

Phytosociological Studies on *Apis cerana* F. and *Apis mellifera* L. in Shiwalik Hills

Avinash Kaur¹, V. K. Mattu²

Sociobiology and Behavioral Ecology Research Lab, Department of Biosciences, Himachal Pradesh University, Shimla (H.P)-171005, India

Abstract: In India beekeeping is still in infancy, offering vast scope for expansion as a prime agri-horticulture and forest-based rural industry. In order to make beekeeping a successful enterprise, first and foremost task in India is to educate beekeepers about the bee pasture availability in different agroclimatic zones. This provides valuable information on availability and abundance of pollen and nectar sources, for honeybees during different seasons and helps ultimately in standardizing the seasonal management practices for honey bee colony. Unfortunately, our knowledge on this aspect in the country is scanty and unorganized. Therefore, phytosociological studies were conducted in shiwalik hills. Observations on the bee flora of shiwalik hills were made in the blooming period. These investigations revealed that predominant honey plants were: *Brassica* sp., *Raphanus* sp., *Murraya* sp., *Eucalyptus* sp., etc. whereas, *calendula* sp., *Mangifera* sp., *Eruca* sp., *Trifolium* sp., *Woodfordia* sp., *Psidium* sp., *Grewia* sp., *Phoenix* sp., *Hibiscus* sp., *Syzygium* sp., *Melia* sp., *Grewia* sp., *Acacia* sp., *Adhatoda* sp., *Citrus* sp., *Azadirachta* sp. etc. were secondary pollen types. The important minor and minor pollen components represented in these honey samples were: *Acacia* sp., *Adhatoda* sp., *Ageratum* sp., *Allium* sp., *Bauhinia* sp., *Berberis* sp., *Bidens* sp., *Callistemon* sp., *Carissa* sp., *Cassia* sp., *Chenopodium* sp., *Dalbergia* sp., *Dianthus* sp., *Gossypium* sp., *Grevillea* sp., *Grewia* sp., *Helianthus* sp., *Lagerstroemia* sp., *Lilium* sp., *Medicago* sp., *Murraya* sp., *Rubus* sp., *Salvia* sp., *Sapindus* sp., *Syzygium* sp., *Zea* sp., *Zizyphus* sp., *Bauhinia* sp., *Cestrum* sp., *Citrus* sp., *Litchi* sp., *Raphanus* sp., *Bombax* sp., *Embilica* sp., *Pisum* sp., *Rosa* sp., *Woodfordia* sp., *Aegle* sp., *Albizia* sp., *Berberis* sp., *Calendula* sp., *Cedrella* sp., *Dianthus* sp., *Leucaena* sp., *Ocimum* sp., *Pisum* sp., *Polygonum* sp., *Punica* sp., *Ricinus* sp., *Robinia* sp., *Taraxacum* sp., *Sonchus* sp., *Syzygium* sp., *Vitis* sp., *Bombax* sp., *Litchi* sp. and members of families *Boraginaceae*, *Convolvulaceae*, *Euphorbiaceae*, *Fabaceae*, *Meliaceae*, *Asteraceae*, *Cucurbitaceae*, *Myrtaceae*, *Acanthaceae*, *Apiaceae*, *Apocynaceae*, *Boraginaceae*, *Brassicaceae*, *Cannabinaceae*, *Lamiaceae*, *Malvaceae*, *Papaveraceae*, *Poaceae*, *Rosaceae*, *Sapindaceae* and *Rutaceae*. Most of the honey samples had pollen of entomophilous plants with a small percentage of anemophilous types. These investigations also revealed both unifloraity and multifloraity in different honey samples. On the basis of present bee botanical investigations, a floral calendar of honey plant resources of Shiwalik hills indicating their taxonomic status, geographic location, honey potentiality, periods of flowering and economic uses has been prepared. Present studies thus suggest that this region offers very rich potential for the development of beekeeping due to the multiplicity of bee flora available throughout the year. Such investigations can be helpful in setting up new apiaries, in migratory beekeeping practices and application of modern bee management technology.

Keywords: Beekeeping, Honey, Phytosociology, Pollen, Nectar, Bee flora

1. Introduction

Most of the flowering plants are pollinated by insects and many insects are specific to certain species of plants. Honey bees, on the other hand have no such restriction of pollen and nectar (McGregor, 1976). There are at least four hundred species of plants which are either major or minor sources of pollen and nectar to Indian hive bee, *Apis cerana* F. (Deodikar and Suryanarayana, 1972; Crane and Walker, 1984). It is obvious that all the plant species are not available in any one locality and a given plant species may also show variations in its utility to bees in different localities or during different years. Information on the utility of each of these plants species, its distribution, abundance and preferences for any climate or soil etc. is of great importance to beekeepers (Suryanarayana, 1978; Mattu, 1982).

Shiwalik hills are the principle temperate and tropical fruit growing region of the country. Every year more and more land is coming under cultivation in this region. With the knowledge of major bee plants of any given place and at any given time, the migratory bee keeping can be scientifically founded.

Phytosociological studies have been carried out in different parts of India by various investigated and fairly good lists of bee plants. However, very little work has been done to identify and evaluate the important honey plants of shiwalik hills, which has great potential for beekeeping. The present studies are a step in the direction of knowing and working out the floral resources of shiwalik hills.

2. Materials & Methods

Observations on the bee flora of Shiwalik hills were made during October, 2008 to September, 2009. Observations on blooming of different plant sources were recorded at weekly intervals. The period of activity of honey bees on a blooming crop was taken as the flowering period of that particular plant species.

The plants at flowering stage near an apiary were visited. The plants which yielded good pollen packs were listed as pollen sources. The abundance of nectar secretion from a large number of plants in a particular situation was taken as the honey flow period, whereas the scarcity of food for the bees was recorded as a dearth period. Definite durations of food scarcity were worked out from the list of bee attracting plants recorded throughout the year.

Source of bee forage during different months of the year in shivalik hills

Name of the Plant		Family	Source of N or P or both	Economic importance
January				
<i>Dahlia pinnata</i>	Dahlia	Asteraceae	N ² P ²	Ornamental
<i>Brassica campestris</i>	Mustard	Brassicaceae	N ¹ P ¹	Oilseed crop
<i>B. campestris</i> var. sarson	Sarson	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Brassica napus</i> var. glauca	Rape	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Brassica napus</i> var. toria	Toria	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Eruca sativa</i>	Rocket salad	Brassicaceae	N ¹ P ¹	Oilseed, Fodder,
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² p ²	Ornamental
<i>Moringa oleifera</i>	Drumstick tree	Moringaceae	N ¹ P ¹	Perfumes and Lubricants, Fertilizer, Gum, Fodder, Vegetable, Antibacterial properties
February				
<i>Centaurea cyanus</i>	Cornflower	Asteraceae	N ¹ P ¹	Ornamental
<i>Helichrysum arenarium</i>	Paperflower	Asteraceae	N ² p ³	Ornamental
<i>Bombax ceiba</i>	Silk Cotton tree	Bombacaceae	N ¹ P ¹	Fodder, Tree, Fibre, Timber
<i>Brassica campestris</i>	Mustard	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>B. campestris</i> var. sarson	Sarson	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Brassica juncea</i>	Indian mustard	Brassicaceae	N ¹ P ¹	Oilseed crop
<i>Brassica napus</i> var. glauca	Rape	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Brassica napus</i> var. toria	Toria	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Eruca sativa</i>	Rocket salad	Brassicaceae	N ¹ P ¹	Oilseed, Fodder
<i>Raphanus sativus</i>	Radish	Brassicaceae	N ¹ P ¹	Vegetable
<i>Cucurbita maxima</i>	Great Pumpkin	Cucurbitaceae	N ¹ P ¹	Vegetable
<i>Bauhinia variegata</i>	Kachnar	Fabaceae	N ² P ³	Fodder, Fuel, Ornamental, Vegetable
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² p ²	Ornamental
<i>Moringa oleifera</i>	Drum stick tree	Moringaceae	N ¹ P ¹	Perfumes and Lubricants, Fertilizer, Gum, Fodder, Vegetable, Antibacterial properties
<i>Salix babylonica</i>	Weeping willow	Salicaceae	N ¹ P ¹	Timber
<i>Litchi chinensis</i>	Litchi	Sapindaceae	N ¹ P ¹	Fruit tree
March				
<i>Mangifera indica</i>	Mango	Anacardiaceae	N ³ P ³	Fruit tree, Fuel, Timber
<i>Daucus carota</i>	Carrot	Apiaceae	N ² P ³	Vegetable
<i>Centaurea cyanus</i>	Cornflower	Asteraceae	N ¹ P ¹	Ornamental
<i>Helichrysum arenarium</i>	Paper flower	Asteraceae	N ² P ³	Ornamental
<i>Taraxacum officinale</i>	Dandelion	Asteraceae	N ¹ P ¹	Juicy Weed
<i>Bombax ceiba</i>	Silk cotton tree	Bombacaceae	N ¹ P ¹	Fodder, Tree, Fibre, Timber
<i>Brassica campestris</i>	Mustard	Brassicaceae	N ¹ P ¹	Oilseed crop,
<i>B. Campestris</i> var. sarson	Sarson	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Brassica juncea</i>	Indian mustard	Brassicaceae	N ¹ P ¹	Oilseed crop,
<i>Brassica napus</i> var. glauca	Rape	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Brassica napus</i> var. toria	Toria	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Brassica oleracea capitata</i>	Cabbage	Brassicaceae	N ² P ²	Vegetable
<i>Brassica oleracea botrytis</i>	Cauliflower	Brassicaceae	N ² P ²	Vegetable
<i>Brassica rapa</i>	Turnip	Brassicaceae	N ² P ²	Vegetable
<i>Eruca sativa</i>	Rocket salad	Brassicaceae	N ¹ P ¹	Oilseed, Fodder
<i>Raphanus sativus</i>	Radish	Brassicaceae	N ¹ P ¹	Vegetable
<i>Chenopodium album</i>	White goose foot	Chenopodiaceae	N ³ P ³	Fodder
<i>Cucurbita maxima</i>	Great Pumpkin	Cucurbitaceae	N ¹ P ¹	Vegetable
<i>Emblica officinalis</i>	Indian goose berry	Euphorbiaceae	N ² P ²	Medicinal
<i>Bauhinia vahlii</i>	Camel'sfoot	Fabaceae	N ² P ³	Fodder, Fuel, Vegetable
<i>Bauhinia variegata</i>	Kachnar	Fabaceae	N ² P ³	Fodder, Fuel, Ornamental, Vegetable
<i>Dalbergia sissoo</i>	Sissoo	Fabaceae	N ¹ P ¹	Timber, Fuel, Fodder, Shade
<i>Melilotus spp.</i>	Mellilot	Fabaceae	N ¹ P ²	Fodder
<i>Pisum sativum</i>	Garden Pea	Fabaceae	N ³ P ³	Vegetable
<i>Tamarindus indica</i>	Tamarind	Fabaceae	N ³ P ³	Avenue tree, Condiment, Fruit, Oil
<i>Woodfordia fruticosa</i>	Dhawi	Lytheraceae	N ¹ P ¹	Dye, Medicinal, Fodder, Fuel
<i>Hibiscus rosa-sinensis</i>	Chinese rose	Malvaceae	N ² P ²	Ornamental
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² P ²	Ornamental
<i>Cedrela toona</i>	Cedrella	Meliaceae	N ¹ P ²	Furniture
<i>Morus alba</i>	Mulberry	Moraceae	P ²	Silkworm rearing, Fruits edible
<i>Moringa oleifera</i>	Drumstick tree	Moringaceae	N ¹ P ¹	Tree, Perfumes and Lubricants, Fertilizer, Gum, Fodder, Vegetable, Antibacterial properties
<i>Musa sapientum</i>	Banana	Musaceae	N ¹ P ³	Fruit
<i>Callistemon citrinus</i>	Bottle brush	Myrtaceae	N ¹ P ¹	Ornamental
<i>Eschscholzia californica</i>	Californian poppy	Papaveraceae	N ³ p ¹	Ornamental

Volume 5 Issue 5, May 2016

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

<i>Papaver rhoes</i>	Poppy	Papaveraceae	N ³ P ³	Ornamental
<i>Plantago spp.</i>	Plantago	Plantaginaceae	N ² P ¹	-
<i>Delphinium roylei</i>	Larkspur	Ranunculaceae	N ³ P ³	Ornamental
<i>Rosa macrophylla</i>	Rose	Rosaceae	N ³ P ¹	Ornamental
<i>Citrus aurantifolia</i>	Lemon	Rutaceae	N ¹ P ¹	Fruit Tree
<i>Citrus grandis</i>	Pumelo	Rutaceae	N ¹ P ¹	Fruit Tree
<i>Citrus limetta</i>	Sweet lemon	Rutaceae	N ¹ P ¹	Fruit Tree
<i>Citrus medica</i>	Citron	Rutaceae	N ¹ P ¹	Fruit Tree
<i>Citrus reticulata</i>	Mandarin orange	Rutaceae	N ¹ P ¹	Fruit Tree
<i>Citrus sinensis</i>	Sweet orange	Rutaceae	N ¹ P ¹	Fruit Tree
<i>Murraya koenigii</i>	Curry leaf plant	Rutaceae	N ² P ²	Medicinal, Ornamental
<i>Salix babylonica</i>	Weeping willow	Salicaceae	N ¹ P ¹	Timber
<i>Litchi chinensis</i>	Litchi	Salicaceae	N ¹ P ¹	Fruit Tree
<i>Lycopersicum esculentum</i>	Tomato	Solanaceae	N ³ P ³	Vegetable
April				
<i>Adhatoda vasica</i>	Basuti	Acanthaceae	N ² P ²	-
<i>Mangifera indica</i>	Mango	Anacardiaceae	N ³ P ³	Fruit tree, Fuel, Timber
<i>Daucus carota</i>	Carrot	Apiaceae	N ² P ³	Vegetable
<i>Carissa caranda</i>	Karandas	Apocynaceae	N ² P ²	Preservation
<i>Asclepias curassavica</i>	Milk weed	Asclepiadaceae	N ² P ²	Fibre
<i>Centaurea cyanus</i>	Cornflower	Asteraceae	N ¹ P ¹	Ornamental
<i>Helichrysum arenarium</i>	Paper flower	Asteraceae	N ² P ³	Ornamental
<i>Taraxacum officinale</i>	Dandelion	Asteraceae	N ¹ P ¹	Juicy Weed
<i>Tussilago farfara</i>	Coltsfoot	Asteraceae	N ³ P ³	Medicinal
<i>Berberis aristata</i>	Berberry	Berberidaceae	N ² P ²	Fruit, Dye, Medicinal
<i>Berberis lycium</i>	Raisin berry	Berberidaceae	N ² P ²	Fruit, Medicinal
<i>Ehretia acuminata</i>	Ivory wood	Boraginaceae	N ¹ P ²	Avenue tree, Fruit, Timber, Fodder
<i>Brassica campestris</i>	Mustard	Brassicaceae	N ¹ P ¹	Oilseed crop
<i>Brassica rapa</i>	Turnip	Brassicaceae	N ² P ²	Vegetable
<i>Opuntia spp.</i>	Prickly pear	Cactaceae	N ² P ²	-
<i>Dianthus caryophyllus</i>	Carnation	Caprifoliaceae	N ³ P ³	Ornamental
<i>Chenopodium album</i>	White goose foot	Chenopodiaceae	N ³ P ³	Fodder
<i>Terminalia spp.</i>	Myrobalan	Combretaceae	N ¹ P ¹	Timber, Fruit, Medicinal, Fuel, Bark for tanning, Dyeing
<i>Convolvulus arvensis</i>	Convolvulus	Convolvulaceae	N ³ P ³	-
<i>Benincasa spp.</i>	Petha	Cucurbitaceae	N ² P ²	Vegetable
<i>Cucurbita pepo</i>	Pumpkin	Cucurbitaceae	N ¹ P ¹	Vegetable
<i>Cucurbita maxima</i>	Great pumpkin	Cucurbitaceae	N ¹ P ¹	Vegetable
<i>Emblica officinalis</i>	Indian gooseberry	Euphorbiaceae	N ² P ²	Medicinal
<i>Euphorbia royleana</i>	Euphorbia	Euphorbiaceae	N ³ P ³	Juicy
<i>Acacia catechu</i>	Acacia	Fabaceae	N ¹ P ¹	Timber, Fodder, Fuel-wood
<i>Albizia lebbek</i>	Siris	Fabaceae	N ³ P ³	Fodder, Timber, Fuel
<i>Bauhinia vahlii</i>	Camel's foot	Fabaceae	N ² P ³	Fodder, Fuel, Vegetable
<i>Bauhinia variegata</i>	Kachnar	Fabaceae	N ² P ³	Fodder, Fuel, Ornamental, Vegetable
<i>Cassia fistula</i>	Indian laburnum	Fabaceae	N ² P ²	Avenue tree
<i>Tamarindus indica</i>	Tamarind	Fabaceae	N ³ P ³	Avenue tree, Condiment, Fruit, Fodder, Oil
<i>Trifolium alexandrinum</i>	Egyptian clover	Fabaceae	N ¹ P ¹	Fodder
<i>Trifolium pretense</i>	Red clover	Fabaceae	N ¹ P ²	Fodder
<i>Vicia spp.</i>	Field beans	Fabaceae	N ³ P ³	Edible, Fodder
<i>Hypericum spp.</i>	Hypericum	Hypericaceae	P ¹	Twigs used as toothbrush, seed as condiment for flavouring curries
<i>Woodfordia fruticosa</i>	Dhawi	Lytheraceae	N ¹ P ¹	Dye, Medicinal, Fodder, Fuel
<i>Hibiscus rosa-sinensis</i>	Chinese rose	Malvaceae	N ² P ²	Ornamental
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² P ²	Ornamental
<i>Cedrela toona</i>	Cedrella	Meliaceae	N ¹ P ²	Woody, Furniture
<i>Morus alba</i>	Mulberry	Moraceae	P ²	Silkworm rearing, Fruits edible
<i>Musa sapientum</i>	Banana	Musaceae	N ² P ³	Fruit
<i>Callistemon citrinus</i>	Bottle brush	Myrtaceae	N ¹ P ¹	Ornamental
<i>Syzygium cumini</i>	Jambolan	Myrtaceae	N ¹ P ¹	Avenue tree, Fruit
<i>Grevillea robusta</i>	Silky oak	Proteaceae	N ¹ P ¹	Avenue tree, Ornamental, Timber
<i>Punica granatum</i>	Pomegranate	Punicaceae	N ² P ¹	Fruit
<i>Anemone spp.</i>	Wood anemone	Ranunculaceae	P ³	Ornamental
<i>Clematis spp.</i>	Clematis	Ranunculaceae	N ² P ²	Medicinal
<i>Delphinium roylei</i>	Larkspur	Ranunculaceae	N ³ P ³	Ornamental
<i>Rosa macrophylla</i>	Rose	Rosaceae	N ³ P ¹	Ornamental
<i>Rosa moschata</i>	Wild rose	Rosaceae	N ³ P ¹	Ornamental
<i>Rubus spp.</i>	Berries	Rosaceae	N ² P ²	Fruit

<i>Citrus aurantifolia</i>	Lemon	Rutaceae	N ¹ P ¹	Fruit tree
<i>Citrus grandis</i>	Pumelo	Rutaceae	N ¹ P ¹	Fruit tree
<i>Citrus limetta</i>	Sweet lemon	Rutaceae	N ¹ P ¹	Fruit tree
<i>Citrus medica</i>	Citron	Rutaceae	N ¹ P ¹	Fruit tree
<i>Citrus reticulata</i>	Mandarin orange	Rutaceae	N ¹ P ¹	Fruit tree
<i>Citrus sinensis</i>	Sweet orange	Rutaceae	N ¹ P ¹	Fruit tree
<i>Murraya koenigii</i>	Curry leaf plant	Rutaceae	N ² P ²	Medicinal, Ornamental
<i>Lycopersicum esculentum</i>	Tomato	Solanaceae	N ³ P ³	Vegetable
May				
<i>Adhatoda vasica</i>	Basuti	Acanthaceae	N ² P ²	-
<i>Allium cepa</i>	Onion	Amaryllidaceae	N ³ P ³	Vegetable
<i>Allium sativum</i>	Garlic	Amaryllidaceae	N ³ P ³	Vegetable
<i>Coriandrum sativum</i>	Coriander	Apiaceae	N ³ P ³	Condiment
<i>Daucus carota</i>	Carrot	Apiaceae	N ² P ³	Vegetable
<i>Carissa caranda</i>	Karandas	Apocynaceae	N ² P ²	Preservation
<i>Phoenix spp.</i>	Wild date palm	Arecaceae	N ² P ³	Fruit tree
<i>Asclepias curassavica</i>	Milkweed	Asclepiadaceae	N ² P ²	Fibre
<i>Calendula officinalis</i>	Marigold	Asteraceae	N ³ P ³	Ornamental
<i>Cardus onopordioides</i>	Musk thistles	Asteraceae	N ² P ²	-
<i>Chrysanthemum spp.</i>	Chrysanthemum	Asteraceae	N ³ P ³	Ornamental
<i>Helichrysum arenarium</i>	Paper flower	Asteraceae	N ² P ³	Ornamental
<i>Taraxacum officinale</i>	Dandelion	Asteraceae	N ¹ P ¹	Juicy Weed
<i>Tussilago farfara</i>	Coltsfoot	Asteraceae	N ³ P ³	Medicinal
<i>Berberis aristata</i>	Berberry	Berberidaceae	N ² P ²	Fruit, Dye, Medicinal
<i>Berberis lycium</i>	Raisin Berberry	Berberidaceae	N ² P ²	Fruit, Medicinal
<i>Campsis grandiflora</i>	Trumpet vine	Bignoniaceae	N ² P ³	Ornamental
<i>Jacaranda mimosifolia</i>	Jacaranda	Bignoniaceae	N ³ P ³	Ornamental
<i>Brassica campestris</i>	Mustard	Brassicaceae	N ¹ P ¹	Oilseed crop
<i>Opuntia spp.</i>	Prickly pear	Cactaceae	N ² P ²	-
<i>Crataeva religiosa</i>	Barna	Cannabinaceae	N ² P ³	-
<i>Dianthus caryophyllus</i>	Carnation	Caprifoliaceae	N ³ P ³	Ornamental
<i>Carica papaya</i>	Papaya	Caricaceae	N ¹ P ¹	Fruit edible
<i>Chenopodium album</i>	White goosefoot	Chenopodiaceae	N ³ P ³	Fodder
<i>Terminalia spp.</i>	Myrobalan	Combretaceae	N ¹ P ¹	Tree, Timber, Fruit, Medicinal, Fuel, Bark, for tanning, Dyeing
<i>Cucurbita pepo</i>	Pumpkin	Cucurbitaceae	N ¹ P ¹	Vegetable
<i>Emblica officinalis</i>	Indian gooseberry	Euphorbiaceae	N ² P ²	Medicinal
<i>Euphorbia royleana</i>	Euphorbia	Euphorbiaceae	N ³ P ³	Juicy
<i>Ricinus communis</i>	Caster oil plant	Euphorbiaceae	P ²	Oilseed, Softwooded
<i>Acacia arabica</i>	Acacia	Fabaceae	N ² P ²	Fodder, Medicinal, Tanning industry, Dyeing, Ornamental
<i>Acacia catechu</i>	Acacia	Fabaceae	N ¹ P ¹	Timber, Fodder, Fuel-wood
<i>Albizzia lebbek</i>	Siris	Fabaceae	N ³ P ³	Fodder, Timber, Fuel
<i>Bauhinia vahlii</i>	Camel's foot	Fabaceae	N ² P ³	Fodder, Fuel, Vegetable
<i>Butea monosperma</i>	Palas	Fabaceae	N ³ P ³	Fuel, Timber, Food for lac insect, Medicinal
<i>Cassia fistula</i>	Indian laburnum	Fabaceae	N ² P ²	Avenue tree
<i>Cajanus cajan</i>	Pigeon pea	Fabaceae	N ³ P ³	Food
<i>Dalbergia sissoo</i>	Sissoo	Fabaceae	N ¹ P ¹	Timber, Fuel, Fodder, Shade
<i>Delonix regia</i>	Gulmohar	Fabaceae	N ² P ²	Avenue tree
<i>Leucaena leucocephala</i>	Ipil-ipil	Fabaceae	N ³ P ¹	Fuel, Fodder
<i>Medicago sativa</i>	Alfalfa	Fabaceae	N ¹ P ²	Fodder
<i>Melilotus spp.</i>	Mellilot	Fabaceae	N ¹ P ²	Fodder
<i>Pisum sativum</i>	Garden pea	Fabaceae	N ³ P ³	Vegetable
<i>Tamarindus indica</i>	Tamarind	Fabaceae	N ³ P ³	Avenue tree, Condiment, Fruit, Fodder, Oil
<i>Trifolium alexandrinum</i>	Egyptian clover	Fabaceae	N ¹ P ¹	Fodder
<i>Trifolium pretense</i>	Red clover	Fabaceae	N ¹ P ²	Fodder
<i>Trifolium repens</i>	White clover	Fabaceae	N ¹ P ¹	Fodder, Cover crop
<i>Vicia spp.</i>	Field beans	Fabaceae	N ³ P ³	Edible, Fodder
<i>Geranium spp.</i>	Geranium	Geraniaceae	N ³ P ³	Ornamental
<i>Hypericum spp.</i>	Hypericum	Hypericaceae	P ¹	Twigs used as toothbrush, seed as condiment for flavouring curries
<i>Lilium spp.</i>	Lilium	Liliaceae	P ³	Ornamental
<i>Woodfordia fruticosa</i>	Dhawi	Lytheraceae	N ¹ P ¹	Dye, Medicinal, Fodder, Fuel
<i>Hibiscus rosa-sinensis</i>	Chinese rose	Malvaceae	N ² P ²	Ornamental
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² P ²	Ornamental
<i>Azadirachta indica</i>	Mangosa	Meliaceae	N ² P ³	Avenue tree, Forest tree
<i>Cedrela toona</i>	Cedrella	Meliaceae	N ¹ P ²	Woody, Furniture

<i>Callistemon citrinus</i>	Bottle brush	Myrtaceae	N ¹ P ¹	Ornamental
<i>Eucalyptus camaldulensis</i>	Eucalyptus	Myrtaceae	N ¹ P ¹	Avenue tree, Fuel wood, Charcoal, Paper pulp, Termite-resistant timber, Medicinal
<i>Psidium guajava</i>	Guava	Myrtaceae	N ¹ P ¹	Fruit
<i>Syzygium cumini</i>	Jambolan	Myrtaceae	N ¹ P ¹	Avenue tree, Fruit
<i>Argemone mexicana</i>	Prickly poppy	Papaveraceae	P ³	-
<i>Papaver rhoeas</i>	Poppy	Papaveraceae	N ³ P ³	Ornamental
<i>Plantago spp.</i>	Plantago	Plantaginaceae	N ² P ¹	-
<i>Cynodon dactylon</i>	Dubgrass	Poaceae	P ³	Fodder
<i>Sorghum vulgare</i>	Sorghum	Poaceae	P ¹	Grain, Fodder
<i>Grevillea robusta</i>	Silky oak	Proteaceae	N ¹ P ¹	Avenue tree, Ornamental, Timber
<i>Punica granatum</i>	Pomegranate	Punicaceae	N ² P ¹	Fruit
<i>Punica nana</i>	Wild pomegranate	Punicaceae	N ² P ¹	Fruit
<i>Anemone spp.</i>	Wood anemone	Ranunculaceae	P ³	Ornamental
<i>Clematis spp.</i>	Clematis	Ranunculaceae	N ² P ²	Medicinal
<i>Delphinium roylei</i>	Larkspur	Ranunculaceae	N ³ P ³	Ornamental
<i>Ranunculus arvensis</i>	Buttercup.	Ranunculaceae	N ³ P ³	-
<i>Rosa macrophylla</i>	Rose	Rosaceae	N ³ P ¹	Ornamental
<i>Rosa moschata</i>	Wild rose	Rosaceae	N ³ P ¹	Ornamental
<i>Rubus spp.</i>	Berries	Rosaceae	N ² P ²	Fruit
<i>Antirrhinum majus</i>	Antirrhinum	Scrophulariaceae	N ² P ²	Ornamental
<i>Sapindus mukorosii</i>	Soapnut	Sapindaceae	N ¹ P ¹	Avenue tree, Fruit used as soap, Timber
<i>Lycopersicum esculentum</i>	Tomato	Solanaceae	N ³ P ³	Vegetable
<i>Grewia optiva</i>	Beolor Bhemal	Tiliaceae	N ¹ P ¹	Fodder, Timber, Fruit
<i>Vitis vinifera</i>	Grapes	Vitaceae	N ³ P ³	Fruit
June				
<i>Adhatoda vasica</i>	Basuti	Acanthaceae	N ² P ²	-
<i>Amaranthus paniculatus</i>	Amaranth	Agavaceae	P ²	-
<i>Allium cepa</i>	Onion	Amaryllidaceae	N ³ P ³	Vegetable
<i>Coriandrum sativum</i>	Coriander	Apiaceae	N ³ P ³	Condiment
<i>Phoenix spp.</i>	Wild date palm	Arecaceae	N ² P ³	Fruit tree
<i>Asclepias curassavica</i>	Milkweed	Asclepiadaceae	N ² P ²	Fibre
<i>Bidens pilosa</i>	Badi gumbri	Asteraceae	N ³ P ³	-
<i>Calendula officinalis</i>	Marigold	Asteraceae	N ³ P ³	Ornamental
<i>Cardus onopordioides</i>	Musk thistles	Asteraceae	N ² P ²	-
<i>Chrysanthemum spp.</i>	Chrysanthemum	Asteraceae	N ³ P ³	Ornamental
<i>Cichorium intybus</i>	Chichory	Asteraceae	N ³ P ³	-
<i>Helichrysum arenarium</i>	Paper flower	Asteraceae	N ² P ³	Ornamental
<i>Senecio spp.</i>	Ragwort	Asteraceae	N ³ P ³	-
<i>Solidago longifolia</i>	Golden rod	Asteraceae	N ² P ³	Ornamental
<i>Sonchus spp.</i>	Sow thistle	Asteraceae	N ³ P ³	-
<i>Taraxacum officinale</i>	Dandelion	Asteraceae	N ¹ P ¹	Juicy weed
<i>Tussilago farfara</i>	Coltsfoot	Asteraceae	N ³ P ³	Medicinal
<i>Berberis aristata</i>	Berberry	Berberidaceae	N ² P ²	Fruit, Dye, Medicinal
<i>Berberis lyceum</i>	Raisin berry	Berberidaceae	N ² P ²	Fruit, Medicinal
<i>Campsis grandiflora</i>	Trumpet vine	Bignoniaceae	N ² P ³	Ornamental
<i>Jacaranda mimosifolia</i>	Jacaranda	Bignoniaceae	N ³ P ³	Ornamental
<i>Cynoglossum spp.</i>	Hounds tongue	Boraginaceae	N ³ P ³	-
<i>Cannabis sativa</i>	Hemp	Cannabinaceae	N ² P ²	Alkaloid Fibre
<i>Dianthus caryophyllus</i>	Carnation	Caprifoliaceae	N ³ P ³	Ornamental
<i>Convolvulus arvensis</i>	Convolvulus	Convolvulaceae	N ³ P ³	-
<i>Momordica charantia</i>	Bitter gourd	Cucurbitaceae	N ³ P ³	Vegetable
<i>Hevea brasiliensis</i>	Rubber tree	Euphorbiaceae	N ¹ P ³	Ornamental
<i>Ricinus communis</i>	Caster oil plant	Euphorbiaceae	P ²	Oilseed, Softwooded
<i>Acacia arabica</i>	Acacia	Fabaceae	N ² P ²	Fodder, Medicinal, Tanning industry, Dyeing, Ornamental
<i>Acacia catechu</i>	Acacia	Fabaceae	N ¹ P ¹	Timber, Fodder, Fuel-wood
<i>Cassia fistula</i>	Indian laburnum	Fabaceae	N ² P ²	Avenue tree
<i>Cajanus cajan</i>	Pigeon pea	Fabaceae	N ³ P ³	Food
<i>Erythrina suberosa</i>	Coral tree	Fabaceae	N ² P ²	-
<i>Delonix regia</i>	Gulmohar	Fabaceae	N ² P ²	Avenue tree
<i>Indigofera spp.</i>	Indigofera	Fabaceae	N ² P ²	-
<i>Leucaena leucocephala</i>	Ipil-ipil	Fabaceae	N ³ P ¹	Fuel, Fodder
<i>Medicago sativa</i>	Alfalfa	Fabaceae	N ¹ P ²	Fodder
<i>Pisum sativum</i>	Garden pea	Fabaceae	N ³ P ³	Vegetable
<i>Trifolium alexandrinum</i>	Egyptian clover	Fabaceae	N ¹ P ¹	Fodder
<i>Trifolium pretense</i>	Red clover	Fabaceae	N ¹ P ²	Fodder

<i>Trifoliumrepens</i>	White clover	Fabaceae	N ¹ P ¹	Fodder, Cover crop
<i>Vicia spp.</i>	Field beans	Fabaceae	N ³ P ³	Edible, Fodder
<i>Castanea sativa</i>	Sweet chestnut	Fagaceae	N ³ P ³	Timber, Seed, Nuts, Edible
<i>Geranium spp.</i>	Geranium	Geraniaceae	N ³ P ³	Ornamental
<i>Hypericum spp.</i>	Hypericum	Hypericaceae	P ¹	Twigs used as toothbrush, seed as comdiment for flavouring curries
<i>Ocimum basilicum</i>	Basil	Lamiaceae	N ² P ³	-
<i>Lilium spp.</i>	Lily	Liliaceae	P ³	Ornamental
<i>Althaea rosea</i>	Hollyhock	Malvaceae	N ² P ²	Ornamental
<i>Malva sylvestris</i>	Mallow	Malvaceae	N ² P ³	Ornamental
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² P ²	Ornamental
<i>Azadirachta indica</i>	Mangosa	Meliaceae	N ² P ³	Avenue tree, Forest tree
<i>Cedrela toona</i>	Cedrella	Meliaceae	N ¹ P ²	Woody, Furniture
<i>Musa sapientum</i>	Banana	Musaceae	N ² P ³	Fruit
<i>Callistemon citrinus</i>	Bottle brush	Myrtaceae	N ¹ P ¹	Ornamental
<i>Eucalyptus camaldulensis</i>	Eucalyptus	Myrtaceae	N ¹ P ¹	Avenue tree, Fuel wood, Charcoal, Paper pulp, Termite-resistant timber, Medicinal
<i>Psidium guajava</i>	Guava	Myrtaceae	N ¹ P ¹	Fruit
<i>Syzygium cumini</i>	Jambolan	Myrtaceae	N ¹ P ¹	Avenue tree, Fruit
<i>Argemone mexicana</i>	Prickly poppy	Papaveraceae	P ³	-
<i>Eschscholzia californica</i>	Californian poppy	Papaveraceae	N ³ P ¹	Ornamental
<i>Plantago spp.</i>	Plantago	Plantaginaceae	N ² P ¹	-
<i>Cynodon dactylon</i>	Dubgrass	Poaceae	P ³	Fodder
<i>Sorghum vulgare</i>	Sorgum	Poaceae	P ¹	Grain, Fodder
<i>Polygonum spp.</i>	Polygonum	Polygonaceae	N ³ P ³	-
<i>Rumex spp.</i>	Rumex	Polygonaceae	N ³ P ³	-
<i>Portulaca grandiflora</i>	Portulaca	Portulacaceae	N ² P ¹	Ornamental
<i>Anemone spp.</i>	Wood anemone	Ranunculaceae	P ³	Ornamental
<i>Ranunculus arvensis</i>	Butter cup	Ranunculaceae	N ³ P ³	-
<i>Rosa moschata</i>	Wild rose	Rosaceae	N ³ P ¹	Ornamental
<i>Rubus spp.</i>	Berries	Rosaceae	N ² P ²	Fruit
<i>Antirrhinum majus</i>	Antirrhinum	Scrophulariaceae	N ² P ²	Ornamental
<i>Sapindus mukorosii</i>	Soapnut	Sapindaceae	N ¹ P ¹	Avenue tree, Fruit used as soap, Timber
<i>Lycopersicum esculentum</i>	Tomato	Solanaceae	N ³ P ³	Vegetable
<i>Solanum melongena</i>	Brinjal	Solanaceae	N ³ P ³	Ornamental
<i>Grewia optiva</i>	Beolor Bhemal	Tiliaceae	N ¹ P ¹	Fodder, Timber, Fruit
<i>Tilia spp.</i>	Lime basswood	Tiliaceae	N ¹	Avenue tree, Ornamental, Timber
<i>Vitex negundo</i>	Indian privet	Verbenaceae	N ¹ P ²	Insect repellent, Medicinal
<i>Vitis vinifera</i>	Grapes	Vitaceae	N ³ P ³	Fruit
July				-
<i>Adhatoda vasica</i>	Basuti	Acanthaceae	N ² P ²	-
<i>Rungia parviflora</i>	Rungia	Acanthaceae	N ³ P ³	-
<i>Amaranthus paniculatus</i>	Amaranth	Agavaceae	P ²	-
<i>Phoenix spp.</i>	Wild date palm	Arecaceae	N ² P ³	Fruit tree
<i>Ageratum conyzoides</i>	Ageratum or Goat weed	Asteraceae	N ³ P ³	Ornamental
<i>Aster spp.</i>	Star wort	Asteraceae	N ³ P ³	Ornamental
<i>Bidens pilosa</i>	Badi-gumbri	Asteraceae	N ³ P ³	-
<i>Calendula officinalis</i>	Marigold	Asteraceae	N ³ P ³	Ornamental
<i>Cardus onopordioides</i>	Musk thistles	Asteraceae	N ² P ²	-
<i>Chrysanthemum spp.</i>	Chrysanthemum	Asteraceae	N ³ P ³	Ornamental
<i>Dahlia pinnata</i>	Dahlia	Asteraceae	N ² P ²	Ornamental
<i>Eupatorium spp.</i>	Throughwort	Asteraceae	N ³ P ³	-
<i>Helianthus annuus</i>	Sunflower	Asteraceae	N ¹ P ¹	Oilseed, Ornamental, Fodder
<i>Senecio spp.</i>	Ragwort	Asteraceae	N ³ P ³	-
<i>Solidago longifolia</i>	Golden rod	Asteraceae	N ² P ³	Ornamental
<i>Sonchus spp.</i>	Sow thistle	Asteraceae	N ³ P ³	-
<i>Tagetes erectus</i>	Marigold	Asteraceae	N ³ P ³	Aromatic, Ornamental
<i>Taraxacum officinale</i>	Dandelion	Asteraceae	N ¹ P ¹	Juicy Weed
<i>Impatiens balsamina</i>	Pink balsam	Balsaminaceae	N ¹ P ²	Medicinal, Aromatic
<i>Impatiens glandulifera</i>	Balsam	Balsaminaceae	N ² P ²	Medicinal
<i>Campsis grandiflora</i>	Trumpetvine	Bignoniaceae	N ² P ³	Ornamental
<i>Convolvulus arvensis</i>	Convolvulus	Convolvulaceae	N ³ P ³	-
<i>Cuscuta reflexa</i>	Amarbel	Convolvulaceae	P ³	Parasitic, Succulent, Medicinal
<i>Cucumis spp.</i>	Cucumber	Cucurbitaceae	N ¹ P ¹	Edible
<i>Luffa cylindrical</i>	Ridged gourd	Cucurbitaceae	N ³ P ³	-
<i>Momordica charantia</i>	Bitter gourd	Cucurbitaceae	N ³ P ³	Vegetable

<i>Hevea brasiliensis</i>	Rubber tree	Euphorbiaceae	N ¹ P ³	Ornamental
<i>Ricinus communis</i>	Caster oil plant	Euphorbiaceae	P ²	Oilseed, Softwooded
<i>Acacia Arabica</i>	Acacia	Fabaceae	N ² P ²	Fodder, Medicinal, Tanning industry, Dyeing, Ornamental
<i>Acacia catechu</i>	Acacia	Fabaceae	N ¹ P ¹	Timber, Fodder, Fuel-wood
<i>Butea monosperma</i>	Palas	Fabaceae	N ³ P ³	Fuel, Timber, Food for lac insect, Medicinal
<i>Cassia fistula</i>	Indian laburnum	Fabaceae	N ² P ²	Avenue tree
<i>Cajanus cajan</i>	Pigeon pea	Fabaceae	N ³ P ³	Food
<i>Glycine max</i>	Soyabean	Fabaceae	N ³ P ³	Oilseed crop
<i>Indigofera spp.</i>	Indigofera	Fabaceae	N ² P ²	-
<i>Leucaena leucocephala</i>	Ipil-ipil	Fabaceae	N ³ P ¹	Fuel, Fodder
<i>Medicago sativa</i>	Alfalfa	Fabaceae	N ¹ P ²	Fodder
<i>Melilotus spp.</i>	Mellilot	Fabaceae	N ¹ P ²	Fodder
<i>Pisum sativum</i>	Garden pea	Fabaceae	N ³ P ³	Vegetable
<i>Trifolium alexandrinum</i>	Egyptian clover	Fabaceae	N ¹ P ¹	Fodder
<i>Trifolium pretense</i>	Red clover	Fabaceae	N ¹ P ²	Fodder
<i>Trifolium repens</i>	White clover	Fabaceae	N ¹ P ¹	Fodder, Cover crop
<i>Vicia spp.</i>	Field beans	Fabaceae	N ³ P ³	Edible, Fodder
<i>Castanea sativa</i>	Sweet chestnut	Fagaceae	N ³ P ³	Timber, Seed, Nuts, Edible
<i>Geranium spp.</i>	Geranium	Geraniaceae	N ³ P ³	Ornamental
<i>Hypericum spp.</i>	Hypericum	Hypericaceae	P ¹	Twigs used as toothbrush, seed as condiment for flavouring curries
<i>Mentha viridis</i>	Mint	Lamiaceae	N ³	Aromatic herb
<i>Ocimum basilicum</i>	Basil	Lamiaceae	N ² P ³	-
<i>Origanum vulgare</i>	Marjoram	Lamiaceae	N ² P ²	Aromatic herb, Oil
<i>Salvia spp.</i>	Red sage	Lamiaceae	N ² P ²	Medicinal
<i>Stachys spp.</i>	Woundwort	Lamiaceae	N ² P ³	-
<i>Lagerstroemia indica</i>	Pride of india	Lytheraceae	N ² P ²	Timber, Ornamental
<i>Abelmoschus esculentus</i>	Lady's finger	Malvaceae	N ² P ²	Vegetable
<i>Althaea rosea</i>	Holly hock	Malvaceae	N ² P ²	Ornamental
<i>Gossypium arboreum</i>	Cotton	Malvaceae	N ¹ P ²	-
<i>Malva sylvestris</i>	Mallow	Malvaceae	N ² P ³	Ornamental
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² P ²	Ornamental
<i>Azadirachta indica</i>	Mangosa	Meliaceae	N ² P ³	Avenue tree, Forest tree
<i>Musa sapientum</i>	Banana	Musaceae	N ² P ³	Fruit
<i>Callistemon citrinus</i>	Bottle brush	Myrtaceae	N ¹ P ¹	Ornamental
<i>Epilobium spp.</i>	Willow herb	Oncraceae	N ² P ²	-
<i>Argemone Mexicana</i>	Prickly poppy	Papaveraceae	P ³	-
<i>Sesamum indicum</i>	Sesamum	Pedaliaceae	N ¹ P ¹	Oilseed
<i>Cynodon dactylon</i>	Dubgrass	Poaceae	P ³	Fodder
<i>Zea mays</i>	Maize	Poaceae	P ¹	Fodder
<i>Fagopyrum sagittatum</i>	Buck wheat	Polygonaceae	N ¹ P ²	Grain, Fodder
<i>Polygonum spp.</i>	Polygonum	Polygonaceae	N ³ P ³	-
<i>Rumex spp.</i>	Rumex	Polygonaceae	N ³ P ³	-
<i>Portulaca grandiflora</i>	Portulaca	Portulacaceae	N ² P ¹	Ornamental
<i>Zizyphus jujuba</i>	Chinese date	Rhamnaceae	N ¹ P ³	Fruit, Fodder, Oilseed
<i>Eriobotrya japonica</i>	Loquat	Rosaceae	N ¹ P ¹	Fruit
<i>Capsicum spp.</i>	Chillies	Solanaceae	N ³ P ³	Vegetable
<i>Datura stramonium</i>	Thorn apple	Solanaceae	P ³	Medicinal
<i>Lycopersicum esculentum</i>	Tomato	Solanaceae	N ³ P ³	Vegetable
<i>Solanum melongena</i>	Brinjal	Solanaceae	N ³ P ³	Vegetable
<i>Grewia optiva</i>	Beolor Bhemal	Tiliaceae	N ¹ P ¹	Fodder, Timber, Fruit
August				
<i>Adhatoda vasica</i>	Basuti	Acanthaceae	N ² P ²	-
<i>Rungia parviflora</i>	Rungia	Acanthaceae	N ³ P ³	-
<i>Foeniculum vulgare</i>	Funnel	Apiaceae	N ³ P ³	Condiment
<i>Ageratum conyzoides</i>	Ageratum or Goat weed	Asteraceae	N ³ P ³	Ornamental
<i>Aster spp.</i>	Starwort	Asteraceae	N ³ P ³	Ornamental
<i>Bidens pilosa</i>	Badi gumbri	Asteraceae	N ³ P ³	-
<i>Eupatorium spp.</i>	Throughwort	Asteraceae	N ³ P ³	-
<i>Helianthus annuus</i>	Sunflower	Asteraceae	N ¹ P ¹	Oilseed, Ornamental, Fodder
<i>Senecio spp.</i>	Rajwort	Asteraceae	N ³ P ³	-
<i>Solidago longifolia</i>	Golden rod	Asteraceae	N ² P ³	Ornamental
<i>Sonchus spp.</i>	Sow thistle	Asteraceae	N ³ P ³	-
<i>Tagetes erectus</i>	Marigold	Asteraceae	N ³ P ³	Ornamental
<i>Taraxacum officinale</i>	Dandelion	Asteraceae	N ¹ P ¹	Juicy Weed

<i>Zinnia elegans</i>	Zinnia	Asteraceae	N ² P ²	Ornamental
<i>Impatiens balsamina</i>	Pink balsam	Asteraceae	N ¹ P ²	Medicinal
<i>Cannabis sativa</i>	Hemp	Cannabinaceae	N ² P ²	Alkaloid fibre
<i>Lonicera</i>	Honey suckle	Caprifoliaceae	N ³ P ³	-
<i>Chenopodium album</i>	White goose foot	Caprifoliaceae	N ³ P ³	Fodder
<i>Convolvulus arvensis</i>	Convolvulus	Convolvulaceae	N ³ P ³	-
<i>Ipomoea batatas</i>	Sweet potato	Convolvulaceae	N ² P ³	Vegetable
<i>Ipomoea pulchella</i>	Railway creeper	Convolvulaceae	N ³ P ³	-
<i>Cuscuta reflexa</i>	Amarbel	Convolvulaceae	P ³	Medicinal
<i>Luffa cylindrical</i>	Ridged gourd	Cucurbitaceae	N ³ P ³	-
<i>Momordica charantia</i>	Bitter gourd	Cucurbitaceae	N ³ P ³	Vegetable
<i>Cucumis spp.</i>	Cucumber	Cucurbitaceae	N ¹ P ¹	Edible
<i>Ricinus communis</i>	Caster oil plant	Euphorbiaceae	P ²	Oilseed, Softwooded
<i>Butea monosperma</i>	Palas	Fabaceae	N ³ P ³	Fuel, Timber, Food for lac insect, Medicinal
<i>Cajanus cajan</i>	Pigeon Pea	Fabaceae	N ³ P ³	Food
<i>Glycine max</i>	Soyabean	Fabaceae	N ³ P ³	Oilseed crop
<i>Indigofera spp.</i>	Indigofera	Fabaceae	N ² P ²	-
<i>Leucaena leucocephala</i>	Ipil-ipil	Fabaceae	N ³ P ¹	Fuel, Fodder
<i>Medicago sativa</i>	Alfalfa	Fabaceae	N ¹ P ²	Fodder
<i>Vicia spp.</i>	Field beans	Fabaceae	N ³ P ³	Edible, Fodder
<i>Mentha viridis</i>	Mint	Lamiaceae	N ³	Aromatic herb
<i>Ocimum basilicum</i>	Basil	Lamiaceae	N ² P ³	-
<i>Origanum vulgare</i>	Marjoram	Lamiaceae	N ² P ²	Oil
<i>Salvia spp.</i>	Red sage	Lamiaceae	N ² P ²	Medicinal
<i>Stachys spp.</i>	Woundwort	Lamiaceae	N ² P ³	-
<i>Asphodelus tenuifolius</i>	Piazi	Liliaceae	N ³ P ²	-
<i>Lagerstroemia indica</i>	Pride of india	Lytheraceae	N ² P ²	Timber, Ornamental
<i>Abelmoschus esculentus</i>	Lady's finger	Malvaceae	N ² P ²	Vegetable
<i>Althaea rosea</i>	Hollyhock	Malvaceae	N ² P ²	Vegetable
<i>Gossypium arboreum</i>	Cotton	Malvaceae	N ¹ P ²	-
<i>Malva sylvestris</i>	Mallow	Malvaceae	N ² P ³	Ornamental
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² P ²	Ornamental
<i>Azadirachta indica</i>	Mangosa	Meliaceae	N ² P ³	Avenue tree, Forest tree
<i>Musa sapientum</i>	Banana	Musaceae	N ² P ³	Fruit
<i>Sesamum indicum</i>	Sesamum	Pedaliaceae	N ¹ P ¹	Oilseed
<i>Plantago spp.</i>	Plantago	Plantaginaceae	N ² P ¹	-
<i>Cynodon dactylon</i>	Dubgrass	Poaceae	P ³	Fodder
<i>Zea mays</i>	Maize	Poaceae	P ¹	Fodder
<i>Fagopyrum sagittatum</i>	Buck wheat	Polygonaceae	N ¹ P ²	Grain, Fodder
<i>Polygonum spp.</i>	Polygonum	Polygonaceae	N ³ P ³	-
<i>Rumex spp.</i>	Rumex	Polygonaceae	N ³ P ³	-
<i>Portulaca grandiflora</i>	Portulaca	Portulacaceae	N ² P ¹	Ornamental
<i>Zizyphus jujuba</i>	Chinese date	Rhamnaceae	N ¹ P ³	Fruit, Fodder, Oilseed
<i>Scrophularia spp.</i>	Fig figwort	Scrophulariaceae	N ¹ P ²	-
<i>Capsicum spp.</i>	Chillies	Solanaceae	N ³ P ³	Vegetable
<i>Datura stramonium</i>	Thorn apple	Solanaceae	P ³	Medicinal
<i>Lycopersicum esculentum</i>	Tomato	Solanaceae	N ³ P ³	Vegetable
<i>Solanum melongena</i>	Brinjal	Solanaceae	N ³ P ³	Vegetable
September				
<i>Adhatoda vasica</i>	Basuti	Acanthaceae	N ² P ²	-
<i>Agave americana</i>	Century plant	Agavaceae	N ³ P ³	-
<i>Foeniculum vulgare</i>	Funnel	Apiaceae	N ³ P ³	Condiment
<i>Ageratum conyzoides</i>	Ageratum or Goat weed	Asteraceae	N ³ P ³	Ornamental
<i>Aster spp.</i>	Star-wort	Asteraceae	N ³ P ³	Ornamental
<i>Bidens pilosa</i>	Badi-gumbri	Asteraceae	N ³ P ³	-
<i>Senecio spp.</i>	Ragwort	Asteraceae	N ³ P ³	-
<i>Solidago longifolia</i>	Golden rod	Asteraceae	N ² P ³	Ornamental
<i>Sonchus spp.</i>	Sow thistle	Asteraceae	N ³ P ³	-
<i>Tagetes erectus</i>	Marigold	Asteraceae	N ³ P ³	Ornamental
<i>Taraxacum officinale</i>	Dandelion	Asteraceae	N ¹ P ¹	Juicy Weed
<i>Zinnia elegans</i>	Zinnia	Asteraceae	N ² P ²	Ornamental
<i>Impatiens balsamina</i>	Pink balsam	Balsaminaceae	N ¹ P ²	Medicinal
<i>Impatiens glandulifera</i>	Balsam	Balsaminaceae	N ² P ²	Medicinal
<i>Cynoglossum spp.</i>	Hounds tongue	Boraginaceae	N ³ P ³	-
<i>Brassica campestris</i>	Sarson	Brassicaceae	N ¹ P ¹	Oilseed crop
<i>Cannabis sativa</i>	Hemp	Cannabinaceae	N ² P ²	Alkaloid fibre

<i>Convolvulus arvensis</i>	Convolvulus	Convolvulaceae	N ³ P ³	-
<i>Ipomoea batatas</i>	Sweet potato	Convolvulaceae	N ² P ³	Vegetable
<i>Momordica charantia</i>	Bitter gourd	cucurbitaceae	N ³ P ³	Vegetable
<i>Butea monosperma</i>	Palas	Fabaceae	N ³ P ³	Fuel, Timber, Food for lac insect, Medicinal
<i>Cajanus cajan</i>	Pigeon pea	Fabaceae	N ³ P ³	Food
<i>Leucaena leucocephala</i>	Ipil-ipil	Fabaceae	N ¹ P ¹	Timber, Fuel, Fodder, Shade
<i>Hypericum spp.</i>	Hypericum	Hypericaceae	P ¹	Twigs used as toothbrush, seed as condiment for flavouring curries
<i>Mentha viridis</i>	Mint	Lamiaceae	N ³	Aromatic herb
<i>Ocimum basilicum</i>	Basil	Lamiaceae	N ² P ³	-
<i>Asphodelus tenuifolius</i>	Piazi	Liliaceae	N ³ P ²	-
<i>Lagerstroemia indica</i>	Pride of india	Lytheraceae	N ² P ²	Timber, Ornamental
<i>Abelmoschus esculentus</i>	Lady's finger	Malvaceae	N ² P ²	Vegetable
<i>Althaea rosea</i>	Holly hock	Malvaceae	N ² P ²	Ornamental
<i>Gossypium arboreum</i>	Cotton	Malvaceae	N ¹ P ²	-
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² P ²	Ornamental
<i>Azadirachta indica</i>	Mangosa	Meliaceae	N ² P ³	Avenue tree, Forest tree
<i>Musa sapientum</i>	Banana	Musaceae	N ² P ³	Fruit
<i>Callistemon citrinus</i>	Bottle brush	Myrtaceae	N ¹ P ¹	Ornamental
<i>Epilobium spp.</i>	Willow herb	Oncraceae	N ² P ²	-
<i>Sesamum indicum</i>	Sesasum	Pedaliaceae	N ¹ P ¹	Oilseed
<i>Plantago dactylon</i>	Plantago	Plantaginaceae	N ² P ¹	-
<i>Cynodon dactylon</i>	Dubgrass	Poaceae	P ³	Fodder
<i>Fagopyrum sagittatum</i>	Buck wheat	Polygonaceae	N ¹ P ²	Fodder
<i>Polygonum spp.</i>	Polygonum	Polygonaceae	N ³ P ³	-
<i>Rumex spp.</i>	Rumex	Polygonaceae	N ³ P ³	-
<i>Portulaca grandiflora</i>	Portulaca	Portulacaceae	N ² P ¹	Ornamental
<i>Zizyphus jujuba</i>	Chinese date	Rhamnaceae	N ¹ P ³	Fruit, Fodder, Oilseed
<i>Eriobotrya japonica</i>	Loquat	Rosaceae	N ¹ P ¹	Fruit
October				
<i>Adhatoda vasica</i>	Basuti	Acanthaceae	N ² P ²	-
<i>Agave americana</i>	Century plant	Agavaceae	N ³ P ³	-
<i>Aster spp.</i>	Star-wort	Asteraceae	N ³ P ³	Ornamental
<i>Chenopodium album</i>	White goose foot	Chenopodiaceae	N ³ P ³	Fodder
<i>Ipomoea batatas</i>	Sweet potato	Convolvulaceae	N ² P ³	Vegetable
<i>Ipomoea pulchella</i>	Railway creeper	Convolvulaceae	N ³ P ³	-
<i>Cuscuta reflexa</i>	Amarbel	Convolvulaceae	P ³	Medicinal
<i>Leucaena leucocephala</i>	Ipil-ipil	Fabaceae	N ³ P ¹	Fuel, Fodder
<i>Hypericum spp.</i>	Hypericum	Hypericaceae	P ¹	Twigs used as toothbrush, seed as condiment for flavouring curries
<i>Mentha viridis</i>	Mint	Lamiaceae	N ³	Aromatic herb
<i>Salvia spp.</i>	Red sage	Lamiaceae	N ² P ²	Medicinal
<i>Asphodelus tenuifolius</i>	Piazi	Liliaceae	N ³ P ²	-
<i>Althaea rosea</i>	Hollyhock	Malvaceae	N ² P ²	Ornamental
<i>Malva sylvestris</i>	Mallow	Malvaceae	N ² P ³	Ornamental
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² P ²	Ornamental
<i>Musa sapientum</i>	Banana	Musaceae	N ² P ³	Fruit
<i>Callistemon citrinus</i>	Bottle brush	Myrtaceae	N ¹ P ¹	Ornamental
<i>Rumex spp.</i>	Rumex	Polygonaceae	N ³ P ³	-
November				
<i>Adhatoda vasica</i>	Basuti	Acanthaceae	N ² P ²	-
<i>Agave americana</i>	Century plant	Agavaceae	N ³ P ³	-
<i>Aster spp.</i>	Star-wort	Asteraceae	N ³ P ³	-
<i>Cosmos sulphureus</i>	Cosmos	Asteraceae	N ³ P ²	-
<i>Ipomoea batatas</i>	Sweet potato	Convolvulaceae	N ² P ³	Vegetable
<i>Ipomoea pulchella</i>	Railway creeper	Convolvulaceae	N ³ P ³	-
<i>Bambusa bambos</i>	Bamboo	Poaceae	N ³ P ³	Forest, Wood, Furniture,
<i>Camellia sinensis</i>	Tea	Theaceae	N ¹ P ¹	Colouring material, Beverages
December				
<i>Brassica campestris</i>	Mustard	Brassicaceae	N ¹ P ¹	Oilseed
<i>Brassica napus var. glauca</i>	Rape	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Brassica napus var. toria</i>	Toria	Brassicaceae	N ¹ P ¹	Oilseed crop, Vegetable
<i>Eruga sativa</i>	Rocket salad	Brassicaceae	N ¹ P ¹	Oilseed, Fodder
<i>Malvaviscus arboreus</i>	Malvaviscus	Malvaceae	N ² P ²	Ornamental

N¹ = Major nectar source P¹ = Major pollen source

N² = Medium nectar source P² = Medium pollen source

N³ = Minor nectar source P³ = Minor pollen source

3. Results and discussion

The bee flora for *Apis* species recorded in different months of the year is given in the Table.

Most of the bee attracting plants provided nectar and pollen for the honey bees. But some plants were visited either for pollen or for nectar only. Early in spring (January-February) the bees worked mainly on Cruciferous crops. During late February to April, citrus species, shisham, curry leaf plant, pumpkin, litchi, mango, roses and bottle brush provided abundant nectar and pollen. Berseem came into bloom in late March and attracted sufficient bees for nectar and pollen upto June.

Late in June through August there was comparatively less bee forage. Bees collected nectar from cucurbits, sunflower, bhindi, cotton and pollen from maize and bajra, sown as early fodder grain crop. After the rainy season, i.e., during September and October, cotton, arhar, toria, maize and sunflower provided both nectar and pollen. Towards the onset of winter (November-December), sarson, toria, rocket salad were found to be the major bee attracting plants.

In shivalik hills, there were two main nectar flow periods, viz., March-May and September-November. *Brassica* species was the major source of nectar during the first while cotton, bottle brush and basuti were quiet significant during the latter flows. There was no definite dearth period for the honey bees in the area. Although late June to August there was comparatively less bee forage, yet honey bees continued their activity on maize, cotton, marigold, chrysanthemum and sunflower to overcome this hot and humid spell. A short dearth period during September was terminated when sarson flowers become available in October. Thus there was no serious gap in the sequence flowering of bee flora in Shiwalik hills.

4. Future Scope

Assessment of bio resources including honey plant resources and their utilization pattern for hilly and plain area of North-West Himalayas. Floral maps should be prepared for whole of the Himalayan region. Detailed ecological and biochemical studies should be conducted on excellent nectar sources. Assessment of bio resources including honey plant resources and their utilization pattern for hilly and plain area of North-West Himalayas. For double-fold benefit, area based scientific beekeeping should be encouraged among the farmers. Need based research activities should be taken up.

References

- [1] Crane, E. and Walker, P. 1984. Pollination Directory for World crops. *IBRA. London*, 183 pp.
- [2] Deodikar, G.B. and Suryanarayana, M.C. 1972. Crop yield and bee pollination. *Indian Bee J.* 34: 53-63.
- [3] Mattu, V.K. 1982. Morphometric and behavioural studies on Indian honeybee (*Apis cerana* F.). *Ph. D. Thesis. Himachal Pradesh University, Shimla, India.*
- [4] McGregor, S.A. 1976. Insect pollination of cultivated crop plants. *USDA/ARC Agric. Washington, DC handbook*, 496 pp.
- [5] Suryanarayana, M.C. 1978. Bee plants of India, *Carvia callosa*. *Indian Bee J.* 40: 7-10.

Author Profile

V. K. Mattu, professor at Department of Biosciences, Himachal Pradesh University, Shimla

Avinash Kaur, Ph.D. research scholar at Department of Biosciences, Himachal Pradesh University, Shimla