

HONEY PLANTS OF THE NORTH-WEST HIMALAYA



**S.K. SOOD
ROMITA SHARMA
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FOREWORD

Beekeeping has been promoted since Gandhian times as a potential industry for rural upliftment. Khadi and Village Industries Commission has both popularised and propagated beekeeping in the country and in majority of the states; beekeeping has gained prominence and has become useful in rural upliftment. Honey and hive products have been in use in India and the orient since times immemorial and these have been considered and used as health potentiators and protectors in the Indian system of medicine.

The quality and medicinal value of honey depends upon the plant source the honeybees forage upon. The diverse climatic conditions, topography and vegetation makes India a preferred habitat for a variety of flowering plants. Many of these plants are natural source of nectar and pollen to the honeybees. Melissopalynology has become integral and important component of research on honeybees. Pioneering studies on melissopalynology were initiated in Himachal Pradesh by Entomology group in the University of Horticulture and Forestry, Solan and Prof. L.R. Verma, in the Department of Biosciences, Himachal Pradesh University, Shimla and have been carried through by his students especially Dr. V.K. Mattu and Dr. Neelam Mattu and the floral calendars have been prepared.

There was a need to consolidate the available information and also to authenticate the identified flowering plants before venturing to publish them in a holistic volume. Prof. S.K. Sood, with his vast experience in systematics of flowering plants and research in ethnobotany of Himalaya, is the most suitable and competent individual to compile this information in such a volume. This has been achieved through the efforts of the three authors jointly. Needless to say that this compendium will serve a great purpose in enhancing the research and extension interests in beekeeping and give a boost to the beekeeping industry in Himachal Pradesh and elsewhere in the country and outside the country.

T.N. LAKHANPAL
Former Director

Institute of Integrated Himalayan Studies, Shimla

PREFACE

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 pasturage 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 honeybee colony. Unfortunately, our knowledge on this aspect in the country is scanty and unorganized.

This necessitated the compilation of present manual—comprehending information on nectar and pollen potential of 290 promising plant species belonging to 221 genera of the North-West Himalaya. It also provides information on synonyms, vernacular name(s), distribution, flowering and fruiting, botanical description and active constituents to serve as a valuable ready-reckoner for beekeeping management on scientific lines in general and for the socio-economic upliftment of mountain rural communities in particular. It is our fervent hope that this compendium will be of great practical utility to farmers, beekeepers, scientists, extension workers and entrepreneurs practising beekeeping.

The authors are greatly indebted to Prof. T.N. Lakhanpal, former Director, Institute of Integrated Himalayan Studies, Himachal Pradesh University, Summer Hill, Shimla for writing Foreword to this publication. This venture could not have been possible without the valuable advice and incessant encouragement of Prof. L.R. Verma, Vice-Chancellor, Himachal Pradesh University, Shimla, a pioneering beekeeping scientist in the country for which we express our sincere gratitude to him.

Well deserved appreciation is due to Prof. D.C. Kalia and other colleagues of Department of Biosciences for their co-operation and well-wishes; to Mr. Dhiraj Rawat, Mr. Suresh, Ms. Anjna and Mr. Munish for their ungrudging help in critically reading the various drafts of this manuscript, and to Mr. Bal Krishan for his help in various ways. Thanks are also due to authors of books, papers and figures listed in

ABBREVIATIONS

α	- Alpha	N.E.	- North-East
alt.	- Altitude	N.W.	- North-West
β	- Beta	%	- Per cent
C	- Central	Pl.(s)	- Plate(s)
δ	- Delta	Sans	- Sanskrit
de-o	- Deoxy	S	- South/Southern
E.	- East/Eastern	S.E.	- South-East
Eng.	- English	S.W.	- South-West
ξ	- Epsilon	spp.	- Species
<i>et al.</i>	- Et alia (and other authors)	syn	- Synonym
etc.	- et cetera (so on)	var.	- Variety
γ	- Gamma	vern.	- Vernacular
H.P.	- Himachal Pradesh	W	- West/Western
H.	- Hindi	vit.	- Vitamin
OH	- Hydroxy	p	- Para
i.e.	- id est (that is)	d	- Dextro
cm	- Centimetre	&	- And
m	- Metre	mg	- Milligram
N	- North/Northern		

INTRODUCTION

HONEY—AN ELIXIR OF LIFE

Honey—a sweet viscous, hygroscopic liquid comprising on an average about 40 per cent fruit sugar (levulose or fructose), 34 per cent grape sugar (dextrose or glucose), about 2 per cent cane sugar (sucrose) and a very small amount of amino acids (cystine, asparagin, lysine, glycine, aspartic acid, glutamic acid, alanine, tyroxine, valine, methionine, leucine), enzymes (invertase, diastase, catalase), vitamins (thiamine, riboflavin, nicotinic acid, ascorbic acid, vitamin K, folic acid, biotin, pyridoxine, pantothenic acid, pigments (carotene, chlorophyll, xanthophylls), and mineral complex (potassium, calcium, phosphorus, sodium, magnesium, manganese, copper, sulphur, silica, silicon, iron etc., and more than 17 trace elements)—is one of the miracle gifts of the mother nature to mankind. Its use as food and medicine to humanity is well-known since ancient times. Our ancient scriptures, The Vedas (3000-2000 BC), contain many references to both honey and the bees. In Central India, rock paintings dating back to Mesolithic period 15,000-11,000 BC have also been found to depict honey-hunting in the country (Fig. 1). Despite this fact, its use as a high energy carbohydrate food has not yet been realized in India. One kg of honey has been estimated to give about 3,150 calories which are equal to 8 kg of plums or 12 kg apples or 13 kg milk or 19 kg of green peas or 65 eggs (Abrol, 1997). The per capita consumption of 8.4 g honey per annum in India in comparison to 1.5 kg in Europe is extremely low (Mishra, 2002).

Pure honey should have the specific gravity of 1.35-1.44, and its colour and aroma mainly depends upon the floral source from which it is collected. Honeys are classified mainly as per their floral origin. If collected from single type, it is called unifloral and the one from mixed flora as multifloral. Its regular use is recommended in severe cases of malnutrition, impaired digestion and stomach and intestinal ulcers. Pythagoras, the father of mathematics, attributed the secret of his healthy and long life till the age of 90 to honey.

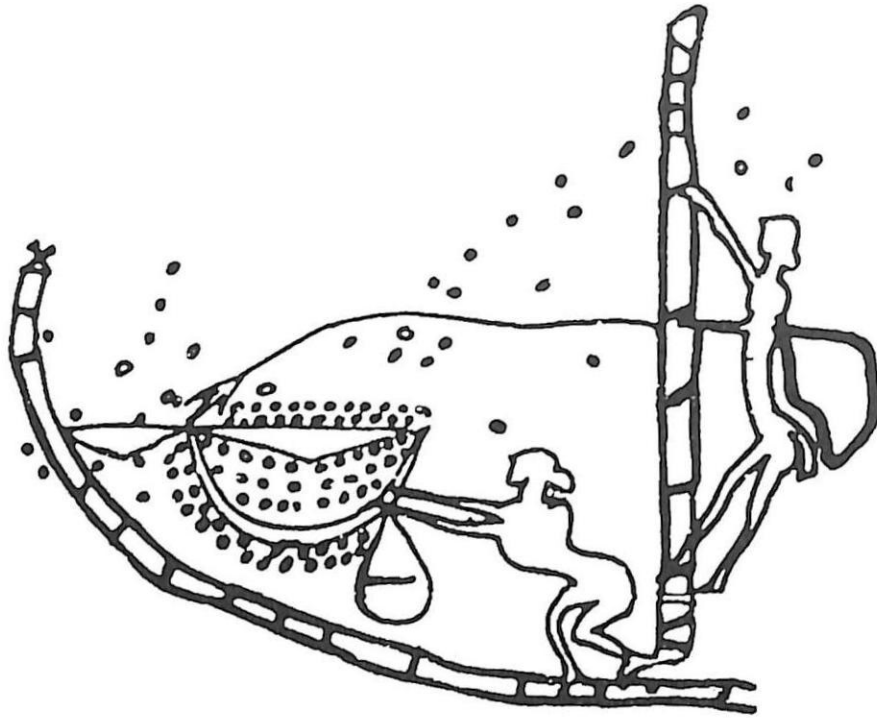


Fig. 1. Rock painting depicting honey-hunting in ancient India (source: Mishra & Kumar, 2002).

BEES, BEEKEEPING AND HIVE PRODUCTS

Bees are social animals and use pheromones for communication among members of the same species, for mating and for locating food and the most favourable environment for their survival. Flowers are the mainstay of bee's life as honeybees are dependent upon a wide variety of wild/cultivated plants for their requirement of pollen and nectar, constituting raw materials of the beekeeping industry which as a profession means rearing honeybees for the production of honey, hive products and for crop pollination (McGregor, 1976; Partap & Verma, 2000; Mishra & Kumar, 2002). In India beekeeping is considered a side business and each beekeeper often handles quite a low number of colonies as compared to his counterpart in other countries. Till 1962, beekeeping in India was solely practised with indigenous honeybee, *Apis cerana*, thereafter exotic bee *A. mellifera* was successfully introduced in the country (Gupta & Dogra, 2002). The concept of efficient beekeeping comprises of managing honeybee colony in such a way as to obtain maximum colony population to coincide with the period of major honey flow in an area and to utilize the population for honey production and pollination (Abrol, 1997). It has been observed that the honey flow period and dearth periods vary from one location to another and with altitudes.

India: Physical Divisions

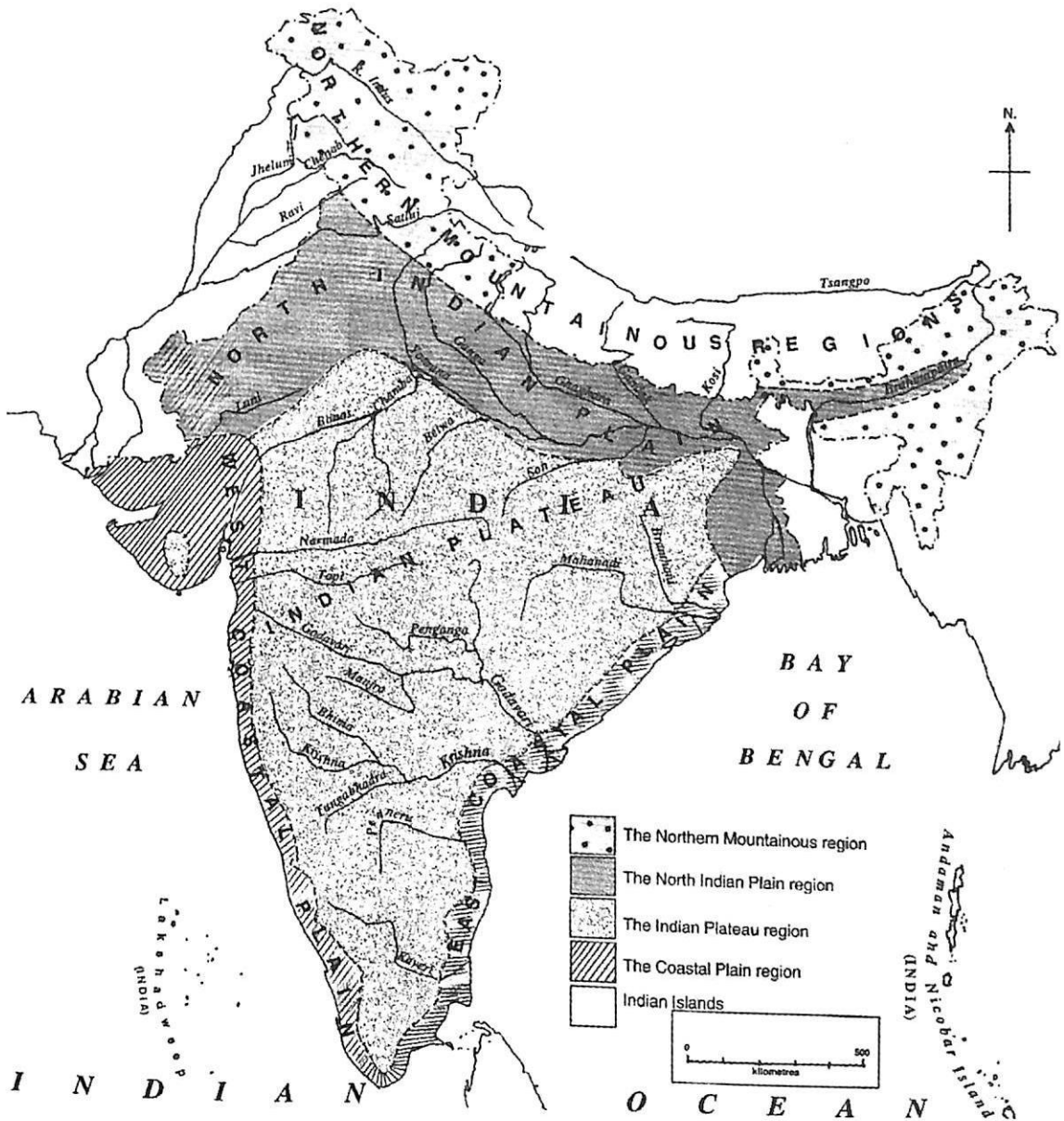


Fig. 2. Physical map of India showing north-west Himalaya located in the state of Jammu & Kashmir and Himachal Pradesh.

A beekeeper should always know about the qualities of good flora. These are: (1) *long flowering period*; (2) high density of flowers per unit area of the plants; (3) good quality of nectar with high concentration of sugars; (4) easy accessibility of the *nectaries to the honeybees* and ease in collection of nectar; and (5) availability of honey plants in the close vicinity of the apiary so that extra energy is not spent for search and collection of food by the bees (Mishra & Kumar, 2002). The speed of foraging activity (rate at which bees visit flowers) depends upon the amount of nectar and pollen present, type of flower, stage of development, climatic conditions (temperature, light intensity, radiation, time of the day, dew drops on flowers, wind velocity) and the number of competing insects. For foraging, the optimum temperature is between 13° and 38°C, and the pollen collection trips are usually shorter than nectar collection ones (Abrol, 1997).

The plants, namely *Ageratum conyzoides* (Pulanu), *Aesculus indica* (Chestnut), *Albizia lebbek* (Siris), *Celtis australis* (Khidak), *Daucus carota* (Carrot), *Ellateria cardamom* (Elaichi), *Lagerstroemia* (Harshingar), *Morus alba* (Mulberry), *Murraya koenigii* (Ghandalu), *Musa paradisica* (Banana), *Pyrus pyrepinnalia* (Nakh), *Raphanus sativus* (Radish), *Solidago canadensis* (Golden rod), and *Zea mays* (Maize) are not categorized as good source of nectar and pollen in India, as these are utilized by the bees during the time of scarcity of major honey plants.

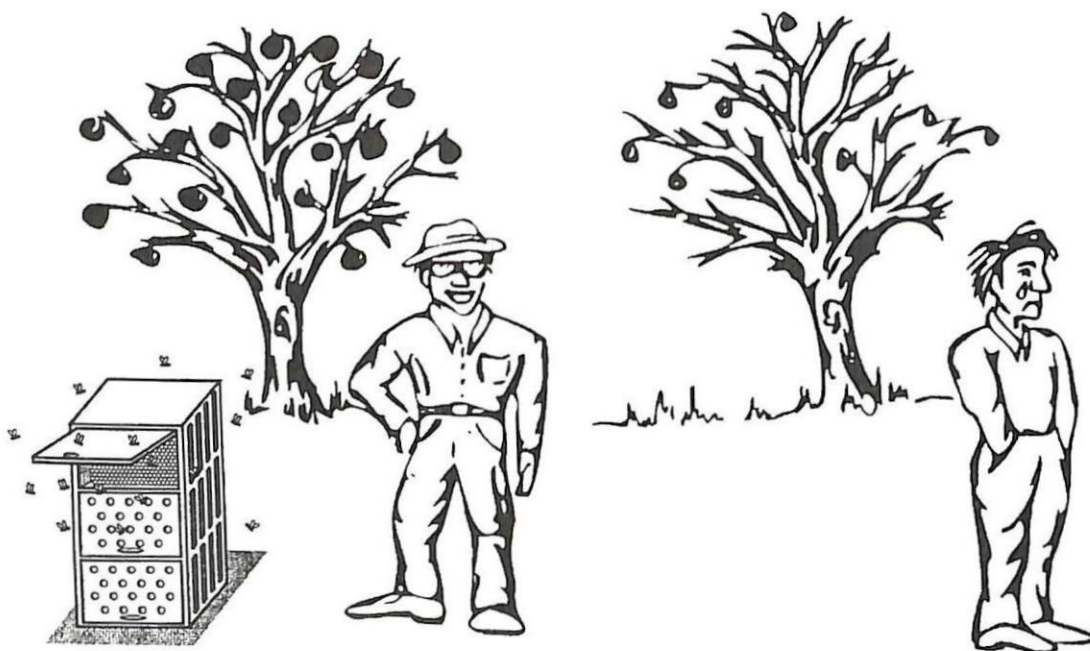


Fig. 3. Cartoon depicting the role of honeybees in yield improvement (source: Roubik, 1995).

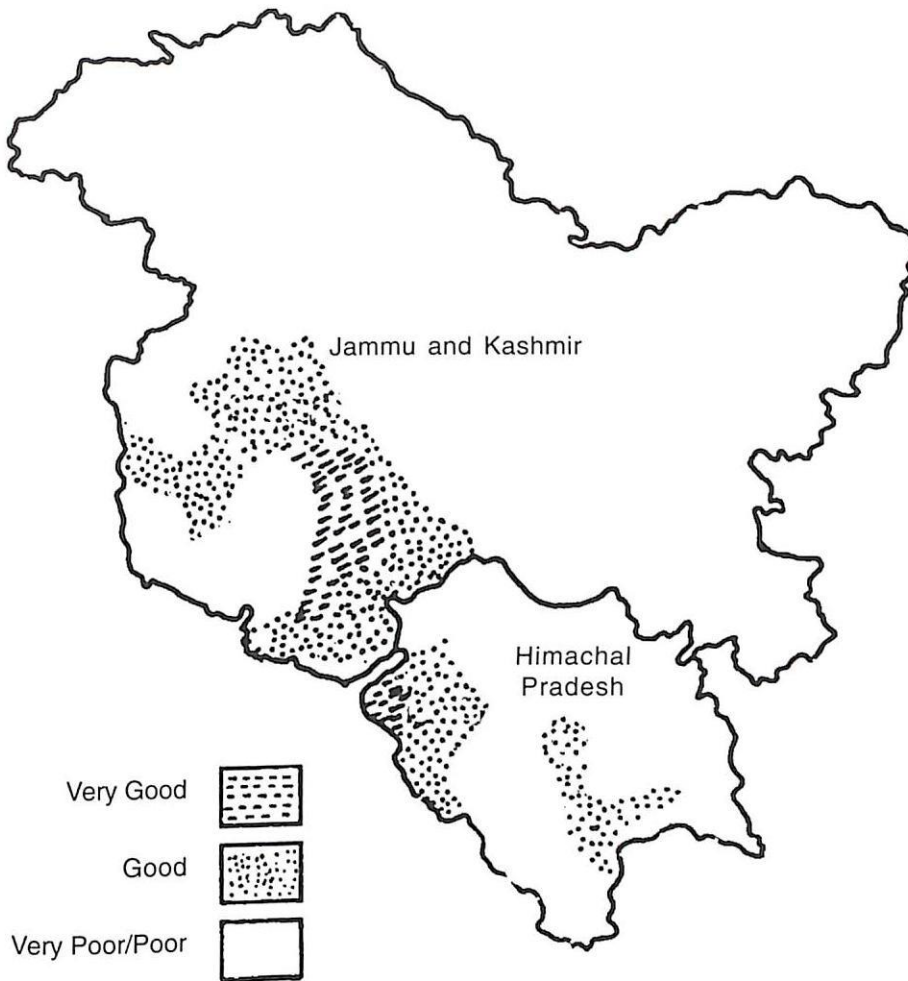


Fig. 4. Beekeeping map of J&K and Himachal Pradesh (source: Mishra & Kumar, 2002).

Keeping in view the availability of honey plants, the state of Himachal Pradesh has very less area which is suitable for beekeeping in comparison to Jammu & Kashmir (Figs. 2, 4, Mishra & Kumar, 2002). The role of bees in enhancing crop yields has also been well-documented (Deodikar & Suryanarayana, 1975; Fig. 3). Deforestation and clearing of wastelands for extensive agriculture account for decline in bee flora and considered as one of the serious setbacks for beekeeping industry. Of the five different species of honeybee occurring in Himachal Pradesh viz., *Apis cerana*, *A. dorsata*, *A. florea*, *A. laborosa* (all native) and *A. mellifera* (European honeybee), two species *A. cerana* and *A. mellifera* can be kept in hives and play a key role in honey production and crop pollination. It has been estimated that the successful beekeeping can generate self-employment to over 15 million rural and tribal families and can

produce annual income of over Rs. 4.5 billion by producing 150,000 tons of honey (Shende, 1992).

Nectar, the sugar juice of plants, which is the main source of carbohydrate fuel provides energy to the bees for their flight, foraging, hive activity and for rearing brood, whereas pollen grains formed in the anther consequent to the reduction division of sporogenous tissue enclosed by the anther wall (main source of proteins and lipids) are used mostly to feed the brood. The microscopic examination of the pollen grains in the honey is called melissopalynology and it helps in both the quantitative and qualitative analysis of honey (Nair, 1985). Such a analytical study provides useful data about pollen and nectar-yielding plants of a locality which should be helpful in establishing apiary gardens (Nair & Chaturvedi, 1974). Besides honey and wax, bees also provide unique products such as propolis (bee glue), bee venom (apitoxin), pollen, royal jelly (chyle) which all contain biologically active substances and are effective as medical cures. Interestingly, propolis has been found to effectively heal sores, burns and wounds.

NECTARIES

These are structures involved in the secretion of a sugary fluid called nectar, which attracts many insects to effect pollination. Nectaries occur on flowers (floral nectaries) and on vegetative parts (extrafloral nectaries). The floral nectaries are found in various positions on the flower whereas the extrafloral nectaries occur on stems, leaves, stipules and pedicels of flowers and are common in the members of the families Verbenaceae, Bignoniaceae and Euphorbiaceae. Both floral and extrafloral nectaries may occur on the same plant as in cotton and broad bean (Butler *et al.*, 1972; Davis *et al.*, 1988).

Secretory tissue of a nectary may be an epidermal layer or several layers of cell deep or trichomes as in *Abutilon* and *Lonicera* (Fig. 5). Usually, the secretory epidermal cells have dense cytoplasm, prominent nuclei, numerous mitochondria, endoplasmic reticulum and dictyosomes, and their cells may be papillate or elongated like palisade cells. On its outer side, the nectary tissue has a thick cuticle and the nectar accumulates between the cell wall and the cuticle. Later the cuticle ruptures releasing the nectar.

A nectary is closely associated with vascular tissues, mostly phloem. Nectaries do not simply release the sugar as it is supplied by the phloem, but they variously transform it by means of enzymes. Secretion of a nectar occurs for a very limited period.

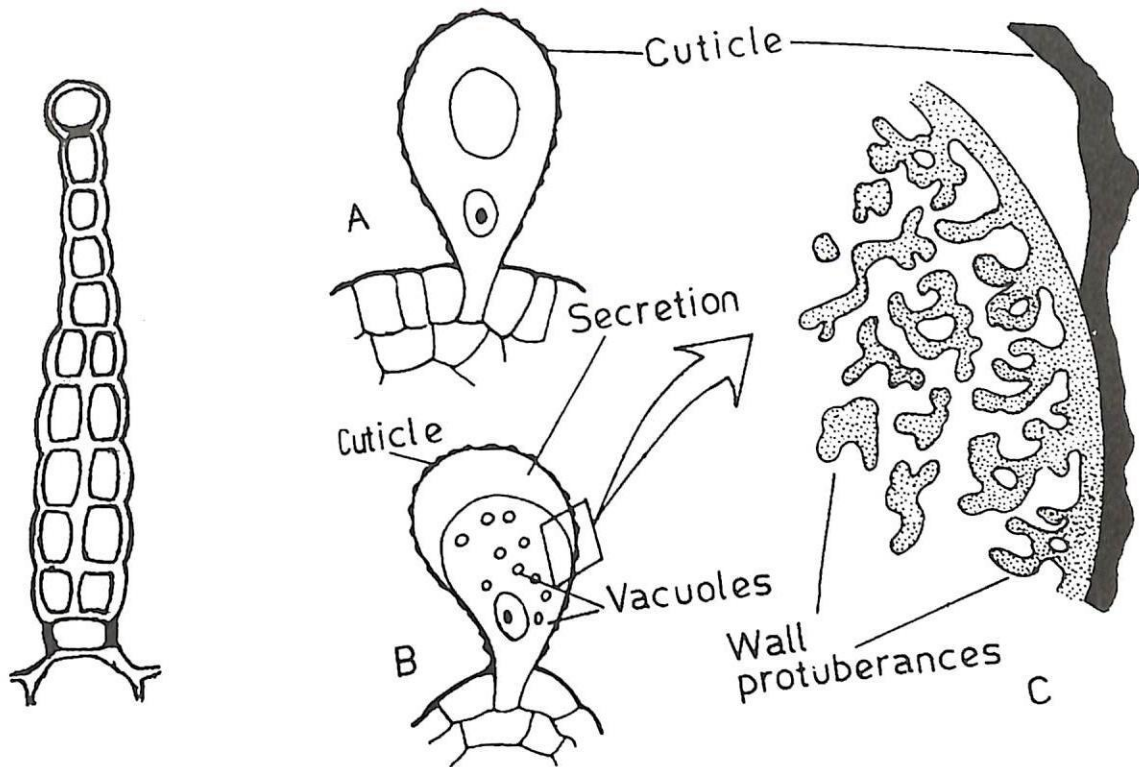


Fig. 5. (A) A nectary trichome from the calyx of *Abutilon*; (B) Secretion of surface nectary in *Euphorbia pulcherrima*; (C) Section of floral nectary of *Malus pumila*.

OVERVIEW OF HONEY PLANTS

Beekeeping has great potential for the upliftment of national economy. The Indian subcontinent is ethnically, floristically and agriculturally very diverse (Arora, 1990). At present China is the world's largest exporter of honey. In India, honeybees are estimated to be availing about one-fourth of the available floral resources, thereby having vast scope for expansion of this enterprise. The states of Jammu and Kashmir and Himachal Pradesh which fall in the north-west Himalaya are not only rich in floristic composition and panoramic views but also have varied pasturage availability in different agroclimatic conditions for sustaining bee colonies for increased honey production (Kaul, 1997; Chowdhery & Wadhwa, 1984; Polunin & Stainton, 1984).

From the Indian perspective, the literature on honey plants (bee flora) is not focused, except a very few relevant accounts of Kumar & Chaudhary (1993), Mishra & Kumar (1987) and Mishra & Kaushik (1992) who enlisted honey plants of the country from North Hill, Indo-Gangetic, North-Eastern and Peninsular regions (see Table 1).

Table 1. Honey Plants of India

Region	Honey Plants
North Hill region	<i>Acacia</i> spp., <i>Eucalyptus</i> , <i>Fagopyrum esculentum</i> , <i>Malus domestica</i> , <i>Toona ciliata</i> , <i>Citrus</i> spp., <i>Robinia</i> spp., <i>Brassica</i> spp., <i>Pyrus communis</i> , <i>Prunus domestica</i> .
Indo-Gangetic region	<i>Acacia catechu</i> , <i>Antigonon leptopus</i> , <i>Azadirachta indica</i> , <i>Bombax ceiba</i> , <i>Brassica campestris</i> , <i>B. juncea</i> , <i>Cajanus cajan</i> , <i>Citrus</i> spp., <i>Coriandrum sativum</i> , <i>Eucalyptus</i> , <i>Gossypium</i> spp., <i>Helianthus annuus</i> , <i>Litchi</i> spp., <i>Sesamum indicum</i> , <i>Trifolium indicum</i> .
North-Eastern region	<i>Eucalyptus</i> , <i>Machilus</i> spp., <i>Medicago sativa</i> , <i>Callistemon lanceolatus</i> , <i>Brassica</i> spp.
Peninsular region	<i>Anacardium occidentale</i> , <i>Bombax ceiba</i> , <i>Carvia callosa</i> , <i>Citrus</i> spp., <i>Cocos nucifera</i> , <i>Coffea</i> spp., <i>Eucalyptus</i> , <i>Eugenia</i> spp., <i>Gossypium</i> spp., <i>Guizotia abyssinica</i> , <i>Helianthus annuus</i> , <i>Hevea brasiliensis</i> , <i>Medicago sativa</i> , <i>Pongamia</i> spp., <i>Sapindus</i> spp., <i>Sesamum indicum</i> , <i>Terminalia</i> spp., <i>Brassica</i> spp.

Besides, there are a few location-specific studies describing honey flora in different localities viz., for Panjab (Rehman & Singh, 1941; Singh, 1948; Brar *et al.*, 1989), Bhopal (Khan, 1948), Mahabaleshwar Hills (Deodikar & Thakur, 1953; Thakar *et al.*, 1962), Northern India (Kohli, 1958), Castle Rock Area (Diwan *et al.*, 1964), Coorg (Suryanaryana, 1966), Delhi (Vasu, 1967), Kodai Hills (Chandran & Shah, 1974), Pusa-Bihar (Naim & Phadke, 1976), Saramal-Maharashtra (Chaubal & Kotmire, 1980) and Jokanhally, Banur-Tamil Nadu (Krishnaswamy, 1981).

For the region of north-west Himalaya, notable contributions on honey flora are those of Singh & Singh (1971) and Saraf (1972) on Kashmir; and Sharma & Raj (1985), Garg (1989), Sharma (1989); and Sharma & Gupta (1993) on Kangra Shivaliks, Paonta valley, Himachal Pradesh and Solan, respectively, whereas Partap (1997) enlisted more than 200 promising honey plants of the Hindu Kush Himalaya covering mountainous areas of Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. Analysis of the results of many surveys of honey flora conducted in the Indian Himalayas reveals that *Allium cepa*, *Litchi chinesis*, *Olea glandulifera*, *Rosa moschata*, *Rubus niveus*, *Shorea robusta* and species of *Berberis*, *Eucalyptus*, *Madhuca*,

Plectranthus, *Polygonum*, *Prunus*, *Pyrus*, *Rumex* and *Trifolium* are the main honey plants (Singh, 1983; Singh *et al.*, 1983, Verma, 1983). In the year 2000, Partap & Verma gave an overview of honey plants describing some aspects of honeybee species diversity, bee products, bee pollination of mountain crops, categorisation of bee flora, bee forage management and important bee plants of Himachal Pradesh. In spite of the above literature and documents, it is rather unfortunate that no attempt has been made so far to prepare a database on honey plant resources of the north-west Himalaya. Against this backdrop, an urgent need was felt to compile the scattered information on the aspect available from this region with a view to give information on the plants of value to the beekeeper as sources of nectar and pollen for seasonal management of colonies during lean periods and for increasing honey production.

ENUMERATION OF HONEY PLANTS

In order to collect data of interest for the preparation of an exhaustive database on honey plant resources (bee flora) of north-west Himalaya, the procedure delineated by Schultes (1962) and Jain (1964, 1967) was followed to scrutinize the old literature (herbals, books, monographs, ancient treatises, floras, compendia, *Materia Medica*, research journals), and the resultant information was compiled and collated in a set format designed by modifying that of Saklani & Jain (1994). For other aspects of information on synonyms, vernacular name(s); English, Hindi and Sanskrit name(s); distribution; flowering and fruiting; botanical description and active constituents, the works of Hooker (1872-1892), Kirtikar & Basu (1984), Anonymous (1948-1976), Chopra *et al.* (1956-1968), Rastogi & Mehrotra (1990, 1991, 1993, 1995a, b), Asolkar *et al.* (1992), Bhattacharjee (1998), Sood *et al.* (2001) and Sood & Thakur (2004) have been consulted and referred.

The present work enumerates scientific names of ever 290 honey plant resources of the north-west Himalaya in alphabetical order along with their synonyms if available and respective families. Vernacular name; English, Hindi and Sanskrit names; distribution; flowering and fruiting; description; active constituents and references, wherever known are also mentioned and presented. Some line drawings, and 15 plates containing 40 photographs have been included for convenience of reference and understanding. Besides, information on various families, genera and species of honey plants of the north-west Himalaya; predominant genera for use as honey plants; habit-wise categorization of honey plants; utilitarian categories of honey plants; Botanical names; English names; Hindi names; Sanskrit names and Glossary of important terms have been included as appendices.

HONEY PLANTS
OF THE
NORTH-WEST HIMALAYA

***Abelmoschus esculentus* (Linn.) Moench.**

(Pl. 1A)

Syn. *Hibiscus esculentus* Linn.; *H. longifolius* Roxb.

Family	– Malvaceae.
Vernacular name	– Bhindi.
English names	– Edible Hibiscus, Gobba, Gumbo, Lady's Finger, Okra.
Sanskrit names	– Asrapatraka, Bhenda, Chatupunda, Darivka.
Hindi names	– Bhindi, Bhindi Tori, Katavandi, Ramturai, Ranturi.
Distribution	– Cultivated throughout India.
Flowering & Fruiting	– November to April. N ³ , P ³ .
Description	– A tall cultivated annual herb covered with rough hairs. Leaves coarsely toothed; petiole bristly. Stipules subulate. Flowers yellow with a crimson centre. Fruit pyramidal-oblong, glabrescent; cells 5-8 seeded. Seeds striate, hairy.
Active constituents	– Quercetin-7-glucoside, quercetin-5-glucoside, quercetin-3- (0-glucosylglucoside)-4'- (0-glucosylglucoside), quercetin-3- (di-0-glucosylglucoside), quercetin-5- (0-rhamnosylglucoside), gossypetin-8-glucose, gossypetin-8- (0-rhamnosylglucoside), gossypetin-3-glucoside-8- (0-rhamnosylglucoside), and two anthocyanins- cyanidin-3-glucoside-4'-glucoside isolated from flower petals.
References	– Abrol (1997), Bennet (1987), Partap (1997), Rastogi & Mehrotra (1991), Saraf (1972).

***Acacia catechu* Willd.**

(Pl. 1B)

Syn. *A. polyacantha* Willd.; *A. wallichiana* DC.;
A. catechuoides DC; *A. sundra* Bedd.; *Mimosa catechu* Roxb.

Family	– Fabaceae.
Vernacular name	– Khair.
English names	– Black Catechu, Cutch Tree.
Sanskrit name	– Khadira.
Hindi names	– Babul, Katha, Khair.

- Distribution – Panjab to Sikkim; ascending to 1700 m.
- Flowering & Fruiting – May to July. P¹.
- Description – A moderate-sized tree with thorny branches and pinnate leaves. Leaflets 60-100, present in each pinna. Rachis prickly. The stipular spines are short, recurved, shiny brown and paired. Inflorescence lax axillary with pale-yellow flowers in cylindrical spikes. Pods 5-6 seeded, straight, flat, dry, and shiny dark brown.
- Active constituents – These are catechin, catechu, tannic acid, tannin (bark) and α , β , γ , -catechin and 1-epicatechin (wood).
- References – Abrol (1997), Garg (1989), Partap (1997), Raju (2000), Sharma (2004), Sharma & Raj (1985).

***Acacia modesta* Wall.**

Syn. *Mimosa dumosa* Roxb.; *M. obovata* Roxb.

- Family – Fabaceae.
- Vernacular name – Phalahi.
- Distribution – Western and Central Himalaya.
- Flowering & Fruiting – March to April. P¹.
- Description – A middle-sized tree with grey branches and dark brown prickles. Leaf rachis slender and with small glands. Corolla greenish. Pods 6-8 seeded, glabrous.
- References – Abrol (1997), Bhardwaj (2003), Garg (1989), Partap (1997), Sharma & Raj (1985).

***Acacia nilotica* Delile ssp. *indica* (Benth.) Brenan.**

Syn. *Acacia arabica* Willd. var. *indica* Benth;
A. nilotica var. *indica* (benth.) Hill.; *A. vera* Willd.; *Mimosa arabica* Lam.

- Family – Fabaceae.
- Hindi names – Babul, Kikar.
- Distribution – Temperate Himalaya.
- Flowering & Fruiting – May to July. N³, P³.
- Description – A shrubby tree with straight branchlets. Spines white,

long, ascending and pungent. Leaf rachis with glands, pinnae long; leaflets membranous, green. Calyx campanulate. Corolla yellow.

- Active constituents – Stearic acid, kaempferole-3-glucoside, isoquercitrin, leucocyanidin and an unidentified phenolic compound isolated from flowers.
- References – Bennet (1987), Bhardwaj (2003), Deodikar (1970), Garg (1989), Partap (1997), Rastogi & Mehrotra (1991), Sharma & Raj (1985).

***Adhatoda vasica* Nees.**

(Pl. 2A)

Syn. *Justicia adhatoda* Linn.; *A. zelanica* Medik.

- Family – Acanthaceae.
- Vernacular name – Basuti, Brankad, Maker.
- English names – Malabar Nut Tree, Vasaka.
- Sanskrit names – Arus, Vasaka.
- Hindi names – Adalra, Adosa, Adulosa, Arusha, Bansa, Rusa, Vasaka.
- Distribution – Frequently cultivated throughout India.
- Flowering & Fruiting – February to April. N², P².
- Description – A wild shrub with minutely pubescent, elliptical leaves. Spikes dense short. Corolla white, tube short. Capsule 4-seeded. Seeds glabrous, tubercular-verrucose.
- Active constituents – Vasicinone, isolated from inflorescence; 2'-hydroxy-4-glucosyloxychalcone identified in flowers.
- References – Abrol (1997), Garg (1989), Partap (1997), Raju (2000), Sood & Thakur (2004), Rastogi & Mehrotra (1995), Sharma & Raj (1985), Sood & Thakur (2004).

***Aesculus hippocastanaceae* Linn.**

- Family – Sapindaceae.
- Distribution – Western Himalaya: 1350-3500 m.
- Flowering & Fruiting – May to June. N¹, P¹.

- Description – A tree having opposite, deciduous, exstipulate leaves and serrated leaflets. Flowers large, polygamous, irregular. Fruits capsular, 1-3 celled. Seeds subglobose, exalbuminous with a broad hilum.
- Active constituents – Oil from buds contains 3,5,3'-trihydroxy-7,4',5'-trimethoxyflavone.
- References – Deodikar (1970), Partap (1997), Rastogi & Mehrotra (1995), Saraf (1972), Shah & Shah (1976).

***Aesculus indica* Linn.**

(Pl. 2B)

Syn. *A. (Pavia) indica* Colebr.

- Family – Sapindaceae.
- Vernacular name – Handoon.
- English name – Horse Chestnut.
- Distribution – North-West Himalaya: 1350-3500 m.
- Flowering & Fruiting – May to June. N¹, P¹.
- Description – Trees having serrated leaflets and large, polygamous, irregular flowers. Petals clawed. Fruits capsular, 1-3-celled. Each cell contains subglobose, exalbuminous seed with a broad hilum.
- References – Abrol (1997), Deodikar (1970), Partap (1997), Saraf (1972), Shah & Shah (1976).

***Ageratum conyzoides* Roxb.**

(Pl. 2C)

Syn. *A. cordifolium* Roxb.

- Family – Asteraceae.
- Vernacular name – Neela Phulnu.
- English names – Goat Weed, White Weed.
- Sanskrit name – Viramustih.
- Hindi name – Koobhi.
- Distribution – Throughout India; ascending the Himalaya to 1700 m.

- Flowering & Fruiting – May. P³.
- Description – A hispidly hairy annual having flowers in small, dense terminal corymbs. Ray-florets many, pale blue or white in colour. Achenes black. Pappus 5-awned.
- Active constituents – Flowers yield 6-demethoxyagertochromene (procene I), ageratochromene (procene II) and β -caryophyllene.
- References – Garg (1989), Partap (1997), Rastogi & Mehrotra (1995), Sharma (2004), Sood & Thakur (2004).

***Ailanthus excelsa* Roxb.**

- Family – Simaroubaceae.
- Sanskrit names – Limmbado, Maharukha.
- Hindi names – Aralu, Atarusha, Madala, Mahanimba, Maharakha, Pisasha.
- Distribution – Often planted in various parts of India.
- Flowering & Fruiting – May to June. N³.
- Description – Trees with much-branched panicles and ovate-lanceolate, reflexed petals. Filaments usually half the length of the anther. Fruits strongly veined. Seeds solitary in the centre of samara.
- References – Abrol (1997), Kirtikar & Basu (1984), Saraf (1972), Shah & Shah (1976).

***Ailanthus glandulosa* Desf.**

Syn. *A. altissima* (Mill) Swingle.

- Family – Simaroubaceae.
- Vernacular name – Alanthrus.
- Distribution – North India.
- Flowering & Fruiting – Late May to June. N³.
- Description – A large-sized tree having imparipinnate leaves. Flowers small, polygamous, bracteolate, and in large axillary panicles. Petals volvate. Seeds central.
- References – Abrol (1997), Saraf (1972), Shah & Shah (1976).

***Albizia lebbek* Benth.**

Syn. *A. latifolia* Boivin.; *Acacia speciosa* Willd.; *A. sirisa* Ham.;
A. lebbek Willd.; *Mimosa speciosa* Jacq.; *M. sirisa* Roxb.; *M. lebbek* Benth.

Family	- Fabaceae.
Vernacular name	- Sirish.
English names	- Parrot Tree, Siris Tree.
Sanskrit names	- Barhapushpa, Bhandi.
Hindi names	- Garso, Shirish, Sirin.
Distribution	- Tropical Himalaya; ascending to 1700 m.
Flowering & Fruiting	- April. N ² , P ² .
Description	- A tall tree. Leaves bipinnate, leaflets short-stalked. Flowers in globose heads, 5-merous and hermaphrodite. Corolla greenish-yellow. Pod strap-shaped, firm, yellow-brown.
Active constituents	- Echinocystic acid, lebbekanin D-glucose, galactose, arabinose, xylose and rhamnose 2:2:5:3:3, lebbekanin F-glucose, arabinose, xylose, fructose and rhamnose, lebbekanin G-glucose, arabinose, xylose, fructose and lebbekanin H-glucose isolated from flowers.
References	- Abrol (1997), Rastogi & Mehrotra (1995), Sharma (2004), Sharma & Raj (1985).

***Albizia stipulata* Boiv.**

Syn. *A. chinensis* (Obs.) Merr.; *Mimosa chinensis* Obs.; *Acacia stipulata* Wall.;
A. marginata Ham.; *Mimosa stipulacea* Roxb.; *M. smithiana* Roxb.;
Arthrospiaion stipulatum Hassk.

Family	- Fabaceae.
Vernacular name	- Oee.
Hindi names	- Kanujerra, Sam Sunddra.
Distribution	- Tropical Himalaya; ascending to 1350 m in Kumaon and Sikkim.
Flowering & Fruiting	- March to June. N ³ .
Description	- A tall unarmed tree with grey branchlets and leaves with

many glands on the rachis. Leaflets membranous, sessile. Flowers in globose heads which are in compound terminal racemes. Pods indehiscent.

References – Garg (1989), Sharma (2004), Sharma & Raj (1985).

***Allium cepa* Linn.**

Syn. *A. cepa* Roxb.; *A. cepa* Wall.; *A. cumaria* Herb.

Family	– Liliaceae.
Vernacular name	– Gande.
English name	– Onion.
Sanskrit names	– Dirghapatra, Mahakanda, Palandu, Rajapriya.
Hindi name	– Piyaz.
Flowering & Fruiting	– May to June. N ² , P ² .
Description	– Cultivated, scapigerous herbs having coated bulbs and narrow leaves. Flowers capitate, umbelled and pedicelled. Sepals linear-oblong. Seeds black.
Active constituents	– Flowers possess alliospiroside A and alliofuroside A.
References	– Abrol (1997), Deodikar (1970), Gupta (2004), Partap (1997), Saraf (1972).

***Allium sativum* (Linn.) Cav.**

Syn. *A. sativum* Roxb.

Family	– Liliaceae.
English names	– Churl's Treacle, Garlic.
Hindi names	– Lahsun, Lasan.
Sanskrit names	– Arishtha, Bhutabhna, Lahsuna, Rasona.
Distribution	– Throughout India.
Flowering & Fruiting	– May to June. N ¹ , P ¹ .
Description	– Cultivated scapigerous herbs with flat leaves and long-beaked scape. Sepals lanceolate.
References	– Abrol (1997), Deodikar (1970), Gupta (2004), Partap (1997), Saraf (1972).

***Alnus nitida* Endl.**

Syn. *Clethropsis nitida* Spach.

- Family – Arecaceae.
 English name – Alder.
 Distribution – Throughout India.
 Flowering & Fruiting – September-November. N³, P².
 Description – A large deciduous tree upto 33 m. Leaves elliptic-ovate
 Male spikes in terminal racemes.
 Reference – Abrol (1997).

***Althaea officinalis* L.; DC.**

- Family – Malvaceae
 English name – Marsh Mallow.
 Hindi names – Gul-Khairo, Khitmi-Ka-Jhar.
 Distribution – Jammu & Kashmir.
 Flowering & Fruiting – April to July. N³, P³.
 Description – A perennial cultivated downy herb. Leaves ovate simpl
 Flowers peduncled in axillary clusters. Bracteoles linea
 lanceolate, Anther valves subglobose.
 Active constituents – Flowers and calyx rich in tiliroside, naringenin-4'-β-1
 glucose and dihydro-kaempferol-4'-β-D-glucosid
 kaempferol-3-glucose, quercetin-3-glucoside, 8- hydrox
 luteolin-8-gentibioside and salicylic, vannilic, ferul
 syringic, caffeic, P-hydroxybenzoic, P-coumaric and
 hydroxylactic acids.
 References – Abrol (1997), Partap (1997), Rastogi & Mehrotra (199
 Saraf (1972), Shah & Shah (1976).

***Althaea rosea* Linn.**

(Pl. 3A)

Syn. *A. coromandelina* Cav.; *A. chinensis* Wall.

- Family – Malvaceae.
 Vernacular name – Saze Posh.

English name	- Common Hollyhock.
Distribution	- Cultivated in Indian gardens.
Flowering & Fruiting	- April to June. N ² , P ² .
Description	- Pubescent herbs. Leaves more or less deeply divided. Flowers peduncled, axillary and in long terminal racemes. Seed solitary in each carpel, ascending.
Active constituents	- Flowers contain rutin, chrysin, kaempferol, robinetin, acacetin and phlorin.
References	- Bhardwaj (2003), Partap (1997), Rastogi & Mehrotra (1993), Saraf (1972), Shah & Shah (1976).

***Amaranthus spinulosus* Linn.**

Family	- Amaranthaceae.
English names	- Prickly Amaranth, Spiny Amaranth.
Sanskrit names	- Apamarisha, Marish, Tandulu, Tanduliya.
Hindi names	- Choli, Janumarak, Kantabhaji, Kantanatia, Kanla Nutia.
Distribution	- Throughout India.
Flowering & Fruiting	- June to July. N ³ , P ³ .
Description	- Erect, glabrous annuals. Leaves long-petioled. Leaf axils with 5 spines. Flowers in axillary clusters. Bracts setaceous. Seeds black.
References	- Abrol (1997), Deodikar (1970), Partap (1997).

***Ammi majus* Linn.**

Syn. *Apium ammi* Crantz.; *Ammi visnaga* (Linn.) Lamk.;
Ammi diversifolium Noulet.; *Dacus visnaga* Linn.;
Visnaga daucoides Gaertn.

Family	- Apiaceae.
Vernacular names	- Honey Plant, Greater Ammi, Bullwort.
English names	- Ammi, Akkerscherm, Bishops Weed, Honey Plant Khella, Tooth Pick Ammi.
Hindi names	- False Queen Annes Lace, Lace Flower.

- Distribution – Trans-North-West Himalaya.
 Flowering & Fruiting – March to April. N¹, P¹.
 Description – Glabrous annuals upto 30-100 cm in height and having grooved stems which is branched at the top. Basal leaves in rosette; leaves pinnate pale-green, shiny; and slightly glazed. Flowers white, united in umbel of 20-30 rays with indented petals. Fruits ovoid, achenes laterally compressed.
 Reference – Abrol (1997).

***Aneilema nudiflorum* (L.) R.Br.**

Syn. *A. radicaus* Don.; *A. diandrum* Ham.; *A. debile* Wall.;
A. nudicaule Kunth.; *A. minutum* Kunth.; *A. foliosum* Hassk.;
A. diversifolium Hassk.; *Tradescantia malabarica* Linn.

- Family – Acanthaceae.
 Vernacular name – Doveweed, Spreading Flower.
 Flowering & Fruiting – July. N², P².
 Description – Herbs. Stem and branches slender, diffuse. Flowers pedicelled and in terminal panicles. Petals small, blue or purplish. Seeds form a capsule.
 Reference – Sharma (1970).

***Anemone nemrosa* Linn.**

Syn. *A. ranunculoides* L.; *A. griffithii* H.f.

- Family – Ranunculaceae.
 Vernacular name – Wood Anemone.
 English name – Anemone.
 Distribution – Kashmir, Eastern Himalaya, Lachen valley in Sikkim.
 Flowering & Fruiting – April to June. N³, P³.
 Description – A small-sized wild plant. Leaves 3-partite; segments cuneate at the base, tapering upwards to a point, 3-lobed; lobes incisocrenate. Flowers white or pinkish.
 Reference – Saraf (1972).

***Antirrhinum majus* Linn.**

Family	- Scrophulariaceae.
Vernacular name	- Dog Flower.
English names	- Antirrhinum, Snapdragon.
Distribution	- Subspontaneous in India.
Flowering & Fruiting	- March to April. N ¹ , P ¹ .
Description	- Annual herbs with small and hairy leaves. Flowers reddish, snout-like. Seeds numerous.
Active constituents	- Flowers rich in apigenin, aureusidin, kaempferol, lutealin, quercetin, cyanidin and pelargonidin.
References	- Partap (1997), Rastogi & Mehrotra (1991).

***Apium graveolens* Linn.**

Family	- Apiaceae.
Vernacular name	- Celery.
English name	- Wild Celery.
Hindi names	- Ajmud, Bori-ajmud, Karafs.
Distribution	- North-West Himalaya, Panjab.
Flowering & Fruiting	- March to April. P ¹ .
Description	- Biennials. Radical leaves pinnate with large deeply lobe segments. Umbels compound. Flowers white.
Reference	- Abrol (1997).

***Arctium lappa* Linn.**

Syn. *Lappa major* Gaertn.; *L. tomentosa* Lamk.

Family	- Asteraceae.
Vernacular name	- Burdock.
English name	- Burdock.
Hindi name	- Jangli-Kuth.
Distribution	- Western Himalaya (Kashmir to Shimla): 2000-2700 m
Flowering & Fruiting	- March to July.

- Description - A tall coarse herb. Leaves alternate, radical, cottony beneath. Heads terminal, sessile, purplish. Involucre subglobose.
- Reference - Saraf (1985).

***Argemone mexicana* L.**

- Family - Papaveraceae.
- English names - Mexican Poppy, Pivia-Dhotra, Prickly Poppy, Yellow Mexican Poppy.
- Sanskrit names - Brahmadani, Pitapushpa, Srigalakantaka, Svarnakshri.
- Hindi names - Bhabhand, Biladhutura, Brahmadundi Poppy, Brahmi Shialkanta, Suchianas.
- Distribution - Subtropical, Subtemperate and Temperate regions.
- Flowering & Fruiting - May to July. N², P².
- Description - An erect prickly annual with bright yellow flowers. Stamens indefinite. Ovary 1-celled. Capsule short prickly, oblong-ovoid, 2.5-3.8 cm, opening by 4-6 valves. Seeds numerous, globose, netted.
- References - Abrol (1997), Kirtikar & Basu (1984), Sharma (1970).

***Artemisia absinthium* Linn.**

Syn. *Absinthium vulgare* Gaertn.; *A. officinale* Lam.

- Family - Asteraceae.
- Vernacular names - Tethwena, Warm Wood.
- English names - Absinth, Madderwort, Mingwort, Mugwort, Old Woman Warmot.
- Sanskrit name - Damar.
- Hindi name - Vilayatiafrantin.
- Distribution - Kashmir: 1700-2350 m.
- Flowering & Fruiting - May to June. P².
- Description - Hoary-pubescent perennial herbs with stems erect angular and ribbed; leaves unequally pinnatifidly cut and segments hoary on both surfaces. Radical and lower

- cauline narrowed into winged petioles. Heads pedicelled, hemispheric and in drooping racemes. Receptacular hairs long straight. Achenes elliptic-oblong.
- Active constituents – These are α - and β -pinenes, P-cymene, β -phellanderene, azulene, cineole, thujone, neral, neryl acetate and cardinene (volatile oil of flower).
- References – Abrol (1997), Deodikar (1970), Partap (1997), Rastogi & Mehrotra (1995), Saraf (1972).

***Artemisia parviflora* Roxb.**

Syn. *A. glabrata* DC.; *A. cuneifolia* DC.

- Family – Asteraceae.
- English name – Worm Wood.
- Distribution – Throughout India from Kashmir (2350-3000 m) to Sikkim (2350-3650 m).
- Flowering & Fruiting – May to July. P².
- Description – A glabrous inodorous herb upto 1 m. Leaves variable; lowest palmately spreading, the upper middle pinnatifid with narrow lobes. Heads pedicelled, greenish; flowers 6-10. Achenes ellipsoid, smooth, brown.
- Reference – Abrol (1997).

***Asclepias curassavica* L.**

- Family – Asclepiadaceae.
- Vernacular name – Milkweed.
- English names – West Indian Ipecacuanth, Wild Ipeca Cuanha.
- Sanskrit name – Kaktundi.
- Hindi name – Kakatundi.
- Distribution – Naturalised in many parts of India.
- Flowering & Fruiting – April to June. N², P².
- Description – Perennial erect herbs having opposite, alternate leaves and umbelliform cymes. Flowers small. Corolla rotate, naked. Seeds ovoid, comma 3 cm long.
- References – Kirtikar & Basu (1984), Abrol (1997).

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