

COLLECTION OF WILD NATURALIZED SUNFLOWERS FROM THE LAND DOWN UNDER

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Introduction

The narrow genetic base of cultivated sunflower has been broadened by the infusion of genes from related wild species which have provided a continued source of unique agronomic traits for crop improvement. The genus *Helianthus* comprises 51 species (14 annual and 37 perennial), all native to North America (Schilling, 2006). However, wild sunflower have been inadvertently and intentionally introduced into several countries where they have become naturalized, most notably in Australia, Argentina, and southern Europe (Dry and Burdon, 1986; Poverene et al., 2004; Bervillé et al., 2005). Within the continent of Australia, there are herbaria records for five *Helianthus* species: *H. annuus* (common annual sunflower), *H. argophyllus* (silver-leaf sunflower), *H. ciliaris* (Texas blueweed), *H. debilis* ssp. *cucumerifolius* (cucumber-leaf sunflower), and *H. tuberosus* (Jerusalem artichoke). The distribution of the wild naturalized species in Australia occurs primarily within the states of Queensland (QLD), New South Wales (NSW), Victoria (VIC), South Australia (SA), and West Australia (WA).

Since these species have been naturalized in Australia, the possibility exists that they may have traits distinct from their North American progenitors due to the different environments, diseases and insect pests. Currently there are no collections of wild sunflower from Australia in the USDA-ARS National Plant Germplasm System (NPGS) sunflower germplasm collection. This germplasm would greatly increase the available genetic diversity for these species from outside of North America. The objective of this exploration was to collect achenes from as many populations as possible of *H. annuus* and *H. debilis*, and make them available for future research and improvement of cultivated sunflower.

Materials and Methods

The Australian exploration took place from February 22 through March 14, 2007. It covered 6,250 miles in the states of Queensland, New South Wales, Victoria, South Australia, and West Australia (Figure 1).

Australia

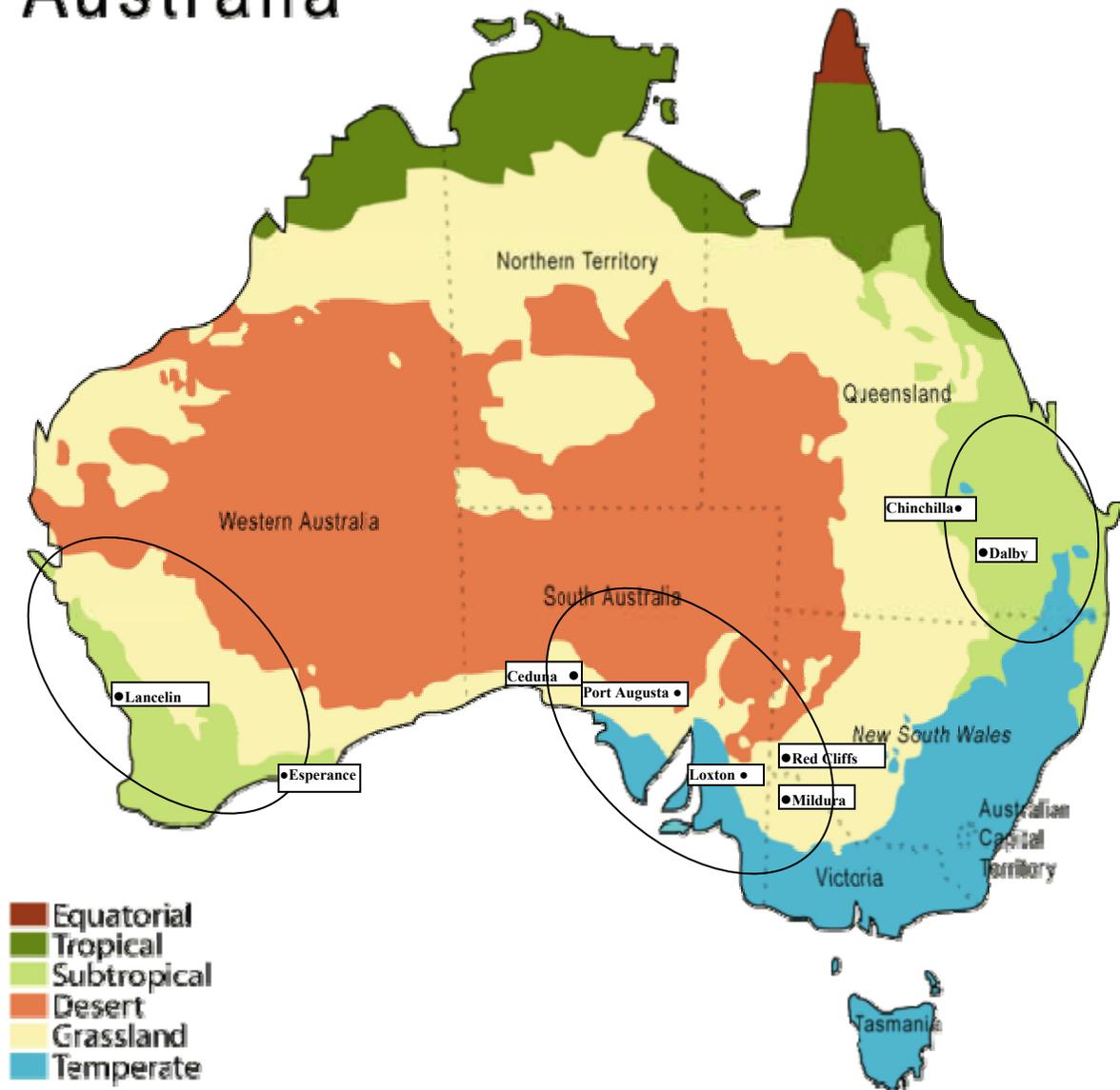


Figure 1. Map of Australia showing the states and climatic zones. Circled areas are the three generalized areas explored for wild naturalized sunflowers and collection sites.

There were two participants from the USDA-ARS, Fargo, ND (Tom Gulya and Gerald Seiler) and three from the Queensland Department of Primary Industries (DPI), Toowoomba, QLD (Gary Kong, Sue Thompson, and Jeff Mitchell). Two teams covered West Australia (WA), one team going southeast of Perth and the other going northwest. In South Australia, two teams also covered the area with one team going to the east and the other to the west of Adelaide. The exploration in Queensland consisted of one combined team. Achenes were collected from as many plants as possible ranging from a low of five plants to as high as 100 plants and with a target number of achenes greater than 3,000 per population. Heads were bulked into a single

sample per population. Herbarium specimens were pressed and deposited in the USDA-ARS wild species herbarium at Fargo, ND. The achene samples were deposited in the USDA-ARS National Plant Germplasm System (NPGS) sunflower germplasm collection at Ames, IA. Additionally, a portion of the achenes was deposited in the sunflower collection held at the DPI, Toowoomba, QLD.

All populations were collected from throughout the broad distributional range of the naturalized species and subspecies. Specific site information was obtained from herbarium specimens and previously collected populations of *H. annuus*, and *H. debilis* ssp. *cucumerifolius* by the DPI, Toowoomba. Population size (number and extent) was estimated, habitat, soil type, estimated seed set, presence of diseases and insects, photo documentation, and GPS coordinates with elevation were recorded for each population.

Results and Discussion

Five days were spent exploring WA. In spite of the extreme drought, 14 populations of naturalized *H. annuus* were collected. Representative populations collected are shown near Esperance, southern coastal WA (Figure 2).



Figure 2. Wild *H. annuus* sunflower in a municipal “rubbish tip” at Esperance, West Australia illustrating “typical” habitat for this species in Australia.

Habitat for the collection site of wild *H. annuus* near the town of Lancelin, WA, northwest of Perth is shown in Figure 3.



Figure 3. Jeff Mitchell collecting wild *H. annuus* near Lancelin along the western coastal area of West Australia.

Wild *H. annuus* was generally associated with disturbed soil in or near areas of habitation. The soils were generally of the sandy loam type.

Six days were spent exploring South Australia, New South Wales and Victoria. These states were especially hard hit with drought, but 21 populations of naturalized wild *H. annuus* were collected. Wild sunflower populations from South Australia and other states were often associated with gardens and grown as ornamentals as seen in Figure 4 from eastern South Australia.



Figure 4. Sue Thompson collecting wild *H. annuus* in the vicinity of Loxton, South Australia.

The only collection of wild *H. annuus* from northern Victoria was from one isolated population in the vicinity of Mildura (Figure 5).



Figure 5. Sue Thompson collecting wild *H. annuus* in an isolated population along a roadside in the vicinity of Mildura, Victoria.

The habitat was more typical of wild *H. annuus* found in the USA along disturbed roadside ditches near cultivated fields.

Populations of wild sunflower were also found in the vicinity of New South Wales near vineyards (Figure 6).



Figure 6. Gerald Seiler and Jeff Mitchell collecting wild *H. annuus* from a robust roadside population near a vineyard in southwest New South Wales in the vicinity of Red Cliffs.

Habitat for wild annual sunflower in the western part of SA was roadside ditches (Figures 7 and 8).

Soil type was generally a lighter sandy loam soil. The population size of wild sunflower in SA, NSW, and VIC varied from a few plants to over several hundred plants, but seldom extending for long distances as seen in the center of origin in the USA.



Figure 7. Gary Kong collecting wild *H. annuus* from a roadside population near Port Augusta, South Australia.



Figure 8. Tom Gulya standing next to a typical roadside population of *H. annuus* near Ceduna, South Australia, the westernmost collection made in South Australia.

An exploration to Queensland, which was also suffering from extreme drought, resulted in the collection of two populations of wild naturalized *H. annuus* and two populations of *H. debilis* ssp. *cucumerifolius*. The wild *H. annuus* populations were associated with disturbed areas near rubbish tips (municipal landfills) (Figure 9).



Figure 9. Gerald Seiler collecting seeds of wild *H. annuus* on top of the town's landfill (rubbish tip) near the town of Dalby, Queensland.

The habitat for the *H. debilis* ssp. *cucumerifolius* populations was typically sandy soil, the same as in the USA (Figure 10).



Figure 10. One of the two populations of *H. debilis* ssp. *cucumerifolius* collected near the town of Chinchilla, Queensland in a typical sandy soil habitat.

The origin of the naturalized populations of wild sunflower in Australia is still open for discussion. It is also possible that the seed was inadvertently introduced in imported forages, or possibly in bird seed. The wild naturalized species found there are sometimes grown in gardens as ornamental flowers. Currently, the time of the introduction of the wild species into Australia is not known. Future genetic population studies may help to answer that question.

Thirty–seven populations of wild naturalized *H. annuus* and two populations of *H. debilis* ssp. *cucumerifolius* were collected from five Australian states. Populations were generally small and scattered, sometimes surviving as garden escapes or in gardens. The achene samples have been deposited in the NPGS sunflower germplasm collection at Ames, IA. Additionally, a portion of the achenes was deposited in the sunflower collection held at the DPI, Toowoomba, QLD. The germplasm collected will be evaluated for oil concentration and fatty acid composition, as well as screened for various diseases and insects as a potential source of genes for the improvement of cultivated sunflower.

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