A Comparative Pharmacognostic and Physicochemical Study of Four Classical Types of *Sahachara* (Roots of *Barleria* species) wsr to Acute Anti-inflammatory Activity in Albino Rats.

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Certificate

I hereby declare that the thesis entitled "A Comparative Pharmacognostic and Physicochemical Study of Four Classical Types of *Sahachara* (Roots of *Barleria* species) wsr to Acute Anti-inflammatory Activity in Albino Rats" completed and written by me has not previously formed the basis for the award of any Degree or other similar title upon me of this or any other Vidyapeeth or examining body.

Research Student

Place:

Date:

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This is to certify that the thesis titled "A Comparative Pharmacognostic and Physicochemical Study of Four Classical Types of *Sahachara* (Roots of *Barleria* species) wsr to Acute Anti-inflammatory Activity in Albino Rats" which is being submitted herewith for the award of Degree of Vidyavachaspati (Ph.D.) in *Ayurveda –Dravyaguna Vigyana* of Tilak Maharashtra Vidyapeeth, Pune is the result of orginal research work completed by Vd. Bipin Ramesh Dhalpe under my supervision and guidance. To the best knowledge and belief the work incorporated in this thesis has not formed basis for the award of any Degree or similar title of this or any other University or examining body upon him.

Research Guide

Place:

Date:

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At this moment of submitting this dissertation in this PhD. Study, first of all I humbly bow my head in front the **Lord Dhanwantari** for giving me an opportunity to be a student of Ayurveda.

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Vd. Bipin R. Dhalpe

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Chapter-1

INTRODUCTION

1. Introduction

Electronics, space travel and genetic-manipulation have opened new vistas for betterment of mankind, ahead of which our diverse biological resources no doubt constitute the apogee of the evolutionary process. God has created the nature in which he has embedded a well programmed controlling and sustaining mechanism to protect his creation. Age old traditional system of medicines such as Ayurveda based upon biological resources, owes its origin in India since the dawn of civilization.

Ayurveda, the Indian indigenous system of medicine, dating back to the Vedic ages has been an integral part of Indian culture. The term comes from the Sanskrit root, 'Ayu' which means life and 'Veda' meaning knowledge. As the name implies, it is not only a science of treatment of the ill but covers whole gamut of happy human life involving the physical, metaphysical and spiritual aspects. Over the centuries, Ayurveda has developed into a well-founded, time tested, empirical science of life.

In the Nature it is found that, a single genus has different species. This botanical variation creates confusion among researchers and practitioners regarding the selection of the appropriate species. As *Dravyaguna* branch is the back bone of *Ayurveda* treatment, selection of a particular drug is very much essential.

यथाविषंयथाशस्त्रंयथाग्निरशनिर्यथा □

तथौषधमविज्ञातंविज्ञातममृतम् यथा □ च. सू. १□ १२४

औषधं ह्यनभिज्ञातंनामरूपगुणैस्त्रिभिः□विज्ञातंचापिदुर्युक्तमनर्थायोपपद्यते□□ च. सू. १□ १२५□

Field visit is an integral part of *Dravyaguna* subject. In *Ayurveda,* different types of a single drug are explained on the basis of color of the flowers, for example *Sahachara*. There are four types of *Sahachara* explained in classical texts viz *Shweta, Rakta, Neela* and *Peeta.*

सैरेयकः श्वेतपुष्पः सैरेयः कटसारिका सहाचरः सहचरः स च झिण्ट्यपिकथ्यते ।५।

कुरण्टकोऽत्र पीतेस्याद्रक्ते कुरूबकः स्मृतः नीलेबाणाद्वयोरूक्तोदासीचार्त्तगलश्च सः ।५।२

सैरेयः कुष्ठवातास्रकफकंडूविषापहः तिक्तोष्णोमधुरोऽनलः सुस्निग्धः केशरंजनः ।५।३

भावप्रकाश निघंटु मिश्रक प्रकरणं पंचमः पुष्पवर्गः

Sahachara has numerous medicinal properties. It is a very good nervine tonic. It is the third largest genus in the family *Acanthaceae*. The genus *Barleria* was dealt by Linnaeus (1753) on the basis of specimens collected from India. It is a pan-tropical but predominantly an old world genus, with its greatest center of species diversity in tropical East Africa, followed by South Africa and Asia. There are different species of *Barleria* in nature having different colors, but only one species is used in clinical practice, i.e. yellow colored variety (*Barleria prionitis* Linn.). The other three types of *Sahachara* are also medicinally useful, but due to lack of Research work regarding their analysis, these species are still unexplored. To explore other types of *Sahchara* with the help of field visits, analysis, pharmacological activity screening and documentation is the need of the era.

In Ayurvedic compendia the four types of *Sahachara* are mentioned. Out of these types, *Peeta Sahachara* is most popular in the clinical practice. The *Sahachara* is classified in *Aragvadhadi, Viratarvadi, Varunadi* and *Kantaka-panchamoola* ganas by *Sushruta*. In the properties of *Kantaka-panchamoola*, it is recommended as *Shothahara*.

In this regard, a thorough literary review on *Sahachara* and its four classical types along with their pharmacognostical, preliminary Phyto-chemical and experimental study for evaluating acute anti-inflammatory activity in animal model had been taken up for the present research study.

Chapter-2

ABBREVATIONS

2. Abbreviations

कै. नि.	:	कैयदेव निघण्टू
रा. नि.	:	राजनिघण्टू
म. नि.	:	मदनपालनिघण्टू
शा. नि.	:	शालिग्रामनिघण्टू
म.नि	:	मदनविनोदनिघण्टू
भा.नि.	:	भावप्रकाशनिघण्टू
आ. नि.	:	आदर्शनिघण्टू
ध. नि.	:	धन्वंतरीनिघण्टू
रा.नि	:	राजनिघण्टू
कै.नि	:	कैयदेव निघण्टू
ध.नि	:	धन्वंतरीनिघण्टू
भा. नि	:	भावप्रकाशनिघण्टू
शा.नि	:	शालिग्रामनिघण्टू
शो.नि	:	शोढल निघण्टू
च.सं	:	चरकसंहिता
सु.सं	:	सुश्रूतसंहिता
अ.सं.	:	अष्टाङ्गसंग्रह
शा.सं.	:	शारंगधरसंहिता
का.सं.	:	काश्यप संहिता
अ.ह्र.	:	अष्टाङग ह्रदय
यो.र.	:	योगरत्नाकार

भै .र.	:	भैषज्यरत्नावली
सु.चि	:	सुश्रुतचिकित्सास्थान
च.चि	:	चरकचिकित्सास्थान
सु.सू	:	सुश्रुतसूत्रस्थान
ड.	:	डल्हन
च.द	:	चक्रदत्त
अ.सं.उ.	:	अष्टाङ्गसंग्रहउत्तर्-स्थान
अ.सं.चि.	:	अष्टाङ्गसंग्रहचिकित्सास्थान
शा.सं.म.ख	:	शारंगधरसंहितामध्यमखण्ड

Chapter-3

AIMS AND OBJECTIVES

3. Aim & Objectives

Research Question

Whether four classical varieties of *Sahachara* show different potencies as per physico-chemical parameters and Anti-inflammatory activity in experimental studies?

Aim

To compare the four classical types of *Sahachara* (*Roots* of *Barleria* sp.) on the basis of its Pharmacognosy and physico-chemistry with Acute Anti-inflammatory Activity in Albino rats.

Objective

To evaluate potent type of *Sahachara* with the help of Acute Anti-inflammatory activity and physico-chemistry.

Chapter-4

PREVIEW WORK DONE

4. Previous work done

Here are some previous works given below. Drug related, methodology related and thesis related references had been incorporated in the thesis accordingly.

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Chapter-5

REVIEW OF LITERATURE

5. Review of literature

5.1 Drug Review According to Ayurveda

Paryaya Nirukti Vivechan

Sahachara seems to be a very well-known plant which was available over a widely spread area of the India. Sahachara seems to have religious and aesthetic uses besides its medicinal utility. As this plant is useful in many dimensions, it must have been used frequently by the people. This particular fact may be one of the reasons why it has got so many synonyms.

Some of the popular synonyms of Sahachara are enlisted here under along with their possible reasons for that particular nomenclature.

Synonym	**Nirukti**	**English Version**
अम्लान Amlana अम्लाटन Amlatana	म्लानिं न गच्छति इति । न म्लानं पुष्पं भवति अस्य इति। न म्लानं पुष्पं भवति अस्य इति।	The flower of which does not wither The flower of which does not wither
आर्तगल Artagala	आर्त इव गलति स्त्रवति रसं आर्तः क्षीणः इव गलति इति	It Sheds its juice same as a man in grief sheds tears.
कुरण्टक Kurantaka	कुर्यते छिद्यते जनैः उपयोगार्थमिति।	The one which is pricked But by people owing to its usefulness.
कुरबक Kurabaka	कुत्सितः ईषद्वा, रवः शब्दः अलीनाम् अत्र।	Where the noise of bees is less.
झिण्टी	झिम इति रटति इति।	It sounds as Zinm /Zum

Zinti झिण्टीका Zintika	झम इति रटति इति।	It sounds as Zinm /Zum
दासी Dasi	दस्यते नाश्यते कुष्ठादिरोगिणां कृते यो वैद्यैः दस्यते क्षीयते इति वा।	Which comes to an end skin diseases, because of frequent used by vaidya's.
Bana	वण्यते शब्द्यते वर्ण्यते वा कवि भिः इति वबयोरभेदः। वण्यते शब्द्यते वर्ण्य वा कवि भिः इति वबयोरभेदः।	The one which is described by scholars. The one which is described by scholars.
Mrudukantaka	---	Which has soft projections.
Saireya	सीरे सूर्यातपयुक्ते आवरण रहितेऽपि प्रदेशे भवतीति।	Which grows even in a region of intense light.
Saireyaka	सीरे सूर्यातपयुक्ते आवरण - रहितेऽपि प्रदेशे भवतीति ।	Which grows even in a region of intense light.
सहचर	सह चरति इति।	It grows in a community.

Table 1 - Paryay Naam Nirukti along with their English version

Sahachara References From Vedic Literature and Samhita Granthas:

Vedic Literature References:

Sahachara does not seen to be popular in Vedic period; but in the *Purana* period, it was considered as a plant of much medicinal use. e.g. *Visnudharmottara Purana* describes it as unabhishyandi and suggests its use for treating Vrana as well as vatavyadhi.

रास्नाहचरैर्वापि तैलं वातविकारिणाम् ।

अनभिष्यान्दि यच्चान्यत्तद् व्रण्ेषु प्रशस्यते ।। - विष्णुधर्मोत्तर पुराण २/५६-५७

Agnipurana describes many synonyms of Sahachara as well as its use in diseases of Vata in the form medicated oil.

रास्नाहचरैर्वापि तैलं वातविकारिणाम् ।

अनभिष्यान्दि यच्चान्नं . तद् व्रण्ेषु प्रशस्यते ।। अग्निपुराण २७८/५३

तत्र शोणे कुरबकस्तत्र पीते कुरुण्टकः ।।

नीला झिण्टी द्वयोर्बाणा झिण्टी सैरीयकस्तथा ।।

तस्मिन् रक्ते कुरबकः पीते सहचरी द्वयोः । - अग्निपुराण ३६२/३७-३८

Matsyapurana emphasizes its use for worshipping goddess *Gauri* in the month of *Pausha.*

.... पौषे पीत कुरण्टकैः ..... देवीं पूजयत्े । - मत्स्यपुराण ६२/२३

हिमवत्प्रदेशवर्णने - कुरबक :

Brahmapurana puts forth that Sahachara with some other plants was born for the sake of marriage ceremony of *Parvati* with Lord *Shiva.*

तथा कुरबकश्चापि कुसुमा.....।

..... उत्सर्ज मनोज्ञानि कुसुमानि समन्ततः ।। ब्रह्मपुराण ३६/१२२

Devibhagwata Purana describes that if an alcoholic drug contained in oral cavity for a while and sprinkled over Sahachara plant, the plant grows rapidly.

After *Purana* period, Sahachara was widely accepted by the scholars, particularly the Ayurvedic authors. Starting from the Agnivesha period (2500 B.C.) upto the Bhavaprakasha period (1400 A.D.) and even after, this plant has been described by many authors.

Charaka Samhita References:

Charakacharya has explained sahachara particularly in the Chikitsa sthana, Sahachara is suggested to be used in different forms. Viz. medicated oil, medicated milk, external application (Pralepa) etc.

Some of the combinations of Sahachara according to Charaka Samhita are enlisted here.

1) Oil medicated with Sahachara should be used for treating Vatavyadhies.

   सर्व वातविकारणां तैलान्यन्यान्यतः शृणु।

   …. सहचरतुलायाश्च रसे तैलाढकं पचेत्।।

   ….. दारुणेष्वेतद्वाव्याधिषु योजयेत्।। च.चि.२८ वातव्याधिचिकित्सित १४२-१६४

2) Amrutadi oil (which contains Sahachara) should be used treating Unamda, Apasamara etc.

   अमृताद्यतैल - सहचर उन्माद उपस्मार वातव्याधिघ्नः

3) Mulaka oil (which contains Sahachara) cures diseases like Shwasa. Kasa etc. and even increase the life span (ayu) the strength (bala) and the complexion (varna)

   मूलकतैल - प्लीहमूत्रग्रहश्वासकासमारुत रोगुनत्।

   एतन्मूलकतैलाख्यं वर्णायुर्बलवर्धनम्।। च.चि.२९/१३९ वातरक्तचिकित्सा (प्रलेपार्थ)

4) In patients of Vatarakta, a mixture containing /consisting of Sahachara should be applied externally.

   घृतं सहचरान्मूलं जीवन्तीच्छागलं पयः।

   लेपः पिष्टस्तिला तद्वभ्दृष्टाः पयसि निवृताः।। च.चि.२९/१३९ वातरक्तचिकित्सा (प्रलेपार्थ)

5) Oil medicated by Sahachara etc. cures graying of hair.

   क्षीरात् साहचराद्भृंगः……. पलितापहम् ।। च.चि. २६

Sushruta Samhita References:

Sushruta includes Sahachara (or its types) in a no. of Vargas viz.

1*) Aragvadhadi* - Sahachara useful in treating diseases like Meha, kustha etc. and for purifying Vrana as well as nullifying Vishas (toxic substances) and Kaphadosha.

कुरुण्टक दासीकुरुण्टक - सु.सू. ३८/७

आरग्वधादिरित्येषः गणः श्लेष्मविषापहः ।

मेहकुष्ठज्वरवमी कण्डूघ्नो व्रणशोधनः।।

डल्हण - कुरुण्टक पीतपुष्पः कण्टशेलुआ इतिलोके नीलपुष्पःस

एव दासी कुरुण्टकः । डल्हण

2) *Kantakapanchamula* - useful in treating diseases like Shopha etc.

सैरीयक रक्तपित्तहरी एतौ शौफत्रयविनाशनौ।

सवमेहहरो चैव शौफदोषविनाशनौ ।। - सु.सू. ३८

सैरेयकः कण्टसेलियाकः । ड.

3) *Varunadi* - useful for decreasing Kaphadosa and medadhatu and for treating Shirashula etc.

वरुणादिगण - आर्तगल, सैरयेक - सु.सू. ३८/१०-११

वरुणादिर्गणो ह्येष कफमेदोनिवारणः।

विनिहन्ति शिरःशूलगुल्माभ्यन्तरविद्रधीन्।।

आर्तगलः ककुभः सुगन्धमूलः कवहा (कौहा) इति नाम्ना

पूर्वदेशे प्रसिध्दः । सैरेयकद्वयं रक्तपुष्पनीलपुष्पकण्टशेलुआ द्वयम्।

4) *Vatasamashamana* - for decreasing Vatadohsa

वातसंशमनवर्ग - सु.सू.३९/७ आर्तगल, सहचर

आर्तगलः ककुभः, केचिदार्तगलं कण्टकीवृक्षमाचक्षते।

सहचरः कण्टशेलीयाकः । ड.

5) *Viratarvadi*- useful for mutra vyadhi (Urinary diseases)

सहचरद्वय, कुरण्टिका - सु.सू.३८/१२-१३

सहचरद्वयं कण्टशेलुद्वयम् । कुरण्टिका कृष्णसूक्ष्मफला 'सिरिवालिका'

इति लोके । ड.

6) *Slesmasamshamana* - for decreasing Kaphadohsa.

श्लेष्मसंशमनवर्ग - सु.सू. ३९/९

Besides this, Sushruta notes that the flower of Sahachara is very similar in qualities as those of flower of the Champaka.

चम्पकं रक्तपित्तघ्नं शीतोष्णं कफनाशनम्।

किंशुकं कफपित्तघ्नं तद्वदेवकुरण्टकम्।। सु. सू. ४६/२८८ (पुष्पवर्ग)

Sushruta suggests the use of Sahachara in Ashmari according to the types.

वातसंभूत अश्मरीघ्न - आर्तगल (कौहा)

पित्तसम्भूत अश्मरीघ्न - कुरुण्टिका

कफसम्भूत अश्मरीघ्न - वरुणादिगण - सु.चि.७ अश्मरीचिकित्सित

He also suggests an external application to be used for treating Vatarakta, which consists of the Sahachara.

सर्व वातरक्तांत प्रदेहार्थ - सैरयक अटरुषक बला अतिबला

जीवन्तिसुषवीकल्क , छागक्षारपिष्ट - सु.चि. ५/१२ महावातव्याधिचिकित्सित

Ashtanga Sangraha References:

1) It is Tikta and Madhura in rasa, Snigdha and Ushna.
2) It is vataghna and kaphaghna drug.
3) Its flower is similar in qualities to those of Bakul, Punnaga, Champaka etc. but it has less intense qualities.
4) It is included under *Varunadi*, *Viratarvadi, Vatasamshamana, Pittashamana*, *Kapahashamana*, *Aragvadhadi* etc. ganas (groups)

5) A noteworthy use of Sahachara is located in Putrakamiya Adhyaya of Sharirasthana (Ch.1) According to that Sahachara may be effectively used for getting a male child.
6) Ghee medicated with Sahachara and other drugs cures Kasa and proves beneficial for the voice culture.

कासमर्दक वार्ताकी मार्करास्वरसैर्घृतम्।

साधितं कासजित्स्वर्य सिध्दमार्तगलेन वा।। अ.सं.चि.७/५५

7) External Applications - Sahachara in combination with other drugs is suggested to be applied externally for treating diseases like Vatarakta. Indralupta, Khalitya etc.

वातरक्ते प्रलेपः ..... सहचरजीवन्तीमूलं वा । अ.सं. चि. २४/८

8) Used in disease of Ear, Nose, Throat etc. Roots of black type of Sahachara are important constituents of the 'Mahanila Taila' ,which is said to be useful for treating most of the 'Urdhva - jatru - gata' diseases, particulary the 'Palitya' (Greying of Hair). The most interesting part of it is that this medicated oil is supposed to be applied externally (abhyanga), through nose (nasya) as well as orally (pana)
9) Ghee medicated with Sahachara, Khadira etc. is useful in Kushta treatment.

इन्द्रलुप्ते ..... माहिषनवनीतेन लिम्पेत्।

मार्कवपत्रसहरचपुष्पपक्वं वा । अ.सं.उ.२८/३६

त्रिफलार्जुनसैर्यकत्वक् पुष्प .....

..... सूचीकूर्चप्रच्छिताया खलतेर्लेपः परं रोमसञ्जननः ।अ.सं.उ.२८/३९

केशमूलानि लिम्पेत् ..... सैर्यकपुष्पनीलिनी..... । अ.सं.उ.२८/४४

10) Oil medicated with Sahachara, Vishwa etc. is suggested to be taken orally for effective treatment of most of the Vata diseases.
11) The powder (Churna) of the seeds of Sahachara is recommended for breaking up the mutrashmaris (urine stones) and helps in their smooth passage.

Ashtanga Hridaya References:

1) Sahachara seems to be included in *Aragvadhadi, Varunadi, Virataravadi* etc. gana's in a similar fashion as that of the Ashtanga Sangraha.

आरग्वधादि गण - सैर्यक - अ. ह्र. सू. १५/१७-१८

आरग्वधादिर्जयति छर्दिकुष्ठविषज्वरान्।

कफं कण्डूं प्रमेहं च दुष्टव्रणविशोधनः।।

वरुणादि गण - सहचरद्वय - अ.ह्र. सू. १५/२१-२२

एकः रक्तपुष्पः कुरबकाख्योऽन्यः पीतपुष्प : कुरण्टकाख्यः।

वरुणादिः कफं मेदो मन्दाग्नित्वं नियच्छति ।

आढ्यवातं शिरःशूलं गुल्मं चान्तःसविद्रधीम्।।

वीरतर्वादि गण - सहाचरः । बाणः नीलपुष्पः सैर्यक :।

कुरण्टः सितवारकः । टीका

वर्गो वीरतराद्योऽयं हन्ति वातकृतान् गदान्।

अश्मरीशर्करामूत्रकृच्छ्राघातरुजाहरः।।

2) It is used for getting a male child (Pumsavana).

पुंसवनार्थ - सैर्यक - अ.ह्र. शा. १/३९

3) In a no. of combinations of medicated oils (Siddha Taila's) Sahachara is one of the constituents.

सहचर सिध्दतैल - अ.ह्र.चि.२१

सहचरं सुरदारु नागरम्..... ।। अ.ह्र. चि. २१/५६

समूलशाखस्य सहाचरस्य .....।। अ.ह्र. चि.२१/६७-६९

सहाचर तुलायास्तु ररे.....।। अ.ह्र.चि.२१/७०-७२

क्षीरात् साहचरात् ..... ।। (सिध्दतैल) - अ.ह्र.उ.२४/३७

पलितान्तकृत् तैलम् । नीलीशिरिषकोरण्ट .....।। अ.ह्र.चि.२४/३५-३६

4) The blue type of Sahachara is recommended for preparing medicated ghee useful for treating Kasa.

वातजे स्वरसादे - आर्तगलः। अ.ह्र. चि. ५/३६

कासमर्दकवार्ताकीमार्कवस्वरसैर्घृतम्।

साधितं कासजित्स्वर्यं सिध्दमार्तगलेन वा।।

आर्तगलेन नीलपुष्पसहचरेण । - अरुणदत्त (सर्वांसुंदर)

5) It is recommended for external applications (Pralepa) in case of Vatarakta in combination with ghee and others.

घृतं सहचरान्मूलं जीवन्ती च्छागलं पयः।

लेपः पिष्टस्तिलास्तव्दद्भृष्टा पयसि निर्वृताः।। - वातरक्ते प्रेलपः । अ.ह्र.चि.२२/३३

6) Something different - Its root is recommended to be taken orally with honey and others to neutralize the toxic effects of rat bite (Akhuvisha).

अथवा सैर्यकान्मूलं सक्षौद्रं तण्डुलाम्बुना।

सैर्यकमूलं या समाक्षिकं ज्येष्ठाम्भसा पिबेत। अरुणदत्त - आखुविषनाशन - अ.ह्र.उ. ३८/३१

Sharangadhara Samhita References:

1) According to Sharangadhara, Sahachara should always be used in a fresh form (Ardra).
2) It is one of the constituents of many medicated oils.

Table 2 - Sharangadhara Sahachara Yoga Particulars

Name of the Combination	Principal Drug	Other Drugs	Useful in
Mashadi	Masha	Yava etc.	All Vata diseases
Nilikadi	Nilika	Ketaki etc.	Greying of hair
Satavarayadi	Shatavari	Bala etc	Vata diseases

केशस्थिरीकृत नीलिकाद्यं तैलम् । (अकालपलितापहम्)

निलकि केतकीकन्दं ..... कुरण्टकः ..... ।। शा.सं.म.खं.अ. ९

दी - कुरण्टक - सहचरपर्ण गूढार्थदीपिका - कुरण्टकः पीतवासा।

माषादि तैलं वातिकारादौ-

माषो यवातसी... च कुरण्टकः .... सर्ववातविकारनुत्।। - शा.सं.म.खं.९/१२४-१३२

दी- कुरण्टकः सहचरः। गू.दी. - पीतवासा

शतावरी तैलं वातादौ -

शतावरी बलायुग्मम्..... कुरण्टक .....।। शा.सं.म.ख.अ. ९/१३३-१४०

वीरतर्वादि गणः सहचरत्रयम्। - शा.सं.म.खं.अ २/१०२-१०४

दी -सहचरत्रयमिति कुरण्टकत्रयम् ।

तच्च पीतरक्तनीलकुसुमभेदेन बोध्दव्यम्।

3) It is recommended in the treatment of Vidradhi.

विद्रधौ वरुणादिकयोग - सौरयकत्रयम् ।। शा.सं.म.खं.अ २/१२७-१३०

दी - सौरेयकत्रयमिति सहचरत्रयम्।

तच्च पुष्पभेदेन भिन्नं विख्यातम्।

गू.दी - सौरेयकत्रयं तत्र श्वेतपीतकृष्णभेदैः।

4) It is one of the constituents of Maharasnadi kwata which is useful for most of the vata diseases.

महारास्नादिक्वाथः सर्वातरोगे।

रास्नाद्विगुणभागा ..... सहचरश्चैव ..... ।। शा.सं.म.खं. अ. २/८८-९४

प्रयोक्तव्यासदैवार्द्रा । - सहचरी - शा.सं.प्र.खं. अ. १

सहचरः कुरण्टकः पियावासा इतिशेषः । दीपिका

Yogaratnakara References:

1) Sahachara should be one of the constituents of a no. of medicated oils viz. Kashmaryadi, Mashadi, Sahacharadi, Rasnadi.

कैश्यतैल - काश्मरी मूल, सहरचर कुसम, केतकी मूल,

केशा:काशप्रकाशा अपि मधुपनिभा अस्य योगाद्भवन्ति ।। क्षुद्ररोगचिकित्सा

2) It should be one of the constituents of a no. of decoctions (Quathas) useful for treating Vata Diseases, Jwara etc.

संधिस्थज्वर चिकित्सा

रास्नाशुण्ठीसहचरादिसिध्दकषाय

ज्वरे कुरण्टकादिनामा लेह:।

कुरण्टकं समूलं..... ।।

वातव्याधिचिकित्सित

माषातसीयवकुरण्टक ..... ।। (सिध्दतैल)

सहचरामरदारु ..... ।। (सिध्दतैल)

रास्नैरण्डमृतोग्रासहचर ..... ।। (क्वाथ)

रास्नाद्विगुणनाभा ... सहचरश्चैव ...।। (क्वाथ)

रास्नापूतिकतैलम् - सहचरम्

3) It may be used as a constituent in Avaleha forming used in vyadhies like .g. Kustha and, Jwara.

भल्लातकावलेह - कुरण्टक - कुष्ठचिकित्सित

Kashyapa Samhita References:

1) Oil medicated with Sahachara, *Agnimantha* etc. should be used for abhyanga of the baby while treating almost all *Graha bhadha* diseases.

   सर्वग्रहेषु सामान्यभेषजम् - अग्निमन्थकुरबकादि सिध्दतैलम् बालाभ्यङ्गार्थम्।

   कुरबक - रक्तझिण्टी - लालकटसरैया - बालग्रहचिकित्साध्याय

2) For treating the *Dhatri*, it should be a constituent of a no. of medicated oils viz. *Bala Taila, Shatavari Taila* etc.

   बलातैल - सहचर (पियाबांसा)

   शतावरी सहचरादिसिध्दतैल

   सिध्दतैल ..... पक्वं तैले सहाचरे।

   सहाचर - नीलीकटसरैया - कालाबाँसा. - धात्रीचिकित्सिताध्याय

Bhaishajya Ratnavali References:

1) Sahachara is included in *Varunadi* and *Viratarvadi* gana and used for treating ashmari in the form of a constituent of medicated ghees. (*Kushadya Ghrita, Pashanbhedadi Ghrita* etc.)

   वीरतर्वादि - सहचरौ (नीलपीत)

   ..... वातविकारनुत्।

   अश्मरीशर्करामूत्रकृच्छ्राघातरुजापहः।।

   कुशाद्यं घृतं पित्ताश्र्याम् । ५९-६१

   कुरण्टिका

   पाषाणभेदादि घृतम्।। ५४-५७

   आर्तगल नीलपुष्प)

   वीरतर्वादि - आर्त्तगलः (नील) शैरीयौ (पीतनील) - अश्मरी चिकित्सा प्रकरणम् । ३६/१२-१४

2) It is used for treating Shiroroga as a constituent of *Kinkini Tailam*.

किडिकनी तैलम् (बृहत)

किडिकनी ..... सहचरस्यच ..... ।। १५२-१५६ शिरोरोगचिकित्सा प्रकरणम्।

3) For treating dantarogas, it is used in the form of quatha (decotion) or medicated oil.

आर्त्तगलदलक्वाथ गण्डुषौ दन्तचालनुत्। १३

सहचरतैलम् । तुलां धृतां नीलसहाचरस्य ..... ।। ६१/१३५

दन्तस्थैर्यकर - मुखरोग चिकित्साप्रकरणम् । ६१

4) It is recommended for treating no. of diseases in case of *Sutika* (Sutikarogas or Post-partum Diseases)

सहचरक्वाथ (प्रथमः) - सहरचकृतः क्वाथः पिप्पली चूर्ण सयुंतः।

दीपनो ज्वरदोषामसूतिकारोगनाशनः ।। ६९/६

पीतकुरण्टकक्वथितं ..... ।।६९/७

सहचरादिक्वाथः । (प्रथमः) सद्योज्वरसूतिकशुलहरम्।

सहचरादिक्वाथः । (द्वितीयः) सद्योज्वरशूलनुत्सूत्याः।। सूतिकारोग चिकित्सा ६९

5) It is also recommended for treatment of a no. of Kshudrarogas. e.g. *Nychha, Nilika, Mukhadushika, Tilakalka* etc.

सहचरघृतम्न्यच्छादिषू। न्यच्छ नीलिकातिलकालक ।

अङ् गुलवेष्टक, पाददारी मुखदूषिकाक्षुद्ररोगचिकित्साप्रकरणम् । ६०

6) It is said to be anti-palita when used in the form of *Mahanila Taila*.

महानीलतैलं पलितघ्नम्। (च.द.)

Harita Samhita References:

कुरबकस्य पुष्पेण जपाया: कुसुमेन च।

घृष्टस्य चेन्द्रलुप्तस्य कृतमेव निवारणम्।। - तृतीयस्थान ४३/८

Chakradatta References:

दन्तदार्ढ्ये महासहचरतैलम् - नीलसहाचर

वीतरादिगण - सहचरौ (पीत, नील) कुरुण्टिका

वीरतरादिरित्येष गणो वातविकारानुत्।

अश्मरीशर्करामूत्रकृच्छ्राघातरुजाऽपह:।।

वाताश्मर्या कुशाद्यं घृतम्, कुरुण्टक:। अश्मरी चिकित्सा

कफमेदोनिवारणो वरुणादिगण: - आर्तगल (नीलपुष्पीकटसरैया)

शैरीयौ (नीलपुष्प, पीतपुष्प पियावासा)

वरुणादि गणो ह्येष कफमेदोनिवारण:।

विनिहन्ति शिर:शूलं गुल्माद्यन्तविद्रधीन्।

सर्वव्याधौविष्णूतैलम् - सहचरमूल. - वातव्याधि चिकित्सा

वातादौ महानाराण तैलम्, - कुरण्टक

सर्ववातव्याधी एकादशशतिकं प्रसारणीतैलम्,- कुरुण्टमूल,

वातव्याधी अष्टदशशतिकं प्रसारणीतैलम्, - सहचर

वातव्याधी महाराज प्रसारणीतैलम्, - पीतसहचर.

Other Sahachara references:

Quotations about Sahachara may be found in Sanskrit Literature other than Veda and Ayurveda e.g. *Kalidasa*, the great, in his *Ritusambhava* describes the beauty of Sahachara inflorescence and compares with that of a lady's face. He further claims that the beauty of the Sahachara indulges every observer to fall in sexual vigour.

Name of the Author	Name of the Book	Special Comment if any about Sahachara
Vd. V.M.Gogate	Dravyagunavignyanam	-
A.P.Deshpande, Ranande, Javalgekar	Dravyagunavignyanam	-
Dr. Mayaram Uniyal	Prayogatmaka Abhinava Dravyagunavigyanan	It is included in Ericaceae Family.Occu-rance in Himalaya. Aware of the contro-versies about Sahachara in texts. Rakta Sahachara ~ Rhododendron anthopogon. Peeta Sahachara ~ Rhododendron lepidotum. Neela Sahachara ~ Rhododenron campanulatum.
Dr. Apte M.V.	Vanashri Srushti - Vol. II	Two types of Sahachara are - Vanya and Upavnya. Vanya - Yellow flowers and Numerous Thorns. Upavnya - White flowers and thorns less in no.
Dr. Mhaskar K.S	Sarpadamshachya Prayujyamanasathi Bhavatalil Vanaspati	*Barleria cristata* Linn. should be used in case of snake bite. e.g. Kwatha for Sleshmanissarana and Lepa using roots and leaves and also the powder and its seeds. No Positive result was observed.

Table 3 - Specific references of Sahachara in Dravyaguna texts.

For the sake of medicinally important compilation, such quotations are not included in this research work. Some recent authors of dravyguna vigyanam or similar subjects are noteworthy. Their names, books and their comments about Sahachara are exhibited in the above table which may serve as a 'ready reckoner' for the scholars in future.

Synonyms in Brihatrayees and other Granthas:

Text	आर्तगल	कुरण्टक	कुरण्टिका	कुरुण्ट	कुरुण्टक	कुरुण्टिका	कुरबक	कोरण्ट	दासीकुरण्टक
च.सं									
सु.सं	✓	✓	✓			✓			✓
अ.सं.									
अ.ह्र.	✓	✓						✓	
शा.सं.		✓							
यो.र.		✓							
च.द.	✓			✓	✓	✓			
भै .र.	✓	✓	✓			✓			
का.सं.							✓		

Table 4 - Synonyms in Brihatrayees and other Granthas

Synonyms in Brihatrayees and other Granthas:

Text	बाण	शैरीय	शेरीयका	सहचर	सहाचरी	सहाचर	सैर्यक	सैरियक	सैरेयक	सौरेयक
च. सं.				✓						
सु.सं.				✓				✓	✓	
अ.सं.				✓						
अ.ह्र.	✓			✓		✓	✓			
शा.सं.				✓	✓					✓
यो.र.				✓						
च.द.				✓						
भै. र.		✓	✓	✓		✓				
का.सं.				✓		✓				

Table 5 - Synonyms in Brihatrayees and other Granthas

Artagala	-	4	Bana	-	1
Kurantaka	-	5	Shairiya	-	1
Kurantika	-	2	Shairiyaka	-	1
Kurunta	-	1	Sahachara	-	9
Kuruntaka	-	1	Sahachari	-	1
Kuruntika	-	3	Sahaachara	-	3
Kurabaka	-	1	Sairyaka	-	1
Koranta	-	1	Sairiyaka	-	1
Dasikuruntaka	-	1	Saireyaka	-	1
Saureyaka	-	1			

Ganas: Brihatrayees and other Granthas:

Text	आरग्वधादि	वरुणादि	वीरतरादि	कंटकपंचमूळ	वातसंशमन	श्लेष्मसंशमन	पित्तसंशमन
च. सं							
सु.सं	✓	✓	✓	✓	✓	✓	
अ.सं.	✓	✓	✓		✓		✓
अ.ह्र.	✓	✓	✓				
च.द.		✓	✓				
बृ.र.	✓	✓	✓	✓	✓	✓	
भै.र.		✓					
शा. सं.		✓	✓				
अ.नि.	✓	✓	✓				

Table 6 - Gana of Sahachara from Brihatrayees and other Granthas

Aragvadhadi	-	5	Vatasamashamana	-	3
Viratarvadi	-	7	Kantakpnachamula	-	2

Varunadi	-	8	Sleshmasamashmana	-	2
Pittasamshamana	-	1			

Rogaghnata of Sahachara According to Various Samhitas:

Rogaghnata	सु.सं	च.सं	अ.ह्र	अ.सं	शा.सं	यो.र.	च.द	का.सं	भै.र.
अश्मरी	✓		✓				✓		✓
मूत्रशर्करा	✓		✓						
मूत्रकृच्छ्	✓		✓						
मूत्राघात	✓		✓						
वातव्याधी	✓	✓	✓		✓	✓	✓		
वातरक्त	✓		✓						
कुष्ठ	✓		✓			✓			
कण्डु	✓		✓						
व्रण	✓		✓						
विषघ्न	✓		✓						
प्रमेह	✓		✓						
ज्वर	✓		✓						✓
च्छर्दि	✓		✓						
मेदघ्न	✓								✓
शिर:शूल	✓		✓						✓
गुल्म	✓		✓						
अन्तर्विद्रधी	✓		✓						
रक्तपित्त	✓								

शोथ	✓								
शुक्रदोष	✓								
प्लीहा		✓							
श्वास		✓							
कास		✓							
वर्ण्य		✓							
बल्य		✓							
आयुष्य		✓							
अग्नीमान्दघ्न			✓						✓
स्वरसाद			✓						
बालग्रह								✓	
धात्रीरोग								✓	
सूतिकारोग									✓
क्षुद्ररोग									✓

Table 7 - Rogaghnata of Sahachara According to Various Samhitas

Ashmari	- 4	Mutrasharkara	- 2
Mutrakruchha	- 2	Mutraghata	- 2
Vatavyadhi	- 6	Vatarakta	- 2
Kushtha	- 3	Kandu	- 2
Vrana	- 2	Vishaghna	- 2
Prameha	- 2	Jvara	- 3
Chhardi	- 2	Medaghna	- 2
Shirashula	- 3	Gulma	- 2
Antarvidradhi	- 2	Raktapitta	- 1

Shotha	- 1	Shukradosha	- 1
Peelha	- 1	Shwasa	- 1
Kasa	- 1	Varnya	- 1
Balya	- 1	Ayushya	- 1
Agnimandya	- 2	Swarsad	- 1
Balagraha	- 1	Dhatriroga	- 1
Sutikaroga	- 1	Kshudraroga	- 1

Rasa of Sahachara According to Various Nighantus:

रस	कै.नि.	रा.नि.	म.नि.	शा. नि.	म.नि.	भा. नि.	नि.आ.	ध .नि.
मधुर	✓		✓	✓	✓	✓		
तिक्त	✓	✓	✓	✓	✓	✓	✓	✓
कटु		✓						
अनम्ल	✓			✓		✓		

Table 8 - Rasa of Sahachara According to Various Nighantus

Rasa of four classical Types of Sahachara According to Nighantu Ratnakara:

Rasa	श्वेत	रक्त	पीत	नील
मधुर	✓			
तिक्त	✓	✓	✓	✓
कटु	✓	✓	✓	✓
कषाय			✓	

Table 9 - Rasa of Sahachara types according to Nighantu Ratnakara

Madhura	-	6	Kashaya	-	1
Tikta	-	12	Anamla	-	3
Katu	-	5			

Doshaghnata of Sahachara According to Various Nighantus:

Doshaghnata	कै.नि.	रा.नि.	म.नि.	शा.नि.	म. नि.	भा.नि.	आ.नि.	ध.नि.
वातघ्न	✓	✓	✓	✓	✓	✓	✓	✓
पित्तघ्न							✓	✓
कफघ्न	✓	✓	✓	✓	✓	✓	✓	✓

Table 10 - Doshaghnata of Sahachara According to Various Nighantus

Doshaghnata of Sahachara Varities According to Nighantu Ratnakara:

Doshaghnata	श्वेत	रक्त	पीत	नील
वातघ्न	✓	✓	✓	✓
पित्तघ्न		✓		
कफघ्न	✓	✓	✓	✓

Table 11 - Doshaghnata of Sahachara Varities According to Nighantu Ratnakara

Vataghna	-	12	Pittaghna	-	4
Kaphaghna	-	12			

Guna of Sahachara according to Various Nighantus :

Guna	कै..नि.	रा.नि.	म.नि.	शा.नि.	मदनविनोद	भा.नि.	आ.नि.	ध.नि.
स्निग्ध	✓							
सुस्निग्ध			✓	✓	✓	✓		

Table 12 - Guna of Sahachara according to Various Nighantus

Guna of Sahachara Types According to Nighantu Ratnakara:

Guna	श्वेत	रक्त	पीत	नील
स्निग्ध	✓			

Table 13 - Guna of Sahachara Types According to Nighantu Ratnakara

Snigdha - 2

Susnigdha - 4

Varga/Gana acoording to various Nighantus:

Sr.No	Nighantu	Gana/Varga
1	Raj	Karaviradi Varga
2	Kaiyadev	Aushadhi Varga
3	Dhanwantari	Guduchyadi
4	Bhavaprakash	Guduchyadi
5	Ashtanga	Aragvadhadi
6	Madanpala	Vatadi
7	Shodhal	Guduchyadi
8	Brihad Nignantu Ratnakar	Aragvadhadi Gana

Table 14 - Varga/Gana acoording to various Nighantus

Veerya of Sahachara according various Nighantus:

Veerya	कै.नि.	रा. नि.	म. नि.	शा. नि.	म.वि.नि.	भा. नि.	आ. नि.	ध. नि.
उष्ण	✓		✓	✓	✓	✓		
शीत							✓	✓

Table 15 - Veerya of Sahachara according various Nighantus

Veerya of Sahachara Varities According to Nighantu Ratnakara :

Veerya	श्वेत	रक्त	पीत	नील
उष्ण	✓	✓	✓	

Table 16 - Veerya of Sahachara Varities According to Nighantu Ratnakara

Uhsna - 8 Sheeta - 2

Karma and Rogaghnata as per Nighantu Granthas:

Karma	कैयदेव निघण्टू	राज निघण्टू	मदनपाल निघण्टू	शालिग्राम निघण्टू	मदनविनोद निघण्टू	भावप्रकाश निघण्टू	आदर्श निघण्टू	धन्वंतरी निघण्टू
कुष्ठघ्न	✓	✓				✓		
कण्डुघ्न	✓	✓	✓	✓	✓	✓		
विषघ्न	✓		✓	✓	✓	✓		
शूलघ्न		✓						
व्रणघ्न		✓	✓					

शोथघ्न		✓					✓	✓
त्वगदोष नाशक		✓						
कासघ्न		✓						
वलीघ्न				✓				
तृष्णा नाशक							✓	✓
विदाहघ्न							✓	✓
वृष्य							✓	✓
बल्य							✓	✓

Table 17 - Karma and Rogaghnata as per Nighantu Granthas

Karma and Rogaghnata of Four Classical types of Sahachara according to Nighantu Ratnakara:

Karma	श्वेत	रक्त	पीत	नील
कुष्ठघ्न	✓			✓
कण्डुघ्न	✓			✓
विषघ्न	✓			
शूलघ्न		✓		✓
व्रणघ्न				✓
शोथघ्न		✓		✓
त्वगदोषनाशक				✓
कासघ्न		✓		
वलीघ्न			✓	
ज्वरघ्न		✓		

वातव्याधी		✓		
आध्मान नाशक		✓		
श्वासघ्न		✓		

Table 18 - Karma and Rogaghnata of Sahachara according to Nighantu Ratnakara

Kushtaghna	- 5	Jvaraghna	- 1
Kandughna	- 8	Vatavyadhi Nashaka	- 1
Vishaghna	- 6	Adhmana Nashaka	- 1
Shulaghna	- 3	Trushna Nashaka	- 2
Vranaghna	- 3	Vidahaghna	- 2
Sothaghna	- 5	Vrushya	- 2
Tvagdosha Nashaka	- 2	Balya	- 2
Kasaghna	- 2	Shwasaghna	- 1
Valighna	- 1		

Paryayas of Peeta Sahachara according to Various Nighantu Granthas:

Paryaya	रा.नि.	कै.नि.	ध. नि.	भा. नि.	शा. नि.	म. नि.	शो. नि.
Kinkirat	✓				✓		
Peetamlan	✓				✓		
Kurantaka	✓	✓	✓	✓	✓	✓	✓
Kanak	✓				✓		
Peetakurava	✓						
Supeeta	✓						
Peetakusum	✓						
Sahachara					✓		

Table 19 - Paryayas of Peeta Sahachara according to Various Nighantu Granthas

Paryayas of Neela Sahachara according to Various Nighantu Granthas :

Paryaya	रा.नि.	कै.नि.	ध. नि.	भा. नि.	शा. नि.	म. नि.	शो. नि.
Aartagala	✓	✓		✓	✓	✓	✓
Neelapushpa	✓						
Dasi	✓			✓	✓		✓
Neela-amlan	✓						
Chhadan	✓						
Bana	✓	✓		✓	✓	✓	✓
Odanpaki		✓				✓	✓
Zhinti	✓						

Table 20 - Paryayas of Neela Sahachara according to Various Nighantu Granthas

Paryayas of Rakta Sahachara according to Various Nighantu Granthas:

Paryaya	रा.नि.	कै.नि.	ध. नि.	भा. नि.	शा. नि.	म. नि.	शो. नि.
Rakta-amlan					✓		
Rakta-pushpa	✓				✓		
Ragaprasarak					✓		
Subhaga					✓		
Kurubak		✓	✓	✓	✓	✓	✓
Shona					✓		
Zhintika					✓		

Table 21 - Paryayas of Rakta Sahachara according to Various Nighantu Granthas

5.2 Pharmacognostic Review

Flora of nature is fascinating. Each and every species of nature has its own identity which is evidenced by macro and microscopical characteristics. As newer drugs are being introduced, to know the pros and cons of drug, Pharmacognosy is the mere necessity. 'Pharmakon' means 'a drug' and 'gnosy' means 'to aquire knowledge'. Pharmacognosy of a plant aid in identification and determines the authenticity.

Sahachara belongs to *Acanthaceae* family. Family key characters along with the morphological review of four varities viz. Shweta (*Barleria cristata* Linn.), Rakta (*Barleria gibsoni* Dalz.), Neela (*Barleria strigosa* Willd.), Peeta (*Barleria prionitis* Linn.) of Sahachara is given as below.

***Acanthaceae* Family:**

Habit - Herbs or shrubs.

Leaves - Opposite, usually entire, stipules 0.

Flowers- Hermaphrodite, usually irregular, in cymes, racemes, or spikes (rarely solidatory); bracts large or small, sometimes o; bracteoles usually 2, sometimes more under the individual flowers, free or connate into an epicalyx.

Calyx -5 (rarely 4) partite (in Thunbergia small,often multifid). Corolla 2 –lipped or sub- equally 5-lobbed; lobes imbricate or twisted in bud**.**

Stamens- 4 or 2, inserted on the **corolla tube-;** anthers 2 or 1 celled, the cells sometimes remote. Disk often conspicuous. Ovary superior,2-celled; ovules 1 or more in each cell,1-or 2-seriate, anatropous; style simple, filiform, or thickened below; stigma usually 2 lobed, the lobes sometimes unequal.

Fruit- A loculicidal capsule, the valves often elastically recurved, the septum splitting, the seeds borne on each half.

Seeds- usually hard, attached (except in a few genera) to recurved subacute supports (retinacula), ovoid or compressed, smooth or rugose, rarely hispid; albumen 0 or (rarely) scanty.

Genera 240. Species 2,000.-Especially tropics, but also Mediterranean,U.S. and Australia.

Thorough research has been done on Peeta Sahachara (*Barleria prionitis* Linn.) sp. which is much more explored type of Sahachara as compared to other types of Sahachara so Phyto-chemical and pharmacological details of *Barleria prionitis* Linn. is given below.

Regional Names of Sahachara:

Sanskrit	:	Kurantaka, Koranda, Kerandaka
Assamese	:	Shinti
English	:	Porcupine Flower
Gujrati	:	Kanta-Saerio, Kantasalio
Hindi	:	Sahachara
Kannada	:	Sahachara
Marathi	:	Koranta, Koranti
Malayalam	:	Kirimkurnji, Karim kurunni
Odiya	:	Dasakeranda
Punjabi	:	Sahachar
Tamil	:	Sammuli
Telugu	:	Mulu Gorinta Chettu
Urdu	:	Pila Bansa, Piya Bansa

Morphology of Peeta Sahachara(*Barleria prionitis* Linn.) :

Root - Well developed, up to 1 cm thick at the top, cylindrical and tapering, bearing lateral branches and numerous rootlets; surface rough due to numerous dot-like lenticels and root scars of fallen roots; external surface greyish-brown, bark thin with smooth internal surface; wood cream coloured; fracture, hard and laminated; odour and taste not characteristic.

Stem - Erect, 1-8 mm thick terete, hard, glabrous, nodes wollen, branching at the nodes, young stem grey, slightly four angled, usually 3-4 divaricate spines at axil of leaf ; mature

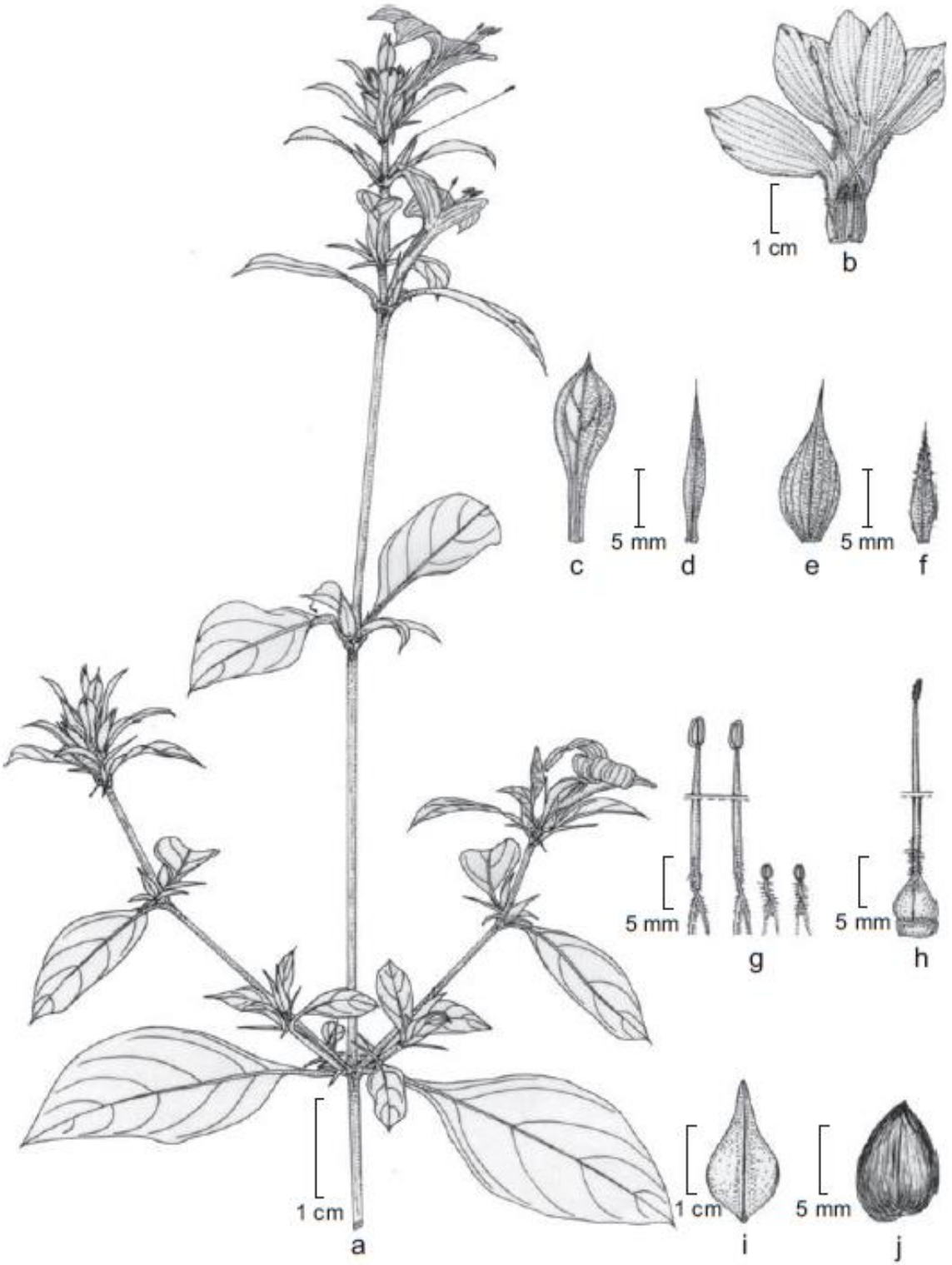

Figure 1 Morphology of *Barleria prionitis* Linn.

a - Flowering Twig; b - Corolla split open; c - Bract; d,e- Outer sepals; f- Inner sepal; g - Stamens; h - Pistil; i- Capsule; j- Seed.

stem cylindrical with longitudinally arranged or scattered dot-like lenticels; externally greyish to light brown; a few mature stem slightly hollow.

Leaf- Dorsiventural, variable in size 6-9.5 cm long, 2.5 - 3.5 cm wide , simple, elliptic, acuminate, antire, acute, reticulate, unicostate, glabrous or pubescent beneath; petiole short. wide and as long as the shorter of the outer ones, linear lanceolate, mucronate; corolla, 3.2-4.5 cm long, yellow, slightly pubescent outside, glabrous inside, somewhat 2 lipped; upper lip 2 cm long or more , deeply 4 lobed, the lobes oblong-obovate, round; lower lip oblong-obovate, round, entire; tube 1.9-2.2 cm long; stamens 2 fertile and 2 staminodes, filaments of fertile stamens excreted beyond the corolla tube, those of the staminode very short; ovary superior of two fused carpels; style, simple, usually with two stigma.

Fruit- Capsules, 2-2.5 cm long , ovoid with long tapering solid beak; 2 seeded.

Seed- Compressed, 0.8 cm in diameter and clothed with silky appressed hairs.

Flowering and fruiting- August –March

Habitat - Ravines and shady habitats in deciduous forests and also grown in gardens.

Distribution –

World : India, Malasia, Pakistan, Philippines, Srilanka, Tropical Africa and Yemen.

India : Throughout.

Flower- Sessile, often solitary in the lower axils, becoming spicate above; bracts foliaceous, 16 by 4.5 mm, oblong or lanceolate, acute, bristle-tipped, nearly glabrous; bracteoles 1.3 cm long, narrowly linear, subulate (almost spinous), bristle tipped; calyx, divide almost to the base, one of the outer sepals rather more than 1.3 cm long, the opposite sepal rather than 1.3cm long, 3.4 mm broad, both oblong-lanceolate. Mucronate; the 2 inner sepals 1.5 mm

Morphology of Shweta Sahachara (*Barleria cristata* Linn.) :

Herbaceous;

Stems - more or less appressedly hairy, densely hairy at the nodes.

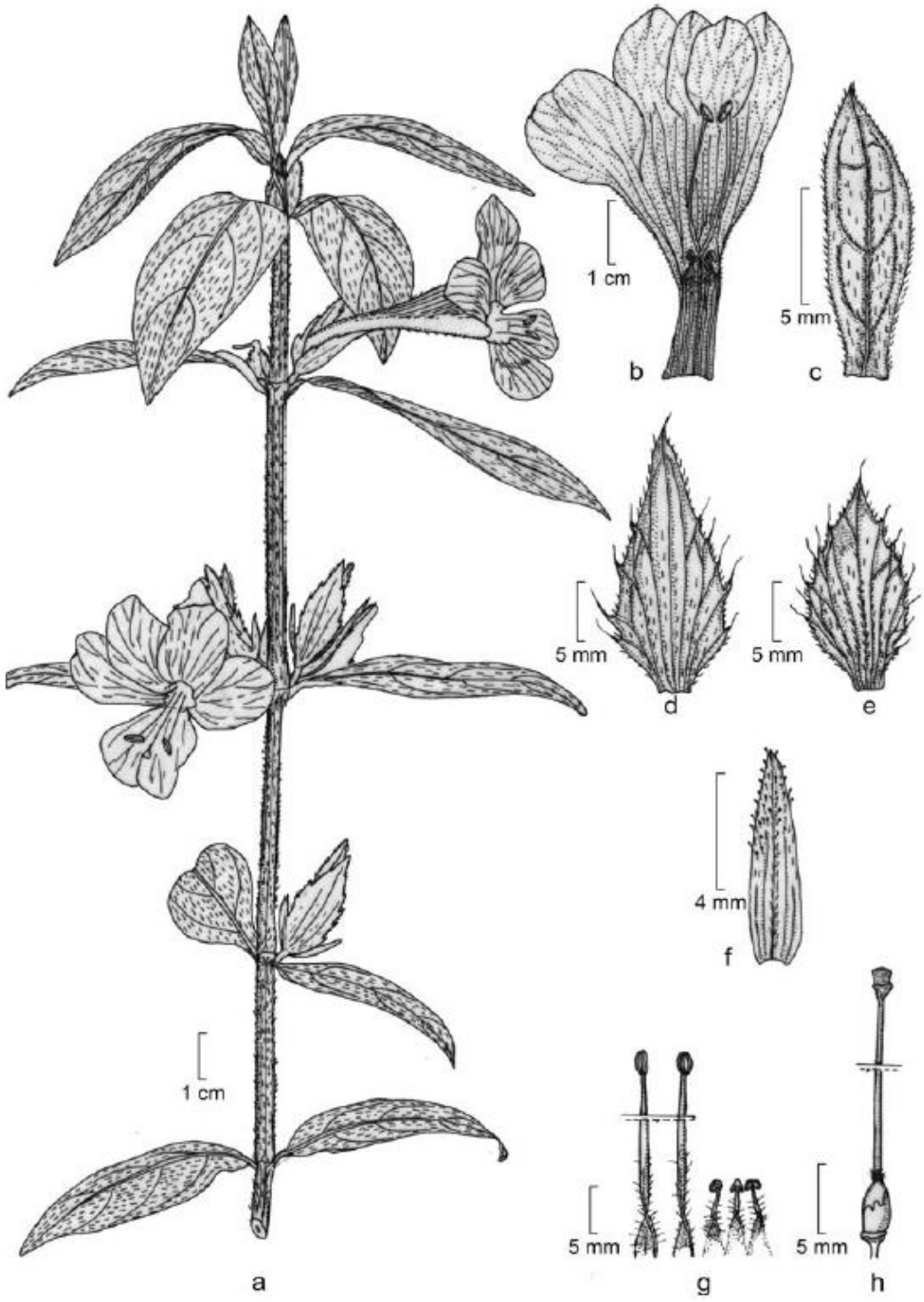

Figure 2- Morphology of *Barleria cristata* Linn.

a - Flowering Twig; b - Corolla split open; c - Bract; d,e- Outer sepals; f- Inner sepal; g - Stamens; h - Pistil.

Leaves - 2 ½ - 4 by 1 - 1 3/1 in, elliptic-oblong, acute or acuminate, hairy on both sides, lineolate above, base tapering; main nerves 6-7 pairs; petioles 1/8 - 1/3 in. long.

Flowers -in axillary and terminal short ovate dense spikes; bracteoles conspicuous, ½ in. long, linear, acute, membranous, veined, pubescent, with ciliate and often distantly toothed margins.

Calyx - hairy at the base; outer sepals membranous, whitish, the longer 1 in. long by 1/3 in. broad (within the marginal spines), broadly lanceolate, long-acuminate, mucronate and with subspinous bristle- tipped teeth on the margins, the opposite sepal similar but slightly narrower and ¾ in. long, both with raised conspicuous nerves running out into the marginal spines and with raised conspicuous recticulate venation between the nerves, pubescent; inner sepals 1/3 by 1/12 in , linear-lanceolate, acute, veined.

Corolla - pubescent outside, blue, 1-1 ¾ in. long; upper part of the tube widely infundibuliform; lobes ¾ in. long, obovate - oblong, rounded.

Capsules -5/8 in. long ellipsoid, acute at both ends, 4-seeded. Seeds 1/6 in. in diam., orbicular, compressed, silky-hairy.

Flowering and fruiting- June –March

Habitat- Cultivated, also found as an escape.

Distribution

World: Bangladesh, China, India, Myanmar, Nepal, Pakistan, Philippines, Srilanka, Vietnam.

India: Throughout.

Morphology of Rakta Sahachara (*Barleria gibsoni* Dalz.)

Suffruticose, glabrous.

Leaves- elliptic, acuminate, 4 - 7 by 2-4 in; glabrous lineolate above, glaucous beneath , base rounded or subacute; main nerves 5- 8 pairs; petioles ¼ - ¾ in. long.

Flowers -solitary, axillary , and in terminal spikes ; bracts foliaceous, 1 in. long, ellicptic-lanceolate , acute, glabrous; bracteoles ½ in.long, narrowly linear, acute.

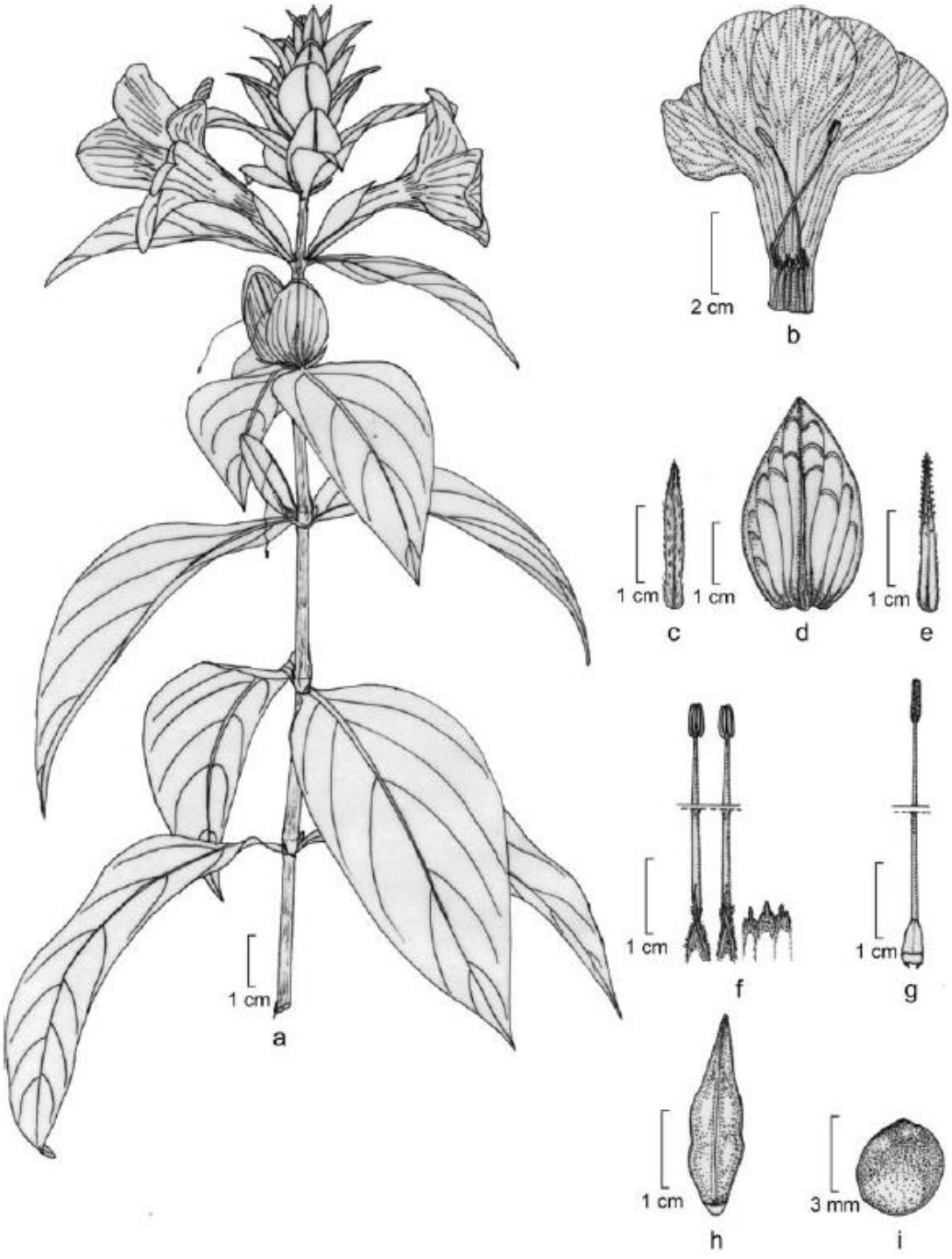

Figure 3- Morphology of *Barleria gibsoni* Dalz.

a - Flowering Twig; b - Corolla split open; c - Bract; d - Outer sepals; e - Inner sepal; f - Stamens; g - Pistil; h - Capsule; i - Seed.

Calyx -glabrous or nearly so; outer sepals subequal, 11/4 by ¾ in., elliptic-oblong or nearly so; outer sepals subequal , 1 ¼ by ¾ in, elliptic - oblong or obovate - oblong, usually rounded at the apex and more or less narrowed towards the base, strongly nerved andreticulately veined ; inner sepals 5/8 by 1/12 in., linear - lanceolate, acute , hairy on both sides, ciliolate, veined.

Seeds- ¼ by 1/5 in. ellipsoid, black, quite glabrous.

Corolla- glabrous of a fine pink, reaching 3 ½ in. long; tube up 2 ½ in.long, enlarged upwards; lobes obovate, rounded. Staminodes without anthers. Capsules 7/8 in.long, oblong acuminate, glabrouse.

Flowering and fruiting - September –March

Habitat - Grassy hilltops and slopes at higher altitudes.

Distribution - India: Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisa, endemic.

Morphology of Neela Sahachara (*Barleria strigosa* Willd.):

A shrub 3-4 Ft.,high; stems more or less sparsely strigose .

Leaves- 4.5-6 by 1.5-2.5 in., eliptic -lanceolate ,acuminate, lineolate on the upper side, sparsely strigosely hairy above, more densely so on the nerves and veins beneath with long, often bulbous-based hairs ,margins ciliate ,base decurrent wing-like into the petiole; main nerves 6-8 pairs;petioles0.5-1 in. long,often obscure from the decurrent leaf-blade.

Flowers-in terminal srtigosely hairy spikes often crowded at the tops of the branches; bracteoles 3/8-1/2 by in. long, lanceolate, hairy on the back and with ciliate margins.

Calyx-densely strigosely hairy; outer sepals herbaceous,subequal,3/4-1 by 1/3 in., eliptic-lanceolate, subacute, strigose with long stout hairs and with ciliate margins; inner sepals 7/16 by 1/12 in., linear, acute, thick, densely clothed with appressed white silky hairs.

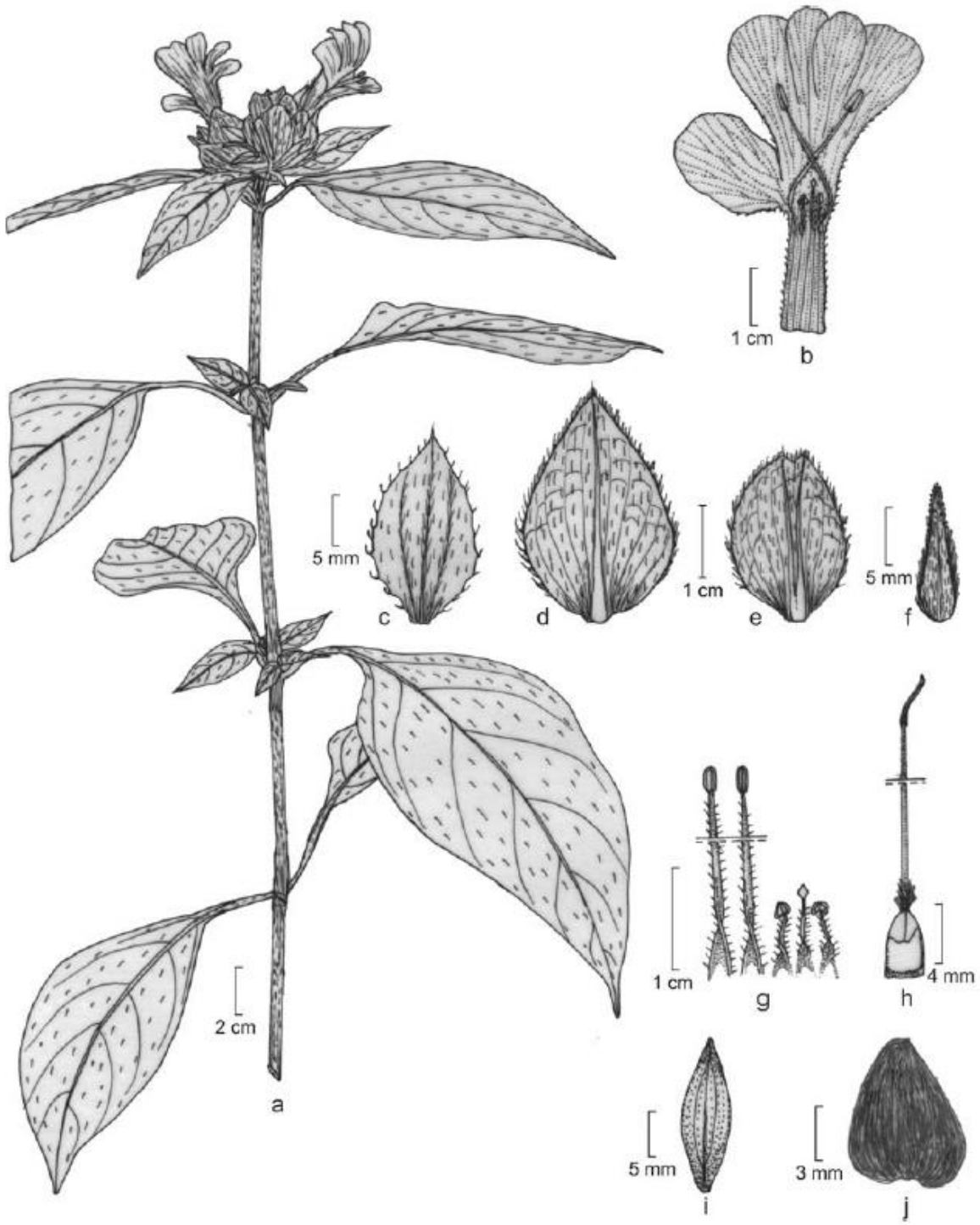

Figure 4 - Morphology of *Barleria strigosa* Willd.

a - Flowering Twig; b - Corolla split open; c - Bract; d,e- Outer sepals; f- Inner sepal; g - Stamens; h - Pistil; i- Capsule; j - Seed.

Corolla-blue, the tube paler than the limb, glabrous, reaching 2.5 in. long ;tube infundibula-form in the upper part; lobes ¾ in.long, obovate-oblong, obtuse. Filaments of the stamens and staminodes hairy at the very base.

Capsules-3/4 in. long, oblong-ellipsoid, acute, glabrous, 4-seeded.

Seeds-1/4 by 1/6 in., ellipsoid, compressed, silky-hairy.

Flowering and fruiting- August–March

Habitat- Undergrowth in moist deciduous forests;also grown in gardens up to 1400 m.

Distribution-India: Throughout.

Chemical composition of *Barleria prionitis* Linn. :

A wide range of Phyto-chemical constituents including balarenone, pipatiline, prionisides, barlerinoside, verbascoside, shanzhiside ;1,8, dihydroxy -2,7- dimethyl 3,6-dimethoxy anthroquinone; 1,3,6,8-tetra methoxy-2,7-dimethyl anthroquinone; 4-carbomethoxy, 5,6-dehydro, 7, 8-dihydroxy, 8- acetylshanzhiside 2 methylester, 13,14- secostigmata-5,14-diene-3-ol; barlerin, acetylbarlerin, gentioside; lupeol; lupulinoside; melilotic acid;p-hydroxy benzoic acid; syringic acid; vanillic acid; scutellarein have been from different parts of this plant.

Pharmacological activities of *Barleria prionitis* Linn. :

Extracts and isolated Phyto-chemicals from this plant have been found to posses wide range of pharmacological activities including antimicrobial, anthelmintic, antifertility, antioxidant, antidiabetic, anti-inflammatory, anti-arthritic, cytoprotective, hepatoprotective, diuretic, anti-diarrheal, enzyme inhibitory and antinociceptive activities without any side effects.

5.3 Experimental Review

Animal Experimentation

All the past history shows that animal experimentation is a great way to make medical advancement in the field of drugs. Biomedical research has included the use of animals as one component of research to understand, treat and cure human diseases. The main aims of experimental pharmacology are to

- Find a suitable therapeutic agent for human use.
- To determine the safety and effectiveness of research test drugs.
- Study the mechanism & site of action of drugs.
- Research on functioning of the cells, pathogenesis, causes of the diseases preventive measures and also how to cure them.
- New drug discovery or to study the action of existing drugs.
- The Physiology of various body systems and the effect of the trial drug on artificially induced diseases can be studied by animal experimentation.

Animal experiments in Ayurveda:

We get ample references regarding the utility of lower animals in different aspects of benefiting the mankind since centuries. In concern to medicine, animals were referred for understanding the disease and drugs by the way of giving simile, also toxic effects of drugs were known by behavioral changes of animals to such drugs. Different parts of the animals were used for treatment and other purposes like storage etc.

There is a reference in Ashtanga sangraha sootrasthana regarding the changes in behavior of animals after feeding them with poison mixed food in small amount. The unnatural behaviors of animals when fed with materials which are poisonous to humans indicate that some kind of reaction takes place in the body of lower animals and humans for a particular drug substance. This paves the way for screening the drug in lower animals for the safety and efficacy before introducing it into humans for clinical trial.

Experimental Evaluation of Anti-inflammatory Activity:

Shotha Meaning:

Swelling or tumour or morbid intumescence. Shopha and Shotha are used synonymous to each other and have same meaning. The recent commentators have considered Shopha as inflammatory swelling and Shotha as generalized swellings.

“Utsedha lakshanam shopha”

“Utsedhata” –“ Elevation”

Samprapti :

" Bahya sira prapya yada kaphasrukpittani sandooshayati vayu

Tairbadhamarga sa tada visarpatyutsedhalingam shwayathum karoti "

Vata which does dooshana of Kapha , Rakta and Pitta when reaches the external Strotas gets obstructed by these vitiated Kapha, Rakta and Pitta resulting in swelling with the characteristic elevation.

Shothahara :

"Shotham haratiti Shothaharam"

The action of the drug which remove Shotha is known as Shothahara.

Inflammation :

Inflammation is defined as the local response of living mammalian tissues to injury due to any agent. It is also a complex reaction of living tissues to injurious agents. It comprises systemic response involving nervous and hormonal adjustments and proliferation of lympho reticulo system and local response (pain, redness, warmth & swelling). The process begins with dilatation of blood vessels and increased blood flow to the area. The vessels become more permeable, allowing plasma to escape from the blood into the extra cellular fluid. This produces swelling of the affected region. Leukocytes also escape from blood vessels in the region and release chemicals that may cause pain. These changes produce the classical signs of inflammation such as Heat (Calor) , redness (Rubor) , Swelling (Tumor) , Pain (Dolor) and Loss of function.

Acute inflammatory reactions are triggered by a variety of stimuli such as Infections, trauma, physical & chemical agents, tissue necrosis, foreign bodies and immune reactions. Persistent infections by micro organisms, prolonged exposure to potentially toxic agents and auto immune reactions lead to chronic inflammation.

Any drug compounds claimed to possess anti-inflammatory activity can be evaluated by their ability to reduce one or more of the phenomena involved in the process of inflammation in experimentally induced inflammation in animals. As Shotha can be compared to inflammation, to evaluate the Shothahara property of the drug Sahachara, four classical types of the drug have been experimented and compared for the acute anti-inflammatory activity.

Edema assays:

Anti-inflammatory activity of a drug can be measured by noting the reduction in edema produced by the local injection of substances like formaldehyde, carrageenan, histamine dextran, and ovalbumin. A modification involves the measurement of leakage of a protein bound marker (Evans blue I) from the circulation into the tissues; the results obtained however vary considerably from laboratory to laboratory.

There are many methods used for the screening of acute and sub-acute anti-inflammatory drugs. One of the most commonly employed techniques is based upon the ability of such drugs to inhibit the edema produced in the hind paw of the rat, after injection of a phlogistic agent (irritant).

The inflamed paw technique is the most successful method (in albino rats) of predicting anti-inflammatory activity in man. Paw inflammation and edema are produced by intra plantar injection of napthoyl heparamine or carrageenan. The effects can be measured in several ways. Usually the volume of the injected paw is measured before and after application of the irritant and then compared with the paw volumes of the treated animals in the standard and control groups. The value of this assessment is less dependent on the apparatus and more on the irritant chosen. Some irritants induce only a short lasting inflammation, whereas others produce an inflammation that continues over more than 24 hours.

The method of Carrageenan induced inflammation (rat paw edema), as introduced by Winter et al (1962) was adopted in this study, owing to its convenience like easy availability of albino rats, Carrageenan and easy measurability of paw volume of rats. Carrageenan, a sulphated mucopolysaccharide - derived from Irish seamass, chondrus. The irritant is devoid of the drawbacks of the others, and also the carrageenan edema model has a fairly high specificity. The activity and potency characteristic of most of the NSAID's roughly parallel to those observed in man.

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 in turn gets obstructed by them leading to swelling with the characteristic elevation. The action of the drug which removes Shotha is known as Shothahara.

As Shotha can be compared to inflammation, to evaluate the Shothahara property of the drug Sahachara, along with their four types have been compared for the anti-inflammatory activity along with the control and standard drug. Compounds claimed to possess anti-inflammatory activity can be evaluated by their ability to reduce one or more of the phenomena involved in the process of inflammation in experimentally induced inflammation in animals.

Experimental evaluation of analgesic activity:

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.

Pain is probably the most fundamental and primitive sensation, teliologically speaking a desirable sensation. Pain usually serves as a protective signal and always indicating a structural damage or some sort of serious functional or metabolic derangement. The free nerve endings are presumably the sense organs for pain. The sensory neurons that mediate pain sensation are known as Nociceptors. They have receptors in the skin, muscles, joints, and internal organs. Nociceptors are activated by a range of potentially damaging (noxious stimuli) which may be mechanical (pinch or cut), thermal (such as burns) or chemicals (exposure to acid). Area subjected to nociceptive stimuli will release algogenic (pain producing) substances which come in contact with receptors & pain is produced. Stimulus for pain include Bradykinin, Serotonin, K+ ions, AMP, Acetyl choline. Analgesics are drugs that selectively relieve pain by acting in the CNS or on peripheral pain mechanisms, without significantly altering consciousness.

As Vedana can be considered as pain, to evaluate the Vedanahara property of drugs, experimental model of Analgesic activity is being selected.

5.4 Drug preparation Review

For the present research work Kwatha Kalpana has been used for the experimentation purpose, so according to Sharangadhara Samhita Kwatha Kalpana review is given as below.

Kwatha Preparation

The term kwatha is basically derived from the root word 'kvathana' which literally means the process of boiling.

Definition

Here Kwatha is the liquid preparation obtained by boiling 1 part of dravya in coarse powder form along with 16 parts of water which is reduced to $1/8^{th}$ part and filtered. The filter rate is taken as Kwatha.

The term Kwatha indicates boiled and reduced water i.e., decoction; Kwatha indicates the instant use of the decoction; and Kwatha boiled over mild fire.

Opinion of Charaka is that the liquid boiled over agni is shruta or the kwatha.

Shruta, Shita, kashaya, niryuha, kadha etc are synonyms of kwatha.

In Sneha Kalpana chapter Sharangadhara samhita other two methods of kwatha preparation as below.

1. **Kwatha preparation depending on the nature of drugs:**

   For soft drugs : 4 times of water

   Medium and hard drugs : 8 times of water

   Very hard drugs : 16 times of water

   (All reduced to $1/4^{th}$ and the term ……indicates ….here)

2. **Kwatha preparation depending on the quantity of the drugs :**

   From 1 karsa to 1 pala : 16 times

   1 pala to 1 kudava : 8 times

   1 kudava to prastha and khari : 4 times

Reason: In the above reference we find that the ratio of water taken for smaller quantity of drug is more and for larger quantity of drugs it is less.

Not bothering about the quality of drug taken one should think on the terms keeping the drug and the water together during the process of boiling, to facilitate the transfer of active principles of water added should last that time duration and remain in desired quantity at the end

of boiling as decoction. Considering the above concept water ratio is decided. Because of the very same reason mild to moderate fire is advised in majority of pharmaceutical preparations.

Precautions:

- Only course power is considered here.
- Chemically inactive vessel should be used.
- Only on mild to moderate heat throughout the process is carried out.
- Vessel is kept open throughout the process.

The lid should not be placed on boiling kwatha for it truns guru in nature.

Reason:

By placing lid over vessel while boiling *kwatha* the *slesmamsa* from the mixture are not let out, as a result of which the end product turns heavy for digestion and may not exert the desired action.

General dosage and shelf life:

2 palas (96 ml)

The kwatha has to be taken after food for better digestion in dwipala matra and it has to be used instantly after preparation.

1 pala (48 ml)

The madhyama matra of kwatha is one pala. But the strength of the patient and the intensity of the disease condition are to be checked before deciding the dosage.

Shell life; for instant use.

The medicated decoctions which are available in the market either will have chemical preservatives in them or they will be fermented to have self-generated alcohol in them as self-preservative.

Chapter-6

MATERIALS AND METHOLDOLOGY

6. Materials and Methodology

Types of study

1. Analytical
2. Experimental

Four Classical types of Sahachara are explained by different Nighantu granthas, later on their respective botanical sources are given by different Dravyaguna Scholars in their books based upon that four classical Variety Root samples were collected from three different localities as mentioned in the below table.

Sr.No	Type of Sahachara	Latin Name	Place of Collection
1	Peeta Sahachara	*Barleria prionitis* Linn.	Pune, Kolhapur, Nagpur
2	Rakta Sahachara	*Barleria gibsoni* Dalz	Matheran, Junnar, Belgaum
3	Shweta Sahachara	*Barleria cristata* Linn.	Pune, Sawantwadi, Mumbai
4	Neela Sahachara	*Barleria strigosa* Willd.	Belgaum, Vegurla, Matheran

Table 1 - Type of Sahachara along with Latin name and place of collection.

In recent Dravyaguna books *Barleria cristata* Linn.sp. was advocated to be taken as Shweta and Rakta Sahachara both, but practically *Barleria cristata* Linn.is having white flowers and not red so after discussing with senior taxonomist, *Barleria gibsoni* Dalz.sp. has been selected as Rakta Sahachara because *B. gibsoni* Dalz. Sp. is having pinkish red flowers which are more appropriate as Rakta Sahachara. Sample codification has been done for each locality sample of Sahachara for better analytical study purpose.

As mentoined in ayurveda literature, collection period of root samples has been advised in *Grishma Ritu* (summer season) but for the authentication purpose *Sahachara* flowering samples were required for herbarium preparation, for this reason root samples were collected in flowering seasons instead of *Grishma Ritu.*

6.1 Pharmacognostical Material

- For field collection of the samples cutter, magnifying lens, mercuric chloride powder, press board, blotting paper were used.
- Digital Camera having Optical zoom 10x used to capture the images of different Species.
- For Microscopy, Research Trinocular microscope having micrometer arrangement with calibrated eyepiece micrometer was used.

6.2 Experimental Material

Animals –Adult healthy forty two Albino Rats of wistar strain, Digital Vernier calliper, Mice gavage needle, weighing machine, Pair of gloves, Aspirin, Carrageenin, Stop watch.

Figure 1 - Inj. Carrageenan

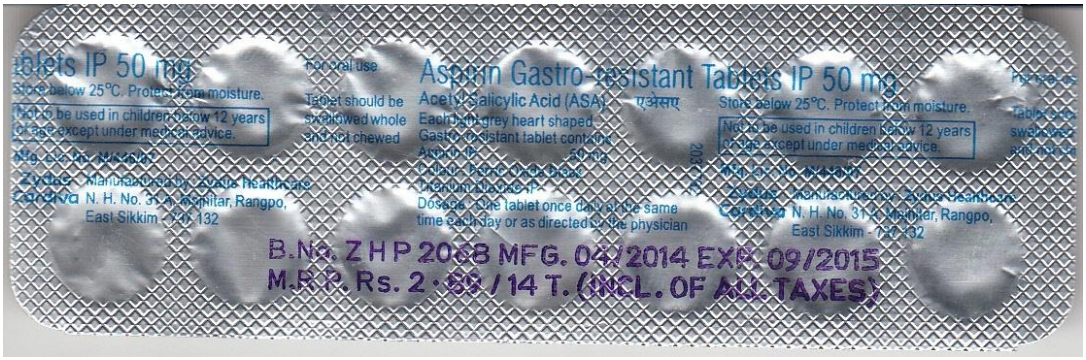

Figure 2 - Aspirin Strip

Aspirin Gastro- resistant Tablets IP 50mg

Company: Zydus Healthcare

Figure 3 - Digital vernier caliper

Methodical collection of information, documenting the result and its analysis is of paramount importance in any new study. Four classical types of Sahachara has been studied under following headings-

Pharmacognostical Study

Physico-chemical Study

Phyto-chemical Study

Animal Experimentation

6.3 Pharmacognostical Study

Four classical variety Root samples of Sahachara were collected from three different localities, in order to compare the pharmacognostical parameters of the each species with each other. These four types of Sahachara were collected from following three different regions as mentioned in Table.no 22. Three different localities were selected as per W.H.O. guidelines for single herbal drug research.

6.3.1 Dravya Sangraha Vidhi

For the field collection of root samples of Barleria varieties from different localities senior taxonomist's, local villagers helped had been taken for the occurrence of that particular Sahachara type in that particular region. As mentioned above root samples of *Barleria Sp.* were collected and they were dried in shed. In dried state also mites, ants, flies, insects and also other microorganism contaminate the sample so necessary precautions were taken. Root samples had been weighed before cleaning and drying. Root samples had been given gentle wash with normal water. After drying with the help of air blower remaining dust removed. Sample were weighed after drying and kept in air tight containers for further analysis.

6.3.2 Herbarium Preparation

A pharmacognostical study of a plant enables the scientist for proper identification of a drug and removes adulteration to provide a basis for authentication of crude drug. By looking the high traditional use of crude drug, herbariums were prepared from collected *Barleria* samples as per following method.

Preparation of herbaria was carried out by certain methods. There are some steps as follows-

1) Selection of material
2) Pressing process
3) Technique of pressing
4) Drying of pressed material
5) Mounting
6) Identification and labeling
7) Protection of prepared herbaria sheet.

1) **Selection**- The plant specimen collected was disease free, with all parts intact without any injuries or deformities. The plant was un-rooted; root was cleaned and gently washed. Plant twigs having leaves and flowers were collected.

2) **Pressing process**-After collection of the plant samples they were pressed immediately in the field condition. Witting of the plant material avoided.

3) **Technique of pressing** - Collected plant specimens were kept in newspapers. Sheets were arranged alternately by blotting paper sheets. These paper sheets were pressed .A wooden press was used. Spreading of plant material inside the sheets and weight on press was done carefully.
4) **Drying-** Blotting paper sheets were changed 2-3 times for proper soaking of moisture from the plant materials. Paper changing in the press was done carefully for 15-20 days by observing the condition of material.

5) **Mounting**- Good quality herbarium sheets were used for pasting or fixing material. Standard size herbarium sheets were used for mounting. Properly dried materials were fixed on the sheet by glue.

6) Identification and labeling- Labeling and identification was done. The identification information carries locality, botanical name, time of collection. The name of the collector is mentioned last.

7) **Protection**- Proper sanitation of storage condition was maintained. Mold, fungi, insects also create problem for herbaria sheet. Thoroughly dried and well ventilated warm conditions were maintained to save the samples from fungal infection.

6.3.3 Authentication

Authentication of the Root samples of *Barleria* species was carried out by botanical Survey of India, Regional Office Pune and Agharkar Research Institute, Pune. Voucher specimens were deposited in concerned institutes.

6.3.4 Microscopical Study

Freshly hand cut transverse sections of root were taken and then thoroughly washed with water and stained with 1% aqueous *safranin* and mounted on slide. The Anatomical Structures were observed under microscope. Images of these sections were taken.

6.4 Analytical Study and Standardization

Due to seasonal and geographical variation chemical composition of plants shows a great variation. These changes reflect in the bio-efficacy and credibility of drugs.

In the early times *Vaidya's* were collecting the plants themselves and marketing the medicines as per requirement of the patients. Most of the time locally available plants were used for preparation.

This trend changed in 20^{th} century. Now due to globalization, many herbal drugs, herbal preparations are imported into India and exported from India. This leads to many pharmaceutical development and increase demand of drug. At the same time due to industrialization there is depletion of forest, which is drug reserve. This position has led to short supply of genuine drugs, adulteration and substitute of drugs. Therefore, authentication and standardization of individual drugs with respective certain parameters which have been described in various pharmacopoeias and recently issued World Health Organization guidelines on the subject is an integral step before it is administered.

There are so many traditionally used drugs having good results in the management of the diseases but their analytical study and standardization procedures were not done before. To put forward them into this pharmaceutical world, there is need to analyze them as analytical parameters help in standardizing drug and gives us an idea of chemical constituents of plant and prove their efficacy according to modern standard parameters. Sahachara is one of the traditional drugs. Analytical study has been done as per following methods.

1) Organoleptic evaluation
2) Macroscopic and Microscopic evaluation
3) Physio-chemical study.

4) Phyto-chemical study

5) High Performance Liquid Chromatography.

6.4.1 Physio-chemical Study

The faulty collection or deterioration of the drug due to the incorrect or extended storage may alter the contact of the active constituents of the drug to a point where it is no longer acceptable. Drugs must therefore be submitted to evaluation procedures, which indicate acceptability by criteria other than their morphology. Following physico-chemical tests were carried out for the comparative analysis of four classical types of Sahachara.

1) Ash Value

Ash is a natural inorganic constituent of the entire herbal residue remaining after incineration.

Ash Value determination

1) The silica crucible was heated for about 10 min. on Bunsen burner.
2) The crucible was cooled and its weight was taken.
3) Accurately weighed 1gm of sample drug was took in the silica crucible and incinerated at 450°C temperature for 3 hours.
4) The crucible was transferred to desiccators for cooling.
5) The crucible was weighed accurately.

$$\text{Formula} = \frac{\text{Weight ash X 100}}{\text{Weight of powder}} = \%\ \text{w/w}$$

i] Ash values -

Total ash :-

Method: 2 gm of ground air dried drug was taken in a previously weighed tarred silica crucible. It was incinerated in a muffle furnace at a high temperature not exceeding 450°C until the residue turned white, indicating absence of carbon. The carbon free residue was cooled in a desiccator and weighed. The percentage of ash was calculated with respect to the dried drug.

ii] Extractive values –

Determination of Alcohol Soluble Extractive: Macerated 5 g of the air dried drug, coarsely powdered, with 100 ml of Methanol of the specified strength in a closed flask for twenty-four hours, shaking frequently during six hours and allowed to stand for eighteen hours. Filtered rapidly, taking precautions for loss of solvent, evaporate 25 ml of the filtrate to dryness in a cleaned dried evaporating dish, and dry at 105^0 C, to constant weight and weighed . Calculated the percentage of alcohol-soluble extractive with reference to the air-dried drug.

Determination of Water Soluble Extractive:

Macerated 5 g of the air dried drug, coarsely powdered, with 100 ml of chloroform-water of the specified strength in a closed flask for twenty-four hours, shaking frequently during six hours and allowed to stand for eighteen hours. Filtered rapidly, taking precautions for loss of solvent, evaporate 25 ml of the filtrate to dryness in a cleaned dried evaporating dish, and dry at 105^0 C, to constant weight and weighed. Calculated the percentage of water-soluble extractive with reference to the air-dried drug.

Moisture Content

The moisture content is necessary to prevent the destruction of crude drug either due to chemical change or due to microbial contamination, in case of moisture sensitive drugs definite moisture content is necessary. Excessive moisture is considered as an adulteration because of its added weight. Moisture content also determines the amount of volatile substance of any kind.

$$\text{Formula} = \frac{\text{weight loss}}{\text{Weight of powder}} = \% \text{ W/w}$$

10 gm of sample was accurately weighted in a tarred evaporating dish. It was dried $105\ ^0$ C in an oven for 3 hrs. and weighed. Then the drying and weighting procedure at the interval

of ½ an hour was continued until the difference between two successive weights were found to be constant approximately. Loss in weight is expressed as % of moisture.

iii) pH Value -: For determination of pH, the instrument was started for half an hour before taking readings .The instrument was calibrated with standard buffer solution(6 pH tablets) after calibration the electrodes were dipped in sample extracts and readings were noted.

6.4.2 Phyto-chemical Study

Phyto-chemical study plays an important role in the standardization of the crude drugs. Phyto-chemical evaluation of a particular crude drug is mainly carried out for the following purpose.

1) To screen the plant for detecting the presence of the various groups of compounds.

2) To quantitatively estimate the various groups of compounds from the plant.

3) To isolate one or more constituents responsible for particular activity.

Determination of Phyto-chemical Constituents

The preliminary Phyto-chemical tests were conducted on root samples of *Barleria* species collected from field by using the two different extractive mediums as Aqueous and Methanol.

1) Test for Alkaloids -:

Hager's Test - 2-3ml extract added with Hager's reagent.

Observation -: The test is considered to be positive with the appearance of yellow precipitate.

2) Test for Glycosides-:

Foam test – 2 to 3 ml of extract was shaken vigorously with distilled water in a test tube. Observation: Honeycomb like foam produced, persists for few minutes. It confirms the presence of saponin.

3) Test for Saponins-:

Foam test – 2 to 3 ml of extract was shaken vigorously with distilled water in a test tube. Observation: Honeycomb like foam produced, persists for few minutes. It confirms the presence of saponin.

4) Test for Flavonoids-:

To 2ml of aquoes extract, add lead acetate solution.

Observation: Yellow colored precipitate formation indicates the presence of Flavonoids.

5) Test for Phenols

Phenol test - When 0.5ml of FeCl3 solution was added to 2ml of test extract, formation of an intense colour indicates the presence of Phenols**.**

6) Test for Tannins and Phenolic Compound:

Add few drops of 5% $FeCl_3$ solution to 2-3 ml of aqueous extarct.

Observation: Deep blue black color precipitate formation indicates prsence of Tannins and phenolic compound

As all four classical variety samples collected from three different localities were more or less similar according to Pharma-cognostic, Physico-chemical and Phyto-chemical parameters. As *Kwatha kalpana* was used for animal experimentation, only one sample having highest water soluble extractive value among three locality samples of each Sahachara type was taken for further HPLC analysis and animal experimentation purpose.In *Barleria prionitis* Linn. root samples collected from three different localities ,Pune region sample was having highest water soluble extractive value as compare to other two samples. Similarly, in *Barleria gibsoni* Dalz. group Matheran

sample, in *Barleria cristata* Linn. group Sawantwadi sample and in *Barleria strigosa* group Matheran sample had highest water soluble extractive values as compared to other two locality samples.

6.4.3 High Performance Liquid Chromatography (HPLC) analysis

Following HPLC method was preferred for analysis.

Standard Working Conditions:

Column	:	C_{18} (150 x 4.6mm)
Mobile Phase	:	Potassium dihydrogen phosphate buffer : Methanol (40:60)
Flow Rate	:	1ml/min
Temperature	:	28℃
Pressure	:	Minimum 0; Maximum 5000 psi
Detection	:	UV at 210 nm.

Sample Preparation:

250mg of fine powder sample was accurately weighed in a 25ml volumetric flask. This was then dissolved in a mixture of (50:50) Methanol: Water and the final volume adjusted to 25ml. These flasks were sonicated for 30minutes. The contents were then filtered and used for injection. Initially the mobile phase was allowed to run to stabilize the column. 20µl of the solutions were injected. The corresponding areas were noted.

6.5 Experimental Methodology

Study Center: National Toxicological Center, Pune.

Preparation of animals -

- Animals :- Wistar strain male
- Body weight:-Adult albino rats having average body weight 150-200 gms.
- At the commencement of the study, the weight variation of the animals was minimal and not exceeded ±20% of the mean weight for each sex.
- The temperature of the experimental animal room was maintained up to 22^0C ($\pm 3^0$C)

- The relative humidity of the room was at least 30% & preferably not exceeded 70% other than during room cleaning.
- Lighting of the room was artificial, the sequence being 12 hours light & dark cycle.
- Balanced commercially available animal feed was provided to animals.
- Potable drinking water was being given *ad libitum*.
- The animals were randomly selected, marked to permit individual identification.
- Animals were kept in the cages at least five days prior to the start of the test to allow for acclimatization to the laboratory conditions.
- Animals were fasted prior to dosing overnight, however drinking water was given *ad libitum*.
- After the dose administration the feed was given after 3-4 hours.

Acute Inflammatory Model

The apparatus used for the measurement of rat paw volume was developed by Buttle et al and modified by Sing and Ghosh (Method of Winter et al) Carrageenan induced hind paw edema method was followed. Standard and Test drugs were administered 1 hr prior to induction of edema. Edema was measured at 0, 30, 60 and 120, 240 min. &24 hr. intervals.

Drug Preparation

Kwatha of four varieties of Sahachara was prepared as per the guidelines mentioned in Sharangadhar Samhita. The drug was administered orally in the form of freshly prepared decoction with 1 part of drug and 16 parts of water reduced to 1/8 part as per the text Sharangadhara Samhita.

Selection of the Animals

Male albino rats with a body weight between 150 - 200 gms, bred in the animal house at National Toxicological Centre, Pune were used as experimental purpose. The rats were selected and grouped into seven groups of six rats each. The animals were administered the drug as per the following table.

Sr.No	Details of the group	Dose Administration Details
1	A- Normal Control group	Distilled water as required
2	B- Disease Control Group	Inj. carrageenan (0.05 ml of 1% sol.)
3	C- Standard Control group	Standard drug Aspirin (100 mg/kg Body wt.)
4	D- Test group - *Peeta* Sahachara *moola kwatha*	As per the animal dose calculation formula.
5	E- Test group - *Rakta* Sahachara *moola kwatha*	As per the animal dose calculation formula.
6	F- Test group - *Shweta* Sahachara *moola kwatha*	As per the animal dose calculation formula.
7	G- Test group - *Neela* Sahachara *moola kwatha*	As per the animal dose calculation formula.

Table 2 - Experimental groups.

Dosage:

Each Animal dose was calculated by using Conversion formula by Paget and Branes (1964).

Total Clinical Dose X 0.018

= 80 ml x 0.018

= 1.44 ml

The volume of the injected paw was measured by Digital Vernier Caliper immediately after carrageenan injection and again at the interval of 0, 30, 60, 120, 240 min and 24 hours readings of the paw volumes were noted.

Chapter-7

RESULTS AND OBSERVATIONS

7. Results and Observation

7.1 Pharmacognostic Observation

***Barleria gibsoni* Dalz. (Location: Matheran)**

Figure 1- Flower

Figure 2- Herbarium

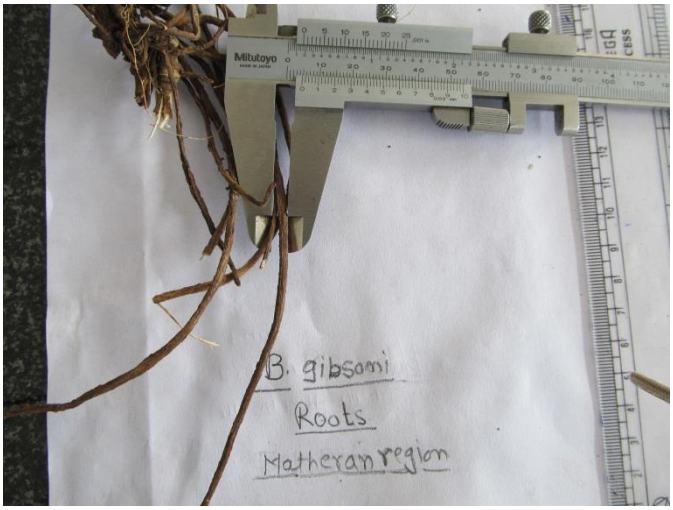

Figure 3- Root

Figure 4- T.S of Root

a = Vascular Cylinder; b = Cortex; c= Periderm;

Barleria gibsoni **Dalz. (Location: Junnar)**

Figure 5-Flower

Figure 6–Herbarium

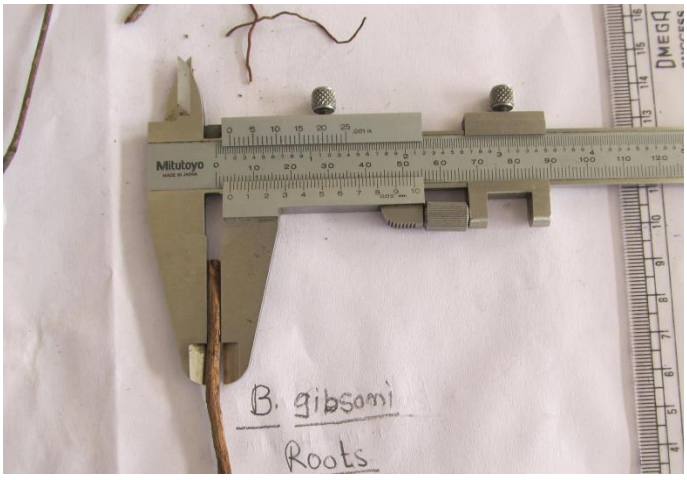

Figure 7 –Root

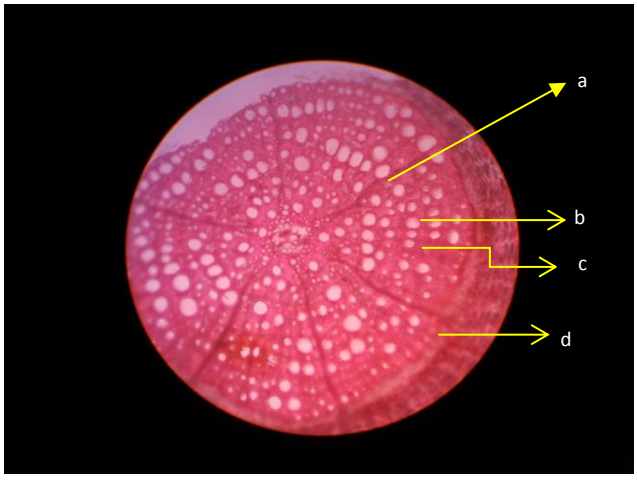

Figure 8 -T.S of Root

a=Primary Medullary Ray; b=Pore [vessel];
c= Xylem sclerenchyma ; d=Cambium;

***Barleria gibsoni*, Dalz. (Location: Belgaum)**

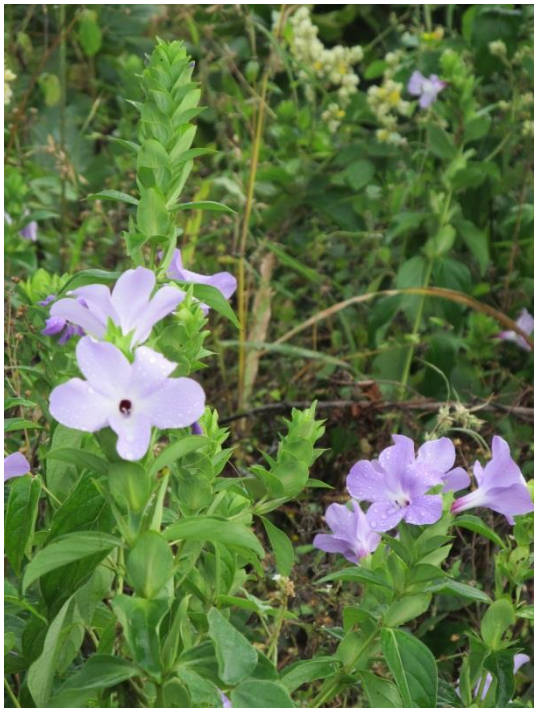

Figure 9 -Flower

Figure 10 – Herbarium

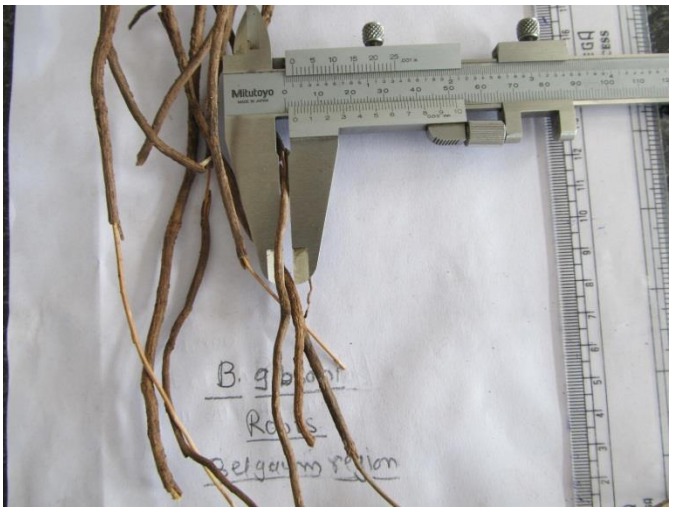

Figure 11 – Root

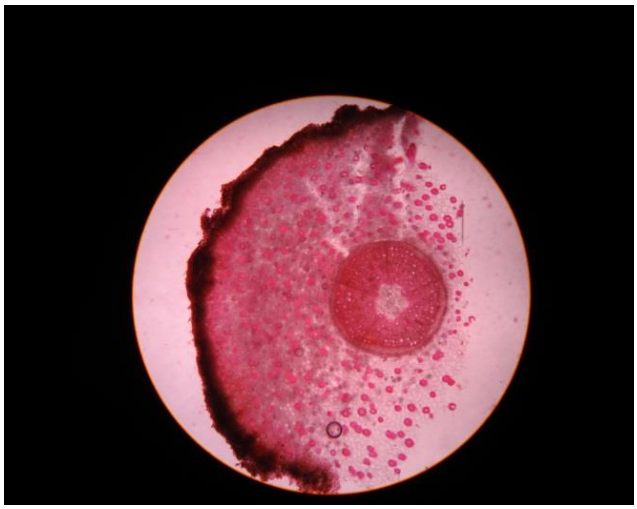

Figure 12 - T.S of Root

***Barleria cristata* Linn. (Location: Pune)**

Figure 13 -Flower

Figure 14 –Herbarium

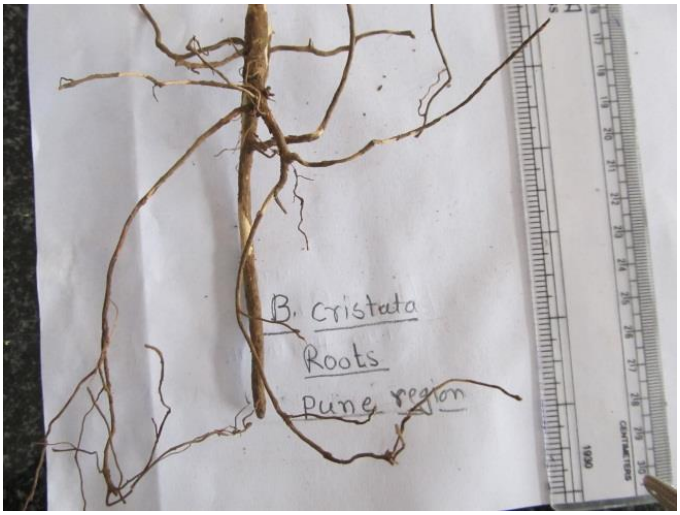

Figure 15 – Root

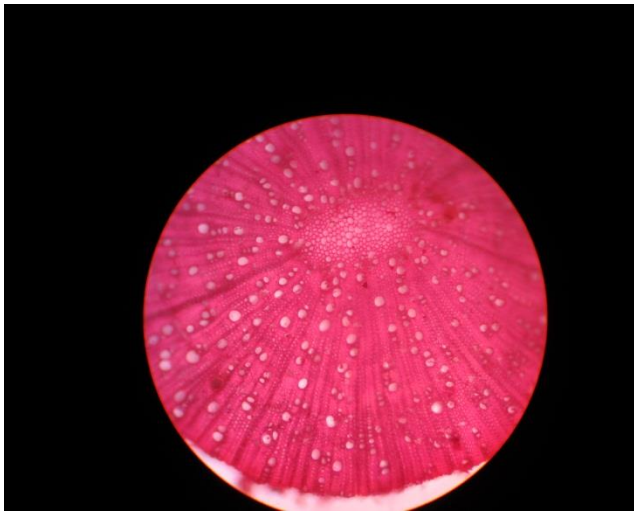

Figure 16 - T.S of Root

***Barleria cristata* Linn. (Location: Sawantwadi)**

Figure 17 -Flower

Figure 18 - Herbarium

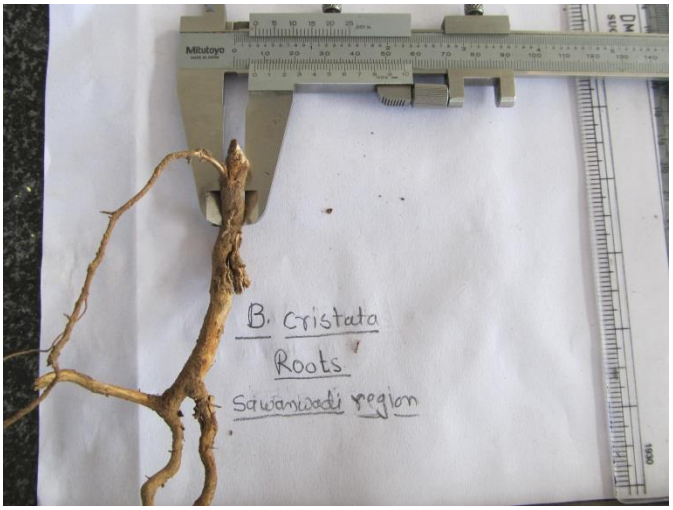

Figure 19 – Root

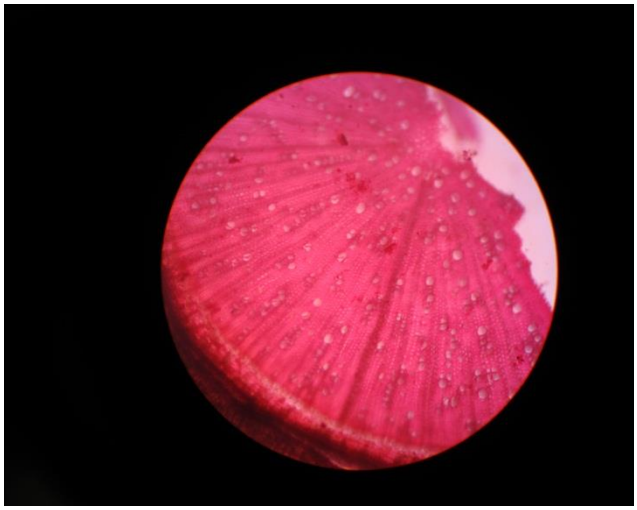

Figure 20 - T.S of Root

***Barleria cristata* Linn. (Location: Mumbai)**

Figure 21 - Flower

Figure 22 - Herbarium

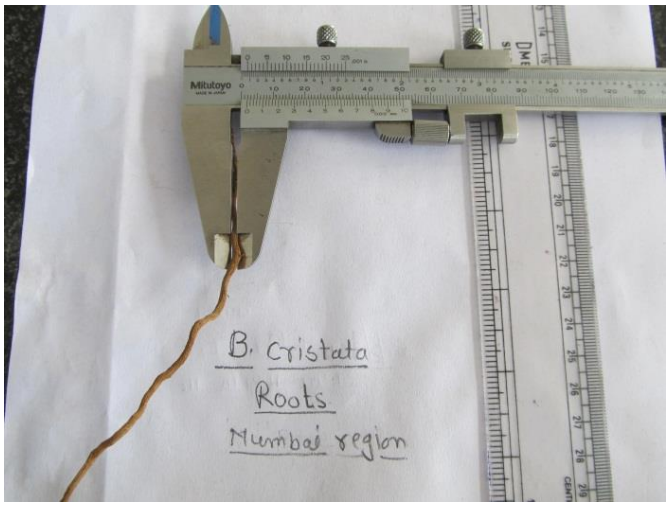

Figure 23 - Root

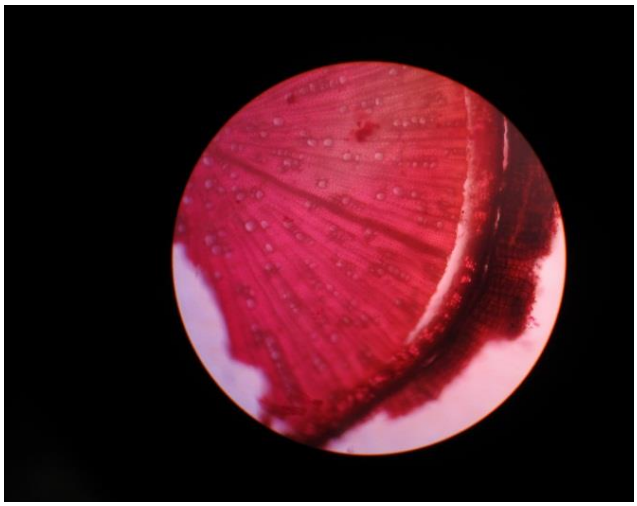

Figure 24 - T.S of Root

***Barleria prionitis* Linn. (Location: Pune)**

Figure 25 - Flower

Figure 26- Herbarium

Figure 27 - Root

Figure 28 - T.S of Root

Barleria prionitis **Linn (Location: Kolhapur)**

Figure 29 - Flower

Figure 30 - Herbarium

Figure 31 – Root

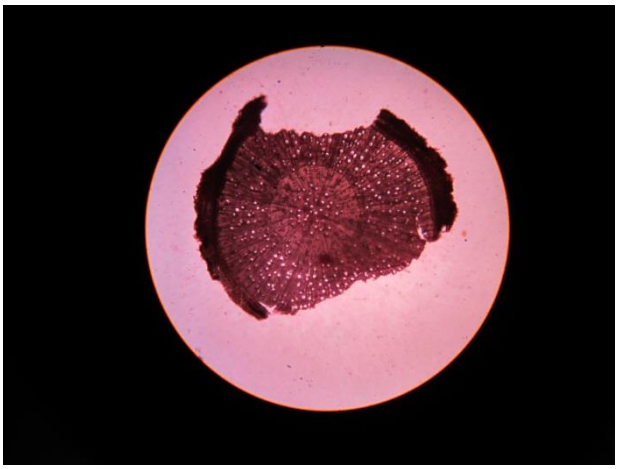

Figure 32 - T.S of Root

***Barleria prionitis* Linn. Location: Nagpur**

Figure 33 - Flower

Figure 34 - Herbarium

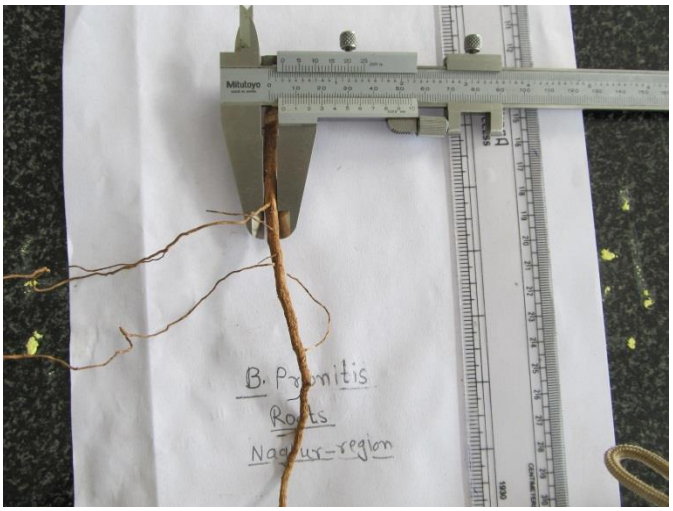

Figure 35 – Root

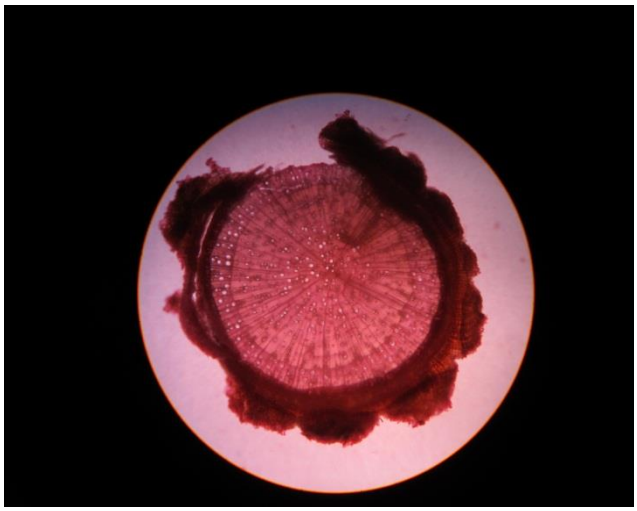

Figure 36 - T.S of Root

***Barleria strigosa,* Willd. Location: Belgaum**

Figure 37 - Flower

Figure 38 - Herbarium

Figure 39 – Root

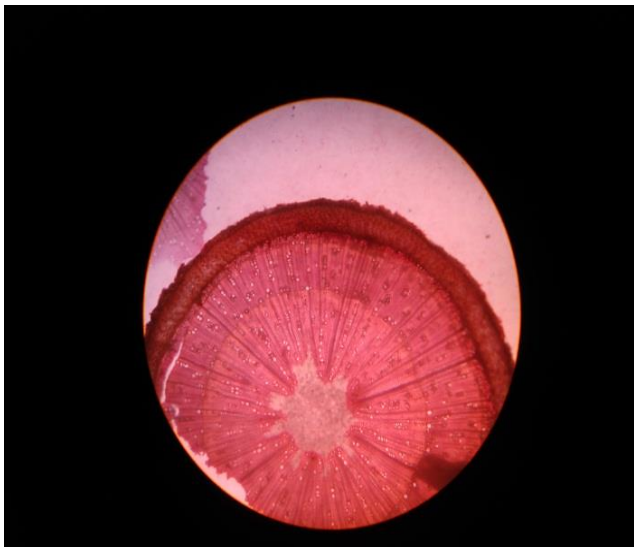

Figure 40 - T.S of Root

***Barleria strigosa* Wild. (Location: Vengurla)**

Figure 41 - Flower

Figure 42 - Herbarium

Figure 43 – Root

Figure 44 - T.S of Root

***Barleria strigosa* Wild. (Location: Matheran)**

Figure 45 - Flower

Figure 46 - Herbarium

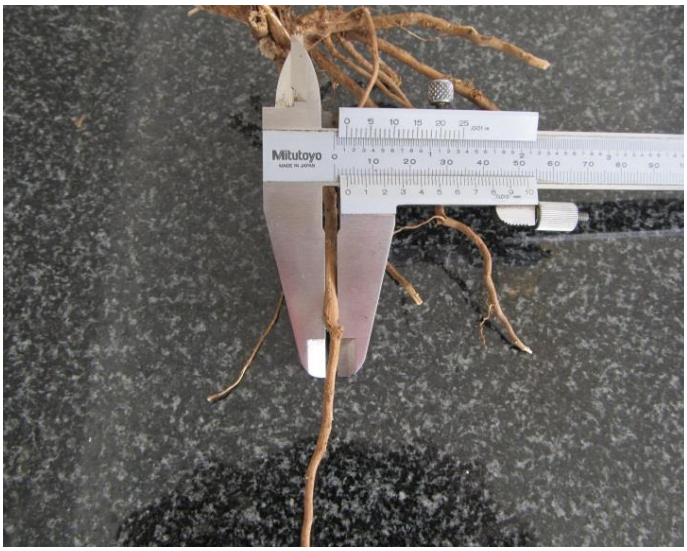

Figure 47 – Root

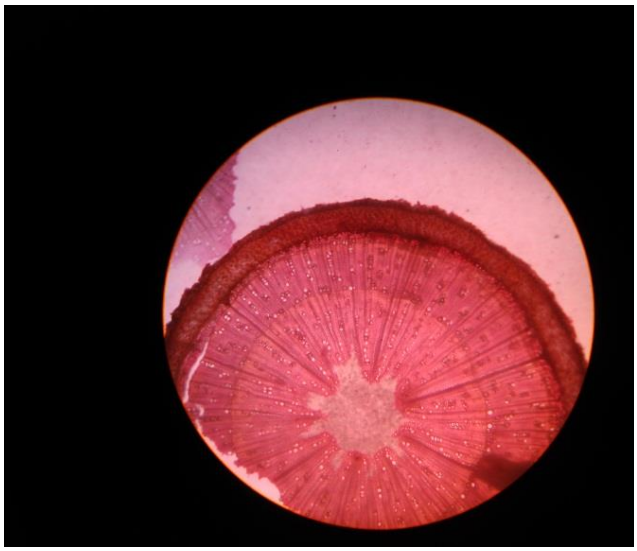

Figure 48 - T.S of Root

7.2 Macroscopical study results

Sr.No	Sample code	Sub code
1	1	A,B,C
2	2	A,B,C
3	3	A,B,C
4	4	A,B,C

Table 1 - Sahachara sample codes along with subcodes.

Sample Code 1 = *B.prionitis* Linn.	A- Pune B-Kolhapur C-Nagpur
Sample Code 2 = *B.Gibsonii* Dalzel.	A- Matheran B- Junnar C- Belgam
Sample Code 3 =*B.cristata* Linn.	A-Pune B-Sawantwadi C-Mumbai
Sample Code 4 = *B.Strigosa* Willd.	A-BelgamB-Vengurla C-Matheran

Table 2 - Sahachara sample region wise codes.

Sample Code	Shabda Fracture	Sparsha Touch INNER OUTER SURFACE	Roop Shape Size Color INNER OUTER	Rasa Taste	Gandha Odour
1A	Short	Outer-Rough Inner-Fibrous	2.55 mm in diameter, Cylindrical, Inner pale white, Outer- Fiant Brown++	Swadukinchit, Tikta	Ground nut specific odour
1B	Short	Outer-Rough Inner-Fibrous	2.06 mm in diameter, Cylindrical, Inner pale white, Outer- Fiant Brown++	Swadukinchit, Tikta	Ground nut specific odour
1C	Short	Outer-Rough Inner-Fibrous	2.31mm in diameter, Cylindrical, Inner pale white, Outer- Fiant Brown++	Swadukinchit, Tikta	Ground nut specific odour

2A	Short	Outer surface with lines and scars or rootlets Inner-not fibrous	2.81mm in diameter, Cylindrical, Inner pale white, Outer- Dark Brown ++	Madhur Tikta +	Ground nut specific odour
2B	Short	Outer surface with lines and scars or rootlets Inner-not fibrous	2.84 mm in diameter, Cylindrical, Inner pale white, Outer- Dark Brown ++	Madhur Tikta	Ground nut specific odour
2C	Short	Outer surface with lines and scars or rootlets Inner-not fibrous	2.58 mm in diameter, Cylindrical, Inner pale white, Outer- Dark Brown ++	Tikta	Ground nut specific odour
3A	Short	Outer soft	2.3 mm in diameter Cylindrical Innerpale white, Outer-Faint brown+	Swadu, kinchittikta	Not specific
3B	Short	Outer soft	2.82mm in diameter Cylindrical Innerpale white, Outer-Faint brown+	Swadukinchittikta	Not specific
3C	Short	Outer soft	2.83 mm in diameter Cylindrical Innerpale white, Outer-Faint brown+	Swadukinchittikta	Not specific
4A	Short	Outer-Rough Inner not fibrous	3.04mm in diameter Cylindrical Innerpale white, Outer-Faint brown+	Swadu, kinchittikta	Characteristic
4B	Short	Outer-Rough Inner not fibrous	6.01 mm in diameter Cylindrical Innerpale white, Outer-Faint brown+	Swadukinchittikta	Characteristic
4C	Short	Outer-Rough Inner not fibrous	4.04 mm in diameter Cylindrical Innerpale white, Outer-Faint brown+	Swadukinchittikta	Characteristic

Table 3 - Macroscopical study results of Sahachara samples.

7.3 Physico-chemical study results

Sample Code	Moisture %	Total Ash%	Aqueous extractive %	Alcohol soluble extractives %
1A	4.03	5.75	6.19	5.024
1B	3.54	2.50	5.16	4.918
1C	4.40	3.50	5.04	3.770
2A	5.86	12.18	13.83	9.872
2B	6.00	11.54	11.86	18.320
2C	6.04	9.77	9.34	9.316
3A	4.74	4.12	7.65	5.936
3B	4.29	3.55	8.08	5.322
3C	4.18	5.59	6.08	4.700
4A	4.44	4.45	15.83	19.790
4B	4.45	4.22	14.46	19.350
4C	4.41	4.66	18.60	20.130

Table 4 - Physico-chemical study results of Sahachara samples.

Sample Code	Specific gravity	Dissolved solids	Color	Taste	Odour	pH
1A	1.003	0.78	Pale brown+	Swadu, kinchittikta	Ground nut specific odour	6.16
1B	1.005	1.30	Pale brown++	Swadukinchittikta	Ground nut specific odour	6.90
1C	1.006	1.56	Pale brown	Swadukinchittikta+	Ground nut specific odour	6.64
2A	1.009	2.34	Dark brown	Madhur Tikta	Ground nut specific odour	6.22
2B	1.002	0.52	Dark brown	Tikta	Ground nut specific odour	6.00
2C	1.008	2.08	Dark brown	Tikta	Ground nut specific odour	6.40
3A	1.008	2.08	Pale brown	Swadu, kinchittikta	Not specific	7.50
3B	1.013	3.38	Pale brown	Swadukinchittikta	Not specific	7.45
3C	1.004	1.04	Pale brown+	Swadukinchittikta	Not specific	7.10
4A	1.011	2.86	Dark brown	Swadu, kinchittikta	Characteristic	4.18
4B	1.011	2.86	Dark brown	Swadukinchittikta	Characteristic	4.91
4C	1.013	3.38	Dark brown	Swadukinchittikta	Characteristic	4.82

Table 5 - Aqueous extract study results of Sahachara samples.

7.4 Phyto-Chemical Study Results

Test Performed	1A	1B	1C	2A	2B	2C	3A	3B	3C	4A	4B	4C
For Alkaloids	-	-	-	-	-	-	-	-	-	+	+	+
Glycosides	+	-	+	+	+	+	-	-	-	+	+	+
Flavinoids	+	+	+	+	+	+	+	+	+	+	+	+
Saponins	+	-	+	+	+	+	-	-	-	+	+	+
Phenolic compunds and Tannins	-	-	-	+	+	+	-	-	-	+	+	+

Table 6 - Phyto-chemical study results of Sahachara samples

7.5 HPLC Images of *Barleria* Species

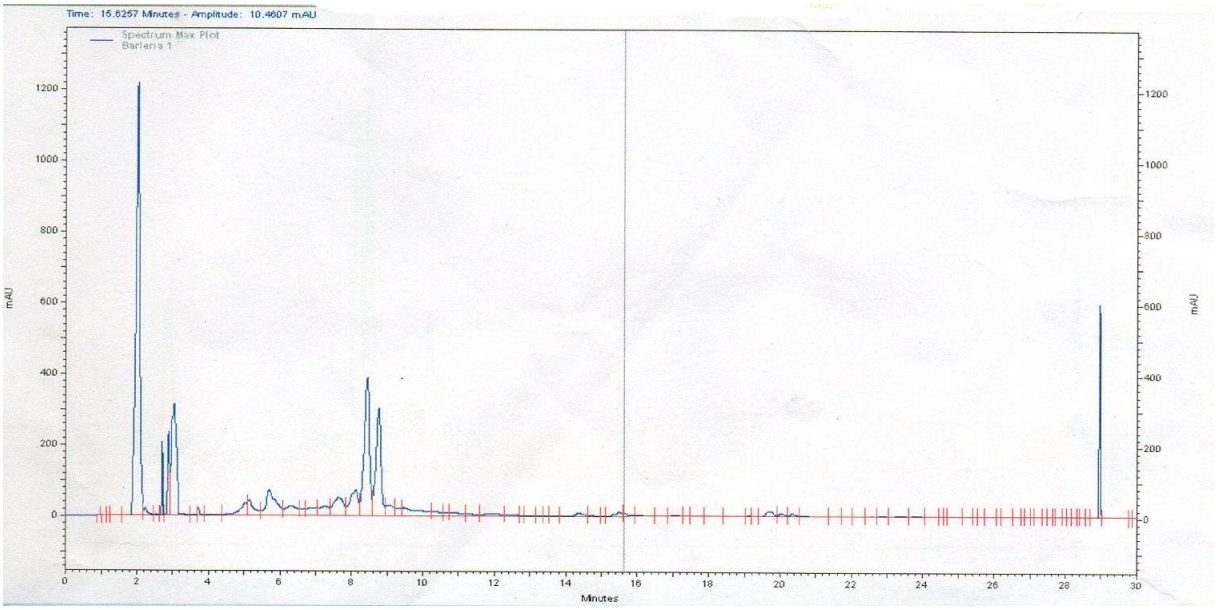

Figure 49 - HPLC image of *Barleria prionitis* Linn. root

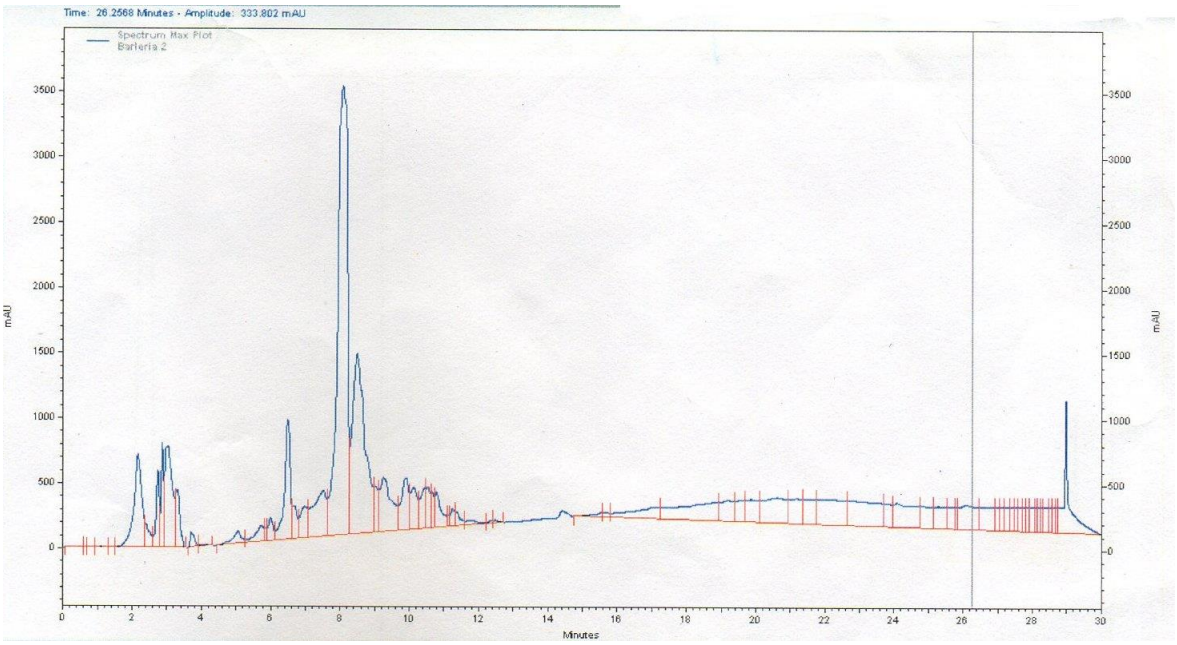

Figure 50- HPLC image of *Barleria gibsoni* Dalz. root

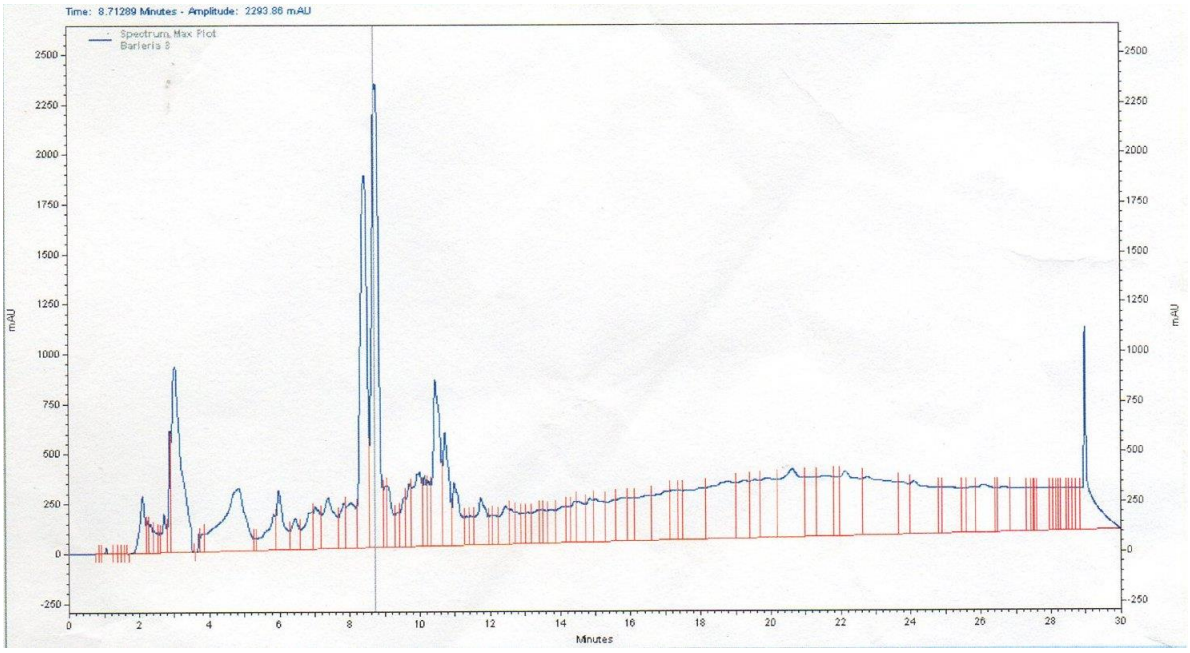

Figure 51 - HPLC image of *Barleria cristata* Linn. root

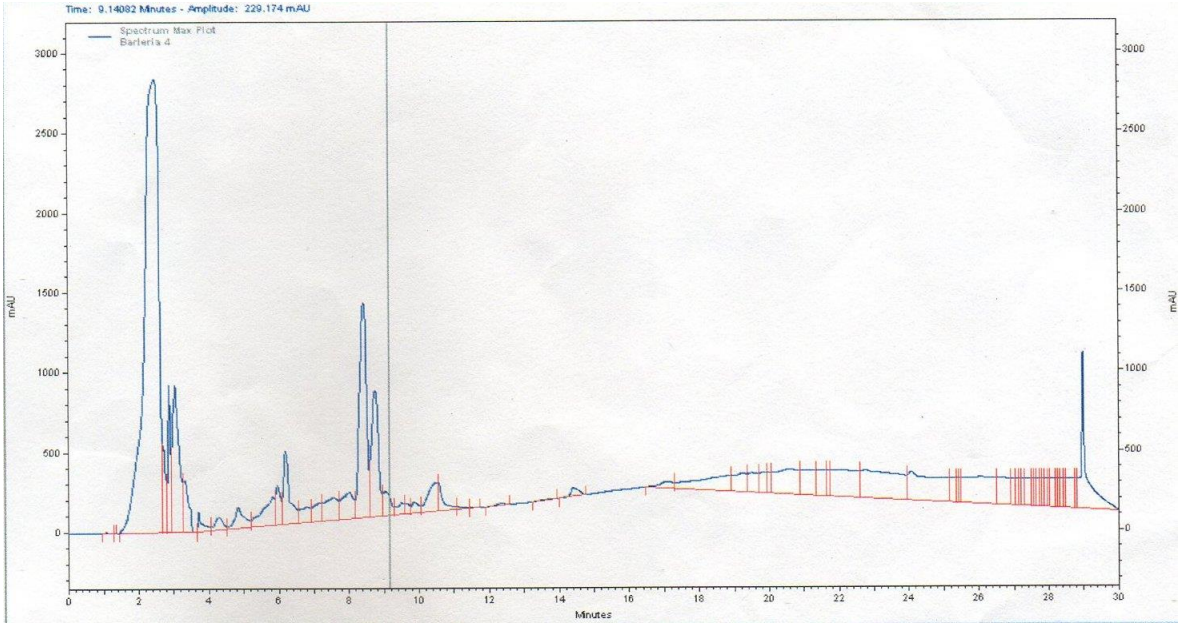

Figure 52 - HPLC image of *Barleria strigosa* Willd. root

7.6 Experimental Observation

Figure 53 - Administration of Standard *Aspirin* drug.

Figure 54 -Administration of Test drug *decoction*.

Figure 55 - Inj. *carrageenan* Administration in the hind paw

Figure 56 - Measurement of Paw volume by Digital Vernier Caliper

Figure 57 - Difference between Normal and Inflamed paw.

7.7 Experimental results

Paw edema volume in mm

The results obtained during the animal experimentation are given in the following tables.

RP NO-218 DATE: 12/Sep/2014

Group				Paw edema volume in mm at various time intervals					
	INITIAL	Durg	Carrageenan	**0 min**	**30 min**	**60 min**	**120 min**	**240 min**	**24 Hrs**
Gr.A	2.83			3	3.03.	2.85	2.86	2.93	2.83
	2.91			2.9	2.92	2.85	2.81	2.54	2.97
	2.93			2.91	2.86	3.08	3	3.12	2.99
	2.98			2.86	2.96	2.93	2.84	3.05	2.95
	2.93			2.86	2.97	2.99	2.95	2.93	2.95
	2.96			3.02	3.03	2.81	2.94	2.92	2.93
Mean	**2.92**			**2.93**	**2.95**	**2.92**	**2.9**	**2.92**	**2.94**
S.D	**0.05**			**0.07**	**0.06**	**0.1**	**0.07**	**0.2**	**0.06**
Gr.B	2.79			4.85	4.87	4.28	4.91	6.84	5.2
	3.05			4.83	4.9	4.62	6.56	8.83	7.01
	2.89			4.96	4.43	4.78	5.39	6.93	5.58
	2.89			4.29	5.49	5.1	7.56	9.25	9.15
	2.92			5.02	5.24	5.08	6.11	7.67	7.22
	2.95			5.87	5.41	7.28	8.54	8.2	7.88
Mean	**2.92**			**4.97**	**5.06**	**5.19**	**6.51**	**7.95**	**7.01**
S.D	**0.09**			**0.51**	**0.4**	**1.07**	**1.36**	**0.99**	**1.46**
Gr. C	3.17			5.4	4.69	4.36	4.06	4.35	4.95
	2.97			4.78	3.95	4.47	5.03	6.52	8.2
	2.75			5.42	5.06	4.33	4	5.78	7.54
	2.85			4.87	4.89	5.19	5.96	6.2	6.1
	2.98			4.6	4.9	4.67	5.76	6.62	6.3
	2.99			5.11	5.1	4.45	5.62	5.63	5.5
Mean	**2.95**			**5.03**	**4.77**	**4.58**	**5.07**	**5.85**	**6.43**
S.D	**0.14**			**0.34**	**0.42**	**0.32**	**0.86**	**0.83**	**1.23**
Gr. D	2.94			4.78	4.73	4.23	4.62	7.64	7.57
	3.27			4.7	4.84	5.61	6.6	7.46	7.04
	2.72			4.37	3.94	4.32	5.38	6.29	5.38
	2.84			5.24	5.98	5.58	6	7.91	7.5
	2.87			5.05	5.17	4.7	7.98	8.78	8.22
	2.8			5.03	5.45	6.3	7.84	8.16	8.03
Mean	**2.91**			**4.86**	**5.02**	**5.12**	**6.4**	**7.71**	**7.29**
S.D	**0.19**			**0.31**	**0.69**	**0.83**	**1.34**	**0.83**	**1.02**

Gr. E	2.86			4.85	4.33	4.19	5.34	6.89	5.45
	2.96			4.89	4.11	5.56	6.38	7.3	6.14
	3.18			4.56	4.77	5.57	5.19	7.86	6.52
	2.91			4.89	4.43	5.19	7.13	6.72	5.58
	2.97			5.29	5.05	5.26	6.68	8.01	7.88
	2.93			5.04	4.41	5.23	7.93	8.12	7.52
Mean	**2.97**			**4.92**	**4.52**	**5.17**	**6.44**	**7.48**	**6.52**
S.D	**0.11**			**0.24**	**0.34**	**0.51**	**1.05**	**0.6**	**1**
Gr. F	3.24			4.85	5.03	4.72	6.26	7.76	7.85
	3			4.58	5.73	4.79	5.04	7.8	7.09
	2.96			4.55	4.47	5.35	4.27	5.2	4.92
	2.94			5.09	4.49	5.24	6.2	7.11	6.89
	2.74			5.1	4.07	4.36	5.97	6.4	6.18
	2.6			4.95	4.31	4.04	5.71	7.72	6.98
Mean	**2.91**			**4.85**	**4.68**	**4.75**	**5.58**	**7**	**6.65**
S.D	**0.22**			**0.24**	**0.6**	**0.5**	**0.78**	**1.03**	**1**
Gr. G	2.88			4.78	5.23	4.35	4.64	6.21	6.77
	2.75			4.89	4.42	4.65	4.74	7.18	7.14
	2.95			4.98	4.06	5.09	5.57	8.05	8.04
	2.91			5.68	4.46	5.09	6.12	7.66	7.6
	3.15			5.5	5.44	4.88	7.02	5.58	5.5
	2.89			5.11	5.15	4.8	5.9	6.07	5.9
Mean	**2.92**			**5.16**	**4.79**	**4.81**	**5.67**	**6.79**	**6.83**
S.D	**0.13**			**0.36**	**0.55**	**0.28**	**0.9**	**0.98**	**0.98**

Table 7 - Paw edema volume in mm

Legends:

Gr. A- Normal Control gr.

Gr. B- Disease Control gr.

Gr. C- Standard Drug Aspirin gr.

Gr. D- *Barleria prionitis* Linn.gr.

Gr. E- *Barleria gibsoni* Dalz.gr.

Gr. F- *Barleria cristata* Linn.gr.

Gr. G- *Barleria strigosa* Willd.gr.

S.D - Standard Deviation.

Percent change in paw volume

Group Name	Percent change in Paw volume at various time Intervals					
	Init to 0 read	0 to 30	0 to 60	0 to 120	0 to 240	0 to 24 hrs
Gr.A	**0.06** ↑	**0.79** ↑	**0.23** ↓	**0.85** ↓	**0.34** ↓	**0.40** ↑
Gr.B	**70.50** ↑	**1.74** ↑	**4.43** ↑	**31.02** ↑	**60.03** ↑	**40.98** ↑
Gr.C	**70.41** ↑	**5.27** ↓	**8.98** ↓	**0.83** ↑	**16.30** ↑	**27.87** ↑
Gr.D	**67.26** ↑	**3.22** ↑	**5.38** ↑	**31.71** ↑	**58.52** ↑	**49.95** ↑
Gr.E	**65.75** ↑	**8.20** ↓	**5.01** ↑	**30.93** ↑	**52.10** ↑	**32.42** ↑
Gr.F	**66.59** ↑	**3.50** ↓	**2.13** ↓	**14.87** ↑	**44.20** ↑	**37.05** ↑
Gr.G	**76.50** ↑	**7.05** ↓	**6.72** ↓	**-9.86** ↑	**31.71** ↑	**32.35** ↑

Table 8 - Percent change in paw volume at various time Intervals.

N.B ↑ means Percent paw volume increased ↓means percent paw volume decreased.1st reading is percent increase after Carrageenan and others are as compared to Carrageenan treated. The control group paw volume was more or less constant.

Chapter-8

STATISTICAL ANALYSIS

8. Statistical Analysis

The present study deals with the comparison in between the groups of different *Barleria Sp*. statistically one-way Analysis of variance (ANOVA) was applied to the obtained data from animal experimentation. During animal experiment in normal control group mean Paw volume values were almost similar to each-other at different time intervals so this group was not considered for statistical analysis.

At 60 min./ 30min Analysis of variance shows that all groups are homogeneous. i.e. there is no significant difference in paw edema for all six groups.

At 0-30 min :

ANOVA

Source of Variation	***SS***	***Df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	0.06573	5	0.013146	0.994949	0.437507	2.533555
Within Groups	0.396379	30	0.013213			
Total	0.462109	35				

As p-value = 0.4375 > 0.05 therefore we accept hypothesis of homogeneity of all six groups
(As F cal = 0.9949 < F critical =2.5335 we accept hypothesis)

At 0-60 min :

ANOVA

Source of Variation	***SS***	***Df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	0.113127	5	0.022625	1.533279	0.209316	2.533555
Within Groups	0.442687	30	0.014756			
Total	0.555814	35				

As p-value = 0.2093 > 0.05 therefore we accept hypothesis of homogeneity of all six groups
(As F cal = 1.5333 < F critical =2.5335 we accept hypothesis)

At 60 min./ 30min Analysis of variance shows that all groups are homogeneous. i.e. there is no significant difference in paw edema for all six groups .Further discussion is as follows.

Contents:

We plot and check the pattern of Paw Edema volume for different drug groups at specified time intervals.

Treatment Groups	Time Points					
	0 min	30 min	60 min	120 min	240 min	24 hours
B	4.97	5.06	5.19	6.51	7.95	7.01
C	5.03	4.77	4.58	5.07	5.85	6.43
D	4.86	5.02	5.12	6.4	7.71	7.29
E	4.92	4.52	5.17	6.44	7.48	6.52
F	4.85	4.68	4.75	5.58	7	6.65
G	5.16	4.79	4.81	5.67	6.79	6.83

Table 1 - Avg. inflammation at various time points

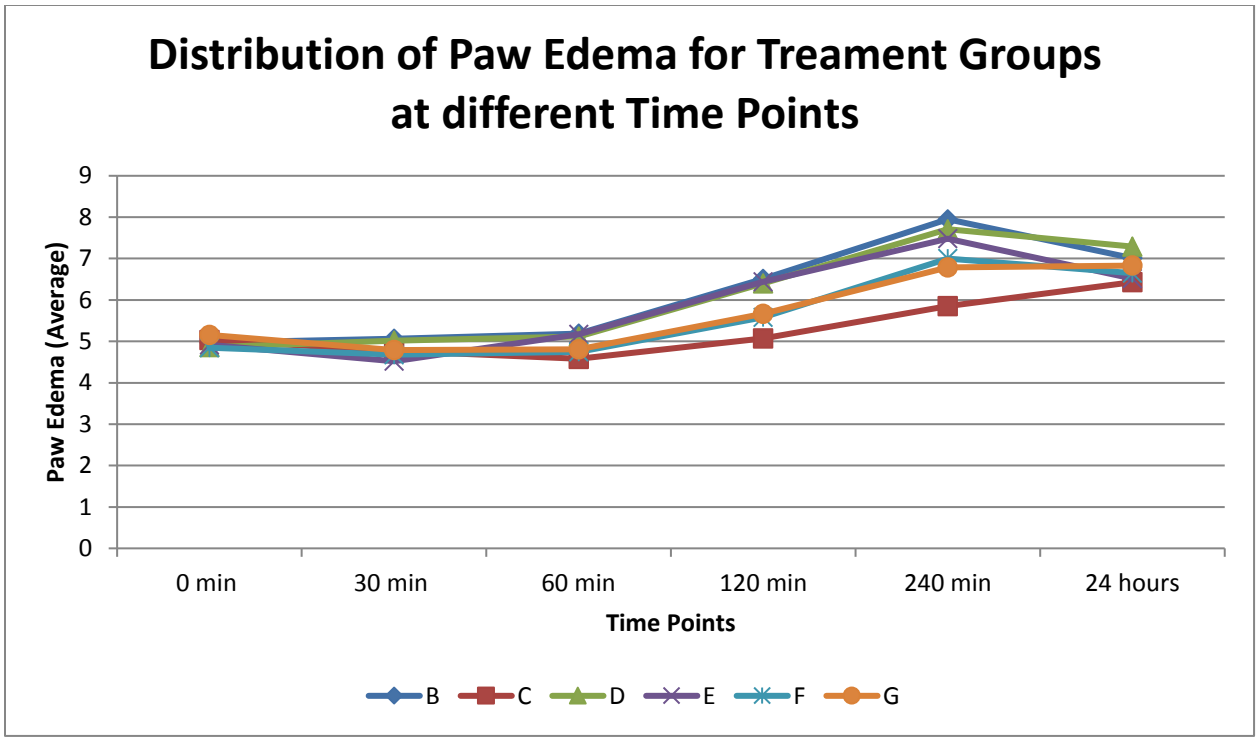

Figure 1 - Distribution of Paw Edema for Treatment Groups at different Time Points

Interpretation:

- After 60mins, all treatment groups show rise in edema.
- After 240 mins, all treatment groups show decrease in edema.

Differences (Avg)					
Treatment Groups	**Time Points**				
	0-30	**0-60**	**0-120**	**0-240**	**0-24h**
B	-0.09	-0.22	-1.54	-2.98	-2.04
C	0.26	0.45	-0.04	-0.82	-1.4
D	-0.16	-0.26	-1.54	-2.85	-2.43
E	0.40	-0.25	-1.52	-2.56	-1.6
F	0.17	0.1	-0.73	-2.15	-1.8
G	0.37	0.35	-0.51	1.63	-1.67

Table 2 - Difference in Avg inflammation at various time points

Interpretation from table no 27:

- At 120 min all groups inflammation has gone up
- Groups C,F G give relief till 60 min.
- C has negligible inflammation at 120 min as compared to others.
- C and G give faster relief but C gives longer relief.
- E and F also provide faster relief but for shorter duration as compared to C and G.

Treatment Groups	% Change in Paw Edema (avg)				
	30 min	60 min	120 min	240 min	24 hours
B	1.8%	2.6%	25.4%	22.1%	-11.8%
C	-5.2%	-4.0%	10.7%	15.4%	9.9%
D	3.3%	2.0%	25.0%	20.5%	-5.4%
E	-8.1%	14.4%	24.6%	16.1%	-12.8%
F	-3.5%	1.5%	17.5%	25.4%	-5.0%
G	-7.2%	0.4%	17.9%	19.8%	0.6%

Table 3 - Percent change (avg) in Paw Edema

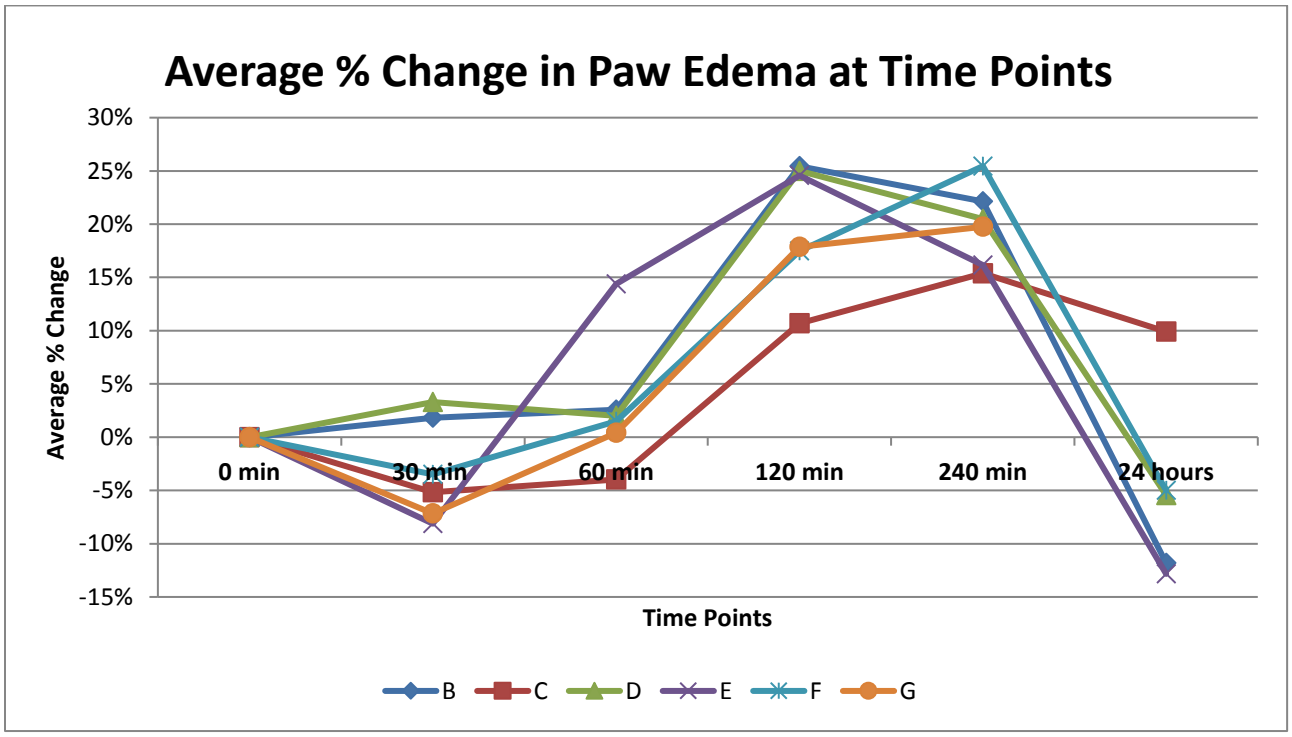

Figure 2 - Average percent change in Paw Edema at Time Points

Interpretation:

At 30 mins,

- Groups B and D show increase in paw edema whereas the rest groups show reduction.
- Group D shows highest rise in edema.
- *Group E shows highest reduction in edema.*

At 60 mins,

- Only Group D shows reduction in edema whereas the rest show increase in edema.
- Group E shows highest increase in edema.

At 120 mins,

- All groups show rise in edema.
- Group B shows highest increase in edema.

At 240 mins,

- Groups F,C and G show rise in edema.
- Groups B,D and Eshow decrease in edema.
- Group F shows highest increase in edema.
- Group E shows highest decrease in edema.

After 24 hours,

- All groups show reduction in edema.
- *Group E shows highest reduction in edema.*

We are still unable to pick the best drug amongst the set.

Consider positive and negative differences of readings recorded for all rats under treatment groups.

We define, negative difference as (succeeding observation-preceding observation), it also indicates reduction in paw edema which can be looked upon as sign of improvement.

Below is tabulation and graphical interpretation of Positive & Negative cumulative differences:

Note- we exclude A from comparison because it is a control group.

Negative Differences

Treatment Groups	0 -30	0-60	0-120	0-240	0-24
B	33%	67%	0%	17%	100%
C	67%	67%	33%	0%	50%
D	33%	50%	0%	0%	100%
E	83%	17%	17%	17%	100%
F	67%	50%	17%	0%	83%
G	67%	50%	0%	17%	83%

Table 4 - Experimental data analysis negative differences

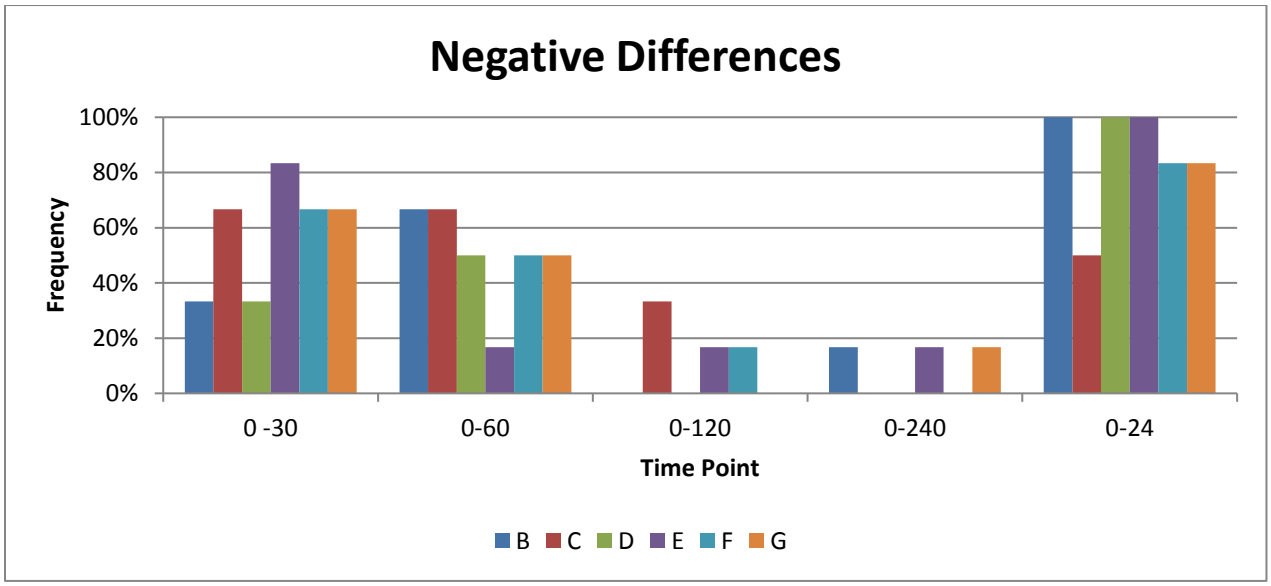

Figure 3 - Experimental data analysis negative differences

Interpretation:

Within 30mins, E shows highest count of reduction (i.e. improvement) in paw edema.

After 24 hours, B,D and E tend to completely reduce edema.

Positive Differences

Treatment Groups	0 -30	0-60	0-120	0-240	0-24
B	67%	33%	100%	83%	0%
C	33%	33%	67%	100%	50%
D	67%	50%	100%	100%	0%
E	17%	83%	83%	83%	0%
F	33%	50%	83%	100%	17%
G	33%	50%	100%	83%	17%

Table 5 - Experimental data analysis positive differences

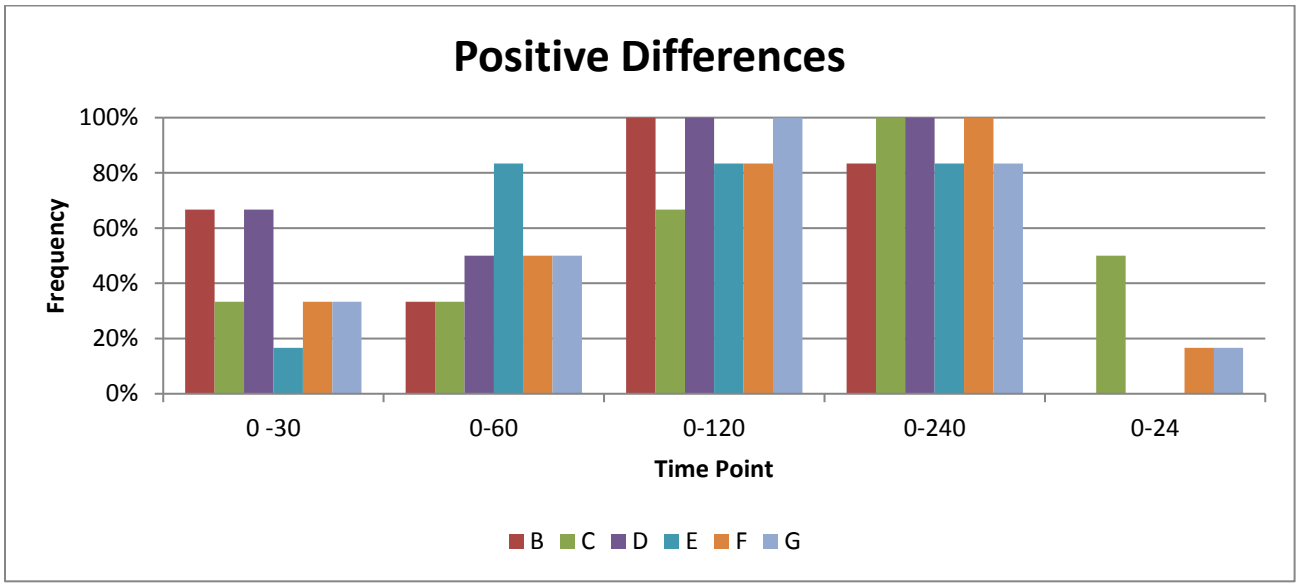

Figure 4 - Experimental data analysis positive differences

Interpretation:

- Within 30 mins, B and D are not much effective in reducing paw edema.
- E is the most effective in reducing edema within 30 mins.
- After 24 hours, C is not much effective in reducing edema.

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, Vatasama-shamana* and *Shleshmsamshamana ganas*. Vagbhata has mentioned under *Varunadi, Viratar-vadi, 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 & Table2 – 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, Vishaghna, Amapachana, Jwarahara, Kandughna and used in the treatment of Shotha, Vatavikaras, Kushtha, Vrana, Vishaghna 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 identifed with the help of macroscopical study characters as mentioned in the following table.

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

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.

(Table 26 – P.N 76). Tikta rasa is having shothahara action. In all *Barleria strigosa* Willd. samples Tikta rasa is predominantly present. Maximum dravyas having Tikta rasa posess 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 Influorescence 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.

% of Inhibition= To−Tt% of Inhibition= $\frac{\mathrm{T}o-\mathrm{Tt}}{\mathrm{T}o} X\ 100$

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 v*ariety 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.

Disease Pathogenesis **Action of Sahachara**

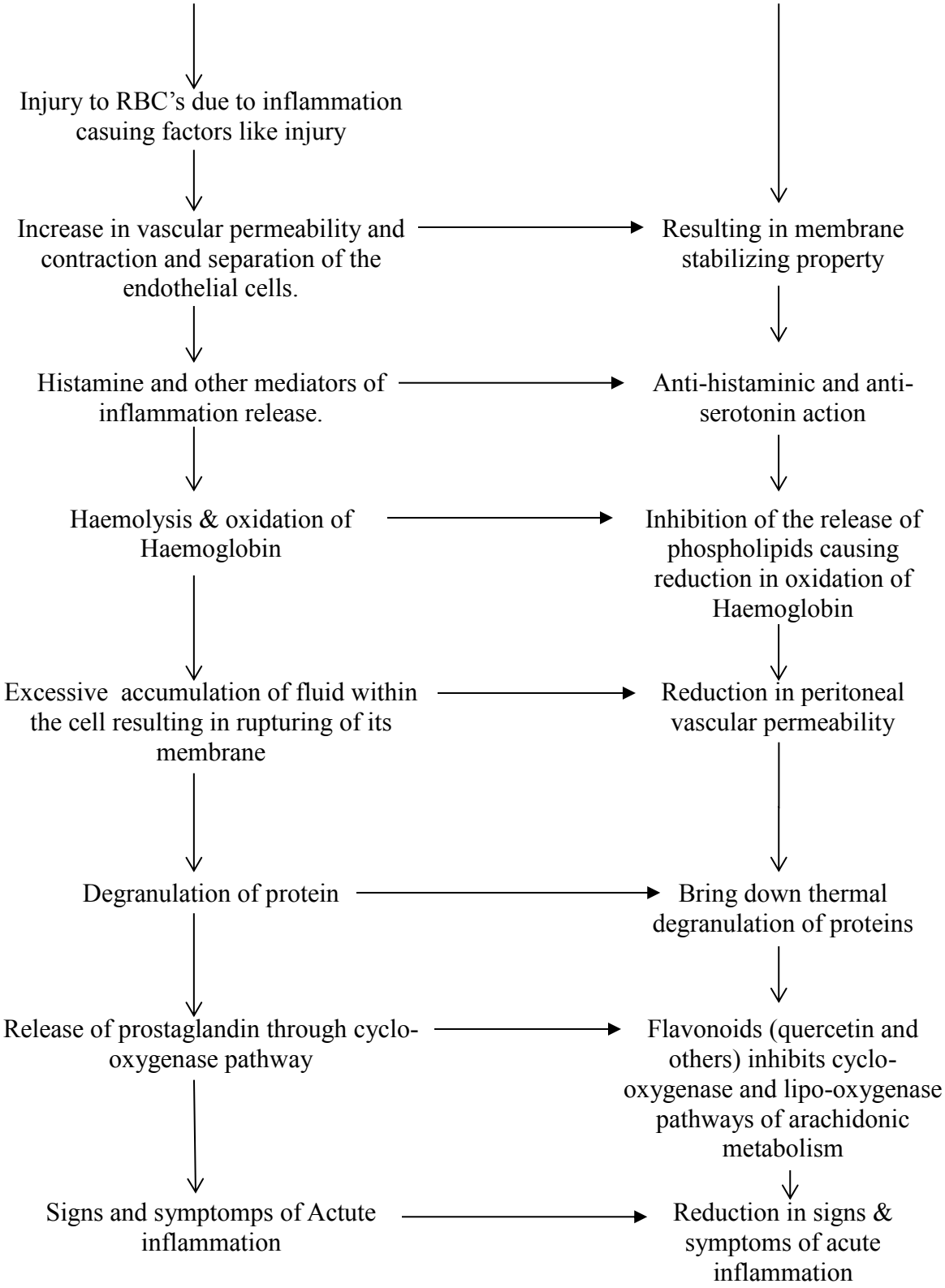

Figure 1 - Probable Mode of Action of Sahachara According to Modern Pharmacology

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.

Chapter-10

CONCLUSION

10. Conclusion

- Neela Sahachara (*Barleria strigosa* Willd.) appears to be the variety, having potent acute anti-inflammatory action compared to other Sahachara types and standard drug aspirin within half an hour and sustained the action for one hour.
- Peeta Sahachara (*Barleria prionitis* Linn.) the conventional type of Sahachara preferred in clinical practice showed anti-inflammatory action, but not as potent as other types of Sahachara.

Chapter-11

SUMMARY

11. Summary

The dissertation entitled “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” had been undertaken with a view to find out potent anti-inflammatory variety amongst four classical type of Sahachara along with their literary, pharmacognostic and physico-chemical study.

Section I consists of 3 chapters- Introduction, aims and objectives and previous work done. Chapter 1 Introduction, focus on the importance of traditional system of medicines and need of Sahachara type exploration along with their detailed study. Selection of appropriate type of Sahachara for Shothahara action amongst four types was the need for the study. Chapter 2 deals with Abbreviations used in thesis. Chapter 3 is the aim and objectives of the study. Previous work done has been mentioned in chapter 4.

Section II chapter 5 is a review of literature which deals with the Drug review. It discloses information about the drug Sahachara regarding historical review, synonyms, classification, properties, uses. Pharmacognostic review deals with the detailed morphological characters of Sahachara types along with family description, Experimental review, which highlights on Analgesic activity that includes brief introduction to Vedana and pain, along with detail analysis of Analgesic activity. Evaluation of Anti-inflammatory activity includes brief introduction to Shotha and Inflammation. Drug preparation review has been given at the end of this chapter.

Section III with Chapter 6 Materials and Methodology divided into two parts. First is of Material part it includes Pharmacognostic and Experimental material methodology. Second part deals with the Pharmacognostic study, Physico-chemical study and Animal experiment methodology.

Section IV Results and Observation is given in Chapters 7. Pharmacognostic observation which includes region wise images of Sahachara type flower, Herbarium, Root and T.S. of root respectively. Experimentation observation and results includes animal experiment result observations also deals with HPLC analysis of results has been given at the end of this

chapter. Chapter 8 dealing statistical analysis was done by applying appropriate statistical tests and significance noted.

Section V with 9th chapter on Discussion, 10th on Conclusion and 11th on Summary are grouped together. Discussion on drug review deals with synonyms, Rasa Panchaka, uses, utility of root and consideration of potent anti-inflammatory Sahachara type. Discussion is also done on Pharmacognostical, Preliminary Phyto-chemical and Experimental study on four types. Probable mode of action of Sahachara according to modern pharmacology and Ayurveda. Further scope for the research has also been mentioned in discussion. Chapter 10th Conclusion, where inference is drawn on the observations made during study. Chapter 11th is Summary, giving gist of the dissertation work.

Section VI comprises of Bibliography, Annexure and Appendices containing thesis related reports as Chapter 12th, 13th and 14th respectively. Roots of all the four classical types can be used for attaining Anti-inflammatory and Analgesic effect, there by conserving these species.

Chapter-12

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Chapter-13

ANNEXURE

13. Annexure

Following are the References compiled by referring various Ayurvedic texts for the reference purpose.

Paryaya Naam Vivechana According to Various Nighantus

कैयदेवनिघण्टू

सैरेयक : सहचर: सैरेयो मृदुकण्टक:।

कोमल प्रसवो दासी वर्णाख्य :दय: किंकिरातक:।।

झिण्टी सहचारोऽम्लान: सैर्यकश्च महासहा।

रक्तपुष्प: कुरबक: पीतपुष्प: कुरण्टक:।।

नीलपुष्पसत्वात्त गलो राजसैरेयक: स्मृत:।।

राजनिघण्टू

सैरेयक: सहचर: सौरेय: किराङ्कतक: ।

दासी सहचर: किण्टी शैर्षक मृदुकण्टक:।।

रक्तपुष्प: कुरुबक पीतो ज्ञेय: कुरण्टक।

नील आर्तगल: प्रोक्तो बाणा गोदनपाक्यपि।।

शालिग्रामनिघण्टु

सैरेयक: श्वेतपुष्प: सैरयं कटसारिका।

सहाचरा: सहचर: स च भिद्यपि कथ्यते।।

किङ्किरातो कुरण्टश्चकनक: पीतपुष्पक:।

पीताम्लान: सहचर: पीतसैरेयकश्च स:।

रक्तम्लानो रक्तपुष्प रामलिङ्गनकामुकः।

रागप्रसवकश्चैव सुभगःशोणझिण्टिकः।।

रक्तपुष्पः कुरबकः पीतपुष्पः कुरण्टकः।

नीलपुष्पश्चार्तगलः सैरेयः श्वेतपुष्पकः।।

मदनविनोदनिघण्टू

सैरेयकः सहचरः सैरेयः किङ्किरातकः।

दासी सहचरो झिण्टो सैर्यको मृदुकण्टकः।।

रक्तपुष्पः कुरबकः पीतोज्ञेयः कुरण्टकः।

नीलश्चाऽर्तगलः प्रोक्तो बाण ओदनपाक्यपि।।

भावप्रकाशनिघण्टु

सैरेयकः श्वेतपुष्प : सैरेयः कटसारिका।

सहाचरचार्तगलः स च झिण्टयपि कथ्यते।। ५१।।

कुरण्टकोऽत्र पीत स्याद्रक्त कुरबकः स्मृतः।

नीले बाणा द्वयोरुक्तो दासी चार्तगलसश्च सः।।५२।।

अभिधानमञ्जरी

सैरयेकः सहचारः सैर्यकश्च सैरेयः।

पर्णाढ्यो मृदुकण्टक उक्तः सामान्यतो हि पर्यायैः।।

सितपुष्पो झिण्टी स्यादोदनपाकी च झिण्टिका चेति।

नीलस्तु बाण उक्तश्चार्तगलः केशरञ्जनो दासी।

सोढलनिघण्टू

सैरेयके सहचरः सैरयश्च सहाचरः।

झिंटीच सैर्यकश्चैव मृदुपुष्पक एव च।

पीतो रक्तः सितो नीलः कुसुमैस्तं विभावयेत्।।

पीतः कुरण्टको ज्ञेयो रक्तः कुरबकः स्मृतः ।

नीलश्चर्तगलो दासी बाण ओदनपाक्यापि ।। २७५-२७७ (गुडूच्यादिवर्ग)

अष्टाङ्निघण्टू

आरग्वधादि गण -

सैर्यकस्तु सहचरः सर्यको मृदुपुष्पकः।

बाणःस्मृतो नीलपुष्पः धीरशौर्यकघोश्वराः।। ७२-७३

धन्वन्तरीनिघण्टु

सैरेयकः सहचरः सैरेयश्च सहाचरः।

पीत रक्तोऽथ नीलश्च कसुमैस्तं विभावयेत्।।

पीतः कुरण्टको ज्ञेयो रक्तः कुरबकः स्मृतः।

Sahachara Guna Karma Vivechana According to Various Nighantus

बृहन्निघण्टूरत्नाकर

आरग्वधादि गण- कुरण्टक (पीत), दासीकुरुण्टक (नील)

आरग्वधादिरित्येष गण: श्लेष्मविषापह:।

मेहकुष्ठज्वरवमी कण्डूघ्नो व्रणशोधन:।।

वरुणादिगण - आर्तगल, सैरीयकद्वय (रक्त, पीत)

वरुणादिर्गणो ह्येष कफमेदोनिवारण:।।

वीरतर्वादिगण - सहचरद्वय

वीरतर्वादिरित्येष गणो वातविकारनुत्।

अश्मरीशर्करामूत्रकृच्छ्राघातरुजापह:।।

कण्टकपञ्चमूळ - सैरेयक

रक्तपित्तहरौ ह्येतौ शोफत्रयविनाशनौ।

सर्वमेहहरी चैव शुक्रदोषविनाशनौ।।

वातसंशमनवर्ग - आर्तगल, सहचर.

कैयदेवनिघण्टू

बाणस्तूद्यानपाकी स्याच्छोणक: केशरञ्जन:।

बाणस्त्वोदनपाकी स्यातशोणक:।

शेरयो मधुरस्तिक्त: स्निग्धोष्ण: केशरञ्जन:।।

केश्यो बलासवातास्त्र कुष्ठकण्डूविषं जयेत्। औषधवर्ग

राजनिघण्टू

सौरेयः कुष्ठवातास्त्रकफकण्डूविषापहः।

तिक्तोष्णो मधुरः केश्यः सुस्निग्धः कैसरञ्जन।।

शालिग्रामनिघण्टु

सैरेयः कुष्ठवातास्त्रकफकण्डूविषापहः।

तिक्तोष्णो मधुरोऽनम्लः सुस्निग्धः केशरञ्जनः।।

श्वेतः कुरण्टकस्तिक्तः केश्यः स्निग्धः कटुः स्मृतः।

कटुश्चोष्णौ दन्तहितो वलीपलितनाशनः।। (७-८ भाग)

निघण्टुरत्नाकर

श्वेतः कुरण्टकस्तिक्तः केश्यः स्निग्धः कटुः स्मृतः।

मधुरोष्णो दन्तहितो वलीपलितनाशनः ।।

कुष्ठं वातं रक्तदोषं कफं कण्डूं विषं तथा।

नाशयेद्दारुणं चैव मुनिभिः परिकीर्तितः।।

रक्त कुरण्टकस्तिक्तो वर्ण्यश्चोष्णो कटुः स्मृतः।

शोथं ज्वरं वातरोगं कफं रक्तरुजं तथा।।

पित्तमाध्यानकं शूलं श्रासं कासं च नाशयेत्।

पीतः कुरण्टकश्चोष्ण स्तित्कश्च तुवरः स्मृतः।।

अग्निदीप्तिकरो वातकफकण्डूहरः स्मृतः।

शोथं रक्तविकारं च त्वग्दौषं चैव नाशयेत्।

नीलः कुरण्टकस्तिततक्तः कटुर्वातकफापहः।

शोथकण्डू शूलकष्ठव्रणत्वग्दोषनाशनः।।

नीला झिण्टी तु कटुका तिक्ता त्वगदोषनाशिनी।

दन्तरोगं कफं शूलं वातं शोथं च नाशयेत्।। - गुणदोषप्रकरण

मदनविनोदनिघण्टू

सैरेयः कुष्ठवातास्त्रकफकण्डूविषापहः।

तिक्तोष्णो मधुरः केश्यः सुस्निग्धः केशरञ्जनः।।

भाव प्रकाशनिघण्टु

सैरेयः कुष्ठवातास्त्रकफककण्डूविषापहः।

तिक्तोष्णो मधुरोऽनम्लः सुस्निग्ध केशरुञ्जनः।।५३।। पुष्पवर्ग

निघण्टु आदर्श

श्वेतपुष्पः सहचरो मृदुकंटो महासहः।

बाणो उद्यानपाकी च श्वेतसैरेयकश्च सः।।

नीलपुष्पो नीलझिण्टी दासी चार्तगलश्च सः।

किंकिरातो कुरंटश्च कनकः पीतपुष्पकः।।

पीताम्लानः सहचरः पीत सैरेयकश्च सः।।

रक्तोम्लनोरक्तपुष्पी रामलिंगणकामुकः।

रक्तपुष्पो रामलिंगनकामुकाः।।

रागप्रसवकश्चैव सुभगः शोणझिण्टिकः।

धन्वन्तरीनिघण्टु

कुरण्टको हिमस्तिक्तः शोफतृष्णाविदाहनुत्।

केश्यो वृष्योऽथ बल्यश्च त्रिदोषशमनो मतः।। २६८- २६९गुडूच्यादिवर्ग

Chapter-14

APPENDICES

14. Appendices

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भारतीय वनस्पति सर्वेक्षण
पश्चिमी क्षेत्रीय केंद्र
७, कोरेगांव रोड, पुणे- ४११ ००१

No. BSI/WRC/TECH/2013 Date-17/01/2013

CERTIFICATE

This is to certify that the plant specimen brought by Vd. Bipin R. Dhalpe , a student from College of Ayurved & Research Centre, Akurdi-Punc-44 , are identified & authenticated as: -

V.NO.	Name	Family
BRDBAC1	**Barleria cristata** L.	**Acanthaceae**
BRDBAG2	**Barleria gibsoni** Dalz.	**Acanthaceae**
BRDBAP3	**Barleria prionitis** L.	**Acanthaceae**

Jayanthi 17/01/13

(Dr. J.JAYANTHI)
Scientist 'C' & H.O.O.
BSI, WRC, Pune

dls

17.1.2013 वैज्ञानिक 'सी' Scientist 'C'
भारतीय वनस्पति सर्वेक्षण
Botanical Survey of India
पश्चिमी क्षेत्रीय केन्द्र, पुणे-१
Western Regional Centre, Pune-1

महाराष्ट्र विज्ञान वर्धिनी
आघारकर अनुसंधान संस्था
Maharashtra Association for the Cultivation of Science
AGHARKAR RESEARCH INSTITUTE
(An Autonomous Grant-in-Aid Institute under the Department of Science and Technology, Govt. of India)

AUTHENTICATION CERTIFICATE

Name of the party: Vd. Bipin Ramesh Dhalpe

Address: Tilak Maharashtra Vidyapeeth, Gultekdi, Pune

Reference: - Nil; dated: 19/2/2015

Name of the sample: Barleria Strigosa

Sample size: - Dried specimen (Mounted on a herbarium sheet)

Date of the receipt: - February 19, 2015

Report: -

The sample has been critically studied with taxonomic characters. We hereby authenticate that the sample belongs to *Barleria strigosa* Willd. (Family: Acanthaceae).

This certificate is issued at your request and is given only for the academic use.

(A.S. Upadhye)

Auth.15-052

Scientist
Plant Drug Authentication Service
Botany Group
Plant Sciences Division

आगरकर पथ, पुणे - ४११ ००४, भारत, दूरभाष : (०२०) २५६७-८९१६/१७/१८, २५६५-३६८०/४३५७/४१०६/४०९७/४१६७ फॅक्स : (०२०) २५६५ १५४२
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P.D.E.A'S

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CENTRAL RESEARCH LABORATORY

REF.NO. – CARC-CRL 27/08/11/2012 DATE -08/11/2012

Analytical report

NAME OF THE STUDENT – Dr. BipinDhalpe

Name of the guide – Dr. Yogini R. Kulkarni

Title of the study – "A Comparative Pharmacognostic and Physico- chemical study of four classical types of Sahachiaramoola (Barleria sp.) W.S.R. to Acute Anti- inflammatory Activity in Albino rats"

Samples– Samples of B.prionitis 1A, 1B, 1C

B.gibsoni2A, 2B, 2C

B.cristata, 3A, 3B, 3C

B.strigosa4A, 4B, 4C

Date of sample received – 08/11/2012 (B. cristata, prionitis, gibsoni), 26/03/2013(B. strigosa)

Tests performed –

Exomorphic characters - Macroscopy, Organoleptic,

Microscopy – L.S. T.S., Permanent slide preparation

Physicochemical Tests - Moisture, TotalAsh

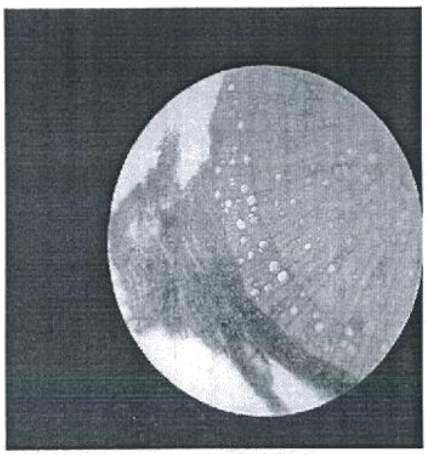
- Extractive studies – Water and alcohol soluble extractive values, pH, Sp. Gravity, Dissolved solids, Phyto-chemical testing for Saponnins, Alkaloid, GlycosideFlavonoids, Beta-sitosteorol, Tannins, Phenolic compound , HPLC

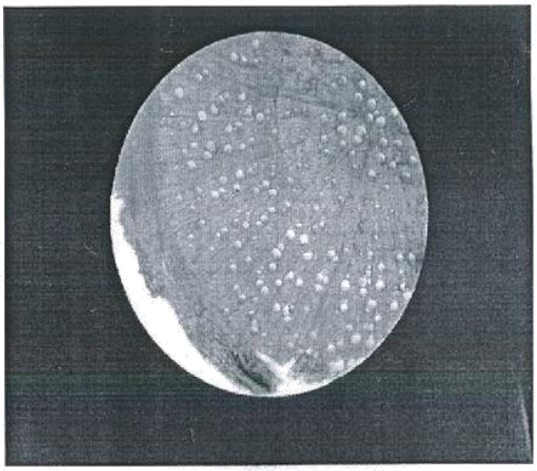
Macroscopic examination

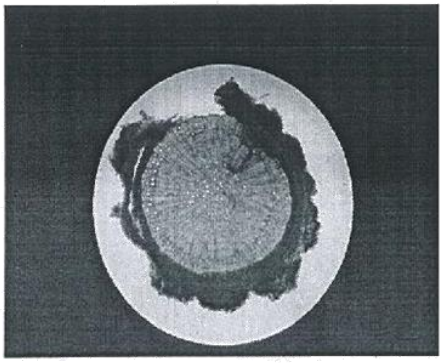
Sample code	Shabda fracture	Sparsha Touch INNER OUTER SURFACE	Roop Shape Size Color INNER OUTER	Rasa taste	Gandha Odor
1A	short	Outer-rough , inner - fibrous	2.55 mm in diameter, cylindrical , inner pale white, outer – faint brown ++	Swadukinchit, Tikta	Ground nut specific odor
1B	short	Outer rough, inner - fibrous	2.06 mm in diameter, Cylindrical inner pale white, outer – faint brown ++	Swadukinchit, Tikta	Ground nut specific odor
1C	short	Outer rough, inner - fibrous	2.31 mm in diameter, Cylindrical inner pale white, outer – faint brown ++	Swadukinchit, Tikta	Ground nut specific odor
2A	short	Outer surface with lines and scars of rootlets Inner – not fibrous	2.81mm in diameter Cylindrical inner pale white, outer –Dark brown +++	MadhurTikta+	Ground nut specific odor
2B	short	Outer surface with lines and scars of rootlets Inner – not fibrous	2.84 mm in diameter Cylindrical inner pale white, outer – Dark brown +++	MadhurTikta	Ground nut specific odor
2C	short	Outer surface with lines and scars of rootlets Inner – not fibrous	2.58 mm in diameter Cylindrical inner pale white, outer – Dark brown +++	Tikta	Ground nut specific odor
3A	short	Outer soft	2.3 mm in diameter Cylindrical inner pale white, outer – Faint brown +	Swadu, kinchittikta	Not specific
3B	short	Outer soft	2.82 mm in diameter	Swadukinchittikta	Not specific

			Cylindrical inner pale white, outer – Faint brown +		
3C	short	Outer soft	2.83 mm in diameter Cylindrical inner pale white, outer – Faint brown +	Swadukinchittikta	Not specific
4A	Short	Outer rough, inner not fibrous	3.04mm in diameter Cylindrical inner pale white, outer – Faint brown +	Swadu, kinchittikta	Characteristic
4B	Short	Outer rough, inner not fibrous	6.01 mm. in diameter Cylindrical inner pale white, outer – Faint brown +	Swadukinchittikta	Characteristic
4C	short	Outer rough, inner not fibrous	4.04 mm in diameter Cylindrical inner pale white, outer – Faint brown +	Swadukinchittikta	Characteristic

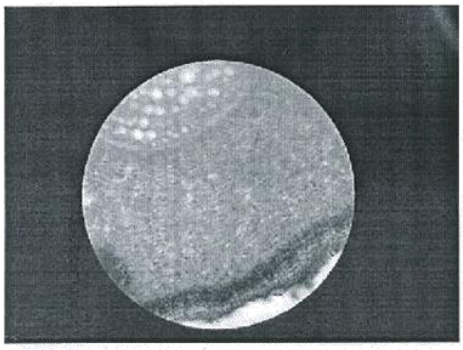
Microscopic examination T.S.1A,1B&1C

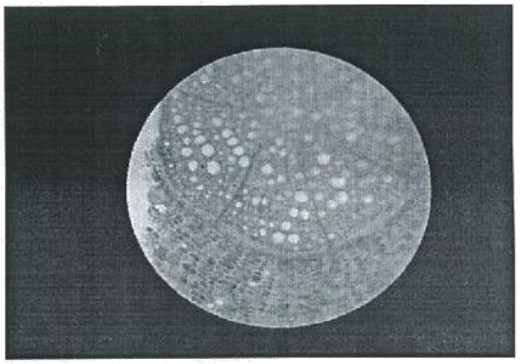


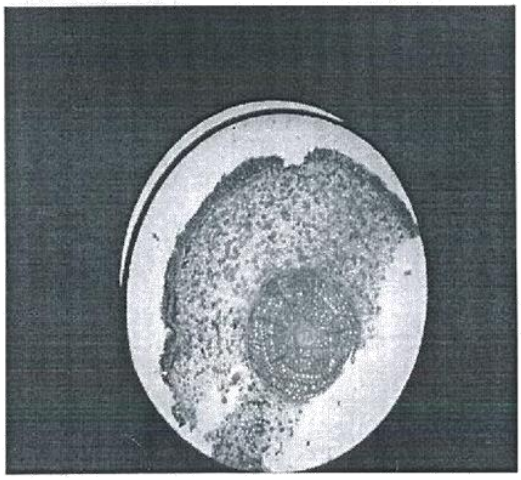




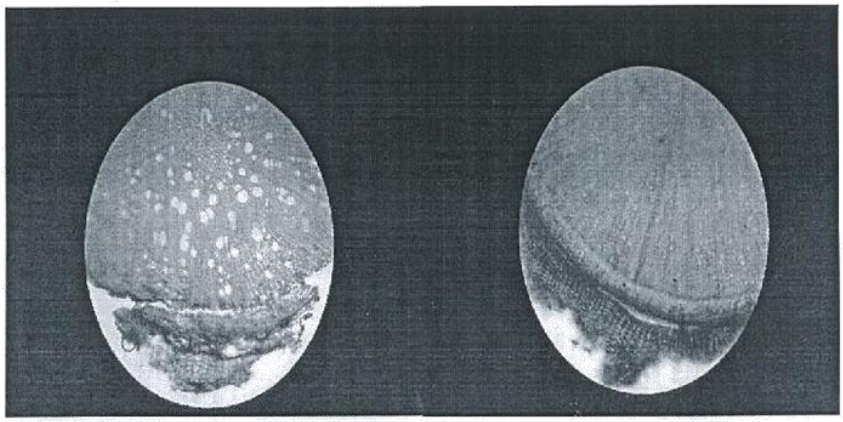
Microscopic sections of 2A,2B& 2C

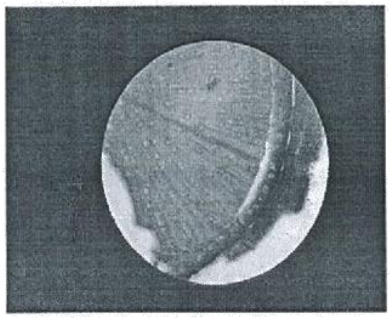




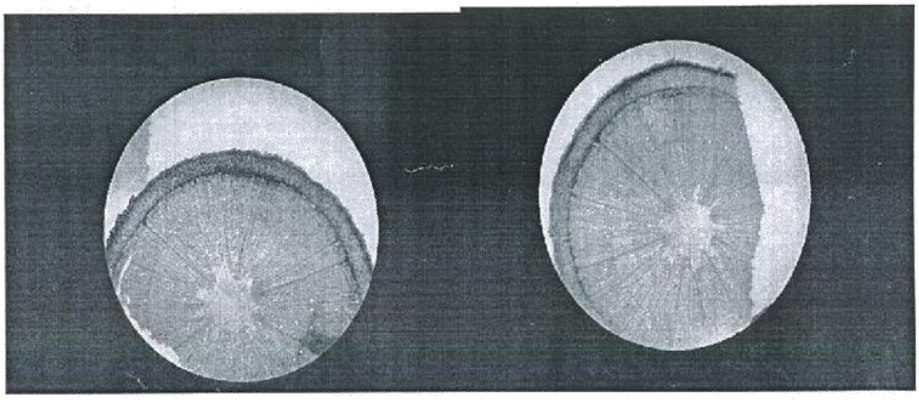


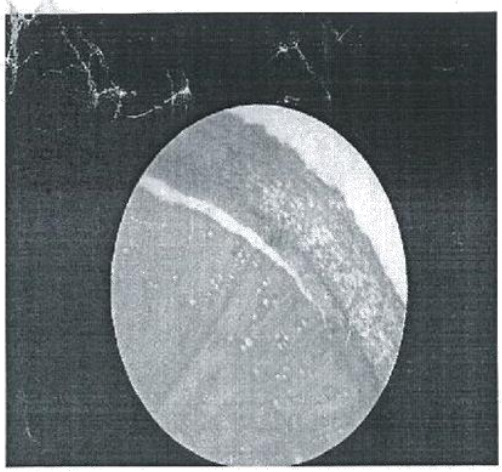
3A, 3B &3C





Microscopic sections 4A, 4B & 4C





Physico chemical test

Sample code	Moisture %	Total Ash %	Aqueous extractive %	Alcohol soluble extractives %
1A	4.03	5.75	6.19	5.024
1B	3.54	2.50	5.16	4.918
1C	4.40	3.50	5.04	3.77
2A	5.86	12.18	13.83	9.872
2B	6.00	11.54	11.86	18.32
2C	6.04	9.77	9.34	9.316
3A	4.74	4.12	7.65	5.936
3B	4.29	3.55	8.08	5.322
3C	4.18	5.59	6.08	4.7
4A	4.44	4.45	15.83	19.79
AB	4.45	4.22	14.46	19.35
4C	4.41	4.66	18.60	20.13

Aqueous Extractive studies

Sample code	Specific gravity	Dissolved solids	Color	Taste	Odor	Ph
1A	1.003	0.78	Pale brown +	Swadu, kinchittikta	Ground nut specific odor	6.16
1B	1.005	1.3	Pale brown ++	Swadukinchittikta	Ground nut specific odor	6.90
1C	1.006	1.56	Pale brown	Swadukinchittikta +	Ground nut specific odor	6.64
2A	1.009	2.34	Dark brown	MadhurTikta	Ground nut specific odor	6.22
2B	1.002	0.52	Dark brown	Tikta	Ground nut specific odor	6.00
2C	1.008	2.08	Dark brown	Tikta	Ground nut specific odor	6.40
3A	1.008	2.08	Pale brown	Swadu, kinchittikta	Not specific	7.50
3B	1.013	3.38	Pale brown	Swadukinchittikta	Not specific	7.45
3C	1.004	1.04	Pale brown +	Swadukinchittikta	Not specific	7.10
4A	1.011	2.86	Dark brown	Swadu, kinchittikta	Characteristic	4.18
AB	1.011	2.86	Dark brown	Swadukinchittikta	Characteristic	4.91
4C	1.013	3.38	Dark brown	Swadukinchittikta	Characteristic	4.82

Saponnins,Alkaloid, GlycosoideFlavonoids, Beta-sitosteorol, Tannins, Phenolic compound ,

Micro-chemical testing for aqueous extract

Test performed	1A	1B	1C	2A	2B	2C	3A	3B	3C	4A	4B	4C
For Alkaloids	-	-	-	-	-	-	-	-	-	+	+	+
Glycosides	+	-	+	+	+	+	-	-	-	+	+	+
Flavonoids	+	+	+	+	+	+	+	+	+	+	+	+
Saponins	+	-	+	+	+	+	-	-	-	+	+	+
Phenolic compounds and Tannins	-	-	-	+	+	+	-	-	-	+	+	+

Fluorescence analysis –

Test performed	1A				1B				1C			
Sample	N	D.L	254	365	N	D.L	254	365	N	D.L	254	365
Sample+ ethyl acetate	FB	NC	G	GF	FB	FB	GF	GF	FB	FB	GF	LG
Sample + Benzene	FB	FB	G	NC	FB	FB	LG	NC	FB	FB	GF	NC
Sample + Methanol	FB	FB	GF	GF	FB	FB	LG	GF	FB	FB	GF	NC
Sample + Pet ether	FB	FB	G	NC	FB	FB	NC	NC	FB	FB	GF	NC
Sample + Fluro glucinol	FB	FB	G	GF	FB	FB	GF	GF	FB	FB	GF	GF

Test performed	2A				2B				2C			
Sample	N	D.L	254	365	N	D.L	254	365	N	D.L	254	365
Sample+ ethyl acetate	DB	DB	DG	NC	DB	DB	DG	GF	DB	DB	GF	LG
Sample + Benzene	DB	DB	G	BF	DB	DB	NC	BF	DB	DB	NC	BF
Sample + Methanol	DB	DB	G	NC	DB	DB	NC	NC	DB	DB	NC	NC
Sample + Pet ether	DB	DB	G	NC	DB	DB	NC	NC	DB	DB	NC	NC
Sample + Fluro-glucinol	DB	DB	G	NC	DB	DB	NC	NC	DB	DB	NC	NC

Test performed	3A				3B				3C			
Sample	N	D.L	254	365	N	D.L	254	365	N	D.L	254	365
Sample+ ethyl acetate	FB	FB	G	GF	FB	FB	G	GF	FB	FB	LG	GF
Sample + Benzene	FB	FB	G	NC	FB	FB	G	GF	FB	FB	LG	GF
Sample + Methanol	FB	FB	G	GF	FB	FB	G	GF	FB	FB	LG	GF
Sample + Pet ether	FB	FB	G	GF	FB	FB	G	NC	FB	FB	DG	NC
Sample + Fluro glucinol	FB	FB	G	NC	FB	FB	G	NC	FB	FB	DG	NC

Test performed	4A				4B				4C			
Sample	N	D.L	254	365	N	D.L	254	365	N	D.L	254	365
Sample+ ethyl acetate	DB	DB	G	NC	DB	DB	G	NC	DB	DB	G	NC
Sample + Benzene	DB	DB	G	NC	DB	DB	G	NC	DB	DB	G	NC
Sample + Methanol	DB	DB	G	NC	DB	DB	G	NC	DB	DB	G	NC
Sample + Pet ether	DB	DB	G	NC	DB	DB	G	NC	DB	DB	G	NC
Sample + Fluro-glucinol	DB	DB	G	NC	DB	DB	G	NC	DB	DB	G	NC

PRINCIPAL

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Principal
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HOD RESEARCH

Dr. Yogini R. Kulkarni

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APT RESEARCH FOUNDATION

Date: 13/September/2014.

C E R T I F I C A T E

This is to certify that Dr. Bipin Dhalpe, Tilak Maharashtra Vidyapeeth, Gultekdi, Pune, under the guidance of Dr. Yogini Kulkarni, has satisfactorily conducted his experiments for the degree of Ph.D Dravyaguna in this Institute as per the approved protocol through Research Project No. 218 entitled "A comparative pharmacognostic and physico-chemical studies of four classical types of *Sahachara* (Roots of *Barleria* spp.) w.s.r. to acute anti inflammatory activity in albino rats."

For APT Research Foundation,

Dr. K. G. Apte.

APT RESEARCH FOUNDATION PUNE