

Infestation of oak trees by the flowering parasite (*Taxillus vestitus* (Wall.) Danser) at Nainital in Uttarakhand

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At places forests of Uttarakhand Himalaya are heavily infested with the flowering parasite, *Taxillus vestitus* (Wall.) Danser. We analysed infection frequency and intensity of the parasite in two oak species, viz. *Q. leucotrichophora* and *Q. floribunda*. The number of infected trees was higher in heavily disturbed sites. The trees of middle girth classes were more susceptible to the *Taxillus* attack. The high anthropogenic pressure in the form of lopping of branches may be one of the reasons for high infestation. Seedlings, saplings and trees of lower girth classes had little or no infestation of *Taxillus vestitus*. These need to be protected to manage the forest in a healthy condition.

Keywords: Himalaya, oak, parasite, *Taxillus*.

THE genus, *Quercus* (Oaks) is one of the important forest-forming trees in the temperate Himalaya^{1,2}. It maintains the ecology and biodiversity of these forests, and is used as leaf fodder, fuel wood, timber and for making agriculture implements. It is considered best for water and soil conservation³. We observed that oaks are heavily infected by the flowering parasite, *Taxillus vestitus* (Mistletoes) in the Nainital forest division as well as in other areas of the Uttarakhand Himalaya. The parasite checks the growth of the host and ultimately causes death of plants⁴. *Taxillus vestitus* is a hemi-parasite perennial evergreen shrub. It belongs to the family Loranthaceae, a parasitic family, widely distributed from the tropics to temperate region with 77 genera and 950 species⁵. Mistletoes (*Taxillus vestitus*) also function as keystone resources in many ecosystems⁶. Comparison between host and parasite with respect to leaf conductance and plant water potential showed that the potential for leaf conductance was considerably higher for parasite than the host⁷. The parasite spreads through birds and wind-dispersed seeds and causes deformity in twigs and trunks. The objective of the present study was to analyse the incidence of the parasite in oak forests of Nainital.

The study area is situated at 29°24'N and 79°25'E between 1900 and 2400 m elevation in the temperate Himalayan forest. Mean monthly temperature ranged from less than 0° to 28°C. Frequent snowfall during winter is the characteristic feature of the area.

The study was conducted during 2003–2004. After a thorough reconnaissance of the infected oak forests, 11

sites were selected (Table 1). Total tree density was determined by placing ten, 10 × 10 m quadrats on each site. Infection frequency of the parasite was determined as:

$$\text{Infection frequency} = \frac{\text{Number of infected trees}}{\text{Total number of trees}} \times 100$$

Infestation intensity was also determined by counting the total number of branches and number of infected branches on a tree as:

$$\text{Infestation intensity} = \frac{\text{Number of infected branches on a tree}}{\text{Total number of branches on a tree}} \times 100.$$

Relationship between tree girth classes and infection frequency was studied.

The infection frequency for *Q. floribunda* was >60% on all sites, except at sites 2, 5 and 9, whereas for *Q. leucotrichophora* >60% frequency was found only on 5 sites (Table 2). The number of infected trees was higher for *Q. floribunda* compared to *Q. leucotrichophora* in almost all the sites. Similarly, the infection intensity was greater for *Q. floribunda* except at sites 2, 3 and 10, whereas it was greater for *Q. leucotrichophora* (Table 2). Thus, *Q. floribunda* is more susceptible for the parasite because it is preferred as fodder.

The relationship between different girth classes and infection frequency indicated that the trees of middle girth classes were highly susceptible to the parasite attack. The maximum number of infected trees was present in the girth class 80 and 130 cm in *Q. leucotrichophora* (Figure 1 b) and 80 and 180 cm in *Q. floribunda* (Figure 1 a). Trees of middle girth classes being frequently used for leaf fodder, firewood and making agriculture implements may provide opportunity to establish the parasite more frequently than older trees, saplings and seedlings. High percent of infected trees occurred near human habitations while it was lower at inner sites of the forests. It indicated that anthropogenic disturbances trigger the infection by the parasite through opening of the canopy. The frequency and infestation intensity of the parasite were higher in disturbed sites and for trees of middle girth classes and when compared for the two hosts, it was greater for *Q. floribunda*. The cutting of branches improves the light availability which in turn promotes the growth of the hemi-parasite.

In natural stands, pathogens are difficult to control and become a challenge before the forest managers. Selective removal of infected trees would be the only option to control the parasite. The cut and burn of infected branches would also be helpful in controlling the parasite. Generally, the lower diameter classes like seedlings and saplings are less

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Table 1. Site characteristics

Site	Location	Elevation (m)	Aspect	Forest type
1	Pines	1900	N-E	Mixed oak forest
2	Kailakhan	1900	N-E	Oak dominated forest
3	University	2000	N-E	Oak dominated forest
4	D. S. B. Campus	2000	N-E	Mixed oak forest
5	Ayar Patta	2100	N-E	Mixed oak forest
6	Raj-bhawan	2100	N-E	Mixed oak forest
7	Sanik School	2150	S-W	Oak conifer forest
8	Sher wood	2150	N-E	Oak dominated forest
9	Snow View	2300	N-E	Oak dominated forest
10	Birla School	2300	S-E	Mixed oak forest
11	Tiffon top	2350	N-E	Mixed oak forest

N-E, North east; S-W, South west.

Table 2. Frequency (%) and intensity (%) of the parasite in different forests

Sites*	<i>Q. leucotrichophora</i>		<i>Q. floribunda</i>	
	Frequency	Intensity	Frequency	Intensity
1	64	62	73	41
2	18	25	40	38
3	73	71	67	58
4	64	25	66	45
5	17	13	27	33
6	71	43	84	69
7	65	39	84	59
8	33	47	45	74
9	34	31	18	10
10	27	80	60	60
11	30	45	74	66

*Sites 1–11 same as in Table 1.

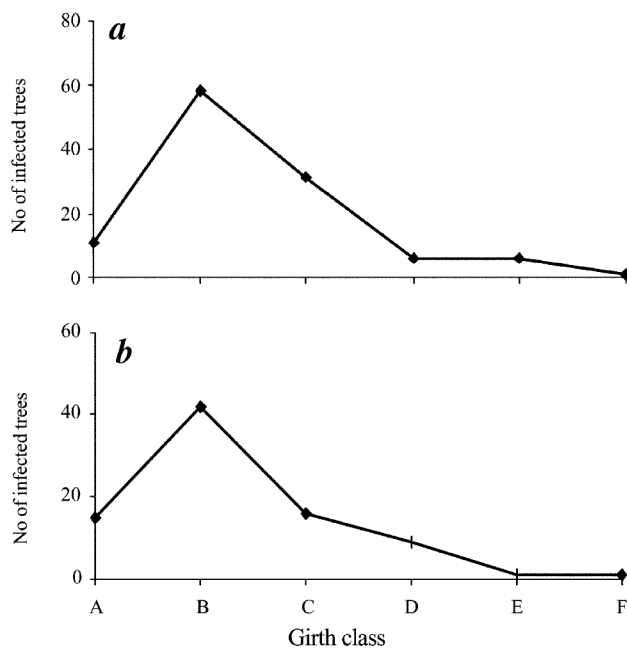


Figure 1. Relationship between girth classes and infection frequency. (a) *Q. floribunda*; (b) *Q. leucotrichophora*. A–F girth classes are: A, 30–80 cm; B, 80–130 cm; C, 130–180 cm; D, 180–230 cm; E, 230–280 cm; F, > 280 cm.

infected by the parasite. Thus, seedlings and saplings should be regularly monitored and protected for the better management of the forests. Precaution should be taken that no single stem of parasite would be present.

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