



PROJECT WORK ON

**“NUTRITIONAL VALUES OF DIFFERENT LOCAL PLANTS
AND PLANT PARTS”**

Submitted by

**B. Sc Third Year
2015-16**

**DEPARTMENT OF BOTANY IN COLLABORATION WITH
DEPARTMENT OF HOME SCIENCE
SAINT MARY'S COLLEGE,
SHILLONG
793003**

ACKNOWLEDGEMENT

We first and foremost would like to thank Sister Mary Harriet Principal of St Mary's college, for giving us the opportunity to do this project and also our teachers Miss Tiewlyngksiar Syiemlieh and Miss Gerandia Marbaniang from Botany Department and Miss Nirupama James from Home Science department for guiding us to complete our project work.

Supervisors:

1. Ms. Tiewlyngksiar Syiemlieh
2. Ms. Gerandia Marbaniang



Co- Supervisor:

1. Ms. Nirupama James



The project was done by the following students;

- I. Kedisha Khar Ir
- II. Markorshisha Pyngrope
- III. Superlity Ryntathiang
- IV. Dahunshisha Mary Dura
- V. Rachel Kharbuli

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INTRODUCTION

Man needs a wide range of nutrients to perform various functions in the body and to lead a healthy life. The nutrients include proteins, fat, carbohydrates, vitamins, and minerals. These nutrients are chemical substances which are present in the food we eat daily. Most foods contain almost all the nutrients in various proportions, some foods being rich in certain nutrients, depending on the relative concentration of these nutrients, foods are classified as protein rich foods, carbohydrate rich foods and rich foods etc.

Proteins, fat and carbohydrates are sometimes referred to as proximate principles. They are oxidised in the body to yield energy which the body needs. Although proteins provide energy, their primary function is to provide energy amino acids for building body proteins, fats particularly the vegetable oils besides being a concentrated source of energy, provide essential fatty acids which have a vitamin-like function in the body.

Vitamins and minerals do not supply energy but they play an important role in the regulation in the metabolism activity in the body and help in the utilisation of the proximate principles. Minerals are also used for the formation of body structure and skeletons.

Man needs all the above nutrients i.e. energy, proteins, vitamins, minerals in different amounts to grow, live and thrive. Some man derives all the nutrients he needs through the diets he eat; his diets must be well balanced to provide the entire nutrient in proper proportions. In planning a diet for the community, foods have to be chosen in proper amounts to provide all the nutrients amounts and also keeping in view the dietary habit and availability of foods. Since a diet should be in sufficient quantity daily to provide the needed energy and also ensure supply of it at least a minimal quantity of essential nutrients to maintain the body function in a proper working order.

Extensive research work carried out in man all over the world has provided information on the amount of each nutrient required by human beings at different ages. This has provided sound basics for planning well balanced diets in terms of foods habitually consumed by the community. Such information has helped to determine which foods are not consumed in enough amounts and how the present diets can be improved by including certain food stuff.

METHODOLOGY

The present work is based on carefully planned field studies conducted during the months of June 2015 to March 2016. In this project, five different fruits, green leafy vegetables and other vegetables have been selected for the study. Each visit in a particular area and a close study of the uses and medicinal values of plants was made in the field from different localities namely Mawpat, Umpling, Madanriting, Upper Shillong (East Khasi Hills District) and Mairang (West Khasi Hills District). Identification and classification of plants was done with reference from the department library books. Nutritional value of different plant parts used was calculated using the book, "Nutritive Value of Indian Foods".

A: Botanical classification and nutritional values of fruits and vegetables

1. *Lagenaria siceraria* (Bottle Gourd)

CLASSIFICATION:

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Cucurcitrales

Family: Cucurbitaceae

Genus: *Lagenaria*

Species: *siceraria*

Botanical name: *Lagenaria siceraria*

Local name: Pathaw klong

USES:

It is helpful in shedding extra calories, its provide relief to people suffering with digestive problems, diabetic and convalescents

PLANT PART USED: Raw juice, pulp of the fruit, leaves and tendrils.

2. *Cucumis sativus* (Cucumber)

CLASSIFICATION:

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Cucurcitrales

Family: Cucurbitaceae

Genus: *Cucumis*

Species: *sativus*

Botanical name: *Cucumis sativus*

Local name: Sohkhia

USES:

It is eaten raw as salad. It is mainly used as fruit, it is also used as a skin conditioning agent and emollient



Lagenaria siceraria



Cucumis sativus

PLANT PART USED: The whole fruit can be eaten raw and also cook.

3. *Artocarpus heterophyllus* (Jack Fruit)

CLASSIFICATION:

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Rosales

Family: Moraceae

Genus: *Artocarpus*

Species: *heterophyllus*

Botanical name: *Artocarpus heterophyllus*

Local Name: Sohphan

USES:

Leaves are useful for curing fever, boils and skin diseases. The seeds from ripe fruits are edible.

Plant Part Used: Seed, fruit and leaves.

4. *Musa sapientum* (Plantain)

CLASSIFICATION:

Kingdom: Plantae

Division: Magnoliophyta

Class: Liliopsida

Order: Zingiberales

Family: Musaceae

Genus: *Musa*

Species: *sapientum*

Botanical name: *Musa sapientum*

Local name: Ka kait im

USES:

The fruit is rich in starch, and can be include in a normal diet after cooking.

Plant Part Used: Leaves and fruit are eaten and peeled unpeeled sliced, whole ripe and unripe.



Artocarpus heterophyllus



Musa sapientum

5. *Carica papaya* (Papaya)

CLASSIFICATION:

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Violales

Family: Caricaceae

Genus : *Carica*

Species: *papaya*

Botanical name: *Carica papaya*

Local Name: Sohkynphor, ka kait kynphor

USES:

It is cultivated for its edible ripe fruit, its juice is a popular beverages and its young leaves shoots and fruits are cooked as vegetables.

PLANT PART USED:

Leaves, fruits and roots.

(B): Botanical classification and nutritional values of green leafy vegetables

1. *Oxalis corniculata* (Yellow wood sorrel)

CLASSIFICATION:

Kingdom: Plantae

Division: Angiosperm

Class: Dicotyledons

Order: Oxalidales

Family: Oxalidaceae

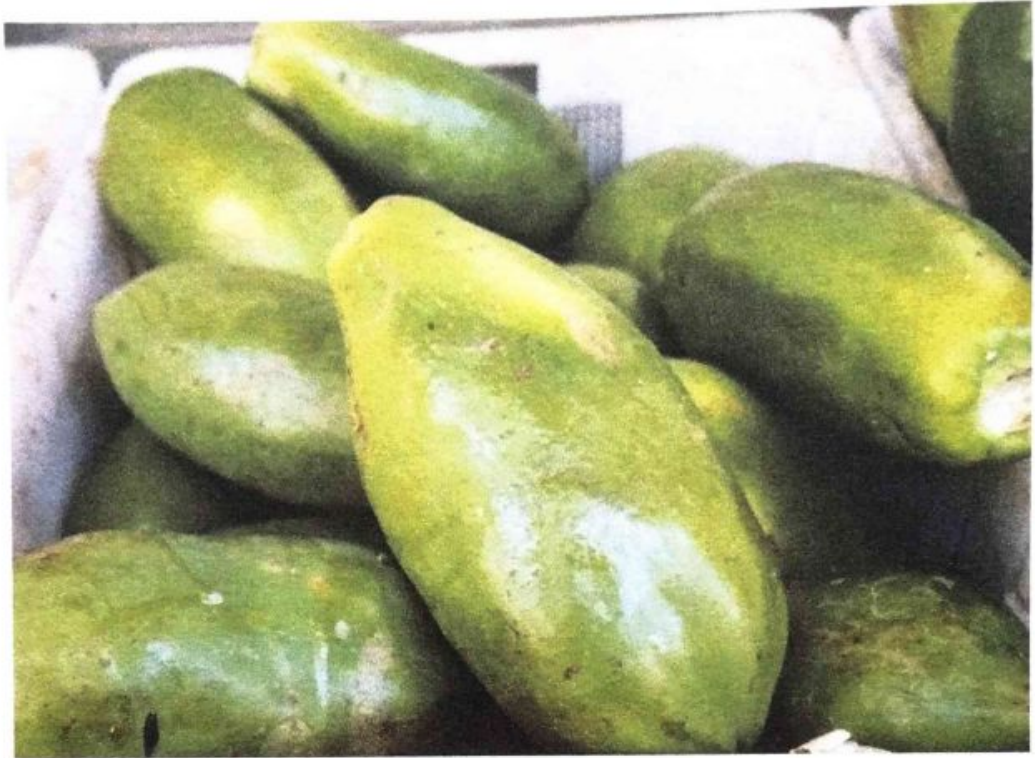
Genus: *Oxalis*

Species: *corniculata*

Botanical name: *Oxalis corniculata*

Local Name: Jajew, soh dkhiew

USES: Stomach pain, chronic cough. It is used in snake bite, the juice is also drink to remove the poison and the leaves are used in dysentery.



Carica papaya

CONCLUSION

A healthy diet is crucial throughout a lifetime and paying attention to the nutritional value of food stuff is a good step toward improving our overall diet. Thus the nutritional value of food stuff provides key information such as total fat, carbohydrate, vitamin content etc. This information helps us to stay on track with our daily diets.

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APPENDIX

NUTRITIONAL VALUE OF FRUITS

Fruits	Amount (gm)	Proteins (gm)	Fat (gm)	CHO (gm)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Thiamine (gm)	Riboflavin (mg)	Fibres (gm0)
<i>Lagenaria siceraria</i>	100	0.2	0.1	2.5	12	20	0.46	0.03	0.01	0.6
<i>Cucumis sativus</i>	100	0.4	0.1	2.5	13	10	0.60	0.03	0.0	0.4
<i>Artocarpus heterophyllus</i>	100	2.6	0.3	9.4	51	30	1.7	1.05	0.04	2.8
<i>Musa sapientum</i>	100	1.4	0.2	14.0	64	10	6.27	0.05	0.02	0.7
<i>Carica papaya</i>	100	0.7	0.2	5.7	27	28	0.9	0.01	0.01	0.9

NUTRITIONAL VALUE OF GREEN LEAFY VEGETABLES

Vegetable	Amount (gm)	Proteins (gm)	Fat (gm)	CHO (gm)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Thiamine (gm)	Riboflavin (mg)	Fibres (gm0)	Vit C (mg)
<i>O. carniculata</i>	100	2.3	0.8	8.0	-	2.5	8.0	-	-	-	125
<i>F. ditorys</i>	100	13	3.4	-	343	150	12	10	-	10	-
<i>A. hookeri</i>	100	3.27	0.0	4.35	100	58.1	1.60	-	-	2.5	58.1
<i>P. betel</i>	100	3.1	0.8	6.1	44	230	10.6	0.07	0.03	2.3	5
<i>C. asiatica</i>	100	9.9	0.0	-	170	28	-	0.15	0.14	-	-

NUTRITIONAL VALUE OF ROOTS AND TUBERS

Roots/Tubers	Moisture (gm)	Proteins (gm)	Fat (gm)	Minerals (gm)	Energy (Kcal)	Calcium (mg)	Carbohydrates (mg)	Iron (mg)	Phosphorus (mg)	Fibres (gm0)
<i>B. vulgaris</i>	87.7	1.7	0.1	0.8	43	18.3	8.8	1.2	55	0.9
<i>I. batatas</i>	68.5	1.2	0.3	1.0	120	46	28.2	0.21	50	0.8
<i>R. sativus</i>	90.8	0.6	0.3	0.9	32	50	6.8	0.37	20	0.6
<i>C. esculenta</i>	73.1	3.0	0.1	1.7	97	40	21.1	0.42	140	1.0
<i>B. rapa</i>	91.6	0.5	0.2	0.6	29	30	6.2	0.4	40	0.9

**Study on morphological and cultural characteristics of
the bacteria isolated from different polluted water
sample.**

B.Sc Project Report

SUBMITTED BY

**IBANIADA KHONGLAM
BANTEIBHA SUCHIANG
LAWANSHISHA LYNGKHOI
BALISHA M. UMLONG
PYNHUNLANG MARNGAR**



[Estd. 1937]

**Department of Botany
St. Mary's College, Shillong**

2016



[Estd. 1937]

ST. MARY'S COLLEGE
(RE-ACCREDITED BY NAAC WITH GRADE 'A')

INSTITUTIONAL BIOTECH HUB

CERTIFICATE

This is to certify that *Ms. Banteibha Suchiang, Ms. Pynhunlang Marngar, Ms. Lawanshisha Lyngkhei, Ms. Ibaniada Khonglam and Ms. Balisha M. Umlong* students of B.Sc Botany (Hons.), 3rd year, Department of Botany, St. Mary's College, Shillong have successfully completed their B.Sc Project on "*Study on morphological and cultural characteristics of bacteria isolated from different polluted water samples*". This project is an initiative of IBT-Hub, St. Mary's College, Shillong to promote scientific enthusiasm among science students.

They were very sincere in their work and we wish them all success in life.

Mr. L. Marbaniang
Coordinator
Institutional Biotech Hub

Mr. P. Sawian
SRF and Project Supervisor
Institutional Biotech Hub

Dr. (Sr.) Mary Harriet
Principal
St. Mary's College, Shillong

2017

SELF ATTESTATION

This is to certify that we, Banteibha Suchiang, Pynhunlang Marngar, Lawanshisha Lyngkhai, Ibaniada Khonglam and Balisha M. Umlong students of B.Sc Botany Honours (III year), Department of Botany, St. Mary's College, Shillong have worked on the project entitled "Study on morphological and cultural characteristics of bacteria isolated from different polluted water samples". The data mentioned in this report were obtained during our work done and collected by us under the Supervision of Mr. Pynshngainlang Sawian, Senior Research Fellow (SRF), Institutional Biotech Hub, St. Mary's College, Shillong. The data obtained from other sources have been duly acknowledged. The result embodied in this project has not been submitted to any other colleges or university for the award of any degree.

Date: Shillong (21st April, 2017).

Place: Shillong.

B. Suchiang
Banteibha Suchiang

P. Marngar
Pynhunlang Marngar

L. Lyngkhai
Lawanshisha Lyngkhai

I. Khonglam
Ibaniada Khonglam

B. Umlong
Balisha M. Umlong

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The success of our B.Sc. Project depends largely on the encouragement and the guidance of many others. First and foremost, we thank the **Lord Almighty** for giving us the power of endurance and perseverance into the completion of this project work and we are also indebted to our parents for their moral support and personal sacrifice throughout our B.Sc. Course.

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B. Suchiang
BANTEIBHA SUCHIANG

Balisha M. Umlong
BALISHA M. UMLONG

I. Khonglam
IBANIADA KHONGLAM

L. Lyngkhai
LAWANSHISHA LYNGKHOI

P. Marngar
PYNHUNLANG MARNGAR

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LIST OF ABBREVIATIONS

spp	Species
i.e.	That is
<i>et al.</i>	And others
DNA	Deoxyribose nucleic acid
%	Percentage
°C	Degree Celsius
PCA	plate count agar
hrs	Hours
m	Meter
km ²	Square kilometer
μl	Microlitre
g	Gram
ml	Milliliter
lbs	Pounds
viz	Namely (or that is)
pH	Potentia hydrogenii
vol	Volume

INTRODUCTION

Water is an important chemical molecule containing feature of life it can be dissolved into organic compounds salts, inorganic compounds and gases that are involved in metabolic processes. Water covers approximately 70% of surface of earth and remaining volume is found in land which has only 2% water which is drinkable. Water is an important component of all cells. Water helps regulates body human's body temperature, work as a nature's air conditioner inside our body. Loss of water from the body can suffer from dehydration, weakness, headaches, etc and consequently reach a state of pathology. It is one of the most critical of all resources, equally for human and for the natural environment. Environmental effects like migrations of peoples, animals, land losses, change of environment factors, depletion of biological resource shows that these activities are noticeable. Sewage pollution which is directly disposed off from chemical factories and septic tanks that cure the main reservoir of pathogens involves in water borne diseases. The role of water in spreading communicable diseases is much evident due to combined source of water i.e. drinkers. Contaminated water with faecal coliform severely affects the performance of humans. *Salmonella*, *Camphylobacter* spp, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Clostridium botulinum*, *Vibrio cholerae* and *Escherichia coli* are the main human pathogens responsible for water contamination (He *et al.*, 2007).

Microbial Diversity

Bacteria are single celled microorganisms that are normally found together in millions in every habitat on earth. They are a few micrometers in length and their morphology ranges from cocci (spherical) to bacilli (rod shaped) and to spirilla (curved walls). In 1674, bacteria were properly identified as microorganisms by Anton van Leeuwenhoek.

The cell structure is simpler than that of other organisms as there is no nucleus or membrane bound organelles. Instead their control centre containing the genetic information is contained in a single loop of DNA. Some bacteria have an extra circle of genetic material called a plasmid. The plasmid often contains genes that give the bacterium some advantage over other bacteria.

Bacteria are most primitive, simple, unicellular, prokaryotic and microscopic organisms. Bacteria occur almost everywhere in air, water, soil and inside other organisms. They lead either an autotrophic or heterotrophic mode of existence. The saprophytic or saprophytic species of

CHAPTER 2

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Wastewaters from the industries and sewage sludge applications have permanent toxic effects to humans and the environment (**Rehman et al., 2008**). Different microbes have been proposed to be efficient and economical alternative in removal of heavy metals from water (**Waisberg et al., 2003**). The ability of microbial stains to grow in the presence of heavy metals would be helpful in the waste water treatment where microorganisms are directly involved in the decomposition of organic matter in biological process for waste water treatment, because often the inhibitory effects of heavy metals is a common phenomenon that occurs in the biological treatment of wastewater and sewage (**Filali et al., 2000**).

The immunological methods have shown limited success in case of solution of indicator bacteria from drinking water because of lacking sensitivity or high rates of false positive due to cross reaction (**Obst et al., 1989; Hubner et al., 1992; Fayer et al., 2000**). Isolation and control of indicator bacteria have played effective roles in reducing the incidences of epidemic by water-borne bacterial pathogens (**Payment et al., 1991**). Bacteria have also been isolated from deep sea mud and benthic organisms such as amphipods and sea-cucumber in the bathypelagic zone (**Kaye and Baross, 2004; Delong and Vayanos, 1985**).

Boyd and Brussow, 2002 suggested that phages associated with bacteria make an important contribution to the evolution of bacterial genomes and therefore to the development of bacterial pathogenicity. **Bland et al., 2005** reported that *M. fortuitum* complex were the most commonly rapidly growing microbacteria isolated from the fresh water and biofilm samples. **Jensen et al., 1996** reported that the gram positive form a variety of taxonomic affiliations including representative of the genus *Bacillus* species. According to **Fenical et al., 1993 and 1997** found that the marine bacteria are capable of producing unusual bioactive compounds that are not isolated from terrestrial sources. **Baya et al., 1986** reported that natural water exposed to toxic chemicals wastes showed a higher coincidence of anti-biotic resistant bacteria. The role of water in spreading communicable diseases is much evident due to combined source of water i.e., drinkers (**Panneerselvam and Arumugam, 2012**). Bacteriological water analysis is a method of analysing water to estimate the number of bacteria present and if needed to find out what sort of bacteria they are (**Hanaor et al., 2014**). The method used to determine the bacteria count of water or waste water in United States is the pour plate procedure using plate count agar (PCA) and incubation for 48 hrs at 35°C (**Reasoner and Geldreich, 1984**). Ground water is an

MATERIAL AND METHODS

The study was conducted in the Institutional Biotech Hub, St. Mary's College, Shillong, Meghalaya and the water samples were collected from various localities present in this state. The state's altitude ranges from 90-2000 m above sea level and the climate shows wide variation depending on the altitude. The total geographical area of the state is 22, 529 km² and lies between 25°47' N to 26°10' N latitude and 89°45' E to 92°47' E longitude.

3.1 Collection of water samples

The water samples were collected from polluted drain of different areas located in Madanrting (Lumjingsuk), Malki (Chinapatty), Laitumkhrah (Upland road), Upper Shillong (Umlyngka) in a small bottle and cover it tightly and brought to the lab.

3.2 Isolation of microorganisms from different water samples

First of all, the laminar air flow was wiped with a disinfectant (70% Ethanol) and then sterilized by UV light for 15 minutes. Aseptic technique was used every time while the media was inoculated with unknown bacteria so as to prevent any contamination of the culture. The inoculating instruments were sterilized prior to use by incinerating it in the Bunsen burner flame, holding it in an angle with the loop end pointing downward to prevent contamination of the media. In some cases like spreading of the taken sample in the media, glass capillary tubes were used apart from the inoculating loop. It is important to cool the loop and the glass capillary tubes for few seconds so that the bacteria wouldn't be killed by heat.

About 2-5 µl of the collected samples were pipette in Nutrient Agar (**Appendix 1**) plates. The plates were then spread out properly throughout. Incubation was done at 37°C for 1-2 days and the total number of colony forming units was determined and was used for morphological studies.

3.3 Morphological Studies of the isolates

After 24 hours, the colonies grown on the plates were examined for their morphology.

1. Size: Pinpoint, Small, moderate, large.
2. Pigmentation: Colour of colony.

RESULTS AND DISCUSSION

After completing the various analyses of all the samples using various techniques viz., isolation, morphological studies and motility test of bacteria isolated from different polluted drain water samples, the following results were obtained.

4.1 Morphological Characteristics of the isolated bacteria

The bacteria isolated from different polluted water samples showed good growth in Nutrient agar medium. The result of the morphological characteristics of bacterial colonies was shown in the following Table 4.1, Figure 4.1, Figure 4.2, Figure 4.3 and Figure 4.4.



Figure 4.1: Bacterial colonies grown on Nutrient agar plates (*Madanring Water Sample*)

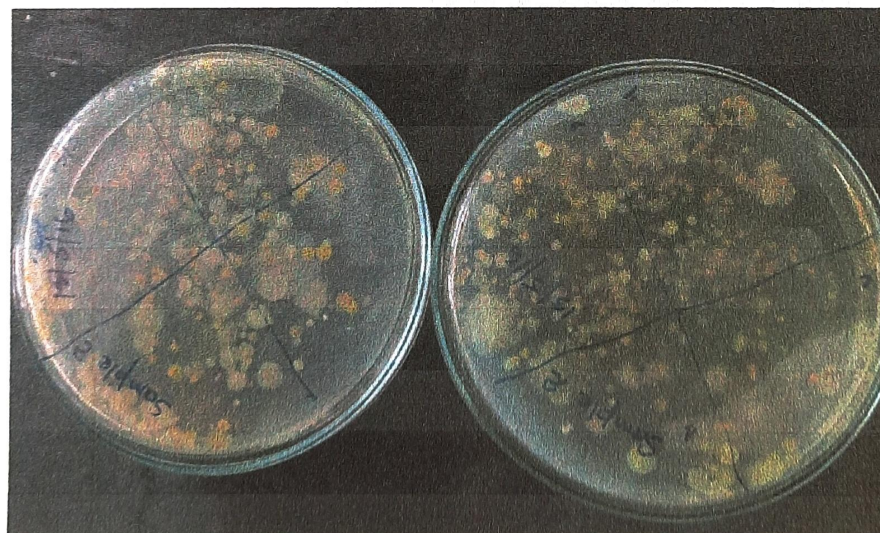


Figure 4.2: Bacterial colonies grown on Nutrient agar plates (*Malki Water Sample*)



Figure 4.3: Bacterial colonies grown on Nutrient agar plates (*Laitumkhrah Water Sample*)



Figure 4.4: Bacterial colonies grown on Nutrient agar plates (*Upper Shillong Water Sample*)

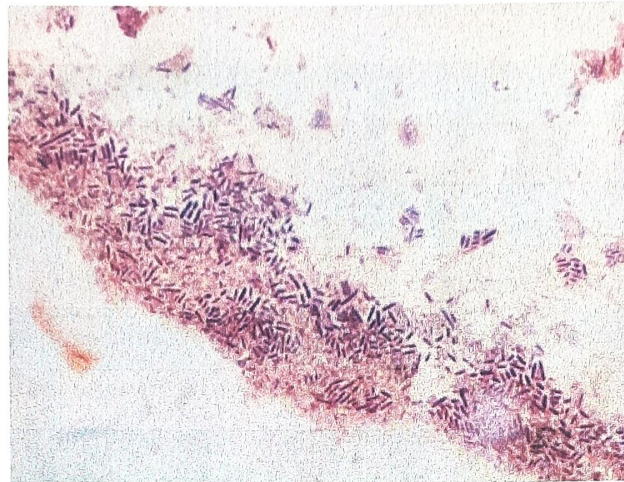


Figure 4.8: Rod-shaped gram negative bacteria

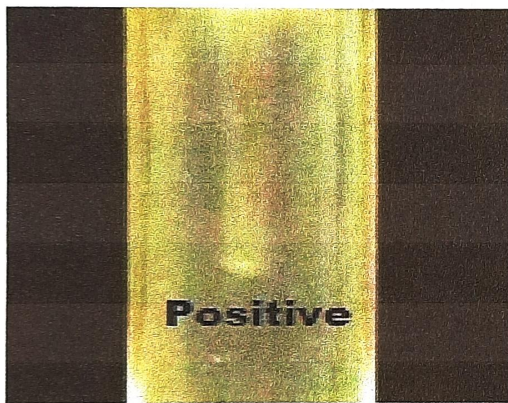


Figure 4.9: Positive result of Motility Test

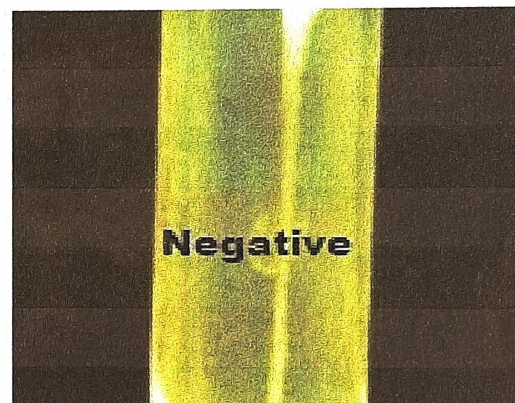


Figure 4.10: Negative result of Motility Test

POLLEN MORPHOLOGY

OF

ALSTROEMERIA AUREA AND AESCHYNANTHUS PARVIFLORUS



B. Sc.6TH SEMESTER (2018):

MS ELEKSHA KHONGSDIR

MS THOKCHOM SELINA DEVI

MS SHAHUNLIN MARTHONG

DEPARTMENT OF BOTANY

ST MARY'S COLLEGE, SHILLONG.



ST. MARY'S COLLEGE
(RE-ACCREDITED BY NAAC WITH GRADE 'A')
DEPARTMENT OF BOTANY

CERTIFICATE

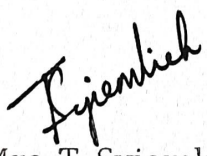
This is to certify that Ms. Shahunlin Marthong, Ms. Thokchom Selina Devi and Ms. Eleksha Khongsdir, Students of B.Sc Botany (Hons), 6th Semester 2018, Department of Botany, St. Mary's College, Shillong have successfully completed their B.Sc Project on "*Pollen Morphology of Alstroemeria aurea & Aeschynanthus parviflorus*". This project is an initiative of the Department to promote scientific enthusiasm among science students.

They were very sincere in their work and we wish them all success in life.


Mrs. I.B Kharsyntiew

HOD

Dept. of Botany


Mrs. T. Syiemlieh

Asst. Professor &
Project Coordinator


Dr. (Sr) Mary Harriet

Principal

St. Mary's College, Shillong

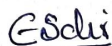
ACKNOWLEDGEMENT

The success of our **B. Sc** project depends largely on the encouragement and the guidance of many others. First and foremost, we thank the **Lord** Almighty for giving us the power of endurance and personal sacrifice throughout our **B. Sc** course

Secondly, we would like to express our deepest appreciation to **Sister Mary Harriet, Principal of St Mary's College, Shillong, and Mrs I. B. Kharsyntiew, The Head of Botany Department**, who gave us the golden opportunity to do this wonderful project. A special word of gratitude, we gave to our teacher **Mrs Tiewlyngksiar Syiemlieh** whose contribution in stimulating suggestions and encouragement, helped us to coordinate our project, especially in writing this report.

Furthermore, we would also like to acknowledge with much appreciation the crucial role of **The Staff of Botany Department**, who gave the permission to use all the required and the necessary materials to complete the project "**Pollen Morphology Of *Alstroemeria aurea* and *Aeschynanthus parviflorus***".

A special thanks then goes to our **team mates** who cooperated to finish the project. By doing this project, we came to know about so many new things and also it helped us in doing a lot of research for our future studies.


Ms Eleksha Khongsdir


Ms Shahunlin Marthong


Ms Thokchom Selina Devi

METHODOLOGY

The study was conducted in the Institution, St Mary's College, Shillong Meghalaya, and the flowers namely *Alstroemeria aurea* and *Aeschynanthus parviflorus* were collected from the college campus and Dilingim, Nongkhnun, West Khasi Hills. The state's altitude ranges from 90-2000m above sea level and the climate shows wide variation depending on the altitude. The total geographical area of the state is 22,529.km² and lies between 25° 47' N to 26° 10' N latitude and 89° 45' E to 92° 47' E latitude.

MATERIALS REQUIRED:

Different flowers i.e *Alstroemeria aurea* and *Aeschynanthus parviflorus*, microscope, slides, cover slips, centrifuge tubes and centrifuge machine, water bath, petridishes, distilled water, acetolysis mixture, glass rod, saffranin, glass rod.

METHOD:

Study of the pollen morphology of *Alstroemeria aurea* and *Aeschynanthus parviflorus* was carried out by using acetolysis method. This method was originally proposed by Gunnar Erdtman (1952). It is generally carried out in a mixture of acetic anhydride, acetic acid and sulphuric acid. It is the best technique for recovering pollen because any tissue is dissolved and lipids and debris are removed from the sample and pollen grains.

The followings are the important steps how to perform this method to get good preparation and observation;

- ❖ The pollen grains of two different flowers were crushed with absolute alcohol. The alcohol was poured out and 5 ml of glacial acetic acid was added and it was centrifuged for 1 minute.
- ❖ The supernatant was decanted and 6 ml of acetolysis mixture was added. The tube was kept in water bath and heated from 70° C boiling points for about 15 minutes.
- ❖ It was stirred with glass rod and centrifuged for 1 minute.
- ❖ The acetolysis mixture was decanted.

DIAGRAMS

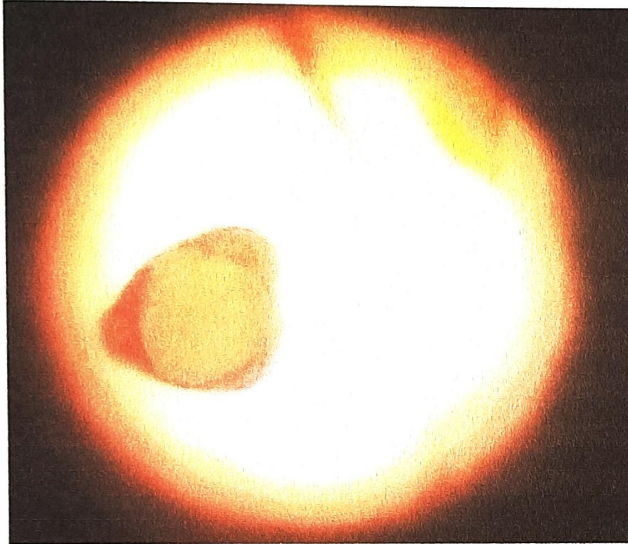


Figure 2-*Aeschynanthus parviflorus* (with stain)



Figure 3-*Aeschynanthus parviflorus* (without stain)



Figure 1-*Alstroemeria aurea*

RESULTS

Name of plant species	Shape	Size
1) <i>Alstroemeria aurea</i>	Ovoid	<u>90 μm</u>
2) <i>Aeschynanthus parviflorus</i>	Spherical	<u>75 μm</u>

Summary and Conclusion

After doing the project we found that most of the pollen grains were different in size and shape. Some pollen grains are oval-shaped, spherical-shaped, round-shaped, and so on. The bigger the size of pollen grains helped those who want to study in detail. Pollen grains are the important reproductive unit of plant for reproduction. Germination of pollen grains takes place when there is favourable condition. Acetolysis method is very important and well accepted technique for the study of pollen morphology, i.e shape and size till date.

Summary and Conclusion

After doing the project we found that most of the pollen grains were different in size and shape. Some pollen grains are oval-shaped, spherical-shaped, round- shaped, and so on. The bigger the size of pollen grains helped those who want to study in detail. Pollen grains are the important reproductive unit of plant for reproduction. Germination of pollen grains takes place when there is favourable condition. Acetolysis method is very important and well accepted technique for the study of pollen morphology, i.e shape and size till date.

**Study on morphological, cultural characteristics and
genomic DNA of bacteria isolated from different soil
samples collected from various localities of
Meghalaya.**

B.SC PROJECT REPORT

SUBMITTED BY

Ngoruh Blaise Paarning

Y. Komuha Ruth

Kyntiewburom Dkhar

Kelevi-I

Ame Debbarma



[Estd. 1937]

**Department of Botany
St. Mary's College, Shillong**

2016



[Estd. 1937]

ST. MARY'S COLLEGE
(RE-ACCREDITED BY NAAC WITH GRADE 'A')
INSTITUTIONAL BIOTECH HUB

CERTIFICATE

This is to certify that *Ms. Ngoruh Blaise Paarning, Ms. Y. Komuha Ruth, Ms. Kyntiewburom Dkhar, Ms. Kelevi-I and Ms. Ame Debbarma* students of B.Sc Botany (Hons.), ^{6th Semester} 3rd year, Department of Botany, St. Mary's College, Shillong have successfully completed their B.Sc Project on "*Study on morphological, cultural characteristics and genomic DNA of bacteria isolated from different soil samples collected from various localities of Meghalaya*". This project is an initiative of IBT-Hub, ^{the Department} St. Mary's College, Shillong to promote scientific enthusiasm among science students.

They were very sincere in their work and we wish them all success in life.

Mr. L. Marbaniang
Coordinator
Institutional Biotech Hub

JBR

Mr. P. Sawian
SRF and Project Supervisor
Institutional Biotech Hub

TS

Dr. (Sr.) Mary Harriet
Principal
St. Mary's College, Shillong

Principal

SELF ATTESTATION

This is to certify that we, **Ngoruh Blaise Paarning, Y. Komuha Ruth, Kyntiewburom Dkhar, Kelevi- I and Ame Debbarma** students of **B.Sc Botany Honours (III year), Department of Botany, St. Mary's College, Shillong** have worked on the project entitled "**Study on morphological, cultural characteristics and genomic DNA of bacteria isolated from different soil samples collected from various localities of Meghalaya**". The data mentioned in this report were obtained during our work done and collected by us under the Supervision of **Mr. Pynshngainlang Sawian, Senior Research Fellow (SRF), Institutional Biotech Hub, St. Mary's College, Shillong**. The data obtained from other sources have been duly acknowledged. The result embodied in this project has not been submitted to any other colleges or university for the award of any degree.

Date: 20-04-2017

Place: Shillong

Ng. Blaise
Ngoruh Blaise Paarning

Y. Komuha Ruth
Y. Komuha Ruth

Dkhar
Kyntiewburom Dkhar

Kelevi-I Pasyie
Kelevi- I

Ame Debbarma
Ame Debbarma

MATERIAL AND METHODS

The study was conducted in the Institutional Biotech Hub, St. Mary's College, Shillong, Meghalaya and the soil samples were collected from various localities present in this state. The state's altitude ranges from 90-2000 m above sea level and the climate shows wide variation depending on the altitude. The total geographical area of the state is 22, 529 km² and lies between 25°47' N to 26°10' N latitude and 89°45' E to 92°47' E longitude.

3.1 Collection of soil samples

The soil samples were collected from various localities such as soil from Jaintia Hills (JH) areas, Lummawbah (LM) areas, Sohryngkham (SK) areas respectively in a sterile plastic bag and brought to the lab.



Figure 3.1: Soil Sample

3.2 Isolation of microorganisms from different soil samples

First of all, the laminar air flow was wiped with a disinfectant (70% Ethanol) and then sterilized by UV light for 15 minutes. Aseptic technique was used every time while the media was inoculated with unknown bacteria so as to prevent any contamination of the culture. The inoculating instruments were sterilized prior to use by incinerating it in the Bunsen burner flame, holding it in an angle with the loop end pointing downward to prevent contamination of the media. In some cases like spreading of the taken sample in the media, glass capillary tubes were used apart from the inoculating loop. It is important to cool the loop and the glass capillary tubes for few seconds so that the bacteria wouldn't be killed by heat.

About 5 gm of soils collected from the three areas were mixed with 50 ml of distilled water and about 2-5 μ l of the mixtures were pipette in Nutrient Agar (**Appendix 1**) plates respectively. The plates were then spread out properly throughout using a spreader. Incubation was done at 37°C for 1-2 days and the total number of colony forming units was determined and was used for morphological studies. Similarly, colonies grown were then

RESULTS AND DISCUSSION

After completing the various analyses of all the samples using various techniques viz., isolation, morphological studies and molecular studies of bacteria isolated from soils collected from various localities such as soil from Jaintia Hills areas, Lumdawbah areas and Sohryngkham areas, the following results were obtained.

4.1 Morphological Characteristics of the isolated bacteria

The bacteria isolated from soil samples showed good growth in Nutrient agar medium. The result of the morphological characteristics of bacterial colonies was shown in the following Table 4.1, Figure 4.1, Figure 4.2, Figure 4.3 and Figure 4.4.

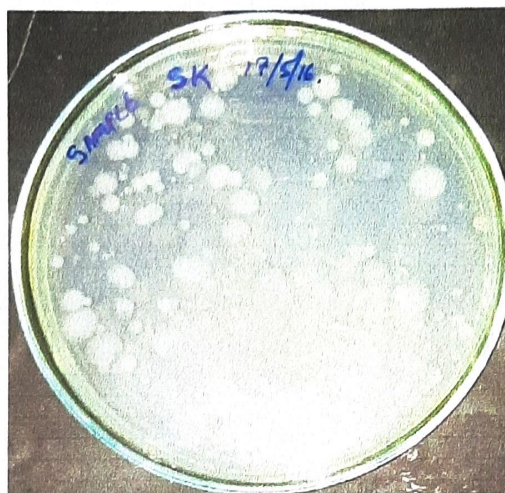


Figure 4.1: Bacterial colonies grown on Nutrient agar plates (Sohryngkham 1 Sample)



Figure 4.2: Bacterial colonies grown on Nutrient agar plates (Sohryngkham 2 Sample)



Figure 4.3: Bacterial colonies grown on Nutrient agar plates (Jaintia Hills Sample)



Figure 4.4: Bacterial colonies grown on Nutrient agar plates (Lummawbah Sample)

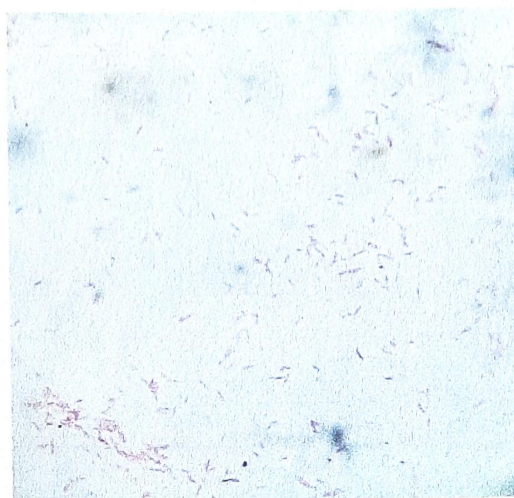


Figure 4.6: Rod-shaped gram negative bacteria of “Sohryngkham 2” Sample

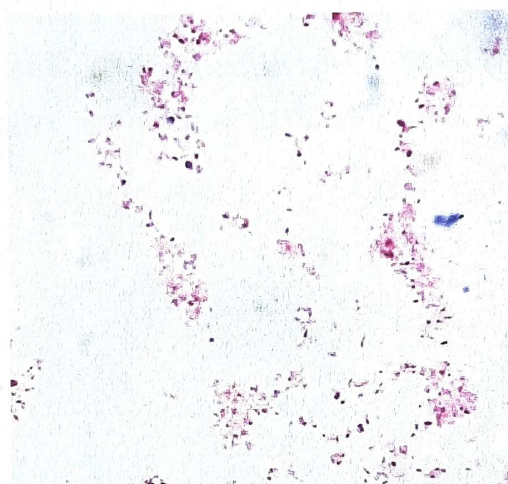


Figure 4.7: Rod-shaped gram negative bacteria of “Jaintia Hills 1” Sample



Figure 4.8: Rod-shaped gram negative bacteria of “Jaintia Hills 2” Sample

SUMMARY AND CONCLUSION

Bacteria were isolated successfully from four different soil samples. These samples were found to contain various bacterial species both of Gram positive and Gram negative groups. Genomic DNA of bacteria was isolated which can be used for the amplification of DNA by 16S rRNA and for further molecular characterization studies and phylogenetic analysis of bacteria. Identification of these unknown bacteria could be performed to determine the importance of these unknown bacterial species especially for the advances in microbiology and medicines which might be of great importance for health related issues and their interaction and important roles in various biological processes.

Therefore, the conclusion drawn from the results shown in this study could be the basis for further studies as outlined below:

- a) Determination of the importance of the bacteria isolated from soil samples.
- b) Applications of the potential microbes present in these samples in pharmaceutical production which might be of great importance for health related issues and in fabric manufacturing process.
- c) Molecular characterization of the microorganisms for further studies such as their interaction and important roles in various biological processes such as in the production process of enzymes and in bioremediation process.

**Quantitative analysis of Photosynthetic pigments
from leaves in some medicinal plants of
Khasi Hills, Meghalaya**

B.SC PROJECT REPORT

SUBMITTED BY

Shahunlin Marthong

Thokchom Selina Devi

Eleksha Khongsdir



**Department of Botany
St. Mary's College, Shillong
2018**



ST. MARY'S COLLEGE

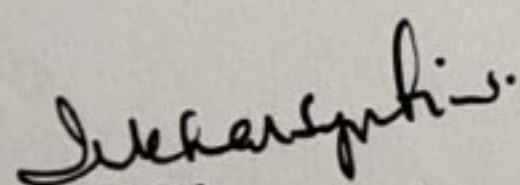
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DEPARTMENT OF BOTANY

CERTIFICATE

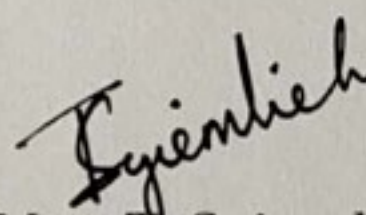
This is to certify that Ms. Shahunlin Marthong, Ms. Thokchom Selina Devi and Ms. Eleksha Khongsdir, Students of B.Sc Botany (Hons), 6th Semester 2018, Department of Botany, St. Mary's College, Shillong have successfully completed their B.Sc Project on "*Quantitative analysis of Photosynthetic pigments from leaves in some medicinal plants of Khasi Hills, Meghalaya*". This project is an initiative of the Department to promote scientific enthusiasm among science students.

They were very sincere in their work and we wish them all success in life.


Mrs. I.B Kharsyntiew

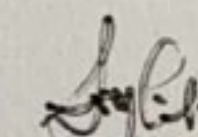
HOD

Dept. of Botany


Mrs. T. Syiemlieh

Asst. Professor &

Project Coordinator


Dr. (Sr) Mary Harriet

Principal

St. Mary's College, Shillong

INTRODUCTION

Chlorophyll is any several related green pigments found in the chloroplast of the plants. The empirical formula of chlorophyll is $C_{55}H_{72}O_5N_4Mg$.

At global level, it has been estimated that each year the total chlorophyll production across the planet exceed 10^9 tonnes with -75% from terrestrial plants, the remainder from aquatic organisms, largely marine phytoplankton. Production of carotenoids, the second most abundant plant pigment, is probably of the order of about 2×10^8 tonnes (Hendry, 1999). The chlorophyll is a dark green waxy solid, but *chlorophyll a* is bluish black while chlorophyll b is dark-green solid, both chlorophylls are soluble in organic solvents giving green solution; *chlorophyll a* melts between $117-129^\circ C$ and *chlorophyll b* between $120-130^\circ C$. Chlorophyll are esters of dibasic acid, the chlorophyllins. These photopigments are active in (a) photosynthesis either by collecting light quanta or by the generation of free electrons leading to the production of reducing compounds and ATP, (b) phototaxis, (c) photokinesis. *Chlorophyll a* like other chlorophylls contains four pyrrole nuclei (I-IV), arranged in porphyrin ring structure. In addition to these nuclei an isocyclic, or cyclopentanone, ring (V) occurs adjoining the nucleus III. A magnesium atom is located in the centre of porphyrin ring. In most cases, including *chlorophyll a* the esterifying alcohols are methanol and phytol.

Chlorophyll b, $C_{55}H_{72}O_6N_4Mg$, its structure is like that of *chlorophyll a*, except for a replacement of the methyl group at C-3 by a formyl group. Chlorophyll has a lot of importance as it is a vital factor for the place during the process of photosynthesis and also has many benefits such as helping optimized metabolic functions and immune system (Campbell, 2002; Hopkins, 2008; Mottens, 1995) chlorophyll also act as a food supplements, thus it can help optimized function, detoxification, immune system, relieves inflammation (inflammation) and also balance the hormonal system (Limantara, 2007; Marliani, 2011; Setiari, 2009; Lestari, 2008). Besides this chlorophyll can also stimulate the formation of blood and providing basic materials sharper haemoglobin (Anonymous, 2008). Products of chlorophyll have been used as important source of anti-cancer and chemopreventive agents. The chlorophyll and its derivatives have long history in traditional

medicines(Esten and Dannin,1950;Kephart,1955), and also various therapeutic uses including wound healing (Dashwood,1977), anti- inflammatory agent(Bower,1947;Larato et al.,1970), internal deodorant (Young et al .,1980).

Carotenoids which also act as photopigments in photosynthesis as auxillary pigments absorbed energy which is transferred to chlorophyll. Carotenoids function possibly as photoreceptors in phototaxins, photokinesis and photomorphogenesis. There are two classes of carotenoid :Polyene hydrocarbons, called carotenes, and their oxygen derivatives the xanthophylls.

Xanthophyll are similar to carotenes but differ in having two oxygen atoms in the form of hydroxyl, carbonyl or carboxyl groups attached to the ' ionone' rings. Apart from the role in absorption of light energy and its transfer to chlorophyll a, the carotenoids are very important in preventing photodynamic damage within the photosynthetic apparatus. Carotenoids prevents these photodynamic damage (i) by quenching the first excited triplets state of the chlorophyll photosynthesizer(ii) by quenching singlet oxygen and (iii) rarely, some of the carotenoids molecules may act as a substrate for oxidation by singlet oxygen which may have left in(i) and (ii).

Some forms of xanthophylls are lutein, $C_{40}H_{56}O_2$, in green plants and algae, violaxanthin, $C_{40}H_{56}O_4$ in green plants and algae, zeaxanthin, $C_{40}H_{56}O_2$ in green plants and algae, fucoxanthin, in diatoms and other brown algae, spirilloxanthin, $C_{40}H_{54}(OCH_3)_2$, in purple bacterial and rhodopsin, $C_{40}H_{58}O$ and $C_{40}H_{56}O$, occurring in purple bacteria.

METHODOLOGY

Collection of plant samples:

Five medicinal plants (*Aeschynanthus parviflorus*, *Aloe vera*, *Piper betel*, *Piper betel* (Bangla meetha patta), *Phrynium capitatum*), and *Alstroemeria aurea*, are collected from different places of Meghalaya for experimental purposes.

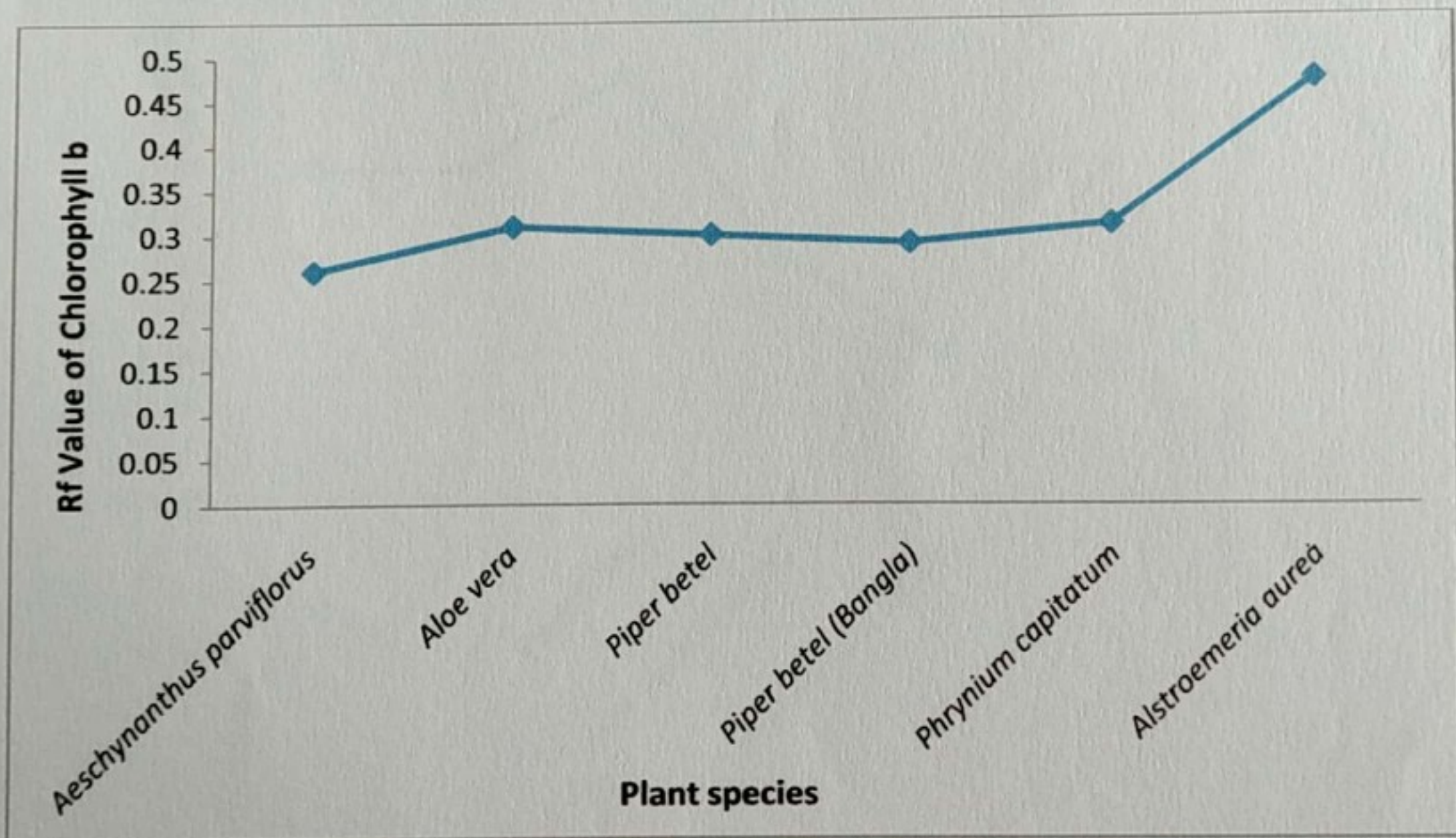
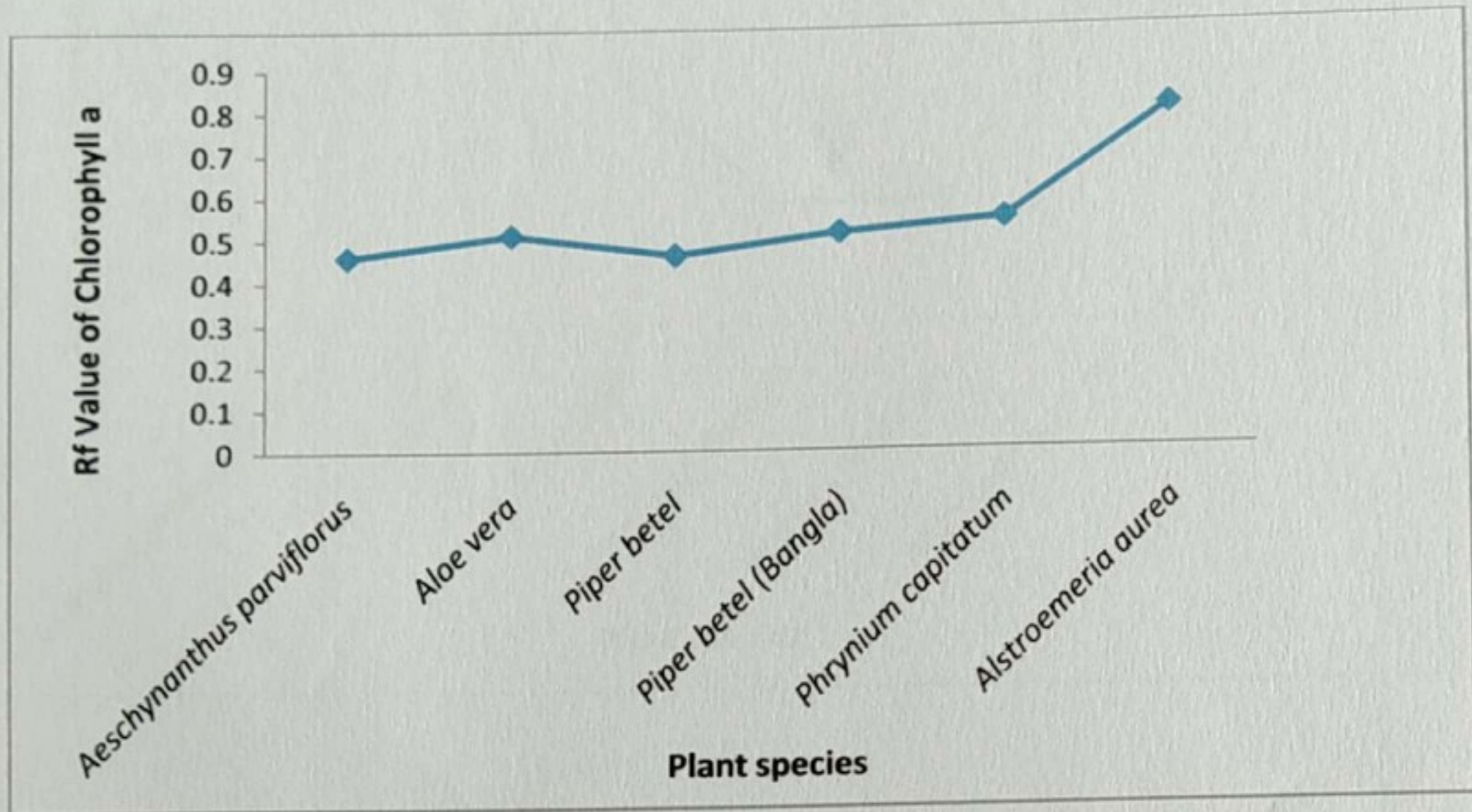
Fresh leaves of different plants, tall glass jars, mortar and pestel, acetone 80%, capillary tubes, measuring cylinders, hair dryer, beakers, chromatography paper (Whitman No. 1), scissors, scales, pencils, thread, Vaseline, cellotapes etc. are materials used.

Extraction of plant pigment is done by **paper chromatography**.

Analytical procedure:

1. A tall glass jar is taken. The jar and the lid are wiped and clean with petroleum ether and acetone.
2. A solvent mixture is prepared taking petroleum ether and acetone in the ratio of 100:12.
3. The solvent is then poured into the jar which is then covered with the lid so that it becomes saturated.
4. Chromatography paper is cut into a square sheet in a size which could fit easily into the jar.
5. A fine line is drawn with a pencil about 2.6cm parallel to the bottom edge of the sheet.
6. A small circle is drawn at the centre of the line.
7. Fresh green leaves are taken, cut into small pieces and crush into a mortar by adding a little amount of acetone at every interval.
8. The pulp is squeezed and the extract was collected. The extract is filtered and the filtrate is collected (pigment extracted).
9. With the help of a capillary tube, the pigment extract is loaded on the small circle on the chromatography paper. The pigment is dried with a hair dryer.
10. The process of loading the pigment is repeated for 4-5 times.
11. The sheet is then placed vertically inside the jar by hanging it on a thread which is already tied around the lid. The spot edge is allowed to just dip inside the solvent.
12. The jar is recovered and then made air tight by applying Vaseline all around the edges. It was then left for 1-2 hours for development.
13. When the solvent has risen to about $3/4^{\text{th}}$ of the chromatography paper, the paper is removed from the jar and dried with a hair dryer.
14. The solvent front is noted and the pigments is identified and mark with a pencil.

GRAPHICAL REPRESENTATION



CHROMATOGRAM OF DIFFERENT PLANT SPECIES

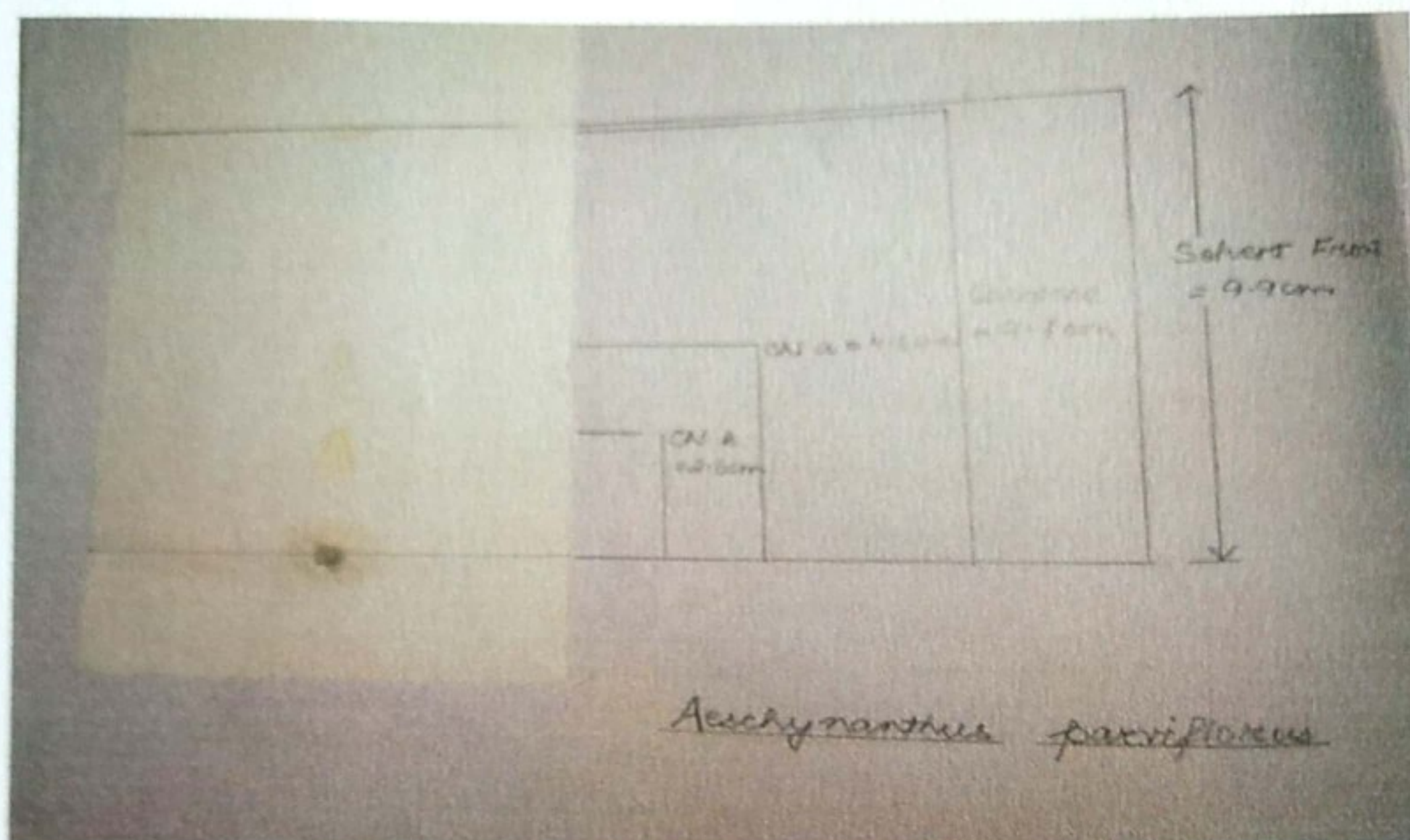


Figure A: *Aeschynanthus parviflorus*

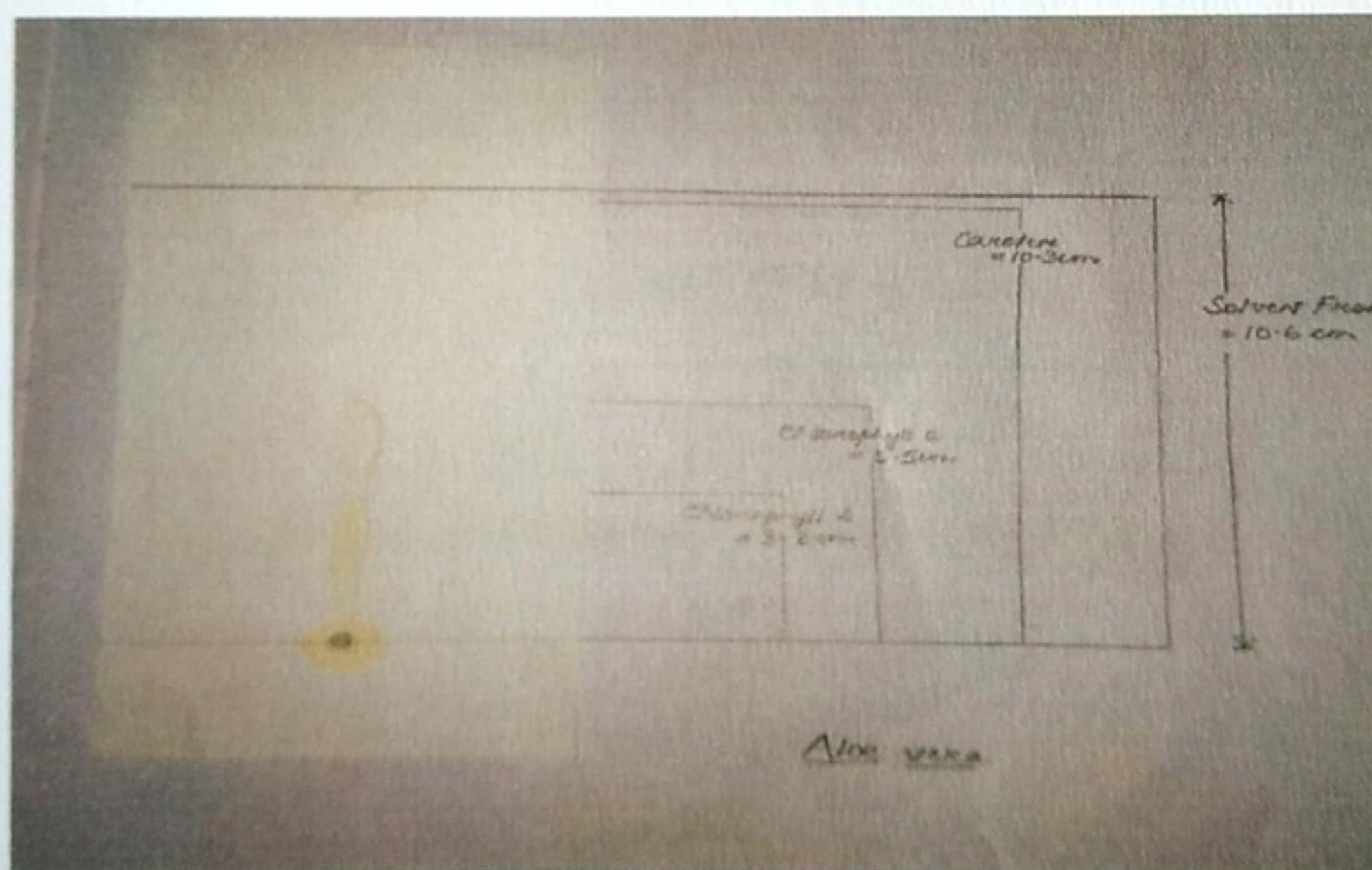


Figure B: *Aloe vera*

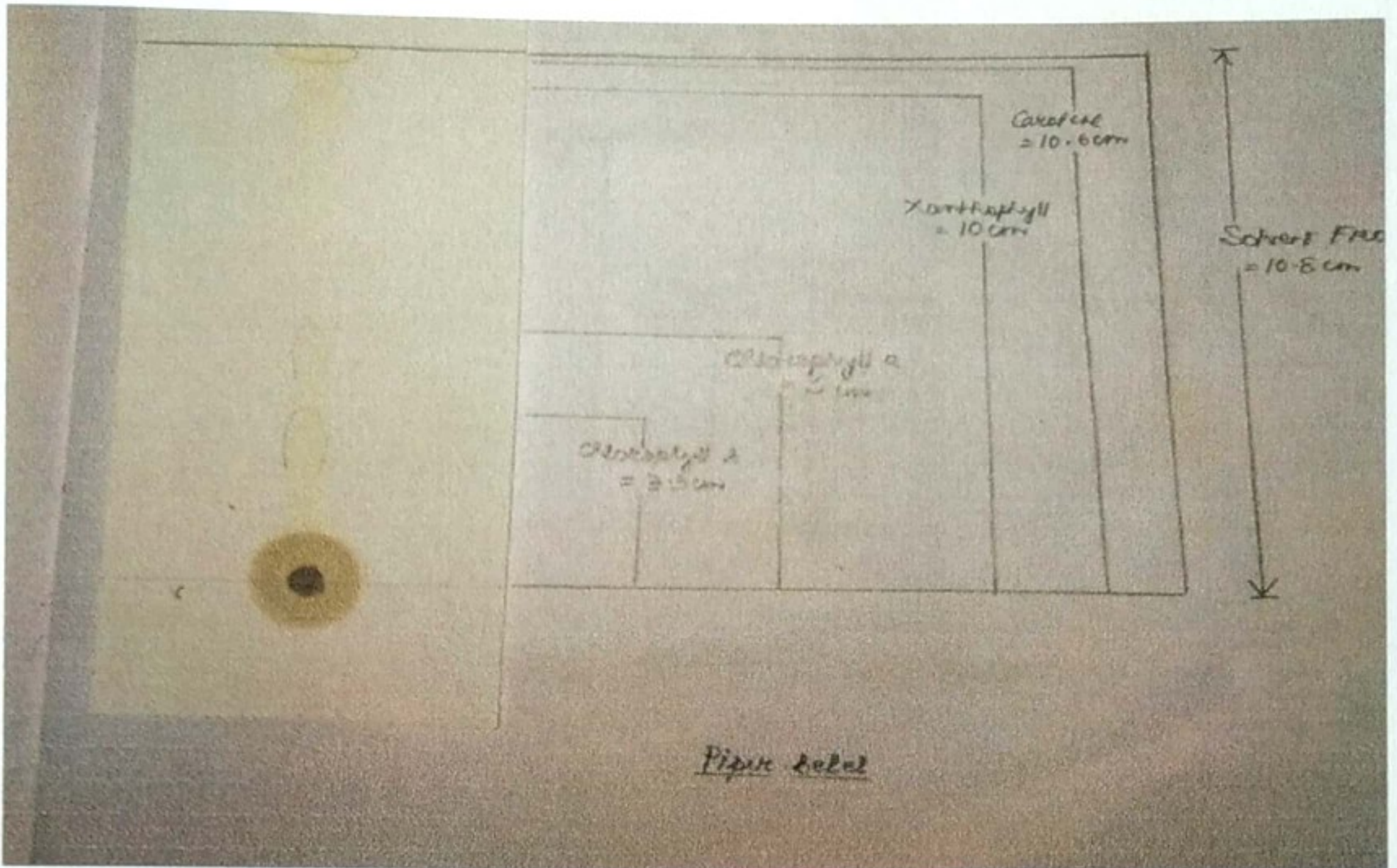


Figure C: *Piper betel*

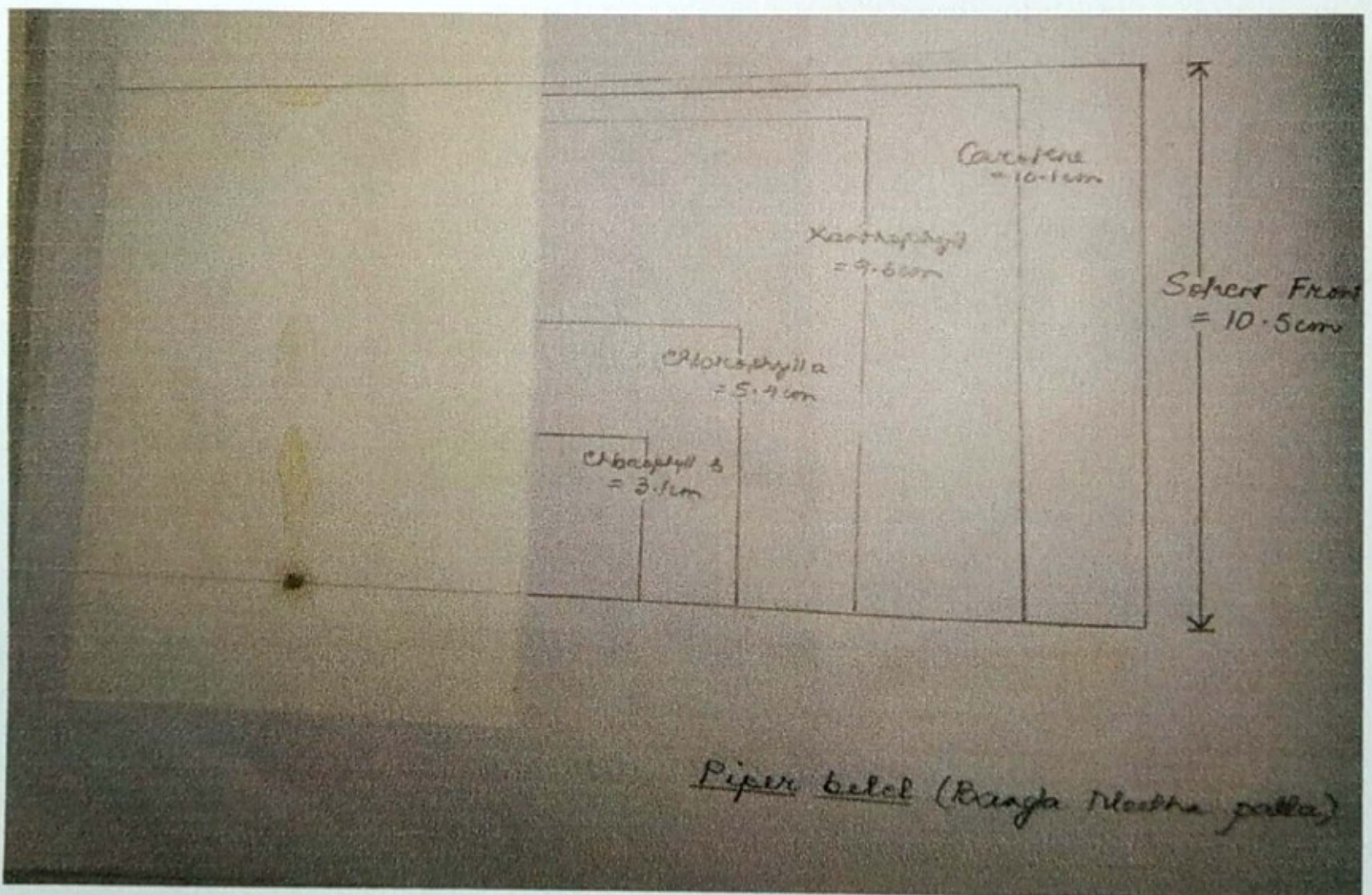


Figure D: *Piper betel* (Bangla meetha patta)

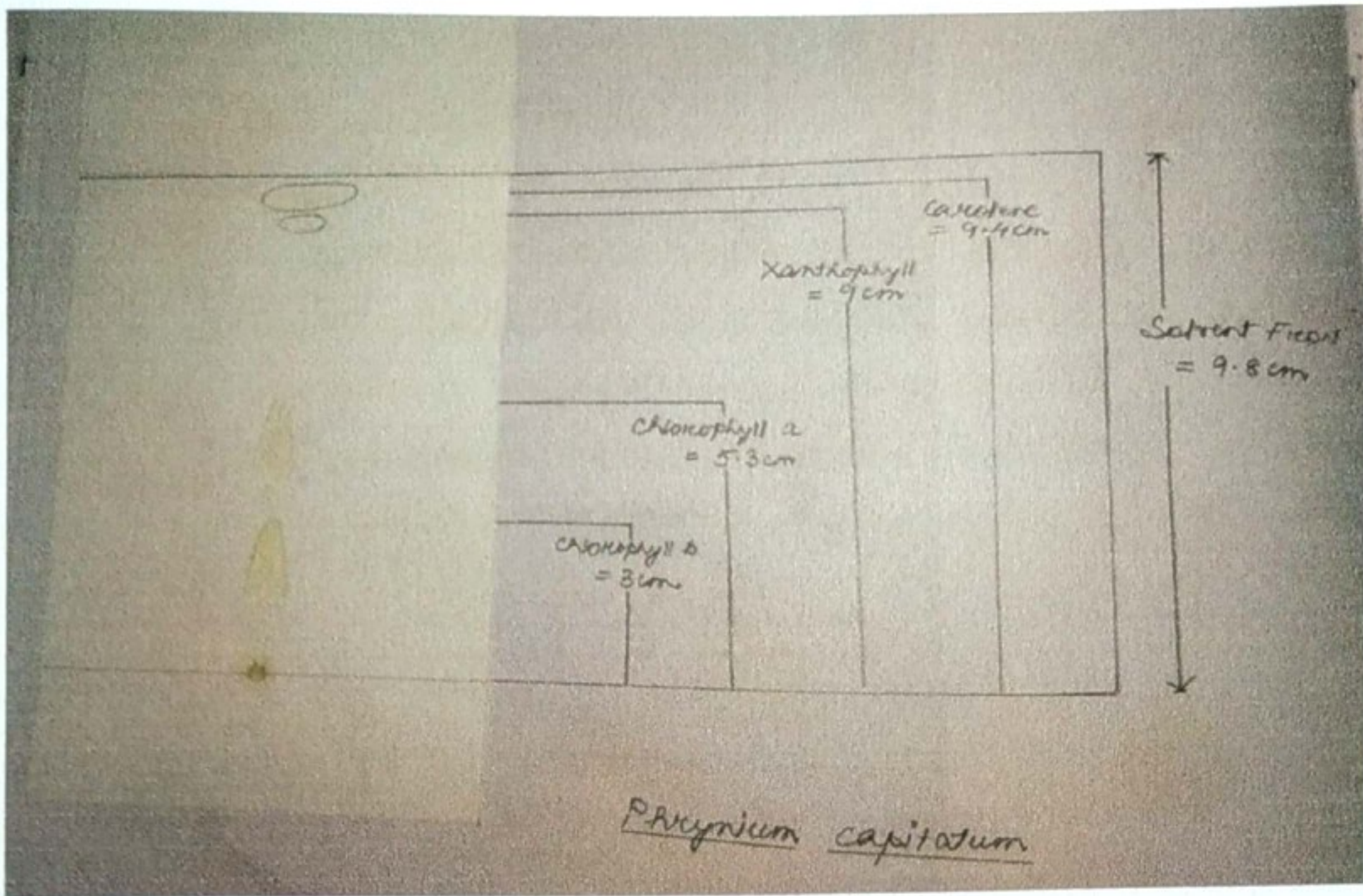


Figure E: *Phrynium capitatum*

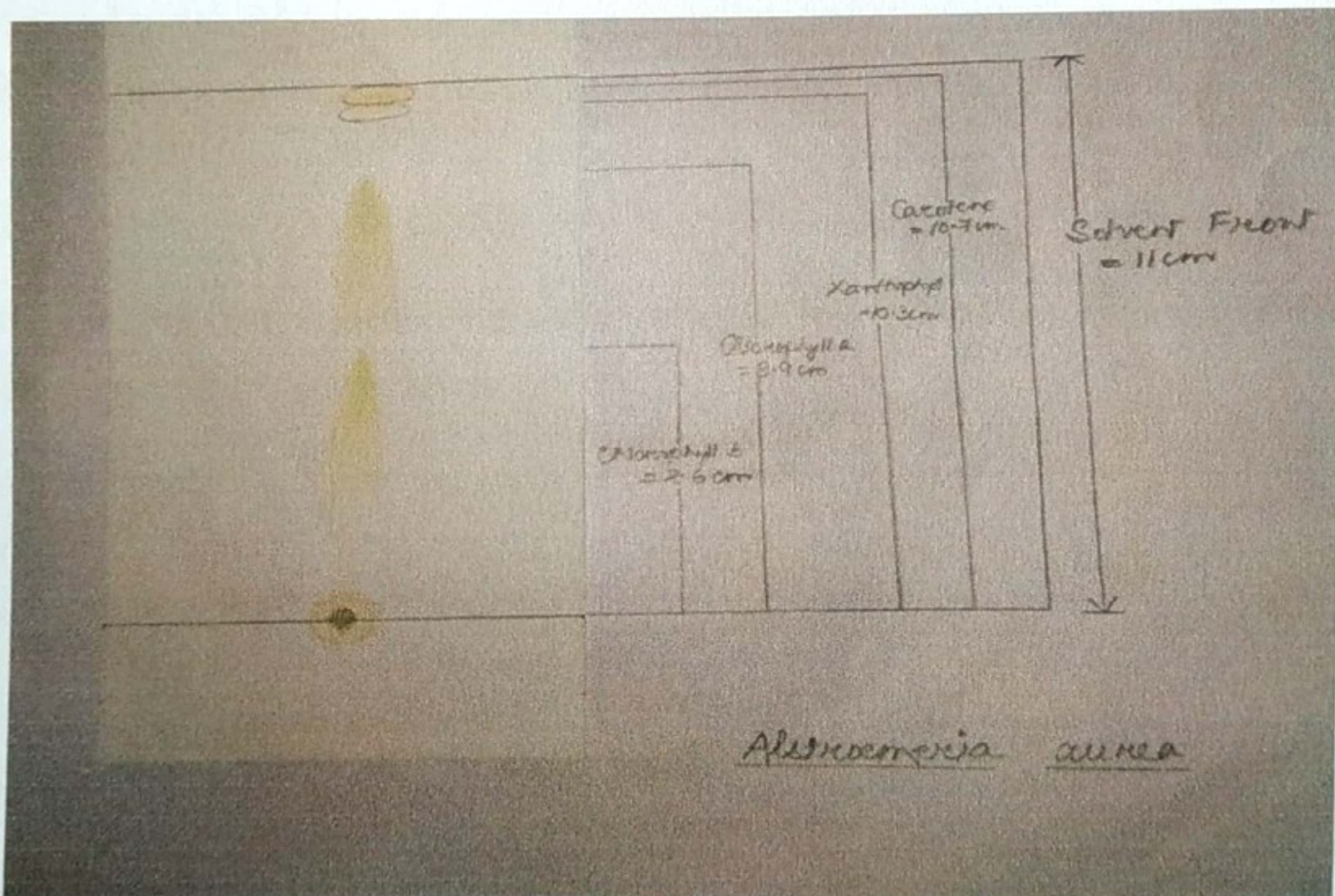


Figure F: *Alstroemeria aurea*

CONCLUSION

Further investigation on chlorophyll is of paramount importance especially for control of weeds and crop productivity. A more advanced study on medicinal aspect of chlorophyll might be of great importance for health related issues. Nowadays, chlorophyll pigments have been used in the field of medicine as remedy and diagnostics. This molecule is also used in pharmacy as photosynthesizer for cancer therapy.

Throughout history, chlorophyll and its derivative are used as traditional medicine and act as chemotherapeutic agents which includes wound healing, anti-inflammatory agent, internal deodorant. Chlorophyll has potential to act as a chemo-preventive agent.

Chlorophyll also possesses dietary compounds that protects against cellular damage caused by environmental carcinogens or endogenously generated reactive oxygen species. These dietary substances can affect death signalling pathways which could prevent proliferation of tumor cells.

A PROJECT ENTITLED
“IDENTIFICATION AND STUDY OF
MEDICINAL PLANTS FOUND IN SAINT
MARY’S COLLEGE CAMPUS”

Submitted by

Idawanbha Syiemlieh

Bidamon Massar

Chonmirin Horam

Timyawon Vashim

Resna Hrangkhawl

Ibateihun Nongspung

Lalengkimi

Lily Mary lawphniaw

Lapyntngenshisha Sohtun

Blessingme Lapasam

Aikmenlin Rongrin

Lhingneikim Kipgen

Sonita Mawkon

2019

BOTANY DEPARTMENT

St. MARY’S COLLEGE

LAITUMKHRAH, SHILLONG -793003


ST. MARY'S COLLEGE
(RE-ACCREDITED BY NAAC WITH GRADE 'A')
DEPARTMENT OF BOTANY





CERTIFICATE

This is to certify that Ms. Idawanbha Syiemlieh, Ibateihun Nongspung, Bidamon Massar, Lapyntngenshisha Sohtun, Sonita Mawkon, Lily Mary Iawphniaw, Aikmenlin Rongrin, Lalengkimi, Blessingme Lapasah, Chonmirin Horam, Lhingneikim Kipgen, Timyawon Vashim and Resna Hrangkhawl, Students of B.sc Botany (Hons), 6th semester 2019, Department of Botany, St Mary's college, Shillong have successfully completed their B.sc Project on "*Identification and study of medicinal plants found in Saint Mary's college campus*". This project is an initiative of the Department to promote scientific enthusiasm among science students.

They were very sincere in their work and we wish them all success in life.


Mrs. T. Syiemlieh
Asst. Professor &
Project coordinator


Dr. Ms. S. Rynjah
H.O.D.
Dept. of Botany


Dr. (Sr) Mary Harriet
Principal
St. Mary's college Shillong

ACKNOWLEDGEMENT

We would like to express our heartfelt gratitude to the Principal of St. Mary's College Dr. Sister Mary Harriet for permitting us to pursue this project and for providing all the necessary requirements during this project work.

We would also like to express our gratitude to the Head of the Botany Department Dr. Ms. Sabina Rynjah for her valuable suggestions and encouragement.

We would like to express our sincere gratitude to the Supervisor Mrs. Tiewlyngksiar Syiemlieh for her expert guidance, valuable suggestions and constant support during this project work.

Our sincere thanks also go to Ms. Deehunkimin Khonglah and Mrs. Emica Lato, for their constant support.

Furthermore, we would also like to acknowledge and appreciate the crucial role of the Staff of Botany Department, who gave the permission to use all the required materials to complete the project "Identification and study of Medicinal Plants found in St. Mary's College Campus".

Special thanks then goes to our team mates who cooperated to finish the project.

Dated: 10/06/2019

Idawarbha Syiemlieh

Bidamon Massar

Chonmirin Horam

Timyawon Vashim

Resna Hrangkhawl

Ibateihun Nongspung

Lalengkimi

Lily Mary lawphniaw

Lapyntngenshisha Sohtun

Blessingme Lapasam

Aikmenlin Rongrin

Lhingneikim Kipgen

Sonita Mawkon

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RESULTS	4-13
CONCLUSION	14
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INTRODUCTION

As per the report of States level planning committee Meghalaya, the State of Meghalaya has 850 species of medicinal plants, 377 of which are used by 70% to 80 % of the state population for primary health care needs. Species like *Nepenthes khasiana* and *Piper peepuloids* endemic to Meghalaya are globally threatened as per I.U.C.N Red Data book. Because of the problem of safety with modern system of medicine, there is increasing global interest in traditional and herbal medicine.

According to WHO (world health organisation) report, over 80% of world population relies on traditional medicines, largely plant based, for their primary health care needs. The plant could be either the cultivated plants in their homesteads, farmlands, cultivation field or wild plants from forest. The formulation made of these medicinal plants are used for primary health care like cuts, wounds, cough, pain, stomach problem, liver disorder etc. The parts of the plant in used could be leaves ,fruits, roots or stems as per their suitability to cure ailments.

Meghalaya is very rich in floral diversity, a significant part of which comprises medicinal plants and there is a long-standing tradition of used of these medicinal plants in the state. The development of medicinal plant sector in Meghalaya has a great scope for providing employment to the people as there is a huge and ever-increasing market for medicinal and their preparation in the county and abroad.

MEDICINAL PLANTS

Medicinal plant species are gaining importance in health care. Majority of the world population is dependent upon traditional plant based on medicines. Many medicinal herbs and spices which find place in our daily use, are used as herbal remedies. These are not only cheaper but are often used as the medicines accessible in remote areas.

Plants synthesized a wide variety of natural products which are valuable sources for maintaining human health. About 80% of the world's population used traditional medicines, which are active constituents derived from medicinal plants. Medicinal plants are used by all sectors of people as folk remedies or in different indigenous systems of medicine or in the pharmaceutical preparation of modern medicines.

The study of traditional human used of plants is recognised as an effective way to discover future medicines .Traditional systems of medicines are widely practise due to variety of reasons .Treatment cost, side effects, population rise, inadequate supply of drugs and resistant's development for infection diseases have all contributed for the increase interest in natural products as a sources of medicines. Plant products today symbolised safety when compared to the synthetic which are unsafe to human as also to environment.

RESULTS

All together 37 plants specimens of medicinal value have been collected and identified.

1. **Botanical name** - *Ageratina adenophora*

Khasi name - Langtana iong

Parts used - whole plant

Medicinal value

- i) Whole plant is ground into a paste and applied to forehead to bring down temperature during fever.
- ii) Leaves are chewed raw to get cure of piles.
- iii) Tender leaves are boiled in water and the soup is taken in dysentery, diarrhoea and stomach ache.

2. **Botanical name** - *Artemisia nilagirica*

Khasi name - Jarynglut

Parts used - whole plant

Medicinal value - Tender shoots are boiled or fried and eaten to get energy.

3. **Botanical name** - *Amorphallus campanulatus*

Khasi name - Shriew

Parts used - Bulb and roots

Medicinal value - Prevents skin problems, heart problem, female health, antioxidant sour, digestive health.

4. **Botanical name** - *Aloe vera*

Khasi name - Tiew aloe vera

Parts used - whole plants

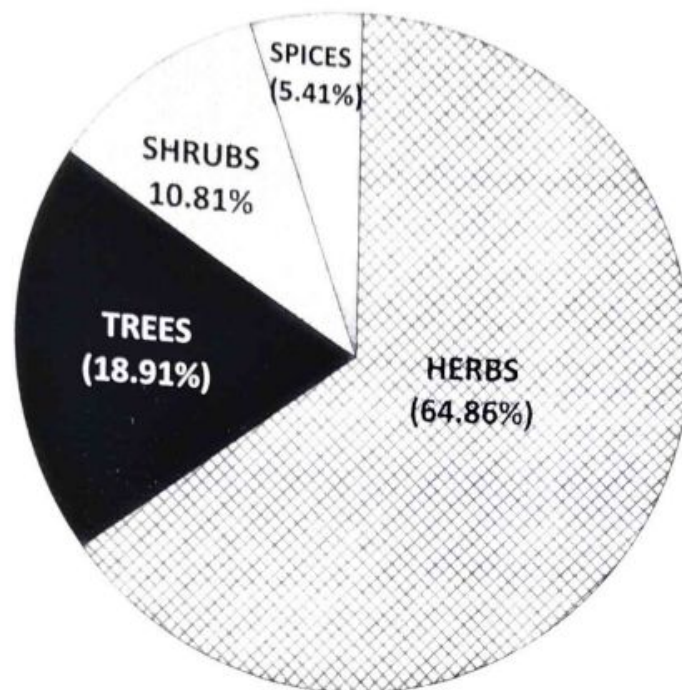


Fig.1. Graphical representation of the number of plant species present in Saint Mary's College Campus, Shillong.

CONCLUSION

After the investigation it was observed that a variety of medicinal plants which can cure many ailments are present in St Mary's campus. These medicinal plants are natural and do not cause any side effects. Moreover with the growing interest in health and wellness medicinal plants are becoming increasingly popular worldwide. On a general review of the already available literature it was observed that not many studies have been done on our local medicinal plants and there is plenty of scope for further research in this field.