Chapter-9

DISCUSSION
9. Discussion

In the dissertation titled “A Comparative Pharmacognostic and Physico-chemical Study of Four Classical Types of Sahachara (Roots of Barleria sp.) With Special Reference to Acute Anti-inflammatory Activity in Albino Rats”, four types of the drug Sahachara mentioned in Ayurveda, which are available in the field have been studied under Pharmacognostic, Physio-chemical, Preliminary Phyto-chemical and Experimental methods along with detailed literary review of Sahachara.

Discussion is carried out under following points

- Drug review
- Pharmacognostical study
- Physio-chemical study
- Phyto-chemical study
- Experimental study

9.1 Drug review

The word Sahachara is available in the literatures of Vedic period like Agni purana, Mastya purana, Vishnudharmottor purana, Devibhagwata purana and Brahma purana. Vishnudharmottar purana and Agni purana cited Sahachara as a vatashamak drug. Other Puranas have emphasized on mythological aspect of Sahachara.

In Samhita period, Sahachara is mentioned in all the important Samhitas of Ayurveda, like Brihatrayees and Laghutrayees. Sahachara is widely used by Charaka in many forms or formulations. Acharya Sushruta mentioned Sahachara in the Kantakapanchamula, Vatasamashamana and Shleshmsamshamana ganas. Vagbhata has mentioned under Varunadi, Viratarvadi, Aragvadhadi ganas. According to Sharangadhara, Sahachara should be always used in fresh form (Ardra). (Table 6 – P.N 24) Nighantu Granthas thrown light on Sahachara as follows -

- Most of the Nighantus describe number of synonyms of Sahachara types. To avoid undue repetition, they are enlisted separately and also exhibited in tabular form. (Table 1 –
P.N 9 & Table 2 – P.N 16) Nighantu ratnakara specially highlighted the guna karma and the uses of these types.

- In case of rasa of Sahachara, differences in opinions are surprising and also it may mislead scholar e.g. Katu, Tikta, Madhura are the rasas enlisted by different authors for different types of the Sahachara. It is also said to be ‘Anamla’ (which is not sour) by some authors in nutshell, Sahachara does not have amla and lavana rasas. (Table 8 – P.N 27 & Table 9 – P.N 27)

- Sahachara is said to be Vataghna and Kaphagna. Very rarely, it is said to be pittaghna (e.g. Kaiyadeva Nighantu) (Table 10 – P.N 28 & Table 11 – P.N 28)

- It is supposed to be effective in treatment of following diseases. Kushtha, Kandu, Visha, Shotha, Kasa, Shwasa, Dantamaya, Vatarakta, Vali, Palitya, Vataroga, Ratkavikara, Trishna etc. (Table 18 – P.N 32)

- Amongst the other qualities (except rasa) of Sahachara, many authors agree that it is snigdha (unctous). Some other says that it is susnigdha (perfectly unctous). Most of them agree that it is unushna but only Dhanwantari Nighantu claims that it is sheeta. (Table 12 – P.N 28 & Table 13 – P.N 29)

- Some of the authors have mentioned its physiological activities such as varnya, agnidiptikara etc. (Table 17 – P.N 31)

Therapeutic actions include Shwayathuhara, Shlemasamashamana, Vatasamshamana, Vishaghn, Amapachana, Jwarahara, Kandughna and used in the treatment of Shotha, Vatavikaras, Kushtha, Vrana, Vishaghn are mainly Vata and Kapha dominant disorders. (Table 7 – P.N 26)

In total there are about four varieties of Sahachara explained by various nighantu granthas based upon the colour of the flowers and later on dravyaguna experts highlighted their their respective botanical sources.

9.2 Pharmacognostical study

Rakta sahachara are having slender wire like symmetrical roots. Shweta Sahachara roots are sturdy, larger in size as compared to other types. Peeta Sahachara variety roots are long, less
thick and sturdy. Neela Sahachara roots are more like Rakta variety, long and medium in diameter. (Table 26 – P.N 76)

9.2.1 Organoleptic study

These four classical types of Sahachara can be identified with the help of macroscopical study characters as mentioned in the following table.

<table>
<thead>
<tr>
<th>Barleria Sp. Root Sample</th>
<th>Shabda Fracture</th>
<th>Sparsha Touch Inner Outer Surface</th>
<th>Roop Shape Size Color Inner Outer</th>
<th>Rasa Taste</th>
<th>Gandha Odour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barleria prionitis Linn.</td>
<td>Short</td>
<td>Outer-Rough Inner-Fibrous</td>
<td>2.31mm in diameter, Cylindrical, Inner pale white, Outer- Faint Brown ++</td>
<td>Swadukinchit, Tikta</td>
<td>Ground nut specific odour</td>
</tr>
<tr>
<td>Barleria Gibsonii Dalzel.</td>
<td>Short</td>
<td>Outer surface with lines and scars or rootlets Inner-not fibrous</td>
<td>2.74mm in diameter, Cylindrical, Inner pale white, Outer- Dark Brown ++</td>
<td>Madhur Tikta</td>
<td>Ground nut specific odour</td>
</tr>
<tr>
<td>Barleria cristata Linn.</td>
<td>Short</td>
<td>Outer soft</td>
<td>2.65mm in diameter Cylindrical Inner pale white, Outer-Faint brown+</td>
<td>Swadukinchittikta</td>
<td>Ground nut specific odour</td>
</tr>
<tr>
<td>Barleria Strigosa Willd.</td>
<td>Short</td>
<td>Outer-Rough Inner not fibrous</td>
<td>4.36mm in diameter Cylindrical Inner pale white, Outer-Faint brown+</td>
<td>Swadukinchittikta</td>
<td>Ground nut specific odour</td>
</tr>
</tbody>
</table>

**Table 1 - Macroscopical study details of Barleria varieties**

Organoleptic evaluation shows Peeta Sahachara is having swadukinchit, Tikta Rasa. Rakta Sahachara shows Madhura-TiktaRasa. Shweta Sahachara on Rasa Parikshana reveals Swadukinchit-Tikta Rasa. Neela Sahachara has shown Swadukinchit-Tikta Rasa. According to Gandha Pariksha Peeta Sahachara and Rakta Sahachara both had Ground nut like specific odour.
Tikta rasa is having shothahara action. In all *Barleria strigosa* Willd. samples Tikta rasa is predominantly present. Maximum dravyas having Tikta rasa possess Alcolids and Glycosides in phyto-chemical analysis.

### 9.2.2 Microscopical study

Detailed microscopical study on the Roots of *Barleria prionitis* Linn., *Barleria cristata* Linn., *Barleria gibsoni* Dalz., *Barleria strigosa* Willd., are done. *Barleria gibsoni* Dalz. samples are having narrow vascular cylinder and central 1/3 part is having broad cortex and narrow band of periderm. *Barleria prionitis* Linn. and *Barleria cristata* Linn. both are having very broad vascular cylinder. *Barleria prionitis* Linn. samples are having broad cortex and periderm and wavy vessels in large numbers. *Barleria cristata* Linn. samples are having broad cortex and periderm and smooth vessels are having few vessel diameter. (Figure 11 – P.N 63, Figure 15– P.N 64, Figure 19 – P.N 65, Figure 23 – P.N 66, Figure 27 – P.N 67, Figure 31 – P.N 68, Figure 35 – P.N 69, Figure 39 – P.N 70, Figure 43 – P.N 71, Figure 47 – P.N 72, Figure 51 – P.N 73, Figure 55 – P.N 74). With the help of above mentioned microscopical structures each variety of Sahachara can be identified on the basis of microscopical study.

### 9.3 Physico-chemical Study

Moisture content in *Barleria prionitis* Linn. Sp. (Peeta Sahachara) is less amongst all *Barleria* variety samples and *Barleria gibsoni* Dalz. (Rakta Sahachara) samples has highest moisture content as compared to other types. Total Ash % is more in *Barleria gibsoni* Dalz. samples compared to other types. Water and alcohol soluble extractive % is present in highest amount in *Barleria strigosa* Willd. (Neela Sahachara) samples. Specific gravity is almost same in all four variety samples. In Influenescence analysis *Barleria strigosa* Willd. samples have not shown fluorescence at 365 wavelengths. (Table 27 & Table 28 – P.N 77)

### 9.4 Phyto-chemical study

Phyto-chemical analysis plays a major role in identification and standardization of drugs. Quality control is required to be regulated from the level of raw materials to the stage of finished product. Today, herbal medicines or any drug is accepted and valued worldwide based on the phyto-chemistry itself. (Table 29 – P.N 78)
The preliminary Phyto-chemical tests are conducted by using the different extracts (Aqueous and Methanol) on the roots of *Barleria* samples collected field. From four Sahachara varieties, phyto-constituent alkaloid is only present in *Barleria Srtigosa* Willd. variety. Glycoside is present in *Barleria strigosa* Willd. variety. Flavonoids, major phyto-constituent responsible for anti-inflammatory action is present in all *Barleria* samples collected from different localities. Saponin is present in *Barleria prionitis* Linn., *Barleria gibsoni* Dalz. and *Barleria strigosa* Willd. Phenolic compounds and tannin are present in *Barleria gibsoni* Dalz. and *Barleria strigosa* Willd., variety samples.

In *Barleria prionitis* Linn. extract in HPLC analysis revealed 20 phyto-constituent graph peaks, *Barleria gibsoni* Dalz. shows 24, *Barleria cristata* Linn. shows 19 and *Barleria strigosa* Willd. variety has shown 16 phyto-constituents separated in the form of HPLC peaks. (Figure 56 - P.N 78, Figure 57 - P.N 79, Figure 58 - P.N 79, Figure 59 - P.N 80)

### 9.5 Experimental study

Experimental study is conducted to evaluate Anti-inflammatory and Analgesic activity of four classical types of Sahachara and their acute anti-inflammatory action is compared in animal model in order to find out potent anti-inflammatory variety amongst them. Mean Paw volume of each group after particular time interval is the parameter of assessment for the study. Below the experimental observations based upon comparative assessment of mean Paw volume of different groups are discussed.

**After 30 min.** of drug administration mean paw volume of all groups has shown decreased except disease control group and *Barleria prionitis* Linn. group which suggests that three *Barleria* types are showing anti–inflammatory action along with aspirin just in half an hour.

*Barleria gibsoni* Dalz. group shows decrease in Paw volume by 0.40 mm as compared to *Barleria cristata* Linn. group and *Barleria strigosa* Willd. group. *Barleria strigosa* Willd. group has shown 0.37 mm reduction in mean Paw volume which is after *Barleria gibsoni* Dalz.gr.

**After 60 min.** Paw volume of all *Barleria* groups has got increased but not substantially. Paw volume of *Barleria gibsoni* and *Barleria cristata* Linn. groups has increased more than *Barleria prionitis* Linn. *Barleria strigosa* Willd. group has shown very minimal increase in mean
Paw volume i.e. by 0.2mm only which is lesser than *Barleria prionitis* Linn. group which suggests *Barleria strigosa* Willd. group is having more potent acute anti-inflammatory action among all *Barleria* groups at 60 min. *Barleria prionitis* Linn. group initially shown increase in Paw volume but after 30 min. had controlled anti-inflammatory action after *Barleria strigosa* Willd. gr.

**After 120 min.** *Barleria prionitis* Linn group and *Barleria gibsoni* Dalz. group increased Paw volume have shown increase in Paw volume as compared to the standard gr. Both *Barleria cristata* Linn. and *Barleria strigosa* Willd. group have shown approximately equal decrease in mean Paw volume which suggests that both the *Barleria cristata* Linn and *Barleria strigosa* Willd. group are showing equal anti-inflammatory action.

**After 240 min.** all groups except normal control group have shown increase in mean Paw volume which suggests that the action of the drug has been declined due to metabolism, so fresh decoction should be again administered to achieve desired anti-inflammatory action of concerned *Barleria* species.

**After 24 hours** due to natural phenomenon of disease in all groups Paw volume have shown decrease. (Table 30 – P.N 84)

**Criteria of Assessment**

Percent of inhibition is the major criteria of assessment to decide potent variety among four classical types of Sahachara. Increase in the % of the Paw volume difference between normal and abnormal Paws was calculated by following formula.

\[
\text{% of Inhibition} = \left( \frac{To-Tt}{To} \right) \times 100
\]

\(Tt = \) thickness of paw of rats given test decoction at corresponding time.

\(To = \) Thickness of paw of the rats of control group at the same time.

**At 30 min**
Standard Drug Group has shown decrease in Paw volume, % of paw volume inhibition is 5.27. Gr.E (*Barleria gibsoni* Dalz.) decreased Paw volume at maximum level more than Standard and other *Barleria* varieties; its % of inhibition is 8.20. (Fig no. 59 – P.N 80). Gr F (*Barleria cristata* Linn.) has shown 3.50% change in paw volume which suggests *Barleria cristata* Linn. variety having action but not more than *Barleria strigosa* Willd. and *Barleria gibsoni* Dalz. group. Gr.G (*Barleria strigosa* Willd.) has shown 7.05% inhibition which is more than standard drug that suggests action of *Barleria strigosa* Willd. variety is more than aspirin at 30 min.

**After 60 min**

Standard drug aspirin gr. has shown maximum % of inhibition i.e. 8.98. *Barleria strigosa* Willd. gr. has shown 6.27% which second than standard that means *Barleria* variety has shown potent acute anti-inflammatory action as compared other types of Sahachara after 60 min. *Barleria cristata* Linn. group has shown 2.13 % decrease in Paw volume, ultimately suggesting *Barleria cristata* Linn. variety is also showing anti-inflammatory action but lesser than *Barleria strigosa* variety.

**After 60 min. and there after**

Due to deterioration in the drug action due to time factor in all groups except normal control group, % of Paw volume in all groups got increased. (Table 31 - P.N 85)

**9.6 Probable Mode of Action of Barleria Root Decoction according to Modern Pharmacology**

On the basis of phyto-constituents present in *Barleria* sp. and literature review, following probable mechanism of action of *Barleria* root was given as below.

Increased vascular permeability occurs as a result of contraction and separation of endothelial cells at their boundaries to expose the basement membrane, which is freely permeable to plasma proteins and fluid. Histamine and other mediators of inflammation increases vascular permeability at various times after injury. Chemical induced vascular permeability (acetic acid) causes an immediate sustained reaction that is prolonged over 24 hr.
and its inhibition suggests that the *Barleria* Root decoction may effectively suppress the exudative phase of acute inflammation.

The vitality of cells depends on the integrity of their membrane, exposure of RBC’s to injurious substances such as hypotonic medium results in lysis of its membrane, haemolysis and oxidation of haemoglobin. The haemolytic effect of hypotonic solution is related to excessive accumulation of fluid within the cell resulting in the rupturing of its membrane. Such injury to RBC membrane will further render the cell more susceptible to secondary damage through free radical induced lipid peroxidation. It is therefore expected that compounds with membrane-stabilizing properties, should offer significant protection of cell membrane against injurious substances. Compounds with membrane-stabilizing properties are well known for their ability to interfere with the release of phospholipases that trigger the formation of inflammatory mediators. *Barleria* root decoction has shown significant membrane stabilizing property, which suggests that its anti-inflammatory activity observed in this study, may be related to the inhibition of the release of phospholipases that triggers the formation of inflammatory mediators.

Degranulation of proteins is a well documented cause of inflammation and rheumatoid arthritis. Anti-inflammatory drugs have shown dose dependent ability to inhibit thermally induced protein denaturation. Ability of *Barleria* root decoction to bring down thermal degranulation of protein is possibly a contributing factor for its anti-inflammatory activity.

The anti-inflammatory activity of *Barleria* root decoction found may be due to the presence of therapeutically active flavonoids i.e. apigenin, quercetin and quercetin-3-O-β-D-glucoside, naringenin and apigeninglucuronide which was detected. The therapeutic applications of flavonoids on inflammation have been previously reported.

Flavonoids inhibit both cylooxygenase and lipooxygenase pathways of the arachidonic metabolism depending upon their chemical structures. Quercetin is a bioflavanoid that blocks the release of histamine and anti-inflammatory enzymes.
Injury to RBC’s due to inflammation causing factors like injury

Increase in vascular permeability and contraction and separation of the endothelial cells.

Histamine and other mediators of inflammation release.

Haemolysis & oxidation of Haemoglobin

Excessive accumulation of fluid within the cell resulting in rupturing of its membrane

Degranulation of protein

Release of prostaglandin through cyclo-oxygenase pathway

Signs and symptoms of Actute inflammation

Resulting in membrane stabilizing property

Anti-histaminic and anti-serotonin action

Inhibition of the release of phospholipids causing reduction in oxidation of Haemoglobin

Reduction in peritoneal vascular permeability

Bring down thermal degranulation of proteins

Flavonoids (quercetin and others) inhibits cyclo-oxygenase and lipo-oxygenase pathways of arachidonic metabolism

Reduction in signs & symptoms of acute inflammation

Figure 1 - Probable Mode of Action of Sahachara According to Modern Pharmacology
The data obtained from the present study indicated that several factors may contribute to the anti-inflammatory action of *Barleria* root decoction. Firstly, *Barleria* root decoction significantly inhibited histamine and serotonin induced rat paw edema showing it is anti-histaminic and ant-serotonin ability. Secondly, *Barleria* root decoction reduced the increased peritoneal vascular permeability in mice, indicating the suppression of the vascular response in the process of acute inflammation. Finally, *Barleria* root decoction exhibited significant membrane-stabilizing property and inhibition of protein denaturation.

The data of our studies suggests that *Barleria* root decoction exhibited good inhibition of prostaglandin in cox-1. The results demonstrated therapeutic potential of all *Barleria* root decoction as anti-inflammatory properties which are mediated by the inhibition of the Cyclo-oxygenase enzymes showed significant anti-inflammatory activity.

**9.7 Mode of action of according to Ayurveda**

‘Sahachara’, one of the *Kantakapanchamula* is valued and widely used for its Shothahara property. It is one of the drug in Vata and Shlem-samshamana gana of Sushruta , Samhita. It is potent Vata and Kaphashamak drug, the doshas which are mainly responsible for the manifestation of Vedana and Utsedha. It is documented that Sahachara possess Shothahara and Vedanahara properties.

Shotha is swelling or tumour or morbid intumescence. Utsedha is the lakshana of shopha, which means elevation. Shopha and Shotha are used synonymous to each other and have same meaning. When Vata reaches the external Srotas, does dooshana of Kapha, Rakta and Pitta. This Vata inturn gets obstructed by them leading to swelling with the characteristic elevation. The action of the drug which removes Shotha is known as Shothahara. Sahachara is having Tikta Rasa, UshnaVeerya, Raktashodhana properties for all these reseasons Sahachara oil and Kantakapanchamula Kwatha is widely used by many Ayurvedic Scholars to control sthanik evam sarvang shotha.

As Shothahara- ahachara is mainly Vata and Kaphahara. Vata is the main dosha involved in the formation of Shotha, Kapha is responsible for utsedha and obstruction is the main
phenomenon. Vedana means Pain, Agony, Sensation and Perception. There are many references in texts which indicate that Vata is the important Dosha for the causation of pain. Acharya Sushruta mentions, there will not be any pain without the involvement of Vata. Vedanahara is a property by which the drug reduces Vedana or pain. As Vedanahara-Vata is the main dosha involved in Vedanasthapana karma. Aggravated Vata produces Vedana or Shoola. Ushna veerya of the drug is responsible for controlling and reducing Vata which is Sheeta in nature.

Predominant katu, tikta rasa of the drug is Rooksha, Kaphahara and produces dryness of kleda. Katu rasa which is Shothahara, Ushna and Tiktarasa which is lekhana does shodhana and vivarana of strotas. Laghu guna is kaphagna and strotoshodhaka, which help in clearing all the blocked channels. Ushna veerya clears strotas, does the shoshana of excess dravatwa which is collected at the place of shotha and helps in dilatation of strotas there by it removing margavarodha. It also controls movement of Vatadosha which is helpful for shothahara karma. All these properties help in reduction and prevention of Shotha.