

SHISHAM DIE-BACK IN PUNJAB , PAKISTAN

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INTRODUCTORY

People connected with forest resources in Pakistan, and the agriculturists at large, have been extremely concerned about the excessive mortality in *Shisham* (*Dalbergia sissoo*, Roxb.), the principal tree species of the Irrigated Forest Plantations of Punjab, caused by a mysterious malady that is generally known as "Sisham Die-back". This tree is the main species in the irrigated agriculture fields of Punjab as well. The problem is serious enough to have caused deliberations in three Seminars arranged by the Punjab Forestry Research Institute of the Punjab Forest Department at national level during the years 2001, 2004 and 2006. Various views have been extended about the cause of such high and abnormal mortality by experts of different disciplines. This paper deals with an aspect of the malady not touched at all so far and establishes that substitute suggested for replacement of this very important and extremely valuable tree of the plains of Pakistan is not feasible.

Critical review of Proceedings of National Seminars

A critical resume of conspicuous thoughts and views about possible causes of *Shisham* die-back expressed during three National Seminars is depicted below briefly:

1. Fungi and other Pathogens : Various species of fungi like *Ganoderma*, *Polyporus* , *Botryodiplodia*, *Fusarium*, *Phytophthora*, etc. etc.; and also some other pathogens, have been indicated to cause mortality in *Shisham* but no concrete evidence has been extended that the present die-back outbreak was actually caused by any of these pathogens; or by other fungal and nematode parasites. Whereas *Ganoderma lucidum* and *Polyporus* sp. are well known parasites of this tree these do not cause sudden death and die-back. The latter mentioned fungi; and about a dozen others quoted by various participants, are mostly seed-borne and related to root rot of seedlings of *Shisham* and many other trees. When they attack root system of older trees the death and die-back is not sudden but gradual and spread over considerable time.
2. Soil Factor: Soil adversity and deficiency of various major and trace elements have been blamed to cause die-back without taking into account the fact that a tree would not have developed to that stage of growth at which it died suddenly if one or more of the essential nutrients were not available to it initially. Again it would have met a gradual instead of sudden death with subsequent depletion and deficiency of nutrients. Further, revival of a tree, whose leave dry up and get shed due to mineral or other deficiency without treatment of the soil for removing such a cause, cannot be imagined.
3. Physiological Factor: Dr, Mohammad Afzal *et al* have reported that studies carried out at Khanewal Irrigated Plantation in 1956 by Dr. A. H. Khan revealed

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that mortality there in *Shisham* was a physiological problem brought about by soil-cum-irrigation factors; the wind and temperature playing an indirect role. According to them following factors were responsible for *Shisham* die-back:

- a) Environment factors including global warming.
- b) Hydrological factors including erratic rainfall, changing relative humidity and sub-surface water level.
- c) Physiological factors.

Drought, incessant lopping and over maturity have been described by them to be the primary cause of the die-back. Whereas the latter two maladies are almost non-existent in case of Motor Way avenue plantations where die-back is as conspicuous as elsewhere, drought does not kill *Shisham* selectively and so suddenly.

4. Mysterious Factor: According to Dr. Mahboob Ilahi "the real cause of death and drying of flora are non-traditional pathogens like those for AIDS, affect the exposed Xylem Tissues, remain therein and lead to a Greene Syndrome for which no treatment is discovered as yet." The theory is strange to say the least.

From the above summary it is apparent that every participant of the three seminars connected with a particular field has tried to view the present die-back of *Shisham* trees in the light of his own expertise and there has been conspicuous lack of collective and coordinated efforts to pinpoint, analyse and tackle this problem. It is also abundantly clear that an extremely important aspect that appears to have been completely lost sight of is the climatic factor that may have been the principle if not the exclusive cause of the malady involved. It is added that when touched at all it has been dealt with most perfunctorily without any effort to study and analyse recent climatic changes viz. a viz. past conditions. It is a sad commentary on the observatory power and interest of the forestry experts that this great and glaring set back to a major and very important forest tree was pointed out by the general public in 1998, in fact by a journalist, and those connected with raising and tending it failed to even notice it.

Typical die-back scenario

Before proceeding further in matter it is added that the typical scenario of the present die-back as envisaged by this author is that when *Shisham* trees get subjected to severe cold and frosty conditions in the winter of a particular year their leaves get scorched and, with the relief subsequently in such conditions, most of the affected trees start sprouting new buds, put on new leaves and assume normal activity once again. It has been noticed that, if the frosty spell is not very severe and prolonged, leaves at the top portion of the crown get affected slightly and become pale yellow imparting a yellowish cap to the crown of the tree affected. Of course, the health and growth of such trees does get considerable set back due to the impaired photosynthesis efficiency. However, trees that face such onslaughts for two or more consecutive years without any relief; specially those that already face soil adversity, drought, attack of fungi and other pathogens, excessive lopping, fires, etc., fail to survive and die out right.

Major cause of die-back

When the author joined the defunct West Pakistan Forest Service in October, 1958 there was great concern, similar and parallel to the present one, about excessive mortality in *Shisham* and research was conducted and papers published in that era dealing with the excessive and mysterious malady of this extremely important tree of the Irrigated Forest Plantations of Punjab. Studies by Dr. A. H. Khan quoted by Dr. Afzal *et al.* were related to this very problem. The author conducted detailed studies of root-system of one to nine years old *Shishm* trees in Inayat and Machu Ranges of Leiah Forest Division in Multan Forest Zone in 1962 and published a paper in the Pakistan Journal of Forestry in 1965. It is quite strange that such a detailed study has not found any place in the literature reviewed during any of the three seminars. It was his view that the die-back rampant in this species in the Irrigated Forest Plantations at that time; specially in the Khanewal Plantation; which was then at prime of its production, and elsewhere was due to two main causes viz. deficiency of water supply and severe frosts in the winters of the late forties and the fifties. Whereas the first cause was attributed by him to the most damaging policy of starving its older crop to favour the younger one although water requirement of older trees was much greater compared to the latter. More so as older trees required deeper irrigations for the water to percolate down to the soil depths at which their root system was effective for absorption. As is generally known it is only a few inches of the distal ends of the root system that bear root hairs and absorb water and nutrients and rest of its length supports the aerial top; although *Shisham* is endowed with a horizontal root system as well which runs a few inches below ground surface, and parallel to it, in addition to its main vertical network. It was author's view at that time that the past excessive die-back of this species in the forties and fifties was mostly climate oriented and was caused by a spell of intensive frost that covered a number of years during those decades. Although climatic data was not studied such a guess was based on frost intensity he observed in December, 1958 when it killed leaves of *Semal* (*Bombax malabaricum* DC) trees in Pira Wala Forest Rest House compound up to a height of about three metres from ground level. He had also the experience of collecting very fine snowy flakes on his ear lobes while walking to his school in Lahore in January 1950; so severe was the frost that year. It is the author's considered view that the current excessive die-back is also the result of damage by the intense frosty spell similar to the one Punjab faced in the forties and fifties and not by disease or any other such factor. The above view is strengthened by the fact that, with the change in the weather from the early sixties, the intensity as well as frequency of frost abated and the author and the rest of his colleagues never heard of *Shisham* die-back during rest of their entire service; so talked about when they joined it in 1958.

Supporting evidence

That, like in the past, the current die-back in *Shisham* has also been caused by frost is supported by the fact that the author noticed the effect of severe frost and of very low temperatures on *Kikar* (*Acacia nilotica*) standing in the road-side avenue along Lahore-Kasur road for the first time in 1995 when crowns of a number these fully grown trees were seen there to have been partially burnt; specially the top branches exposed to the wind draft generated by the fast moving vehicular traffic. At that time he did not attach it much importance as *Kikar* is a frost tender species. However, now he feels that the

height to which the damage ascended was quite intriguing and should have received special attention; more so as during 1958 frost damage to *Semal* leaves had ascended from below upward against the present die-back scenario.

That the present *Shisham* die-back is not the result of any pathogen but has been caused by an intense frosty spell is supported by following observations gleaned mostly during author's journeys along the Motor Way from Lahore to Faisal Abad during 2008-2009; of trees growing in its roadside land strips and in the agriculture fields; as well as from the condition of agriculture crops in the contiguous fields.

It should, however, never be inferred that the present and past mortality in *Shisham* resulted exclusively from frost as such factors as fire, drought, fungal and insect attack, etc. must also have played their part to kill some of its trees and taken their normal share of the toll.

1. In case of majority of the affected *Shisham* trees it was foliage of their top most portion that got burnt up and had dried. Later with change in season from winter to spring; and then to summer and rains, most of the affected trees revived and trees that died completely were few and far between. As mentioned earlier milder effect of frost was manifest through the yellowing of leaves in the top crown portion and leaves that turned pale yellow regained normal green colour in 2009.
2. Majority of trees that died completely and those affected partially stood on the inner edge of the right and left strips on the Motor Way and thus faced the frosty draught generated by the moving traffic as well as water deficiency due to excessive run-off.
3. The die-back invariably started at the top of almost all the affected trees.
4. Some of the trees affected by frost in the preceding years with dead tops had started sprouting at the base. One such tree is seen in the attached picture. Had there been any fungal or other disease; specially attacking the root system, such revival would not have been possible.
5. A large number of trees with dried up crowns/leaves seen in the winter of the year 2008 had already started sprouting again during March, 2009 and very few trees are completely dead now. However, some of these trees are still struggling.
6. Trees standing in areas facing comparatively more arid conditions; specially on the higher road-berms and steep terrain with excessive run-off, were mostly affected, some getting dried up completely.
7. In a number of cases only one of the two trees growing very close to each other was affected, the surviving one perhaps availing some side protection, or being genetically better endowed, to resist frost damage. This was also the case of some trees where only one of its two main branches was affected. Had there been some disease affecting the root system both of the trees and all the branches of an affected tree would have been the victim.

8. Trees previously weakened by fires had succumbed to frost and dried up completely.
9. Had it been some fungal or other disease, trees affected would not have started sprouting again as soon as winter was over in 2008 which apparently was the severest of the decade.
10. In fact frost was so severe during the winter of the year 2008 that entire fields of Sugar Cane were burnt dry and were never harvested as the crop standing in these fields was not fit even as fodder. What is more, even such a comparatively hardy tree as Guava was affected and some of its gardens dried up completely. Last year's damage to some Guava gardens is still visible at some places in the Sharq Pur area of Sheikhpura District.
11. The effect of frost of the year 2008 resulted in very low yield of Sugar Cane and Guava that year.
12. That it was frost that caused excessive die-back in *Shisham* during the past few years is evident from the fact that not only most of the *Shisham* and other trees affected in the past few years have re-sprouted but also no new tree suffered any die-back in the winter that has just passed. It is added that low yield from Sugar Cane and Guava during 2009 has mainly been due to the after effects of last year's intense frosty conditions.

Corroborating the findings

The author is quite confident that the above observations shall be fully corroborated by climatic data for the period from 1990 to 2009. Special attention should be paid to the mid- morning temperatures.

The author also wishes that instruments to collect climatic data that were available in the past in various Forest Rest Houses are reinstalled there once again and recording of data resumed as done previously so that Forest Managers can plan their operations accordingly.

Substitution of *shisham*

From the proceedings of the three seminars it appears that Rose-wood, *Dalbergia latifolia*, Roxb. , a sister species of *Shisham* and a very important timber tree of Southern India, has been suggested as its substitute by some experts. This author would, however, like to caution and suggest strongly that, before delving in such a venture on any large scale, experiments must be conducted about feasibility of such replacement as, according to R. N. Parker, its introduction in Changa Manga failed in the past due mainly to damage by frost. It must also be remembered that Rosewood is a frost tender species that does well only in the frost free Western Ghats in India. The author is of considered view that *Shisham* could be saved from frost, or at least its effect mitigated to some extent, in the Irrigated Forest Plantations by winter irrigation; and by other precautionary measures adopted in case of agriculture and fruit crops. Evidently in places where these

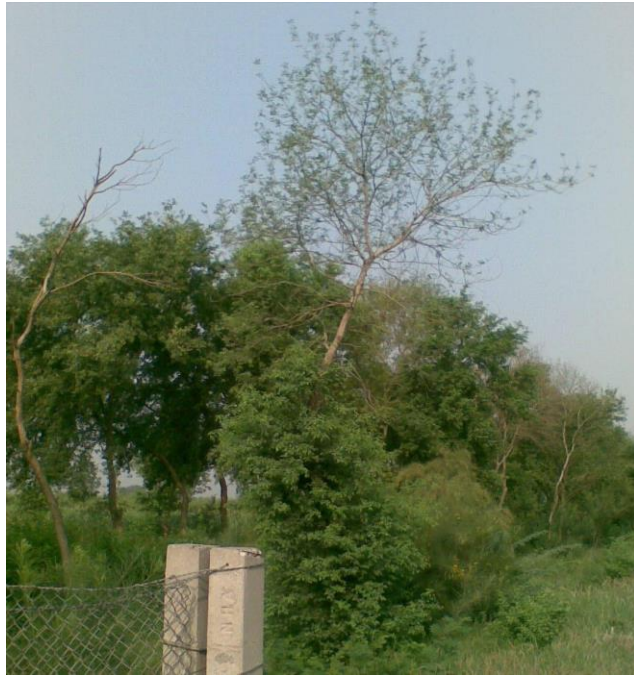


Fig.1. Shisham tree affected by frost with copious new branches at the base struggling for revival



Fig.2. Picture showing two shisham growing together only one of which has become victim of frost



Fig.3. Shisham tree with one of its branches affected by frost standing close to a dead tree

are impossible to undertake, fate of *Shisham* shall have to be left to the nature and it is hoped that present frosty spell ends soon; as did the frosty spells of the forties and fifties. Even if the cold spell continues for another ten or more years *Shisham* trees that survive are expected to be frost hardy genetically. For road and canal side plantations *Eucalyptus camaldulensis* is by far the best substitute of the endangered *Shisham* as is evident from its marvelous success in Motorway avenues under all sorts of adversities, both manmade and natural. In his opinion *Eucalyptus tereticornus*, Sm. can also do as well.

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