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DISTRIBUTION AND CONTROL OF BROOMRAPE (*Orobanche* spp.) AND OTHER MAJOR WEEDS IN DISTRICT SWABI, NWFP

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ABSTRACT

A survey was conducted in district Swabi during May 2002, to investigate the population dynamics and management of Orobanche spp. and major kharif and rabi weeds. Forty two farmers were randomly selected for detailed interview to learn about their knowledge, perceptions, control strategies and difficulties concerning the parasitic and other weeds in six villages like Yar Hussian, Yaqoobi Bazargai, Dagi, Sardchna and Tarake of the district Swabi. The results obtained indicated that wheat and tobacco were the major rabi crops of the research area. The major rabi weeds were Trianthema sp., Phalaris minor, Orobanche sp., Cyperus sp., Echinochloa sp. and Avena fatua. Similarly, maize, vegetables and rice were the important kharif crops of the research area, and the major kharif weeds were Trianthema sp., Cyperus Sp., Echinochloa sp., Cynodon dactylon and Convolvulus arvensis. Being a cash crop with higher expected returns, more area is devoted to tobacco. A total of 10 weeds were reported as problem weeds and Orobanche was one of them. The Orobanche infestation in air cured (Nicotiana rustcia) was sever than the flue cured (Nicotiana tobacum). Orobanche infestation in tobacco was reported as causing up to 45% losses. It was found that Orobanche population is increasing in those fields where tobacco is cultivated continuously or the area is rainfed. Hand pulling is the only method that the local farmers apply to control the Orobanche in tobacco fields. The weedy species are also used for different useful purposes because some have medicinal and nutritional value. There seems to be a lack of information concerning chemical control of Orobanche. Farmers use only suckericides for the de-suckering in tobacco. Moreover, the major problems of the farming community were weeds, scarcity of irrigation water, lake of good quality seeds, agreement with tobacco companies and prices of output.

Key words: *Tobacco* Orobanche *Swabi weed management*

INTRODUCTION

Agriculture is the mainstay of Pakistan's economy. Its share in GDP is 24%. It contributes by 35 % to export earring, employs 51 % of the labour force and provides livelihood to 70 % of rural popu'ation (Anonymous, 2002). Increased pressure of population is however demanding more output from agriculture to feed and cloth the teeming millions. The productive resources on the other hand are limited and rapidly shrinking. We expect good food in adequate quantities. Our farmers are getting poor yields of agricultural crops as compared to the advanced countries of the world. There are several reasons that are responsible for lower yields of agricultural crops among which weeds infestation is the most important one. Weeds compete with crop plants for nutrients, soil moisture and sunlight and hence reduce yield. Most of the weeds are more

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competitive than the crop plants (Fitter and Hay, 1981). Reduction in crop yield has a direct correlation with weed competition. Generally an increase in one Kg of weed growth corresponds to a reduction in one Kg of crop growth (Rao, 2000). Approximately 6700 species of weeds plague world agriculture (Holm *et al.*, 1979). Of these species, 76 have been categorized as the "world's worst weeds" (Holm *et al.*, 1977). Marwat (1984) reported a total of 284 weeds from NWFP. Five to thirty weeds plague each crop where at least 14 weeds have been reported from wheat and 20 each from sugarcane and maize. Annual losses due to weeds on farmlands are far greater than realized. The figures would be alarming if these losses are interpreted in monetary terms. Studies show that the annual crop losses in Pakistan due to weeds range from 17-25%, 20-63%, 10-35% and 13-31% in wheat, rice, sugarcane and cotton crops, respectively (Abbas, 2000). Marwat *et al.*, (1993) reported 54 parasitic weeds in Pakistan. Over 3000 species of flowering plants utilize a parasitic mode of nutrition (Miller, 1994). The major parasitic weeds are Orobanche, Cuscuta, Striga, Alectra, and Mistletoes. Orobanche infests tobacco, cotton, sunflower, tomato, carrot, soybean, sesame and finger millet (Rao, 2000). The broomrape (*Orobancho* sp.) is one of the serious parasitic weeds of tobacco in NWFP.

Tobacco contribution to the world economy is significant. In Pakistan tobacco makes a significant contribution in different sectors of the economy, i.e. from farming through manufacturing and to retailing the end product. Tobacco industry is also a major purchaser of inputs from other industries. This crop also carries a great economic significance and its impact on the fiscal and monetary policies of major producing exporting/importing countries is quite pronounced. In Pakistan its total income contribution to GDP is Rs 34 billion (4.7% of the total GDP of Pakistan). And its contribution to the government revenue receipts is very sizeable by way of Central Excise Duty and Sales Tax. The industry is the single largest contributor to excise duty. It generates six times more excise duty than cotton yarn. It generates nearly 25 per cent of the total excise duty in the country (Anonymous, 2002).

Tobacco industry employs over one million people. The growers get higher income from tobacco as compared to other cash crops in NWFP. Tobacco was grown on an area of 43.9 thousand hectares in 1991 and it was increased to 49.4 thousand hectares in 2002. The production of tobacco is increased from 75.0 thousand tons in 1991 to 94.5 thousand tons in 2002 and the yield per hectare of tobacco crop was 1914 Kg in Pakistan (Anonymous, 2002).

Orobanchaceae, the broomrape family, comprises approximately 150 species in 17 genera (Thieret, 1971). *Orobanche* genus is represented by about 20 species in Pakistan (Siddiqui *et al.*, 1993). The broomrapes are variable in color, ranging from yellowish brown and reddish violet to purple, blue, and orange. Majority of species grow only on one or two host plants (Marudarjan, 1950). The parasitic broomrapes live directly on their hosts by attaching strong haustoria to their roots, penetrating the tissues, and absorbing the food gathered by the host plants for their own development.

Broomrape damages their host by creating a powerful sink in host plants for nutrients, especially sugar. Broomrapes reduce the biomass of its host by 30% with main adverse effect on the leaves of tobacco (Ernst, 1986). The incidence of *Orobancho* occurs in tobacco at an intensity of 4.3-7.3 shoots per host plant. At an infestation of 7.3 shoots per host plant, growth inhibition and yield losses in tobacco were 50% (Krishnamurthy *et al.*, 1977).

The best control remedy is prevention, i.e. sowing clean seed. Broomrape seeds are among the tiniest in existence, so they are easily removed from large seeded crops (Brenchley, 1920). Cultural methods generally involve the use of a susceptible species called a "trap" crop, which is alternated in rotation with the desirable crop species (King, 1966). Badly infested fields should be planted for 2 or 3 yr with crops that are not parasitized by the weed (Georgia, 1942). For centuries, clean cultivation followed by hand weeding or hoeing broomrape plants before they produced and disseminated seeds were advocated for control. This was especially important with new infestations. The attachment with the host roots is not very firm, and the whole parasite breaks away readily. Manual removal is practiced in NWFP, to reduce the yield losses of tobacco and prevent seed production of many weeds but it needs to be repeated several times in the season and hence it proves labour intensive and uneconomical. Few herbicides have shown promising results for controlling the broomrape in tobacco. The most effective and economical method of controlling *Orobanche* is to grow trap crops in rotation with tobacco. The trap crops stimulate germination of *Orobanche* seeds, but they do not infect these. In this way trap crops reduce the seed bank in the soil and cause a considerable decrease of infestation. Lolas, (1997) reported Weedicides like Chlorsulfuron @ 2, imazaquin @ 70-100 and imazapyr @ 20 - 30 g/ha applied as pre-transplanting gave effective control of broomrape. Glyphosate @ 200-300, sulfosate [glyphosate-trimesium] @ 300-400, imazaquin @ 70-100 and maleic hydrazide @ 450-550 g/ha applied in tobacco were effective in the control of *Orobanche* with no phytotoxicity on the crop.

The information regarding the infestation of Orobance and other weeds in different crops of NWFP is lacking therefore the instant studies were initiated in district Swabi to quantify the magnitude of losses due to weeds, including parasitic weeds.

Materials and Methods

The methodology employed in the study consisted of two stages: The initial information collected and informal and formal survey.

Initial Information Collected

In this stage the initial information regarding the study area and the problem under discussion were collected from different sources like questionnaires, farmer's perception and personal observations. The purpose of the activity was to identify important issues and problems facing the farmers and to have a general outline of questions to be asked from the farmers, later during the interview.

Research Site and Sample Design

The study has been conducted in district Swabi. The villages selected are those, which constitute the major part of the tobacco growing area, were Yar Hussian, Yaqoobi, Bazargai, Dagi, Sardchna and Tarake. Forty-two farmers were randomly selected for detailed interview in each village. Farmers are divided in to three categories: farmers operating up to 5 acres of land are categorized as small farmers, 5 to 10 acres are medium and operating more than 10 acres of land are categorized as large holding farmers. These farmers were interviewed during May 2001. During the survey, personal observations were also recorded regarding the different weeds. The data obtained from the questionnaires and personal observations is presented in the form of tables and discussed.

Informal and Formal Survey

Informal survey was conducted in order to get maximum information from the selected farmers that could help in improving the interview schedule. Data was collected through a comprehensive interview schedule by conducting formal survey.

Results And Discussion

The data/information obtained during the survey was tabulated and presented in separate Tables. The perceptions about the way *Orobanche* infests the tobacco crop and the major problems of the farmers are presented.

Farm and Farmers Characteristics

Literacy Level of the Sample Farmers

Table-1 shows the literacy level of the respondents of the selected farm categories. The illiteracy level in small, medium and large farm size is 16, 12 and 2 %, respectively. Similarly, 6, 5 and 1 % farmers are educated up to primary level. The farmers that are educated up to matric were 8 % in small, 22 % in medium and 10 % in large farm size. The percentages of the farmers that are educated above matric level are 2, 4 and 12 % in small, medium and large holding, respectively. Majority of the respondents (70%) are literate. Of the total number of respondents 40% are educated up to the secondary level, while 18% are having education above secondary level.

Table-1. Literacy Level of the Sample Farmers (%)

Education Level	Farm Size Categories			
	Small	Medium	Large	Total
Illiterate	16	12	2	30
Primary	6	5	1	12
Matric	8	22	10	40
Above Matric	2	4	12	18

Tenancy Status of the Respondents

Table-2 shows three land tenure categories. More than 45% of the farmers were found as landowners. The second major class of growers was of the owners- cum-tenants who were about 33% and tenants were 22% in the study area.

Table-2. Tenancy Status of The Farmers (%)

Particulars	Farm Categories			
	Small	Medium	Large	Total
Owners	5	15	25	45
Owners-cum-tenants	2	20	11	33
Tenants	10	6	6	22

Cropping Pattern and Intensity of Weed Infestation

Major Rabi Crops and Their Weeds

Table 3 shows the major rabi crops that are sown in the area. These crops were reported as, wheat, tobacco, vegetables, shaftal and rapeseed and mustard. The number and percentage (%) of farmers (respondents) who had cultivated the crop in the current year or at least in the previous year were 36 (85.71) for wheat, 28 (66.67) for FCV tobacco, 21 (50) for desi tobacco, 9 (21.43) for vegetables, 6 (14.29) for shaftal, and 3(7.14) for rapeseed and mustard. Hence the data indicated that more than 50% of the farmers grow wheat, FCV and desi tobacco.

The major weeds of rabi crops recorded were *Trianthema* sp., *Phalaris minor*, *Orobanche* sp., *Cyperus* sp., *Echinochloa* sp. and *Avena fatua*, for which the number and percentage (%) of the respondents were 30(71.43), 24(57.14), 21(50), 19(45.24), 16(38.10), 14(33.33), respectively. Therefore, *Trianthema* sp., *Phalaris minor*, *and Orobanche* sp. were recorded as the most serious and major weeds of the study area.

Table-3. Major Rabi Crops And Their Associated Weeds

Crops	Number of respondents (%)	Major Rabi Weeds	Number of Respondents (%)
Wheat	85.71	*Trianthema* sp.	71.43
FCV Tobacco	66.67	*Phalaris minor*	57.14
Desi Tobacco	50.00	*Orobanche* sp.	50.00
Vegetables	21.43	*Cyperus* sp.	45.24
Shaftal	14.29	*Echinochloa* sp.	38.10
Rapeseed and mustard	7.14	*Avena fatua*	33.33
		Convolvulus arvensis	30.95
		Rumex sp.	30.95
		Paspalum sp.	19.05
		Sorghum halepense	19.05
		Carthamus oxyacantha	19.05
		Chenopodium album	16.67
		Anagalis arvensis	16.67
		Amaranthus *sp.*	16.67

Major Kharif crops and their Weeds

Table-4 indicated that major kharif crops sown in the area were maize, vegetables, rice, sugarcane and sorghum. The numbers of farmers and their percentage (%) who had cultivated the crops this year or at least in the previous year were 39 (92.86)

for maize, 30 (71.43) for vegetables, 17(40.48) for rice, 12 (28.57) for sugarcane and 02(4.76) for sorghum.

The major weeds of kharif crops recorded were *Trianthema* sp., *Cyperus* Sp., *Echinochloa* sp., *Cynodon dactylon and Convolvulus arvensis* for which the number and percentage of respondents were 32(76.19), 31(73.81), 23(54.76), 13(30.95), 13(30.95) and12 (28.57), respectively. Therefore, *Trianthema* sp., *Cyperus* sp. and *Echinochola* sp. were recorded as the most serious and major weeds as they contribute a major part in the weed flora of the area kharif season.

Table-4. Major Kharif Crops and their Weeds

Kharif Crops	Number of Respondents (%)	Major Kharif Weeds	Number of Respondents (%)
Maize	92.86	*Trianthema* sp.	76.19
Vegetables	71.43	*Cyperus* sp.	73.81
Rice	40.48	*Echinochloa* sp.	54.76
Sugarcane	28.57	*Cynodon dactylon*	30.95
Sorghum	4.76	*Convolvulus arvensis*	30.95
		Digitaria sp.	28.57
		Sorghum halepense	26.19
		Amaranthus sp.	26.19
		Portulaca oleraceae	21.43

Infestation of *Orobanche* spp. and Major problems of the Farmers

Infestation of Orobanche spp.

Table-5 shows that the infestation of *Orobanche* was recorded as 50% in FCV tobacco, and 31% in desi tobacco. The *Orobanche* infestation in desi tobacco (*Nicotiana rustica)* was severe than the flue cured (*Nicotiana tobacum)* but as the cultivation of FCV tobacco is more than desi tobacco, the positive response of the farmers about the *Orobanche* infestation in the study area was more in FCV tobacco.

Table-5. Infestation of *Orobanche* spp.

Description	Number of Respondents	Percentage (%)
FCV Tobacco	21	50
Desi Tobacco	13	31

Major Problems of the Farmers

Table-6 depicts the problems of the farmers and the constraints in the way of achieving higher yields of different crops. During the survey, farmers mentioned different constraints related to their farming. Major problems, reported by farmers were the increasing weeds problem, scarcity of irrigation water, unavailability of good quality seed, and marketing of tobacco. The unavailability of effective herbicides for the control of weeds was also a major constraint to farming community.

Table-6. Major Problems of the Farmers

Type of Problem	Number of respondents	Percentage (%)
Weeds problem	35	83.33
Irrigation problem	28	66.66
Unavailability of good quality seed	25	59.52
Marketing of tobacco	24	57.14
Low prices of output	20	42.00
Favoritism	16	38.09
Delayed payment	13	30.95
Fertilizers high rates	11	26.16
Insects	10	23.42
Diseases	9	21.42
Unavailability of agrochemicals	8	19.04
Tax problem	6	14.28

Uses of Weeds

Table-7 shows the uses of weeds of the selected flora for different purposes by the farmers. *Trianthema* sp., *Phalaris minor*, *Cyperus* sp., *Echinochloa* sp. and *Avena fatua* are used for fodder purposes. *Chenopodium album*, *Amaranthus* sp. *Portulaca oleraceae* and *Rumex* sp. are used as green vegetable. Now ethnobotanical societies emphasize on the use of indigenous species for various useful purposes. Similarly various other weeds are also collected by local Hakeems for the preparation of medicines.

Table-7. Uses of Weeds

Name of Weed	Ethonobotanical uses of Weeds
Phalaris minor	Use as fodder
Avena fatua	Use as fodder
Echinochloa sp.	Use as fodder
Trianthema sp.	Use as fodder
Cyperus sp.	Use as fodder
Chenopodium sp.	Use as green vegetable
Amaranthus sp.	Use as green vegetable
Portulaca oleraceae	Use as green vegetable
Rumex sp.	Use as green vegetable
Fumaria indica	Use as medicinal plant

Limitations of the study

The researchers faced a number of problems during the data collection that could affect the results of the study. These problems were;

1. Although the researchers tried there best to explain the nature and purpose of the study to the respondents, however, their suspicious attitude about the purpose of the study may falsify some of the information provided.

2. The quantitative data collected were only rough estimates, as most of the farmers do not keep the input/output records of farming. This could therefore, might have led to considerable variations in their response to the questions.

REFERENCES CITED

Anonymous. 2002. Agricultural Statistics of Pakistan. Ministry of Food, Agriculture and Live Stock Food. Tobacco: 38-39pp.

Anonymous. 2002. Economic Survey of Pakistan. Govt. of Pakistan, Economic Advisor's Wing Finance Division, Islamabad.

Anonymous. 2002. PTB advice to tobacco growers. Tuesday November 26, 2002. ISSN 1563-9479.

Abbas, M.A. 2000. Weeds. General Agriculture. Publishers Emporium. Pp. 147.

Brenchley, W. E. 1920. Weeds of Farm Land. Longman, Green and Co., London.

Ernst, W.H.O.1986. Mineral nutrition of *Nicotiana tobacum* cv. Bursana during infection by *Orobanche ramose* in biology and control of *Orobanche* (Ed S.J.Te Borg). PP. 80-85.

Fitter, A.H. and R.K.M. Hay. 1981. Environmental physiology of plants. London Academic Press.

Georgia, A. E. 1942. A Manual of Weeds. The MacMillan Co., New York.

Holm, L.G., D.L. Plucknett, J.V. Pancho and J.P. Heoberger. 1977. The world's worst weeds, University Press of Hawaii, Honolulu.

Holm, L.G., J.V. Pancho, J.P. Heoberger and D.L. Plucknett. 1979. A Geographical Atlas of world weeds, John Wiley And Sons, New York.

King, L. J. 1952. Germination and chemical control of the giant foxtail grass. Contrib. Boyce Thompson Inst. 16:469-487.

King, L. J. 1966. Weeds of the world. Interscience Publishers, Inc., New York.

Krishnamurthy, G.V.G., K. Najarajan and R. Lal. 1977. Some studies on *Orobanche cernua*. Loefl., a parasitic weed on tobacco in India, Indian J. Weed Sci. 9:95-106.

Lolas, P. 1997. Sub-group collaborative study on broomrape. Bulletin-d'Information - CORESTA. 3: 79-85.

Marudarjan, D. 1950. Note on Orobanche cernua Loefl. Current Sci. 19(2): 64-65.

Marwat, K.B., G.R. Marwat and F.M. Sarim.1993. A checklist and key to parasitic weeds of Pakistan. Pak. J. Weed Sci. Res. 6 (1-2):1-15.

Marwat, K.B.1984. Studies on the weeds of important cereal crops of NWFP. Ph.D.Thesis, Department of Botany, Univ. of Peshawar, Pakistan.

Miller, P. 1994. The biology and distribution of parasitic plants within the Orobancheaceae: An overview of secondary plant compound involvement. Coloado State University Fort Collins, Colorado 80523.

Rao, V.S. 2000. Harmful effects caused by weeds. Principles of Weed Science. Oxford and IBH Publishing Co.Pvt.Ltd. New Delhi & Calcuta. Pp.1. 2nd Ed.

Rao, V.S. 2000. Weed Parasitism. *In* Principles of Weed Science 2nd ed. Oxford and IBH publishing Co.Pvt.Ltd. New Delhi & Calcuta. pp.17.

Siddiqui, S.U., S.Khalid, R.A. Shad and K.B. Marwat. 1993. Host range and distribution of *Orobanche aegyptiaca* and *Orobanche cernua*: Two important parasitic weeds of crops in Pakistan. Pak. J. Weed Sci. Res. 6(1-2):61-67.

Thieret, J. W. 1971. The genera of Orobanchaceae in the southeastern United States. J. Arnold Arboretum. 52: 404-413.