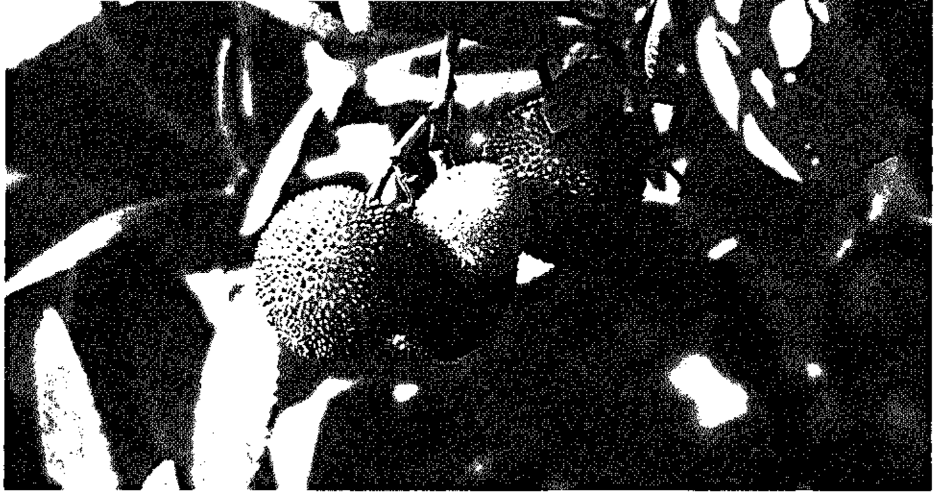

J. van der Maesen

The fruits of the strawberry tree (Arbutus unedo) are edible

The Council of Europe and biodiversity

Jos van der Maesen

In 1989 the Council of Europe established a Group of Experts on Biodiversity and Biosubsistence, whose tasks were to review the current conservation status of relatives of crop plants. Conservation action is needed with priority, as resources to manage all threatened plants cannot be made available. There are 2,200 or more species in Europe either with an endangered, vulnerable, rare or undetermined status. "Only" 27 species are recorded as extinct by the World Conservation Union (IUCN).

Plants for the future

Even as Europe has probably the most man-made environment of all continents, and some of its agriculture only survives with subsidies, crop cultivars (varieties) need to be constantly monitored and usually improvement is needed. This implies replacement of old landraces or cultivars: genetic erosion. Despite the successes of genetical engineering, the engineering parts should remain available. For crop species these parts are the obsolete cultivars as well as wild relatives; wild subspecies or varieties, or other species in the same genus. For European crops genotypes from Europe already have a degree of adaptation, so have less unadapted genes, and as part of Europe's natural heritage, the countries in Europe should protect this germplasm. A list of the main cultivated plants, agricultural, horticultural as well as silvicultural, with their wild relatives, was drawn up for the Council of Europe by the Botanic Gardens Conservation Service in Kew (England), and the expertise of the Group's members added considerably to the number of species and the accuracy of the contents. This list is due to be published this year, 1993.

Some examples

Our agriculture depends heavily on germplasm from other continents. Potato, tomato, fodder and seed maize are of American origin, large numbers of ornamentals came from China and Japan. However, quite a few crops originated in our continent. Some crops, sometimes important only locally or in a distant past, also deserve attention as their use may gain importance. Conservation involves not just maintaining species, but maintaining a reasonable number of genotypes, accessions with differing genetic make-up. Particularly of minor crops germplasm collections are not large. Wild beets (*Beta vulgaris subsp. maritima*) and wild cabbage (*Brassica oleracea*) occur along the coasts and some populations are threatened or have disappeared. *Crocus* relatives from Greece, Italy, Hungary and Balkan countries are part of the ancestry of various cultivated *Crocus*.

Integrated strategies

Two workshops have been planned to substantiate the "Conservation of the wild relatives of European cultivated plants: developing integrated strategies". The first workshop was organised at Faro (Portugal) on 8-11 November 1992, very aptly held in the Ria Formosa Nature Reserve, and addressed the following themes:

- Ecogeographical surveys: in which climate and geographical zones do the plants occur;

- Demography: what populations are like, statistics of size, density and distribution;

- Reproductive biology: particularly small populations that do not reproduce rapidly are under threat, and human and animal interference need to be checked.

The second workshop was held in Neuchatel, Switzerland, on 14-18 October 1993. The themes considered were:

- Interactions among organisms and ecosystems;

- Geneflow in wide-ranging species and spatial problems;

- Environmental stress and survival strategies;

- Synthesis: managing the populations.

Apart from the Group's experts several specialist scientists are invited to contribute. Oddly no funds were available to attract those scientists, but personal contacts and invitations, and aware of the undeniable importance of the need to conserve biodiversity, the speakers have attended and arranged their own travel funds. This makes the final reports even more thorough, and provide backing with a more varied reference list.

Measures to be taken

The scientists' contribution is to back up politicians with firm data. The Council of Europe, with the Group's reports in hand, will decide what priorities can be taken so to have the respective governments move for practical implementation.

The Group wishes to arrive at management and protection plans both *in situ* as well as *ex situ*. Long-term research and critical mass of research bodies is required to continue to provide a sound basis for correct conservation of target species of crop relatives. The classical discipline of plant systematics or taxonomy is the most basic one in biology. With genetics, plant breeding, advanced techniques and mathematics, our knowledge of the relationships between plants continues to grow, and some more knowledge of their evolutionary history can benefit use as well as conservation. However, insufficient means are provided and consequently the knowledge on wild relatives of cultivated plants is uneven and often inadequate. Timely action is required, not necessarily timeless. And co-ordination for an interdisciplinary approach can help economise manpower and resources, not to be translated in involving more bureaucrats. The existing infrastructure (university departments, research institutes, botanic gardens etc) can deliver the goods, but staffing needs to be guaranteed and increased in various places. Awareness is raised, and technical details will be presented in the Group's reports.

How to conserve ?

We know two ways to conserve crop relatives: *in situ* and *ex situ*. *In situ* usually means in a conserved habitat - we are talking of wild species - without or with certain degrees of management. There are legal and socio-economic aspects as well. Where rare animals are protected plants also fare well.

T. McNeilly

Disused mines prove to be open-air laboratories

Weedy species might prefer a man-disturbed habitat, some plants have to grow in such areas. Nature cannot always be depended upon for keeping genotypes, natural selection continues. Nature reserves and protected zones harbour many of the crop relatives, so good inventories and monitoring tell us what is available. This knowledge is unevenly distributed. A major task: for instance the Netherlands alone have some 3,000 protected areas, some smaller than one hectare!

More accessible and convenient to use are *ex situ* collections of germplasm, the seed or "gene" banks, provided the seeds can be kept long and funds are available for upkeep of the stores. Carefully dried and refrigerated seeds of many crop species (cereals, legumes, oilseeds) will keep at least 25 to 100 years. Of the wild relatives seed storage particulars are often unknown, but they will probably resemble their economic siblings in this respect. A good knowledge of reproduction and longevity of seeds indicates what policy to follow. Usually only a minority of samples in gene banks is of wild origin. A good way to conserve crop relatives is by nature itself, provided we give it its chances, without letting it run amok, and are careful to monitor and manage the various habitats. ■

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Natural selection

Tom McNeilly

Evolution conjures up a vision of prolonged, slow, small, steady, adaptive changes over long time periods. Studies in the Poaceae have altered that view dramatically. Normal populations of *Agrostic canina* and *A. capillaris* grew over a site proposed for a zinc/cadmium smelter in northern Germany. Smelting began in 1969, emission of zinc making the immediately surrounding soils phytotoxic. After one year natural selection caused a fourfold increase in the zinc tolerance of those populations. Similar rapid changes have been found in grazed pastures. Plots sown with equal quantities of ryegrasses bred for grazing (S23), hay production (S24), or early establishment (S22), underwent rapid changes in component frequencies due to natural selection. Nine months after sowing, S22 made up 80% of the swards, S24 13% and S23 7%. Twelve months later S22 had decreased to 4%, whilst S24 and S23 increased to 36% and 60% respectively. Change due to natural selection can thus be very rapid.

Heavy metal toxicity exerts very high selection pressures. Boundaries between toxic and normal soils can be very sharp. Distinct metal tolerant and normal populations have been found one metre apart in *Agrostis capillaris* and in *Anthoxanthum odoratum*. *A. odoratum* populations growing 10 cm apart on adjacent grass plots limed or unlimed since 1903 differ markedly in plant height. Scales of population differentiation reflect the strength of natural selection and the scale of environmental change.

The Poaceae examined in these studies are self compatible and anemophilous. Distinct populations, as we have seen, may occur adjacent to each other. Because pollen dispersal and pollination can be considerable and effective over 5 m, such populations may exchange genes (gene flow) coding for their contrasting adaptive features. This may affect the impact of natural selection on population divergence patterns. Studies within the Poaceae have shown that with high or low gene flow, and high selection pressures, sharp boundaries are maintained between populations. Weak selection and high or low gene flow results in blurred boundaries between populations.

Only a small number of species grow on toxic metal mine wastes. Why? Of 15 grass species growing along the edge of a large copper mine in North Wales, only five grew on the mine waste itself. Artificial selection showed that the remaining ten could not evolve copper tolerance, necessary for them to grow on the mine waste. Many species do not appear to have the necessary genetic variability within them to allow survival at toxic metal levels. This may have wide implications for understanding the ecology of species.

A very large proportion of the fundamental studies of natural selection both within and outside the Poaceae have been carried out on abandoned heavy metal mine sites in Europe. Yet these sites are rapidly disappearing because of reclamation. The plant populations which each site supports are just as unique as those of any endangered species. They can never evolve again once the sites on which they have evolved are "reclaimed to support a further - ecological and academic - desert of amenity grasses, or treated as, or levelled to become, another rubbish tip. We should surely take rapid steps to preserve at least some of these uniquely informative habitats before all have disappeared. ■

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