

Contribution of Interspecific and Intergeneric Hybridization in Sunflower Breeding

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Abstract

The experiment covered a 30-year period. Its aim was to improve sunflower *Helianthus annuus* L. by conducting wide hybridization. Thirty-six species of *Helianthus* and 28 species of other genera of the *Compositae* family were included in the study. From cultivated sunflower, 16 varieties and 18 lines were used with their sterile analogs. Intraspecific, interspecific, and intergeneric hybridization and a targeted consecutive selection were conducted. New sunflower materials with bio-morphological, biochemical, and phytopathological characteristics were developed.

More than 65,000 F₁ hybrid plants were obtained from the interspecific hybridization, and more than 1,900 F₁ hybrid plants from intergeneric crosses. The following generations were derived; F₂, F₃, BCF₁, etc. until obtaining stable hybrid forms for creating new lines. Many of the new lines have resistance to downy mildew, phomopsis, phoma, alternaria, tolerance to sclerotinia, and full resistance to the new races of the parasite sunflower broomrape. The lines have a new plant architecture, different vegetation periods, and varying seed size and color. Developed A, B and R lines are characterized by high combining ability, high oil content, varying fatty acid composition of the oil, and an amino acid composition of the protein in the seed. These lines have been used to create and register six hybrid sunflower varieties; five oil types and one confectionery type.

Eighteen cytoplasmic male sterility (CMS) sources have been obtained from interspecific hybridization. Two hundred-seventy sources of fertility restorer genes (*Rf* genes) were established and transferred into cultivated sunflower. The new sources of CMS and *Rf* genes have greatly

diversified the genetic of the CMS-fertility restorers system that have been successfully used in heterosis breeding. As a result of this long study, new genetic material was transferred to the cultivated sunflower and contributed interspecies and intergeneric hybrids for use in breeding sunflowers.

Key words: *Compositae*, *Helianthus*, interspecific hybridization, CMS lines

种间和属间杂交对向日葵育种的贡献

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摘要

本试验前后历时 30 年，目的是通过远缘杂交来对一年生向日葵材料进行改良。本研究所使用的材料包括向日葵属的 36 个种和 28 个位于菊科其它属的种，而栽培向日葵的 16 个品种和 18 个自交系作为受体材料。本研究进行了种内、种间和属间杂交，并对目标性状进行连续选择。在此过程汇总，我们对产生的向日葵新材料进行生物形态、生物化学和植物病理学特性等研究。

通过种间杂交和属间杂交，我们分别获得了超过 65,000 株和 1,900 株的 F₁ 代杂交种。在此基础上，我们获得了 F₂, F₃, BCF₁ 等衍生后代，直到获得稳定的自交系材料。新获得的自交系多数具有抗霜霉病、茎溃病、黑茎病、黑斑病、耐菌核病等抗性，并且全部具有针对寄生性列当新的生理小种的抗性。这些自交系具有新型株型，并表现出不同的营养生长期、籽粒大小和颜色。育成的保持系/不育系和恢复系具有高配合力和高籽粒含油量等特点，并且具有不同的脂肪酸组成和氨基酸组成。在育成的材料中共登记注册了 6 个向日葵杂交种（包括 5 个油用型和 1 个食用型）。

通过种间杂交获得了 18 个细胞质雄性不育系（CMS），并发现和转育了 270 个恢复基因（Rf genes）到栽培向日葵中。新的 CMS 和 Rf 基因资源使遗传体系（CMS 和 Rf）的多样性大大增加，并且这些资源在杂交育种中得以成功运用。

作为我们长期研究的成果，新的遗传基因转移到了向日葵栽培种，并使种间杂交和属间杂交等手段在向日葵育种中得以成功运用。

关键词：菊科，向日葵，种间杂交，自交系