WILD SUNFLOWER GERMPLASM COLLECTION FROM THE EASTERN UNITED STATES

GERALD J. SEILER [1], WILLIAM W. ROATH [2], DRAGAN ŠKORIĆ [3]

INTRODUCTION

In addition to constituting the basic genetic background from which cultivated sunflower (*Helianthus annuus* L.) originated, germplasm from *Helianthus* species continues to contribute specific characteristics for sunflower improvement. The present cultivated sunflower has a very narrow genetic base that is particularly deficient in genes for resistance to disease and insect pests. Increased genetic variability and additional sources of resistance to diseases and insects will become more important as cultivated sunflower production intensifies in different areas of the world. The 50 wild species of sunflower possess considerable variability for most economic and agronomic characteristics, disease and insect resistance, and seed quality factors. The wild sunflower species have the potential of markedly improving the commercial hybrid sunflower through interspecific hybridization.

This paper presents information about the collection of wild sunflower species from the Eastern and Northeastern United States and gives field observations which may be useful for the utilization of the collected germplasm in cultivated sunflower breeding programmes.

MATERIALS AND METHODS

The sunflower germplasm exploration took place from October 16—29, 1985. The exploration was a joint project of the USDA — Agricultural Research Service (ARS) and National Plant Germplasm System (NPGS), with a cooperator from the International Board for Plant Genetic Resources (IBPGR), European Cooperative Programme for Conservation of Crop Genetic Resources (ECP/GR). The exploration covered some 8.300 km, and collections were made in 11 states of the Eastern and Northeastern United States. These states included: Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Vermont, Virginia, and West Virginia (Fig. 1). Seed was collected from 85 accessions, and rootstocks were collected from 74 accessions. Pressed herbarium specimens were collected for each species accession. Seed stocks and rootstocks are maintained at the Regional Plant Introduction Station at Ames, Iowa.

Species accession were collected from known species locations and from the general distribution of the species. General species distribution maps used were from Heiser et al. (1969) and Rogers et al. (1982). Specific locations were obtained from local botanists familiar with wild sunflower species population distributions. Species accessions were collected as they were encountered, and, usually, the species was not recollected in an area closer than 3 km. Field notes were kept on size of population, habitat, and any diseases or insects present.

RESULTS AND DISCUSSION

Ninety accessions representing 13 species of wild sunflower were collected during the exploration (Table 1). All species accessions except one (*Helianthus petiolaris* ssp. *petiolaris*) were perennial.

The exploration was undertaken in the fall (October), with the assumption that adequate seed would be set on the plants and fewer rootstocks would have to be collected and maintained. A very early frost, a hurricane two weeks before the exploration began, and an extremely dry summer season in upstate New York complicated the collection and identification of wild sunflower species.

[1] U.S. Dept. of Agriculture, Agricultural Research Service, Conservation and Production Research Laboratory, Bushland, TX 79 012.

[2] U.S. Dept. of Agriculture, Agricultural Research Service, Regional Plant Introduction Station, Ames, IA 50 011.

[3] Institute of Field and Vegetable Crops, 21 000 Novi-Sad, Yugoslavia.

Fig. 1 — Wild sunflower exploration — fall 1985

Table 1

Summary of the wild sunflower species collected from the Eastern and Northeastern United States during the fall of 1985

Species	Number of accessions	Location
H. atrorubens	5	VA
H. decapetalus	12	VA, WV, NY, CT
H. divaricatus	10	VA, WV, PA, NY, CT
H. giganteus	5	VA
H. x *laetiflorus*	9	VA, DE, NY, MA, NH
H. laevigatus	4	VA, WV
H. maximiliani	1	VA
H. microcephalus	1	VA
H. petiolaris ssp. *petiolaris*	1	NJ
H. rigidus ssp. *rigidus*	2	DE, NJ
H. strumosus	14	PA, NY, CT, MA, NH
H. tuberosus	23	VA, WV, MD, NJ, PA, NY, CT, MA, VT
H. grosseserratus	1	IA
	2	PA, CT
Total	90	

VA = Virginia, WV = West Virginia, MD = Maryland, DE = Delaware, NJ = New Jersey, PA = Pennsylvania, NY = New York, CT = Connecticut, MA = Massachusetts, VT = Vermont, NH = New Hampshire and IA = Iowa.

The early frost created two problems for the exploration. First, it killed developing seeds and second, it killed many of the leaves, which made field identification of species difficult. Pressed specimens of the species accessions have been examined by Dr. Charles B. Heiser Jr., Indiana University, Bloomington, Indiana, for proper identification. Species identifications were confirmed also by examining plants from transplanted rootstocks grown at the Plant Introduction Station at Ames, Iowa, during the summer of 1986. All but two accessions have been satisfactorily identified.

Many of the population accessions collected had very low seed set. This may be due, in part, to the fact that many perennials usually have low seed set, substantiated by past experience with a limited number of perennial sunflower species. Occasionally, a few of the perennial sunflower species accessions had good seed set. From an ecological sense, perennials do not set many seeds because they do not depend on seeds to survive as annual species do. Since all the species collected are self-incompatible, they require pollinators for proper cross-pollination and seed production. Since the populations were small and scattered, good interpollination may not have taken place, resulting in lower seed set. Seed set, at least in the northern area, certainly was also affected by the early frosts causing abortion of developing seeds.

The general area of exploration was basically a climax forest. Most areas are densely populated by humans, some for over 300 years. Habitat disturbance and destruction were plentiful in most areas. Almost all the sunflower species were perennials which had become established in small scattered niches, with species appearing to be habitat-specific. There was a conspicuous absence of annual species, unlike in the Central and Western United States where annual species invade most disturbed areas.

The New England states and other areas close to the coast did not appear to have many populations of sunflower. This absence of sunflower could be attributed to at least two possibilities : 1) we were there at the wrong time of the year ; or 2) the populations have been destroyed or were never there in the first place. Probably, it is a combination of both the factors. In the Northeast, the most productive collecting areas were along large river valleys and mountainous areas. Many of these areas were more secluded and less accessible to humans than many of the surrounding areas. Habitat destruction was also not as great in the more rugged terrain of Virginia and West Virginia.

A considerable amount of time was spent collecting in Virginia and West Virginia because collecting conditions were at their peak in this area. Several additional populations of the species *H. laevigatus, H. divaricatus, H. decapetalus,* and *H. atrorubens* were collected from this area. One of the more interesting finds, botanically speaking, was a possible natural interspecific hybrid between *H. giganteus* and *H. atrorubens.* These species have been hybridized artificially in captivity, but there are no reports of natural hybrids in the literature. This possible interspecific hybrid will be researched further.

During the exploration, a number of accessions of *Helianthus tuberosus* were collected. Previously, some populations of this species have shown some potential for disease resistance and/or tolerance to some of the major diseases Leaf rust *(Puccinia helianthi)* was present on some populations and not on others. This confirmed previous limited observations concerning this species where specific populations showed resistance while others did not. These observations also lend support to the concept that we need additional species populations to characterize the species'potential for disease resistance. Having several more populations of *H. tuberosus* will add to the available genetic diversity in this species. In some cases, it was difficult to tell whether the populations were native or cultivated garden escapes. Nevertheless, a good cross section of this species was collected and incorporated into the germplasm collection. The value of these collections will depend on considerable evaluation and enhancement since the *H. tuberosus* is perennial and the cultivated crop species is annual. *Helianthus tuberosus* and the crop species *(H. annuus)* also have different chromosome numbers, making interspecific crossing more difficult.

Other probable diseases were observed on some of the species accessions collected. The diseases include *Alternaria, Sclerotinia,* and *Erysiphe,* which were observed on only a few occasions. Insect stem pith damage was found most often, while insect caused root galls were observed on two occasions. Due to the advanced maturity of most populations, we observed limited insect damage activity on the heads.

Additional explorations for wild sunflower species germplasm are planned for the Northwestern, Mideastern and Central Plains of the United States, Canada, and possibly, Mexico. For more detailed information and a copy of the exploration report, contact the senior author.

CONCLUSIONS

Ninety accessions of wild sunflower species were collected from the Eastern and Northeastern United States. Thirteen different species are represented in the accessions. *Helianthus tuberosus* is represented by 23 accessions. The addition of these populations to the wild sunflower germplasm collection will greatly increase the available genetic variability of this species which has shown promise for providing genes for resistance to some of the major plant pathogens. Future explorations are planned to expand the genetic diversity available from the wild sunflover species for the improvement of the cultivated sunflower crop species.

REFERENCES

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LA COLLECTE DE GERMPLASME SAUVAGE DE TOURNESOL DANS L'EST DES ETATS-UNIS

Résumé

On a collecté 90 échantillons d'espèces sauvages de tournesol de l'est et nord-est de Etats-Unis. Dans ce nombre sont représentées 13 espèces différentes. L'addition de ces populations à la collection de germplasm sauvage de tournesol contribuera à l'accroissement notable de la variabilité génétique disponible au tournesol, spécialement se référant aux gènes de résistance à l'attaque de plus importants agents pathogènes végétales. D'autres futures explorations sont préconisées, pour permettre l'extension de l'utilisation de la diversité génétique existant aux espèces sauvages, dans l'amélioration du tournesol cultivé.

LA COLECTACIÓN DE GERMOPLASMA SALVAJE DE GIRASOL DEL ESTE DE LOS ESTADOS UNIDOS

Resúmen

Se han colectado 90 pruebas de especies salvajes de girasol del Este y Noreste de los Estados Unidos. En este número están representados 13 especies diferentes. Añadiendo estas poblaciones a la colección de germoplasma salvaje de girasol se contribuirá al crecimiento notable de la variabilidad genética disponible del girasol, con especial referencia a los genes para resistencia al ataque de unos patogenes vegetales importantes.

Se preconizan otras próximas exploraciones, para extender el empleo de la diversidad genética existente en las especies salvajes a la mejóra del girasol cultivado.