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APPRAISAL OF DIFFERENT WILD OATS (*Avena fatua* L.) BIOTYPES COLLECTED FROM PAKISTAN FOR THEIR GROWTH AND DEVELOPMENT

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ABSTRACT

Laboratory studies were conducted during 2004-2005 in Weed Science Research Laboratory, Department of Weed Science, NWFP Agricultural University, Peshawar, Pakistan for comparing different biotypes of wild oatsc collected across the NWFP and Federal capita Islamabad. The tested wild oats biotypes included NARC-Islamabad, Peshawar, Swabi, Mardan, D.I Khan (white) and Swat. The data were recorded on germination percentage, number of leaves plant^{-1}, plant height (cm), fresh weight (g,) leaf area (cm^2) plant^{-1} number of seeds plant^{-1} and maturity status of wild oats biotypes. The data for individual traits were subjected to ANOVA technique. The analyses of data revealed that the tested biotypes statistically varied in plant height, fresh weight, No. of seeds palnt^{-1} and time to maturity. Although, non significant statistically the germination percentage varied among the genotypes from 18.33% in Mardan to as high as 51.663% in Peshawar. The tallest plants were recorded in D.I.Khan (white), although it was statistically at par with NARC, Peshawar and Swabi biotypes. The greatest leaf area (11.735 cm^2) was attained by Swabi biotype as compared to only 0.363 cm^2 in D.I.Khan (white). The genotypes also varied in the No. of seeds palnt^{-1}. On the average 7.55 seeds were possessed by Swabi as compared to only 0.125 seeds in Swat biotype. Peshawar and Mardan were early maturing biotypes as compared to D.I.Khan being late. The rest fell intermediate in time to maturity. Different biotypes contemplated exhibit that they differ in their competitive ability as their performance varied in the morphological and physiological and agronomic parameters. Therefore, in the native areas of the more vigorous wild oats more attention will be needed on the control as compared to the less competitive genotypes.

Key Words: Wild oats, Biotypes, Growth, Development

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INTRODUCTION

Avena fatua is a grassy weed of wheat, which belongs to family Poaceae. A. fatua L. is a hexaploid wild oat (2n=6x=42) known as a noxious weedy plant from Pakistan and other grain producing regions of the world. It is highly competitive with wheat and causes sèvere reduction in its yield. It is difficult to differentiate this weed from wheat at the seedling stage, as seedling is identical to wheat seedling in morphology. Life cycle of this weed also coincides with wheat. The problem in identification at the early stage impedes in the manual control, hence herbicides application becomes inevitable (Luby and Stuthman, 1983).

The increase in wheat yield during the recent years in Pakistan which has rendered the nation from a wheat importer to the exporter country is attributed to the successful launching of Topik15WP (clodinafop-propargyl) and Puma Super75EW (fenoxaprop-p-ethyl). The grass species most competitive in wheat are wild oats and little seed canary grass. These weeds could be controlled at much lower rates as compared to those specified in the label. But, accurate information regarding the tolerance of biotypes of these weeds in Pakistan is lacking. Juan *et al.* (1995) studied the effects of post-emergence selective graminicides upon the development of *A. fatua* seed bank in wheat crop and *A. fatua* seed production was reduced to between 60 and 95% as compared with control.

Joseph *et al.* (1990) studies the differences in tolerance, morphology, and physiological response of diclofop-resistant and -susceptible *A. fatua* biotypes collected from fields were investigated under growth room and field conditions. Under herbicide-free conditions the resistant biotype had more upright leaves with about 12% less leaf area and 50% less leaf width than the susceptible biotype. A marked difference in the level of tolerance to diclofop was observed. Photosynthesis was initially reduced in both biotypes after treatment with diclofop at 0.70 kg ha ^{1}, but the resistant biotype was able to recover. Injury to the susceptible biotype was reduced by coating the seeds with 1,8-naphthalic anhydride. Differential foliar retention was not an important factor in selectivity of diclofop among the two biotypes.

Kiec (1999) carried out an experiment in 1995-96 to check the efficiency of common wild oat herbicides - fenoxaprop-p-ethyl + fenchlorazole-ethyl, diclofop-methyl, quizalofop-p-ethyl, fluazifop-p-butyl, fenoxaprop-p-ethyl and cycloate. Herbicides were used at recommended rates and weed growth stages, except cycloate, which was used before sowing. Percentage of dead plants was determined. fluazifop-butyl and fenoxaprop-p-ethyl showed 100% efficacy. Fenoxaprop-p-ethyl + fenchlorazole-ethyl and quizalofop-P-ethyl are the best for wild oat control in the studied region. Diclofop-methyl controlled this weed poorly and cycloate gave the worst results. Varieties E, F and G were very well controlled by all herbicides. Variety A was weakly controlled by diclofop-methyl and cycloate, the differences being statistically significant.

Thill *et al.* (1994) communicated that herbicide-resistant biotypes of wild oats infest most major cereal producing regions in the western USA and Canada. An integrated wild oats management strategy to delay or prevent the development of herbicide resistance should be based on preventing the movement of wild oats seed into the soil.

To investigate the differential competitive ability among the wild oat germplasm, seeds collected across NWFP and from the Federal capital to study at Weed Science Department NWFP Agricultural University, Peshawar under the auspices of the HEC Project with the following objectives 1) to evaluate the biotypes for morphological traits 2) o evaluate the biotypes for physiological and agronomic traits and 3) to caution the weed managers regarding the competitive genotypes.

METHODS AND MATERIALS Appraisal of different biotypes of wild oats collected from Across NWFP and Federal Capital Islamabad was conducted during 2004-2005 in Weed Science Research Laboratory, Department of Weed Science, NWFP Agricultural University, Peshawar. The wild oats biotypes were collected from different locations of NWFP. Fifteen seeds of each biotype were placed in plastic pots having 15 cm dia. and 12 cm depth. The plants were raised from December 16, 2004 to the 2nd week of March 2005. From the start of the experiment, the required quantity of water was applied to each pot. The detail of the different treatments is provided in Table-1.

Table-1. Different wild oats biotypes used in the experiment

S.No.	biotypes	Collection sites
1.	NARC-Islamabad	NARC
2.	Peshawar	Malkandher Farm
3.	Swabi	Yar Hussain
4.	Mardan	Lundkhawar
5.	D.I.Khan (white)	Tatta Balochan
6.	Swat	Batkhela

In order to compare different wild oats biotypes, data were recorded on germination percentage, Number of leaves plant^{-1}, plant height (cm), fresh weight (g), leaf area (cm^2) plant^{-1}, Number of seeds plant^{-1} and maturity status of biotypes. The data for the individual trait were subjected to the analysis of variance technique and the means were separated by LSD test.

RESULTS AND DISCUSSION

Germination percentage

The analysis of data showed that different wild oats biotypes treatments had non-significant effect on germination percentage. Data regarding the effect of different wild oats biotypes on germination percentage are given in Table-2. The analysis of data revealed that maximum germination percentage (51.663) was recorded in Peshawar wild oats biotype followed by (33.33) in Swabi biotype. The lowest germination percentage

(18.33) was recorded in Mardan wild oats biotype. The germination percentage of NARC, D.I.Khan and Swat are almost similar. A variation in the germination among the biotypes exhibits their varying repose in the soil seed bank. An even germination among the species and ecotypes has been claimed as an adaptive significance for its behavior in the soil seed bank and ultimate competition with the crops (Paterson and Sorrells, 1990). Thus, our findings have an implication that biotypes of wild oats have differential genotypic status regarding their inherent dormancy.

Number of leaves plant^{-1}

The analysis of data showed that different wild oats biotypes treatments had non-significant effect on number of leaves plant^{-1}. Data regarding the effect of different wild oats biotypes on number of leaves plant^{-1}are given in Table-2. The analysis of data revealed that maximum number of leaves plant^{-1} (4.83) were recorded in NARC, Islamabad wild oats biotype followed by 4.20 in Swabi wild oats biotype. The lowest number of leaves plant^{-1} (1.68) were recorded in Swat wild oats biotype. The number of leaves plant^{-1} of Peshawar, Mardan and D.I.Khan (white) are comparable to one another. The canopy development has an enormous role in determining the competitive ability of different species and biotypes. Thus, although the trait under reference is statistically non-significant, yet a spread in data indicates a differential competitive status of various biotypes.

Plant height (cm)

The analysis of data showed that different wild oats biotypes treatments had significant effect on plant height (cm). Data regarding the effect of different wild oats biotypes on plant height (cm) are given in Table-2. The analysis of data revealed that maximum plant height (31.40) was recorded in D.I.Khan (White) wild oats biotype followed by 27.72 in NARC Islamabad wild oats biotype. The lowest plant height (cm) (8.73) was recorded in Swat wild oats biotype. Tessema and Tanner (1997) reported that plant height was most closely associated with weed competitive ability of different wild oats biotypes.

Fresh weight (g)

The analysis of data showed that different wild oats biotypes treatments had significant effect on fresh weight (g). Data regarding the effect of different wild oats biotypes on fresh weight (g) are presented in (Table-2). The analysis of data revealed that maximum fresh weight (5.333) was recorded in D.I.Khan (white) wild oats biotype followed by (1.16) in Swabi wild oats biotype. The lowest fresh weight (g) (0.12) was recorded in Swat wild oats biotype. Again the biotype gathering more biomass is a clear indication for its competitive ability to capture nutrients, light, gases, and space for its growth (Abbate *et al.* 1997). The differential status of the biotypes reflects their differential competition potential in the localities they were collected. Thus, more attention of the managers will be required to control wild oats in one ecological zone as compared to the other.

Leaf area (cm^2) $plant^{-1}$

The analysis of data showed that different wild oats biotypes significantly had a different leaf area $plant^{-1}$. Data regarding the effect of different wild oats biotypes on leaf area $plant^{-1}$ are also given in Table-2. The analysis of data revealed that maximum leaf area $plant^{-1}$ (11.74) was recorded in Swabi wild oats biotype followed by 9.41 in NARC- Islamabad wild oats biotype. The lowest leaf area $plant^{-1}$ (0.36) was recorded in D.I.Khan (white) wild oats biotype. Although, the plant height was the highest in D.I.Khan (white), yet it possessed the lowest leaf area depicts the biotype is not investing much of its photsynthate on photosynthetic apparatus, rather it salvaged the assimilates for structural tissue. With a greater height it can better compete with wheat. Analogous results were reported by Storkey (2004), who stated that models of crop yield loss based on relative weed green area to different growing seasons and assessment dates can be used.

Number of seeds $plant^{-1}$

The analysis of data revealed that different wild oats biotypes treatments had significant effect on number of seeds $plant^{-1}$. Data regarding the effect of different wild oats biotypes on number of seeds $plant^{-1}$ are given in Table-2. The analysis of data exhibit that maximum number of seeds $plant^{-1}$ (7.55) was recorded in Swabi wild oats biotype followed by 5.35 in NARC Islamabad wild oats biotype. The lowest number of seeds $plant^{-1}$ (0.13) were recorded in Swat wild oats biotype. Swat biotype has emerged as the weakest in most of the parameters studied.

Maturity status of wild oats

Data on maturity status of wild oats were recorded by categorizing maturity status into the three early, intermediate and late maturity groups. By visual observation of each wild oats biotypes we assigned intermediate maturity status to NARC Islamabad wild oats biotype, early maturity status to Peshawar and Mardan wild oats biotype. While Swabi, Swat and D.I.Khan (white) wild oats biotypes having the late maturity status. The biotypes maturing at different times will be having an implication that if they mature well before the maturity of wheat they will shatter their seeds into the soil seed bank resulting in their persistence in the habitat. Contrarily the biotype maturing with wheat will carry some of its seeds along with the harvest and will be carried away from the habitat.

CONCLUSIONS AND RECOMMENDATIONS

Different biotypes contemplated exhibit that they differ in their competitive ability as their performance varied in the morphological and physiological parameters. Therefore, in the native areas of the more competitive wild oats more attention will be needed on the control of wild oats as compared to the less competitive genotypes.

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Table-2. Comparison of different biotypes of wild oats based on morphological, physiological agronomic traits.

Biotypes	Germ. %	#Leaves plant^{-1}	Plant height (cm)	Fresh weight (g)	Leaf area plant^{-1}	Seeds plant^{-1}	Maturity status
NARC	25.00	4.83	27.73a b	0.48b	9.41b	5.35b	Intermediate
Peshawar	51.66	2.88	24.08a b	0.30	6.38c	4.38b	Early
Swabi	33.33	4.20	27.23a b	1.16b	11.74a	7.55a	Intermediate
Mardan	18.33	2.58	18.28b c	0.89b	8.49b	1.58c	Early
D.I.Khan (White)	25.00	2.53	31.40a	5.33a	0.36e	4.95b	Late
Swat	25.00	1.68	8.73c	0.12b	3.20d	0.13c	Late

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