

**Preparation of value added products from flower and fruits of
*Bombax Ceiba (Simbal tree)***

Dissertation 1 Report

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CERTIFICATE

This is to that **Anjali kishor** (Registration No. 11715596) has personally completed M.Sc. dissertation II entitled “**Preparation of value added products from flower and fruits of *Bombax ceiba (Simbal tree)***” under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of dissertation has ever been submitted for any other purpose at any University.

The project report is appropriate for the submission and the partial fulfillment of the conditions for the evaluation leading to the award of Master of Food Science and Technology.

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Chapter 1: Introduction

Plants have been used by mankind since the evolution of human beings. They had been remained integral part of food, medicines, healthcares and other useful things. In India there are about 1748 species of medicinal plant and 1532 species of wild food plants with various traditional uses (Semant *et al.*,1998).Out of these 675 species are found in Himalayan region (Kala, 2007; Reddy *et.al.*, 2007, Samant and Dhar 1997). Himachal Pradesh is the North western Himalayan state of India and has a wide topography ranging in latitude from 30° 22' 40" N to 33° 12' 40" N and longitude from 75° 45' 55" E to 79° 04' 20" E. the sea level height in state ranges from 350 meters in planes to 6975 meters in the upper hills (Himachal Forest Statistics, 2013). The hill people are dependent on the forests for their food, medicines and other daily needs. They are well aware about toxic varieties and are using a variety of forest harvest in their routine life for food, medical and other purposes. Besides providing basic nutrition wild produce is also rich in phyto-chemicals like phenolics, alkaloids, terpenoids etc. These phytochemicals have a capability to cure various diseases and hence such foods are also considered as protective foods (Rai *et al.*, 2004). Among such trees *simbal* also occupies a unique place. *Simbal* tree is found in Northern states of Himachal Pradesh. Its average height is 20cm. It is also known by various other names such as *Kapok*, Red silk-cotton or Red cotton tree. Flowers are red in colour and are used to prepare vegetable and pickles (Uprety et al, 2012). In Northern Thailand the dried petals are important component of the spicy noodle soup of the cuisine of Northern Thailand. Fruiting can start as early as March. Immature fruits are light green in colour, while on maturations their colour changes to brown, shell becomes hard and hence they become unfit for consumption.

Chapter 2: Review of literature

2.1 Distribution and traditional uses

There are total 675 edible wild plant species in Himachal Pradesh (Kala, 2007; Reddy et.al. 2007). Various parts of these plants like fruits, leaves, stems, bark are used for edible purposes. The various edible plants/trees and their edible parts has been discussed in Table 1. The fruits are used fresh or processed into pickles and chutney. *Aesculus Indica* (*Khanor*) is found in Mandi, Shimla, Dharampur, Kasauli, Dharamsala regions of state. It is found up to about 3,000 m above the sea level. Seeds are bitter in taste and hence bitterness need to be removed before consumption. To remove bitterness, seeds are separated from the fruits and crushed to get smaller pieces in order to remove bitterness. The crushed seed are kept in a big bamboo basket, and then placed under running water. These seeds are stirred daily to enhance the cleaning process and to prevent spoilage of seeds. After washing, seeds are dried and beaten into flour, called *Tattawakher* (Rajasekaran and Singh, 2009). The flour is mixed with wheat flour to make chapattis and also to make a *halwa* (*porridge*). *Juniperus indica Bertol.* (*Bhitaru*) mainly grows in range of 3300 to 4000m above the sea level and is found majorily in Lahaul and Spiti, Kullu, Kinnaur and Shimla. The dried leaves are used for dhoop preparation and an extract of fresh leaves are used in the fermentation of ingredients for the wine known locally as *balma* (Makhuri et al., 2000). Pods of *Moringa oleifera Lam.* (*Drumstick tree*) leaves are garnished with mustard seeds, their paste are cooked like beans and consumed with rice (Pandey et.al, 2011). *Bombax ceiba* (*Simbal tree*) found in Mandi, Bilaspur, Palampur, Kangra, Shimla. Its flowers are cooked as vegetable. Ripe seed are roasted, and oil obtained from the seeds. Young roots are eaten fresh (Rameshwar et.al, 2014).

Table 1: Various wild trees found in Himachal, their distribution, food applications and medicinal uses

Name	Flowering Time	Fruiting Time	Distribution	Food applications	Medicinal uses	Reference
<i>Aesculus Indica</i> (<i>Khanor</i>)	April-may	Sept-Oct.	Mandi Shimla Dharampur Kasauli Dharamsala	Fruits are edible. Flour is mixed with wheat flour to make chapattis and <i>halwa</i> .	Treatment of skin diseases Rheumatis Relief of headache.	Chauhan <i>et al.</i> , 2016.
<i>Bombax ceiba</i> (<i>Simbal Semal</i>)	Jan-March	March	Mandi Bilaspur Palampur Kangra Shimla	Flowers are cooked as vegetable. Ripe seed are roasted, and oil obtained from the seeds. Young roots are eaten fresh.	Flower is used as astringent and good for skin trouble, haemorrhoids. Roots are used for the treatment of dysentery. Leaves are used for the treatment of skin irritation.	Rameshwar <i>et.al</i> , 2014
<i>Juniperus indica</i> Bertol. (<i>Bhitaru</i>)	Jan-Feb	Sep-Oct	Lahaul and spiti Kullu Kinnaur Shimla	Fresh leaves are used in the fermentation of ingredients for the wine known locally as <i>balma</i> .	Leaves of Juniper are used to increase appetite, Cure stomachache, killing microorganisms of stomach, controlling dysentery, piles, bronchitis etc. Fruit is used for curing Asthma, old bronchitis, lever and bone marrow related diseases.	Makhuri <i>et al.</i> ,2000
<i>Moringa oleifera</i> Lam. (<i>Drumstick tree</i>)	March-may	April-June	Darlaghat Una Hamirpur	Fruits and leaves are used as vegetable. Pods garnished with mustard seeds paste are cooked like beans and consumed with rice.	Stem and the root for the treatment of ear infection.	Pandey <i>et.al</i> , 2011

2.2 Nutritional composition of edible part of wild trees in Himachal Pradesh

In Himachal Pradesh Wild trees are also rich source of nutrients like carbohydrates, proteins, fat, dietary fiber, minerals and vitamins. The nutritional composition of the edible parts of wild trees is given in Table 2. The seeds of *Amaranthus Cuadatus L.*, leaves of *Capsella bursapastoris Medic.*, and *Sonchus oleraceus* Linn. contain major nutrients. Leaves on dry basis of *Bombax ceiba* rich in minerals i.e. 7.82, and also contain high amount of calcium and potassium i.e. 177 and 153.66 respectively.

Table 2: Nutritional composition of various edible parts of wild trees

TREE	EDIBLE PARTS	Macronutrients (%)	Major Minerals (mg/100g)	REFERENCE
<i>Amaranthus Cuadatus L.</i> (Damkhon)	Seeds	Carbohydrates- 64 Proteins- 14 Fat-10 Dietary fibre- 8 Total minerals- 2.5	Calcium -370.3 Potassium -341.9 Magnesium-65.87 Iron-12.23 Zinc -0.91	Pedersen <i>et.al</i> ,1987 Kachiguma <i>et al.</i> , 2015
<i>Bombax ceiba</i>	Leaves(dry basis)	Carbohydrates- 1.48 Proteins- 0.7 Fat-0.75 Dietary fiber- 2.85 Total minerals- 13.23	Sodium - 19.07 Potassium - 153.66 Calcium - 177 Magnesium- 48.15 Chromium - 0.005 Iron - 1.54 Zinc- 27.09 Aluminum - 3.320 Copper – 0.059 Lead - 0.020 Manganese - 0.177 Nickel – 0.012	Bhogaonkar <i>et.al</i> , 2016 Aziz <i>et.al</i> , 2016
<i>Capsella bursapastoris Medic.</i> (Chibotey)	Leaves	Carbohydrates- 44.1 Proteins- 35.6 Fat-4.2 Dietary fibre- 10.2 Total minerals- 16.1	Calcium-935 Phosphorus-240 Magnesium-155 Potassium-1923 Sodium- 44 Sulfur-136 Zinc-2382 Iron- 25455 Copper-1253	Ali-snafi ,2015 Tuncturk <i>et al.</i> , 2015
<i>Sonchus oleraceus</i> Linn. (Puyanau)	Leaves	Carbohydrates- 44.1 Proteins- 35.6 Fat-4.2 Dietary fibre- 10.2 Total minerals- 16.1	Magnesium- 0.610 Calcium -2.992 Potassium -4.558 Phosphorus-0.352 Sodium -0.05 Iron-19.3 Zinc-30 Copper -13 Manganese- 191	Guil-Guerrero <i>et al</i> , 1998 Jimoh <i>et al.</i> , 2011

2.3 Phytochemical content and their medicinal use

Plants are rich source of phytochemicals and are used to cure various diseases. Phytochemicals are naturally occurring and biologically active plant compounds (Saxena et.al, 2013). They play an important role in plant growth, defense against pathogens and have disease inhibition capabilities. Various phytochemical like flavonoid, alkaloids, tannins, phenol, sterol, saponins, terpenoids etc. possess medicinal values. Major phytochemicals and their medicinal application has been described in Table 3. Leaves of *Aesculus Indica*, Seeds of *Carum carvi* L., and leaves of *Dipsacus Inermis* Wall contain important phytochemicals. Leaves, roots and stem bark of *Bombax ceiba* contains major phytochemicals like alkaloid and saponins. Leaves are used for the treatment of skin irritation, paste of fresh bark are used to heal wounds and its powder used for the treatment of constipation. Paste of roots used to cure piles and its juice are also used in the treatment of Gynaecological disorder (Aguoru *et al.*, 2015).

Table 3: Phytochemicals present in edible part of wild trees

Flower	Part used for consumption	Phytochemical reported (%)	Reference
<i>Aesculus Indica</i> (Khanor)	Leaves	Tannins – 5 Saponin - 13.4	Kaur <i>et.al.</i> , 2011
<i>Bombax ceiba</i> (Simbal)	Leaves	Saponins - 5.04 Steroids - 0.18 Flavonnoids - 3.1	Aguoru <i>et al.</i> , 2015
	Root	Alkaloids - 1.04 Saponins - 1.37	
	Stem bark	Alkaloids - 1.52	
<i>Carum carvi</i> L. (Kala Jeera)	Seeds	Limonene - 1.5 – 51.3 Carvone - 44.5 – 95.9 β -Myrcene - 0 – 0.4	Raal et.al, 2012
<i>Dipsacus Inermis</i> Wall (Wapal hath)	Leaves	Triterpenoids Iridoids Phenolics Alkaloids	Zhao and Shi ,2011

2.4 Medicinal formulations from wild trees

Depending up on the composition different parts of plants are used as herb or formulation of traditional medicines. The various commercial medicines prepared using these wild trees are described in Table 4. Whole plant of *Achyranthes aspara* Linn. are used to prepare Kshara , Gorochandi Gulika medicine (Jadav *et.al*, 2015). Roots of *Berberis asistala* DC. are used to prepare Darubaridra medicines (Sharad *et.al*, 2006). Roots and stems of *Cissampelos pareira* Linn. are used to prepare Pyshyanuga churna medicines (Kaur *et.al*, 2016).

Table 4: Commercial medicines prepared from wild plants

Trees	Part used	Medicines	Manufacturer	Reference
<i>Achyranthes aspara</i> Linn.	Whole plant	Kshara Gorochandi Gulika	AVN, Kottakkal Arya Vaidya Sala.	Jadav <i>et.al</i> , 2015
<i>Berberis asistala</i> DC.	Root	Darubaridra	Neeraj Enterprises Hyderabad, an herbal manufacturing unit.	Sharad <i>et.al</i> , 2006
<i>Cissampelos pareira</i> Linn.	Root, Stem	Pyshyanuga churna	AVN Ayurveda Formulations Pvt. Ltd.	kaur <i>et.al</i> , 2016

2.5 Limitations and solutions

Some of the phytochemicals present in the wild produce also act as antinutrients and hence decreases the absorption and utilization of nutrients present in food. It is important to reduce antinutrients to a safer limit to increase their nutritional value. Various traditional methods of food preparation like cooking, extraction, fermentation of food are known to decrease the antinutrients. The major antinutrients and the ways for their removal are described in Table 5. *Aesculus Indica* contains antinutrients like oxalate, phytate, tannin and saponin in a higher amount. To reduce these factors, microwave treatment for 2.5 minutes has been reported most effective by Rafiq *et al.*, (2016). *Lathyrus sativus* Linn contain a large number of antinutritional substances, the most frequently occurring antinutritional substances are tannin, phytic acid, trypsin inhibitor and β -ODAP. Fermentation of *Lathyrus* seed reduces tannin and phytic acid approximately by 80% and extrusion of the seeds results in the more reduction of β -ODAP level approximately by 46.09% (Ramachandran and Ray, 2008). Raw leaves of *Moringa oleifera* are

rich in phytate, total phenol, saponins and tannins. However, the juice extracted from leaves contains no tannins (Foidl *et al.*, 2001).

Table 5: Antinutritional properties of some wild tree

Name	Antinutrients (%)	Treatment to reduce antinutritional factors	Reference
<i>Aesculus Indica</i>	Oxalate - 0.0004 Phytate - 0.00004 Tannin – 0.0012 Saponin –0.0002	Microwave treatment for 2.5 minute reduces the content of oxalate, phytates, tannins and saponins by 95.45%, 91.67%, 68.14%, 87.19%, respectively..	Rafiq et al, 2016
<i>Lathyrus sativus</i> <i>Linn.</i>	Tannin - 1.3 Phytic acid - 6.52 Trypsin inhibitor - 31.42 β -ODAP- 1.28	Fermentation of <i>Lathyrus</i> seed reduces tannins by 80.7%, phytic acid by 85.1%, while trypsin inhibitor is unaffected. Extrusion of the seeds reduces β -ODAP level by 46.09%.	Ramachandran and Ray, 2008
<i>Moringa oleifera</i>	Tannins – 1.4 Phytate - 3.1 Total phenols – 3.4 Saponins – 5.0	Extraction of <i>Moringa</i> leaves reduced the tannin by 100%, phytate by 19.35%, total phenols by 52.94% and saponins by 96%.	Foidl <i>et al.</i> , 2001

Chapter 3: Proposed research objectives:

1. To conduct a survey to explore traditional dishes prepared from the flower and fruits of *Bombax ceiba*.
2. To determine the proximate composition of fruit and flower of *Bombax ceiba*.
3. To prepare of value added products from the flower and fruits of *Bombax ceiba*.
4. To study the storage life of prepared products.

Chapter 4: Detailed plan work:

Experiment I:

4.1 A survey will be conducted in various part of Himachal Pradesh to explore the traditional use of *Bombax ceiba*.

Table 6: Questionnaire for the survey of traditional use of *bombax ceiba* in various part of Himachal Pradesh.

PLACE:	DATE:
PERSON NAME:	
1. Do you use Bombax Ceiba for food purpose. (Simbal tree)	<ul style="list-style-type: none">• Yes ()• No ()
2. If yes, then which part is used.	<ul style="list-style-type: none">• Branch ()• Skin ()• Flower ()• Leaves ()• Fruit ()
3. Months of flowering.	<ul style="list-style-type: none">• January ()• February ()• March ()• April ()• May ()• June ()• July ()• August ()• September ()• October ()• November ()• December ()
4. It's believed health benefits.	
5. It's believed toxication.	
6. In which form it is consumed.	<ul style="list-style-type: none">• Fresh ()• Pickles ()• Sbjji ()• Chatni ()• Juice ()
7. Pretreatment	

8. Consumption limits.	
9. Storage life of product.	
10. It's processing steps.	
11. It is used alone or mixed with other vegetables.	<ul style="list-style-type: none"> • Yes () • No ()
12. If Yes, then in which vegetables.	
13. Is it sold in the market?	<ul style="list-style-type: none"> • Yes () • No ()
14. If yes, then which form it will sold.	
15. Other benefits of this tree.	
16. Any medicinal use of the tree.	

4.2 Quality evaluation of flower and fruits of *Bombax ceiba*

4.2.1 Test to be performed:

Proximate composition

1. Moisture content (Hot air oven method by AOAC, 2005)
2. Ash (AOAC, 2005)
3. Total sugar (Lane and Eynon micrometric method by AOAC, 1999).
4. Proteins (Kjedhal method by AOAC 2005)
5. Fats (Soxhlet extraction method)
6. Dietary Fibers (Van Soest and Wine (1967), AOAC 991.43)
7. Crude fiber (AOAC 2000)

Anti-nutrient factors

1. Flavonoids (Elezabeth and Subramanian, 2013)
2. Alkaloids (Lakhvir et.al, 2011)
3. Total phenols (Sakakibara et al. 2003)
4. Anthocyanins (Elezabeth and Subramanian, 2013)
5. Tannins (Ricci et al. 2015)

4.2.2 Products to be developed

1. Soup

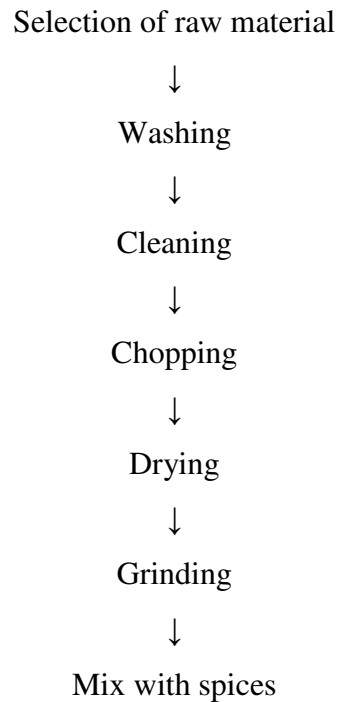
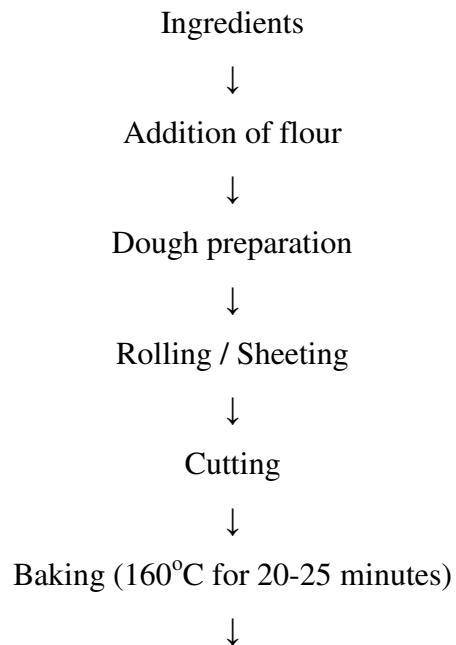


Fig2. Flow chart for the preparation of soup.

(Sources: Saranya and Dr. Rari, 2017)

2. Cookies



Cooling at room temperature



Distributing

Fig3. Flow chart for the preparation of cookies.

3. Muffins

Preheat the oven 375°F



Mix all the ingredients
(Flour, sugar, baking powder, salt, milk, oil and sample)



Pour the batter in muffins wells
(about 1/3 cup of batter per well)



Bake until muffins are golden brown

Fig4. Flow chart for the preparation of muffins.

4.2.3 Sensory evaluation

Final product will be evaluated for the sensory characteristics on the basis of 9 Point hedonic scale and composite sensory scale.

A. Sensory analysis:

A 9 point hedonic scale will be used to evaluate the experimental samples using 100 semi trained panelists. Healthy male and female of suitable age will be selected for the evaluation.

- a. Color and appearance
- b. Flavor and sweetness
- c. Body and texture
- d. Mouthfeel
- e. Overall acceptability

Expression	Points to be assigned
Liked extremely	9
Liked very much	8
Liked moderately	7
Liked slightly	6
Neither liked nor disliked	5
Disliked slightly	4
Disliked moderately	3
Disliked very much	2
Disliked extremely	1

Sample code	Color and appearance	Flavor and sweetness	Body and texture	Mouth feel	Overall acceptability	Remarks (if any)

Optimized product will be obtained using the above experimental setup.

4.2.4 Microbiological study

1. TPC
2. Mould Count
3. Yeast Count

Chapter 5: Expected new knowledge

Bombax ceiba is a wild tree with edible flowers and fruits. It is rich in vitamins, carbohydrates and dietary fibres and contains phytochemicals like alkaloids, flavonoids, cumains, glycosides, tannins, steroids, phenols. It is used indigenously to prepare traditional dishes. The exploitation of the traditional methods of its consumption and its nutritional evolution will add more option for the existing market and can also be helpful for meeting the prevailing challenges of the production of vegetables.

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