications in using plant nodule bacteria from the genus *Rhizobium* as donors of nitrogen-fixing ability were anticipated since the presence of N_2-fixing activity in *Rhizobium* cannot be shown in laboratory cultures, and the genus *Rhizobium* lacks an effective genetic system for mobilising genes. This difficulty now seems to have been overcome by Dunican and Tierney of University College, Galway (*Biochem. biophys. Res. Commun.*, **57**, 62; 1974) who have been able to transform a derepressed antibiotic resistance transfer factor into *R. trifolii*. This work greatly increases the possibility of mobilising *Rhizobium* genes since this same factor is known to mobilise with an appreciable frequency genes in other bacterial systems. With this R factor present the *Rhizobium* acted as if it had had a sex factor and transferred the ability to fix nitrogen when mated with a non-fixing strain, *Klebsiella aerogenes*. Hybrids capable of fixing nitrogen, measured by the acetylene reduction technique, oc-