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EXPLORATION AND COLLECTION OF WILD SPECIES FROM THE GENUS Helianthus FROM NORTHERN MEXICO

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ABSTRACT

Helianthus species are native from North America. Cultivated sunflower *H. annuus* L. has reduced genetic variability and therefore breeding programs lack significant advances. Wild species from this genus may provide the genetic pool that will allow genetic advancement. The objective of the present study is to collect germplasm from 12 species of *Helianthus*, reported as native to Mexico, for preservation and breeding purposes. During 1988 and 1990 seasons 35 populations from the species *annuus, petiolaris, niveus* and *similis* were explored and herbarized. Seed was collected from 21 of these populations and is now available for use in breeding programs with cultivated sunflower. It is necessary to continue the exploration to collect plants from all the reported species and others that may exist.

Key words: *Helianthus*, **wild species, collecting**

INTRODUCTION

According to botanical and archaeological evidences, sunflower natural habitat runs from Northern Mexico to Southern Canada (Heiser, 1955). From America it was taken to Europe by the Spanish, English and French settlers (Vranceanu, 1977). The first cultivated forms were developed in Russia and were the ancestors of most modern cultivars formed in other countries in the late nineteenth century (Vranceanu et al., 1988). New variaties and hybrids with high oil content were obtained through breeding, but, unfortunately, during this process of selection some important characteristics were lost. As a result actual sunflower populations have small genetic variability and breeding to improve some traits as drought tolerance and disease resistance requires of a larger genetic pool to be succesful. This genetic diversity exists in wild populations of the genus *Helianthus* (Škorić and Vannozzi, 1984). Drought is one of the most limiting aspects of production in Northern Mexico and new materials with better adaptation are necessary (Gallegos, 1978; Ortegon, 1982). The collections reported in the present paper are made as a basis to obtain genetic material for a program of breeding for drought tolerance or escape.

MATERIALS AND METHODS

The geographic area for this exploration is comprised between 22° 00° and 32° 30' latitude North and 97° 30' and 117° 00' longitude West (Fig.No.1), with altitudes ranging

from 0 to 2270 m. Soil types vary widely. Weather classifications correspond to: dry semitropic; temperate semidesert; temperate desert; and temperate mountain. The states (Mexican political departments) in this area are: Baja California, Baja California Sur, Sonora, Sinaloa, Chihuahua, Durango, Coahuila, Nuevo Leon, Tamaulipas and Zacatecas, with a combined acreage of 1,187,2000 km^2. To locate the places where wild species of *Helianthus* are growing, 83 botanical accessions, made in a frame of 115 years and describing 11 species were used. These collects, made between 1870 and 1985, belong to the herbariums at the National Autonomuos University of Mexico (UNAM), and the National Polytechnic Institute (IPN). Another species was reported by Rogers et al. in 1982.

Taxonomic classification of these twelve species is as follows: Section ciliares: Series Ciliares: *Helianthus ciliaris* D.C., *H. laciniatus* Gray.; Series Pumili: *H. gracilenthus* Gray.; Section Divaricati: Series Divaricati: *H. tuberosus* L., *H. strumosus* L., *H. hirsutus* Raf.; Series Gigantei: *H. californicus* D.C., *H. maximilianii* Shrad.; Section Annui: *H. annuus* L, *H. niveus* (Benth) Brandegee., *H. petiolaris* Nutali., *H. similis (Brandegee) Blake.*

The keys used were those described by Heiser in 1955 and 1969 and Rogers et al. in 1982. According to these the haploid number of chromosomes for these species is n=17 except *H. ciliaris* and *H. hirsutus* with n=34; *H. tuberosus, H. strumosus* and *H. californicus* with n=51. The chromosomic number of *H. similis* is unknown (Rogers et al., 1982). The collects were made following the technique described by Lawrence in 1969. The taxonomic identification was done at the herbarium of the Center for Interdisciplinary Research for Rural Development (CIIDIR) of IPN, where the specimens from the collects of 1988 and 1990 are preserved.

RESULTS AND DISCUSSION

During the first collecting season (1988), eight populations were herbarized (Table No.1.). Three of these were collected in the state of Durango (D) and the other five in the state of Coahuila (C), these states are shown in Fig. No.1. A composite seed sample from 30–40 individual plants was taken from each population. According to Sanders (personal communication, 1990) these samples have a good probability of containing a representative sample of the genetical composition of the populations. It is probable that samples taken in the same state have common genetic composition, but populations from different geographical provenances (as much as 90 km away) have more probable differences among them. One of the samples taken in Durango (D388) has heads with lemon yellow colored ray flowers which is considered an epistatic recessive character (Fick, 1976).

Table 1. Wild populations of sunflower collected during 1988.

Species	Population	Seed (g)
01. *H.annuus* L.	D188	12
02. *H.annuus* L.	D288	10
03. *H.annuus* L.	D388	10
04. *H.annuus* L.	C188	16
05. *H.annuus* L.	C288	13
06. *H.annuus* L.	C388	8
07. *H.annuus* L.	C488	16
08. *H.annuus* L.	C588	7

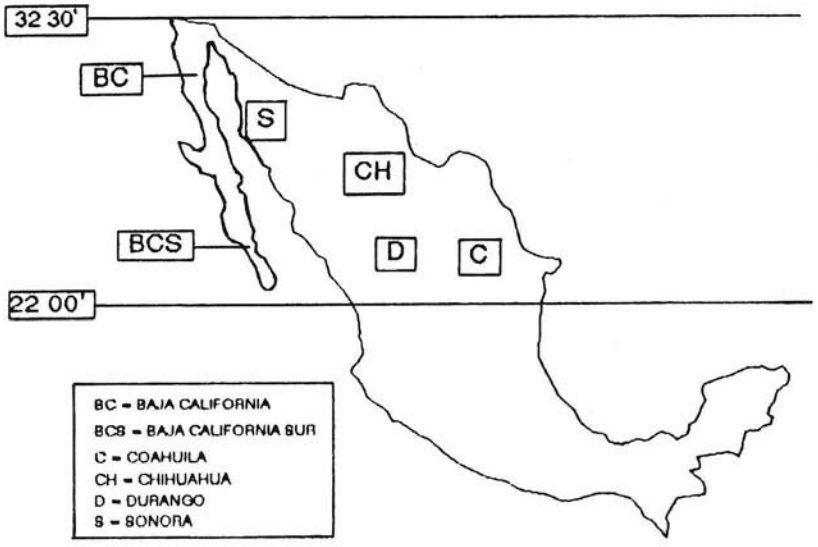

Fig.1. – Geographic distribution of wild populations of sunflower herbarized during 1988 and 1990 collecting seasons.

During the second collecting season (1990) 27 populations were explored (Table No.2.). These were localized in the states of: Chihuahua (CH), Durango(D), Sonora (S), Baja California (BC), and Baja California Sur (BCS), (Fig. No.1.). Seeds were collected in only 21 of these populations and normally were taken from 30–40 plants per site, except in the cases CH190, CH290, CH2190, S2490, S3290 and S3390, where not enough plants were present and the samples were made in only 1 to 10 plants. Those samples are therefore considered non representative. In the places where no seed at all was collected the plants were in bloom at the time of the visit.

During 1990 four different species were located: *H. annuus* L., *H. petiolaris* sspe. fallax haiser., *H. niveus sspe. canescens (A. Gray) Heiser and H. similis* (Brandegee) Blake. The last species was in bloom at the time of collecting and no seed was obtained. This species was assigned to the genus *Helianthus* in the past, but actually is under *Viguiera*

based on the presence of a decidous pappus (Heiser, 1969). It is considered a transitional species and intergeneric breeding with *Helianthus* and *Viguiera* has been recommended to study their affinity. The most abundant species was *H. annus* of which the forms H were found. This form was defined by Vranceau in 1977 as a wild form from western USA, present from Canada to Mexico and having a great variability and classification difficulties. As an example, the population S2790 presented plants with red stigmata and plants with yellow stigmata growing together. One of these forms is labelled *H. annus* ssp. lenticularis (Dougl.) Ckll. The collect CH1390, from which only two plants were found, results from interespecific breeding between *H. annus* and *H. petiolaris*. Rogers et al. in 1982, indicated that this hybridization was common in places where both species grow together, unfortunately no seed was collected at the site.

Table No. 2 Wild populations of sunflower collected in 1990.

Species	Population	Seed (g)
09. *H.petiolaris* ssp. fallax Heiser	CH0190	3.4
10. *H.petiolaris* ssp. fallax Heiser	Ch0290	2.5
11. *H.annuus* L.	CH0890	–
12. *H.annuus* L.	CH1190	376.0
13. *H.annuus* L.	CH1290	–
14. *H.annuus* L. x (*H.petiolaris* Nutt)	CH1390	–
15. *H.annuus* L.	CH1490	4.8
16. *H.petiolaris* ssp. fallax Heiser	CH1590	4.5
17. *H.annuus* L.	CH1690	22.7
18. *H.annuus* L.	CH1890	96.3
19. *H.petiolaris* ssp. fallax Heiser	CH1990	9.9
20. *H.annuus* L.	D2090	4.7
21. *H.annuus* L.	CH2190	2.8
22. *H.annuus* L.	CH2390	13.6
23. *H.annuus* L.	S2490	0.8
24. *H.annuus* L.	S2590	6.4
25. *H.annuus* L.	S2690	15.6
26. *H.annuus* L. form H.	S2790	57.6
27. *H.petiolaris* ssp. fallax Heiser	S2890	14.8
28. *H.annuus* L. form H.	S2990	82.2
29. *H.annuus* L. form H.	S3090	–
30. *H.niveus* ssp. can. (A. Gray) Heiser	S3290	0.2
31. *H.annuus* L.	S3390	1.6
32. *H.annuus* L.	S3490	16.7
33. *H.annuus* L.	BC3590	5.1
34. *H.similis* (Brandegee) Blake	BCS4090	–
35. *H.similis* (Brandegee) Blake	BCS4190	–

CONCLUSIONS

Wild populations from species of the genus *Helianthus* are present in Northern Mexico. these populations have great genetic variability that can be used in breeding for better cultivars of the cultivated sunflower. It is important to continue the exploration and register of species present in the country to make this germplasm diversity available to breeding programs.

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EXPLORACION Y COLECCION DE ESPECIES SILVESTRES DEL GENERO HELIANTHUS EN EL NORTE DE MEJICO

RESUMEN

Las especies silvestres de *Helianthus* son nativas de América del Norte. El girasol cultivado H. *annuus* L. tiene reducida variabilidad genética y por tanto los programas de mejora no tienen avances significativos. Las especies silvestres de este género pueden proveer la variabilidad genética que permita el avance genético. El objetivo del presente estudio es coleccionar germoplasma de 12 especies de *Helianthus*, mencionados como nativas de Méjico, para su preservación y utilización en mejora. Durante 1988 y 1990, 35 *similis* fueron coleccionadas. La semilla fue recogida de 21 de estas poblaciones y está ahora disponible para uso en programas de mejora para girasol cultivado. Es necesario continuar la exploración para coleccionar plantas de todas las especies descritas y otras que puedan existir.

RECHERCHES ET COLLECTES D'ESPÉCES SAUVAGES DU GENRE *Helianthus* DANS LE NORD DU MEXIQUE.

RÉSUMÉ:

Les espéces *Helianthus* sont originaires du nord de l'Amérique. Le tournesol cultivé *Helianthus annuus* posséde une variabilité génétique réduite et de ce fait les programmes de sélection souffrent d'un certain handicap. L'objectif de cette étude est de collecter des germplasm de 12 espéces d'*Helianthus* , reportées comme natives du Mexique, dans un but de préservation et de sélection. Au cours des saisons 1988 et 1990, 35 populations appartenant aux genres *annuus* , *petiolaris* ,*niveus* et *similis* ont été examinées et herborisées. Des graines de 21 populations ont été collectées et sont maintenant disponibles pour des programmes de sélection concernant le tournesol cultivé. Il est nécessaire de poursuivre ce type de recherche et de collecte pour toutes les espéces décrites et pour celles qui pourraient nous être inconnue.