Insects as Bioindicator for Monitoring Biodiversity in Simbalbara Wildlife Sanctuary, Himachal Pradesh

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Introduction

The long-horn beetles or borers also known as Longicornia belong to the family Cerambycidae of the order Coleoptera. It is a cosmopolitan family of beetles that can be easily identified by extremely long filiform (thread-shaped antennae) which are often as long as or longer than the beetle's body. However, in various members of the family the antennae are quite short; but they should not be confused with the metallic wood borers (Buprestidae) which have got smaller filiform antennae. The Cerambycidae family is large with over 20,000 species described worldwide. In India, there are over 290 genera and 1,100 species of borers, making it the seventh largest family of beetles (the largest being of the dung-beetles belonging to the family Scarabaeidae).

Simbalbara Wildlife Sanctuary

The biogeographically significant Simbalbara Wildlife Sanctuary lies in the southernmost Sirmaur district of Himachal Pradesh is a representative of the lower *Bhabar* Shivalik region lying in the confluence of the *Terai* plains and the main Shivalik system (Fig. 1). The flora, fauna and physical features shows affinities to western Himalaya, Punjab plains and upper Gangetic plains. It has an altitudinal range of 350m to 700m above mean sea level. Moist and dry Sal forests and northern dry mixed deciduous forests with some plantations of *Eucalyptus*, Khair (*Acacia catechu)* characterizes the sanctuary. The forests in the sanctuary are considered to be the western most distribution limit of Sal *(Shorea robusta)* in protected areas of north western India. Apart from these two major types, there are *Eucalyptus citriodora* mixed woodlands and riverine forests.

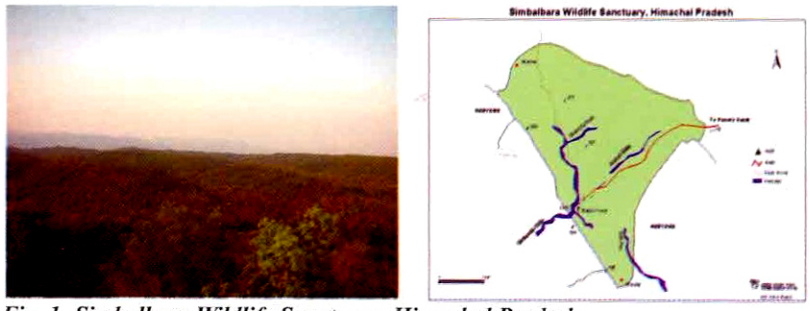

Fig. 1- Simbalbara Wildlife Sanctuary, Himachal Pradesh

Borers

These species can be easily sampled by visual search, sweep net capture, beating trays and most effectively by using the light trap capture. Recently, Rapid Estimation Procedure (REP) is used for classifying individual trees into infestation history classes I, II and III corresponding to low, moderate and high degree of borer infestation. It uses two variables: crown condition and number of emergence holes from tree base to a height of 2 m.

52 species of borers and 19 families of their natural enemies were recorded from different mixed forest habitat types in the sanctuary. While Teak (*Tectona grandis*) mixed forest, Sal (*Shorea robusta*) mixed forest and bamboo (*Bambusa bambos*) mixed forest were the most species rich; Khair (*Acacia*

catechu) mixed forest and Jamun (*Syzygium cumini*) mixed forest were least species rich for borers. Natural enemies of borers were mostly found in Sal mixed forest, Teak mixed forest and Bamboo mixed forest habitats. In all, 16 species of borers belonged to infestation history class I, 16 species to class II, and 20 species to class III. All the borer species showed peak in their abundance soon after one or two monsoon showers. The species to emerge first was Sal sapwood borer *Aeolesthes holosericea* during early April and the *Xylotrechus smei* was recorded till late September. Species composition of borers was found to be quite similar between Sal and Teak mixed forests and Sal mixed forest-bamboo habitats. The areas of the sanctuary prone to human disturbance and fire and monoculture plantations of *Eucalyptus* showed high prevalence of borers and low occurrence predators and natural enemies of borers. But in mixed forest stands with good understory vegetation there is concomitant increase in predators and natural enemies of borers.

Ecological significance as bioindicators

The monitored habitats of the sanctuary harboured a good diversity of borers but the apparent damage due to borers is under control, due to the presence of their natural predators and parasitoids in natural mixed forest ecosystems. Management goals for forest ecosystems should thus identify mechanisms for controlling fire and anthropogenic disturbance that have a role in altering their assemblages. The larvae of most long-horned beetles develop within either living or dead wood and feed by mining galleries in the wood. There is a great range in the breadth of host tree species that may used by the larvae of different species. This range of habitat specificity within the family extends from monophagous species specialized on a single host tree species to generalist species that can make use of a large variety of tree genera.

Long-horned beetles thus may potentially be the excellent indicator species of the health of the wood decomposer community because of their habitat specificities and also they are relatively easy to identify. Such saproxylic (dependent on dead wood) beetles in general are regarded as excellent indicators of woodland biodiversity. While there may be many borer species that could function as valuable indicators, it would be beneficial to carefully consider different long-horned beetle species with sites containing different assemblages of trees.

Management recommendations

Maintaining the understorey vegetation or ground cover is important for sustaining the diversity of borers in plantations. Mixed forest plantation is a better environment for maintaining beetle composition than monoculture plantation. Therefore, conversion of forests into monoculture plantations will have a more adverse effect on the beetle fauna compared with mixed forest plantation e.g., increasing and maintaining biodiversity in low diversity monocultures such as in *Acacia catechu* plantation may potentially help pest management by reducing the population and the prevalence of these pest species.

Since the natural balance may regulate pest numbers and at the same time, maintain the diversity of a habitat; this may help to promote conservation of biodiversity in compromising situations, especially when establishing large-scale plantations. Natural forest remnants act as reservoirs of diversity; retaining such forest remnants may help to secure a balanced ecosystem in the broad sense and specifically to shelter beneficial predatory species.

Table 1. Some representative species of borers recorded from Simbalbara Wildlife Sanctuary

S. No.	Scientific name/Common name
1.	*Aeolesthes holosericea* (Fabr.) – Sal sapwood borer
2.	*Aeolesthes induta* (Newm.) - Satin-wood Borer
3.	*Cantharocnemis downesi* (Pasc.)
4.	*Celosterna scabrator (Fabr.)* –Babool root borer
5.	*Ceresium simplex* (Gyll.)
6.	*Derolus demissus* (Pasc.)
7.	*Dihammus cervinus (Thoms.)* - Teak canker grub
8.	*Dorystenes (Lophosternus) hugelii* (Redt.) – Sal root borer
9.	*Dorystenes (Lophosternus) indicus* (Hope) – Sal root borer
10.	*Hoplocerambyx spinicornis* (Newm.) – Sal heartwood borer
11.	*Niphona (Nothopeus) tibialis* (Rits.)
12.	*Pachydissus parvicollis* (Gah.)
13.	*Plocaederus obesus* (Gah.)
14.	*Plocaederus pedestris* (White.)
15.	*Pyrestes pyrrhus* (Gah.)
16.	*Stibara (Polyzonus) tetraspilota* (Hope)
17.	*Stromatium barbatum* (Fabr.) - Kulsi teak borer
18.	*Trinophylum cribratum* (Bates)
19.	*Xylotrechus subscutellatus* (Chevr.)
20.	*Xystrocera globosa (Oliv.)* - Monkeypod / samanea round-headed borer

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