

3/93-8/93

1

CRDC Project : CSP 41C

FINAL REPORT

COLLECTION OF GERMPLASM OF WILD *Gossypium sturtianum* IN
SOUTHEASTERN AUSTRALIA AND ITS MULTIPLICATION

Summary

The objectives of this project were to sample *Gossypium sturtianum* (Sturt's Desert Rose) in the Flinders and Barrier Ranges, and multiply the samples for research and conservation. The area for exploration forms the southern boundary of the genus.

Specimen records from major herbaria were used to plan the field trip. This was carried out 8 -19 February, and samples of individual capsules were obtained from 23 sites, including the three most southerly populations, and eight new populations. This represents a substantial sampling of a very rare plant. The typical habitat for the species was a well drained bank of a dry creek, protected from winter exposure and with local air drainage. Throughout the area of study, the plant was very rare. At about one third of the sites, only a single plant was found and only four sites had appreciable populations. Most populations showed little sign of herbivore damage.

Plants have been established from the seed samples in the glasshouse at Canberra and seed will be harvested, evaluated and processed for storage over the subsequent twelve months as part of the germplasm program.

A H D Brown

sent to John Cullen
12/19/93

Collaborators on Field Trip

Dr A H D Brown, CSIRO Division of Plant Industry, Canberra;
 Mr L A Craven, CSIRO Division of Plant Industry, Canberra;
 Mr J P Grace, CSIRO Division of Plant Industry, Canberra;
 Professor H Hurka, visiting scientist from Biology Department, University of
 Osnabrueck, Germany

Objectives

The purpose of the project was to obtain seed samples of wild populations of *Gossypium sturtianum* in the Flinders Ranges area of South Australia and in western and central New South Wales. The germplasm would provide material for research on genetic variation, herbivore resistance and cold tolerance in this species. The area for exploration forms the southern-most limit of the natural range of the genus in Australia.

Methods

Data from specimen records in the major public herbaria in Adelaide, Canberra and Sydney were obtained and the overall route of the field trip was planned to visit as many known locations as possible. Particular attention was paid to sampling the southern limits of the species. Within these constraints and that of time, brief searches were also made in similar habitats. All samples were of ripe capsules harvested individually in separate packets with material from different plants kept separate. A herbarium voucher specimen accompanied all field germplasm samples. The daily overnight stopover, distance travelled and number of sites we found are listed in Table 1.

Results

Collections

Twenty-three populations were located and samples of capsules with ripening seed taken from 22 of these (Table 2). (The exception, Mt Manara†, will be sampled by the farmer when fruit are available). The list of the sites gives their latitude and altitude, the adult population size and whether or not seedlings were present. Three of the collections (01087, 01093 and 01096) were not from wild plants, but were from plants cultivated from seed of local origin. The remaining 20 are natural populations. The set of samples comprised 3 from north-western NSW, 14 from Northern Flinders Ranges, 4 from Central and Southern Flinders and 2 outliers west of Port Augusta. It includes samples from the three most southerly recordings for this species in herbaria (collections 01091, 94 and 97).

Fourteen of the samples represent collections at the same sites from which plant collectors had already lodged specimens in Australian herbaria. These sites are listed in Table 3. In some cases (e.g. 01063, 67, 69, 90) our collections were taken probably from the same plants previously located or their direct descendants (01093 and 01096). In addition to the sites already known to science, we found a further eight new populations. Considering that the species is a very rare plant in the target area, the total collection represents a substantial sampling of this species.

Field Observations

1 Ecology

The complete geographic distribution of *Gossypium sturtianum*, or Sturt's Desert Rose, comprises the Pilbara region of Western Australia east to the central highland region of Queensland, and from Mount Isa south to the Flinders Ranges. This range has a number of major disjunct areas. Of these, the one we explored on this trip (the Flinders and Barrier Ranges and nearby smaller mountain ranges) is the most southerly area.

In this area the typical habitat for *G. sturtianum* was a well drained bank of a dry creek on semi stable alluvial sandy loam deposited on the level or sloping "bench" forming the creek bank. In some rare cases, large mature plants were growing in creek pebbles on stoney substrate without alluvial sands. As these plants were not surrounded with regenerating seedlings, we surmised that a sandy substrate was needed for seedling establishment. Later the sand may be washed away during floods, but sufficiently large plants can persist. A few large plants were possibly decades old, and some showed resilience to flood damage and the capacity to regenerate at the base of dead stems. The aspect of the sites protected the plants from harsh winter exposure. The plants were not in frost prone pockets, but in areas with good local air drainage. The altitude of nearly all sites was in the range 100 - 400 meters, which could reflect the need for a temperate, well drained habitat.

2 Population Sizes, Distribution and Dynamics

Throughout the area of study, plants of Sturt's Desert Rose were very rare. Occurrence was patchy and sporadic, or very clumped when more than a single plant occurred at a site. At about one third of the sites, only a single plant was found despite search for others. Table 2 lists the numbers of plants at the site. In only four cases (01072, 74, 86 and 94) were moderate populations present when a favourable habitat combined with some protection from feral or agricultural grazing.

More than half the sites lacked regenerating seedlings. In most cases the adult populations at these sites consisted of one or a few individuals. However where favourable alluvium was present, small seedlings could be found even when adult numbers were low.

3 Reproductive Biology

In nearly all cases, we found plants bearing a large crop of capsules containing seeds. Early summer rains had been ideal for the timing of the collecting trip. The high fertility in populations of single isolated plants also indicated that the species is capable of a high level of autogamy.

Delayed selfing could have been assisted by a variety of insects, or by closure of the floral tube after the full opening of the corolla until it dried out and dislodged. At a few sites insects were abundantly associated with the flowers. At 01084, flies with a long stylet-like proboscis were feeding at the base of the gynoecium. At other sites ants were active, moving all over the flower. This could have facilitated self-pollination within a flower. At others the Hibiscus beetle were feeding on the flower parts. The pollen grains possess spines that helped adherence to moving casual insect visitors.

Individual flowers differed in their degree of herkogamy, i.e. in the amount of spatial separation between dehiscing anthers and receptive style. Our observations solved some questions, such as whether self fertilization could be prevalent in nature, but opened many others. Time course studies are needed to determine whether the positioning of the anthers and stigma varies during the development of the flower, and whether flowers of the same plant differ, or whether plants in a population differ. Nectar production is also requires determination.

4 Seed Dispersal

The pattern of occurrence in the field suggested two modes of dispersal. Mature seed dislodge from capsules, or the capsules themselves fall from the plant over a prolonged period. Either the fruit or the seed, buoyed by the indumentum or lint, could assist flotation and dispersal downstream during peak flow or floods. A second mode of dispersal is through bird feeding or animal browsing of the seed which may resist digestion and be spread over wide areas. Nothing is known of about seed longevity and dormancy, but we should obtain evidence on these from the germplasm multiplication and conservation we will be undertaking.

5 Associated insects

Most population showed little evidence of insect herbivore activity. Where leaf damage was present, no herbivores were found for study. insects associated with the flowers have already been mentioned.

Field situation

Despite the small size of most populations, we were able to obtain good quality seed samples at all but one of the sites. The population at this site (Mt Manara, Ivanhoe), consisted of only one plant that had no flowers or fruit. Formerly a large population occurred at the site, and a specimen was collected nearby 10 years ago. The population was subject to grazing by feral goats and rabbits. Because of the importance of this population at the margin of the species distribution, we have asked the farmer to arrange for the plant to be fenced and seed to be collected.

In general, most populations of the species in this region are in a precarious state. Many of the sites had few plants and no signs of current regeneration (seedlings). Without some assistance the species might struggle to survive. Fortunately Sturt's Desert Rose is an attractive plant and has penetrated the horticultural trade, or has been protected or grown by local farmers.

Conclusions

Research projects to undertake experimental hybridizations and other studies are dependent upon adequate materials being available. The objectives of this project were to establish in the glasshouse, plants derived from wild-collected material of southeastern Australian *G. sturtianum* populations, and to multiply seed from these plants for conservation. This phase of field work is complete and the plants established for seed increase over the next six months. Seed will be harvested, evaluated and processed for storage over the subsequent twelve months as part of the regular germplasm program at Canberra. Meanwhile we will be using the accessions in the new CRDC project (CSP47C) which is aimed at hybridizing *G. sturtianum* with cotton.

Table 1 Daily destination (8 - 19 February 1993), distance travelled and number of sites located

Date	Overnight	Distance	Sites
8	Hillston	539	-
9	Wilcannia	380	1
10	Broken Hill	362	1
11	Wilpena	449	1
12	Blinman	174	1
13	Arkaroola	173	6
14	Lyndhurst	227	4
15	Hawker	472	5
16	Port Augusta	465	2
17	Peterborough	325	1
18	Menindee	559	1
19	Canberra	917	-
Total		5042	23

Table 2 Collecting sites for *Gossypium sturtianum*, February 1993 († no seed, see text)

Coll. No	Site Locality	Lat. (° S)	Alt. (m)	No. of plants	Seedlings present
† -	Mt Manara, Ivanhoe	32 29	140	1	-
01063	Mundi Mundi Creek, Silverton	31 44	250	15	+
01066	Mt Billy Creek, Wilpena	31 20	310	2	-
01067	Brachina Creek Road	31 20	400	2	-
01069	Chambers Gorge road	30 57	190	1	-
01072	Blinman - Wertaloona road	30 55	220	30	+
01073	Blinman - Wertaloona road	30 54	230	5	+
01074	Wearing Gorge	30 52	220	20	+
01075	Teatree Outstation	30 52	180	10	-
01076	Mt McKinlay Creek	30 37	130	3	-
01078	Paralana Hot Springs	30 11	200	10	+
01081	Italowie Creek crossing	30 34	200	1	-
01083	Oocaboolina Outpost	30 36	335	1	-
01084	Angepena	30 32	480	1	+
01086	West Mount Creek	30 01	100	25	+
01087	Tulloch's Bakery, Copley	30 33	230	2	-
01088	Emu Creek	30 37	230	1	-
01089	Green Well Creek	31 02	145	1	-
01090	Brachina Gorge entrance	31 20	210	1	-
01091	Winninowie Range	32 43	170	1	-
01093	Pernatty Homestead	31 29	105	3	+
01094	Carriewerloo Homestead	32 24	170	90	+
01096	Corona Homestead	31 17	220	3	+

Table 3 Collecting details of previous herbarium collections at sites where we made germplasm collections on this trip

Coll. No	Locality	Previous herbarium collection		
		Name	No	Date
	Mt Manara; Ivanhoe	Mulham	1517	10/83
01063	Mundi Mundi Creek,	West	4078	
01067	Brachina Creek Road	Symon	11967	1/80
01069	Chambers Gorge road	Kilgour	598	11/86
01074	Wearing Gorge	Hj Eichler	19692	10/67
01076	Mt McKinlay Creek	Kraehenbuehl	754	10/62
01078	Paralana Hot Springs	Kuchel	913	8/63
01086	West Mount Creek	Badman	4110	2/90
01088	Emu Creek	Lothian	s n	10/53
01090	Brachina Gorge entrance	Symon	13033	11/82
01091	Winninowie Range	Spooner	8933	10/83
01093	Pernatty Homestead	French	s n	4/39
01094	Carriewerloo Homestead	Michael	144	10/90
01096	Corona Homestead	Milthorpe	642	1/72