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Extent of Shisham (*Dalbergia sissoo* Roxb.) Decline in Sialkot, Gujranwala, Lahore and Sargodha Districts

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Abstract

A thorough survey of four districts of Punjab viz. Sialkot, Gujranwala, Lahore and Sargodha was carried out during May-June 2003 to study the present scenario of shisham (*Dalbergia sissoo* Roxb.) decline in these areas and to find out relationship, if any, between disease severity and edaphic conditions. From each of the four districts, canal banks, highways and roadsides, and agricultural lands were surveyed. In Lahore surveyed areas also included University of the Punjab, Aitchison College and roadside along the canal bank of BRB Lahore Branch. From each district 700 – 1200 plants were observed. Shisham trees were found to be attacked with two types of diseases viz. wilting and dieback, the latter being the more prevalent than the former. Maximum mortality of 75 – 80 % was observed along the canal banks except BRB Lahore branch. Along the highways and roadsides 20 – 40 % plants were found dead. In the Punjab University about 10 % plants were found dead while 17 % were affected with dieback and wilting ranging from mild infection to highly diseased. The least disease incidence and mortality rate was observed on plants growing on agricultural lands, along the roadside of BRB Lahore branch and in Aitchison College. Disease incidence and severity seemed to have no relation with soil pH. Generally older plants were found to be more susceptible to the disease attack than the younger ones. It was concluded that plant resistance to disease attack was associated with proper irrigation management. Apparently stressed conditions especially high soil moisture content is responsible for the attack and severity of the disease. It is recommended that along the canal bank shisham should be replaced with *Eucalyptus* spp. Furthermore, seeds from the resistant shisham plants, standing healthy among the hundreds of dead ones along the canal banks, should be used to raise nurseries for shisham plantation on suitable places away from the canals.

Key words: *Dalbergia sissoo*, dieback, wilting, Punjab.

Introduction

Shisham (*Dalbergia sissoo* Roxb.) – a deciduous tree of family Papilionaceae, is an important plant of great economic importance. Its wood is very hard and is best suitable for furniture. It grows naturally in Sub-Himalayan Tarai tract from Bangladesh to Afghanistan. It is now planted throughout the South Asian subtropical regions, and extensively so in Pakistan, India and Nepal. Shisham was introduced in Pakistan in mid 1800s. In the irrigated tract of Punjab it is widely planted along roads, rail sides and canals as linear plantations. The farmers in Punjab have been planting shisham since decades in linear form around the fields. It is even retained in the agricultural fields, in isolation, for shade. In the state forests it is planted extensively in irrigated plantations of Punjab, and in riverian sites in Punjab and Sindh. The irrigated plantations were established at various sites in Punjab, mainly for production of fuel wood for steam engines. All of these plantations are located along main railway lines. Some of the major plantations are Changa Manga, Daphar, Perowal, Bahawalpur, Kundian, Kamalia and Chichawatni. At present the area under such plantations in Punjab is 154,886 ha, with an average annual production of 28,000 m^3 (Khan & Khan, 2000).

Shisham has been inflicted with dieback or decline in the recent years and incidence is also reported in the Tarai tract of Nepal, believed to be its home. The dieback has been reported in literature as early as 1900 but has never assumed an alarming proportion. It was in 1998 that dieback was reported as an epidemic in central irrigated tract of Punjab province (Naz, 2002). Any one who travels on any road, especially along the canal banks, is shocked to see the dry shisham trees with no leaves, branch or an iota of normal life. The extent of shisham mortality in the natural forests, plantations and agroforestory has not yet been enumerated seriously. The present survey was, therefore, carried out to record the extent of shisham mortality along highways and roadsides, along canal banks and on agricultural lands in four

districts of Punjab viz. Sialkot, Gujranwala, Lahore and Sargodha.

Materials and Methods

Four districts of Punjab province viz. Sialkot, Gujranwala, Lahore and Sargodha were surveyed during May – June 2003. In each district survey was carried out on agriculture lands, along the highways and roadsides, and along the road side of canals BRB (Sialkot, Lahore), Upper Chanab (Gujranwala) and Lower Jehlum (Sargodha). In Lahore district survey areas also included Quaid-e-Azam Campus Punjab University, Aitchison College, and roadsides of BRB canal Lahore branch. From each district 700-1200 shisham plants were investigated for apparent morphological disorders and for insect attack incidence. Soil samples from the rhizosphere of diseased and healthy plants were collected for pH and soil texture study. The disease rated was done as follows:

Healthy:	No signs of disease
Mildly diseased:	Yellowing of leaves/few upper smaller branches become dry
Moderately diseased:	Up to 25 % of the plant became dead
Highly diseased:	More than 25 % of the plant became dead
Dead:	No signs of life with bare branches without leaves.

Results

The highest percentage of mortality of shisham, ranging from 75 – 80 %, was recorded along the canal banks except BRB Lahore Branch. The mortality rate along the road sides especially along highways was also fairly high ranging from 20 – 40 %. The least mortality and disease incidence of 10 % or below was recorded on the shisham trees growing on agricultural lands either in linear rows along the boundaries of the field or as scattered plants (Fig. 1 & 2). In Aitchison College Lahore only 2 % of shisham plants showed mild disease symptoms. However, in the premises of University of the Punjab, a considerable number of plants had fallen victim to disease. About 10 % plants have been killed and another 17 % were found to be attacked and would die shortly (Fig. 2). Soil of the most surveyed localities was of the sandy loam type. Disease incidence and severity had no relation with soil pH and texture (Table 1).

Two types of disease symptoms viz. wilting and dieback were observed. Older plants were usually more prone to mortality. Signs of small insect boring were observed on the stems of the weakend or dying trees especially where the bark had been removed.

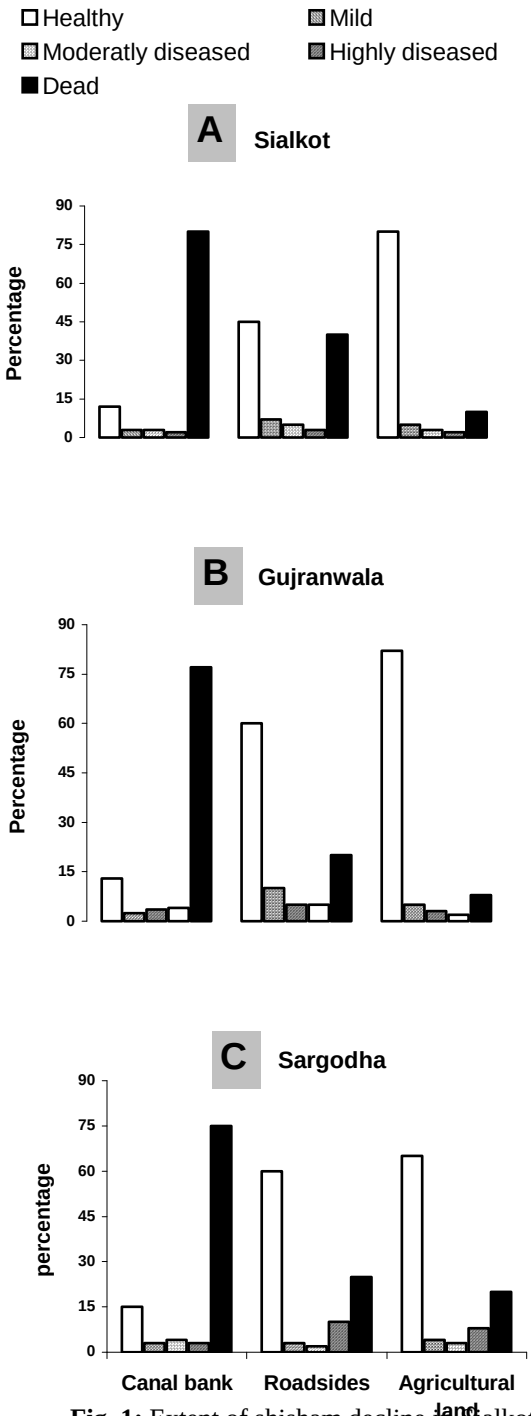

Fig. 1: Extent of shisham decline in Sialkot, Gujranwala and Sargodha districts.

Discussion

Two types of disease symptoms viz. wilting and dieback were observed at various survey localities. In wilt disease effects produced on trees were more or less of the same type as those produced by drought or frost. The disease was first observed by Bakhshi (1954) both in natural forests and plantations in UP, India. The disease is systematic in that the entire tree shows symptoms of the attack. In the early stage, an affected tree is characterized by drooping leaves and branches, due to loss of turgor. The leaflets turn yellow, dry up and eventually drop off rendering the branches bare. The entire tree becomes thin in contrast to the adjoining dense green trees (Plate 1). Death of the affected tree is rapid and occurs within 4 –6 months after the crown shows the symptoms of wilt. In the surveyed areas less than 10 % affected trees were suffering from wilting. However, in Bangladesh wilting is very common (Baksha & Basak, 2000). *Fusarium solani* is suggested to be the cause of this disease (Bakhshi, 1954; Manandhar & Shrestha, 2000; Sharma *et al*., 2000). The pathogen is mostly restricted to roots. The fungal hyphae and jelly like substances plug the vessels resulting in wilt symptoms. Unidentified toxins are produced in the culture filtrate, which may also be responsibe for causing wilt (Bakhsai & Singh, 1959).

The dieback disease had more specialized symptoms than wilt. The symptoms were thinning of leaves and crown, drying up of end branches, yellowing of whole plant in certain cases, table topped conditions and stag-headness in extreme cases. Small dry twigs kept on falling continuously and the tree looked like a blunt stub containing thick branches (Plate 1). The dieback in a tree takes place in successive stages and is characterized by progressive death of shoots and roots starting at the tip. *Ganoderma lucidum* is considered to be the primary cause of this disease. This pathogen is root inhabiting and infects the roots through intact as well as injured surfaces. Lateral spread of the disease in plantations is through root contact (Sharma *et al*., 2000). Another fungus *Phellinus gilvus* has also been isolated from the roots of dying back shisham trees (Bakshi, 1974).

The highest mortality percentage of 75 – 80 % was recorded along the canal banks (Plate 1). It reveals that disease incidence and severity is related to high soil moisture contents. The soil along the canal banks was sandy loam through which seepage can easily takes place rendering the below surface soil water logged. Some earlier workers have also reported that high soil moisture level increases the severity of this disease (Sharma *et al.*, 2000; Keerio, 2001). The low incidence of disease along the roadside of BRB canal Lahore Branch may be attributed to the adequate soil moisture contents. The width of this canal branch is short and bank is lined with bricks, which makes the seepage comparatively difficult. Furthermore, the mixed cropping of shisham with other trees may be a contributory factor for resistance to disease at this site (Buksha & Basak, 2000; Zakalullah, 2001).

Along the roadsides the mortality rate was fairly high ranging from 20 to 40 %. However, the disease attack was not uniform. At certain places there were very large patches of healthy plants while at other places there were considerably extended patches of dead plants. In general rate of mortality was higher at places where there were depressions bordering the highways, where soil is frequently dug up for repairs of the road. Water remains standing in these depressions for a considerable time period during rainy season rendering the shisham plants susceptible to disease attack.

In Aithchison College only 2 % plants were showing mild symptoms of dieback. It may primarily be attributed to the better management practices of college lawns, better irrigation schedule and fairly good sanitation conditions of the College campus. The low mortality rate on agricultural lands may also be attributed to the proper irrigation management. In Punjab University a considerable number of shisham plants were attacked either by wilt or dieback diseases. The ratio of wilting to dieback incidence at this locality was comparatively higher as compared to other surveyed areas. It was observed that disease severity and incidence was comparatively higher on dry soil patches as compared to irrigated and well-maintained areas. It reveals that similar to water logging, drought stress also provides favourable environment for disease attack and severity. Some dying plants did not show the typical symptoms of wilting or dieback. The unhealthy condition of these plants might be due to drought or termite attack. Javaid & Afzal (2001) have already reported the problem of termite attack on trees in the Punjab University.

There was no any correlation between soil pH and disease attack. These findings are in line with the reports of some earlier workers (Bakshi *et al.*, 1959; Sharma *et al*., 2000). In the present survey soil of most of the studied sites was sandy loam and there seemed to be no relationship between soil texture and disease incidence and severity. However, the experience of the other workers reveals the fact that shisham thrives well on loose sandy soils but suffers adversely from root

diseases in stiff and clayey soil (Sharma *et al*., 2000). The success of the species in loose sandy soil appears to be proper soil aeration with good drainage, which leads to healthy growth (Bakshi, 1957). The soils with heavy texture and water logged conditions for a considerable period of time causes a asphyxiation of the roots. In the absence of oxygen, the tender roots are killed and colonized by a variety of fungi (Buksha & Basak, 2000, Shrma *et al*., 2000).

No research based remedial measures have been suggested to tackle the problem, as research is still in the initial stages. Meanwhile, some interim preventive measures can be suggested to help contain the problem. These include:

- The dead and dying plants should be uprooted so that the breeding place of the fungus/insect is destroyed to stop further spread of the disease.
- New plants should be planted in suitable sites i.e. on well-drained sandy soils. Plantations on clayey and waterlogged soils should be avoided.
- The seedbed for shisham nurseries must be disinfected before sowing.
- Mixed cropping is recommended rather than monoculture to avoid dieback.
- New shisham nurseries should be raised from the seeds and cuttings of the resistant genotypes..

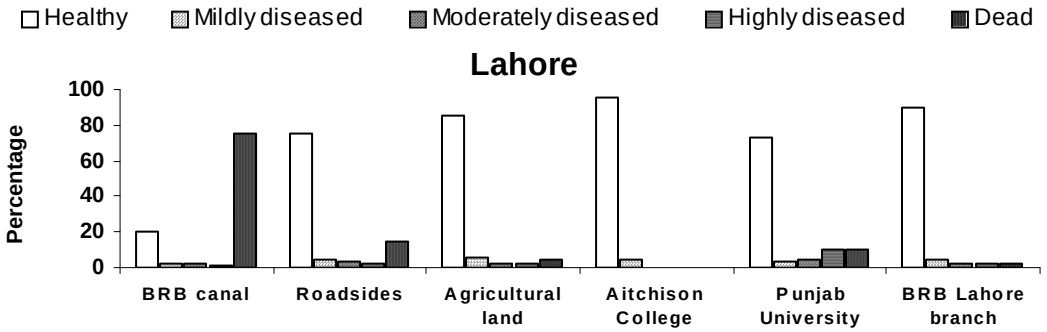

Fig. 2: Extent of shisham decline in Lahore district.

Table 1: Soil pH of study sites of Sialkot, Gujranwala, Lahore and Sargodha districts.

Districts	Locality	Sample from diseased plants	Sample from healthy plants
Sialkot	Canal bank	7.54	7.56
	Road side	7.58	7.57
	Agricultural land	7.62	7.61
Gujranwala	Canal bank	7.58	7.56
	Road side	7.57	7.59
	Agricultural land	7.63	7.61
Lahore	Canal bank	7.55	7.56
	Road side	7.57	7.58
	Agricultural land	7.64	7.65
	Aitchison College	7.60	7.59
	BRB Lahore Branch	7.53	7.54
	Punjab Univ.	7.66	7.64
Sargodha	Canal bank	7.75	7.76
	Road side	7.78	7.77
	Agricultural land	7.65	7.67

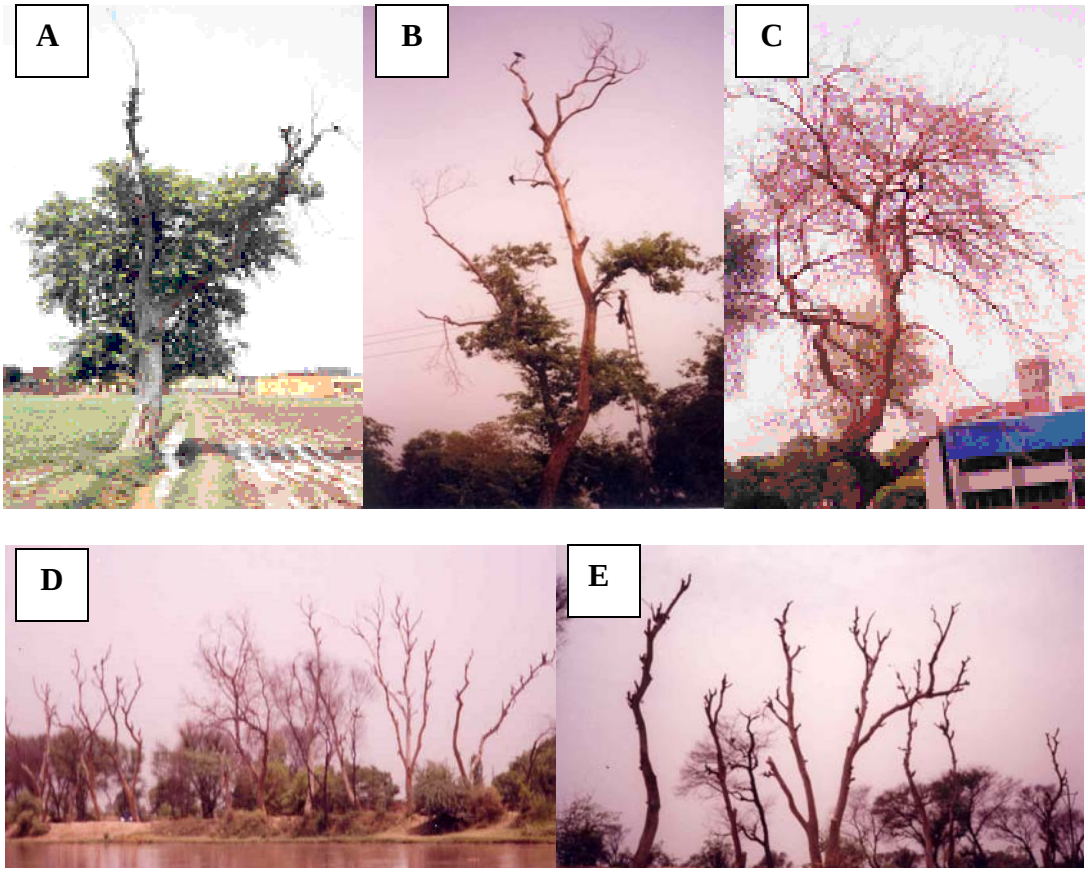

Plate 1: A&B: Shisham plants showing symptoms of die back. **C:** Shisham plant showing symptoms of wilting. **D&E:** Dead Shisham plants along the road side of BRB Canal near Daska.

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