A.V. Anashchenko, USSR

HELIANTHUS ANNUUS L. - INTERSPECIFIC CLASSIFICATION AND GENETIC RESOURCES

We revised the Helianthus L. genus on the basis of many years of study of cultivated sunflower (some 1,200 samples), wild annual sunflower species, numerous hybrids between them and herbariums from the universities and museums in the USA, Canada, Great Britain and other countries, as well as literary data.

Principles of Interspecific Classification

Developing N.I. Vavilov's idea (1931) on the Linnaeus species as a system we believe that the systems idea must be the basic one also in the interspecific classification of cultivated plants. Our second principle is the evolutionary approach to the intraspecific systematics and the third consists in the assumption that the system must be convenient and capable of being used in practice. The new classification is based on genotype relationship, the existence of transitional forms and the common area. We have also used the laws of the homological series and hereditary mutability (N.I. Vavilov, 1935).

Model of Intraspecific Classification

We have included all the annual diploid sunflower species identified earlier (with a tap root) among one species - H. annuus L. - further subdivided into three subspecies (A.V. Anashchenko, 1974).

H. annuus subspecies are self-incompatible and hybrids of different subspecies are fertile as a rule. Meiosis, even under the hybridization of extreme forms, is not accompanied by deep changes or violations. H. annuus subspecies petiolaris has been found to have a more conservative type of inheritance and has the over-

whelming majority of the dominant alleles in many features. This may serve as a sound argument to suggest that on the evolutionary plane the divergence of the H. annuus type proceeded from H. annuus subspecies petiolaris (the oldest subspecies evolutionarily). through H. annuus subsp. lenticularis to H. annuus subsp. annuus.

Let us now dwell on the application of the subspecies discussed. The most primitive of them is the Subsp. petiolaris which has not been so far used for the purposes of selection.

Subsp. lenticularis. P. Leclerq (1968, 1969) is believed to have used H. petiolaris to obtain the CMS, but the description of the plants cited shows that in his work series he actually used the subsp. lenticularis plants as initial forms. In our experiments the CMS resulted from the hybridization of the subsp. lenticularis subsp. annuus (A.V. Anashchenko, T.V. Mileyeva, V. T. Rozhkova, 1974). Similar work has lately been carried out in the VNIIMK. The subsp. lenticularis also include the wild sunflower forms from Texas which are a reliable donor of rust resistance (V. S. Pustovoit, 1946; E. D. Putt, 1963) and downy mildew, namely the Red River race (D. E. Zimmer, M. L. Kinnman, 1972) and have a restorative capacity to CMS.

Thus, over the last two decades the selection value of the subsp. lenticularis has considerably grown and its practical use will be on a steady increase. At present and in the near future this is a powerful and easily tapped reserve of hereditary mutability which deserves a special attention.

Naturally, the cultivated sunflower (subsp. annuus) formed in Europe over several centuries has the greatest practical value.

We shall just take a glance at a very interesting group of the decorative forms (subsp. annuus var. annuus) limiting ourselves to just a few peculiarities of this variety. Var. annuus, one of the most "ancient" forms of cultivated sunflower, formed in the 16th century, mainly in

the central part of Western Europe (France, Belgium, Netherlands, and German dutchies). Var. annuus is used for the selection of sunflower decorative varieties.

Oil-bearing sunflower (subsp. annuus var. pustovoitii Anashcz.) emerged and developed as a field crop in the central part of Europe and Russia in the middle of the 18th century.

A practically new type of highly efficacious cultivated sunflower has now been produced from the samples of weakly cultivated peasant sunflower as a result of a vast amount of purposeful work done by Academician V. S. Pustovoit. This plant has never had equal in the world by the oil content, husk, a whole complex of economically valuable features, and high resistance in the field to the principal diseases, in particular broomrape. The basic varieties of Soviet selection in f. pustovoitii are identified as the most progressive part of the genofund within var. pustovoitii, Such a detailed subdivision is also made for purely practical purposes: the barrier of a set of economic features between f. pustovoitii and old peasant populations (f. peasanti) is so great that all variety selection is practically limited to f. pustovoitii.

The relict var. armeniaka Anashcz. stands apart from the mainstream of sunflower improvements on the territory of the USSR. We examined this form in detail earlier (A.V. Anashchenko, 1971) and now only want to note its applied significance. By its morphological structure it is generally akin to var. pustovoitii f. peasanti, but differs sharply from all known forms in its lengthened achenes (up to 25-28 cm), the ratio of length to width being 3:1. Var. armeniaka is a reliable donor of autogamy, protogyny and the CMS. The self-pollination of these plants helps bring out a wide spectre of recessive mutations.

Finally, the var. australis Anashcz. is represented by powerful late plants, usually giants of the silage type. Some hold the view (F. S. Venclavovic, 1941) that the southern forms also took

shape on the territory of European Russia, but this view does not seem to correspond to reality. First, historically sunflower did not grow on the territory of the USSR within its present boundaries whenever the southern variety could have been formed. Second, there was no isolation barrier in European Russia to the ability to cross with the var. pustovoitii, except the Loriisky isolate. Third, the first European discriptions of sunflower point to two types of this plant, viz. (1) high, giant, and (2) small and branchy. In the picture cited by Lobel (1576) the first type roughly corresponds to var. australis. Consequently, such type of plant had already taken shape prior to its introduction in Europe, the formation centre of var. australis being supposedly Central America (Peru or South Mexico).

The var. australis have a somewhat different set of physiological reactions as compared to var. pustovoitii. Specifically, their reaction standard is broader in a number of features. On the evolutionary plane it is one of the earliest varieties of cultivated sunflower. Possibly, var. pustovoitii to some extent owes its emergence and development to the hybridisation of var. annuus and var. australis. In the practical use var. australis is an excellent initial material (in several cases even representing almost ready-made varieties) for producing feed and silage varieties. In the selection of oil-bearing sunflower var. australis can be successfully used for enriching hereditary mutability and, in the case of several samples from Argentina and Uruguay, as a cultural donor of field resistance to rust. In its geographical varieties var. australis is represented fairly broadly, ranging from South and Central America to Central and North Africa and Asia Minor.