

NODULATING LEGUMINOUS WEEDS OF SOME MAJOR CROPS OF PAKISTAN

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ABSTRACT

A survey was conducted to explore the nodulating leguminous weeds of some major crops of Pakistan. A total of 20 weeds are reported from the major crops which consisted of carrot, cotton, maize, potato, rice, sugarcane, tomato and wheat.

KEYWORDS: Nodulation, leguminous weeds, major crops, Pakistan.

INTRODUCTION

Generally, weeds are defined as plants growing where they are not desired. Many weeds grow in areas where they are not well adapted, but may still thrive in the absence of competition. Usually they are favored by vigorous reproductive powers. Most of them are tolerant to adverse conditions of growth such as extreme heat or cold, drought or excessive moisture, saline or water-logged environments and marginal or disturbed soils. Weeds often possess hard seeds, underground root stocks or tubers, and show greater persistence.

Weeds compete with crops for nutrients, water and light. They are often fast-growing and more efficient in utilizing nutrients than are crop plants and therefore have a distinct competitive advantage (Holst et al., 2007). Weeds may be pathogenic or act as an alternative host for insect pests, nematodes, and fungi. Certain weeds secrete substances that inhibit the growth of other plants. In short, weeds are

often harmful to crop plants and may cause serious yield losses. Their effect on crops is not as spectacular as insect pests or plant diseases, but they may lower yields as much as 80% and often by more than 50% if not controlled (Parker & Riches, 1993).

Weeds belong to practically all plant families but certain families, particularly Asteraceae, Brassicaceae and Poaceae constitute the major weed flora throughout the world (Nasir & Ali, 1972; Muenscher, 1980; DiTomsa & Healy, 2007). Leguminous plants enrich the soil with fixed nitrogen and also increase the rhizobia population (Amarger, 2001). However, under certain conditions many legume species usually considered as harmless, may turn into weeds difficult to eradicate. No research has been carried out in Pakistan to determine the role of nodulating legumes as weeds. The present study is aimed at exploring the nodulating weeds of the major crops of Pakistan.

MATERIALS AND METHODS

Periodic field trips were made to various parts of Pakistan during different seasons of the year and major crops were screened for nodulating leguminous weeds. The major crops included cotton, maize, rice, sugarcane and wheat. The vegetables surveyed were carrot, potato, and tomato. In the present report a "leguminous weed" means either a legume of no agricultural significance or one which, though used in agriculture, is growing in some other crop. At least five nodulated plants were collected per field of crops and the frequency of nodulation was determined by counting the average number of nodules per plant. Only positive reports of nodulation were recorded. The flowering period of these weeds was also observed. Special care was taken to distinguish root nodules from other kinds of malformations such as those caused by nematodes, insects or other root-inhabiting parasitic microorganisms (Truchet et al., 1989). Weeds were arranged alphabetically within species and their distribution in various crops of Pakistan is described. The nomenclature and classification follow Nasir & Ali (1972) and Nasir & Rafiq (1995), and author citations follow Brummitt & Powell (1992).

RESULTS AND DISCUSSION

Leguminous weeds found to be nodulated are listed in Table 1. The plants examined included herbs, vines and shrubs. A total of 20 leguminous species are reported as nodulating weeds of different major crops. The crops included carrots, cotton, maize, potato, rice, sugarcane, tomato and wheat. Such weeds were also observed growing in a number of different summer and winter vegetables, as well as in grassy lawns. Most of the weeds were abundantly nodulated, indicating wide spread and large populations of rhizobia (Table 1).

Various soil bacteria have been reported as natural antagonists against parasitic weeds (Mabrouk et al., 2007). As reported in a number of plant microbe-interactions, antagonistic bacteria interact by competition and antibiosis (Buchenauer, 1998). Rhizobia released from legume nodules activate various defense responses, ranging from hypersensitive cell-death of infected cells, to accumulation of enzymes responsible for defense reaction (Mabrouk et al., 2007). Apart from their usual role, rhizobia also fix atmospheric nitrogen. Most of the nitrogen added to the biosphere each year is supplied by nitrogen-fixing plants (Amarger, 2001; Vessey et al., 2004). Although their potential has been established, the exploitation of such novel nitrogen sources will be dependent on the identification of limiting factors and agronomically feasible practices to eliminate them. The general account presented here is an essential first step in quantifying the contribution of these nodulating weeds to the nitrogen cycle of the biosphere.

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Table 1. List of nodulated leguminous weeds of some major crops of Pakistan.

Species	Nod. Freq.	Flowering Period	Crops
<i>Alysicarpus monilifer</i> (L.) DC	+	Oct	Cotton, maize
<i>Indigofera cordifolia</i> Heyne ex Roth.	+	Aug-Oct	Cotton, maize, potato, tomato, summer veg.
<i>Indigofera hochstetteri</i> Baker	+	Aug-Oct	Cotton, maize, potato
<i>Indigofera linifolia</i> (L. f.) Retz.	+	July-Oct	Cotton, potato, tomato, summer vegetables
<i>Indigofera oblongifolia</i> (L.) DC	+	Sep-Nov	Cotton, maize, potato, tomato, summer veg.
<i>Lathyrus aphaca</i> L.	++	Feb-Apr	Wheat
<i>Melilotus alba</i> Desr.	++	March	Carrot, mustard, onion, pea, sugarcane, wheat
<i>Melilotus indica</i> (L.) All.	++	March	Carrot, mustard, onion, pea, sugarcane, winter vegetable
<i>Medicago laciniata</i> (L.) Mill.	++	March	Wheat
<i>Medicago lupulina</i> L.	+++	Mar-Jun	Wheat
<i>Medicago polymorpha</i> L.	+++	Mar-May	Wheat
<i>Medicago sativa</i> L.	+	May	Carrots, wheat
<i>Sesbania bispinosa</i> (Jacq.) W.F. Wight	+++	Jun-Sep	Cotton, rice, summer vegetable
<i>Sesbania sesban</i> (L.) Merr.	+++	Aug	Maize, potato, rice, summer vegetables
<i>Trigonella monantha</i> C.A. Meyer	++	April	Carrot, coriander, wheat, winter vegetables
<i>Vicia monantha</i> Retz.	++	Feb-Apr	Sugarcane, wheat
<i>Vicia peregrina</i> L.	++	Apr-May	Sugarcane, wheat

<i>Vicia sativa</i> L.	++	Jul-Aug	Sugarcane
<i>Vigna aconitifolia</i> (Jacq.) Marechal	++	Sep-Oct	Cotton, potato, tomato, summer vegetables
<i>Vigna trilobata</i> (L.) Verde.	++	October	Cotton, potato, tomato, summer vegetables

Nodulating status:

- + Indicates 1 to 5 nodules per plant
 - ++ Indicates 6 to 10 nodules per plant
 - +++ Indicates more than 10 nodules per plants
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