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GENETIC VARIABILITY AND CORRELATIONS OF VARIOUS PLANT TRAITS WITH BIRD DAMAGE RESISTANCE IN SUNFLOWER

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Four sunflower varieties and their all possible crosses excluding reciprocals were studied for the estimation of genetic variability and correlations of various plant traits with bird damage. The estimation of phenotypic correlation coefficients for bird damage were positive with the flowering and maturity periods, head shape, head diameter, hull percentage and oil concentration but were negative with stem inclination, 100-achene weight and plant height. Highly significant variation among genotypes for these traits suggested that these traits could be utilised for improving resistance of sunflower to bird damage.

INTRODUCTION

Bird damage is a serious problem and a limiting factor in the production of sunflower. Many birds species damage sunflower before or at the time of seed ripening. Among these rose-ringed parakeet *(Psittacula krameri* Scopoli) and house sparrow *(Passer domesticus* L.) are important. Black birds have also been reported to cause seed losses in North America. Oilseed cultivars are much preferred by most birds over confectionary or even over those cultivars specially grown for bird feed market (Besser, 1978). Traditional control measures of scaring or chasing birds from fields are costly and provide only temporary control. Some progress has also been made to protect the ripening sunflower from bird damage by using chemicals (Calvi *et al.,* 1977).

Certain plant characteristics of sunflower are found to limit bird damage. Lammerisk and Stewart (1974) observed that F_1 hybrids being less variable in height, flowering time and ripening should minimise seed damage by birds. Black bird damage on sunflower was found less on dwarf plants with reflexed and concave heads (Doedikar *et al.,* 1978). Varieties with stem curvature, concave heads and thick hulled seeds were found to be partially bird resistant (Robinson, 1973; Parfitt, 1984).

The present investigations were undertaken to estimate correlation of bird damage, with different plant traits. This study will be helpful for genetic improvement of sunflower against bird damage.

MATERIALS AND METHODS

Four cultivated sunflower *(Helianthus annuus* L.) namely Suncom 90, Record, SF 100 and SF 103 maintained by sib-pollination were crossed in all possible combinations excluding the reciprocals. The parents and six F_1 crosses were sown in a replicated trial having three repeats during 1988. The data were recorded on days to complete flowering, days to maturity, plant height, head diameter, hull percentage, oil percentage, 100-seed weight, seed yield plant^{-1} and bird damage.

Qualitative traits like stem inclination and head shape were tabulated by giving scores. Stem inclination (0), erect (1), slight bending making an angle of 1-20° with

stem, (2) partial bending making an angle of 21-50° with stem, (3) partial making an angleof 51-75° with stem, (4) complete bending, making an angle of above 75° with stem. Head shape was noted on a scale following Shein as cited by Knowles (1978). The head shape being (i) flat, (ii) concave, (iii) convex, (iv) flat but perphery of head rolled slightly up to collect water when head is bending down and (v) irregular. Genotypic and phenotypic correlations of bird damage with various plant characteristics were computed following the formula of Kwon and Torrie (1964).

types for various traits except flowering period and oil concentration.

The estimates of genotypic correlation coefficients of plant height with bird damage was negative and significant (Table 1) but showed significant and negative phenotypic correlations indicating that bird damage could increase significantly with decrease in plant height. The taller plants have comparatively weaker stem, the parakeets when alight on plant head could cause the stem to swing and destabilise the birds resulting in lower seed damage. On the contrary, shorter plants with solid compact stem could bear

Table 1. Means, coefficients of variations (CV) and phenoypic and genotypic correations of bird damage with different traits

Characteristics	Mean	CV (%)	Bird damage correlation		S.E. for genetic correlation
			Phenotypic	Genotypic	
Flowering period (days)	7.20	16.49	0.4151^{NS}	0.6490	± 0.5158
Maturity period (weeks)	13.96	11.34	0.5091	0.5658	± 0.0009
Plant height (cm)	96.83	26.83	-0.5456*	-0.6915	± 0.4153
Head diameter (cm)	18.61	24.45	0.0850^{NS}	0.0759	± 0.8051
Hull percentage	46.18	1.90	0.1151^{NS}	0.1243	± 0.7243
Oil content (%)	40.20	2.06	0.1625^{NS}	0.1830	± 0.7123
100-seed weight (g)	7.76	2.51	-0.1467^{NS}	0.1562	± 0.6381
Seed yield plant-1 (g)	10.17	126.63	-0.9869**	-1.0239	± 0.0363
Stem inclination	1.97	18.04	-0.6243**	-0.7394	± 0.3331
Head shape	1.87	19.05	0.3342^{NS}	0.3884	± 0.6316

NS = Non-significant.
* = Significant at 0.05 probability level.
** = Significant at 0.01 probability level.

RESULTS AND DISCUSSION

The genotypes showed a wide range of variation and analysis of variance indicated highly significant differences among geno-

weight of birds and hence showed more damage.

The significant negative genotypic and phenotypic correlations between bird damage and seed yield suggested that decrease

in bird damage resulted with an increase in achene yield which itself depends on several plant and seed characteristics.

A significant negative genotypic and phenotypic correlations were observed between bird damage and stem inclination. The erect plants were relatively more exposed to bird damage and the bird damage would be lesser on plants showing greater degree of stem inclination. These results are in confirmity with Harada (1975) and Parfitt (1984).

The present investigation suggested that dwarf plant and stem inclination can play a significant role in control of bird damage in sunflower. Similarly, plants which take longer time to reach maturity are subjected to higher bird damage.

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