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A PRELIMINARY NOTE ON THE CONSERVATION OF SAPROXYLIC FLIES (INSECTA : DIPTERA) IN HIMACHAL PRADESH

BULGANIN MITRA* AND H.S. MEHTA**
**Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053*
E-mail: bulganin_mitra@yahoo.co.in
***High Altitude Zoology Field Station, Zoological Survey of India, Solan*

INTRODUCTION

Saproxylic flies comprise a diverse, species-rich and dominant functional group which depends (parts of thier life) on dead or dying wood or dead trees (standing or fallen), or wood-inhabiting fungi. The importance of dead wood in forest ecosystems has been emphasised worldwide (Harmon *et al.* 1986, Hale, Pastor & Rusterholz 1999, McGee, Leopold & Nyland 1999, Siitonen 2001). The insects using the wood comprise a diverse fauna in terms of their nutritional ecology (Essen *et al.*, 1997). On the other hand, dead wood is one of the most important substrates for maintaining biodiversity in forest ecosystems, and a substrate that is strongly negatively impacted by human activities.

There is already a large body of knowledge on saproxylic insects and their interaction with dead wood and fungi. Gilbertson (1984) stated that dead wood provides habitat for both insects and fungi where insects act as vectors for fungi and fungi serve as food for the insects. Fruiting bodies of wood decay fungi are important microhabitats and many fungi species host unique insect faunas (Økland 1995, Komonen 2001, Komonen *et al.* 2004).

The conservation of saproxylic organisms has recently gained recognition as an important issue in the protection of European biodiversity (Mason *et al.* 2003). A large number of saproxylic species have suffered from loss and degradation of their habitats all over the world. Among this group of organisms, insects are particularly rich in species. In several European countries, special projects have been initiated to promote the study and conservation of saproxylic insects (Cavalli and Mason 2003; Fayt *et al.* 2003). Some of these projects focus on particular taxonomic groups, like Diptera or even more specifically on the family Syrphidae (Rotheray and MacGowan 2000; Rotheray *et al.* 2001). In contrast to the large number of publication on saproxylic flies in other parts of the globe nothing has been known from India and particularly from Himachal Pradesh.

The Forests of Himachal Pradesh known for their grandeur and majesty are like a green pearl in the Himalayan crown. This life supporting systems are presently under great stress due to impact of modern civilization, economic development and growth in human and cattle population. But we have no record about how manyy species have suffered from loss and degradation of their habitats all over Himachal Pradesh or in threat. The threats against many hold-growth forest species cannot be reduced if our knowledge about the complex interactions between the species involved is lacking.

This communication reports 8 families of Diptera of Himachal Pradesh which are wholly/partially dependant on dead or decaying wood of managed or unmanaged ecosystems (Table-1).

SAPROXYLIC FLIES OF HIMACHAL PRADESH

Of the 38 families of Diptera known from Himachal Pradesh, 8 families are considered to be saproxylic in nature. The larvae of Ceratopogonidae (under bark or damp wood). Mycetophilidae (Fungus), Sciaridae (root

Table-1 : Habit and Habitats of Saproxylic flies of Himachal Pradesh

Family name	Common Adult	Habit and Habitats	
		Adult	Immature stages
Cearatopogonidae	Biting Midges	Usually seen on flower	Under bark, damp wood
Mycetophilidae	Fungus Gnats	Nocturnal, found in damp, dark places in the day	Decaying wood, woody fungi
Sciaridae	Root Gnats	Terrestrial in woody vegetation, agricultural field	Rotten wood, under bark of fallen trees, decaying plant matters
Therevidae	Stiletto flies	Vegetation, grass meadows	Leaf mould, fungi, decaying wood
Asilidae	Robber flies	Vegetation, grass meadows	Plant roots
Empididae	Dance flies	On leaves, tree trunks, aquatic vegetation, or in stream beds and seepage habitats, agricultural fields, grasslands, marshes, coastal zones and beaches	Decaying wood, humus, moss
Syrphidae	Hover flies	Flower visitors and pollinators	Litter, dead wood, fungi, tubers, stems, leaves

and fungi), Scatopsidae (decaying plant matter). Therevidae (rotting bark and fungi), Asilidae (rotting wood). Empididae (decaying wood), and Syrphidae (rotting wood) are common in the forest of Himachal Pradesh.

The family Ceratopogonidae, commonly known as biting midges, no-see-ums or punkies are tiny, often with spotted wings of 1-6 mm. In the field, most adults can be recognized by the wings overlapping each other over the abdomen (when not flying) and the presence of front legs that are shorter than the hind legs. The larvae are rather easy to recognize. They are the only fly larvae in which there is a head capsule. Larvae occupy a variety of moist habitats, including soil, moss, under bark and in the rock pools; they may be algaevorous, saprophagous, mycophagous or predaceous. In India, 220 species of biting midges are reported of which only a species *Atrichopogon montivagus* (Kieffer) is reported from Himachal Pradesh.

The second wood inhabiting family of Himachal Pradesh is the Mycetophilidae or “fungus gnats” and are very delicate flies of small or medium size (2.2-13.3 mm), bearing a resemblance to gnats or midges and exceedingly numerous individuals and species. Fungus gnats usually are strikingly black, brown and yellowish, sometimes brightly coloured with pictured wings. The body is elongate, and compressed with the thorax more or less arched and sometime marked by so. Adults are mostly nocturnal and they are commonly met within damp, dark places, especially among forest undergrowth during the day. Most mycetophilids inhabit wet forests but are quite common in swamps. Of the 77 species so far reported from India only 21 species are reported from Himachal Pradesh.

The sciarids (“rootgnats” or Dark-winged fungus gnats) resemble the mycetophilids in most habits but more compact, separated from other related families by the usual dorsal extension of the eye which meet medially forming an ‘eye bridge’. Adults are about 1-22 mm long, slender to moderately robust, long legged, usually black, brown or yellowish in colour. Larvae have a shining black head, white translucent body and some species migrate in a snake like formation. Immature stages mostly found in rotten wood, under bark of fallen trees, in other kinds of decaying plant material, feeding in fungi or animal excrement. Out of 61 species reported from India only 9 species are reported from Himachal Pradesh.

The Scatopsidae are a species-poor, cosmopolitan family of small dark nematocerans (0.6 mm to nearlyy 5 mm) usually black, and wings with distinctly darkened and thickened anteior radial veins contrasting with paler posterior veins. Of the 3 species of India only a species *Ectaetia nigronitida* (Brunetti) is present in the Himachal Pradesh.

Therevids (Stiletto flies) are more or less elongate densely pubescent flies with slender non-prehensile legs. They are brightly coloured, elongate, with largely glabrous bodies. The antennae are sometimes very distinctive. They are found in a variety of habitats ranging from rainforest to desert. The snake-like larvae are very mobile and move with considerable speed through sand and loose soil. Larvae inhabit the soil in leaf-mould, fungi, decaying wood etc. The Therevidae are represented by 16 species in India of them only *Thereva bilineata* Brunetti known from Himachal Pradesh.

The Robber flies, or Asilidae, comprise one of the largest and most abundant families of Diptera. Adult stages are medium to large flies often observed on stems of plants, on the ground and grass or flying low. Species vary in apperance and some mimic wasps and bees. Most species are gray to black, hairy-bodied, have a long, narrow, tapering abdomen containing segments that may be banded, patterned or contrasting in color. The larva of Robber-flies is believed to be mostly herbivorous (vegetarian) but the adult flies are highly active carnivores. Of the 482 species reported from India 6 species are known from Himachal Pradesh.

The family “Empididae” in the traditional sense is a diverse group of medium to small sized (1 to 15 mm), grey, yellowish or dark very rarely metallic coloured flies. The head is variously shaped and usually narrower than thorax. The wings are of varied shape and size. They are commonly called as “dance-flies” and gain their common name from their courtship behaviour. Empidoids breed in a variety of habitats, including running water, tidal zones, decaying wood, and moist soil. Adults are often found in various forest habitats, on leaves, tree trunks, aquatic vegetation, or in stream beds and seepage habitats. Larvae are soil inhabitants, but also sometimes found in decaying wood, humus, dungs, moss or in water. The family includes 57 species in India with only 13 species being reported from Himachal Pradesh.

Flower Flies or hover flies belong to the family Syrphidae are abundant everywhere except in arid areas of the Old World and in the extreme southern latitudes. Their size ranges from 4 mm to over 25 mm and their coloration from bright coloration from bright yellow or orange to dull dark black or gray with a few iridescent forms. Larvae of the subfamily Syrphinae are predaceous on soft-bodied arthropods, although some may occasionally be scavengers. Most of the milesiines are saprophagous and found in litter and dead wood, some of the rhingiines are mycetophagous, and a few rhingiines and merodontines are phytophagous (as borers in tubers, stems, and wood, miners in leaves). 46 species of hoverflies are reported from Himachal Pradesh whereas 256 species known from India.

DISCUSSION

Invariably, insects are overlooked when forest management issues are discussed, because there are so many species, which are taxonomically intractable and so poorly known. Often people take the view that if you look after the vegetation and vertebrates, the insects will look after themselves. This may be true for some functional groups, but for saproxylic insects, this seems unlikely. Their study deserves high priority, since they are dependent on the very resource “wood” whose removal from the ecosystem is the usual object of forest management (Grove S.J. and Stork N.E. 1999).

The ecological value of dead wood is broadly acknowledged worldwide. Recent research has highlighted their sensitivity to forest management, with managed or secondary forests generally supporting fewer individuals, fewer species, and different assemblages compared to old-growth or primary forests. this sensitivity is a product of their association with a habitat that tends to diminish in managed forests. Many saproxylic insect species have declining populations and are regarded as threatened due to low habitat availability in managed forests.

The geographical area of Himachal Pradesh is 56,673 km2. According to the State Forest Report, 1997 of FSI, the actual forest area in the state occupies only 22.5% of its area. Of them non-Forest : 74.2%, Very Dense

Forest (VDF) : 2.0%. Open Forest : 9.7%, Moderate Dense Forest (MDF) : 14.2%. Like all other parts of India, the forest cover of Himachal Pradesh is also decreasing mostly due to man made hazards.

To conserve the saproxylic flies there is a need of change of forest management in Himachal Pradesh. In recent years, data on the occurrence of Syrphidae in the Netherlands suggested that many saproxylic species had increased. According Reemer *et al.* (2003), it has been attributed to the tendency of leaving dead wood and ill trees in the forests. It is unfortunate that detailed studies on saproxylic flies of Himachal Pradesh and their conservation for maintaining biodiversity of forest are rare, especially in our country, but hopefully this work can serve as baseline data for future research work.

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