# Wild Aussie genes to battle sunflower diseases

**By Jan Suszkiw, ARS–USDA**

Improved global disease resistance could be in store for tomorrow's sunflower varieties, thanks to plants that USDA Agricultural Research Service scientists collected in Australia and are evaluating in US greenhouse trials in Fargo, North Dakota.

ARS plant pathologist Thomas Gulyer and ARS botanist Gerald Seiler collected seeds of wild sunflowers while in Australia in the southern hemisphere summer of 2007. The ARS Plant Exploration Office funded their trip.

Assisted by their Australian hosts, Thomas and Gerald travelled to every corner of Australia to make 59 collections of *Helianthus annuus* and *H. debilis* sunflowers – marking the first time the ARS researchers collected these wild species outside the plants' native United States.

Thomas and Gerald say their ultimate goal is to find new genes that can be incorporated into sunflower hybrids to make them more resistant to fungi that cause diseases such as downy mildew, rust, and Sclerotinia stalk rot. Each year in the US alone, out-

...14▷

Close-up of an individual flower of wild *Helianthus annuus*, common annual sunflower. It was taken in Wudinna, in southern Australia. (PHOTO: Thomas Gulyer)

*Helianthus debilis*, commonly referred to as the 'dune sunflower', growing in a sandy roadside area in Queensland. This species is rarely found naturalised in Australia, but this roadside stand is the exception. (PHOTO: Thomas Gulyer)

**ARS botanist Gerald Seiler (left) and plant pathologist Gary Kong (with the Queensland Department of Primary Industries and Fisheries) inspect the first wild sunflower found on their trip to Western Australia on the outskirts of Esperance.** (PHOTO: Thomas Gulyer)

**Gary Kong collects sunflowers in South Australia along the Stuart Highway enroute from Port Augusta to Woomera.** (PHOTO: Thomas Gulyer)

◁13…WILD AUSSIE GENES

breaks of stalk rot and other forms of Sclerotinia disease cost about US$250 million in losses to sunflower, canola, soybean, and other susceptible crops.

In Australia, rust is the bigger menace. Mild to subtropical climates in areas where sunflowers grow allow the rust fungus, *Puccinia helianthi*, to skip its winter survival phase and evolve more rapidly via sexual recombination.

The upshot is "a great diversity of rust races in Australia – far greater than those observed in the United States," notes Thomas, who, along with Gerald, is in the Sunflower Research Unit, which is part of ARS's Red River Valley Agricultural Research Center in Fargo.

Their hope is that rust's nearly year-round presence has prompted a kind of sunflower survival of the fittest, whereby genes from the hardiest Aussie plants could be used to fortify the defenses of their US brethren.

"In autumn 2007 we began greenhouse trials of the 59 wild Australian sunflower populations we collected to evaluate their resistance to downy mildew, which doesn't currently exist in Australia, and to rust, which is severe there," says Thomas. "We'll also compare them with some North American wild sunflower populations for resistance to Sclerotinia stalk rot.

Of the three diseases, it is by far the most significant threat to the US crop, so finding new sources of even partial resistance would be a great accomplishment."

Gerald will analyse the Aussie plants' seed oil content and fatty acid composition. Loren Rieseberg, a University of British Columbia collaborator, will compare their genetic profiles to those of American wild sunflowers. This could reveal whether the Australian sunflowers have undergone significant genetic changes since arriving there more than 100 years ago from America.

"Though we were mainly interested in disease resistance, we collected across a broad geographic and climatic range to capture as much genetic diversity as possible," says Thomas. Indeed, their expedition took them on a 10,000 km journey through Western and South Australia, New South Wales, Victoria, and Queensland.

Plant pathologist Gary Kong and technicians Jeff Mitchell and Sue Thompson, from the Department of Primary Industries and Fisheries in Queensland, helped organise the trip itinerary and accompanied the ARS researchers.

The Australians also made an additional collection trip to areas near their Toowoomba, Queensland, location.

On average, the team gathered 6000 seeds per collection, which included wild populations from yards, hedgerows, vacant lots, sandy beaches, and many municipal garbage dumps, which were among the most productive sites for collecting seed.

The ARS researchers arrived back in the US three months before their sunflower bounty, however. That's because the seeds first had to be fumigated and inspected.

Even if new genes for disease resistance aren't found, the Australian plants' seed will be made available to researchers in both the United States and abroad. After testing is complete, the ARS team plans on storing the seed in the Helianthus germplasm collection at ARS's Plant Introduction Station in Ames, Iowa.

"That way," says Thomas, "future researchers who might have different research objectives can use this germplasm to find traits we're currently not interested in, or are unaware of, at the moment."

**Thomas J. Gulyer and Gerald J. Seiler are in the USDA-ARS Sunflower Research Unit, Red River Valley Agricultural Research Center, Fargo, North Dakota 58105.**
**Ph: 701 239 1316 [Thomas]; 701 239 1380 [Gerald]. Fax: 701 239 1346.** ■

**'Rubbish tip' sunflowers near Bowenville, Queensland. Town dump sites like this one often had the largest wild sunflower populations.** (PHOTO: Thomas Gulyer)