

PROJECT SUMMARY

TITLE OF PROJECT: Systematics of *Parkinsonia* and closely related species in the genus *Cercidium*.

R NUMBER: R5063

RNRRS PROGRAMME: Forestry

PROGRAMME MANAGER: OFI

SUB-CONTRACTOR: OFI

RNRRS PROGRAMME PURPOSE: The use of trees within farming systems, including community and farm woodlots, optimised.

RNRRS PRODUCTION SYSTEM: Semi arid

COMMODITY BASE: Fuelwood, charcoal

BENEFICIARIES: Resource poor farmers

TARGET INSTITUTIONS: National forestry research institutions

GEOGRAPHIC FOCUS: Guatemala, Honduras, Mexico, Nicaragua

START DATE: 01/10/92 **FINISH DATE:** 31/03/97

TOTAL COST: £72,020

1. Project purpose:

Parkinsonia aculeata, a small thorny tree native to the neotropics, has an outstanding ability to flourish on saline, high pH and waterlogged soils, and to survive high temperatures and extreme drought. The species' useful products are only firewood, small poles and low quality livestock fodder, but its ability to tolerate difficult conditions has resulted in it being widely planted as an exotic. Despite an aggressive weediness tendency becoming apparent under some circumstances, *P. aculeata* continues to be seen as important for the reclamation of degraded sites in harsh environments. The introductions to date, however, have used seed largely from unrecorded sources and have ignored the implications that the likely pronounced genetic variation has for plantation performance. Therefore, preliminary investigations of the species were included as part of R3714 (*Tropical hardwoods for dry and semi-arid zones*, 01/03/82 to 31/03/85) and R4091 (*The intensive study of tropical and sub-tropical multipurpose gene resources*, 01/04/85 to 31/03/88). The results emphasised the need for improved knowledge of the biology and genetics of *P. aculeata* and its near relatives to provide a firm foundation for the rational use of the species' genetic resources, thus facilitating **identification of multipurpose trees with improved performance and the promotion of their use in agroforestry systems**.

2. Outputs:

The overall project objective was **to investigate the systematics of the genera *Parkinsonia* and *Cercidium*, with particular reference to *Parkinsonia aculeata***. The specific objectives were:

- 1) to determine the true natural distribution of *Parkinsonia aculeata* and patterns of intraspecific variation in both natural and naturalised populations;
- 2) to investigate closely related species in the genus *Cercidium* with a view to resolving the longstanding confusion surrounding the separation of the genera *Parkinsonia* and *Cercidium* using a range of morphological and molecular evidence;
- 3) to investigate and verify the occurrence of hybrids between *Parkinsonia* and *Cercidium*.

3. Contribution of outputs to project goal:

The project made substantial progress towards achieving all three objectives, thus furnishing more complete knowledge of the species which will guide the **optimisation of their use in farming systems**.

Field work carried out in Mexico, Honduras, Nicaragua, Costa Rica and Guatemala identified a number of strongly delimited, widely disjunct populations of *P. aculeata* on seasonally flooded lake bed sites. Outside these sites *P. aculeata* was cultivated, or formed extensive weedy populations closely associated with watercourses. The observation of numerous weedy populations of *P. aculeata* might suggest that introduction and utilization of this species should be carefully controlled.

In the course of field work sufficient botanical material was collected to make a study of the systematic relationships of *Parkinsonia* and *Cercidium*, and of the status of putative hybrids between *P. aculeata* and *C. praecox*. Morphological cladistic analysis showed that the species comprising *Cercidium* (mostly from Sonora Mexico) are extremely closely related, comprising a well-characterised group. The African species *P. africana* is the species most closely related to this group. The widespread species *P. aculeata* is also a close relative, but the East African species of *Parkinsonia* may have closer affinities elsewhere. It was not possible to collect molecular

data to test this scheme further: a range of approaches were employed, but of nine sequences examined three were invariable and six could not be sequenced. Ecological, distributional, molecular and morphometric data was used to clarify the status of a putative hybrid between *Parkinsonia aculeata* and *Cercidium praecox*. The putative hybrid occurs in disturbed sites, often where *P. aculeata* is established as a weed, and where *C. praecox* and the putative hybrid were cultivated as shade, ornamental and fodder trees. All hybrid sites are located within the area of sympatry of the widespread *P. aculeata* and the more narrowly distributed *C. praecox*. A morphometric data set was analyzed using principal component analysis and the character count procedure. Morphometric, ecological and distributional evidence was considered to support the hypothesis of hybridity. A RAPD data set was more equivocal. The hybrid is popular with farmers, and is preferred to *P. aculeata*. However, the ease and extent of natural and semi-natural hybridization suggests that either parent or the hybrid should be used with care, since weediness of hybrid or introgressed entities may be problematic.

4. Dissemination products:

See PROREC output.

5. Follow-up:

The research produced sufficient evidence to justify uniting *Cercidium* with the American and South African species of *Parkinsonia*. However, further higher level analyses are required for the placement of the East African *Parkinsonia* species.