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SOME MORPHOLOGICAL TRAITS IN F_1 HYBRIDS BETWEEN WILD SUNFLOWER SPECIES

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SUMMARY

Behavior of some morphological traits in F_1 hybrids between perennial wild species was studied in sunflower. The dark green coloring of leaves dominated over green one. The dark green coloring from *H.divaricatus* also dominated over grey-green coloring of *H.mollis*. The grey-green coloring of *H.mollis*, as well as dark green, dominated over green one, especially in the cases when *H.mollis* was represented in crossing as a female parent. While crossing species with green leaves the hybrids had only green color of leaves. Sessile leaf of *H.mollis* was found in all hybrids with this species. Hybrids, which included *H.divaricatus*, except hybrids between *H.divaricatus* and *H.mollis*, had the same petiole (0.3-0.4 cm) as *H.divaricatus*. An intermediate inheritance of petiole length was observed in combinations where *H.eggertii* was present, which was characterized by completely sessile leaf.

Key words: **sunflower, wild species, interspecific hybrids, inheritance, leaf color, petiole length**

INTRODUCTION

Knowledge of inheritance of traits and number of genes that control them, as well as evaluation of genetic effects are important for plant breeder irrespective of the crop he works with. That helps both to choose a correct methodology for character improving and to substantiate the program on faster development of desirable genotypes.

The aforesaid concerns in full measure wild sunflower species, which represent a rich source of germplasm for improving cultivated *H.annuus* and now are widely involved in crossings with it.

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MATERIALS AND METHODS

F_1 sunflower hybrids and 10 perennial wild species representing parental components of the hybrids analyzed were used. Five of them - *H.divaricatus* L., *H.mollis* Lambert, *H.nuttallii* Torey and Gray, *H.giganteus* L., and *H.grosseserratus* Martens are referred to as diploid species (n=17), *H.hirsutus* Raf. is a tetraploid species (n=34), *H.decapetalus* L. and *H.strumosus* L. can be presented by samples with haploid number of chromosomes being equal either 34 or 51, the other species - *H.californicus* DC. and *H.eggertii* Small - are presented by samples with haploid number of chromosomes equal to 51 (Rogers *et al.*, 1982; Seiler and Reiseberg, 1997). F_1 plants in 28 cross combinations were produced in the usual way and majority of them flowered during the first year after sowing. F_1 plants of *H.eggertii* x *H.strumosus*, *H.strumosus* x *H.eggertii*, and *H.strumosus* x *H.decapetalus* crosses flowered only in the second year and their height during the first year was 2-8 cm. The following characters of full flowering plants were analyzed: length of a leaf petiole, leaf color (the upper side of the leaf) and form of the leaf blade.

RESULTS AND DISCUSSION

Coloring of the leaf

Among ten of the used species, six species - *H.divaricatus*, *H.californicus*, *H.decapetalus*, *H.strumosus*, *H.eggertii* and *H.hirsutus* - had dark green coloring of their leaves, *H.mollis* - gray-green, other species - *H.grosseserratus*, *H.nuttallii*, *H.giganteus* - had green coloring of leaves (Table 1).

In overwhelming majority of cases the dark green coloring of leaves dominated over green one (except for a cross combination *H.nuttallii* x *H.decapetalus*, where leaves were green). The dark green coloring from *H.divaricatus* also dominated over gray-green coloring of a *H.mollis* type, even in the case when the latter represented a maternal component of a hybrid. However, when crossing *H.mollis* with other species with dark green leaves - *H.californicus* - direct hybrid had gray-green coloring of leaves (dominance of *H.mollis*), and reverse hybrid - green leaves (intermediate inheritance).

The gray-green coloring of *H.mollis*, as well as dark green coloring, dominated over green one, especially in the cases when *H.mollis* was represented in crossings as a pistil parent.

While crossing species with green leaves, the hybrids had only green color of leaves.

Table 1: Leaf color in F_1 hybrids and their parents

Parents		F_1
Female	Male	
H.mollis	*H.nuttallii*	
H.mollis	*H.grosseserratus*	
H.mollis	*H.giganteus*	
H.mollis	*H.divaricatus*	
H.divaricatus	*H.nuttallii*	
H.grosseserratus	*H.divaricatus*	
H.nuttallii	*H.divaricatus*	
H.nuttallii	*H.giganteus*	
H.giganteus	*H.nuttallii*	
H.nuttallii	*H.grosseserratus*	
H.grosseserratus	*H.giganteus*	
H.grosseserratus	*H.decapetalus*	
H.decapetalus	*H.nuttallii*	
H.nuttallii	*H.decapetalus*	
H.californicus	*H.nuttalli*	
H.nuttalli	*H.californicus*	
H.californicus	*H.mollis*	
H.mollis	*H.californicus*	
H.californicus	*H.giganteus*	
H.eggertii	*H.californicus*	
H.hirsutus	*H.grosseserratus*	
H.grosseserratus	*H.eggertii*	
H.hirsutus	*H.eggertii*	
H.hirsutus	*H.decapetalus*	
H.decapetalus	*H.hirsutus*	
H.strumosus	*H.decapetalus*	
H.strumosus	*H.eggertii*	
H.eggertii	*H.strumosus*	

green color of the leaf
dark-green color
grey-green color

Length of the petiole

Among species used in crossings, two species - *H.mollis* and *H.eggertii* - had completely sessile leaf, i.e., they were characterized by absence of a petiole, and *H.divaricatus* had almost sessile leaf, with only small petiole of 0.3-0.4 cm in length. The other species had petiolated leaves, with the length of the petiole varying from 0.6 cm in *H.strumosus* to 2.75 cm in *H.giganteus* (Table 2).

All hybrids which included *H.mollis* had no petiole, i.e., their leaves were sessile, and that indicates full dominance of the sessile leaf character of the *H.mollis* type over petiolated leaf. Even when crossing *H.mollis* with *H.divaricatus* the leaves of the hybrid were completely without petioles.

In turn, hybrids which included *H.divaricatus*, except the above-mentioned one, had the same petiole as *H.divaricatus*, that testifies to the dominance of such type of leaf over others with a longer petiole.

In combinations where *H.eggertii* was present, which was characterized by the completely sessile leaf, the leaves had petioles from 0.3 cm to 1.25 cm. The intermediate inheritance of petiole length was more often marked.

When crossing species with petiolated leaves, all hybrid plants were characterized by the presence of a petiole of certain length.

In the literature some information are available on the inheritance of a short petiole trait in cultivated sunflower. Thus, it is known that the given trait detected in one of the varieties was under the control of two dominant genes with a cumulative effect (Miller, 1992).

Table 2: Petiole length in F_1 hybrids and their parents

Parents				F_1
Female		Male		
|	*H.mollis*	├	*H.nuttallii*	|
|	*H.mollis*	├	*H.grosseserratus*	|
|	*H.mollis*	├	*H.giganteus*	|
|	*H.mollis*	├	*H.divaricatus*	|
├	*H.divaricatus*	├	*H.nuttallii*	├
├	*H.grosseserratus*	├	*H.divaricatus*	├
├	*H.nuttallii*	├	*H.divaricatus*	├
├	*H.nuttallii*	├	*H.giganteus*	├
├	*H.giganteus*	├	*H.nuttallii*	├
├	*H.nuttallii*	├	*H.grosseserratus*	├
├	*H.grosseserratus*	├	*H.giganteus*	├
├	*H.grosseserratus*	├	*H.decapetalus*	├
├	*H.decapetalus*	├	*H.nuttallii*	├
├	*H.nuttallii*	├	*H.decapetalus*	├
├	*H.californicus*	├	*H.nuttallii*	├
├	*H.nuttallii*	├	*H.californicus*	├
├	*H.californicus*	|	*H.mollis*	|
|	*H.mollis*	├	*H.californicus*	|
├	*H.californicus*	├	*H.giganteus*	├
|	*H.eggertii*	├	*H.californicus*	├
├	*H.hirsutus*	├	*H.grosseserratus*	├
├	*H.grosseserratus*	|	*H.eggertii*	├
├	*H.hirsutus*	|	*H.eggetii*	├
├	*H.hirsutus*	├	*H.decapetalus*	├
├	*H.decapetalus*	├	*H.hirsutus*	├
├	*H.strumosus*	├	*H.decapetalus*	├
├	*H.strumosus*	|	*H.eggertii*	├
|	*H.eggertii*	├	*H.strumosus*	├

\| no petiole
├ length of petiole 0.3-0.4 cm
├ length of petiole >1.0 cm

Reciprocal effects

The differences in inheritance were found for some traits in a number of direct and reverse cross combinations.

Length of the petiole - from almost sessile (0.3-0.4 cm) in *H.californicus* x *H.nuttallii* up to petiolated (1.0) in *H.nuttallii* x *H.californicus*, from 0.3 cm in *H.strumosus* x *H.eggertii* up to 1.5 cm in *H.eggertii* x *H.strumosus*.

The coloring of the leaf - gray-green in *H.mollis* x *H.californicus*, green in *H.californicus* x *H.mollis*.

The form of the leaf blade - when crossing *H.decapetalus* with *H.hirsutus* in F_1 the intermediate form of leaf blade was observed - wide egg-shaped-lanceolate in *H.decapetalus* x *H.hirsutus*, closer to the *H.decapetalus* type or widely-lanceolate in *H.hirsutus* x *H.decapetalus*, closer to the *H.hirsutus* type; the oval shape of a leaf blade, characteristic for *H.mollis*, was exhibited while crossing *H.mollis* with *H.californicus*. At the same time, F_1 plants *H.mollis* x *H.californicus* had leaves of widely oval-lanceolate shape, which resembled leaves of *H.mollis*, and leaves in F_1 plants *H.californicus* x *H.mollis* were more oblong, similar to *H.californicus*.

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UNAS CARACTERISTICAS MORFOLÓGICAS DE HIBRIDOS F_1 DE LAS ESPECIES SILVESTRES DE GIRASOL

RESUMEN

Unas caracteristicas morfológicas de hibridos F_1 de las especies del girasol silvestre de varios años han sido estudiadas. El color verde oscuro de hoja era más dominante que el color verde. El color verde oscuro de hoja proveniente de la especie *H.divaricatus* era más dominante que el color grisaceo-verde proveniente de la especie *H.mollis*. El color grisaceo-verde de la especie *H.mollis*, asi como el color verde oscuro eran más dominantes que el color verde, particularmente cuando *H.mollis* fué utilizada para el cruce como la componente materna. Cuando eran cruzadas las especies con las hojas verdes, los hibridos tenian exclusivamente el color verde de hojas. El tipo sésil de hoja de la especie *H.mollis* fué encontrado en todos hibridos de esa especie. Los hibridos de la especie *H.divaricatus*, a escepción del cruce con las especies *H.divaricatus* y *H.mollis*, tenian la misma largura de peciolo (0.3-0.4 cm) como *H.divaricatus*. La herencia intermediaria de la largura de peciolo fué notada en las combinaciones con la especie *H.eggertii* que tenia las hojas totalmente sesiles.

QUELQUES CARACTÉRISTIQUES MORPHOLOGIQUES DES HYBRIDES F_1 PARMI LES ESPÈCES DE TOURNESOL SAUVAGE

RÉSUMÉ

Le comportement de certaines caractéristiques morphologiques des hybrides F_1 des espèces sauvages vivaces de tournesol a été observé. La couleur vert foncé des feuilles dominait sur la couleur verte. La couleur vert foncé des feuilles originaires de l'espèce *H.divaricatus* l'emportait sur la couleur gris-vert originaire de l'espèce *H.mollis*. La couleur gris-vert de l'espèce *H.mollis* ainsi que la couleur vert foncé l'emportaient sur la couleur verte, surtout dans le cas où l'espèce *H.mollis* était utilisée comme parent femelle dans le croisement. Lorsque des espèces à feuilles vertes étaient croisées, les hybrides avaient des feuilles de couleur verte exclusivement. La feuille de type sessile de l'*H.mollis* a été trouvée dans tous les hybrides de cette espèce. Les hybrides *H.divaricatus*, sauf les croisements avec *H.divaricatus* et *H.mollis*, avaient la même longueur de pétiole (0.3-0.4 cm) que celui de l'*H.divaricatus*. Une héritage intermédiaire de la longueur du pétiole a été observé dans les combinaisons où le *H.eggertii* était présent et avait comme caractéristique des feuilles complètement sessiles.