

INFORMATION AND REPORTS

WORKING MEETING ON SUNFLOWER GENETICS AND BREEDING

held in France from 26 to 30 July 1982

1. **The purpose** of the meeting was to facilitate the exchange of experience and knowledge among the participants co-operating in the field of sunflower genetics and breeding. The following subnetworks of the F.A.O. Research Network on Sunflower were represented:

- Experimentation of sunflower cultivars in international trials;
- Applied genetic studies in sunflower;
- Use of wild species in sunflower breeding.

2. **Participation and organization.** The meeting was attended by 16 researchers representing 7 countries: Bulgaria, Czechoslovakia, France, Italy, Romania, Spain, Yugoslavia (see the list of participants). The travel costs for 6 delegates from the above-mentioned countries, except France, were supported by the F.A.O. Regional Office for Europe.

The I.N.R.A. Research Centre of Montpellier and the Plant Breeding Station of Clermont-Ferrand provided an excellent organization of the whole activity and the remarkable contribution of Dr. M. Arnoux (Montpellier) and Dr. P. Leclercq (Clermont-Ferrand) ought to be mentioned in this respect.

3. **The programme of work** was so established as to combine the working sessions with nursery visits. In this way the participants were able to debate not only the theoretical background of the common investigations, but also the practical aspects of methodology and experimental technique and to evaluate the progress achieved in sunflower breeding and genetics.

The working meeting was chaired by dr. A. V. Vrănceanu, co-ordinator of the F.A.O. Research Network on Sunflower, assisted by dr. M. Arnoux and dr. P. Leclercq.

The first two days (Montpellier 26—27 July) were devoted to the subnetwork on the use of wild species in sunflower breeding. In the last two days (29—30 July) the meeting moved to Clermont-Ferrand, with the main emphasis being placed upon sunflower applied genetics. A study tour was performed from Montpellier to Clermont-Ferrand on July 28, which included a visit at the Experimental Centre of the Rhône Valley (CEVER), near Puygiron.

4. At the **INRA Research Centre of Montpellier**, where sunflower investigations are being carried out by the Division of Research

and Teaching on Plant Breeding and Phyto-technology (Director M. Arnoux), the participants analysed the activity of the subnetwork on wild sunflower species, taking into consideration the large development of the co-operative research works in this field at Montpellier.

Dr. Dragan Skorić, in charge with the subnetwork on the use of wild species in sunflower breeding, reported on the results obtained in the last three years and the research objectives for the next period. He evaluated the contribution of different countries to the establishment of a comprehensive collection of wild species and stressed the need for joint efforts to study their morpho-physiological and genetic traits, so that this valuable germplasm material could be used for improving the present cultivated sunflower as concerns disease resistance and tolerance to unfavourable environmental conditions.

Dr. H. Serieys, in charge with wild *Helianthus* at Montpellier, presented an information about his research programme, based mainly on interspecific crosses with cultivated sunflower. The French contribution to the joint research programme will develop in the following directions:

- Description of morphological and botanical characters;
- Testing of wild species to identify sources of genetic resistance to *Sclerotinia sclerotiorum* L.;
- Determination of self-fertility degree in wild sunflowers;
- Interspecific hybridization between wild and cultivated sunflower;
- Identification of new sources of male sterility and restorer genes from wild sunflowers;
- Use of wild sunflower, especially *H. argophyllus*, in breeding for drought resistance.

The large and representative collection of wild species established at Montpellier was examined by the participants, who discussed the various ways of crossing the wild and cultivated sunflowers, such as the pollination of wild species used as female with a mixture of *H. annuus* pollen, or pollination of *cms* lines with wild pollen. Also, two methods of testing the reaction of wild sunflowers to *Sclerotinia* attack were discussed, namely the summer ascospores test and the mycelium test

on survival organs. The co-operating researchers examined certain physiological factors which may be related to drought tolerance such as transpiration, diffusive resistance, leaf water potential, and stomatal density.

A division of tasks was agreed regarding the screening of sunflower wild species for resistance to diseases and the multiplication and distribution of sources for resistance genes. The co-operation in this field will be performed mainly between research institutions from Bulgaria, France, Romania, Spain and Yugoslavia.

In the second part of the working meeting of Montpellier the participants became acquainted with the breeding and genetic programme conducted by dr. G. Piquemal. The main emphasis is put upon the creation of early maturing and self-compatible hybrids, with high tolerance to drought and high temperatures and hence with good yield stability. An interesting collection of marker genes is maintained and used in sunflower breeding. Remarkable are also the investigations carried out by dr. M. Tersac with respect to the improvement of B and R populations.

5. At the INRA Plant Breeding Station of Clermont-Ferrand the participants discussed the co-operative research programme of the sub-network on sunflower applied genetics.

On behalf of the Liaison Centre of this sub-network, dr. V. Skaloud from Ruzyně-Prague presented a detailed report on the main achievements and considerations concerning the further development of the joint studies on genetics of characters influencing plant productivity, as well as of *cms* pollen sterility and fertility restoration and resistance to diseases.

A preliminary evaluation of trials with diallel crosses, in which variability of genetic parameters of quantitative characters has to be estimated, was analysed. Only four traits: plant height, number of days to flowering, head diameter and number of leaves, were evaluated by the Liaison centre, and these are the traits for which complete data were received from Novi Sad, Fundulea, Cordoba and Prague-Ruzyně. The evaluation was performed using variance analysis with Tukey method of determination of the least significant differences among means of variants and simple correlation and regression analysis of phenotypic value of individual traits.

Height of plants and number of days to flowering are the traits which manifest relatively high variability between individual variants. Number of leaves manifests a little lower number of significant differences and head diameter displays very low variability. Heterosis in head enlargement was observed in all 21 hybrid combinations in F_1 and F_2 generations. Heterosis in plant height was manifested in 18 combinations in F_1 and 13 combinations

in F_2 generation. Number of leaves increased in comparison with the parents in 10 F_1 and 9 F_2 combinations. Heterosis in the number of days to flowering consists in shortening of this period in 3 F_1 and 5 F_2 progenies or in lengthening of this period in one F_1 and one F_2 hybrid.

No substantial differences were found in plant height evaluating means of variants of the whole sets in individual countries. The maximal height in Yugoslavia was 155.8 cm and the minimal one in Czechoslovakia was 145.6 cm, thus the difference was only 10 cm. Head diameter was similar in Romania, Yugoslavia and Czechoslovakia: 20.5—21.5 cm. Mean head diameter was considerably smaller in Spain: only 16 cm. Comparing mean values from some countries, considerable differences were found in number of leaves per plant. Not only the data from Romania and Yugoslavia differed, but the data from Czechoslovakia were quite different from the mean values of other countries. It seems that methodology of evaluation of this trait has to be defined more precisely.

Values of correlation coefficients were determined for all binary combinations of the four studied traits. Relations between plant height, number of days to flowering and number of leaves per plant display correlation higher than 0.5. Head diameter was correlated with other traits much weaker: the correlation coefficient was 0.35 with plant height, 0.26 with number of leaves and nearly 0 with number of days to flowering.

The course of regression line was determined only for two couples of traits. The first one was number of days to flowering vs plant height and the second one head diameter vs plant height. Other trait relations were not evaluated because head diameter and number of days to flowering did not show any association and different methodologies used in evaluating number of leaves caused entirely diverse courses of regression lines.

Regression of head diameter on plant height indicates that head diameter increases with increasing plant height only in Spain. The relationship is much weaker in other countries. Relatively largest heads on low plants were reached in Czechoslovakia. Taller plants were necessary for head enlarging in Yugoslavia and Romania.

In the field of pollen sterility and fertility restoration studies the participants agreed upon the completion of *cms* sources and *Rf* genes collection in the next period and upon initiation of trials aimed at the determination of the final number of sources known at present, of the relations between different cytoplasm types and *Rf* genes, of mutual interactions of *Rf* genes as well of stability of the trait expression under different environmental conditions.

Studies on genetics of markers will be continued with enlarging the line collections, choice of further morphological traits for the determination of their inheritance, number of genes and their interactions. Evaluations of a higher number of traits accumulated into several lines aiming at genetic linkages determination will be also initiated. In these studies lines possessing traits with already known linkages will be used as testers.

Dr. P. Leclercq exposed the research objectives of Clermont-Ferrand team in the field of applied genetics and breeding of sunflower. Attention is paid mainly to resources and use of pollen sterility and *Rf* genes, to heritability of multihead and isomature type of plants, to dwarf plants and to crosses between *H. annuus* and *H. argophyllus*.

The group of participants visited the genetic and breeding sunflower nurseries established at Clermont-Ferrand as well as two hybrid trials organized in two different locations.

6. The visit to the Experimental Centre of the Rhône Valley (CEVR), Domaine de la Vesc, Montboucher sur — Jabron, near Puygiron, which took place on 28 July, offered the possibility to examine six sunflower hybrid trials performed in co-operation with C.E.T.I.O.M. and to evaluate the progress achieved by the French sunflower breeders in the last years, in comparison with some commercial foreign hybrids produced by different seed companies.

7. Various aspects of the experimentation of sunflower hybrids in F.A.O. co-operative trials were discussed at the Breeding Station of Clermont-Ferrand. Unfortunately, the two I.N.R.A. Breeding Station which are members of Sunflower Research Network, did not perform, for different reasons, any F.A.O. trials with sunflower hybrids. The only one replication of trial No. 1 existing at Clermont-Ferrand doesn't permit a scientific evaluation of this trial.

A. V. Vrânceanu

LIST OF PARTICIPANTS

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2. *Skaloud, V.* Institute of Crop Production, Prague-Ruzyně, Czechoslovakia.
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4. *C. Piquemal*, I.N.R.A. Station d'Amélioration des Plantes, Montpellier, France.
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7. *P. Leclercq*, I.N.R.A. Station d'Amélioration des Plantes, Clermont-Ferrand, France.
8. *Claudine Lamarque*, Station de Pathologie Végétale, C.N.R.A., Versailles, France.
9. *R. Paolini*, Istituto di Agronomia Generale e Coltivazioni Erbacee, Pisa, Italia.
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12. *V. Pirani*, Istituto Colture Industriali, Sezione Operativa Periferica, Osimo (An.), Italia.
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