SONOPANT DANDEKAR ARTS, V.S. APTE COMMERCE AND M.H. MEHTA SCIENCE COLLEGE, PALGHAR

Department of Botany

PROJECT REPORT

Master of Science Botany

Academic Year 2022-2023

Prepared by

Department of Botany

Sonopant Dandekar Arts, V.S. Apte Commerce and M.H. Mehta Science College, Palghar

INDEX

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Department of Botany

NOTICE

M.Sc – II (Botany) 2022-23

Project submission

All Master of Science Botany Part-II Botany students are hereby informed that submit the submission of your Master of Science project Soft Copy and Black-Book on and before dated - 24/01/2023. The guidelines for the project report format have been provided previously.

HOD
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PRINCIPAL Principal
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UNIVERSITY OF MUMBAI

Syllabus for Semester III and IV

Program: M.Sc.

Course: BOTANY

(Credit Based Semester and Grading System with effect from The academic year 2017–2018)

M.Sc Botany Semester III

Outline of the Course: PSBO301 and PSBO302 are common papers for all specialisations

PSBO301: Techniques and Instrumentation

PSBO302: Cell and Molecular Biology

PSBO303 and PSBO304 are Optional Papers in any one of the following specialisations.

1. Mycology and Plant Pathology (MPP)
2. Plant Physiology and Biochemistry (PPB)
3. Angiosperms and Phytochemistry (ANP)
4. Molecular Biology, Cytogenetics and Biotechnology (MCB)
5. Environmental Botany (EB)

Theory	**PSBO301**	**:**	**4 Credits**
	PSBO302	**:**	**4 Credits**
	PSBO303	**:**	**4 Credits**
	PSBO304	**:**	**4 Credits**
Practicals (based on all 4 courses) PSBOP303 & Project		**: PSBOP301, PSBOP302,**	**16 Credits**

SEMESTER III
Common Papers

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
PSBO301	Title of the Paper: TECHNIQUES AND INSTRUMENTATION			
	I	Biostatistics	4	1
	II	Bioinformatics		1
	III	pH and buffers and Electrophoresis		1
	IV	Colorimeter, UV-visible spectrophotometer		1
PSBO302	Title of the Paper: Molecular Biology			
	I	DNA replication	4	1
	II	Transcription		1
	III	RNA processing		1
	IV	Translation		1

PSBOP301	**Techniques and Instrumentation**	**2**	**4**
PSBOP302	**Molecular Biology**	**2**	**4**

Specialization : Mycology and Plant Pathology (MPP)

PSBOMPP303	**Title of the Paper: General Mycology**	**4**
	I History of Mycology	**1**
	II Taxonomy and Life Histories	**1**
	III Fungal Physiology	**1**
	IV Fungal Cytology & Ecology	**1**
PSBOMPP304	**Title of the Paper: Applied Mycology& Plant Pathology**	**4**
	I Pathogenesis and Crop Pathology	**1**
	II Seed Pathology & Seed Mycoflora	**1**
	III Culture Studies and Food Borne Fungi	**1**
	IV Industrial Mycology	**1**

PSBOMPPP303	**Mycology and Plant Pathology**	**2**	**4**
PSBOMPPP304	**Research project proposal and review of literature**	**2**	**4**

Specialization : Plant Physiology and Biochemistry

PSBOPPB303	**Title of the Paper: Plant Biochemistry**	**4**
	I Enzymes	**1**

	II Vitamins as Coenzymes	**1**
	III Plant proteins	**1**
	IV Nucleotide metabolism	**1**
PSBOPPB304	**Title of the Paper: Plant Physiology**	**4**
	I Solute transport & photo assimilate translocation	**1**
	II Post-harvest technology	**1**
	III Stress Physiology: Drought	**1**
	IV Stress Physiology: Salinity	**1**

PSBOPPBP303	**Plant Biochemistry**	**2**	**4**
PSBOPPBP304	**Research project proposal and review of literature**	**2**	**4**

Specialization : Angiosperms and Phytochemistry (ANP)

PSBOANP303	**Title of the Paper: Angiosperms and Phytochemistry I**			
	I	**Approaches to Angiosperm Taxonomy**	**4**	**1**
	II	**Anatomy**		**1**
	III	**Tools of Angiosperm Taxonomy**		**1**
	IV	**Methods in Evaluating Crude Drugs**		**1**
PSBOANP304	**Title of the Paper: Angiosperms and Phytochemistry II**			
	I	**Evolution**	**4**	**1**
	II	**Cladistics**		**1**
	III	**Nomenclature**		**1**

	IV	Embryology and Palynology		1

PSBOANPP303	Angiosperms -I	2	4
PSBOANPP304	PROJECT	2	4

Specialization : Molecular Biology, Cytogenetics and Biotechnology (MCB)

PSBOMCB303	Title of the Paper: Plant Biotechnology			
	I	Plant Tissue Culture I	4	1
	II	Plant Tissue Culture II		1
	III	Biotransformation		1
	IV	Commercial aspects		1
PSBOMCB304	Title of the Paper: Molecular Biology and Cytogenetics			
	I	Cytology	4	1
	II	Cancer Biology		1
	III	Immune System		1
	IV	Genetic Diseases		1

PSBOMCBP303	Plant Biotechnology	2	4
PSBOMCBP304	PROJECT	2	4

Specialization : Environmental Botany (EB)

PSBOEB303	Title of the Paper: Ecology and Environmental Botany	4
	I Basic Ecological Concept	1

	II Ecosystem	**1**
	III Bio-Geochemical Cycle	**1**
	IV Natural Resources	**1**
PSBOEB304	**Title of the Paper: Recent Trends & Applied Environmental Botany**	**4**
	I Conservation Ecology –I	**1**
	II Conservation Ecology II	**1**
	III Biodiversity Studies	**1**
	IV Renewable and Non-Renewable Sources of Energy	**1**

PSBOEBP303	**Ecology and Environmental Botany**	**2**	**4**
PSBOEBP304	**Research project proposal and review of literature**	**2**	**4**

SEMESTER IV

Common Papers

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
PSBO401	**Title of the Paper: TECHNIQUES AND INSTRUMENTATION**			
	I	**Centrifugation**	**4**	**1**
	II	**Chromatography**		**1**
	III	**Tracer Technique & PCR**		**1**
	IV	**Nanotechnology & IPR**		**1**

PSBO402	**Title of the Paper: Molecular Biology**			
	I	**Gene Regulation I**	**4**	**1**
	II	**Gene Regulation II**		**1**
	III	**Gene Regulation III**		**1**
	IV	**Cell signaling**		**1**

PSBOP401	**Techniques and instrumentation**	**2**	**4**
PSBOP402	**Molecular Biology**	**2**	**4**

Specialization : Mycology and Plant Pathology (MPP)

PSBOMPP403	**Title of the Paper: General Mycology**	**4**
	I History of Mycology	**1**
	II Taxonomy and Life Histories	**1**
	III Fungal Physiology	**1**
	IV Fungal Genetics & Ecology	**1**
PSBOMPP404	**Title of the Paper: Applied Mycology& Plant Pathology**	**4**
	I Pathogenesis and Crop Pathology	**1**
	II Seed Pathology & Seed Mycoflora	**1**
	III Culture Studies and Food Borne Fungi	**1**
	IV Industrial Mycology	**1**

PSBOMPPP403	**Mycology and Plant Pathology**	**2**	**4**
PSBOMPPP404	**Research project report and presentation**	**2**	**4**

Specialization : Plant Physiology and Biochemistry

PSBOPPB403	**Title of the Paper: Plant Biochemistry**	**4**
	I Lipid Metabolism	**1**
	II Amino Acid Metabolism	**1**
	III Cytosolic Carbon & Mitochondrial Metabolism	**1**
	IV Senescence	**1**
PSBOPPB404	**Title of the Paper: Plant Physiology**	**4**
	I PGR	**1**
	II Phytoremediation	**1**
	III Sensory photobiology	**1**
	IV Secondary Metabolism	**1**

PSBOPPBP403	**Plant Physiology**	**2**	**4**
PSBOPPBP404	**Research project submission and presentation**	**2**	**4**

Specialization : Angiosperms and Phytochemistry (ANP)

PSBOANP403	**Title of the Paper: Angiosperms and Phytochemistry III**			
	I	**Approaches to Angiosperm Taxonomy**	**4**	**1**
	II	**Anatomy**		**1**
	III	**Medicinal plant biotechnology**		**1**
	IV	**Methods in Evaluating Crude Drugs**		**1**
PSBOANP404	**Title of the Paper: Angiosperms and Phytochemistry IV**			
	I	**Progressive taxonomy**	**4**	**1**
	II	**Tools of taxonomy**		**1**
	III	**Applied taxonomy**		**1**
	IV	**Evolution of Reproductive elements**		**1**

PSBOANP P403	**Angiosperms and Phytochemistry -I**	**2**	**4**
PSBOANP P404	**PROJECT**	**2**	**4**

Specialization : Molecular Biology, Cytogenetics and Biotechnology (MCB)

PSBOMCB403	**Title of the Paper: Plant Biotechnology**			
	I	**Environmental Biotechnology**	**4**	**1**
	II	**Traditional Knowledge & IPR**		**1**
	III	**Nanotechnology**		**1**
	IV	**Food Biotechnology**		**1**
PSBOMCB404	**Title of the Paper: Molecular Biology and Cytogenetics**			
	I	**Plant Breeding I**	**4**	**1**

II	Plant Breeding II		1
III	Molecular plant Breeding		1
IV	Plant Genetic Engineering		1

PSBOMCBP303	Plant Biotechnology	2	4
PSBOMCBP304	PROJECT	2	4

Specialization : Environmental Botany (EB)

PSBOEB403	Title of the Paper: Ecology And Environment Botany			
	I	Pollution	4	1
	II	Climatic Change		1
	III	Plant Population Dynamics		1
	IV	Coastal Zone Management In India		1

PSBOEB404	Title of the Paper: Recent Trends & Applied Environmental Botany			
	I	Restoration Of Ecosystems I	4	1
	II	Restoration Of Ecosystems II		1
	III	Restoration of Land		1
	IV	Water Shed management		1

PSBOEBP P403	Ecology and Environmental Botany	2	4
PSBOEBP P404	PROJECT	2	4

List of M.Sc. II Students (2022-23) (Botany)

Sr. No	Roll No.	Names of Students	Title of the Project	Signature
1	2627821	Roshani Santosh Padwale	Determination of the Phytochemicals present in the given in a particular plants (*Curcurga Longa* Linn., *Vitex negundi* Linn., *Holostema ada-kodien* Schult Trianthus curcumerina Linn.)	
2	2627817	Rutim Pravin Korda	Algal diversity in Surya Lotus Dam (Kavdas Dam) Of Vikramgad Taluka Palghar District, Maharashtra State, India.	
3	2627816	Madhu Kale	Determination of the Phytochemicals present in the given in a particular plants (*Adhatoda vasica* , *Achyranthus aspera* , *Commelina bengalenis* , *Cynodon dactylon*)	
4	2627818	Rutuja Mane	Absent	
5	2627814	Nitin Bhusara	Absent	
6	2627813	Archana Bhusara	Study of wild edible plants in Vikramgad Taluka, Palghar district (MS),India	
7	2627815	Jayesh Chote	"Bioactivity And Nutritional Evaluation Of Some Wild Vegetables Of Talasari Taluka, Palghar District"	
8	2627823	Sapana Pandey	"Evaluation Of Some Bioactive Phytoconstituents And Its Antimicrobial Activity From Selected WildVegetables Collected From Vikramgad Taluka, Palghar District"	
9	2627830	Anjali Yadav	"Nutritional Evolution and antimicrobial activity of some given medicinal plant (Sheeham, Carica Papaya, Bryophyllum pinnata), Palghar district."	
10	2627827	Vedika valavi	Determination of the Phytochemicals present in the given in a particular plants (*phyllanthus niruli, Linn.)*	
11	2627811	Lalita bhoir	"Phytochemical analysis and GC-MS Diospyros angustifolia of Palghar taluka, Palghar district, Maharastra state, india"	
12	2627819	Vishal Mathe	"Comparative studies of air pollution tolerance index of some common road site plant species of industrial area [(Kudus) Experiment site] and residential area (control site)."	
13	2627810	Tushar Bagul	"A Case Study Of Soil Nutrient Analysis."	
14	2627828	Radhika Vishwakarma	"To detect the presence of carbohydrates, protiens, oils and fats and minerals in vegetable juices."	
15	2627825	Asma Shaik	"Nutritional evalution and antimicrobial activity of some given in boisar and palghar, Maharastra"	
16	2627820	Nitshita Pachalkar	Influence of Lead acetate on germination of *Vigna radiata.*	
17	2627826	Shreya Tiwari	Phytochemical analysis of some selected plants occuring in local area of Boisar and Palghar, Maharastra.	
18	2627824	Sujata Raut	Soil analaysis of two villiages (Bharsatmet, Khardwand) in Jwahar Taluka, Palghar District.	

"BIOACTIVITY AND NUTRITIONAL EVALUATION OF SOME WILD VEGETABLES OF TALASARI TALUKA, PALGHAR DISTRICT"

A SYNOPSIS SUBMITTED
TO THE
UNIVERSITY OF MUMBAI
FOR THE FULLMENT OF

M.Sc. (Part II) EXAMINATION

BOTANY

WITH SPECIALIZATION
ENVIRONMENTAL BOTANY

BY

MR. JAYESH PATLYA CHOTHE

DEPARTMENT OF BOTANY
SONOPANT DANDEKAR ARTS, V. S. APTE COMMERCE.
M. H. MEHTA SCIENCE COLLEGE, PALGHAR-401 404

UNDER THE SUPERVISION OF

DR. VIRAJ. D. CHABAKE

ASSISTANT PROF.
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M. H. MEHTA SCIENCE COLLEGE, PALGHAR-401 404

2022-2023.

CERTIFICATE

This is to certify that the Project work entitled **"BIOACTIVITY AND NUTRITIONAL EVALUATION OF SOME WILD VEGETABLES OF TALASARI TALUKA, PALGHAR DISTRICT"** has been carried out by **MR. JAYESH PATLYA CHOTHE**, student of M.Sc. (Part – II) Botany (Ecology and Environmental Botany) in the Department of Botany, Sonopant Dandekar Arts. V. S Apte Commerce, M. H. Mehta Science College, Palghar, 401-404, during the academic year, **2022-2023**.

Place: Palghar

Date: 24/01/2023

Dr. Viraj Chabake
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EXAMINER

CONTENT

Introduction:

Different living forms have been created by nature so that humans can live on Earth. Before discovering how to cultivate useful plants, primitive humans consumed all varieties of fruits, leaves, and plant roots that they collected from the wild. Living out of nature, human selected plants those are edible and identified plants those are unsuitable for consumption [1]. World over, local communities strengthen their nutrition security and socio-cultural identity from the use of traditional food which has been developed in harmony with the natural environment [2]. Even today, indigenous people continue to follow many traditions and have long experience and close association with the nature. Wild vegetables constitute all vegetables that are gathered (not cultivated) including species harvested in agricultural areas, uncultivated areas, or forestland [4]. These foods are especially important for the poorest members of user communities, rural populations and women, particularly during critical food shortages. They are valued mainly for their high carbohydrate, vitamin and mineral contents. Vegetables may be edible roots, stems, leaves, fruits or seeds. Each group contributes to diet in its own way [2]. Green leafy vegetables have numerous dietary and health benefits, being very rich sources of essential bio-chemicals and nutrients such as carbohydrates, proteins, vitamins, calcium, iron and palpable concentration of trace minerals [5] [6]. Trace elements that have been implicated in combating a variety of human ailments are found mainly in wild plants especially vegetable [5]. The functional activities of specific organs can be improved by continuous dietary ingestion of trace elements, which could lead to their bioaccumulation at normal or safe levels [6]. These wild edible vegetables not only serve as alternatives to staple food during periods of food deficit but they play as a valuable supplement for a nutritionally balanced diet [8].

Since ancient times *Cassia tora* has been a subject of considerable interest as herbal medicine worldwide. The leaves and seeds of *C. tora* are reported to have curative effect in leprosy, flatulence, colic, dyspepsia, constipation, cough, bronchitis, cardiac disorders, skin diseases, and liver disorders [9]. *C. tora* leaves were found positive for phenols, tannins, saponins, glycosides, flavonoids, steroids, and alkaloids [10].

Celosia argentia is Herbal medicines are being used by nearly about 80% of the world population, primarily in developing countries for primary health care. The *Celosia* species

belongs to *Amaranthaceae*. The generic name is derived from the Greek word *kelos*, meaning "burned," and refers to the flame-like flower heads. There are more than seventy different species identified and among all including *C. argentea* are routinely used as leafy vegetable [11]. Literature indicated that *C. argentea* used for treatment of fatigue, atherosclerosis, leucorrhoea and osteoporosis. The plant is also used as antidiarrhoeal agent and its other parts also used in the Ayurveda medicine (Wiart) [12]. Sequential extraction was carried out by using solvents such as petroleum ether, ethanol and aqueous from leaf, root and stem of the plant were investigated for preliminary phytochemical analysis and exhibiting antimicrobial activity [13-14]. Aqueous extract showed moderate inhibitory activity against bacteria and fungi. Phytochemical analysis showed the presence of Alkaloids, Phytosterols, Fixed oils, Saponins and Phenolic compounds [15-16].

Radermachera xylocarpa belonging to family Bignoneaceae is screened for its biochemical contents. The plant is known for its antiseptic property. Its resin is used for the treatment of skin diseases. Its root bark is bitter in taste and astringent in nature. It is also known as yellow snake tree. The leaves gave flavonoids, dinatin and its glycoside. The roots of the plant yielded Oacetyl oleanic acid and stigmasterol. It is a tree with compound leaves and long dehiscent pods. Several other compounds like dinatine-7-glucuronide (from the leaves) [18], o-acety-loleanic acid8 and stismasterol6 (from the root) were also reported from this plant. Considering the presence of biologically active phytochemicals, present study aims to explore antioxidant properties of *R. xylocarpa.*

Many wild vegetables are also traditionally using with staple food in both urban and rural areas of Palghar Dist. The wild vegetables traditionally used as food that enhance the taste and color of the diets but scientific data on the nutrients and chemical composition of those wild vegetables still unknown in our country, and people do not have adequate knowledge on whether those are beneficial or not and have any toxic effect or not. Food safety is a major public concern nowadays. Considering the potential toxicity, persistent nature and cumulative behavior of heavy metals, frequent consumption of wild vegetables, safety aspect of foods and the awareness of the people, much research work is still needed to be done on wild vegetables grown in Palghar dist. Thus the study was designed to analyze the nutritional composition, minerals content and phytochemical evaluation of wild vegetables available in the Talasari Taluka. A large part to these region is botanically

under-explored. These Taluka provide a large number of plants whose fruits, seeds, tubers, shoots, leafy vegetables etc. make an important contribution to the diet of the tribal people.

Review of literature:

- **Misra *et al* (2008)** study that traditional knowledge of wild food is largely transmitted through participation of individuals helps for future generation to obtain inexpensive food resource.
- **Shakywar *et al* (2011)** studied that leaves and seeds of *C. tora* are reported to have curative effect in leprosy, flatulence, colic, dyspepsia, constipation, cough, bronchitis, cardiac disorders, skin diseases, and liver disorders
- **Rejiya *et al* (2009)** found that methanolic extract of leaves of *Cassia tora* was found to possess antioxidant and antiproliferative activity.
- **Odukoya *et al* (2009)** The prominent use and consumption of *Celosia* species in Nigeria is as a result of their nutritional and medicinal importance.
- **Freiberger *et al* (1998)** showed that the plants play an important role in supplying nutrients and calories especially during the dry season when cultivated vegetables are scarce.
- **Zheng *et al* (1995)** studied that Minerals are essential in plant growth and development, and in managing human health. Some necessary trace elements for bio-system such as Fe, Mn, Cu, and Zn, involved in metabolism, and are closely related to immune function. *C. argentea* subsists of over eighteen minerals.
- **Bhakuni *et al* (1969)** reported to *C. argentea* was exhibit antibacterial activity against *Bacillus subtilis, S. aureus, Salmonella typhi, Escherichia coli, Agrobacterium tumefaciens*, and *Mycobacterium tuberculosis*
- **Priya *et al* (2004)** found that *C. argentea* extract on wound healing, and also suggested that this may be due to mitogenic and motogenic promotion of dermal fibroblasts.
- **Borokini *et al* (2004)** showed that Food plants such as leafy vegetables have played an important role in human nutrition especially in the aspect of food security and micronutrient deficiencies.
- **Ayodele, J.T., and Olajide, O.S., (2011)** found that plant has high protein and vitamin contents and is also a good source of calcium, iron, carbohydrates and phosphorus.

- **Anjaneyulu *et al* (2016)** reported that the seed oil of *Radermachera xylocarpa* was studied for its fatty acid composition and minor constituents and it was found that the oil contained α-linolenic acid in considerable amounts.

- **Jong T, Chien-Chin H (1995)** reported that phytochemical screening of ethanolic extract revealed that ethanolic extract of the leaves of C. argentea contains various classes of phytoconstituents such as Alkaloids, Sterols and flavonoids.

- **Rejiya et al (2009)** showed that aqueous extracts of leaf of C. tora revealed the presence of phenolics, tannins, steroids, flavonoids and saponins. The highest total phenolic content was found in the methanolic extract (13.15±0.78% dw GAE) followed by the aqueous (11.22±0.12% dw GAE), chloroform (9.66±0.57% dw GAE), petroleum ether (6.18±0.13% dw GAE) and benzene (6.17±0.31% dw GAE) extracts respectivel.

- **Malabade R, Ashok T (2015)** showed that *C. tora* leaves extract showed significant cognition enhancing property in scopolamine-induced amnesia models.

- **Vadivel V. and Janardhanan K. (2005)** reported that *Cassia tora* seeds contain antinutritional factors such as total free phenolics tannins and trypsin inhibitors. However, these antinutritional factors probably have little nutritional significance if the seeds are properly processed.

Aims and Objectives:

Aim

This work is mainly aiming to identify, separate and evaluate nutritional composition and active phytoconstituents of selected plant species & to document traditional knowledge in using wild plants to treat health problems in order to conserve this valuable knowledge from loss; to identify the key plant species used.

Objective

1. To collect and authenticate selected plant.
2. To evaluate the nutritional components of Wild vegetables.
3. To classify active phytoconstituents from the different wild vegetables by various chemical tests.

Materials and Methods:

Collection of plant material

Cassia tora, *Celosia argentia* and *Radermachera xylocarpa* will collect from Talasari taluka is a taluka in Palghar. Then clean and the necrotic parts will remove wash with tap water to remove any associated debris and shade drying will be done at room temperature (28 ± 2^0C) for 5-8 days or until they are brittle easily by hand.

Proximate analysis

Proximate analysis for crude proteins, crude fibre, total fat, ash, moisture and carbohydrate using standard methods [34].

Mineral Content

Such as K, Ca, Mg, Na, P, Ca and Mg using standard methods.

Extraction of the plant material

The materials will grind to a fine powder using Electrical blender. The extract will prepare using hot extraction method. For extraction 10 gm of sample powder will take and extract successively with 100 ml of solvents (Methanol and Ethanol) in Soxhlet extractor unit.

Preliminary phytochemical analysis

Phytochemical screening for some constituents like alkaloids, glycosides, flavanoids and saponins of plant extracts by using standard method as described by [35].

- UV visible spectrophotometric analysis for different biochemical compounds.
- Study of antimicrobial activity.

Expected Results

The present study will help to investigate nutritional evaluation and bioactivity of some wild vegetables of Talasari taluka, Palghar district. Most of the plants in these area is having the medicinal importance. The value of wild vegetables will help to know the nutritional importance of plants. The another part of the work will include phytochemical evaluation. it will help in the identification of various phytochemical constituents. our data will also be useful in planning strategies regarding conservation of Talasari taluka in view of its importance.

References:

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7. Aryal MP, Berg A, Ogle B. Uncultivated plants and livelihood support-A case study from the Chepang people of Nepal. Ethnobot Res Appl2009; 7: 409-422.

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10. Shaikh, R. and Syed, I.Z. (2015) Proximate and phytochemical analysis of *Cassia tora* leaves. *J. Res. Pharm. Sci.*, 2(8): 1-3.

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13. Ozsoy N, Can A, Yanardag R, Akev N. Antioxidant activity of *Smilax excelsa* leaf extracts. Food Chem 2008; 110:571-583.

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PHYTOCHEMICAL ANALYSIS OF SOME SELECTED PLANT IN GIVEN LOCAL AREA OF BOISAR SHIRGAON MAHARASHTRA

Dissertation Submitted to the

UNIVERSITY OF MUMBAI

For the fulfillment of

Master of Science

In Botany (Taxonomy in angiosperms)

Submitted by

VALVI VEDIKA KASHIRAM (M.Sc. ||)

Under The Guidance of

Prof. HARSHAL CHAUDHARI

(Associate Professor)

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2022-2023

SONOPANT DANDEKAR ARTS, V.S.
APTE COMMERCE &
M.H.MEHTA SCIENCE COLLEGE,

PALGHAR, DIST. PALGHAR, PIN - 401 404.

Department of Botany

Certificate

This is to certify that project work entitled " **Phytochemicals Analysis of some selected plants given in local area of Boisar, Shirgaon , Maharashtra** " has been carried out by student **Ms. Vedika Kashiram Valvi** student of M.Sc. (Part II) Botany with specialization in **Taxonomy in Angiosperms** . In the Department of Botany, S.D.S.M. College, Palghar, University of Mumbai during the academic year **2022-2023**.

Place: Palghar

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College Seal

Examiner

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INTRODUCTION

Phytochemicals are simply plant-derived chemicals. The word "phyto" comes from the Greek word plant. It is used to refer to the secondary metab- olites produced by plants. As noted earlier, these metabolites are usually synthesized as a measure for self-defense against insects, pests, pathogens, herbivores, ultraviolet exposure, and environmental hazards. Phytochemicals differ from the essential nutrients (primary metabolites) such as the carbohydrates, proteins, fats, minerals, and vitamins that are needed for the day to day maintenance of the plants. Sometimes, phytochemicals are used to refer to functional foods with antioxidant properties, nutraceuticals, phytonutrients, anti-nutrients, phytotoxins, and so forth.

Phytochemicals are isolated from the plants, which are useful and effective for us in this era. We highly recommended for ayurveda, which Innovate from the idea of the plants. In India the treatment of microbial diseases, fungal diseases, deficiency diseases was treated by the Assistance of plants crude extract but now this idea has been spread everywhere in the world. Ayurveda is also a traditional strength in india And many research scholars now endorse for natural remedies in regards to some diseases that were already completely treated with the help Of phytochemical components. Every clinical expert is planning to give effective treatment and researches also increasing in plant species.

Throughout human history herbal remedies have been used to treat a variety of infectious diseases. Plant products either as pure compounds Or as standardized plant extracts provide unlimited opportunities for brand spanking new drug leads due to the unequalled availability of Chemical diversity. India is a medicinal plant varietal emporium and one of the world's richest countries in terms of medicinal plant genetic Resources.

The phytochemical analysis is essential for identifying bioactive constituents in plants in order to develop new therapies and treatments. It should also be investigated whether there is a common systemic signalling cascade and biomarker for all types of cancer. A detailed metabolomics and pharmacokinetics study of this plant material is also required to investigate its potential as a potent anticancer drug molecule. This evolutional theory is supported by recent evidence in the compositional patterns of phytochemicals in plants. For instance, plant parts such as the leaves, flowers, stems, barks, roots, and seeds that are prone to insects, pests, microbial attacks, and the harsh environment have more amounts of phytochemicals than other parts of the plants.

Phytochemical analysis is extremely beneficial to the next generation of scientists. To determine how much phytochemicals will be effective for new diseases like COVID-19, we must develop new methods for analysing phytochemicals.

Classification and type of phytochemicals

The exact classification of phytochemicals has not been given so far, because of their diverse forms and structure. Classically the phytochemicals have been classified as primary or secondary metabolites depending on their role in plant metabolism. Primary metabolites include the common sugars amino acid, proteins, purines and pyrimidines of nucleic acid chlorophyll etc . Secondary metabolites are the remaining plant steroids, curcumines, saponins, phenolic, and glucoside.

- **Alkaloids :-** Alkaloids are natural products that contains heterocyclic nitrogen atoms and are always basic character. The name of Alkaloids derived from the alkaline nature and it was used to describe any nitrogen containing base. All the Alkaloids have a bitter tastes. The various classes of Alkaloids according to the heterocyclic ring system. Pyrrolidine alkaloids and pyridine piperidine alkaloids.
- **Flavonoids :-** they are the largest group of plant phenol and also the most studies one they are polyphonic compound in nature and occurs as a glycine, glucoside and methylated derivatives more than 4000 flavonoids have been recognised many of which occurs in vegetable fruits and beverage like tea coffee and fruits drink. flavonoids have gained recent attention because of their broad biological and pharmaceutical activities .
- **Tannins :-** tannins are naturally occurring complex organic compounds possessing nitrogen free polyphonic of high molecular weight. Tannins also called as tannins acid, which are found in many species of plants.
- **Saponins :-** most members of this group from stable foam in aqueous solution such as soap hence the name saponins chemically saponins as a group include compound that are glycosylated steroids triterpenoids and steroids alkaloids.
- **Phenolic compound :-** phenolic compound represent the largest category of phytochemicals and are most widely distributed in the plant kingdom. Phenolics are hydroxyl group (-OH) containing class of chemical compounds where the (-OH) group is bonded directly to an aromatic hydrocarbon group.
- **Terpenoids :-** this class comprises natural products which have been delivered from five carbon isoprene units. Most of the terpenoids have multi cyclic structure that differ from one another by their functional groups and basic carbon skeleton.
- **Glycosides :-** glycosides can be defined as the compound in which one or more sugar are combined with non sugar molecules through glycoside linkage.

1. *Phyllanthus niruri* L.

- **Part used :-** all parts, panchang
- **Common name :-** gale of the wind
- **Family :- Phyllanthaceae**
- **Family characters :-** The Phyllanthaceae are nearly all trees, shrubs, or herbs. A few are climbers, or succulents, and one species, Phyllanthus fluitans, is aquatic. Unlike many of the Euphorbiaceae, none has latex, and only a very few produce a resinous exudate. Any hairs, if present, are almost always simple.
- **Habitat :-** Common in Central and Southern India extending to Sri Lanka.
- **Botanical description :-** The annual herb, is 30-60 cm high, quite glabrous, stem often branched at the base, angular. Leaves numerous, subsessile distichous often imbricating, elliptic oblong obtuse. Stipules present, very acute. Flowers yellowish, very numerous, axillary, the male flowers 1-3, female flowers solitary. Capsules 2,5 mm diameter depressed globose, smooth, scarcely lobed.
- **Flowering and fruiting time :-** June – October

2..Eclipta alba (L.) L.[2]

- **Part used :-** seed, juice of leaves, herb oil.
- **Common name :-** false daisy
- **Family :- Asteraceae**
- **Family characters :-** These are herbs, shrubs or trees. Taproots are modified into tubers. The stem might be erect, hairy, woody or prostrate. The leaves may be radical, petiolate, exstipulate, and Flowers are tubular or ligulate, bisexual or unisexual, usually dithecous, filament free with united anthers.
- **Habitat :-** It is quite a common weed, like dandelion in the west growing in moist places throughout the plains of India and up to 800 m above sea level.
- **Botanical description :-** This annual herb has a short flat or round stem deep brown in colour. Serrated leaves are opposite and sessile to subsessile. Small Perry size flower white in colour are on a long stalk.
- **Flowering and fruiting time :-** July – October

3.*Clitoria ternatea* L.

- **Part used :-** Root, seed and leaves
- **Common name :-** butterfly pea
- **Family :- Fabaceae**
- **Family characters :-** Root are Dicotyledons, taproot with root nodules. Stem: Erect or climber; Fabaceae includes shrubs, herbs, trees and majorly climbers. Leaves: Petiolate, pinnately compound or simple; pulvinus leaf base, stipulate; reticulate venation.
- **Habitat :-** It is naturally found in grassland, open woodland, bush, riverine vegetation, and disturbed places. Clitoria ternatea grows within 20°N and 24°S, from sea level up to an altitude of 1600-1800 M, and in equatorial Africa up to 2000 M.
- **Botanical description :-**Clitoria ternatea has twining fine stems, 0.5-3 m long. The leaves are pinnate, with 5-7 elliptic to lanceolate leaflets, 3-5 cm long and shortly pubescent underneath. Flowers are solitary, deep blue to blue mauve; very short pedicel late and 4-5 cm long. Pods are flat, linear, beaked, 6-12 cm long, 0.7-1.2 mm
- **Flowering and fruiting time :-** July – January

4.*Hibiscus cannabinus* L.

- **Part used :-** leaves, seed and root
- **Common name :-** Kenaf
- **Family :- Malvaceae**
- **Family characters :-** Monothecous anthers are the distinctive feature of the genus of Malvaceae. The stamens of Malvaceae family are indefinite, monadelphous and form a staminal tube.
- **Habitat :-** Not known in a truly wild situation, but the plant is found in cultivated land, old gardens, dikes between irrigated fields, ridge tops in shallow soil, rocky fissures, talus, open grassland plains, savannash, flood plains, seasonal swamps.
- **Botanical description :-** The Hibiscus cannabinus is an annual or biennial herbaceous species that can reach 4 meters in height, with 1-2 cm diameter stems, thick but not always ramified. The leaves are 10-15 cm long and variable in shape, from basal lobed to weakly lobed or lanceolate, the upper ones. The flowers have a diameter of 8 15 cm, white, yellow or purple. The fruit (capsule) has a diameter of 2 cm with numerous seeds.
- **Flowering and fruiting time :-** August – November

Review of literature

1. **Anbalagan S, Sankareshwaran M, Moorthy m, Elakkia B and Fahamitha E**. has done work on phytochemical analysis and anti fungal activity of *vitex negundo* leaf extract against clinically isolated fungal pathogens. In **20 Nov 2017**. They found the vitex negundo ethanol and methanol leaf extract showed a broad spectrum of activity against fungal strains. And application of such natural compound for treatment of infection causes by fungal and bacterial diseases.
2. **Sangeetha V.S, Michael Babu, Beena Lawrence** has done work on phytochemical analysis of *Annona Reticulata* L. Leaf extract. In **2014**. Thay found present study demonstrated that different leaf extract of *Annona Reticulata* are excellent source of bio active phyto compound like Quinton, comumarin, steroids, tannins, phenols, cardiac glycoside, Alkaloids, Flavonoids,and Terpenoids. Phytochemical screening of medicinal plants is very important in identifying new sources of therapeutically and industrially important compounds.
3. **V. Nandagopalan , A. Doss and C. Marimuthu** has done work on phytochemical analysis of some traditional medicinal plants. In **20 Jan 2016.** They found the present study leads to the further research in the way of isolation and identification of the activity compound from the selected Plants using chromatographic and spectroscopic.
4. **Mohd Amir, Ahsanullah Khan, Mohd Mujeeb, Sheeba Usmani, Mohd Akhtar** has done work on phytochemical analysis and in vitro antioxidant activity of *Zingiber officinale* in **12 April 2011.** They found of the present study suggested that *Z.officinale* could be a potential sources of natural antioxidant that could have great importance as therapeutic agents in preventing or slowing the progress of aging and age as associated oxidative stress related degeneration diseases.
5. **Pradeep A, Dinesh M, Govindaraj A, Vinothkumar D** has done work on phytochemical analysis of some important plants In **2014**. They found mostly plants play a major role in traditional medicinal system to combat several disease. It act as a source of useful drug and also improve the health status of consumers that were assayed.
6. **Hetty Manu rung, Retno Aryani** has done work on phytochemical analysis antioxidant activity of leaves extract of endemic plants j ahe balikpapan in **9 Sep 2019** they found phytochemical analysis showed that the leaves extract of *E.balikpapanesis* had Alkaloids, Flavonoids, and steroids content. Ethyl acetate and ethanol extract had very high and high antioxidant activity, subsequently.
7. **Amir Muhammad Khan, Rizwana Aleem Qureshi, Faizan Ullah, Syed Angel Gilani,** has done work on phytochemicals analysis of selected medicinal plants of margalla Hills and surrounding in **9 Nov 2011** . They found In Alkaloids, saponins, tannins, anthraquinones, Flavonoids, and chalcone, Terpenoids and cardiac glucoside were present in *Woodfordia*

fruticosa but comumarin and found absent in *Adhathoda vasica,* all constituents were present except anthraquinones, steroids and Terpenoids.

8. **Anuradha Singh, Kshitiz C Srivastava, Answers Banrjee and Neeraj Wadhwa** has done work on phytochemical analysis of peel of *Amorphophallus Paeoniifolilus* in **2013 July.** They found the bioactive compound reported in various extract and subsequently literature evidence of their medicinal activity provide ample proof to the therapeutic and pharmaceutical.
9. **Esther O, Faboro, loqing Wei, shaobo Liang, Armando G, MC Donald and Craig A. Obafemi** has done work on phytochemical analysis from leaves of *Bryophyllum pinnatum* in **25 April 2016**. they found The analysis revealed the presence of Alkaloids, carboxylic acid, dicarboxylic acid sugar, sugar acid, alcohol, sugar alcohol fatty acid monoarylphenolics, steroids, vitamin and cyclical compound. In the extract are most likely responsible for its antimicrobial, antifungal, anti cancer, and insecticide activities.
10. **Anusha Kulkarni, Govindappa M, Channabasava , Ramchandra and Prasad's koka** has done work on phytochemical analysis of cassia fistula and it's in vitro antimicrobial antioxidant and anti inflammatory activity in **2015 Feb**. they found phytochemical analysis of three solvent extract of C fistula revealed the presence of 11 important phyto constituents.
11. **Jaures Ak Noumedem, Jean de Dieu Tomakou, Gerald Ngo Teke** has done work on phytochemical analysis, antimicrobial and radical- scavenging properties of *Acalypha manniana* leaves in **2013**. They found the methanol extract A.*manniana* showed the Highest anti microbial Activity while the residual fraction displayed the largest scavenging activity against DPPH confirming the traditional use of this plant in the treatment of various bacterial diseases such as diarrhea and skin infection.
12. **Jothi chimahali, Anjelin jebamalar, Gajalakshmi Duraikannu, Sivakumar Thirumala** has done work on phytochemical analysis of Evaluation of Anti microbial Activity in the whole plant Extracts of *Glorious Superba* in **1 may 2019**. they found Whole plant (shoot, flower,and tuber) extract showed anti bacterial and anti fungal activity with maximum inhibition against to selected microorganisms. *G.superba* can be used as anti microbial agents and ingredients in the human pathogenic diseased formulation in the different pharmaceutical fields.
13. **Ankita sood , Parminder Kaur and Ruby Gupta** has done work on phytochemical screening and antimicrobial assays of various seeds extract of cucurbitaceae family. On **3 Aug 2012**. They found the present study reveals that these plants under study can be used for the treatment of cancer, congestive heart failure, lowering of cholesterol levels in blood, healing of wound , endotoxemia etc. Since they contain various phytochemical that are known to treat above mentioned disease.
14. **Shibam mondal, Imrul Hossain, Md. Nur Islam** has done work on phytochemical screening of ethanolic extract of leaves and stems of *Cucurbita pepo* Linn. In **2 Nov 2017**. They found the most valuable for therapeutic activity. So identification of the natural of the compound is essential to evaluate the biological activity of the extract.

15. **Shankhajit De, yadu Nandan Dey, A K Ghosh** has done work on phytochemical investigation and chromatographic evaluation of different extract of *Amorphophallus Paeoniifolilus* (Araceae) in **October 2010**. They found the tuber contains phytochemical like Alkaloids, steroids, fats and fixed oil, Flavonoids, tannins, protein and carbohydrates. The TLC results of the petroleum ether extract and methanol extract show that at least three different phytochemical were present in each extract of tuber
16. **Jamuna Senguttuvan, Subramanian paulsamy, and krishnamoorthy, Karthika** has done work on phytochemical analysis and evaluation of leaf and root parts of the medicinal herb, *Hypochaeris radicata* L. For in vitro antioxidant activity in **2014 may** . They found from this study, it can conclude that the special is effective is scavenging free radicals and has the potential to be a powerful antioxidant.
17. **Sapna patil, Malika Ahaja** has done work on phytochemical analysis and Anti bacterial Determination of *Costus lgneus l*eaves in **April 2019.** They found *Costus igneous* antidiabetic property and prevent the body from disease protect mind and which prolongs the longevity of life.
18. **Okafor I.A and Ezejindu D.N** has done work on phytochemical studies on *portulaca oleracea* (purslene) plant. In **March 2014**. They found the plant has been reported as a global panacea due to it several medicinal uses the phytoconstitation observed study the plants potency for use in producing pharmaceutical bioactive components for therapeutic drug.
19. **Pragati Shah, Hansh Awasthi Keshari Kunwar** and **Surya Kant Kalauni** They work on phytochemical analysis and antioxidant activity of *Ipomoea Aquatica* for Ghadaghodi wet land area Nepal in **2021**. They found the phytochemical screening of the methanolic extract of laquatica revealed the presence of Alkaloids carboxylic reducing sugar glycosides tannins Flavonoids phenolic compound.
20. **Sherif H. Abd-Alrahman, Mounir M. Salem Bekhi, Manal E.A, Elhalwagy Wael M. Abdel Mageed and Awwad A. Radwan** has done work on phytochemical screening and antimicrobial activity of EthOH/ water *Ziziphus jujuba* seeds Extract. In **Nov 2013.** They found in conclusion the 50% ethanolic extract of seeds has microbial Activity against various microorganisms.

- **AIM :- Phytochemicals analysis of some selected plants occurring in local area of boisar shirgaon.**

- **OBJECTIVES :-**

- **Collection of plants :-** ***1.Phyllanthus niruri*** **L.** ***2. Eclipta Alba*** **(L).L.[2]** ***3.Hibiscus cannabinus*** **L.** ***4. Clitoria ternatea*** **L.**
- **Test :-** following test are taken to find out the phytochemicals compounds present in all four plants .
- **Qualitative analysis :-**
    1. Test for Alkaloids
    2. Test for steroids
    3. Test for tannins
    4. Test for glycosides
    5. Test for proteins
    6. Test for Amino acid
    7. Test for Phenols
    8. Test for Carbohydrates
    9. Test for flavonoids
    10. Test for saponins
    11. Test for Terpenoids
    12. Test for reducing sugar

MATERIAL AND METHODS

- **Plants material** :- 1.***Phyllanthus niruri*** L. ***2. Eclipta Alba*** (L).L[2] ***3.Hibiscus cannabinus*** L. ***4. Clitoria ternatea*** L.

- **Extraction of plant material** :-
- The plant material were identified and collected from the difference areas from boisar.shirgaon
- The extraction of plant material was done by hot water extraction method.
- The plant material was allowed to dry naturally i.e Under shade drying.
- After completion of drying process, material was kept in an appropriately labelled plastic bottle.
- 5gm of ground material was weighed using an electronic weighing balance, dissolved in a 25 ml of sterile water and then boiled at 50-60°C for 30 minutes on water bath.
- The extract was filtered through whatman no.1 filter paper and centrifugal the filtrate at 2500 rpm for 15 minutes. Resulting extract was stored in sterile bottles at 4-8°C for further analysis.
- **Phytochemical analysis** :-
- Preliminary qualitative screening for phytochemical, of all these plants species was carried out with the following methods.
- **Test for Alkaloids (Mayer's test)**
  2 ml of extract was treated with 2 drops of Mayer's reagents. Presence of white creamy precipitate indicated the positive test .
- **Test for steroids (Libermann Burchard test)**
  1 ml of extract was dissolved in 10 ml of chloroform. To this mixture equal volume of concentrate sulfuric acid was added by sides of the test tube . The upper layers become red while lower layer of sulfuric acid turns yellow in color with green fluorescence indicating the presence of steroids.
- **Test for Tannins (Braymer's test)**
  2 ml of extract was allowed to react with 10% alcoholic ferric chloride solution. Formation of blue or greenish color of the solution was observed. This was the indication of the presence of the tannins.
- **Test for Flavonoids (Alkaline reagent test)**
  2 ml of extract was treated with few drops of 1 N sodium hydroxide solution and observed the formation of intense yellow color.
- **Test for saponins (Foam test)**
  2 ml of extract was taken in a test tube and 6 ml of distilled water was added to it. The mixture was then shaken vigorously. The persistence of foam was observed that indicates the presence of saponins.
- **Test for Terpenoids (Salkowski test)**

2 ml of extract was treated with 2 ml of ascetic anhydride. Few drops of concentrate sulfuric acid was then added to this solution and observed the formation of blue green rings that indicates the presence of Terpenoids.

- **Test for carbohydrates (Benedict's test)**
  Crude extract when mixed with 2 ml of Benedict's reagents and boiled, a reddish brown precipitation formed which indicates the presence of the carbohydrates.
- **Test for reducing sugar (Feeling 's test)**
  Equal volume of feeling A and B reagents were mixed together and 2 ml of it was added to crude extract and gently boiled. A brick red precipitation appeared at the bottom of the test tube indicated the presence of reducing sugar .
- **Test for glycoside (Keller-kilani test)**
  Crude extract was mixed with 2 ml of glacial ascetic acid containing 1-2 drops of 2% solution of FeCl3 . the mixture was then poured into another test tube contacting 2ml of concentrate H_2SO_4 A brown ring at the inter phase indicated the presence of cardiac glycoside.
- **Test for Amino acid (Ninhydrin test)**
  Crude extract when boiled with 2 ml of 0.2% solution of Ninhydrin, violet colour appear suggesting the presence of amino acid.
- **Test for protein (Biuret test)**
  To 0.5 mg of extract equal volume of 40% NaOH solution and two drop of 1% copper sulphate solution was added. The appearance of violet color indicated the presence of protein.
- **Test for phenols (lead acetate test)**
  Ten mg of bark extract was taken and 0.5 ml of 1% lead acetate solution was added and the formation of precipitation indicated the proof phenolic compound.

Study area

1.*Phyllanthus niruri* L. :- Plant collected from PQ65+8M5, Mission Compound, Banjar para, Boisar, Palghar, Maharashtra 401404, India

Latitude :- 19.710641666666668

Longitude :- 72.75929666666666°

Date :- 22 July 2022

Time :- 08:39 AM

2. *Eclipta Alba* (L).L[2] :- plant collected from Shirgoun road, RQ68+PW5, Dhanani Nagar Rd, Boisar, Maharashtra 401501, India

Latitude :- 19.8118722°

Longitude :- 72.7675297°

Date :- 21 August 2022

Time :- 12:30 PM

3.*Hibiscus cannabinus* L. :- plant collected from Shirgoun road, RQ68+PW5, Dhanani Nagar Rd, Boisar, Maharashtra 401501, India

Latitude :- 19.8118722°

Longitude :- 72.7675297°

Date :- 10 August 2022

Time :- 12:50 PM

4. *Clitoria ternatea* L. :- Plant collected from katkarpada Shirgoun road Maharashtra 401501, India

Latitude :- 19.806928°

Longitude :- 72.7601°

Date :- 17 November 2022. Time :- 9:00 AM

Expected Results

- The present study aim to investigates phytochemical analysis of some plants of boisar Shirgaon.
- Most of the plants in these areas having the medicinal importance.
- The value of medicinal plants will help to know the importance of the plants.
- People from this village areas has known the importance of the plant. And they must be aware that the plants they are considering as weed having beneficial affects on their health.
- Phytochemical analysis it will help in the identification of various phytochemical constitutions like protein, carbohydrates, amino acid, lipids, glycosides and etc.

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COMPARATIVE STUDY OF AIR POLLUTION TOLERANCE INDEX OF SOME COMMON ROAD SITE PLANT SPECIES OF INDUSTRIAL AREA AND RESIDENTIAL AREA OF KUDUS CITY, WADA TALUKA, PAGHAR DISTRICT, MAHARASHTRA .

Dissertation Submitted to the

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For the fulfillment of

Master of Science

In Botany (Environmental Botany)

Submitted by

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Under The Guidance of

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2022-2023

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Department of Botany

Certificate

This is to certify that project work entitled **" Comparative Study Of Air Pollution Tolerance Index (APTI) Of Industrial Area And Residential Area Of Kudus City, Wada Taluka,Palghar District, Maharashtra**" has been carried out by student **Mr. Vishal Krishna Mathe,** student of M.Sc. (Part II) Botany with specialization in **Environmental Botany**. In the Department of Botany, S.D.S.M. College, Palghar, University of Mumbai during the academic year **2022-2023**.

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Last but not the least, I thanks the Almighty, who has always guided me. Thank you to one and all.

- Vishal Krishna Mathe .

DECLARATION

Vishal Krishna Mathe, Student of M.Sc Botany hereby declare that the research project entitled "**Comparative Study Of Air Pollution Tolerance Index (APTI) Of Selected Plant From Industrial & Residential area Of Kudus City,Wada Taluka, Palghar district,Maharastra**" Submitted by me for the academic year 2022-2023, is based on the actual work carried out by me under the guidance of Asst. Prof. Asmita Raut, I further state that this work is original and no part has been presented for any degree, diploma or similar title of any university.

INDEX

ABSTRACT

Plants are well known for their capabilities to reduce air pollution. Plant shows visible changes depending on the intensity level of air pollution. Hence, plants are commonly used as a pollution indicator. It is important that plants used for the development of urban forests, green belts near and around industrial sites must be tolerant to air pollutants.

The current investigation was focused on to screen the five different plants for their air pollution tolerance index (APTI). APTI has been calculated for five different species such as *Ficus racemase,Mangifera Indica,Polyalthia Longifolia,Syzygium Cumini,Ficus Religiosa,* growing in two different areas, i.e. industrial area and residential area of Kudus City,Wada Taluka,Palghar district.Four parameters i.e. leaf extract pH, total chlorophyll, ascorbic acid and relative water content selected for the present study to calculate the tolerance index (APTI). From the selected plants, the highest value of air pollution tolerance index (APTI) registered in *Syzygium Cumini* and *Ficus Religiosa* while lower in *Polythene Longifolia,Ficus racemosa,Mangifera indica* in industrial area and in residential area highlight value of air pollution tolerance index (APTI) registered in *syzygium Cumini,Ficus Religiosa,Polyalthia Longifolia* and lowest APTI recorded in *Mangifera Indica* and *Fucus Racemosa.*

Selected plants assessed for its air pollution tolerance index in both the locations i.e. experimental (industrial) and control sites (residential) to compare its tolerance level to air pollution. The present study suggests a suitable alternative for selecting plants based on their tolerance and performance index (API) for greenbelt development in industrial areas.

INTRODUCTION

CHAPTER: 1- INTRODUCTION

Air pollution is one of the severe problems world facing today (Khareshi.s.G.D) [13].Urban air pollution is one of the major atmospheric pollution issues that is getting worse with the growing urban population increasing traffic density and Industrialization (GuLia.S) [10]. et al,2015).Air pollution in roadsides and the industrial areas are the major consequences of environmental problems(Anju. P. S and Jaya. D. S,2014)[3].Air pollution is the contamination of air by any chemical, physical or biological agents that modifies the natural characteristics of the atmosphere. Complex mixture of pollutants like air borne particulate matter (PM), heavy metals, nitrogen dioxide (NO2), sulphur dioxide (SO2), carbon monoxide (CO), ozone (O3), benzene, uncombust hydrocarbons etc. contribute for the air pollutions. Long term exposure to these air suspended pollutants can cause harm or discomfort to human with different diseases such as respiratory, cardiovascular, neuropsychiatric complications, cancer and even death (GhoraniAzam et al. 2016)[8]. Air pollution also has adverse impacts on biodiversity, infrastructure, cultural heritage and the natural climate system (Pradhan 2012)[19].

Trees are stationary and are continuously exposed to the air pollutants. Plants which are growing along roadsides are exposed to many pollutants emitted from motor vehicles such as suspended particulate matters, NO2, SO2, CO, heavy metals, benzene, smoke, dust and soot particles. These air pollutants may alter the physiological process of plants, thereby affecting the growth of plants (Jitin & Jain 2014)[11].

The primary receptor of air pollutants are leaves of the plants. The leaves provide large surface area for absorption and accumulation and hence act as a sink to accumulate pollutants (Liu & Ding 2008). The effects of pollutants are most apparent on leaves showing direct harmful impact on them (Lohe et al. 2015)[22]. Hence, leaves are generally used to analyze the sensitivity of plants to air pollutants because of its absorbance of largest amount of air pollutants. The leaves of roadside plants may act as stressors for pollutants as they are in direct contact with air pollutants, hence the plant leaves have been advocated for examination to access their ability for absorption and/or adsorption of pollutants (Sharma et al. 2007)[23]. Plants are further classified as tolerant and sensitive plants. Tolerant plants can thrive in polluted environment and help in cleaning the various sources of man-made pollution but the sensitive plants cannot withstand pollutants and hence can be used as indicator. The efficiency of tolerant plants in absorbing pollutants is such that it can produce pockets of clean air (Gilbert 1968)[26]. Thus, these plants act as the scavengers of air pollutants as they are the initial acceptors of air pollution (Mahecha et al. 2013)[9]. Hence, such tolerant trees can play a major role in improving air quality by exchanging gases as they act as a sink of the air pollutants which can reduce the concentration of pollutants in air and help in mitigating air pollution (Prajapati & Tripathi 2008)[15].

pollution tolerance index (APTI) is measured by using four parameters such as relative water content (RWC), total chlorophyll content (Tchl)(Sadasivan.S and Manickam.A, (1991), leaf extract pH [Sames. A. A. et al. (2021)]and ascorbic acid content (AA) [Are. N. C(2019)]in leaves to ascertain the response of plants bio-chemically and physiologically (Singh & Verma 2007)[27]Air Pollution Tolerance Index (APTI), help us to find and choose tolerant plant species and help to monitor and assess the plants which are tolerant towards air pollution. The assessment

of plants based on its APTI and their tolerance level is very crucial and essential. To check the APTI, biochemical parameters play a crucial role, and with the help of these biochemical parameters the tolerance level of plants can be easily detected[Chaubey.et,al;(2021)[7].

Different plant species show different tolerance level depending upon their physiological and morphological characteristic. Ascorbic acid and chlorophyll are two of the main indicators for pollution, the ascorbic acid when present in high amounts are considered to be tolerant to the air pollution. Whereas the chlorophyll is considered to be an important stress metabolite, higher the chlorophyll, higher will be the chances for plants to be tolerant towards different air pollutants in the atmosphere[Chaubey.et,al;(2021)[7].

Air pollution tolerance index (APTI) is measured by using four parameters such as relative water content (RWC), total chlorophyll content (Tchl), leaf extract pH and ascorbic acid content (AA) in leaves to ascertain the response of plants bio- chemically and physiologically (Singh & Verma 2007)[27]. Higher APTI values indicates more tolerance of plants to air pollution than those with low APTI value. Hence, APTI assessment of the trees is an important tool for evaluating plants' response to air pollutants. The value of APTI is obtained (Singh S.K; Rao, D.N.)(1983)[29]

REVIEW OF LITURATURE

CHAPTER: 2-REVIEW OF LITURATURE

1. Agbaire,p.o and Esiefarienrhe,E.(2009): Examined that the air pollution tolerance indices (APTI) of six plant species around otorogus gas plant in Ugheli - south local government area of Delta state in which physiological and biochemical parameter were studied.
2. Arathi.K. and Sumeetha.V. (2011): studied that total chlorophyll content (Tch) in each was estimated by spectrophotometric method by using 80% acetone as a solvent described by sudasivan.S. and Manickam.A. (1991).
3. Seyyednjad.S. M, et al (2011): examined Air pollution tolerance indices (APTI) of forur plant specie) around petrochemical station in south west of ran and compared with unpolluted area and four physiological and biochemical parametres; ascorbic acid content (AA),Teal Relative waters Content (RWC), leaf extract pH and Total leaf chlorophyll (Tch) were used to conput the APTI values and result shows that in case that APTI incrence from control site to polluted site.
4. Khureshi. S.G.D,(2013) According to khuveshi S.G.D(2013) found that all the biochemical parameter differs as pe the increase of intensity of pollution level by studying 8 different plant species in which that the species Delonix regia(3.413), is most tolerant and followed by Tamarindus indica (10.712),ficus benghalensis (11.336),ficus religiosa (14.046),Anacar dium occidentalis (18.000) are moderately tolerant, sophora japonica (41,945), Alistonia scholaris (43.141) and Azadirachta indica (59,029) are sensitive respectively.
5. Anju and jaya (2014) Evaluated that the tolerance index (APTI) of Quisqualis indica Linn.where it was found that the Quisqalis indica Linn. Plants in control station (chempakamangalam) showed highest air pollution tolerance index values and revealed that it can serve as an indicator species of air pollution ranged from 6.26 to 13.43 respectively.
6. Marimuthu krishnaveni and kp lavanya (2014) Concluted that the air pollution tolerance index was high for syzygium cumini in locaton 1 and ficus benghatensis in location 2 in which it was found that all plants studied in both location were found to be sensitive to pollution which ranges from 02.29 to 12.53 but variation can be found in biochemical parameters.
7. Lohe at, al.(2015) Illustrated that the air pollution tolerance Index was calculated for various plant species growing at two site Nagal village at sahastra. dhara Road and the clock Tower (the experimental site) of Dehradun city India in which four biochemical parameters were analysed and statistically it was observed that control and experimental group for Ascorbic acid, t (6)=-4.848, p = .003,paired t test for air pollution

   olerance index between the two groups showed a statistically significant difference,t (6)=4.548, P = .004.
8. Gholami.A et al (2016): Examinated that Air pollution is one of the main environmental problems in many cities around the world. Controlling this kind of pollution is more complex than other environmental challenges. Many plants can absorb and save some of the environmental pollutants through their leaves. Therefore, air pollution tolerance index (APTI) was tested in polluted and blank areas in six plant species, namely, Conocarpus, Myrtus, Prosopis, Eucalyptus, Ziziphus, and Lebbek, which are abundant in the Ahvaz region during 2014. Dust deposition on leaf surfaces was determined to observe the extent of particulate deposition. The highest and the lowest deposition rates were observed in Myrtus (maximum 80.3 g.m-2 in polluted site) and Lebbek (minimum 10.7 g.m-2 in blank site), respectively. The APTI showed that Myrtus is resistant to plant pollution, whereas Prosopis is sensitive to plant pollution.

9. Kiran.K.et al (2016): studied that air pollution Tolerance Index (APTI)in the urban Centers,plays an important role in the amelioration of the air quality with higher abundance were explained for bio-chemical parameters such as pH, ascorbic acid, total chlorophyll and relative water content with various plant species plant species such as Jacaranda mimosifolia, pinus roxburghi, Ficus benjamin, celtis australis,Alnus nepalensis, callistemon lanceolatus, schima wallichi, pyrus pyrifolia and Punica grantum were found sensitive, among which pranus persia, populus deltoides, Thuja sp.and Grevillea robusta were found to be the most tolerant species in which higher number of tolerant to moderately tolerant species of trees results in better air pollution sink and air quality refinement.
10. Zouari.M.(2018): Studied that suggests that the most tolerant species, i.e., olive and date palm, can be planted in polluted sites for both air pollution abatement and aesthetic improvement. While, the sensitive species, namely common figand white Mulberry, help indicating air pollution and should be utilized as bio-indicators.
11. Acry .N.C. (2019): The study examined that all pollution tolerance indices (APTI) Formula = A(TChl+P) +R/10 and abo studied that four physidogical biochemical parameters which are Ascorbic acid content (AA). total leaf chlorophyll (TChl), leaf extract, pH and leaf relative water content (RWC). were used to compute the APTI values.
12. Manjunath BT. and Reddy jayaram ((2019): Studied that the six plants commonly growing in the polluted regions and NP control area in Bengaluru was analyzed as a biomonitoring tool to assess the responce of plants to air pollution induced stress. APTI indices of ocimum Sanctum, Ricinus communis Leucas aspera Lantana camera bougainvillea spectabilis, and Vinca rosea were assessed and compared with the plants growing in non polluted sites of bengaluru to analyze air pollution, and APTI Correlation with the biochemical response to and phystochemical parameters were analyzed toidentify the important determinants of air pollution telerance.
13. Sodia H.E, et al (2019): studied that air pollutions tolerance index (APTI) of the Mango (mangifera indica leaves growing in the great Dhaka regions, Bangladesh and leaf sample were collected in winter seasons from both sites roadsides and Industrial areas of different parts of great, dhaka region and the ARTI values of leave calculated from the total chlrophyll content (TChl) Ascorbic acid Concentration,relative water content (RWC), and pHof the leaf extract. The highest APTI Values observed in Dhaka city sampling location (10.6) where the lowest value was found in Narayangonj (9.70) In this study that mengifera indica is verry sencitive to the air pollution.
14. Ruqaya .J. (2019):Examinated that n plant species from the roads with heavy traffi c in Abha Saudi Arabia were collected and studied for their phyto-monitoring potential by calculating their Air Pollution Tolerance Index (APTI). Physiological as well as the biochemical parameters like Relative Water Content (RWC), Ascorbate Content, leaf extract pH as well as the Total Chlorophyll Content (Chl) were used to calculate the APTI values. Bougainvillea glabra and Ricinus communis plants showed highest tolerance to vehicular pollution, Shinus molle, Catharanthus roseus, Hibiscus rosa-sinensis, Myoporum pictum, Juniperus procera, Phoenix caespitora showed moderate tolerance while as Tagetestanui folia and Vitis vinefera were least tolerant species, thus making Bouganivillea glabra and Ricinus communis plants the ideal candidates to be used for green belt development in Abha region of Saudi Arabia.
15. Uka et al. (2019) Conducted a survey to evaluate the impact of vehicular air pollutant of roadside trees species in the kumasi Metropolis in which it was found that higher level at the arterial road site,were more polluted and among which Mangifera indica,Ficus plalyphylla and terminalia catappa were been performly air cleaning functions as compared to polyallhia longifolia were poor and unstable as a pollution sink.

16. Tak and Jake (2020): Focused on the appropriate plant species for the reduction of air pollution from three industrial site; where it had been found that air pollutants is essential for the greenbelt development in Urban areas.
17. Ter sabita et al (2020): evaluated that the air polluction tolerant trees from the roadside of pashupati area of kathmandude with heavy traffic dencity was Can Considered as the polluted site and BudhaniKantha, ying at the outskirt of Kathmandu with very less traffic was considered as the less polluted site and air pollution telerance index (APTI) values of the breed were calculated and analyzed brochemical prosthetes. auch al solathe water content, total leaf chlorophyll, ascorbic acid and leaf extract pH by uing standard method.based on APTI values it can be concluded that the tree species such as phyllanthus emblica and schima wallich are highy sensitive to air pollution and can be used as boindicator of air pollution.

18. Amin.A.S. et al (2011): Illustrated that the leaf -sample collected from study area and species were ued to determine their Air pollution to tolerance index (APTI) and calculated the ascorbic acid, chlorphyll, pH and relative water content (RWC), biochemical parameters and APTI of the study species are stongly affected by the pollution in the study area.
19. Kanwar et al. (2021) studied that the air population tolerance index of some plants growing in the vasai-virar area in palghar district of maharastra where the tolerance level of any plant species is mainly dependent on its physiological and morphological characteristics along with various type of abiotic, biotic and physical factor control plant life; including temperature, humidity, soil chemistry,pH, oxygen levels and salinity respectively.
20. Arul Pragasan.L et al (2022): In this study, we assessed the concentration of air pollutants to understand the pollution status of the Narasapura industrial area located in India. Also, we identified pollution-tolerant tree species for the development of greenbelts for NIA. Monthly air samples were collected from three sites from NIA and the samples were analysed for the determination of air pollutant concentration following standard methods.Twenty common tree species to NIA were selected and their air pollution tolerance potential was determined by the Air pollution tolerance index using leaf relative water content, total chlorophyll content, leaf extract pH, and ascorbic acid content. Tree species, Spathodea campanulata (9.58 ± 0.33) recorded maximum APTI value followed by Terminalia catappa, Tabebuia avellanedae, Anthocephalus cadamba, and Syzygium jambos. We conclude that the development of greenbelts is necessary for the mitigation of air pollutants.

AIM AND OBJECTIVE

CHAPTER: 3-AIM AND OBJECTIVE

AIM - Comparative studies of air pollution tolerance index of some common roadsite plant species of industrial area (Experiment site) and residential area (control site) of Kudus.

OBJECTIVE -

The air pollution tolerance index was calculated by using the formula given by (Singh and Rao,1983);

APTI = A (T+P) +R / 10

Where, A = Ascorbic Acid (mg/g)
T = Total chlorophyll (mg/g-fresh weight
P = pH of the leaf extrat.
R = Reletive water content of leaf (%)

CHAPTER: 4-STUDY AREA

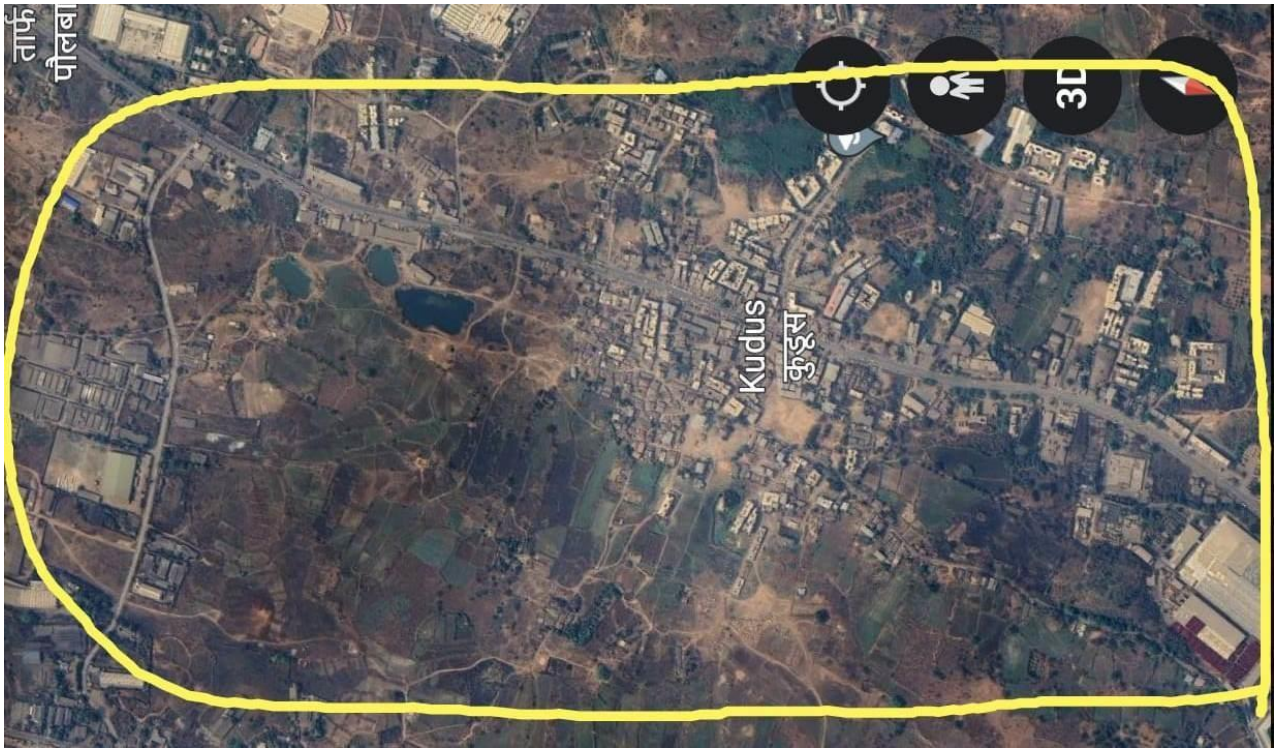
The present study focused on evaluating the Air pollution tolerance index of plants species in the KUDUS city road site an industrial area at the district of PALGHAR, MAHARASHTRA was selected as the experimental site, and a site residential area nearby in KUDUS city at 'KHINDICHA PADA' with limited industrial activities and lower pollution level of residential area was selected as the control site.

The City 'KUDUS' is situated In a highly industrialized region with a dense population and a significant concentration of vehicular traffic. This area experiences various sources of city pollution, including emissions from Industrial activities, exhaust fumes from vehicles and other anthropogenic sources. The geographical Coordinates of city kudus are 19.5307928 Latitude and 73.1018358611928 Longitude and it covers an approximate area of 307,713 km. The climate in this region is characterized as temporate region, and tropical region, with distinct seasonal variation. The average annual temperature ranges from 21.5 to 39°C and precipitation varies from 2458mm.

The prevailing air pollution scenario in KUDUS City is a matter of growing Concern due to the detrimental effects on both human health and the environment. The sources of air pollution include particulate matter (pm), nitrogen oxides (Nox) sulfur dioxide (S02), volatile organic compounds (VOCs), and other pollutants associated with industrial and vehicular emissions.

This study aims to assess the PPT of selected plant species Pu efly kadus cply. The results will provide valuable insights, Porto the tolona- nie levels of plants and their potential fax mitiga ting the impacts of air pollution in urban environ ments. Additionally, this research will contribute to the development of effective strategies for urban greenery planning and management, pro- imeting sustainable and healthier living conditions in KUDUS City.

Map : 1 The map shown in the Picture is industrial area




3D

Map:2The map shown in the picture is Residential area

MATERIALS AND METHODS

CHAPTER: 5-SAMPLE COLLECTION

For the possent study, The Fresh matured '5' leaf sample were collected are *Polyalthia Longifolia, Mangifera Indica, Ficus Religiosa, Syzygium Cumini, Ficus Racemosa* between January to April 2023 from roadsites Industial area and (experimental sites) and residensial area (control sites). The leaves were collected manually from the bottom of the tree crown about 8 - 20 feet above from the soil. The mature leaf sample were collected from nearby branches of tree.

keeping in mind precautionary measures and brought to laboratory for an experimental process. The fresh leaf sample were collected in early morning from both sites Industrial and residential anea grown on the edge of the road almost with similar topography or condition and immediately brought to laboratoury in polythene bag, Kept in refrigerator for further analysis of various biochemical paramenters such as leaf extracts PH, relative waters content, total chlorophyl content and ascorbic acid content.

Collection of the sample from Industrial

Collection of the sample from Residential

METHODOLOGY

To obtain the four parameters in APTI formula, samples were treated as follows :

1.To estimate ascorbic acid content in fresh leaves.

2.To pH determination of plant leaves extract.

3.To measure the relative water content (RWC) in plant leaves.

4.Estimation of chlorophyll content in plant leaves.

ANALYSIS OF BIOCHEMICAL PARAMETERS

CHAPTER: 6-ANALYSIS OF BIOCHEMICAL PARAMETERS ASCORBIC ACID CONTENT

AIM : To estimate ascorbic acid content in fresh leaves.

PRINCIPAL : It is water soluble,heat labile,antioxidant and present in all fresh vegetables and fruits.It reduce 2,6 dichlorophenolindopheno (DSP),to s colourless base and itself gets oxidized to dehydro ascorbic acid.

REQUIREMUNTS :

(i) Na-EDTA 0.075%

(ii) Oxalic acid 4%

(iii) Ascorbic acid: Dissolve 1 g ascorbic in 100 ml. of oxalic acid solution (45) This acts as stock solution. Dilute Iml, of stock solution to 100 ml. with 4% oxalic acid. This is working standard with a concentration of 100 mg ml.

(iv) Dichlorophenolindophenol (DCPIP): Dissolve 42 g of sodium bicarbonat a 50 ml. of double distilled water Divulle 4 mg 2,6-dichlorophenolindophenid in and make up the final volume to 200 with double distilled water

PROCEDURE:

1. Take 0.5 mg of fresh leaf sample and homogenize it with 20 ml. extracting solution containing 4% oxalic acid and and 0.075% Na-EDTA using mortar and pestle.
2. Keep it in an ice bath. Centrifuge the homogenate at 6000 rpm for 15 minutes.
3. Aspirate 1 mL of the supernatant and 5 ml of DCPIP solution and shake well.
4. Measure OD of this pink coloured solution at 520 nm. Let the OD be A.
5. Now add one drop of 1% ascorbic acid content solution to bleach the pink colour completely.
6. Take OD of this turbid solution at 520 Let it be B.
7. Take 1ml of extracting solution and add 5 mL of DCPIP.Mix well.
8. Take OD at 520 nm. Let it be C.
9. The calculate the Ascorbic acid content using following formula.

FORMULAS:

Ascorbic acid gm^{-1} dry weight = C-A-B/W x 1000 x V

Where, V volume of extract = 20.

W dry weight of leaf sample in grams.

OBSERVATION TABLE:

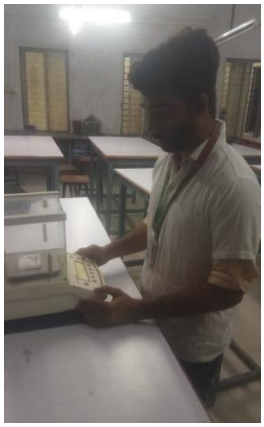
Industrial Area (Experimental Site):

SAMPLE NO	PLANT SPECIES NAME	OD-A. 520 nm	OD-B. 520 nm	OD-C 520 nm	TOTAL ASCORBIC ACID CONTENT.
1.	*Fficus Religiosa . (Pimple)*	0.85	0.0.79	0.41	0.453
2.	*Mangifera Indica (Mango)*	0.64	0.73		0.246
3.	*Polyalthia Longifolia (Ashoka)*	0.83	0.79		0.456
4.	*Syzygium Cumini (Jambhul)*	0.74	1.01		0.374
5.	*Ficus Recemosa (Umbar)*	0.89	0.79		0.501

RESIDENTIAL AREA (CONTROL SITE) :

SAMPLE NO	PLANT SPECIES NAME	OD-A 520 nm	OD-B 520 nm	OD-C. 520 nm	C-A-B/W x 1000 x V
1.	*ficus Religiosa . (Pimple)*	0.50	0.52	0.35	0.171
2.	*Mangifera Indica* (*Mango*)	0.55	0.45	0.35	0.210
3.	*Polyalthia Longifolia* (*Ashoka*)	0.60	0.30		0.250
4.	*Syzygium Cumini (Jambhul)*	0.30	0.20		0.474
5.	*Ficus Racemosa* (*Umbar*)	0.65	0.40		0.313


Weighing Balance

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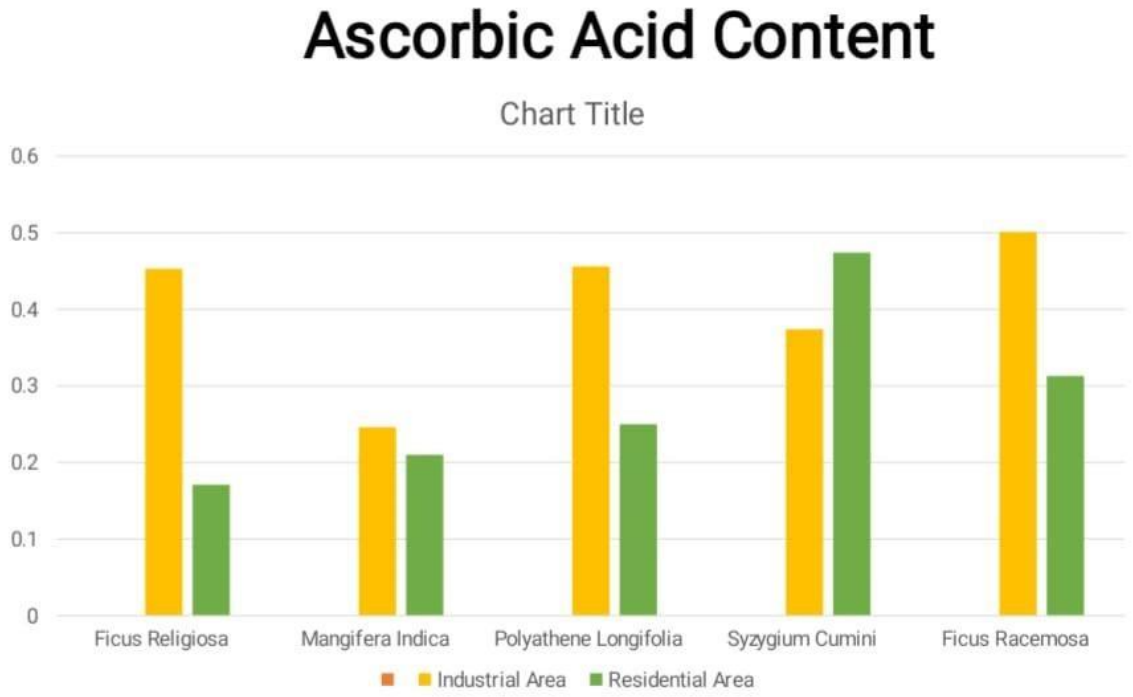
RESULT

Among studied plants high ascorbic acid content was found in *Ficus Racemosa* (0.501) and *Polyalthia Longifolia* (0. 456) In Industrial site. (Table 1). But the tree species such as *Mangifera* Indica (0.246) and *Syzygium Cumini* (0.374) had low ascorbic acid content in polluted sites (Table 1). In Residential site the ascorbic acid content was found to be high in *Syzygium Cumini* (0.474) and low in *Ficus Religiosa* (0.171) (Table-2). There was increase in AA in all tree leaves in Industrial site than in Residential site and Highest increase in AA content in industrial site was recorded in *Ficus Racemosa* (0.501).



TOTAL CHLOROPHYLL CONTENT:

AIM: To determination the Chlorophyll 'a'/Chlorophyll 'b' ratio in industrial and residential area of plants described by Sadasivan.S. and Manickam.A. (1991).

PRINCIPLE: Chlorophyll synthesis is influenced by the interaction of a number of environmental factors such as light, temperature, oxygen, moisture, metallic ions and nutrients Stress in any of these factors results in reduction in chlorophyll synthesis, which varies from species to species: Chlorophyll a b d total are determined following the method of Sadasivan.S. and Manickam.A. (1991).

REQUIREMUNTS:

1.CHEMICALS: 80% Acetone (80 ml Acetone + Distilled Water).

2.APPARATUS: Mortar with pestle,Buncher Funnel,Beakers,WhatMan No.42 Filter Paper,Spectrophotometer.

3.PLANTS MATERIAL: 1g Fresh and Green Leaves of industrial and non industrial area.

4.VOLUME OF EXTRACT :100 ml.

PROCEDURE:

1. 1 g of finely cut fresh leaves were ground to a fine pulp with the addition of 20 ml of 80% acetone with a mortar and pestle.
2. This paste was the centrifuged for 5 minutes at 5000 rpm.
3. The supernatant was transferred to a Buncher Funnel with WhatMan Filter Paper. The residue was then ground with 20 ml of 80% acetone, centrifuged for 5 minutes at 5000 rpm and the supernatant was transferred to the same Buncher Funnel.
4. This process was repeated for 4 times till the residues became almost colorless.
5. The inside of the mortar and pestle were also washed with 80% acetone and the clear washings were also collected in the beaker.
6. The volume was made up to 100 ml with 80% acetone. This was repeated for all the leaf samples.
7. The absorbance of the extract solutions were read at 645, 663 and 652 nm against the solvent (80% acetone) blank.
8. Then calculate the Chlorophyll 'a' and Chlorophyll 'b' and total from the Following equations :

   Milligrams of **Chlorophyll a** per gram of tissue = [12.7(A663) – 2.69(A645)] ×V/(1000×W). Milligrams of **Chlorophyll b** per gram of tissue = [22.9(A645) – 4.68(A663)] ×V/(1000×W). Milligram of **total chlorophyll** per gram of tissue = [20.2(A645) +8.02(A663)]×V/(1000×W)

OBSERVETION TABLE:

Industrial area(Experimental Site):

SAMPLE NO	PLANTS SPECIES NAME	ABSORBANCE AT 663 nm	ABSORBANCE AT 645
1.	*Ficus Religiosa* (*Pimple*)	1.341	0.563
2.	*Mangifera Indica (Mango)*	1.258	0.551
3.	*Polyalthia Longifolia (Ashoka)*	1.0290	0.552
4	*Syzygium Cumini (Jambhul)*	1.242	0.587
5.	*Ficus Racemosa* (*Umbar*)	1.309	0.646

Residential Area (Control Site):

SAMPLE NO	PLANTS SPECIES NAME	ABSORBANCE AT 663 nm	ABSORBANCE AT 645
1.	*Ficus Religiosa (Pimple)*	0.707	1438
2.	*Mangifera Indica (Mango)*	0.664	1.182
3.	*Polyalthia Longifolia (Ashoka)*	0.897	1.192
4.	*Syzygium Cumini (Jambhul)*	0.599	0.482
5.	*Ficus Racemosa (Umbar)*	1.074	1.641

CALCULATION:

The amount of chlorophyll present in the extract i.e. mg of chlorophyll present per gram of tissue was calculated using the following equations as described in S. Sadasivan and A.Manickam(1991).” Biochemical methods”:

Milligrams of Chlorophyll a per gram of tissue = [12.7(A663) – 2.69(A645)] ×V/(1000×W)
Milligrams of Chlorophyll b per gram of tissue = [22.9(A645) – 4.68(A663)] ×V/(1000×W)
Milligram of total chlorophyll per gram of tissue = [20.2(A645) + 8.02(A663)] ×V/(1000×W)

Here A= absorbance at specific wavelengths, V= final volume of chlorophyll extract in 80% acetone which in this case is 100 ml and W= fresh weight of tissue extracted which is 1 g. Thus V× (1000×W) = 100×(1000×1) = 0.1

CALCULATION TABLE:

Industrial Area (Experimental Site)

SAMPLE NO	PLANT SPECIES NAME	CHLOROPHYLL 'a' 'Mg 1g' FRESH WEIGHT	CHLOROPHYLL 'b' Mg 1g FRESH WEIGHT	TOTAL CHLOROPHYLL ' mg 1g' FRESH WEIGHT
1.	*Ficus Religiosa (Pimple)*	3.517	1.500	5.016
2.	*Mangifera Indica (Mango)*	1.278	0.593	1.871
3.	*Polyalthia Longifolia (Ashoka)*	0.719	0.318	1.038
4.	*Syzygium Cumini (Jambhul)*	1.449	0.778	2.227
5.	*Ficus Racemosa (Umbar)*	1.582	0.921	2.503

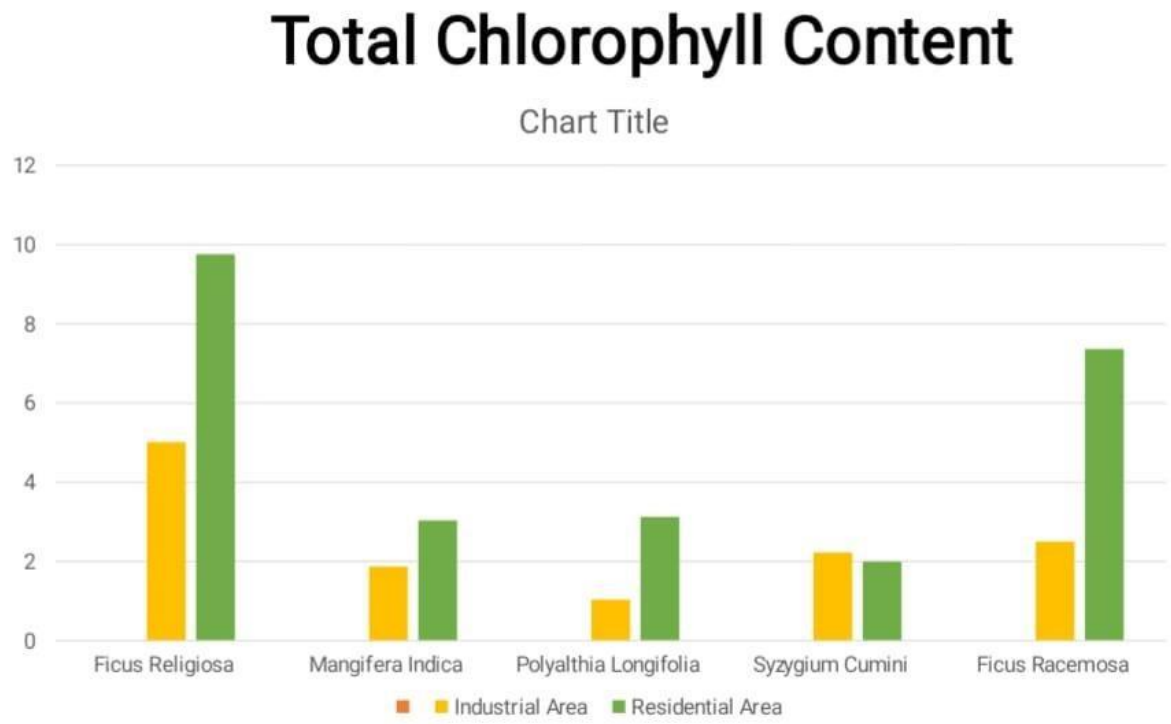
Residential Area (control site):

SAMPLE NO	PLANT SPECIES NAME	CHLOROPHYLL 'a' 'Mg 1g' FRESH WEIGHT	CHLOROPHYLL 'b' 'Mg 1g' FRESH WEIGHT	TOTAL CHLOROPHYLL ' mg 1g' FRESH WEIGHT
1.	*Ficus Religiosa (Pimple)*	1.436	8.616	9.758
2.	*Mangifera Indica (Mango)*	0.554	2.530	3.083
3.	*Polyalthia Longifolia (Ashoka)*	0.642	1.813	3.127
4.	*Syzygium Cumini (Jambhul)*	0.204	1.130	1.996
5.	*Ficus Racemosa (Umbar)*	1.627	5.742	7.3667


Weighing Balance
HIGH PRECISION BALANCE
106.1 g

RESULTS

Ficus Religiosa (5.016) showed the highest value of average total chlorophyll content in Industrial as well as *Ficus Religiosa* (9.758) in Residential area (Table 1 and 2). The lowest average value of total Chlorophyll content was observed in *Polyalthia Longifolia* (1.038) from the Industrial area (Table 1) and in *Syzygium Cumini* (1.996) from the Residential area (Table 2). There was decrease in Tchl in the tree leaves at Industrial area than in Residential.



LEAF EXTRACT pH:

AIM: To Measure PH in plant leaves extract (Fatyavar and Sinha -Ray (1995).

PRINCIPAL: pH is the measure of hydrogen ion activity and mostly depends on the relative amount of the absorbed hydrogen and metallic ions. It is a good measure of the intensity of acidity and alkalinity of suspension.

REQUIREMENT: pH meter,25 mL Distilled water,Plants material.

PROCEDURE:

1. '5'g of fresh leaves were washed with distilled water.
2. And then crushed and homogenised with 25 mL of distilled water using mortar and pestle.
3. pH of the leaf extract filtrate was measured with the help of pH meter.

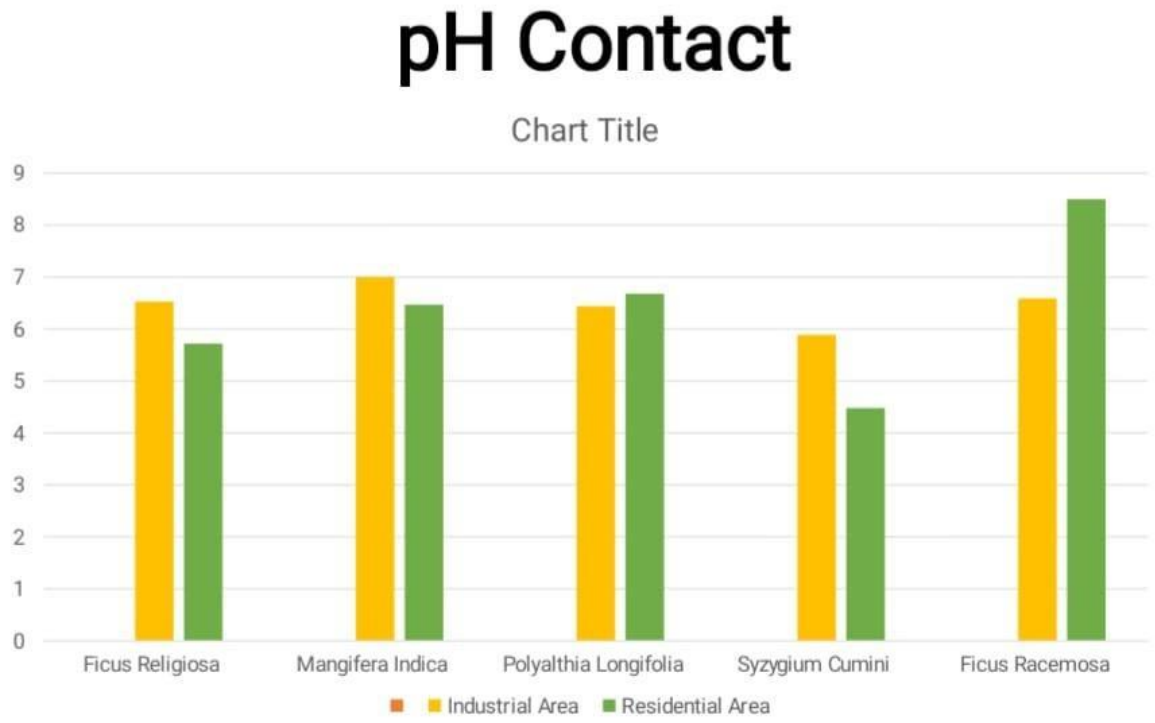
OBSERVATION TABLE:

Industrial Area and Residential Area

SAMPLE NO	PLANT SPECIES NAME	pH of industrial Area	PH of Residential area
1.	*Ficus Religiosa . (Pimple)*	6.53	5.72
2.	*Mangifera.Indica (Mango)*	7.00	6.47
3.	*Polyalthia.Longifolia. (Ashoka)*	6.44	6.68
4.	*Syzygium.Cumini (Jambhul)*	5.89	4.48
5.	*Ficus Racemosa . (Umbar)*	6.49	8.50

RESULTS

Highest value of leaf extract pH was recorded in *Mangifera Indica* (7.00) whereas its lowest value was observed in *Syzygium Cumini* in Industrial Area. In Residential Area , maximum value of pH was recorded in *Ficus Racemosa* (8.50) and its minimum value was observed in *Syzygium Cumini*.



RELATIVE WATER CONTENT (RWC)

AIM: To Measure the relative water content (RWC) in leaves sample.

PRINCIPAL: According to Barrs (1968), the measurements of water content expressed on a tissue fresh or dry basis have been mostly replaced by measurements based on the maximum amount of water a tissue can hold is referred to as Relative water content. The relative water content of a plant tissue is expressed by:

$$RWC = \frac{FW - DW}{TW - DW} * 100$$

FW, DW and TW are the fresh, dry and turgid weight, respectively, of the plant (Botânica et al., 1999). The oldest method to check and measurement of water content in plants were based on water content which is expressed as a percentage of either dry or fresh weight. Moreover, the fresh weight is extremely insensitive to small changes in water content. Whereas in dry weight, the measurement of water content is quite unsatisfactory as dry weight of fully expanded leaves undergoes both short and long term changes resulting from photosynthesis, translocation and respiration thus causing measurable changes in the amount of solutes. Due to the difficulties faced during measurement of water content in dry and fresh weight leaves, the concept of expressing leaf water content as a percentage of turgid water content came to an existence (Raymond Hunt et al., 1987).

REQUIRMENTES :

Apparatus used	Specimen used	Solution taken
1.Petri-plate(10 numbers)	1.*Ficus Religiosa*	1.Distilled water
2.Oven	2.*Mangifera Indica*	
3.Polythene bag	3.*Polyalthia Longifolia*	
4.Weighing machine	4.*Syzygium Cumini*	
5.Punching machine	5.*Ficus Racemosa*	

PROCEDURE:

1. First, collected 5 different species with two different areas which is raodsite industrial area and residential area (Kudus).
2. Then placed the leaf samples carefully in polythene bags while carrying them to the lab in order to minimize transpiration losses.
3. Then, petioles/ sheaths were removed and Ten discs from each replications of leaf sample (1 cm diameter) were taken out with the help of punch machine and their fresh wight(FW) was recorded using weighing balance immediately.
4. Then, all the samples were put into a petri dish having distilled water and allowed it to float for 4 hours.
5. The excessive water from the leaves were blotted with the help of blotting paper then, turgid weight (TW) was measured.
6. Then, the leaves were dried in the oven at 80-850C for about 10 mins and their dry weight was recorded.
7. Then tabulated the observations and calculated the relative water content (RWC) using the formula.

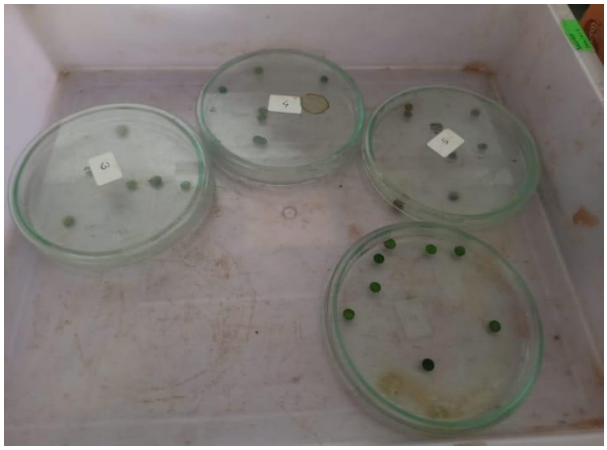
OBSERVETION TABLE:

Industrial area (Experimental site):

SAMPLE NO	PLANT SPECIES NAME	FRESH WEIGHT	TURGID WEIGHT	DRY WEIGHT	RWC %
1.	*Ficus Religiosa* (Pimple)	0.044	0.055	0.022	66.66%
2.	*Mangifera Indica* . (Mango)	0.026	0.038	0.018	40%
3.	*Polyalthia Longifolia* (Ashoka)	0.017	0.035	0.007	35.71%
4.	*Syzygium Cumini* (Jambhul)	0.038	0.044	0.016	78.57%
5.	*Ficus Racemosa (Umar)*	0.026	0.043	0.012	37.83%

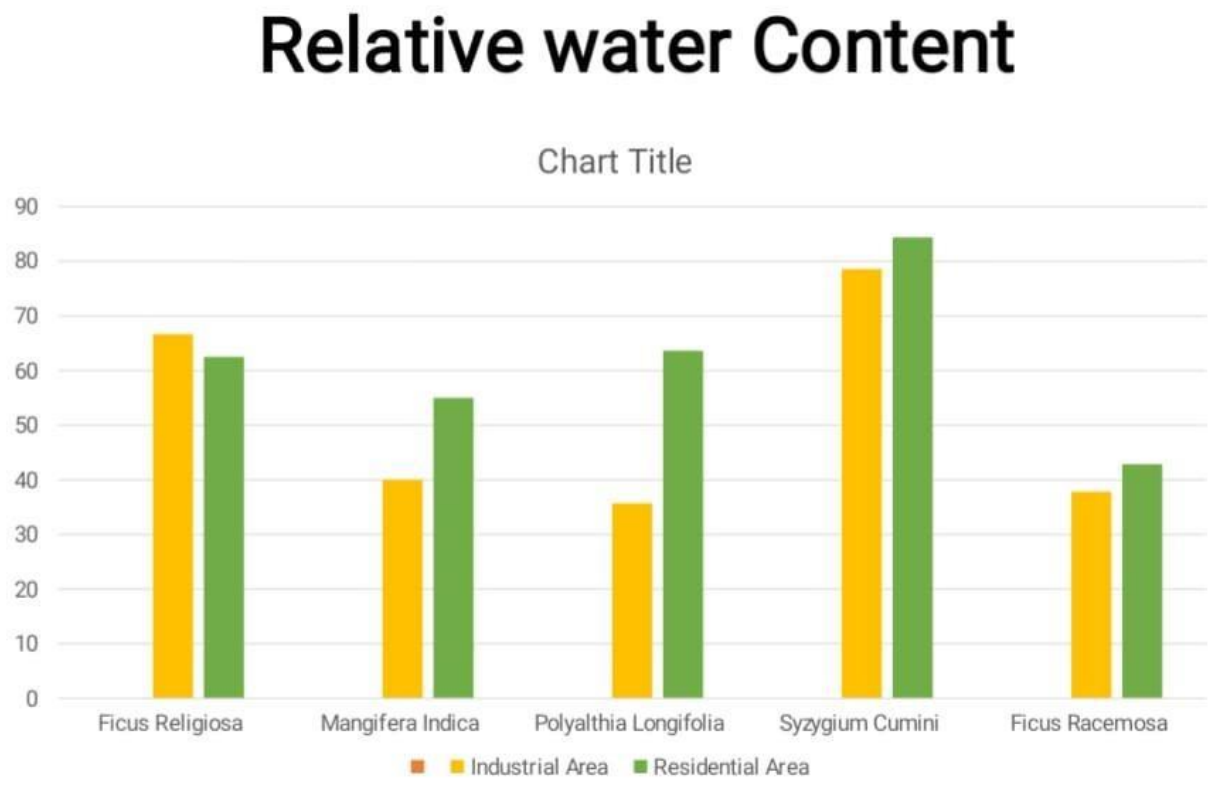
Residential Area (Control site):

SAMPLE NO	PLANT SPECIES NAME	FRESH WEIGHT	TURGID WEIGHT	DRY WEIGHT	RWC %
1.	*Ficus Religiosa (Pimple)*	0.051	0.057	0.041	62.5%
2.	*Mangifera Indica . (Mango)*	0.042	0.051	0.031	55%
3.	*Polyalthia Longifolia (Ashoka)*	0.028	0.032	0.021	63.63%
4.	*Syzygium Cumini (Jambhul)*	0.027	0.032	0.028	84.37%
5.	*Ficus Racemosa (Umar)*	0.031	0.039	0.025	42.85%



RESULT

Highest value of average relative water content was noticed in Syzygium Cumini (78.57%) at the Industrial area (Table 1) and similarlyin Residential area the ascorbic acid content was found to be hiegh *Syzygium Cumini* (84.37) (Table 2).Lowest value recorded, in *Polyalthia Longifolia* (35.71) at Industrial area and in also Residential Area *Ficus Racemosa* (42.85).There was increase in relative water content in almost all tree species in Residential area than in Industrial area.



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AIR POLLUTION TOLERANCE INDEX

APTI values determined by the method of Singh & Rao(1983).
APTI= [A (T+P) + R] /10
Where: A=Ascorbic acid content (mg/gm),
T=Total chlorophyll (mg/gm),
P=pH of the leaf extract,
R=Relative water content of leaf (%).

OBSERVATION TABLE :

Industrial Area:

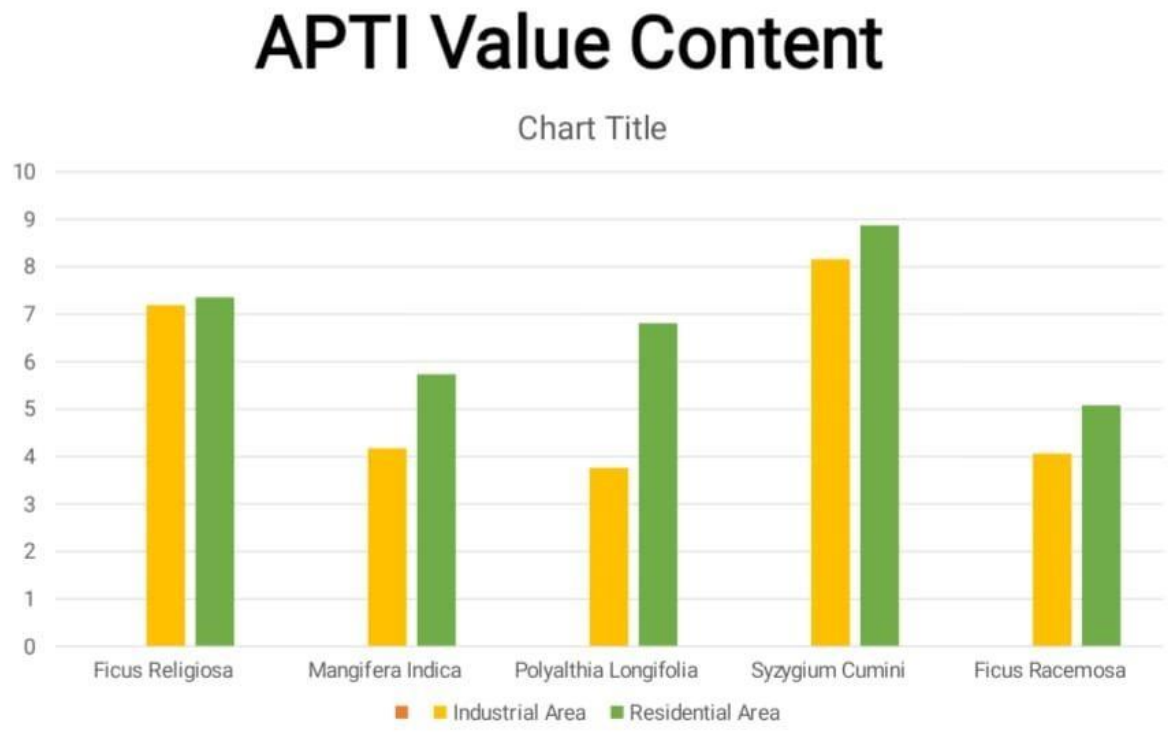
SAMPLE NO	PLANT SPECIES NAME	APTI VALUE
1.	*Ficus Religiosa (Pimple)*	7.189
2.	*Mangifera Indica (Mango)*	4.175
3.	*Polyalthia Longifolia (Ashoka)*	3.763
4.	*Syzygium Cumini (Jambhul)*	8.160
5.	*Ficus Racemosa (Umar)*	4.064

Residential Area :

SAMPLE NO	PLANT SPECIES NAME	APTI VALUE
1.	*Ficus Religiosa (Pimple)*	7.356
2.	*Mangifera Indica (Mango)*	5.735
3.	*Polyalthia Longifolia (Ashoka)*	6.810
4.	*Syzygium Cumini (Jambhul)*	8.873
5.	*Ficus Racemosa (Umar)*	5.079

RESULT

The maximum and minimum APTI value observed in Industrial area were 8.160 in *Syzygium Cumini* and 3.763 in *Polyalthia Longifolia* respectively (Table 1). In residential area maximum APTI value recorded in *Syzygium Cumini* (8.873) and Minimum in *Ficus Racemosa* (5.079) ,respectively (Table 2).



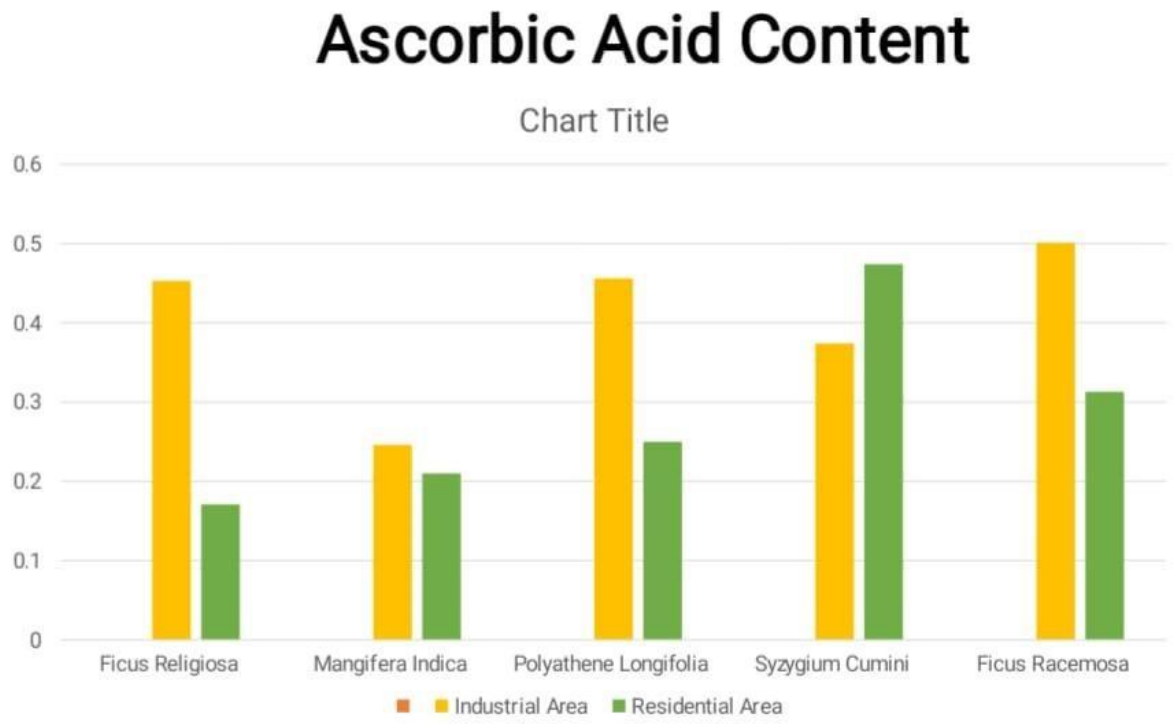
RESULT AND DISCTION

CHAPTER: 7-RESULT AND DISCUSSION

ASCORBIC ACID CONTENT:

Among studied plants high ascorbic acid content was found in *Ficus Racemosa* (0.501) and *Polyalthia Longifolia* (0.456) In Industrial site. (Table 1). But the tree species such as *Mangifera Indica* (0.246) and *Syzygium Cumini* (0.374) had low ascorbic acid content But in polluted sites (Table 1). In Residential site the ascorbic acid content was found to be high in *Syzygium Cumini* (0.474) and low in *Ficus Religiosa* (0.171) (Table-2). There was increase in AA in all tree leaves in Industrial site than in Residential site and Highest increase in AA content in industrial site was recorded in *Ficus Racemosa* (0.501).

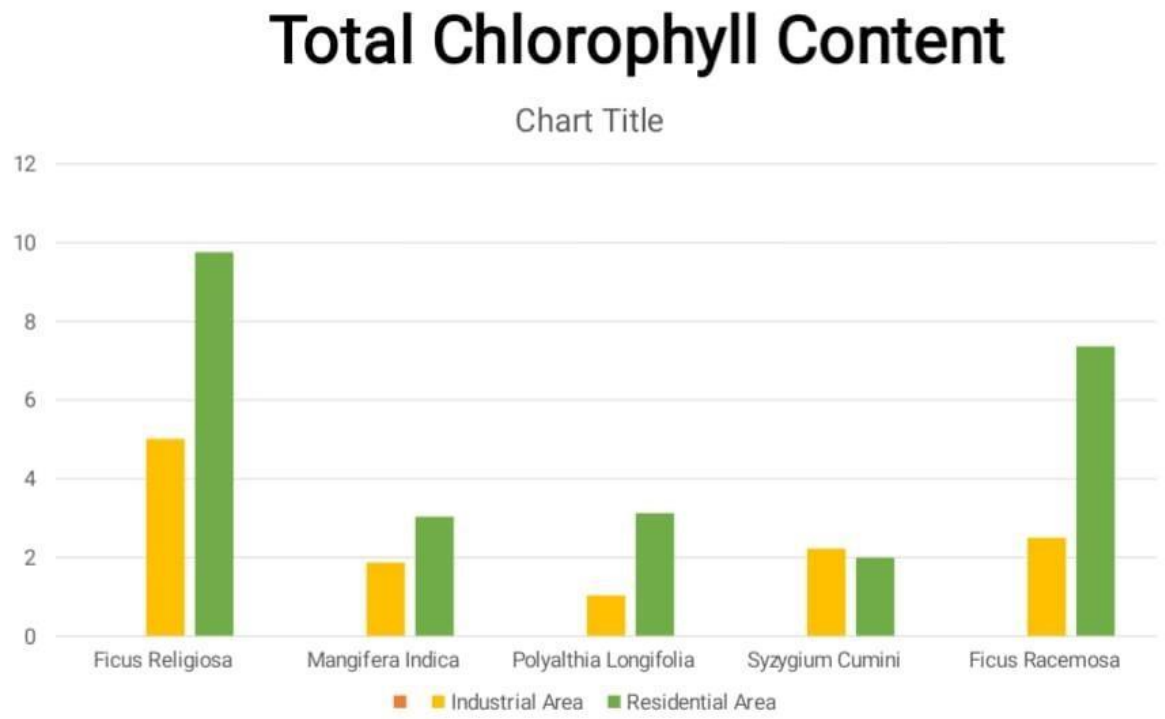
Ascorbic acid is a strong reductant and it activates many physiological and defence mechanisms in plants. Its reducing power is directly proportional to its concentration (Raza and Murthy, 1988; Agbaire and Esiefarienrhe, 2009). However, its reducing activity is pH dependent, being more at higher pH levels because high pH may increase the efficiency of conversion of hexose sugar to ascorbic acid and is related to the tolerance to pollution (Liuand Ding, 2008).



TOTAL CHLOROPHYLL CONTENT :

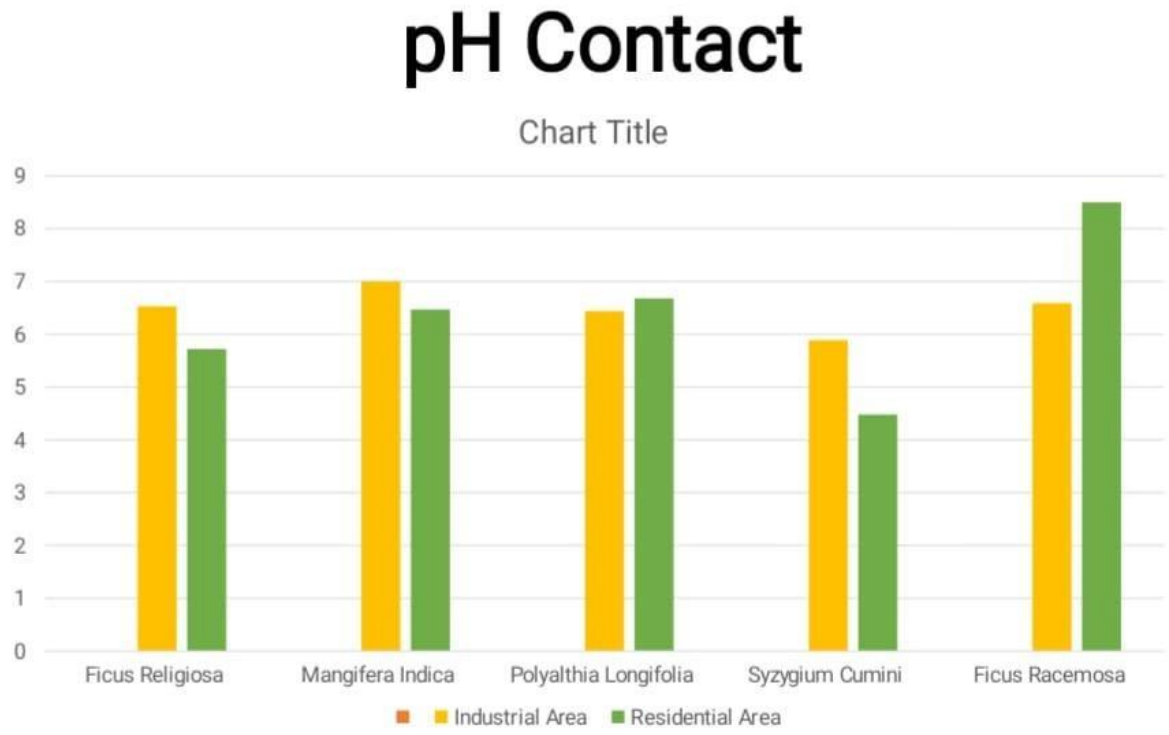
Ficus Religiosa (5.016) showed the highest value of average total chlorophyll content in Industrial as well as *Ficus Religiosa* (9.758) in Residential area (Table 1 and 2). The lowest average value of total Chlorophyll content was observed in *Polyalthia Longifolia* (1.038) from the Industrial area (Table 1) and in *Syzygium Cumini* (1.996) from the Residential area (Table 2).

There was decrease in Tchl in the tree leaves at Industrial area than in Residential.
Chlorophyll is an index of productivity of plant (Raza and Murthy, 1988). Chlorophyll content of plants signifies its photosynthetic activity as well as the growth and development of biomass. It is well evident that chlorophyll content of plants varies fromspecies to species; age of leaf and also with the pollution level as well as with other biotic and abiotic conditions (Abida, and Harikrishna, 2010). Whereas certain pollutants increase the total chlorophyll content other decrease it (Allen et al., 1987).



LEAF EXTRACT pH:

Highest value of leaf extract pH was recorded in *Mangifera Indica* (7.00) whereas its lowest value was observed in *Syzygium Cumini* in Industrial Area. In Residential Area , maximum value of pH was recorded in *Ficus Recemosa* (8.50) and its minimum value was observed in *Syzygium Cumini* .

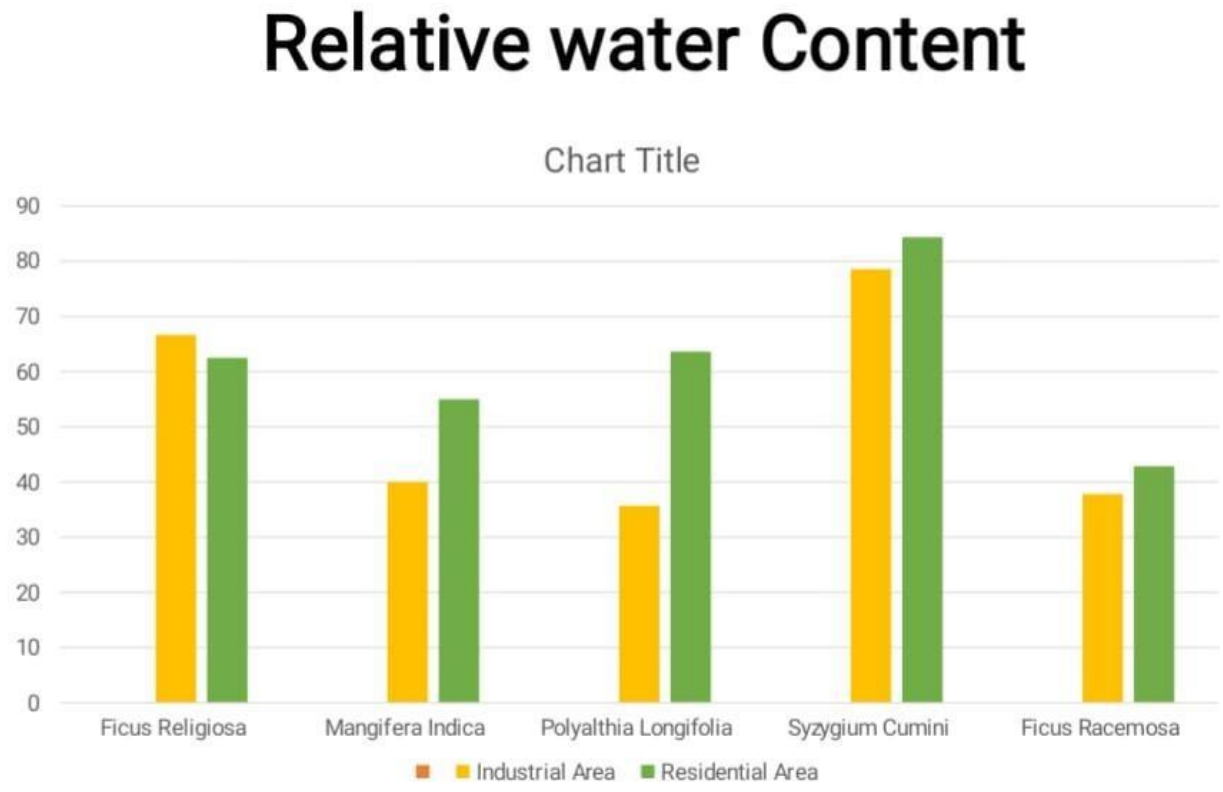


RELATIVE WATER CONTENT:

Highest value of average relative water content was noticed in *Syzygium Cumini* (78.57%) at the Industrial area (Table 1) and similarlyin Residential area the ascorbic acid content was found to be

hiegh *Syzygium Cumini* (84.37) (Table 2).Lowest value recorded, in *Ficus Racimosa* (37.83) at Industrial area and in also *Ficus Racemosa* (42.85).There was increase in relative water content in almost all tree species in Residential area than in Industrial area.

RWC of a leaf is the water present in it relative to its full turgidity. High water content within plant body helps to maintain its physiological balance under stress conditions such as exposure to air pollution when the transpiration rates are usually high. It also serves as an indicator of drought resistance in plants.
Due to the air pollution, there is reduction in transpiration rate and damage to the leaf engine that pulls water up from the roots (1-2 % of the total). Consequently, the plants neither bring minerals nor cool the leaf. Reduction in relative water content plant species is due to impact of pollutants on transpiration rate in leaves (Swami et al.,2004).

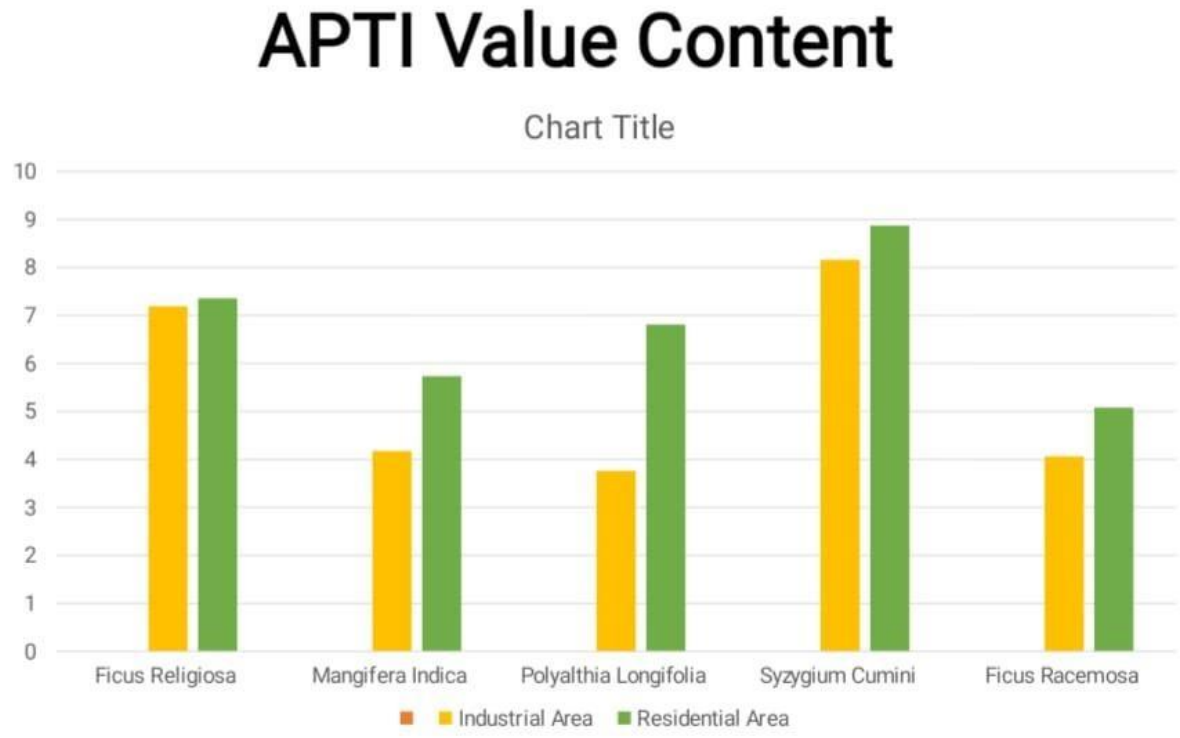


APTI VALUE CONTENT :

The maximum and minimum APTI value observed in Industrial area were 8.160 in *Syzygium Cumini* and 3.763 in *Polyalthia Longifolia* , respectively (Table 1). In residential area maximum APTI value recorded in *Syzygium Cumini* (8.873) and Minimum in *Ficus Racemosa* (5.079) ,respectively (Table 2). The highest increase in APTI value at Residential area was observed in the leaves of Cinnamomum camphora.

APTI values of different plant species responded differently to air pollution. Higher values of APTI found in all plants at polluted site than in control site indicate that these plants are tolerant. Rai et al. (2013)

All resultant APTI values correlated with some significant biological and socio-economic characters and the API determined for different species. Based on these traits, different grades (+ or -) were allotted to plants. All plants score according to their performance grades (Mondal et al., 2011).



CHAPTER: 8
-CONCLUSION

In the present study it was found that, as per APTI value, the tolerant species are *Syzygium Cumini* (8.160) and *Ficus Religiosa* (7.189), hence these species can be cultivated along the road side industrial area as they are least effected by the pollutants. and these plants are most tolerant plants found and useful as a bio-monitoring tool for the betterment of the environment. Hence, these plants can be planted and maintained in the industrial areas to control the effect of air pollution. Air pollution in the urban areas abetted partially by planting tolerant plant species as a greenbelt development initiative. Determination of APTI helps in identifying tolerant plant species.

APTI was found to be minimum in *Polythene longifolia, Ficus recemosa, and Mangifera indica,*hence this species should be avoided to be planted along the industrial area.
Out of five plant species studied, *Syzygium Cumini* found to be the best to be grown in both industrial as well as redintial locality. It has a dense canopy, which can give protection against pollution stress. The economic and aesthetic value of this tree is well known and it can be recommended for extensive planting as a first curtain.

Air pollution tolerance index (APTI) of plants is becoming a vital parameter because it assists the assessment of plants' tolerability to air pollution since the eventual increase of air pollution levels will be detrimental to the health of the existing vegetation. The results from this study provide information for the selection of tolerant species for future planning of the roadside landscape in order to mitigate air pollution and even ultimately reduce pollution Species in sensitive groups is best to be used as bio-indicators to air quality and species ranked as tolerant is best to be planted around areas with poor air quality since the tolerant species have the ability to absorb air pollutants. With increasing urbanization and industrialization, the air quality is degrading. Plants plays a significant role in mitigating the air pollution and maintains ecological balance. APTI determination is of utmost importance because with increase in small scale industries the pollution load rises at a rapid rate. From the results of the present study, tolerant plant species can be used as indicators of pollution there by acting as a sink to all air pollutants.

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CHAPTER: 9-REFERENCES

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