Screening of sunflower *Helianthus annuus* L. germplasm for resistance against sunflower stem weevil *Cylindrocopturus adspersus* LeConte.

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SUMMARY

Sunflower *Helianthus annuus* L. as an oilseed crop is grown two times in a year in Pakistan, i.e., spring and autumn. During spring 1991, a total 69 sunflower entries including hybrids and open pollinated cultivars were screened against sunflower stem weevil for resistance. Among these entries X-2578 was found comparatively more resistant whereas, 13 entries were moderately resistant. During autumn sunflower stem weevil was not found in any of the sunflower material indicating that at present, it is a season specific problem.

INTRODUCTION:

Sunflower (*Helianthus annuus* L.) was introduced in Pakistan during early 1960's and its commercial cultivation began from 1965. Due to hot summer and mild winter, two crops are grown in a year, first crop is planted in spring and the second in autumn season. During 1991, it was grown on 31,418 hectares. However, not much information about insect pests of sunflower is available because entomological aspects of sunflower were not studied in the country previously.

During autumn, 1989 a considerable lodging was noted in some of the varieties. On close investigation it was found that most of the lodging was associated with the insect damage to the stem. Later investigations lead to the identification of stem weevil causing the damage. Sunflower stem weevil (SSW) *Cylindrocopturus adspersus* Leconte is a univeltine species and its life cycle depends upon regional climate, local topographical features and microhabitat characteristics (Danks, 1978). SSW infest composite family including ragweed (Geoden and Richer 1976); *Helianthus* spp. and commercial sunflower (Charlet, 1989).

Sunflower stem weevil lay their eggs under the epidermis layer in the stem at early crop growth stage. After hatching, these well protected larvae feed on vascular tissue in the stem limiting the supply of nutrients to the plant (Roger et el, 1983). In case of heavy infestation, crop lodging takes place, which may result in yield losses to a tune of 27-41%. (Roger & Jones, 1979). This insect may help to transmit phoma black (Gaudet and Schulz, 1984) and enhance charcoal rot to epidemic scale (Yang and Owen, 1982).

Some works has been reported on chemical and cultural control of SSW (Rogers, et al., 1983). Resistance to SSW was found in some annual and perennial *Helianthus* spp. excluding *H. annuus*. (Roger and Seiler 1985). In view of potential threat of SSW to sunflower, a study has been initiated to screen the commercial hybrids and varieties for resistance. This report includes results of fist year trials during spring and autumn, 1991.

MATERIAL AND METHODS:

A total of 69 sunflower entries were planted on January 31, 1991 in four different field trials as depicted in Tables 1-4. Hysun-33 was used as check in all the trials. Entries were replicated four times using randomized complete block design. The plot size was 15 square meters having four rows five meter long and 0.75 meter spaced apart. All other cultural practices were according to the local production recommendations. The same material was planted in autumn season on 15th August using the similar experimental design and cultural practices.

At physiological maturity, each plot was sampled by selecting five plants at random from the two central rows. The selected plants were cut just from the ground level. To draw uniform samples lower 30 cm portion of the stem were removed, labeled and shifted to laboratory for recording the observations on infestation and tissue damage.

Plant infestation: The stem was splited in two halves vertically and the number of infested plants in each entry and four replications were counted and reported in percentage.

Tissue damage: The running length of tissue damage by the insect were measured in centimeters from the infested stems and reported as an average of tissue damage per 30 cm of stem length.

The data for each experiment was analyzed using the analysis of variance by computer software package MStat-C. The LSD at (0.05) was used to test the differences in the entries means.

RESULTS AND DISCUSSION:

Sunflower germplasm trial: The 23 entries of germplasm were significantly different for infestation percentage and plant tissue damage (Table 1). The X-2578 was the least infested (10%) entry in this group of sunflower cultivars, the other 10 entries, viz., NK-259, Euroflor, Suncross-843, DO-728, Gloriasol, 8139005, 8139006, X-1528, X-3623 and X-3593 were not statistically different from X-2578. Hysun-33 was found the most infested (90%) hybrid.

The X-2578 also had the least damage (3.21 cm/30 cm). The other nine entries, viz., NK-259, Suncross-843, Gloriasol, 8139006, X-1528, X-3623, X-3593, 8139002 and 8139001 were not statistically different from X-2578 having a damage range 4.73-9.90 cm/30 cm.

From the results, it can be concluded that X-2578 was resistant to SSW as it had the least infestation as well as damage. Other entries such as NK-259, Suncross-843, Gloriasol, 813006, X-1528 and X-3623 can be rated as moderately resistant to SSW. These had 20-40% infestation and less than 10 cm/30 cm tissue damage. Hysun-33 was the most susceptible entry.

Table 1. Screening of sunflower germplasm for resistance against stem weevil during spring, 1991.

Entry	Infestation (%)	Damage cm/30 cm
X-2578	10.00 a	3.12 a
NK-259	20.00 ab	6.37 ab
Euroflor	30.00 abc	14.93 cdef
S-X-843	30.00 abc	9.29 abcde
DO-728	30.00 abc	10.81 abcde
Gloriasol	30.00 abc	7.91 bcd
8139005	35.00 abc	12.50 bcdef
8139006	35.00 abc	4.73 bc
X-1528	35.00 abc	9.68 abcde
X-3623	40.00 abcd	8.75 bcd
X-3593	40.00 abcd	9.90 abcde
DO-827	50.00 bcd	17.69 ef
8139003	50.00 bcd	13.85 cdef
DO-704	55.00 cde	17.13 ef
8139002	55.00 cde	10.71 abcde
NK-212	60.00 cdef	14.41 cdef
8139001	60.00 cdef	10.34 abcde
DO-730	70.00 def	12.66 bcdef
Agrisol	70.00 def	14.13 cdef
DO-725	70.00 def	20.42 f
DO-707	85.00 ef	15.92 def
NK-256	85.00 ef	12.90 bcdef
Hysun-33	90.00 f	16.16 def

Means followed by the same letters in a column are not significantly different at *P=0.05* (LSD).

National uniform yield trial (NUYT): In NUYT, 20 entries were evaluated for SSW attack. These entries were significantly different for infestation percentage and tissue damage (Table 2). NK-212 and SF-187 were the least infested (10%) entries, other 10 entries, viz., SMH-87, NK-265, SC-90, NK-277, SMH-24, Suncom-110, Al-extra, SMH-88, SMH-133 and NK-268 were not statistically different from NK-212 and infestation in these entries ranged from 20 to 45%. Hysun-33 and SMT were damaged heavily (85%). NK-212 had the least damage (3.62 cm/30 cm) and other seven entries, viz., NK-265, SC-90, NK-277, Al-extra, SMH-88, NK-268 and IS-3107 were not statistically different from NK-212.

In this group of sunflower cultivars, NK-212, NK-265, SC-90, NK-277, Al-extra and NK-268 were comparatively less infested and damaged, therefore, can be considered moderately resistant.

Table 2. Screening of sunflower NUYT for resistance against stem weevil during spring, 1991.

Entry	Infestation (%)	Damage cm/30 cm
NK-212	10.00 a	3.62 ab
SF-187	10.00 a	13.25 bcde
SMH-87	20.00 ab	14.13 bcde
NK-265	25.00 ab	6.75 abc
SC-90	25.00 ab	7.71 abc
NK-277	25.00 ab	9.87 abcd
SMH-24	35.00 abc	13.43 bcde
Suncom-110	35.00 abc	14.46 bcde
Alextra	40.00 abc	5.75 abc
SMH-88	40.00 abc	10.75 abcd
SMH-133	45.00 abc	13.38 bcde
NK-268	45.00 abc	9.02 abcd
9UO-349	50.00 bcd	14.50 bcde
IS-3312	50.00 bcd	15.77 cde
IS-3107	50.00 bcd	11.26 abcd
DO-855	55.00 bcd	22.33 e
ATI-3	65.00 cd	15.55 cde
HO-1	70.00 cd	21.76 e
SMT	85.00 d	14.50 bcde
Hysun-33	85.00 d	18.59 de

Means followed by the same letters in a column are not significantly different at *P=0.05* (LSD).

Local sunflower hybrid trial-I: In this trial, 16 entries including 11 local hybrids were evaluated for SSW attack. These entries were significantly different in infestation percentage but not in tissue damage (Table 3). Among these entries, local hybrid SMH-24, SMH-81 and SMH-90 were less infested (30%). Entry 8UO-497 was heavily infested (95%).

Although the tissue damage was statistically not different in this set of hybrids, SMH-81 and NK-212 had the least damage of 7.59 and 9.49 cm/30 cm, respectively. In this group of sunflower cultivars, local hybrid SMH-81 can be considered moderately resistant, because, its infestation and damage values were lower than NK-212.

Table 3. Screening of sunflower local hybrid-I for resistance against stem weevil during spring, 1991.

Entry	Infestation (%)	Damage cm/30 cm
SMH-24	30.00 a	12.32
SMH-81	30.00 a	7.59
SMH-90	30.00 a	12.83
SH-3322	40.00 ab	14.42
NK-212	40.00 ab	9.47
SMH-43	45.00 abc	12.06
SMH-109	45.00 abc	15.85
SMH-68	50.00 abc	11.29
SMH-23	55.00 abc	14.17
SMH-34	55.00 abc	12.33
SH-222	60.00 abcd	14.52
NK-265	70.00 bcd	14.40
PI-6480	75.00 bcd	16.83
SMH-15	75.00 bcd	12.77
SMH-26	80.00 cd	18.89
8UO-497	95.00 d	20.25

Means followed by the same letters in a column are not significantly different at *P=0.05* (LSD).

Local sunflower hybrid trial-II: In this field trial, 16 entries including and 2nd set of 11 local hybrids were evaluated against SSW resistance. These entries were significantly different for infestation percentage and tissue damage (Table 4). SMH-68 and NK-212 were less infested (30%) and the other six entries viz., SC-90, SMH-90, SMH-57, SMH-44, SMH-65, SMH-25 and SMH-112 were not statistically different from NK-212. Hysun-33 was heavily infested (95%).

SC-90, an open-pollinated variety, had the lowest damage by SSW 5.48 cm/30 cm. Other entries, viz., SMH-90, SMH-44 and SMH-65 also had tissue damage less than 10 cm/30 cm.

Table 4. Screening of sunflower local hybrid-II for resistance against stem weevil during spring, 1991.

Entry	Infestation (%)	Damage cm/30 cm
NK-212	30.00 a	16.79 de
SMH-68	30.00 a	10.34 abcd
SC-90	40.00 ab	5.48 a
SMH-90	40.00 ab	7.81 ab
SMH-57	45.00 abc	12.76 abcd
SMH-44	45.00 abc	8.50 abc
SMH-65	55.00 abcd	9.50 abcd
SMH-25	60.00 abcd	10.10 abcd
SMH-112	65.00 bcde	9.91 abcd
HO-1	65.00 bcde	15.57 cde
9UO-349	65.00 bcde	21.04 e
SMH-30	65.00 bcde	12.15 abcd
PI-6480	75.00 bcd	16.83 bcd
SMH-15	75.00 bcd	12.77 bcd
SMH-26	80.00 cd	18.89 cd
8UO-497	95.00 d	20.25 d

Means followed by the same letters in a column are not significantly different at *P=0.05* (LSD).

The sunflower material planted during autumn, 1991 was completely free from SSW infestation indicating that SSW has a single generation in a year which appeared in spring season and is in agreement with the findings of Rogers and Serda (1982).

CONCLUSION

Results revealed that, in natural field conditions, X-2578 entry of cultivated sunflower *Helianthus annuus* can be considered a good addition to already identified resistant material to SSW (Rogers and Seiler, 1985). Among commercial hybrids, NK-212 was found moderately resistant to SSW. More studies will be required for the confirmation of these results and for finding the resistance mechanism in sunflower against stem weevil. It will facilitate the breeders to incorporate the gene for the resistance in hybrids and varieties.

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