J B.N.Bandodkar College of Science

Volume 2 January 2014
(Yearly)

"Dream high, drive carefully, unite together; we will take this mission to newer heights".

Vidya Prasarak Mandal's
B.N.Bandodkar College of Science,Thane
NAAC Re-Accredited 'A' Grade
Best College Award (University of Mumbai)
Selected for FIST 'O' Level

Mission
To mould the students into rational thinkers, competent workers and socially aware citizens.

Vision
Imparting Quality Education in Science.

J B.N.Bandodkar College of Science

Editor's Message ……

Second scientific journal- **JBNB** (Journal of B. N. Bandodkar College) in the form of e- issue is being regular phenomenon of our Science College that affiliated to Mumbai University. The overwhelming response has been shown by our students being learners and teachers as rational thinker for the production of academic excellence. The scientific researches with this focused mind always produce dimensions to science era.

Compilation of this volume putting in the hands of reader, warrens, is due to greatly appreciation of students and teachers efforts. Especially congratulations to the students who immensely worked on project and contributed in special section 'Students Corner'. Scientific research papers such as Extraction of oil, Microbial study of infected plants leaves; Delopment of software; MATLABS ; some students also completed correlated reviews articles by giving facts is really been appreciated. Hence the purpose of the e-journal is to have constructive decisions by the student for the development pathways for developing countries. e-JBNB is growing from fetus to baby by creating path for the student to gen in their subjects. Because, inculcation of research culture among them is criteria of the journal. Its our immense pleasure to be on editorial of e-JBNB.

'Devotes itself not to making the important measurable but to making the measurable important'.

Dr. (Mrs) M.K.Pejaver

Dr. (Mrs) A.S.Goswami-Giri

J
B.N.Bandodkar College of Science

INDEX

Please Note: The Authors of the papers are alone responsible for the technical content of the papers and reference cited therein. However students' papers are considered as apprentice.

How to submit

Authors are required to submit manuscripts electronically by Email: asgoswamigiri@vpmthane.org

Strategies of Global Access in Higher Education

Anita S. Goswami-Giri[a], Milan J. Gholba[b] and Madhuri K. Pejaver[ab]

[a] Department of Chemistry; [b] Department of Statistics; [ab] Department of Zoology ;

B.N. Bandodkar College of Science, Thane (W), - 400 601. MS,(India)

Corresponding Authors:

[a] Anita S. Goswami-Giri : anitagoswami@yahoo.com
[b] Milan J.Gholba : mgholba@gmail.com
[ab]Madhuri K. Pejaver : formpejaver@yahoo.com

ABSTRACT:

Government and non-government bodies together shall brand constitutional limitations in federal legislation. Access, equity and relevance, reorientation of programmes in educations, moral values, ethics, assessment in unabridged system including teaching-learning, utilization of multiple task knowledge and capabilities, efficiency, accreditation of institutions , expectations from the Indian higher education system and qualities are the main tools which enhances the accession in higher education globally. Quality, Transparency, Policy, Social accountability are essential factors in any revolutions in higher education.

Keywords: Higher education**;** accountability; efficiency; teaching learning;

Introduction:

Developing countries are facing the difficulty of preparing new generations which will be able to tackle social and economic challenges in this increasingly globalised economy. Quality is a key factor to access the challenges of their country in terms of development and competitiveness because without quality, an education leads to desertion, causing individual and social costs. Challenges may provoke a fundamental change in higher education from the policy level to the institutional level and to the everyday lives of college and university administrators, faculty and students. Now the time has come to create a second wave of institution building and of excellence in the fields of education, research and capability building. India need higher educated people who are skilled and can drive our economy forward as the country lacks the critical mass in higher education.

Our President Pranav Mukherjee commented "The standards of higher education in India today need improvement. In ancient India, we had universities like Nalanda and Takshashila

which had established themselves as international centres of educational excellence where students from all over the world came and studied. We must change the reality of our universities for not figuring in the list of top universities. Indian universities should aim at becoming top educational institutions in the world with global standards of research, teaching and learning."

The Indian Institute of Science, Bangalore, comes in somewhere in the top 400 and IIT, Kharagpur. According to the University Grants Commission (UGC), India needs 1500 more universities with adequate research facilities by the end of the year 2015 in order to compete in the global market.

During the Diamond Jubilee function of the University Grants Commission in New Delhi on 27th December' 2013; our Prime Minister Manmohan Singh says 'University system should dwell more on research and Adopt inter-disciplinary approach than working individual departments that are largely operating as islands. He also expressed concern about the quality of higher education and pointing out that even Indian premier institutions do not figure among the best in the world.

Number of Ph.D.s produced each year is very low and those required by academia is far higher. Quality education in Indian Institute of Management (IIMs) and Indian Institute of Technology (IIT's) UGC, All India Council for Technical Education (AICTE), Distance Education Council (DEC), Indian Council for Agriculture Research (ICAR), Bar Council of India (BCI), National Council for Teacher Education (NCTE), Rehabilitation Council of India (RCI), Medical Council of India (MCI),Pharmacy Council of India (PCI), Indian Nursing Council (INC), Dentist Council of India (DCI), Central Council of Homeopathy (CCH), the Central Council of Indian Medicine (CCIM) and such other regulatory bodies from time to time to accommodate these development and yet maintain quality students in higher education.

Similarly, Prime Minister stressed on the need for strengthening the university-industry interface to give a fillip to Research and Development. Of the view that this would be beneficial to both the university system and the industry, he asked academics to make a detailed study of how this interface works in other countries so that the best international practices can be replicated in India.

Governmental committees, academicians, politicians and policy makers have the need

for radical reconstruction of the system and reformation. Libraries, Information technology, laboratories and classrooms that make it very difficult to provide top quality instruction or engage in cutting-edge research. The overall scenario of higher education in India does not match with the global quality standards. This gap has to be bridged if we want to speed up our path to development. Hence, there is enough justification for an increased assessment of the quality of the country's educational institutions. For the development of strategies needed to widen student access and success.

Strategies needed to widen student access and success:

Worldwide, the traditional control of the central elements of the academics; faculty is being diminished in the name of efficiency and accountability, business practices. Governance, the traditional term used to describe the uniquely participatory way that academic work, is being replaced by management/administration. The same review has also been conducted for six nations by Peta Lee (11 October 2013 Issue No:291) .In this system, motto of the authors in quality education should provide updating knowledgeable information to teachers, students and society. Effectiveness of widening participation of students in research and teaching focus, participation in the type and length of foundation programmes to elevate the standard of education.

Today, the traditional form of participatory government of university governance is being fiercely criticized. It is been considered alternately or simultaneously inefficient, corporative, insensitive to the society's needs and unable to reverse the diminishing quality of the teaching and research.

Another issue the premier flagged as an area of concern pertained to shortage of faculty; more so since the problem was likely to become more acute with the expansion that is planned in the coming years (Chinwe M. T. Nwezeh (**2010**).

Measures facilitate the equitable access to higher education resulting in the Gross Enrolment Ratio (GER) up to 19.4 % in 2010-11 from 11 % in 2005-06. The GER for women in higher education increased from 9.4 % to 17.9 % during the same period. But the GER was still below the world average and India had set for itself the target of 30 % by 2020. HR minister stating that a special drive would be undertaken to make teaching and research an attractive career option by using tools of communications technology that are

fast and explosive and by setting up of chairs in various universities in the name of Indian Nobel laureates.

Today's, learners are competent and confident internet users, although with the expected inequalities imposed by age, educational background and social class. There seems to be no clear, recognizable national strategy for the integration of ICT within academic curricula and pedagogical activities. It probably depends more on the school leadership and dynamism and enthusiasm of teachers.

Teachers in the developing world will have to change their teaching styles and acquire Internet skills as new technologies. ICT Services includes the use of various computer operating systems including software packages specially designed for library operations and data management applications. These can be harnessed by academics for good scholarly work. These technology oriented services have shifted most university libraries from traditional library services to technology oriented services. Libraries these days provide reading resources as well as online information. (Chinwe M 2010)

Collaborations between higher socio-economic groups, middle-income students also issue to attend for access and success in higher education. Foundation courses for longer term impact of this approach on outcomes for students allow them to develop integrally in conditions of equality, politicized and have become subject to caste communal considerations.

Reflecting on the findings of a confidential report by the National Assessment and Accreditation Council (NAAC) shall recommend to the University Grants Commission (UGC) to improve the rules and regulations, by providing financial aid for the upgrading educational Institute, Collaboration among Government and non-government bodies, upliftment of meritorious and economically backwards students.Regulation should not be left to the market; governments should design ordinance to force institutions to behave in accordance with the goals of governmental policies. The financing contracts are based on performance and the assessment systems.

"Low-ranked' universities also require attending these above points. Still the thorny issue of financial aid also came under the spotlight, as did international comparisons on basic and further as well as higher education.

To achieve this goal rigorously involve Efficiency, or delivering the most effective use of limited public and institutional resources,

was key to achieving an appropriate balance between financial support, outreach and retention activities at higher education institutions worldwide.

Conclusion:

Collaborations between higher socio-economic groups, Adopt inter-disciplinary approach, Accreditation of quality work, ruling policies, mass skilled programs and tools of communications technology may figure out Indian academic institutions among the best in the world with global standards of research, teaching and learning.

References:

1. Peta Lee11 October (2013) Issue No: 291 Strategies needed to widen student access and success, University world news.

2. www.thehindu.com › News › National Dec 28, 2013.

3. Chinwe M. T. Nwezeh (2010)The Use of ICT in Nigerian Universities: A Case Study of Obafemi Awolowo University, Ile-Ife *Library Philosophy and Practice 2010 College and Research Libraries 65*(4):276-286.

STUDY OF MEMBERSHIP FUNCTIONS IN THE DEVELOPMENT OF FUZZY MATHEMATICS

A. S. SHINDE

Department of Mathematics, B.N.Bandodkar College of Science, Thane (W)- MS 400 601.

akankshashinde1@rediffmail.com

ABSTRACT:

The aim of this paper is to study fuzzy logic and its applications. Also, we study different types of membership functions. These membership functions are simulated by MATLAB software.

KEYWORDS: Fuzzy logic, Membership functions, MATLAB software.

1. INTRODUCTION

Fuzzy logic is another form of artificial intelligence (AI), a branch of engineering that deals with the development of computer programs based on the study of human intelligence and nature of human thinking. "As complexity rises, precise statement loses meaning and meaningful statements lose precisions". Based on this, Dr. Lofti A. Zadeh, a computer scientist at the University of California, Berkeley, originated the 'fuzzy logic' or fuzzy set theory in 1965 that gradually emerged as a discipline in AI. Fuzzy logic is much more than a logical system. It has many facets. The principal facets are: logical, fuzzy set theoretic, epistemic and relational. Most of the practical applications of fuzzy logic are associated with its relational facet [3].

Progression from bivalent logic to fuzzy logic is a significant positive step in the evolution of science. In large measure, the real-world is a fuzzy world. To deal with fuzzy reality what is needed is fuzzy logic. In coming years, fuzzy logic is likely to grow in visibility, importance and acceptance.

In fuzzy approach, each variable is represented by triangular or straight line segment membership functions (MFs). Although the triangular membership function is most commonly used, the shape may be trapezoidal or Gaussian (bell- shaped) [1].

The conventions of various membership function shapes are simulated by MATLAB software, in detail in section III and in Section II some basic concepts used in fuzzy mathematics are discussed. Section IV presents applications of fuzzy mathematics in various fields.

2. CONVENTIONS OF FUZZY TERMS

To enable a discussion of membership functions, we need to formally define the terminology used in fuzzy logic. In this section, we study some basic definitions used

in the development of fuzzy mathematics [2, 4].

2.1: Fuzzy set: A fuzzy set μ is a function from the reference set X to the unit interval, i.e.

$$\mu : X \to [0,1]$$

Where,

$\mu(X)$ represents the set of all fuzzy sets of X.

2.2: Membership function: The membership function is a graphical representation of the magnitude of participation of each input. It associates a weighting with each of the inputs that are processed, define functional overlap between inputs, and ultimately determines an output response. It is a graphical representation of fuzzy sets, $\mu_F(x)$.

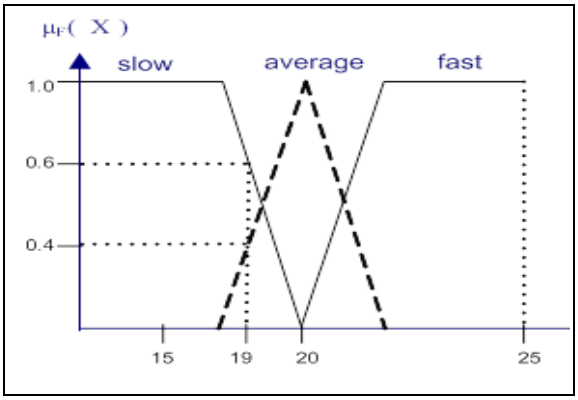


Figure 1: An example of fuzzy logic membership function

Above figure shows membership functions of three fuzzy sets, "slow", "average", and "fast", for a Fuzzy variable *Velocity* The universe of discourse creates all possible values of *Velocity*, i.e., X = 19.

For *Velocity* value 19 km/h, the fuzzy set "slow" has the membership value 0.6. Hence,

μ_{slow} (19) = 0.6. Similarly, $\mu_{average}$ (19) = 0.4, and μ_{fast} (19) = 0.

2.3: Universe of discourse:

It is a range of all possible values considered as fuzzy system input.

2.4: Degree of membership: The degree of membership of an element in fuzzy logic can be any real number in the interval [0, 1].

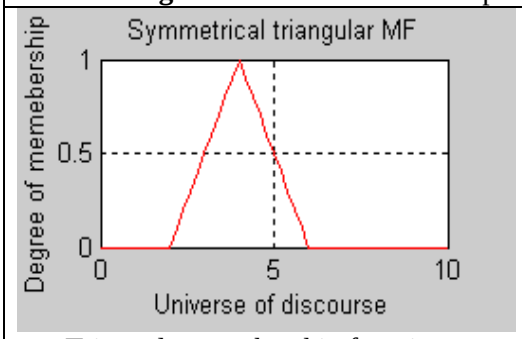
2.5 Support of fuzzy set: The support of a fuzzy set A is the crisp set of all elements of X with nonzero membership in A, symbolically

$$S(A) = \{x \in U / \mu_A(x) \geq 0\}$$

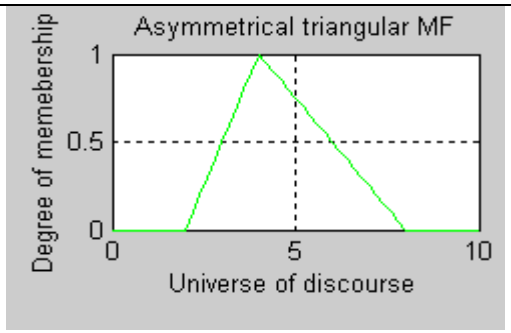
2.6: Level set: The α-cut of fuzzy set A at level α is the set of those elements of A where membership function is greater than or equal to α. Mathematically the α -cut of a fuzzy set A defined over a universe of discourse U is

$$A_\alpha = \{x \in U / \mu_A(x) \geq \alpha\} \quad 0 \leq \alpha \leq 1.$$

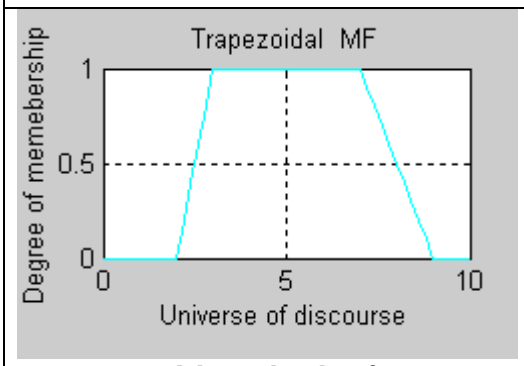
Figure 2 Various membership functions and their MATLAB simulation.



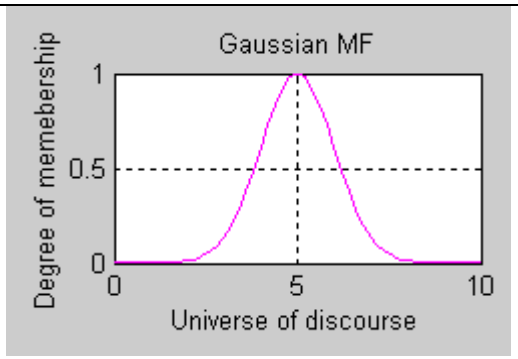
Triangular membership function



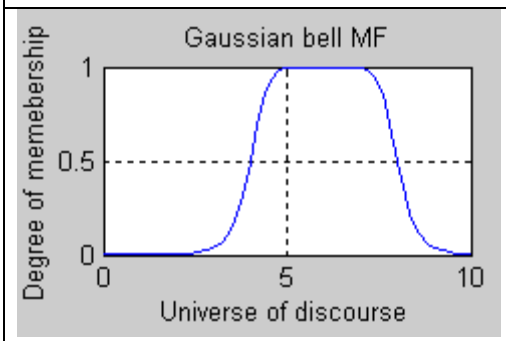
Asymmetrical membership function



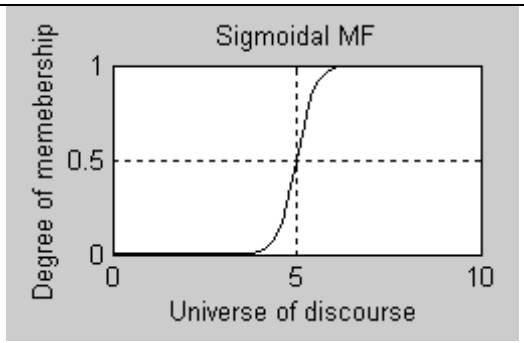
Trapezoidal membership function



Gaussian membership function



Gaussian Bell membership function



Sigmoidal-right membership function

3. MEMBERSHIP FUNCTIONS

In this section, review some available membership functions. It is our view that fuzzy systems developers should be careful not to miss opportunities to best represent human

knowledge by excluding such fuzzy sets without consideration.

In a fuzzy system, each input and output variable is composed of two or more overlapping fuzzy sets specifying the variable range on x-axis as the universe of discourse. Each variable has a minimum and maximum value, varying in increasing order from left to right. These values can be both positive and negative. The membership functions can have different shapes such as triangular, trapezoidal,

Gaussian,bell-shaped, etc. It can be symmetrical or asymmetrical [4, 5].

Though triangular and trapezoidal membership functions are simple as they are straight-line functions, Gaussian and Bell- shaped membership functions are more popular because they are smooth and non-zero at all points. A sigmoidal membership function can be open to the right and left. In addition to this, users can generate any other arbitrary functions.

Following table shows some fuzzy membership functions and their MATLAB simulation.

4. APPLICATIONS

In recent years, the number and variety of applications of fuzzy logic have increased significantly. The applications range from consumer products such as cameras, camcorders, washing machines, and microwave ovens to industrial process control, medical instrumentation, decision-support systems, and portfolio selection [2,3,6].

Fuzzy logic has recently been applied in the field of process control, modeling, estimation, stock market prediction, military science, etc. In recent years, the application of power electronics has grown tremendously. Rapid advances made in microelectronics had great impact on the evolution of power electronics products by making the technically and economically feasible. Some applications that are increasingly being dominated by power electronics are [5]:

a. Switched mode power supplies,

b. Adjustable speed motor drives,

c. Efficient control of heating and lighting,

d. Efficient interface for photovoltaic,

e. High voltage dc system for efficient transmission of power.

5. CONCLUSIONS

(i) We study the importance and development of fuzzy logic in various fields.

(ii) We study different membership functions and these functions are simulated by using MATLAB.

6. REFERENCES

[1]. **Kosko, Bart**. [*Fuzzy Thinking]* New York : Hyperion, 1993.

[2]. **Nguyen, Hung T., Nadipuram R. Prasad, Carol L. Walker, and Elbert A. Walker**.[*A First Course in Fuzzy and Neural Control]* . Boca Raton, FL: Chapman & Hall/CRC, 2003.

[3].**Dorf, Richard C., and Robert H. Bishop.** [*Modern Control Systems]* . 9th ed. Upper Saddle River , NJ : Prentice Hall, 2001.

[4].**Wang L-X., Hassanein H., Alian.N.**,[Adaptive fuzzy systems and control: design and stability analysis. Englewood Cliffs, N.J: Prentice Hall], 1994, xxvii, 275 p. ISBN 978-013-1471- 092.

[5].**Witold, Pedrycz** [*Fuzzy Sets Engineering]*. Boca Raton , FL : CRC Press, 1995.

[6].**Zadeh, L.** (1965) [*Fuzzy sets]*. Information and Control 8 (1965), 338-353.

STUDIES ON THE MORPHOLOGICAL AND UTILITARIAN ASPECTS OF INDIAN SAGO PALM (*CARYOTA URENS* L.)

Tejal Ambre and Moses Kolet*

Department of Botany, B.N.Bandodkar College of Science, Thane, 400601

*corresponding author, Email: mjkolet@vpmthane.org

ABSTRACT:

Palms are one of the most significant groups of plants of economic value to mankind. The Indian sago palm (*Caryota urens* L.), a lesser acclaimed palm of tremendous value and potential, is a common tree in peninsular India and one of the common wild palms in the Western Ghats. Its elegant nature and distinct silhouette have found applications in gardening and landscaping. Despite its insignificance in international trade, the tree is nevertheless of great value and regarded as a boon of nature by tribal folk for fulfilment of their basic needs of life. A survey of this palm was carried out and important facts are compiled and presented. The economic value of the tree was studied. Low numbers of the tree in the area of study are a cause of concern and conservation measures for increasing its population are urgently required and recommended. Systematic efforts are also required to popularize the palm in landscaping and gardening.

Keywords : Key words: *Caryota urens*, *berli maad*, fish tail palm, Indian sago pal

INTRODUCTION:

Members of the botanical family Arecaceae (Palmae), referred to as the palms, have always been close to humanity, prominently featuring as one of the most significant group of plants of economic importance to mankind. Their fruitful association with human civilizations can be traced back to ancient times, when they provided basic necessities of life (Balambal, 1993) and were considered as indicators of health (Sadhale, 1996). In recent times also, palms are the mainstay of agro-horticultural economy, yielding thousands of products, especially in the tropics (Leaser, 2005). The family holds several records in the plant kingdom (Kolet *et al*., 2013). Palms occur both in wild and cultivated habitats; about 63 palms are reported indigenous to India and an almost equal number of exotic introductions have been acclimatized in the country (Mahabale, 1982). Kulkarni and Mulani (2004) reported 96 species of palms in India. While those such as the coconut (*Cocos nucifera* L.) and areca nut (*Areca catechu* L.) have enjoyed

status of economically important plants, other members of the family are none the less important; one such member being the fish tail palm, one amongst the 7 species of the genus *Caryota*, known to occur in India (NISCAIR, 1992).

This palm, also known as the Indian sago palm (*Caryota urens* L.) has been reported as a common tree in India (Kirtikar and Basu, 2007), one of the commonest wild palms in the Western ghats (Santapau, 1999); recorded in the Mumbai, Konkan and Malabar regions, and also a component of sacred groves in some parts of Maharashtra (Gazetteer of India, 1987). The palm is generally solitary in habit in the wild. Its distinct silhouette and lofty handsome elegant nature has awarded this tree a unique status in the domains of gardening and landscaping (Gopalaswamiengar, 1991; Swarup 1997). The tree has a fast rate of growth, reaching heights of 12-18 metres and sometimes even up to 30 metres (Santapau, 1967). Although *Caryota urens* does not feature prominently in international trade and business, in comparison with other cultivated palms of commerce, this tree is nevertheless revered as a boon of nature and a divine tree by aborigines and tribals for fulfillment of basic needs of life, especially in places where the coconut does not grow (Gunjatkar and Vartak, 2004). While its potential remains underutilized, numbers of this lesser acclaimed palm, of great value, in wild and cultivated habitats are fast dwindling, and the information available is also scattered and piecemeal, all of which inspired the present investigation.

MATERIALS AND METHODS:

The study was carried out from April 2012 to October 2013; wherein a survey of *Caryota* palms was carried out in the Chendani and surrounding areas of Thane, India. The specimens were identified in the field and in the department of botany, B.N Bandodkar College of Science, using standard literature. The related facts presented in the section of results and discussion, were compiled from different sources, duly cited in the references section.

RESULTS AND DISCUSSION:

Four specimens of fish tail palm (*Caryota urens* L.) were recorded in Chendani area of Thane and a few more in the surrounding areas. The characteristic features and morphology of the palm tallied with the descriptions of NISCAIR (1992), Santapau (1999) and Kirtikar and Basu (2006, 2007). Quadros (2009) documented the palm from an educational campus in Mumbai. In cultivated habitats, the tree is usually planted at perimeters of gardens and landscapes or sometimes even positioned as an avenue tree. The basic facts and information on this tree is presented in Table 1. The fruits contain needle like crystals and the pulp has been reported as irritating and toxic, causing several hours of inflammation and discomfort in the mouth and tongue (Santapau, 1999; Parrotta, 2001). The

growth being determinate, no new leaves are known to arise after emergence of the first immense inflorescence from the axils of one of the upper leaves, thereby indicating initiation of its reproductive phase (www.lawersnjurists). The flowering which begins from the top, continues downwards year after year for the next several years, till the tree is finally exhausted, signalling the end of its life span. Such an exhausted tree usually breaks near the top with a loud explosive crack and the crown topples down; the still standing trunk, if not cut down, gradually disintegrates over the next 4-5 years by the combined action of physical, chemical and biological forces acting upon it. Considering the findings of the tree census in Thane (TMC, 2012), the population of *Caryota urens* in the city and area of study, comprising a handful of specimens, is very negligible and needs a boost in numbers. Species of the genus *Caryota*, as all other palms in the wild have been threatened by anthropogenic factors and conservation measures worth mentioning are apparently almost negligible, which is a cause for concern.

The economic value of the palm is depicted in Table 2. The basic products of importance are its sap/ sweet toddy, fibre and edible starch; the lesser ones being its bud, leaves, wood, trunk, peduncle, roots and fruits. All parts of the fish tail palm are valuable and yield products which have several applications (Table 2). The tree is valued in Sri Lanka for its sweet sap and jaggery (De Zoysa, 1992). Kumar *et al*., (2012) reported this palm a source of income for tribals from Chhattisgarh in India. The fibre yielding potential of this tree was considered by Pandey and Gupta (2003) while Renuka *et al*., (1996) carried out an audit of its utilization. The utilization potential of its starch was reported by Rajyalakshmi (2004). The palm also has medicinal value (Parrotta, 2001). There was a consensus regarding underutilization of the tree however, considering its rapidly dwindling numbers and low rates of germination under prevailing natural conditions, there is an urgent need for conservation measures and steps to increase its population for sustainable exploitation of this natural asset. Systematic attempts and efforts are also required and recommended to popularize the species in gardens.

Table 1: Basic Facts on Fish Tail palm.

(NISCAIR, 1992; Santapau, 1999; Kirtikar and Basu, 2006)

Information	
Botanical name	*Caryota urens* L.
Family	Arecaceae (Palmae)
Vernacular names	*Berli maad* (Mar.), *Dirgha*, *Meda* (Sans.), Fish tail palm, Horse tail palm, Indian sago palm, Jaggery palm, Malabar palm, Toddy palm, Wine palm, Kittool tree
Origin	Indigenous to India, Sri Lanka and Malaysia
Distribution	Tropical; common in the wild, in evergreen, semi evergreen and moist deciduous forests; occasionally cultivated, also planted in gardens
Habit	Evergreen tree, unbranched
Appearance	Attractive, elegant and graceful, especially when young; old specimens appear wild and ragged; very distinct silhoutte
Requirements	Loam, sandy or sandy loam soil with good drainage, leaf mould manure, plentiful water supply for best results; however can adjust to any type of soil
Growth	Quick growing, attains full height and vegetative growth within 10-15 years
Flowers	Summer or little later, flowering and fruiting continues all round the year
Fruits	January-June
Propagation	By seeds
Germination period	150-180 days
Germination tip	Presoaking seeds in cold water for enhanced germination in shortened period
Expected life span	20-25 years. The tree continuously produces flowers in huge pendulous panicles from axil of upper leaf, the flowering descending downwards in subsequent years from axils of lower leaves, till the tree is exhausted; flowering continues till the end
Progeny	Mature fruits fall on the ground and few self sown seeds germinate and start growing around the parent tree; animals are also known to aid dispersal

Table 2: Contribution of Fish tail palm (*Caryota urens* L.) towards utility products.

(Gunjatkar and Vartak, 2004; NISCAIR, 1992; Parrotta, 2001; Rajyalakshmi, 2004; Renuka et al., 1996; Santapau, 1999)

Plant part/ product	Utility
Entire tree	Ornamental tree in gardens and landscapes
Spadix	Sweet juice/ sap (*neera*)
Roots	Charcoal of excellent quality used by gold smiths
Trunk*	Durable close grained termite resistant wood/ timber Fishing rods, walking sticks *used for wood after last flowering
Pith (trunk)	Pith flour, popular famine/ emergency food
Fibrovascular bundles	Commercial Kittul fibre (salopa fibre, black fibre)
Leaves	Thatching material, partitions, pandals Feeding elephants Flower arrangements Fibre, used in cordage Green manure
Scruff from leaf stalks	Caulking of boats
Inflorescence	Decorations
Fruits	Long spikes used for decorations Nuts used for beads, buttons and decorations Nuts rarely used for chewing like betel nut by tribals Immature nuts used in adulteration of chopped areca nuts Medicinal, treatment of hemicranias, Used in ayurveda to reduce thirst and fatigue
Peduncle	Used for tying bundles of firewood, as roofing material and partitions for huts
Terminal bud*	Edible, cooked as vegetable, pickled *As numbers are dwindling, they are not cut for the terminal bud as it destroys the tree
Wooly substance (from apical portion)	Caulking of boats
Wood/ timber	Agricultural equipments, plough shafts, tool handles, water conduits Rice pounders, containers Rural construction, fencing, beams, rafters, ornamental work, spikes Tribal drums Potential applications as panelling and flooring material
Dye from fruits	Edible dye used to colour areca nuts
Fresh sap	Fresh sap is medicinal (laxative) Yields palm wine/ sweet toddy (neera) Used for making jaggery/ palm gur Raw material for vinegar, food yeast and palmolates On fermentation yields toddy

Toddy	Ethnomedicinal value Distillation yields arrack (strong alcoholic beverage)
Jaggery/ palm gur	Preparation of palm candy,Sweetener Treacle (syrup- used in confectionery)
Pith flour	Bread making, Preparation of gruel Yields starch/ sago (of excellent quality)on processing
Starch / sago (Palm starch)	Biscuits, bread, confectionary, crackers, desserts, fish crackers, modified starch, noodles, sago pearls Caramel, dextrose monohydrate, glucose syrup, high fructose syrup, maltodextrins, maltose, mono sodium glutamate, sweeteners Adhesives, biodegradable plastics, paper industry, plywood, textile industry
Fibres	Sack making, cloth, corsets, caps,Gun brushes, brooms, brushes, bristles, cloth brushes, hair brushes, horse brushes, brushes for under water operations,Mattresses, baskets, bow strings stuffing upholstery Strong ropes (used to tie elephants, newly captured wild elephants, fishing vessels, steamers, ships) Fishing nets, fishing lines, sewing, manufacture of paper

REFERENCES:

Balambal, V. 1993. Agriculture in the sangam age In, Agriculture in Ancient India (V.V.Bedekar, Ed.). Itihas Patrika Prakashan, Thane. pp26-39.

De Zoysa, N. 1992. Tapping patterns of the Kitul palm (*Caryota urens*) in the Sinharaja area, Sri Lanka. *Principes* 36(1): 28-33.

Gazetteer of India. 1987. Maharashtra State Gazetteers, Botany- Part IV. Gazetteers Department, Govt. of Maharashtra, Bombay. pp 438-663.

Gopalaswamiengar, K.S. 1991. Complete Gardening in India. . Gopalaswamy Parthasarthy, Bangalore, India. pp 544-553.

Gunjatkar, N. and Vartak, V.D. 2004. Ethnobotanical and floristic studies on Bherli-mad (*Caryota urens* L.) from Western India. In,

Focus on Sacred Groves and Ethnobotany (Ghate, V., Sane, H. and Ranade, S.S., Eds.). Prism Publications, Mumbai. pp. 89-95.

Kirtikar, K.R. and Basu, B.D. 2006. Indian Medicinal Plants Plate Vol. IV. International Book Distributors, Dehradun, India. Plate No. 986.

Kirtikar, K.R. and Basu, B.D. 2007. Indian Medicinal Plants Vol. IV. International Book Distributors, Dehradun, India. pp. 2556-2560.

Kolet, M., Ambre, T. and Zanjad, S. 2013. A survey of palms from Jnanadweepa campus and studies on their status of conservation. *Proc. National Conference on Biodiversity: Status and Challenges in Conservation-FAVEO 13* (B.N.Bandodkar Colege of Science, Thane): 201-204.

Kulkarni, A.R. and Mulani, R.M. 2004. Indigenous palms of India. *Curr. Sci*. 86(12): 1598-1603.

Kumar, S., Poya, J.K., Soni, V.K. and Nema, S. 2012. *Caryota urens*: a potential species for livelihood support of rural people in Bastar region of Chhattisgarh. *Life sciences Leaflets* 7: 34-40.

Leaser, David. 2005. Palm Trees: A Story in Photographs. Westwood Pacific Publishing, USA.

Mahabale, T.S. 1982. Palms of India. Monograph No. 3. Maharashtra Association for the Cultivation of Science, Pune, India.

NISCAIR. 1992. The Wealth of India, Raw Materials Vol 3 (rev.) Publications and Information Directorate, CSIR, New Delhi. pp 320-324.

Pandey, A. and Gupta, R. 2003. Fibre yielding plants of India: genetic resources, perspective for collection and utilization. *Natural Product Radiance* 2(4): 184-204.

Parrotta, J.A. 2001. Healing Plants of Peninsular India. CABI International, Oxon, New York. pp 112-113.

Quadros, G. 2009. Report of the 'Study of the Biodiversity of Indian Institute of Technology Bombay Campus' by World Wide Fund for Nature, India, Maharashtra State Office, Mumbai. www.iitb.ac.in

Rajyalakshmi, P. 2004. *Caryota* palm sago a potential yet underutilized natural resource for modern starch industry. *Natural Product Radiance* 3(3): 144-149.

Renuka, C., Bhat, K.V. and Chand Basha, S. 1996. Palm resources of Kerala and their utilization. KFRI Research Report 116. Kerala Forest Research Institute, Thrissur.

Sadhale, Nalini (Tr.). 1996. Surapala's Vrikshayurveda (The Science of Plant Life by Surapala). Agri-History Bulletin No.1. Asian Agri-History Foundation, Secunderabad, India. pp. 43-62.

Santapau, H. 1967. The Flora of Khandala. Records of the Botanical Survey of India, vol XVI No. I (3rd rev. edn.). Govt. of India. pp 288.

Santapau, H. 1999. Common Trees (7th Rep.). National Book Trust, India. pp. 74-86.

Swarup, V. 1997. Ornamental Horticulture. Macmillan India Ltd. Delhi. pp 129-133.

TMC. 2012. www.thanecity.gov.in/department (tree authority and garden department)

www.lawyersnjurists.com/biological investigation- *Caryota urens* (30/12/2013)

Extraction and physicochemical Characterization of *Citrus limon* seed oil

Pooja Kanse, Ashwini Bhor, Ritesh Oza and Anita S. Goswami – Giri*

Department of Biochemistry, B.N.Bandodkar College of Science, Thane - (W)-400 601.

Address for correspondence *: anitagoswami@yahoo.com

ABSTRACT:

Lemon /*Citrus limon* is the third most important species of citrus after orange and mandarin. It contains 5% citric acid having pH 2 and 3 which contributes for a sour taste. Huge quantity of Lemon seed discarded as an agroindustry waste a potential source of oil. Hence, its seeds have been renewed for the extraction of oil by solvent. The yield of oil is 75% (W/V) having pale yellow in colour. Its Physicochemical characteristic was determining by measuring its saponification value, iodine value, acid value. The extracted oil had refractive index 1.473-1.476 at 20^0C and specific gravity 0.677 g/ml, iodine value was 109.2-111.3, acid value was 0.156 while the saponification value was 9.52. A significant level of Fe was also present in the lemon peel. Fe, Cu, Zn and Mg play an important role in biological systems; they are essential for nutrition and are widely used in the field of clinical medicine, environmental science, medical jurisprudence and health.

KEYWORDS: oil extraction**,** lemon seed**,**

INTRODUCTION:

Citrus Limon, /Lemon is a small tree in the Rutaceae that originated in Asia including India and Pakistan. Grown commercially worldwide in tropical, semi-tropical region and is also warm temperate countries[1, 2] including California, Florida, Arizona, and Texas[1,3] . There are many common varieties of this fruit including Lisbon, eureka, ponderosa and Meyer.

Lemon fruit juice and flavours acts not only in beverages and cooking as a freshener but also act as a preservative due to its anti-oxidant properties. Juice is highly acidic containing abundantly citric acid, vitamin C[2] and other important constituents such as potassium, calcium, B-Complex vitamins, flavonoids and iron etc. Citric acid tart flavour is popular in beverages, ice-creams, desserts, salad dressings, and many meat and vegetable dishes. The fruit exhibited 29 calories per 100 g. Lemons contain limonene is an antioxidant that is important to the immune system.

Indian market for processed food is growing at over 12% a year, propelling demand for flavors in savoury foods and beverages as the large food makers make inroads into the region. Huge quantity of Lemon seed discarded as an agroindustry waste a potential source of oil and value added. Presently, lemon oil also obtained from peal is used in wood cleaning; polishing and also it act as non-toxic pesticide[4].Traditional medicinal uses for the fruit peels, oil, and oil obtained from seed include treating fever and colic and as an astringent and diuretic[5]. Lemon oil has a sharp, fresh smell, is a pale-yellow in colour and is watery in viscosity[6]. The shelf life of lemon oil is only 8-10 months. Lemon essential oil is used widely in aromatherapy application as a kind of "cure-all" especially as it relates to infections illness[7]. It has a used for fever, malaria, typhoid and scurvy, for skin care, balancing digestive disorders, cold and respiratory ailments and to affect mood[8]. Lemon oil is a complex organic compound isolated from citrus peel, which is commonly used as a flavouring agent in beverages, foods, cosmetics, and household products [9]. Nevertheless, so fat no specific study in form of following objectives-

1. Extract the oil from lemons seed,

2. Characteristics of the lemon seed oil,

3. Study physicochemical characteristic of seed oil was yet reported.

MATERIAL and METHODS

Materials:-

KOH, HCL, Phenolphthalein, indicator, potassium hydroxide (0.1N), Iodine, monochloride reagent, potassium iodide, 0.1 N sodium thiosulphate, 1% starch indicator solution, chloroform from loba chemicals Thane, Iodine crystals from sigma. Weighing balance, Abbe-Refractometer, UV Chamber, TLC Plates [silica gel $60F_{254}$ Precoated on AL plate], Shimadzu UV Spectrophotometer [UV-1800].

Preparation of fat solvent:

Equal volumes of 95% volume of alcohol and ether neutralized to phenolphthalein.

Distilled water used throughout the experimental work.

Method:-

Collection of lemon seed:

Lemon seeds were collected from local market of Thane (MS) India in the month of June and November 2013. Seed were manually segregated by cutting fruits and seed were washed with tap water dried well, powdered stored in a sealed bag until the use in freeze.

I] Extraction of oil:

The dried lemons seeds powdered (10gm) was kept in thimble of soxhlet extractor for extraction of oil using n-hexane. The process was continuously monitored from to 90 min to

180 min. After 30' sample was tested for fatty acid . At the end of this period, the solvent was recovered by simple distillation and oil was allowed to cool, and weighed. The extracted oil sample was in well-sealed glass bottle and kept for analysis test.

II] Characterisation of lemon seed oil:

a) Ninhydrin test for protein

Oil sample and few drops of ninhydrin reagent were mixed. This solution was boiled in water for 2-3 min.

b)Barfoed's test:

Barfoed's reagent, a mix of ethanoic (acetic) acid and copper (II) acetate, is combined with lemon seed oil solution and boiled it. A red copper (II), oxide precipitate formed.

c) Saponification value:

Alcoholic KOH solutions ($10cm^3$) were diluted into $100cm^3$ with distilled water in a standard measuring flask. $10cm^3$ of the solution was pipette out in a conical flask and titrated against 0.1N HCL solution by using phenolphthalein indicator. End point was pink to colourless. $10cm^3$ of the standardized alcoholic KOH solution added to the lemon seed oil solution in a round bottom flask. Water condenser was fixed to the round bottom flask. After Reflux for 90 min, cooled and diluted the contents of the flask to $100cm^3$ in standard measuring flask, with distilled water. $10cm^3$ of it was pipetted out in conical flask and titrated against 0.1N HCL solution from the burette using phenolphthalein indicator. End point was pink to colourless.

d)Acid Value:

Lipid compound (10 g) was accurately weighed and the melted fat was suspended in about 50 ml of fat solvent. 1 ml of phenolphthalein solution was added and mixed thoroughly and titrated with 0.1N KOH until the pink color was obtained.

e)Iodine value:-

Lemon seed oil (10 ml) was dissolved in chloroform in an iodination flask labelled as "test". 20 ml of iodine monochloride reagent into the flask was added and the contents were mixed. The flask was incubated for 30 minutes in dark. After incubation of first "test" flask, in that 10 ml of potassium iodide solution was added. Rinse the stopper and the side of the flask with distilled water, then this "test" solution was titrated against standardized sodium thiosulphate solution until a pale straw colour observed. Starch indicator was added into the contents in the flask till a purple colour was observed. Endpoint was purple colour to colourless. This is the end point of the titration, similarly the procedure is repeated for the iodination flask and the end point is recorded.

Specific gravity-

Specific gravity of lemon seed oil is determined by dividing the weight in air expressed in gm of the quantity of a liquid which fills a pycnometer at 20 degree or 25 degree c by the capacity of the pycnometer at 20 degree or 25 degree c respectively expressed in ml. The capacity of pycnometer at these temperatures is ascertained from the weight in gm of the quantity of water required to fill the pycnometer.

The following data is assumed –

20^0C – 0.99719 gm

25^0C – 0.99602 gm

Ordinary deviation in the density of air will not affect the result of determination significantly for pharmacopoeia purpose. Since pycnometer was not available, following methods was carried out:-

Empty beaker was taken and tarred the weight. Oil (1ml) was added and weight was noted. Again it was tarred and by serially addition of volume of oil in same beaker and weight was noted. Foe the exact measurement of specific gravity the process was recycled for 10 times. Weight per volumes value was calculated statically.

Refractive index-

Refractive index of the oil sample is done by Abbe-refractometer.

Thin layer chromatography:-

TLC analysis of the oil was carried by using solvent system is chloroform+ n-hexane. The bands were developed using iodine crystals and observed in UV Cabinet.

UV Spectrophotometer:-

Absorbance maxima of the oil were obtained by spectrophotometric analysis using n-hexane as a blank. A λ maximum was used for further quantification studies.

III] Stability of lemon seed oil [14]:

Extracted oil was kept at room temperature as well as in the freeze to check its stability.

RESULT AND DISCUSSION:

Lemon oil is said to be uplifting and to relieve stress. Lemon seed (10g) procured 9ml of oil(W/V) (figure 1).The oil was extraction after 90min and showed the same characteristic which was extracted at 180 min. Physicochemical characteristic of it is shown in table 1.

Figure 1 Isolated Lemon Seed Oil.

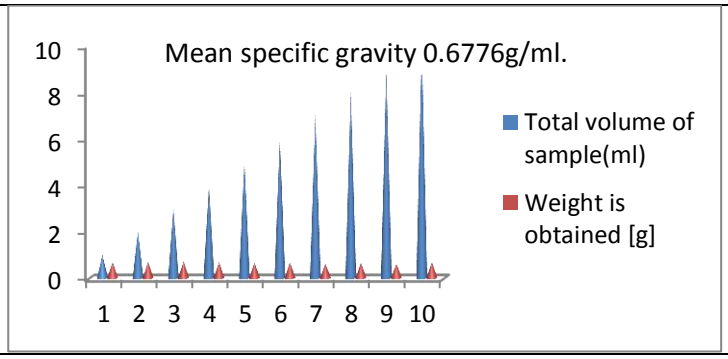


Figure 2 Specific gravity of various sample of lemon seed oil.

Table 1 Physicochemical characteristic of lemon seed oil.

Description	**Result**
Color	Yellowish
Smell	Fresh smell
pH	2 to 3
Saponification value	9.52
Acid value	0.156
Free Acid	1.04
Iodine value	109.2-111.3
Refractive index	1.473-1.476 at 20^0C
Ninhydrin test	Protein present
Barfoed's test	Carbohydrate present

UV Spectrophotometric study

λ nm	**Absorbance**
963.00	0.152
661.00	0.150
535.00	0.248
451.00	4.000

Table 2 Rf values of lemon seed oil after dialysis on natural filtration media

Spots	**Rf value**	**Color of the spot**	**Triglycerols**
1	0.070	Dark Brown	Saturated fatty acid methyl esters
2	0.105	Brown	Saturated fatty acid methyl esters
3	0.157	Yellowish Brown	Saturated fatty acid methyl esters
4	0.192	Dark Yellow	Monoenoic fatty acids methyl esters
5	0.333	Dark Yellow	Monoenoic fatty acids methyl esters
6	0.456	Yellow	Monoenoic fatty acids methyl esters
7	0.491	Yellow	dienoic fatty acids methyl esters
8	0.596	Faint Yellow	dienoic fatty acids methyl esters
9	0.666	Faint Yellow	dienoic fatty acids methyl esters
10	0.807	Colorless	dienoic fatty acids methyl esters
11	0.807	Colorless	dienoic fatty acids methyl esters

Oil extracted from lemon seeds was acidic, which was indicative of the presence of fatty acid in extracted oil. The yellowish colour indicates the vitamin A, giving the oil a medicinal value. Extracted oil when treated with Ninhydrin, it procured bluish – blackish colour. Hence lemon seed oil is showed the presence of protein while Barfoed's test shows the monosaccharide sugar in the extracted oil. Sometime oil nature was turbid therefore free acid also checked showing that 1.04 .

Saponification is an indicator of average molecular weight and, hence chain length. This value indicates the oil is good for soap making industry. The acid value is an indication of the amount of fatty acid present in the oil sample. Because essential oils are highly concentrated they can irritate the skin when used in undiluted form.[10]. Iodine value indicates the higher degree of unsaturation. Refractive index of oil increases with the increase in unsaturation and also chain length of fatty acid. TLC is a cheaper chromatographic method as it helps in visualization of separated compound spots easily.

The behaviour of an individual compound in TLC is characterized by a quantity known as Rf value. This technique manipulates polarity. Oil is less polar substances bind weakly to the adsorbent and elute faster. UV absorption spectroscopy showed its quantitative determination of compounds that absorb UV radiation. The absorption in the U.V. is related to the presence of conjugate double bonds. Consequently, TLC was monitored using Different solvent isomer. System ratio of chloroform+ n-hexane is (9: 1) showed good result for checking conjugate bond.

Due to their structural relationship within the same chemical group and natural tendency of oil components are known to easily convert into each other by oxidation, isomerization, cyclization, or dehydrogenation reactions, triggered either enzymatically or chemically[11]. Upon stability evaluation of essential oils, it needs to be kept in mind that the chemical composition may already vary in the starting material, being influenced by plant health, growth stage, habitat including climate, edaphic factors, as well as harvest time. Its concentration may vary along with its viscosity.

Stability of oil is also depends impurities and external factors. Based thereon, the Van't Hoff law states that a temperature rise of 10 °C approximately doubles chemical reaction rates, a relation that can be consulted to predict stability at different temperatures[12]. Extracted oil from seed showed that humid condition is not much suitable as fungal growth was

observed on oil when it kept at dark. It may be due presence of moisture.as citrus fruits known undergo acid-catalysed reactions in aqueous solutions[13,14] At room temperature and freeze stored liquid is very clear liquid. After 4 months the condition of stability need to explore different auto oxidation methods to quantify its stability. At gradually increasing temperature, under heat exposure is likely to contribute to the initial formation of free radicals.

CONCLUSION:

Yield of oil is depends on extraction methods and lemon grown on geographical conditions. The refractive index, yellowish colour exhibited the physical state of the oil. Acid value, iodine value and saponification value specifies the chemical state and quality of the oil. Lemon juice an inexpensive, readily available acid for use in educational science experiments. The lemon oil is good in areas such as soap making and these techniques can be used in detection of adulteration of the oil. Agrochemical waste; seeds are used as source of oil in order to know industrial applications of it. The value of the product yield makes the oil recovery a profitable, and will reduce the level of waste that is obtained from the juice making industry.

Acknowledgement: Greatly acknowledge to our Principal Dr Mrs M.K. Pejaver for her support.

REFERENCES

1. Morton, J. (1987) Fruits of Warm Climates Published by Julia F. Morton, Miami, Florida. Capon, Brian. 2010. Botany for Gardeners: Third Edition. Portland, Oregon: Timber Press, Inc. p.160-168.
2. Sauls, Julian W. (1998) "Home Fruit Production- Lemons" The Texas A and M University System. https://aggie-horticulture.tamu.edu/citrus/lemons.htm
3. Alessandra Bocco , Marie-Elisabeth Cuvelier , Hubert Richard and Claudette Berset (1998), Antioxidant Activity and Phenolic Composition of Citrus Peel and Seed Extracts, J. Agric., vol. (46) 6, 2123-2129.
4. T. A. El-Adawy, A. A. El-Bedawy, E. H. Rahma, A. M. Gafar (1999), Properties of some citrus seeds. Part 3. Evaluation as a new source of protein and oil, Molecular Nutrition and Food Research, Volume 43, Issue 6, pages 385–391.
5. Mondello L, Casilli A, Tranchida PQ, Cicero L, Dugo P, Dugo G. 2003.Comparison of fast and conventional GC analysis for Citrus essential oils. J Agric Food Chem. 51:5602-5606.
6. Davicino Roberto, Patricia Micucci, Turner Sebastian, Ferraro Graciela, Claudia Anesini

(**2010**), Antioxidant Activity of Limonene on Normal Murine Lymphocytes: Relation to H_2O_2 Modulation and Cell Proliferation, Basic and Clinical Pharmacology and Toxicology, Volume (106),1, 38–44 .

7. M. L. Lota, D. De Rocca Serra, F. Tomi, C. Jacquemond, and J. Casanova,(2002) "Volatile components of peel and leaf oils of lemon and lime species," Journal of Agricultural and Food Chemistry, Vol.(50) 4, 796–805.

8. Rao J, Mc Clements D. Epub **2012** Impact of lemon oil composition on formation and stability of model food and beverage emulsions. J. Food Chem. 2012 15; 134 (2):749-57.

9. Grassman, J; Elstner, E F (1973). "Essential Oils". In Caballero, Benjamin; Trugo, Luiz C; Finglas, Paul M. *Encyclopedia of Food Sciences and Nutrition* (2nd ed.). Academic Press. ISBN 0-12-227055-X.

10. Turek C, Stintzing FC. 2012. Impact of different storage conditions on the quality of selected essential oils. *Food Res Int* **46**:341–53.

11. Sköld M, Hagvall L, Karlberg A-T. 2008. Autoxidation of linalyl acetate, the main component of lavender oil, creates potent contact allergens. *Contact Dermatitis* **58**:9–14.

12. Pratt DA, Porter NA. 2003. Role of hyper conjugation in determining carbon-oxygen bond dissociation enthalpies in alkylperoxyl radicals. *Org Lett*ers **5**:387–90.

13. Claudia Turek, Florian C. Stintzing 3 2013 Stability of Essential Oils: A Review Volume (12) 1, 40–53.

14. Turek C, Stintzing FC. 2011b. Evaluation of selected quality parameters to monitor essential oil alteration during storage. *J Food Sci***76**:C1365–75.

15. Rajeswara Rao BR, Rajput DK, Patel RP. 2011. Storage of essential oils: influence of presence of water for short periods on the composition of major constituents on the essential oils of four economically important aromatic crops. J Essent Oil Bear Plants14**:**673–8.

FORBIDDEN ACTIVITY OF MICROBIAL INTERACTION IN LANTANA *CAMARA* L

Mital Patil, Sonali Karandikar, Ritesh Oza and Anita Goswami-Giri*

Department of Chemistry, B.N.Bandodkar College of Science, Chendani Bunder Road, Thane (W)-400 601 (MS) India.

Address for correspondence *: anitagoswami@yahoo.com

Abstract:

Lantana camara is an obnoxious invasive weed species responsible for huge economical loss across the world. Its invasion affects the resources of agriculture, horticulture, livestock, pasture, ecotourism leading to loss of biodiversity and its degradation. Therefore, in the present project attempts were made to isolate and characterize bacteria and fungi infecting *Lantana camara* leaves. The effect of various environmental factors on these organisms at the nucleic acid level were also studied by spectrophotometric and conductometric techniques along with biochemical methods. This knowledge may be utilized to develop novel targeted biocontrol agents for *Lantana camara* eradication.

Keywords: *Lantana camara*, Biocontrol Agents, Spectrophotometer, Conductometer

Introduction:

Lantana camara (*Verbenaceae*) is one of the fast-growing notorious natural biomass; occurs in tropical and subtropical region of world[1] popularly used as an ornamental garden plant. It is a low erect or subscandent, vigorous shrub with stout recurred prickles and a strong odour of black currents. It grows to 1.2-2.4 metres or even more. Root system is very strong, and it gives out a new flush of shoots even after repeated cuttings. Leaves are ovate or ovate-oblong, acute or sub-acute, crenate-serrate, rogues above, scabrid on both sides. Flowers are small found in bunch, usually orange, sometimes varying from white to red in various shades and having a yellow throat, in axillary heads, almost throughout the year[2]. It has been the primary feature for distinguishing between different forms. Inflorescences are produced in pairs in the axils of opposite leaves. In almost all colour forms, the flower opens yellow and changes to pink, white or red depending on the variety. Lantana's aromatic flower clusters are mix of red, orange, yellow or blue and white florets. It contains wide array of compounds exhibiting diverse range of bioactivity. Fruit small, greenish-blue black,

blackish, drupaceous, shining, with two nutlets, almost throughout the year, dispersed by birds. Seeds germinate very easily[3]. Some taxa of L. *camara* complex are toxic to small ruminants due to presence of triterpene ester metabolites. Lantana threatens natural habitats, native flora and fauna, various endangered and species and hence diminishes the economic viability of the crops[5]. The allelopathic qualities of Lantana condense the dynamism of active plant and its productivity[4]. Lantana infestations can sometimes be so persistent that they can completely stall the regeneration of rain forests for several years. Lantana can affect agriculture in a number of ways, besides reducing the productivity of crops, Lantana also interferes with harvesting and loss of pasture is the greatest single cost of Lantana invasion in grazing areas. Therefore need to checks forbidden activity of Lantana conservation of agriculture.

Current status of *L. camara* control –

The key to good management of lantana is constant vigilance[6]. Stick raking, bulldozing, ploughing and grubbing are the main methods of control. Hand cutting using brush cutters, hand pulling, chain pulling and flame weeding are also used. Re-growth is imminent if the rootstock is not removed while weeding. In India, use of elephants to uproot Lantana has been practiced. However, mechanical control is suitable only for small areas and is not recommended in areas susceptible to erosion. Fire is often used prior to mechanical or herbicidal control to improve their effectiveness or as a follow-up to such methods. But, while using fire as a management tool, the risk to people and property need to be avoided. Hence *Lantana camara* control using bio controlling agents offers significant value.

Biocontrol of *Lantana camara* -

Biocontrol agents have decreased the volume of individual plants. Other controlling 40 agents trialled have resulted in total control but some have been partially successful including *Teleonemia scrupulosa* Stal (Hemiptera),*Octotoma scabripennis* (Coleoptera), *Uroplata girardi* Pic (Coleoptera) and *Ophiomyia lantanae* (Froggatt) (Diptera)[6]. Diversity *of L. camara* cultivars (forms) has frustrated and preferably for some cultivars and an inability to survive on others. Attempts due at biological control by insect natural enemies ; of the 16 insect herbivore species imported into South Africa for biological control of *L. camara*, six have become established and two were already present. Two leaf-feeding chrysome lid beetle species, *Octotoma scabripennis* and *Uroplata girardi* Pic, usually in association with the

tingid bug, *Teleonemia scrupulosa* Stal, are exerting some degree of control. A seed-feeding agromyzid fly, *Ophiomyia lantanae* (Froggatt), may be contributing to the overall stress on the plant, but its contribution to biocontrol has not been determined. A flower-feeding pyralid moth, *Salbia haemorrhoidalis* Guenèe, is established in low numbers at isolated sites over a wide area. A noctuid moth, *Hypena strigata* (F.), an African species that was mistakenly 'imported' into South Africa, contributes little to biocontrol of *L. camara* in this country, although it was very successful in Hawaii.

L. camara was the first weed ever targeted for classical biological control at the turn of the century, and since then 36 insect species have been released in 33 countries throughout the exotic range. Despite these efforts, control of the weed has generally been disappointing[7]. Many reasons have been suggested for this failure: the great genetic diversity of the plant, its ability to hybridise, and that fact that its origin as a hybrid ornamental plant complicates the search for its centre of origin and thus for potential agents[8]**.**No insect agent released to date has caused significant damage to the very important Common Pink biotype. In general, the insect agents released have a restricted host range within this complex, and, in addition, the weed is able to tolerate wider climatic and geographical areas[9]. Fungi have been used for many years to control arthropod pests but have been underexploited against invasive weeds. Fungal pathogens have been considered to have great potential as agents for classical biological control of weeds Agents including *Prospodium tuberculatum*, *Puccinia lantanae* and *Ceratobasidium lantanae-camarae*. The fungi are limited to specific geographical location like *P. tuberculatum* is rust limited to the tropical and subtropical regions of North and South America. Therefore, in the present paper (1) Isolation of normal flora, infecting bacteria and fungi from Lantana *camara* leaves, (2) Characterization of the different infecting bacterial and fungal colonies at different pH and temperature and (3) Spectro-photometric and conductometric analysis of growth of these organisms' invivo and invitro has been discussed.

Materials and Methods:

Sample: Lantana leaves with bacterial and fungal infections were collected from the campus of B.N. Bandodkar College, Thane in the month of April 2013.

Materials: Himedia Nutrient agar, Himedia Sabouraud's agar, Microscopes, Slides, Test tubes, Petri plates, Autoclave, High temperature incubator, Buffer, Sodium

Chloride, Distilled water, Gram stains (crystal violet, grams iodine, alcohol, basic fuchsin), Shimadzu UV spectrophotometer (UV-1800 system), Equiptronics conductometer model - eq-6650.

Method: Disc of equal dimensions were cut from the infected and non-infected area of the leaves.

Cultures were made using this infected and non-infected part of the leaves in sterile saline.

The test and the control samples were isolated on Nutrient agar (NA) and Sabouraud's agar (SAB) to study the bacteria and fungi separately.

Composition of Nutrient Agar:

Ingredients	Gms/ Litre
Peptic digest of animal tissue	5.000
Sodium chloride	5.000
Beef extract	1.500
Yeast extract	1.500
Agar	15.000
Final pH (at 25°C)	7.4±0.2

Composition of Sabouraud's Agar:

Ingredients	Gms / Litre
Dextrose	40.000
Mycological, peptone	10.000
Agar	15.000
Final pH (at 25°C)	5.6±0.2

Plates were incubated at room temperature for 48 hours.

Colonies type found only on test plate (NA and SAB) was used for further enumeration and preparation of pure cultures.

The colony characteristics and the microscopic study of these colonies were done.

Suspensions of two such colonies each from NA and SAB were made with different pH conditions (acidic, basic, neutral) and stored at room temperature to study the effect of pH on the organism.

Another set of the suspensions were stored at 10^0C , room temperature (30^0C) and 45^0C to study the effect of temperature on growth of these organisms .

The effects were determined by DNA quantitation, CBB method, Lowry method, Biuret method and UV analysis by spectro-photometric method.

Conductometric analysis was also done to ascertain the effect of these environmental

conditions on the organisms and hence conductance of the medium.

One plate was inoculated with infecting organism were named as test plates and the other plates of normal flora .Two types of colonies present only on plate having infecting flora and not on plates having normal flora were taken. The gram character of these colonies was observed and following suspensions were made.

Suspensions:

i) Leaf control (LC)**:** Leaf sample without infection

ii) Leaf test (LT)**:** Leaf sample with infection

iii) Bacterial test 1 (BT1)**:** Bacterial colony present only on test plate .

iv) Bacterial test 2 (BT2)**:** Bacterial colony present only on test plate but different than BT1.

v) Fungal test1 (FT1) **:** Fungal colony present only on test plates.

vi)Fungal test2 (FT2)**:** Fungal colony present only on test plates other than FT1.

Result and Discussion:

Total concentration of protein in infected leaves solution is varies from 0.5 μg/mL to 1.5 mg/mL measured at 280nm. The consequence of pH and temperature on the *Lantana camara* infected leaves (bacteria and fungi) (figure 1) produced significant effect on their overall activity on the weed. Leaf and fungal interaction and gram staining of colonies were obtained on Nutrient Agar plates of test samples were observed under microscope (10 X). Table 1 showed the characteristics of bacterial colonies on 'test' nutrient agar plate, Hence, deliberated spectro-photometrically and conductometrically by incubating samples in different pH and varying temperature conditions was studied (Table 2,3,4 and 5). *Lantana camara* being a woody species can grow under different soil pH and temperature conditions. For a biological agent to be effective against it must also grow in versatile environmental conditions, study emphasised by taxation of nucleic acid and proteins.

The literature has shown that gram negative bacteria display some particularities that inhibit censibiotic penetration while gram positive bacteria are more sensitive to antibacterial activity. Researcher suggests that results obtained may varied due to seasonal influence and with the presence of bioactive compounds from lantana species.

Table 1 Characteristics of bacterial colonies on 'test' nutrient agar plate.

Characteristics	**Colony 1**	**Colony 2**
Size	1mm	1mm
Shape	Circular	Irregular
Colour	Yellow	Black
Consistency	Smooth	Smooth
Elevation	Flat	Flat
Margin	Entire	Entire
Opacity	Opaque	Opaque
Gram nature	Gram positive cocco bacilli	Gram positive cocci

The improvement of antibacterial activity against the gram negative bacteria showed a significant result as the gram positive bacteria are more susceptible to natural products but the gram negative bacteria showed improvement of antibacterial activity against essential oil. Many plants have the ability to interfere with the antibiotic resistance as well as shows antibacterial properties (Sousa E.et al; 2011). The study can justify the popular use of *L. camara* to treat respiratory infection by *L. camara* can justify by the study (Sousa E.et al; 2012).

The growth curve suggests the four phases in the growth of micro-organisms – lag phase, log phase, stationary phase and death phase (figure 2).

Still it needed auxiliary investigation for the assumption. Since fungicides are very expensive and cause serious environmental pollution; control strategies are today directed towards replacing the use of hazardous chemical fungicides by environmentally friendly natural products. According to revelations, antifungal compounds present in the plants are active at different stages of germination growth. The isolated basic proteins from Lantana especially the high molecular weight fractions of protein showed the novel antifungal properties which can be used in crop improvement program of sugarcane. (Hiremath L.et al; 2011) Environmental or geographical condition was also affected including pH and temperature; on the bacterial and fungal growth curve.

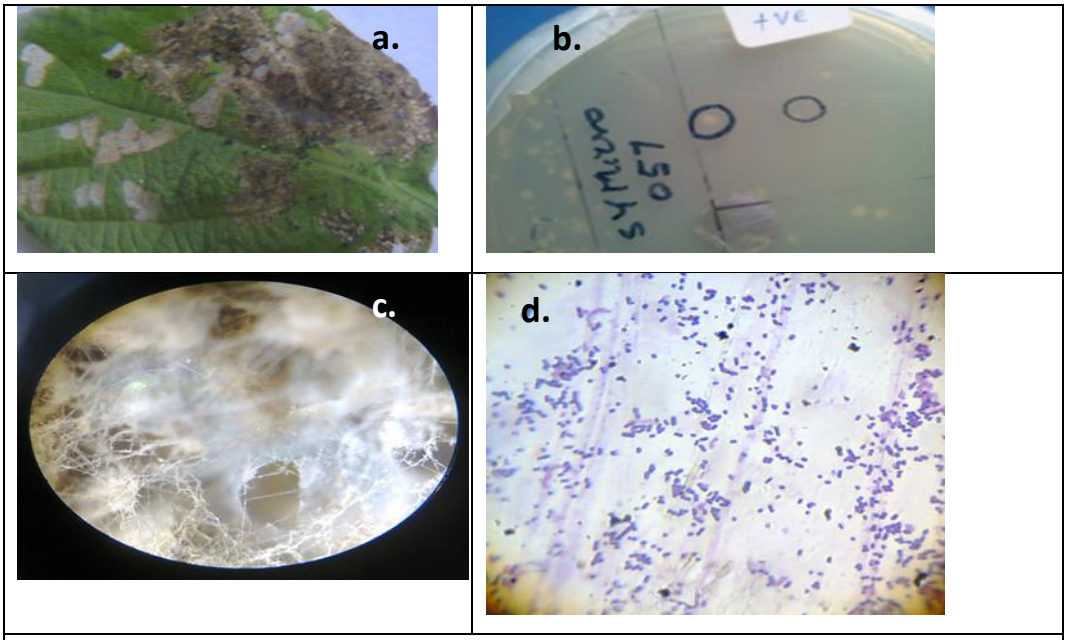


Figure 1 – a. Infected *Lantana camara* leaves; b.Nutrient Agar plate with two test colonies; **c.** Leaf and fungal interaction observed under microscope (10x); **d.** Gram staining of colonies obtained on Nutrient Agar plates of test samples.

Table 2 Effect of pH on protein content .

		Leaf Control	Leaf Test	Bacteria Test 1	Bacteria Test 2	Fungus Test 1	Fungus Test 2
Acidic pH	T1	0.002	0.004	0.001	0.002	0.006	0.001
	T2	0.005	0.008	0.001	0.011	0.012	0.002
	T3	0.008	0.017	0.002	0.019	0.020	0.002
	T4	0.016	0.032	0.002	0.026	0.031	0.002
Neutral pH	T1	0.009	0.011	0.010	0.012	0.014	0.013
	T2	0.011	0.012	0.010	0.011	0.013	0.013
	T3	0.015	0.014	0.013	0.014	0.015	0.013
	T4	0.017	0.016	0.015	0.018	0.017	0.018
Basic pH	T1	0.001	0.008	0.002	0.001	0.001	0.006
	T2	0.001	0.013	0.011	0.002	0.002	0.011
	T3	0.002	0.021	0.020	0.002	0.002	0.019
	T4	0.002	0.031	0.027	0.002	0.002	0.029

Table 3 Effect of temperature on protein content.

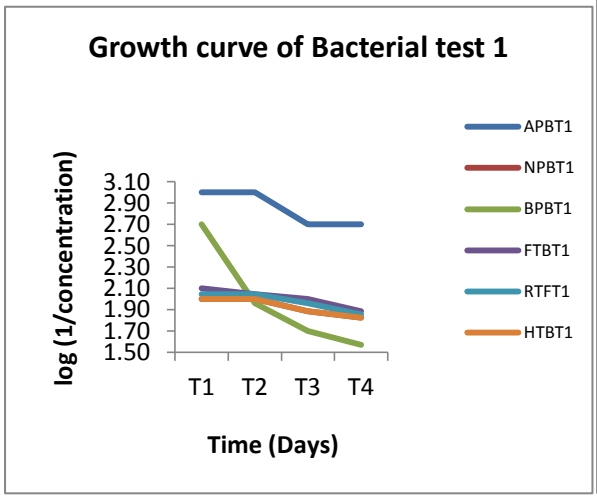
		Leaf Control	Leaf Test	Bacteria Test 1	Bacteria Test 2	Fungus Test 1`	Fungus Test 2
Freezer Temperature (FT)	T1	0.001	0.007	0.008	0.008	0.008	0.008
	T2	0.001	0.010	0.009	0.008	0.009	0.008
	T3	0.002	0.012	0.010	0.009	0.010	0.010
	T4	0.002	0.014	0.013	0.012	0.013	0.012
Room Temperature (RT)	T1	0.001	0.007	0.009	0.008	0.009	0.009
	T2	0.001	0.011	0.009	0.009	0.009	0.009
	T3	0.002	0.014	0.011	0.010	0.011	0.011
	T4	0.002	0.016	0.014	0.013	0.014	0.013
High Temperature (HT)	T1	0.001	0.015	0.010	0.002	0.011	0.013
	T2	0.001	0.018	0.010	0.005	0.011	0.013
	T3	0.002	0.019	0.013	0.010	0.013	0.016
	T4	0.002	0.023	0.015	0.012	0.017	0.019

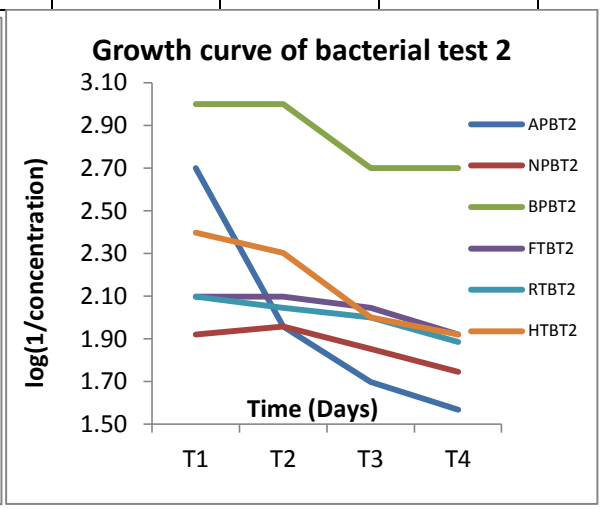
Table 4 Effect of pH by conductometric analysis.

		Leaf Control	Leaf Test	Bacteria Test 1	Bacteria Test 2	Fungus Test 1	Fungus Test 2
		LC	LT	BC	BT	FC	FT
Acidic pH	T0	20.146	26.259	22.695	24.993	26.105	23.721
	T1	22.384	27.641	23.397	25.766	26.912	24.455
	T2	24.871	29.096	24.121	26.563	27.744	25.211
	T3	27.635	30.627	24.867	27.384	28.603	25.991
	T4	28.786	32.239	25.636	28.231	29.487	26.795
Neutral pH	T0	20.085	25.494	22.471	22.929	22.700	24.970
	T1	22.317	26.836	23.165	23.638	23.402	25.742
	T2	24.797	28.248	23.882	24.369	24.126	26.538
	T3	27.552	29.735	24.621	25.123	24.872	27.359
	T4	28.700	31.300	25.382	25.900	25.641	28.205
Basic pH	T0	20.065	28.043	26.965	24.076	24.970	32.461
	T1	22.295	29.519	27.799	24.820	25.742	33.465
	T2	24.772	31.073	28.658	25.588	26.538	34.500
	T3	27.524	32.709	29.545	26.379	27.359	35.567
	T4	28.671	34.430	30.458	27.195	28.205	36.667

Table 5 Effect of temperature by conductometric analysis.

		Leaf Control	Leaf Test	Bacteria Test 1	Bacteria Test 2	Fungus Test 1	Fungus Test 2
Freezer Temperature (FT)	T0	16.052	20.375	17.958	18.325	18.142	19.956
	T1	17.836	21.447	18.514	18.892	18.703	20.573
	T2	19.818	22.576	19.086	19.476	19.281	21.209
	T3	22.020	23.764	19.677	20.078	19.878	21.865
	T4	22.937	25.015	20.285	20.699	20.492	22.542
Room Temperature (RT)	T0	20.065	25.469	22.448	22.906	22.677	24.945
	T1	22.295	26.809	23.142	23.615	23.378	25.716
	T2	24.772	28.220	23.858	24.345	24.101	26.512
	T3	27.524	29.705	24.596	25.098	24.847	27.332
	T4	28.671	31.269	25.357	25.874	25.615	28.177
High Temperature (HT)	T0	20.226	33.109	28.060	25.197	22.904	29.934
	T1	22.473	34.852	28.928	25.976	23.612	30.860
	T2	24.970	36.686	29.823	26.779	24.343	31.814
	T3	27.745	38.617	30.745	27.608	25.095	32.798
	T4	28.901	40.649	31.696	28.462	25.872	33.812





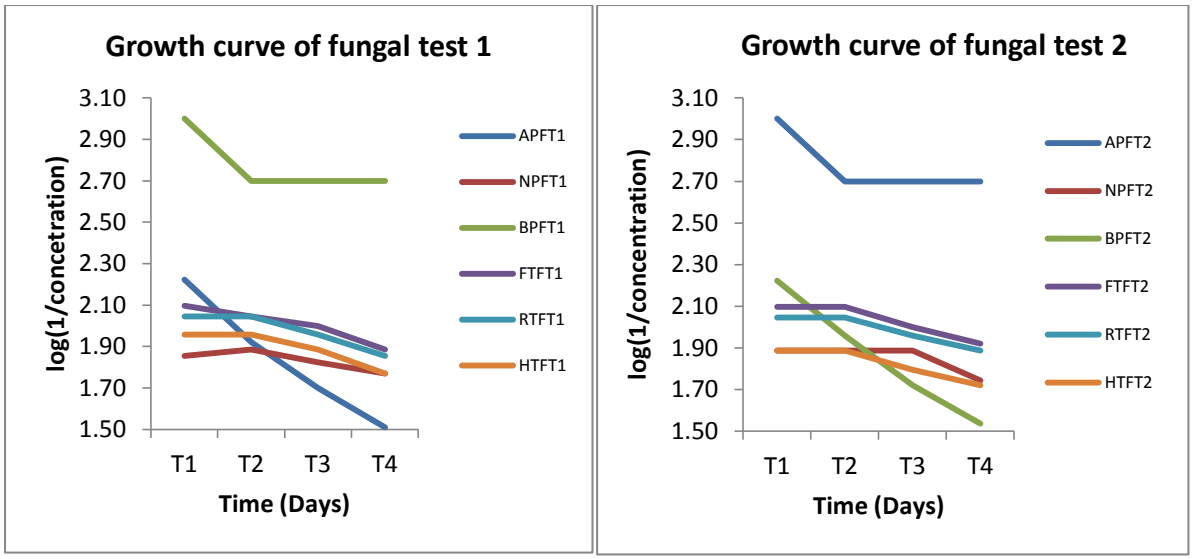


Figure 2 Effect of different pH and temperature on growth curves of bacteria and fungi.

Conclusion:

Protein content analysis gave a measure of proteins present in medium due to cell lysis whereas conductometric analysis represents change in cell membrane permeability because of change in temperature and pH. The Bacterial test 1 is more resistant to pH change than Bacterial test 2. Similarly, fungal test 2 is more resistant to pH change than Fungal Test 1 in acidic pH range. Bacterial test 2 is more resistant to pH change than Bacterial test 1 and fungal test 1 is more resistant to pH change than fungal test 2 in basic pH. The protein content in the normal pH remains almost unchanged among all species. Freezer temperature and Room temperature results were almost similar. Bacterial test 2 and Fungal test 1 are more stable than Bacterial test 1 and Fungal test 2 at higher temperature respectively. The results obtained with conductometric analysis are in line with the spectro-photometric analysis.

Acknowledgement: Greatly acknowledge to our Principal Dr Mrs M.K. Pejaver for running Science square activity in the College.

References:

1. SharmaO.P., Sharma P.D.,(1989).”Natural products of the Lantana plant-the present and prospect. J.sci.Ind.Res.48:471-478.
2. Sastri and Kavathekar, 1990, Plants for reclamation of wastelands.

3. Sharma M., Dalal R. Sharma N, N(2011), Design Synthesis and evaluation of Lantadene A Cognear wish hydroxyl functionality in ring A as an antitumor agent *Equb, Feb* ,5(4) ,387-96 .
4. Australian Weeds Committee, 2008. Weeds of National Significance. Lantana. Australian Department of the Environment and Heritage, 2003. Lantana (*Lantana camara*). Weeds of National Significance: Weed Management Guide Department of the Environment and Heritage and the CRC for Australian Weed Management, 2003.
5. Day, M.D., Wiley, C.J., Playford, J. and Zalucki, M.P. 2003. Lantana: Current Management, Status and Future Prospects. Australian Centre for International Agricultural Research: Canberra 2003.
6. Ellison, C.A. 2001. Classical Biological Control of Weeds with Pathogens: Release of Lantana Rust in Australia. In: *IBG (International Bioherbicide Group) News 10* (2).
7. Thomas S E, Ellison C A, Tomley A J. 2006. Studies on the rust *Prospodium tuberculatum*, a new classical biological control agent released against the invasive alien weed *Lantana camara* in Australia. 2. Host range. Australasian Plant Pathology 35, 321–328.
8. Thomas, E. Sarah and Carol, E. Ellison, 2000. A Century of Classical Biological Control of *Lantana camara*: Can Pathogens Make a Significant Difference? In: Neal R. Spencer (Ed.). *Proceedings of the X International Symposium on Biological Control of Weeds 97*. 2000.
9. Dunn,M. J. 1992. Protein determination of total protein cncentration. Harris, E. L. V., Angel S., [Eds], Protein Purification methods, Oxford: IRL Press.

Available online www.vpmthane.org

BNB-2014

EFFECT OF BIO-ORAGANIC FOLIAR SPRAY ON GROWTH AND YIELD OF LUCERNE (*MEDICAGO SATIVA* L.)

V. M. JAMDHADE

Department of Botany; B.N.Bandodkar College of Science, Thane (W)-400 601

Email: vmjamdhade@vpmthane.org

ABSTRACT:

Alfalfa (*Medicago sativa* L.) is most popular forage crop. It is an oldest crop with 2000 years of documental history. It requires relatively high quantities of nutrients to achieve optimum yields. Commercially available foliar applied fertilizers and growth regulators reportedly provide adequate nutrient levels and increase alfalfa stem number, yield, and quality. The objective of this research was to determine the effectiveness of Bio-Organic commercially available foliar spray growth regulators to stimulate shoot development and increase forage yield and quality on high fertility soils in Maharashtra. Three treatments including controls foliar application of Bio-Organic products increased Vegetation per plot and dry matter of alfalfa.

Keywords: Lucerne, *Medicago sativa*, fodder, foliar spray

INTRODUCTION:

Lucerne (*Medicago sativa* L.) is most popular forage crop of tropical as well as temperate climate .It is called as “Alfa Alfa” is an Arabic word i.e. ”the best”.It is also known as “ Green Gold” .It is an oldest forage crop with 2000,years of documental history.

Lucerne is perennial and is used as green fodder since, up to three years it can maintain its productivity with cost benefit ratio of 1:3 .In the month of October sowing is done broadcasting the seeds or by drilling them in rows. About 9-10 weeks are required to get the crop ready for harvesting. After subsequent regrowth of 20-30 days crop can be harvested. After fodder, yield of Lucerne, ranges from 850-900 quintals per hectare. This can be increased to 1200 to 5500 quintals per hectare in 9-10 cuttings by using high fertility, improved agronomic practices, superior germplasm and assured irrigation, (Relwani,1979). Field trials at Research Laboratory of Botany Department Dr. Babasaheb Ambedkar Marathwada University, Aurangabad confirmed that Lucerne is highly productive crop with consistent performance (Dev et al,.1974,).

The green foliage of Lucerne is rich in protein and the use of this crop for regular production of Leaf Protein (LP) has been suggested by many workers.

The use of green leaves as source of protein in human nutrition has long been advocated (Pirie,1942).By the popular techniques of "Green Crop Fractation" (GCF) it is possible to extract the protein from green leaves and protein rich mineral vitamin rich concentrate referred as Leaf Protein Concentrate (LPC).

MATERIALS AND METHODS:

The present investigation was undertaken to effect of various concentration of foliar spray on growth and yield of Lucerne. Var.T-Chikhalthana. This experiment was conducted in randomized block design with plot size 6X5 meter.

Treatment: Experiment was conducted with the following treatment

1. T-1 Control
2. T-2 Bio-Organic Spray (1 Ml/Liter)
3. T-3 Bio-Organic Spray (2 Ml/Liter)
4. T-4 Bio-Organic Spray (3 Ml/Liter)

Preparation of Land:

The research trial was laid out on black soil rich in organic matter with well leveled field. The land was prepared by ploughing, harrowing and brought to fine tilt.

Seed sowing:

The seeds were obtained from local market and sowing operation was done on November.

Bio-Organic Foliar Spray:

it is obtained from local market and first spray was given at four leaf stage of crops and second spray was given after one week interval.

After Care:

The recommended practices of Lucerne cultivation and all the plant protection measures were timely carried out during the growth period of the crop.

Statistical analysis was carried out by method Panse and Sukhatame (1968).

RESULTS AND DISCUSSIONS:

The observations are recorded on per plot vegetation and percent dry matter were statically analysed and presented in Table No.1. It was observed from the data shown in table no.1 that per plot vegetation increased from 2.980 kg in T4 treatment and T3 treatment 2.910 kg were statically significant over control. Control produced 2.246 kg per plot vegetation.

As regards percent dry matter data shown in the table np.1 dry matter maximum increase from 21.1 % in T3 treatment and treatment T4 produced 20.7 % and T2 20.2 were statistically significant over control. Control showed 20.1 dry matters. Similar type's results are observed Growth regulator showed marked influence on average per plot vegetation .It was revealed that the vegetation increased in 2 ml/lit and 3 ml/lit concentrations.

Dong Shu-Fa et al., (1987) recorded dry weight of Soybean plant was promoted triacontanol.

Table1. Effect on average number of per plot vegetation and percent dry matter of Lucerne.

Sr.No.	Treatment	Vegetation Per Plot (Kg)	Dry Matter %
1	T-1 Control	2.246	20.1
2	T-2 1 Ml/Liter	2.213	20.2
3	T-3 2Ml/Liter	2.910	21.1
4	T-4 3 Ml/Liter	2.980	20.7
5	S.E.	0.077	0.056
	C.D. At 5 % level	0.189	0.135
	F.(t)	14.21	35.30

The maximum vegetation was recorded in T4 treatment 2.980 kg and T3 2.910 kg where growth regulator applied in five split doses. However increases of vegetation per plot due to easy availability of essential elements in it. Lowest per plot vegetation recorded in T2 treatment was 2.213 kg.Similar types of observation recorded, Malik and Richa (1984) have shown 14 % increase in yield of rice by the foliar spray of Miztalol,Reddy and

Krishnappa (1984(recorded yield of Potato tuber were sprayed 2 ppm triacontanol over control.

Conclusion:

Investigation carried out and concluded that the application of Growth regulator at the rate of 2 ml/lit. and 3 ml/lit. in five foliar sprays was found to be suitable for more growth of the crop and percent dry matter of the crop.

Acknowledgement:

The author thankful and grateful to B.N.Bandodkar College of Science, Thane for Moral support for preparation of manuscript.

References:

Dev, D. V. Batra, Y. R. and Joshi, R.N. (1974): Yield of Extracted leaf protein from Hybrid Napier grass: Journal Science Fd.Agric 25 725

Dong-Shu Fa, Wang Shu-Xiong Li-rui (1987): Effect of Triacontanol on shape physiological index and output of wheat. International Symposium on Triacon Nov.: 25-28, pp12.

Malik, C. P. and Richa (1984): A dramatic role fatty alcohol combination in increasing rice production. Abstract Annual Meeting of Society for Plant Physiology and Biochemistry A U Hissar, pp.43.

Mungikar, A.M., (1974). Agronomic studies on leaf protein production IV. Ph.D. Thesis, Marathwada University, Aurangabad.

Pirie, N.W. (1971): Ed. Leaf Protein; its agronomy, preparation, quality and use: IBP Hand Book No.20, Blackwell Scientific Publications of ford and Edinburgh.

Reddy, H. S. and Krishnappa (1984): Effect of Triacontanol on growth and yield of two cultivar of potato: South Indian Horti.Jour. 32 (3): 138-142.

Relwani, L. L. (1979) Fodder crops and grasses, Ind.Coun. Agricul. Res., New Delhi.

STUDIES ON THE INFLUENCE OF ORGANIC INPUTS ON WATER RETENTION CAPACITY OF SOIL

MOSES KOLET

Department of Botany, B.N.Bandodkar College of Science, Thane 40060, India

Email: mjkolet@vpmthane.org

ABSTRACT

There is a renewed interest in recycling of organic residues in recent times. Composting, as a practice of recycling of wastes has been strongly advocated. Apart from its multitude of beneficial effects, compost and organic matter positively influence the water retention capacity of soil, resulting in conservation of water. The effect of partially degraded leaf litter and compost prepared from garden leaf litter on the water holding capacity (WHC) of soil was determined. Incorporation of both forms of organic matter vastly improved the WHC. Partially degraded garden leaf litter effected a slightly higher augmentation in the water retention capacity.

Key words: Water holding capacity, compost, leaf litter, conservation of water

INTRODUCTION:

Recycling, which is a key step towards sustainability, has witnessed renewed interest in recent times. India has a rich and diverse potential of locally available and renewable organic resources for recycling. Composting as a form of recycling has been actively and strongly advocated since the last few decades. Incorporation of composts and organic manures in the soil is known to have beneficial effects on the soil microflora (Lazcano *et al.*, 2013), improve fertility of the soil (ICAR, 2000) and increase the yield (Tiamiyu *et al.*, 2012) especially under integrated nutrient management systems (Shinde *et al.*, 2013). The positive influence of organic matter on the properties and overall health of the soil is well studied.

Water retention capacity is an important characteristic of soil and is said to depend principally upon the texture. Organic matter also has an influence on the water holding capacity and cultivators have the choice of increasing the water holding capacity of their soil by increasing the organic matter content of soil (Vengadaramana and Jasothan, 2012), a move which would also result in the conservation of water. A survey of literature on the topic revealed scattered, piecemeal and relatively less volume of scientific information on the relationship between composts and water

retention capabilities of the compost-amended soils, especially relevant to local conditions; thereby inspiring the current investigation.

MATERIALS AND METHODS:

Mature compost and partially decomposed leaf litter were utilized as organic inputs, for investigations, carried out in the laboratory in triplicate. The study was carried out in the Department of Botany, B.N.Bandodkar College of Science, located in Thane, India. Compost prepared from garden leaf litter, using a consortium of cellulolytic fungal organisms (Kolet, 2014) for hastening the process of composting, was used for the study. Maturity of the compost was ascertained as prescribed by Rasal and Patil (2001). Partially decomposed leaf litter, representing organic matter, was obtained from the college campus. Red soil amended with various percentages of the organic inputs was used for the study. Water holding capacity of soil was determined according to the method outlined by Harding and Ross (1964).

RESULTS AND DISCUSSION:

The influence of various quantitative treatments of mature compost (prepared from garden leaf litter) and partially degraded leaf litter incorporation on the water retention capability of soil is depicted in Table 1. Addition of compost as well as partially degraded organic matter vastly improved the water holding capacity of soil.

The results agree with those of Jeyamangalam *et al* (2012) and Chanthai *et al*., 2013. Organic matter is usually known to improve the water retention capacity (Mapa and De Silva (1994). Augmentation in water holding capacity varied according to particle size of the organic matter; WHC influenced by incorporation of larger particle sized partially degraded leaf litter was higher than what the fine organic matter or compost could influence. This finding is in agreement with Naeth *et al* (1991). Hudson (1994) reported an increase in water retention at a much greater rate as organic matter content of soil increased and findings are in agreement with the same. Application of compost and organic manure is practiced by farmers in remote areas, as indigenous techniques which promote conservation of resources (Mishra and Rai, 2013) and is recommended as a healthy environment-friendly practice. While incorporation of organic matter in any form eventually augments the organic matter content of soil, degraded and mature forms such as compost, vermicompost and farm yard manure are recommended for best results from agricultural and horticultural points of view.

Table 1. Influence of different forms of organic matter on water retention capacity of soil.

Organic additive	**Partially degraded leaf litter**		**Mature compost**	
Treatment	Amendment Soil: organic additive (%) amendment	Water retention capacity (%)	Amendment Soil: organic additive (%) amendment	Water retention capacity (%)
1	Soil (Control)	59	Soil (Control)	59
2	9 : 1 (10)	71	9 : 1 (10)	66
3	8 : 2 (20)	75	8 : 2 (20)	74
4	7 : 3 (30)	78	7 : 3 (30)	76
5	6 : 4 (40)	80	6 : 4 (40)	77
6	1 : 1 (50)	81.5	1 : 1 (50)	77.5

CONCLUSI

An improvement in the water retention capacity of soil was observed after amendment with organic matter comprising fully mature compost as well as partially degraded leaf litter. Particle size of the organic material incorporated also had influence on the augmentation of water holding capacity. Conversion of urban and garden leaf litter to compost is recommended instead of the usual practice of burning.

REFERENCES:

Chanthai, S., Machikowa, T., Wonprasaid, S. and Boonkerd, N. 2013. Effects of fertigation, water application frequency and soil amendment on tomato production. ISHS *Acta Hort*. 984: 187-195.

Harding, D.E. and Ross, D.J. 1964. Some factors in low temperature storage influencing the mineralisable nitrogen of soils. *Journal of the Science of Food and Agriculture* 15: 829-834.

Hudson, B.D. 1994. Soil organic matter and available water capacity. *Journal of Soil and Water Conservation* 49(2): 189-194.

ICAR. 2000. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi. pp. 203-247.

Jeyamangalam, F., Annadurai, B. and Arunachalam, N. 2012. Effect of tank silt as organic amendment on physical properties of theri soil using groundnut (*Arachis hypogea* L.). *J. Soils and Crops* 22(1): 10-14.

Kolet, M. 2014. Studies on mineralization of compost from vegetable market wastes. *Bionano Frontier* 7(1): 169-171.

Lazcano, L., Gomez-Brandon, M., Revilla, P. and Dominguez, J. 2013. Short-term effects of organic and inorganic fertilizers on microbial community structure and function. *Biol Fertil Soils* 49: 723-733.

Mapa, R.B. and De Silva, A. 1994. Effect of organic matter on available water in noncalcic brown soils. *Sri Lankan Journal of Agricultural Science* 31: 82-93.

Mishra, P.K. and Rai, S.C. 2013. Use of indigenous soil and water conservation practices among farmers in Sikkim Himalaya. *Indian Journal of Traditional Knowledge* 12(3): 454-464.

Naeth, M.A., Bailey, A.W., Chanasyk, D.S. and Pluth , D.J. 1991. Water holding capacity of litter and soil organic matter in mixed prarie and fescue grassland ecosystems of Alberta. *Journal of Range Management* 44(1): 13-17.

Rasal, P.H. and Patil, P.L. 2001. *'Jeevanu Khate'* (Biofertilizers), 2nd rev.edn. Continental Prakashan, Pune, India. pp 46-174.

Shinde, K.G., Kadam, J.M., Bhalekar, M.N. and Pawar, P.K. 2013. Effect of organic, inorganic, and biofertilizers on uptake of nutrients by onion (*Allium cepa* L.) grown under Western Maharashtra conditions. *J.Agric. Res. Technol*., 38 (2): 192-195.

Tiamiyu, R.A., Ahmed, H.G. and Muhammad, A.S. 2012. Effect of sources of organic manure on growth and yields of okra (*Abelmoschus esculentus* L.) in Sokoto, Nigeria. *Nig. J. Basic Appl. Sci.*20(3): 213-216.

Vengadaramana, A. and Jasothan, P.T.J. 2012. Effect of organic fertilizers on the water holding capacity of soil in different terrains of Jaffna peninsula in Sri Lanka. *J. Nat. Prod. Plant Resour*. 2(4): 500-503.

SLUMS IN MUMBAI

Sudhir k. Bhosale[a] and Anita S. Goswami- Giri[b]

[a] Department- Foundation Course; [b] Department of Chemistry

B.N. Bandodkar College of Science, Thane-400601,(MS) India.

ABSTRACT:

A slum is a densely populated shantytowns, barrios, ghettos, or favelas with low incomes groups, compacting humanity into filthy, densely packed areas with poorly constructed and often dangerous homes poverty create conditions in which a natural or technological hazard has the potential for much greater impact on people. At the same time, access to services like health care, fresh food, and basic sanitation may become restricted, creating filth and squalor. These factors are affects the lifeline of human being in slums. To overcome this problem, Energy, water, telecommunications, and public transport constitute systems, networks up gradation of income literacy which are not only essential, but increasingly complex and interdependent.

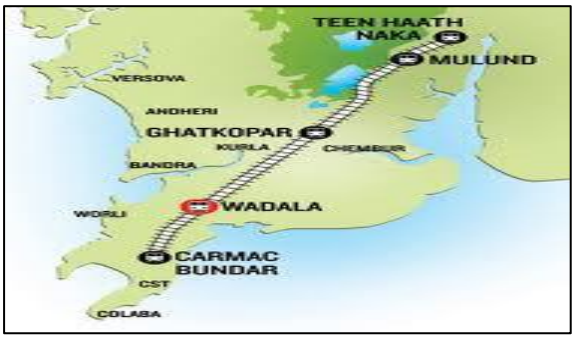
Key Words: Slums, health and hygienic; remedies

Introduction:

A Slum means dense cluster of houses in a hap hazard way, many a times in a non-hygienic way. The slum may be consisting of plastic houses, wooden houses, cardboard houses, thermacol houses and gunny bag houses. The slums in Mumbai have all these types of houses. It has become a worth ideal study case. Mumbai city is the economic capital of India. It is the international tourist attraction for various reasons due to Its strategic importance in all aspects.

Location of slums:

The slums are located almost in all areas in Mumbai, either in figures of hundreds or thousands depending upon the available open space for illegal encroachment. The largest one is the dharavi slums. Though major part of it is well developed yet an equal half still has many other related problems of severe concern in many aspects.



The slums at Mahim junction, Bandra, Kurla Complex, the slums at wadala railway tracks, the slums on the pipe lines, the slums near the airport, railway stations and on near the railway tracks, the slums below the bridges, the slums near the public toilets, the slums near the creeks and the slums on the foot-path.

Conditions:

(a) Roads, **(b)** Street-Lights, **(c)** Sanitation, **(d)** Health, **(e)** Education, **(f)** waste and garbage.

Causes and Effects: Overall Conditions:

(a)Roads: The roads in the slum areas are very narrow. The children as well the grown up adults also sit on the streets for nature call activity. In some of the slums the roads actually do not exist

(b) Street-Lights: The Street lights are major time absent. There are no electric poles to sustain the bulbs. Even, if there are bulbs, the anti-elements steals the street bulbs, hence again no lights in spite of the electric poles being there. Many a times the street lights are of poor qualities. Some huts take illegal connection to their huts from these street light poles. Due to insufficient street light, there is growth of rats and mosquitoes in the areas as well as security problem against the thief become a matter of concern.

(c) Sanitation: The slums do not have proper sanitation facilities. As so many people live illegally there, it becomes difficult to provide sufficient sanitation or toilet facilities to all. As a result people sit on the streets and on the railway

People climb on walls, or narrow spaces between huts to reach their huts in the slum.

The roads are actually undeveloped road and uneven ones, with ditches and pot holes in it. Many a times the road is flooded with dirty water as well as solid wastes. The roads are not approved by the municipality authorities due to technical reasons. The people staying in the slums near the tracks have to cross the track taking risk to their lives. Those living near gutters have to jump over the gaps in the wall of the gutters thus again taking risk.

track and the open gutters, thus causing major health problem to the city health life. Now as people litter in open, the pigs, dogs, rats and other animals and rodents spread these dirt all over the area, thus causing danger of spread of disease in the rainy season due to flooded waters.

This water rushes through huts, on the streets, then in open grounds and thus affecting the entire city. Longer-term impacts also could include salinization of groundwater leading to freshwater shortages.

(d) Health: The health is another important issue here. In the slums here, one will find major TB patients, cancer patients, HIV patients and other unlisted disease suffering patients. This is because due to lack of guidance, lack of proper knowledge

and the absence of health care. There are no proper health clinics. Even if there are any, then either the doctors are bogus with fake certificates or illegally running medical practices. This also endangers the lives of the people coming to such clinics here's the food cooked here in the huts is not in clean process as well as the water used for cooking is contaminated water. Due to overcrowding or unavailability of privacy, particularly acute for women, adolescent girls, young couples, and large families /people suffer from diphtheria, malaria, vomiting and fever and measles. Many women and girls may to engage in sexually risky behaviour, making them more vulnerable to HIV/AIDS and other sexually transmitted diseases. As the roads are not proper here, it becomes very difficult to reach the patients with ambulance.

(e) Education: The slums here do not have sufficient schools around for education. Even if there are schools still it serves no purpose because major public staying here do not have birth certificates and other relevant documents for admission. Hence major children are not studying or not going to school. The major children are either engaged in begging at the signals or doing some work as cleaners and labourers in nearby city factories and industries. Some children work as rag pickers; some are engaged as pick pocketers whom the society calls as juvenile.

(f) Waste and garbage: As there is no proper disposal of garbage and waste, it becomes danger as accumulating centre for mosquitoes and rats and other harmful insects. The other danger is that during summer season this unattended garbage catches fire. This fire then spreads all over the hutments and may cause great untold damage to human lives as well as it will add to the smoke pollution in the air. In rainy season these garbage becomes water logged and causes floods in the city. Poor drainage and waste management amplify the effects of disasters especially people at risk of sea-level rise.

g) National economy: disproportionately of income, High population density coupled with poverty creates conditions in which a natural or technological hazard has the potential for much greater impact on people. Economic losses when hit such area by a disaster because there is always competition amongst different social groups for access to land.Land costs for housing often beyond the reach of most or all low-income groups. Illegal lots with no services are settled. Most often, these locations are unsafe such as hillsides, marshy lands, river gulleys and low-lying coastal areas. Extremely vulnerable of people living in the slum area to the impact of disasters

Remedies: The overall remedies to the above problems are as follows:

The municipal corporation should provide better roads with proper facilities like street lights. The excess encroachment should be removed with better alternatives for the people. To improve water supplies, toilets and sanitation, NGOS and Governments must be implemented for the reduction of spreading disease in slums, also by regular cleaning of the streets. Sanitation facilities should be developed and more public toilets should be constructed for better hygienic conditions. Chemical medicinal sprays should be sprayed regularly to control mosquitoes as well as the rats. Free medical camp must be arranged by the municipality and the NGO's for regular health check-up.

"Mulgi shikali pragati zahali" slow gun of government of Maharashtra has taken measures on education to urban and rural part. Such measures can be conducted by opening additional schools for girls and women by giving admission for primary learning without difficulty. NGO's must reach these slums and give free teaching to the street slum children.

Awareness on cleanliness must be created, importance of education must be told. Doctors from reputed hospitals must a visit as a part of social service and the NSS cadets; scouts guides NCC Cadets should also visit these places to create social awareness. Slum upgrading and prevention policies for the HIV/AIDS epidemic

To improve their lives and raise their income training shall be conducted on business skill in group and individual businesses. Government make them available infrastructural facility and habit of daily savings. Slums are able to access affordable small loans from their savings, helping to improve their credit rating. Positive impact on women's access to resources and enlarged their decision-making roles.

By showcasing their work need government support to them in future development plans and registered their identity in the record hence no one is unrecognised, ignored and excluded.

The government should formulate healthy policies to improve the conditions like reduce soil erosion, improve air and water quality and protect biodiversity to control and remove the illegal slums. They are targeted specifically at slums .Thus; city will surely become an ideal place to all coming here.

Reference:

The readings from Magazines and newspapers of:

India Today, Outlook, The articles and news in Times of India, The Indian Express, Lok Satta, Sakal, Mumbai Mirror and readings from Foundation Course Text Book and reference book.

Sharad Shankardass "Cities, Slums and the Millennium Development Goals." Asia specific ministerial conference on housing and human settlement. 3rd -15th December 2006.

AGRO BIODIVERSITY –NUTRITION AND HEALTH NEXUS

Monali Torane and Anita S. Goswami-Giri*

Department of Biochemistry, B.N.Bandodkar College of Science, Chendani Bunder Road, Thane- 400 601(MS) India.

Address for correspondence *: anitagoswami@yahoo.com

ABSTRACT:

An Agro biodiversity response broadly condenses dietary diversity, nutrition and health. Societies derive benefits from globalisation and modernisation in methods of crop production. In India, globalisation and modernisation have been neither simple or nor linear to attend threats. Hence the present review article addresses the biodiversity of the essential nutrients and the physiological effect of their deficiency and over-consumption forming a nexus between agro biodiversity, health and nutrition.

KEY WORDS: Nutritional Discrepancies, Nutrients, Agro -biodiversity

INTRODUCTION:

An agricultural system embraces remarkably similarity in all civilizations. One major prerequisite for the maintenance of health is that there is optimal dietary intake of vitamins, certain amino acids, fatty acids, minerals, and water. While creating nutrition-sensitive food, the need to preserve ecosystem is essential for man's survival. Multi-sectoral approaches bridges the gap between agriculture, nutrition and health which ease the problem of malnutrition. To balance the food supply and growing population there is a need to prioritise the evaluation and conservation of food crops for mankind.

Nutritional approaches in human diets wholly associated with increased accessibility of economical agricultural commodities, erosion of agro biodiversity. Therefore it leads to nutrient deficiencies or excess energy consumption, reflecting non-communicable diseases; that are current causes of death worldwide (Johns and Eyzaguirre 2006). Moreover, more emphasis is being placed on systematic attempts to maintain health and forestall disease. Understanding nutrition

depends to a great extent on knowledge of agro biodiversity.

Assessment of agro-biodiversity in India:

In developing world where diversity lacks, diets consist of starchy staples to a great extent with nutrient-rich foods for balanced diet (Johns et.al.2006).Nutrition and health consideration forge a strong connection between imperatives to ensure human well-being and conserves biodiversity. Agro biodiversity comprises the cultivated plants and animals that form the raw material of agriculture, (Jarviset al. 2006). Top-ten states wise percentage production in India (2011-12), which was still the same in year 2013,(Table 1).It is divided in the production being less available but important for a balanced diet (figure 1 and 2).Organic and inorganic nutrients maintain a nutritional status, healthy growth. Hence agro-biodiversity is a necessary response to the increase in diseases associated with the globalization of food systems. Benefits from enhanced use of such biodiversity have legitimately flown to the undernourished poor, while potential negative consequences have been minimized and mitigated (Frisonet.al, 2006).Table 2 shows the unbalance organic and inorganic nutrients discrepancies on human health. The effects of nutrients are dose-dependent and shortages are called deficiencies that have been explained in biochemistry of diseases. Table 3 specifies the nutrients and minerals present in cereals and pulses that is the main production in India and consumed by the society. Statistics of production in India has to be pay attention of researcher to improve the quality of crops/food to cop-up against health issue.

TABLE 1 Top ten state wise percentage (%) productions to all India (2011-2012).

	MS	**MP**	**UP**	**AP**	**PB**	**KA**	**BR**	**OR**	**RJ**	**GJ**	**TN**
WHEAT	2.15	9.67	33.02		19.26	20.56	5.16	0.17	9.31	2.49	
JOWAR	44.28	10.12	3.48	6.3	-	3			6.8		5.14
BAJRI	15.3	1.9	9.2	1.1	-	3.7		7.31	5	10.6	1.4
RICE			11.91	12.71	10.86	-	5.34	-	--	-	7.08
SOYABEAN	8	8	-	-	-	18.94		-	8	-	
MAIZE	10.65	5.97	6.07	17.42	-	-		-	7.74	3.57	7.27
LENTIL		19.15	43.62	-	-	17.57	22.34	--	4.26	-	-
TUR	39.24	7.26	11.85	10.94	-	8		-		10.65	-
MOONG	15	24	13	9	-	-	3	-	12	3	1

MS –Maharashtra, **MP**-Madhya Pradesh-**,UP**- Uttar Pradesh-**,AP**-Andhra Pradesh**, PB**-Punjab**, KA**-Karnataka**, BR**-Bihar,**OR**-Orissa**, RJ**-Rajasthan**, GJ**-Gujarat**, TN**-Tamil Nadu

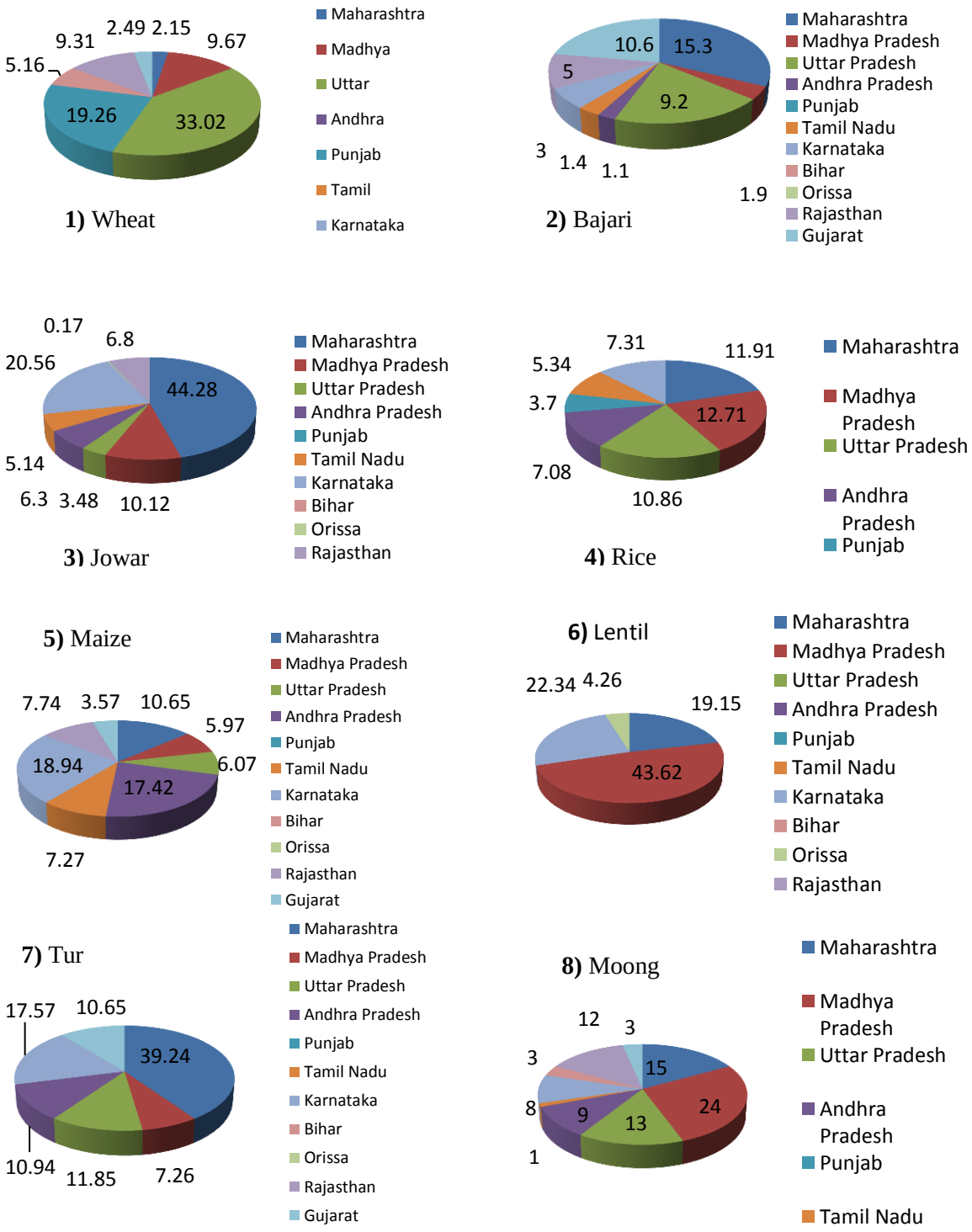


Figure 2 State wise distributions of pulses.

TABLE 2 List of nutrients and its discrepancies respocible for various types of diseases.

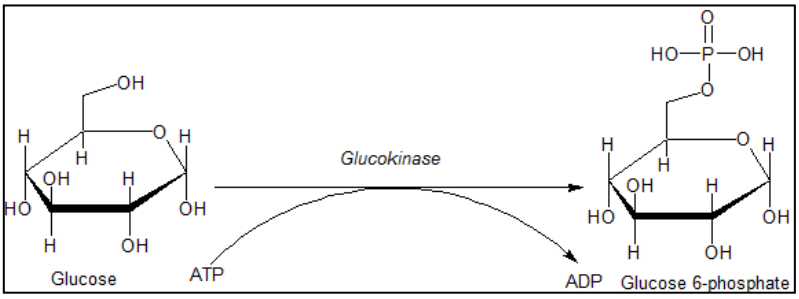
NUTRIENTS	DISCREPENCIES		
	INCREASE	DECREASE	References
Carbohydrates	Obesity, Insulin Resistance(Diabetes)	Water Related Weight Loss	Vijan, S,2010
	Heart Disease , hypertension	Hypoglycaemia , Ketosis	Harvey & Champe;2011
Proteins	Constipation , Diverticulitis	Kwashiorkor ,	Williams,1950
	Osteoporosis , Gout,	Hyperthyroidism	R Curto et al.,1998 , Elahi et al., 2011
	Mild Metabolic Acidosis	Muscle Degeneration	Greenhaff, 1997
Fats	Obesity , Type II Diabetes,	Increase In Triacylglycerol Level ,	Fernández-Sanchez.et.al., 2011
	Cardiovascular disease, Hypertension	Atherogenic Postprandial,	Zilversmith, 1979
	Osteoarthritis , Gall Bladder Disease	Poor Vitamin Absorption, Depression,	Donovan, 1999
Vitamins	Vitamin. A: Hair Loss , Growth Retardation	Vitamin A :Chronic Malabsorption of lipids	Tanumihardjo, 2011
	Blurred Vision	Xeropthalmia	Tanumihardjo, S.A. ; 2011
	Vitamin D : Nausea , Kidney Damage	Vitamin D : Osteomalacia	Donovan , 1984
	Vitamin E : Nausea Digestive Tract Disorders	Vitamin E: Muscle Weakness , Abnormal Vision	Bellows L. et al.,2014
	Vitamin K: Porphynuria, Thrombosis	Vitamin K : Liver Damage , Cystic Fibrosis	Shearer et al.,2008
	Vitamin B_6: Nerve Damage To Leg and Arm	Vitamin B_6 : Seizures, Inflammation of Tongue, Ulcers In Mouth	Ida K Kjeldby; 2013
	Thyroid Cancer	Goitre, Hypothyroidism, Cretinism	Davis Kibirige et al.2103
Minerals	Phosphorous : Calcification of Kidney ,	Phosphorous :Anaemia , Rickets (Osteomalcia)	John J.B. Anderson :1996

TABLE 3 The list of various cereals and pulses and the nutrients and minerals present in it.

SOURCES	ORGANIC NUTRIENTS (Average value per 100gm)				INORGANIC NUTRIENTS (Average value per 100gm)							
CEREALS	Carbohydrate,	Proteins	Fat	vitamin	Na	K	Ca	Mg	Fe	P	Mn	Zn
WHEAT	71	14	2.5	B_6-20%	2	12	3	36	-	-	-	
JOWAR	73	10	2	-	-	-	25	-	4	22	-	-
BAJARI (MILLET)	67	12	5	-	-	-	25	-	0.04	0.022	-	-
RICE	23	2.6	0.9	B_6-5%	0.5	0.43	-	10%	-	-	-	-
NAACHNI	88	7.6	1.5	A-0.4	-	-	0.37	-	-	-	-	-
SOYABEAN	30.16	36.49	19.4	C-7% E-6% K-47µg	0.2	0.17	0.27	0.28	1.57	0.704	0.25	-
MAIZE	27	5	1.9	C-3mg B_6-61mg	-	0.39	0.3	-	0.08	0.129	0.02	-
PULSES												
MASUR (LENTIL)	60	26	1	B_1-0.08 B_2-0.02 C- 0.4	0.6	0.9	0.5	0.1	0.7	0.45	0.1	0.4
TUR(PIGEON PEA)	62.7	21.7	14	B_1-0.06 B_2-0.01	0.2	-	0.13	0.18	0.05	0.367	0.02	0.1
MOONG (GREEN GRAM)	62.62	23.86	1.5	B_1-0.06 B_2-0.01	-	0.01	0.13	0.18	0.06	0.36	0.1	

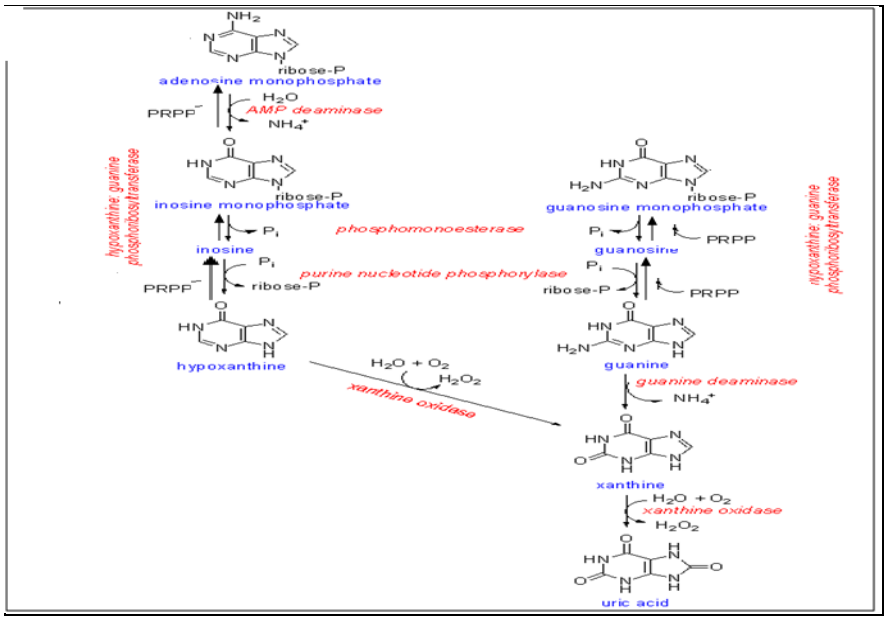
BIOCHEMISTRY OF VARIOUS DISEASES:

1) DIABETES: Glucokinase act as a 'glucose sensor' for the pancreas. it carry out phosphorylation of glucose to glucose -6-phosphate .Defect in glucokinase functioning leads to increase in blood glucose level, which ultimately leads to diabetes.



2) GOUT :

Gout also known as hyperuricemia due to excess production and accumulation of uric acid is due to elevated level of 5′ phosphoribosyl-1′-pyrophosphate synthatase (PRPP).PRPP is essential for purine which produces uric acid. Defect in PRPP synthatase which is due to deficiency of purine nucleotide phosphorylase (PNP) leads to excess production of PRPP and elevated level of uric acid, leading to gout.



3) OSTEOPOROSIS:

Osteoporosis is due to destruction of proteoglycan synthesis leading to suppression of matrix synthesis ultimately lead to reduction in chondrocytes which is responsible for

synthesis of collagen that makes up cartilage matrix.

4) HYPERTHYROIDISM:

Hyperthyroidism is due to excess secretion of thyroid hormones (T_3 and T_4) under the influence of TSH. Iodine deficiency leads to decrease in T_3 and increased secretion of TSH by pituitary which produces hyperplasia and goitre.

5) RICKETS (OSTEOMALCIA):

Rickets is softening of bone that leads to fractures and deformity. It is due to deficiency of Vitamin D which is present as calcitrol in an inactive form in body. Calcitrol which in turn activate osteoclasts, involved in maintenance and repair of bone.

CONCLUSION

Agricultural biodiversity is a concern worldwide realization. Presently, developing countries are facing micro-nutrient deficiency co-existing with obesity and related cardiovascular diseases which constitute a frightening change for future. Agro biodiversity is a core component to achieve sustainable development of human health. Agriculture biodiversity is a matter of life and death for us. We cannot separate agro biodiversity from food security. Health as a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity.

REFRENCES

1) Emile A. F., Cherfas, J. and Hodgkin, T. **(2006) "**Agricultural biodiversity, nutrition and health: Making a difference to hunger and nutrition in developing world. "Food and nutrition 27(2): 167.

2) Johns, T. and Eyzaguirre, P.B. (2006) "Symposium on Wild-gathered plants: basic nutrition, health and survival" Cambridge Journals 65(2): 182.

3) Frison, E. A., Smith, I. F., Johns, T., Cherfas, J. and Eyzaguirre, P.B.(2006) "Agricultural biodiversity, nutrition, and health: Making a difference to hunger and nutrition in the developing world". Food and Nutrition Bulleten 27(2) 167.

4) Johns, T., Smith, I.F. and Eyzaguirre, P.B. **(1997)** "Understanding The Links Between Agriculture & Health" Agrobiodiversty, Nutrition & Health, Focus 13 • Brief 12 Of 16.

5) Vijan, S "Type 2 diabetes". **(2010)** Annals of Internal Medicine **152** (5): ITC31-15

6) Elahi , S., Rasheed,H. , Syed , Z., Aman , Z. and Riffat Y. **(2010)** "Serum Concentration of Thyroxin and Thyroid Stimulating Hormone in Children Suspected of Thyroid Dysfunction". *Journal of Scientific Research* 40 (2).

7) Johns, T. Smith, I.F. and Eyzaguirre, P.B. (**2006**)"Understanding The Links Between Agriculture & Health" For Food, Agriculture, and the Environment ,focus 13 • brief 12 of 1

8) Williams C. (1950) "The British Medical Journal" 2(4673): 284.

9) Tanumihardjo, S.A., (2011) "Vitamin A: biomarkers of nutrition for development" American Society for Nutrition, Vol 94. 658S.

10) Greenhaff, P.L. (1977) "The nutritional biochemistry of creatine" The Journal of Biochemistry 8(11): 610-618.

11) Donovan J.M (1999) "Physical and metabolic factors in gallstone pathogenesis". pubmed 28(1):75-97.

12) Zilversmith, D.B., (1979) "Atherogenesis: a postprandial phenomenon." pubmed 60(3):473-85

13) Curto, R. ,E.O.Voit ,M Cascanate **(**1998**)** "Analysis of abnormalities in urine metabolism leading to gout and other neurological disease" Biochem J. 329(3): 477.

14) Harvey and Champe, (2011) Biochem. 117.

15) **(2013)** "Diabetes-Overview NHS",
Williams textbook of endocrinology (12th ed.) Elsevier/Saunders, pp. 1371–1435.

16) Fernández-Sánchez, A., Madrigal-Santillán,E. , Bautista,M. , Esquivel-Soto,J. , Morales-González, A., Esquivel-Chirino, C. , Durante-Montiel,I. , Sánchez-Rivera,G. , Valadez-Vega,C. and Morales-González ,J.A., **(2011)** , "Inflammation, Oxidative Stress, and Obesity" International Journal of Molecular Sciences ,12: 3117-3132.

17) Shearer, M.J. and Newman P., (2008) " Metabolism and cell biology of vitamin K" Thrombosis and Homeostasis : 100/4,517-726.

18) Kjeldby.I.K., Fosnes,G.,S., Ligaarden S.C. , and Per G Farup" Vitamin B6 deficiency and diseases in elderly people – a study in nursing homes" BMC Geriatrics,13:1471-2318.

19) Davis Kibirige and Raymond Mwebaze "Vitamin B12 deficiency among patients with diabetes mellitus: is routine screening and supplementation justified?" Journal of diabetes & metabolic disorders, 2:17 doi:10.1186/2251-6581-12-17.

20) John J.B. Anderson, Sanford C. Garner "Calcium and Phosphorus in Health and Disease" ,(1996) :40-41

22) Bellows L.,Moore R. (2014**)** "Fat –Soluble Vitamins:A ,D E and K" Colorado State university.

23) i)www.agropedia.iitk.ac.in

ii)www.farmer.gov.in/imagedefaultpulses.pdf

iii)www.efreshindia.com.

Available online www.vpmthane.org

BNB-2014

INVESTIGATIONS ON BETEL-NUT PALM (*ARECA CATECHU* L.) FROM THANE, INDIA

Moses Kolet

*Corresponding author, Department of Botany, B.N.Bandodkar College of Science, Chendani, Thane. 400601.

Correspondence: mjkolet@vpmthane.org

ABSTRACT

The areca palm, also known as the betel-nut palm (*Areca catechu* L.) is commonly cultivated in the Konkan region of Maharashtra and in South India. Like most other palms, all parts of the tree are useful. The basic products of commercial importance are the areca nuts. Many of the 79 areca palms recorded on Jnanadweepa, V.P.M.'s Thane College Campus were young; yet to attain the age of flowering and fruiting and potted specimens placed at various garden locations and vantage points for ornamental purposes. 22 specimens were observed in fruiting stage. Salient features, economic importance, contribution towards utility products, medicinal importance and potential medicinal applications of the tree are discussed.

KEY WORDS: *Areca catechu*, areca nut, betel nut, supari, arecaceae

INTRODUCTION:

The botanical family Arecaceae or Palmae as it was formerly known has always been in close proximity to humanity and civilization. Its members popularly referred to as the palms, are one of the most significant group of plants of economic importance to mankind, second only to the grasses. They have been associated with ancient Indian civilization (Mehra, 1997; Nene, 1997). Ancient records indicate palms being considered as indicators of health (Sadhale, 1996). In modern times also, they significantly contribute towards agro-horticultural economy, especially in the tropics. Palms occur both in wild and cultivated habitats; about 63 palms have been reported indigenous to India with an almost matching number of exotic introductions (Mahabale, 1982). Kulkarni and Mulani (2004) reported 96 species of palms in India. Palms such as the areca nut (*Areca catechu* L.) and coconut (*Cocos nucifera* L.) are commercially valuable as commodities of international trade and commerce (GOI, 2013) and enjoy the privilaged status of economically important plantation crops.

The areca palm, also known as the betel-nut palm (*Areca catechu* L.) is commonly found in the western coastal regions of India from Maharashtra to Kerala and Tamil Nadu; on the Deccan plateau, Assam, Meghalaya, West Bengal, Puducherry and the Andaman and Nicobar islands. The tree is commonly cultivated in the Konkan region and South India (KKV,

1997, Pullaiah and Chandrasekhar Naidu, 2003). This unarmed, tall and slender palm, easily reaching heights of 15-20 metres, capped by a crown of pinnate leaves, cuts a distinct silhouette. Like most other palms, all parts of the tree are useful. The fruits, 2- 2.5" long and 1.5-2" across, are made up of hard and fibrous outer pericarp and the inner kernel which constitutes the areca nut or betel nut of commerce. Apart from a host of applications, nuts are also a part of socio religious functions and symbolize respect in some cultures (Sharma and Gogoi, 1999). The plant and its constituents have been successfully tested on animal models for several useful medicinal properties and activities (Lee *et al*., 2003, Khan *et al*., 2011). Pobutsky and Neri (2012) drew a correlation between chewing of betel nut and incidence of oral cancer. While acknowledging its deleterious effects, Lingappa *et al*. (2011) cited several advantages of areca nuts on human health and well being. Rajput *et al*. (2005) highlighted their applications in veterinary medicine. During routine studies, it was noticed that awareness, knowledge and information on this commercially valuable palm was lacking, deficient and scattered, which prompted the current investigation.

MATERIALS AND METHODS:

A survey of Areca palms was carried out in the Chendani and surrounding areas of Kalwa and Thane, India. The specimens were identified in the field and in the department of botany, B.N Bandodkar College of Science, using standard literature. The related facts pertaining to economic importance and uses, presented in the section of results and discussion, were compiled from sources cited in the references section.

RESULTS AND DISCUSSION: Out of the 79 specimens of betel-nut palms (*Areca catechu* L.) recorded in the Chendani area of Thane (Kolet *et al*., 2013), 22 were observed in fruiting condition. Many of the 79 areca palms recorded were young; yet to attain the age of flowering and fruiting (CSIR, 1948), and potted specimens placed at various garden locations and vantage points in Jnanadweepa, V.P.M.'s Thane college campus for ornamental purposes. Heights of the potted specimens were in the range of 5-14 feet, while those of specimens planted at permanent locations were in the range of 15-20 feet. No specimens could be recorded from the immediate surrounding areas. Few trees were documented in Kalwa area outlying Chendani, Thane. The characteristic features and morphology of the palm tallied with the descriptions of Sahni (2000) and Kirtikar and Basu (2006). The salient features and information on this evergreen tree is presented in Table 1.

The economic value of the palm is depicted in Table 2. The basic products of importance are the areca nuts. All parts of the betel-nut palm are valuable and yield many products which have several applications (Table 2). The palm is valued in coastal regions of Maharashtra, Kerala, Tamil Nadu as well as other locations of growth and cultivation; and looked upon as a source of

income since betel nuts command economic value in international trade and commerce. Medicinally also nuts are valuable; reported to contain alkaloids, tannins and several phytoconstituent chemicals (Chopra *et al*., 1956; 1969), they were attributed with several medicinal properties (Kirtikar and Basu, 2006). Fugh-Bergman (2000) cautioned on careful monitoring of doses of the drug and its concurrent usage with pharmaceutical drugs. While chewing of betel-nut is said to induce oral cancer (Auluck *et al*., 2009; Chen *et al*., 2013) and unripe fruits are known to be poisonous and harmful to eyes (Parrotta, 2001), its constituents and extracts have been successfully tested for valuable properties and activities namely, analgesic, anthelminthic, anti-bacterial, anti-depressant, anti-fungal, anti-inflammatory, anti-nematodal, anti-oxidant, appetite-suppressant, CNS stimulant, hypoglycemic, hypolipidaemic, molluscicidal, platelet aggregation inhibitor, sedative, wound healing among many others and investigated for potential roles in management of Alzeimer's disease, HIV-AIDS and psychiatric disorders on animal models (Vermani and Garg, 2002; Jaiswal and Singh, 2008). Areca nut oil was reported to promote healing of burns and wounds (Verma *et al*., 2012). Reported activities of areca nuts such as anti-aging, anti-hypertensive (Amudhan *et al*., 2012), protector against tooth decay and strengthener of gums (Prabhu, 2013), activity against motility of sperms (Jaiswal *et al*., 2011) suggest roles for the plant in cosmetics, dental care products, contraceptives and lifestyle-related drugs in the near future. Several new and useful products of areca nut are expected to be launched soon (Vinayak, 2013). Considering problems of shortage and unavailability of labour, a simple, manually operated mechanical device for plucking nuts from the trees was recently developed and marketed (The Hindu, 2012; Srikrishna, 2013). Taking into account the economic and cultural value, systematic attempts and efforts are required and recommended to raise awareness levels and popularize the species in gardens and parks.

Table 1 Salient Features of Betel-nut Palm

(CSIR, 1948; Pullaiah and Naidu, 2003; Kirtikar and Basu, 2006; Staples and Bevacqua, 2006)

Information	
Botanical name	*Areca catechu* L.
Family	Arecaceae (Palmae)
Vernacular names	Areca palm, areca-nut palm, betel-nut palm, supari, pophali, gubak, guvaka, kramuka, puga, tantusara.
Origin	Indonesia, Philippines, South or South East Asia
Distribution	Found in coastal regions, warmer parts of Asia, in tropical regions at altitudes of 0-900 m, cultivated or semi-wild, also planted in back yard gardens and in gardens as ornamentals
Climate requirements	Tropical wet climate, shade loving
Habit	Evergreen tree, unarmed, slender single trunked palm, annulated stem, prominent bright green crown shaft and crown comprising 8- 12 fronds
Height	Trees commonly attain heights of 10-20 m; can also reach 30 m
Appearance	Attractive, elegant and graceful, young and old both species are attractive
Soil requirements	Can grow in various soils ranging from lateritic to loams and clay loams Prefers well-drained medium textured soils with good water holding capacity pH range of 5-8 Irrigation required during dry periods Early management of weeds required in establishment stages
Intolerance to	Cold Drought Extreme temperatures Salt Strong sunlight Strong wind Water logging Wide variations in temperatures
Growth	Moderate rate of growth; c 50cm/ year
Flowers	Spadix branched, with numerous small male and larger female flowers
Fruits	Ovoid, bright orange, yellow or scarlet when ripe
Propagation	Seedlings raised from ripe fruits in November
Germination period	Around 90 days after sowing
Expected life span	60-100 years
Invasiveness	Non invasive

Table 2 Contribution of Betel-nut Palm (*Areca catechu* L.) towards utility products.

(Chopra *et al*., 1956; CSIR 2010, Chen *et al*., 2013)

Plant part/ product	Utility
Entire tree	Ornamental tree in gardens and landscaping projects Young palms especially suited for modern urban landscaping Boundary indicators Economically important Many crops and new seedlings can be grown under betel nut palms Grasses can be interplanted with betel nut palms for fodder usage Pepper (*Piper betle*, *P. nigrum*) vines are commonly trailed on trunks of betel nut palms
Roots	Medicinal
Trunk	Construction and other rural uses, Construction of temporary ceremonial structures Fuel, firewood, Wood/ Timber Medicinal
Fruit	Medicinal
Nut/ seed	Importance in trade and commerce, Local importance Masticatory Medicinal, Ingredient of ethno veterinary medicines Socio religious importance; chewing of betel nut has social and cultural importance Tannins, dyes
Shoot	Medicinal
Leaves	Young leaves used in culinary preparations Medicinal Manufacture of alcohol Fuel Yield organic manure of good quality when composted Burning of dried leaves yields ash; added to soil for renewal of nutrients
Leaf base	Good source of paper pulp Manufacture of localized items such as hats and insoles of foot ware
Leaf sheath	Become flexible on pre treatment, made into cups, plates, bags and natural wrapping materials Book covers Good source of organic manure Manufacture of localized items such as hats and foot ware, Packing material
Spathe	Makes attractive natural wrapping material Manufacture cheroots Manufacture of localized items such as hats and foot ware, Packing material Used as material to write upon Burning of dried fallen spathes yields ash; added to soil for renewal of nutrients Fuel
Inflorescence	Ceremonial decorations Fuel Usage in various auspicious ceremonies and rituals Women use to adorn their hair
Terminal bud	Edible, culinary preparations, eaten raw, cooked or pickled Medicinal
Tender shoots	Edible, eaten cooked Medicinal
Wood/ Timber	Manufacture of stationery articles such as scales, rulers, etc. Manufacture of elegant utility articles, clipboards, fibreboards Rafters
Flowers	Male flowers are bee forage Perfumery uses Rites and rituals Salad ingredient
Extract of nut	Black and red dyes Analgesic, ant-inflammatory action

Tender seeds/ nuts	Medicinal Yield tannin
Husk	Domestic fuel Insulating wool Manufacture of boards, tooth brushes Manufacture of furfural Medicinal Rich in cellulose
Powdered nuts	Medicinal
Fresh nuts	Ripe or unripe fresh nuts are products of local trade and importance Ripe and unripe nuts are consumed Commercial product viz. dried nuts prepared from fresh ripe or unripe fruits
Dried nuts	Medicinal Dried nuts (entire or sliced) are the main commercial product in international trade Dry nuts are good source of organic manure
Nut oil	As extender for cocoa butter Medicinal
Dyes	Black and red dyes obtained from extract of nut
Tannins	By products obtained during boiling of nuts as part of processing

Table 3 Medicinal value of *Areca catechu* L.

(Dastur, 1977; Parrotta, 2001; Pullaiah and Chandrasekhar Naidu, 2003; Kirtikar and Basu, 2006; Cyriac *et al*., 2012)

Plant part	Medicinal use
Root	Treatment for sore lips and liver diseases
Trunk	Deobstruent in flatulence and dropsy and for choleric affections
Shoot	Young shoots abortifacient
Leaves	Treatment of lumbago Treatment of cough and bronchial afflictions
Fruit	Cooling, laxative, Improves appetite and taste, Breath freshner
Husk	Anti-fungal properties Used for cleaning teeth
Nuts	Astringent, anthelmintic, cardiotonic, digestive, diuretic, emmenagogue, cure for inflammation of eye, giddiness, gleet Chewing dry nuts has stimulating effect Fresh nuts intoxicating, Juice of tender nuts laxative Possess wound healing property Powdered nuts said to have aphrodisiac properties, used to cure diarrhoea and urinary disorders, ulcers and skin disorders Paste of dry nut and burnt nuts used as dentrifice, Removes pus, Strengthens gums Tonic for nervous system Treatment of diabetes Treatment of polyuria, gynaecological problems, bleeding and problems of nervous system, heartburn during pregnancy, Vermifuge, Young nuts used in treatment of ulcers and bowel ailments Veterinary medicine for healing of wounds, diarrhoea, as vermifuge and in snake bite
Tender fruits	Juice used as laxative
Nut oil	Anti fertility action
Potential medicinal applications	Anti-aging, anti-depressant, anti-HIV, antioxidant, anti-schizophrenic, anti-inflammatory, anti-nematodal, anthelminthic, analgesic, protection against dental cavities and tooth decay, sedative

Acknowledgement: Greatly acknowledge to Shubhangi Zanjad, Akshada More, Trupti Pawar and Tejal Ambre for their help to count plants in the Bandodkar campus.

REFERENCES:

Amudhan, M.S.,; Begum, V.H. and Hebbar, K.B. 2012.A review on phytochemical and pharmacological potential of *Areca catechu* L. seed. *Int J Pharm Sci Res* 3(11): 4151-4157.

Auluck, A., Hislop, G., Poh, C. Zhang, L. and Rosin, M.P. 2009. Areca nut and betel quid chewing among South Asian immigrants to western countries and its implications for oral cancer screening. *Rural Remote Health* 9(2): 1118.

CSIR. 1948. The Wealth of India (Raw Materials) Vol. I. CSIR, Delhi. pp. 109-114.

CSIR. 2010. The Wealth of India (Raw Materials) Vol. I. CSIR, Delhi. pp.391, 408.

Chen, S.C., Huang, B.S. and Lin, C.Y. 2013. Depression and predictors in Taiwanese survivors with oral cancer. *Asian Pacific Journal of Cancer Prevention* 14(8): 4571-4576.

Chopra, R.N., Nayar, S.L. and Chopra, I.C. 1956. Glossary of Indian Medicinal Plants. CSIR, New Delhi. 23.

Chopra, R.N., Chopra, I.C. and Varma, B.S. 1969. Supplement to Glossary of Indian Medicinal Plants. Publications and Information Directorate, CSIR, New Delhi. pp. 7.

Cyriac, M.B., Pai, V., Varghese, I., Shantaram, M. and Jose, M. 2012.Antimicrobial properties of Areca catechu (Areca nut) husk extracts against common oral pathogens. *IJRAP* 3(1): 81-84.

Dastur, J.F. 1977. Medicinal Plants of India and Pakistan. Taraporevala Sons & Co., Bombay. pp. 22.

Fugh-Bergman, A. 2000. Herb-drug interactions. *The Lancet* 355: 134-138.

GOI. 2013. India 2013. Publications Division, Ministry of Information and Broadcasting, Government of India. pp. 1057-1141.

Jaiswal, P. and Singh, D.K.. 2008. Molluscicidal activity of *Carica papaya* and *Areca catechu* against freshwater snail *Lymnaea acuminata*. *Vet. Parasitol*. 152: 264-270.

Jaiswal, P., Kumar, P., Singh, V.K. and Singh, D.K. 2011. *Areca catechu* L.: A valuable herbal medicine against different health problems. *Research Journal of Medicinal Plants* 5: 145-152.

KKV, 1997. *Kokanaatil phalzaade* (3rd rev. edn.) . Kokan Krishi Vidyapeeth, Dapoli, India.

Khan, S., Mehmood, M.H., Ali, A.N.A., Ahmed, F.S., Dar, A. and Gilani, A.H. 2011. Studies on anti-inflammatory and analgesic activities of betel nut in rodents. *Journal of Ethnopharmacology* 135: 654-661.

Kirtikar, K.R. and Basu, B.D. 2006. Indian Medicicinal Plants, Vol. IV. International Book Distributors, Dehradun, India. pp. 2546-2549.

Kolet, M., Ambre, T. and Zanjad, S. 2013. A survey of palms from Jnanadweepa campus and studies on their status of conservation. *Proc. Nat Conf. Biodiversity: Status and Challenges in Conservation*, FAVEO 2013, Bandodkar College, Thane. pp. 201-204.

Kulkarni, A.R. and Mulani, R.M. 2004. Indigenous palms of India. *Curr. Sci*. 86(12): 1598-1603.

Lee, S.E., Hwang, H.J., Ha, J., Jeong, H. and Kim, J.H. 2003. Screening of medicinal plant extracts for antioxidant activity. *Life Sciences* 73: 167-179.

Lingappa, A., Nappalli, D., Sujatha, G.P. and Shiva Prasad, S. 2011. Areca nut: to chew or not to chew? *e-journal of Dentistry* 1(3): 46-50.

Mahabale, T.S. 1982. Palms of India. Monograph No. 3. Maharashtra Association for the Cultivation of Science, Pune, India.

Mehra, K. L. 1997. Biodiversity and subsistence changes in India: the Neolithic and chalcolithic age. *Asian Agri-History* **1** (2): 105-126.

Nene, Y. L. 1997. Additional comments on Surapala's Vrikshayurveda. *Asian Agri-History* **1** (2): 157-159.

Parrotta, J.A. 2001. Healing Plants of Peninsular India. CABI Publishing, Wallingford, Oxon, UK. pp. 110-111.

Pobutsky, A.M. and Neri, E.J. 2012. Betel nut chewing in Hawaii: is it becoming a public health problem? Historical and socio-cultural considerations. *Hawaii J Med Public Health* 71(1): 23-26.

Prabhu, N. 2013. Anti microbial effect of chewing *Tamboolam* (betel leaves and its combinations) by testing saliva of volunteers. *Indian Journal of Applied Research* 3(2): 290-292.

Pullaiah, T. and Chandrasekhar Naidu, K. 2003 Antidiabetic Plants in India. Regency Publications, New Delhi. 89.

Rajput, D.S., Tripathi, H. and Bhanja, S.K. 2005. Ethnoveterinary practices of Raika pastoralists for camel health management in Bikaner District of Rajasthan. *Asian Agri-History* 9(3): 243-252.

Sadhale, Nalini (Tr.). 1996. Surapala's Vrikshayurveda (The Science of Plant Life by Surapala). Agri-History Bulletin No.1. Asian Agri-History Foundation, Secunderabad, India. pp. 43-62.

Sahni, K.C. 2000. The Book of Indian Trees. Bombay Natural History Society, Mumbai & Oxford University Press, New Delhi. pp. 184.

Sharma, K.K. and Gogoi, R.1999 Agriculture in traditional wisdom of Assam. *Asian Agri-History* 3(3): 199-206.

Srikrishna, D. 2013. The wonder climber for areca nut trees. *India Together*. indiatogether.org/2013/sep/agr-arecanut.htm (accessed on 16/1/2014)

Staples, G.W. and Bevacqua, R.F. 2006. *Areca catechu* (betel nut palm), ver. 1.3. In, Elevitch, C.R. (Ed.). Species Profiles for Pacific Island Agroforestry. Permanent Agriculture Resources (PAR), Holualoa, Hawaii. pp. 1-16.

The Hindu. 2012. It plucks arecanut in just three minutes. *The Hindu*, Puttur Edn.Nov. 3, 2012.

Verma, D.K., Bharat, M., Nayak, D., Shanbhag, T., Shanbhag, V. and Rajput, R.S. 2012. *Areca catechu*: effect of topical ethanolic extract on burn wound healing in albino rats. *Int J Pharmacol and Clin Sci* 1(3): 74-78.

Vermani, K. and Garg, S. 2002. Herbal medicines for sexually transmitted diseases and AIDS. *Journal of Ethnopharmacol*. 80: 49-66.

Vinayak, A.J. 2013. Alternate uses of arecanut yet to catch up. *Business Line*. www.thehindubusinessline.com (accessed on 17/1/2014)

LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRIC METHOD FOR THE ESTIMATION OF *R* BICALUTAMIDE IN HUMAN PLASMA

Varad R. Pradhan[1] and M.V. Rathnam*

[1]B. N. Bandodkar College of Science, Chendani Bunder Road, Thane-400601, Maharashtra, India.

Corressponding Authors: *mvrathnam58@rediffmail.com ; [1]varadpradhan@yahoo.com

Abstract:

Bicalutamide (BCT) is a non-steroidal antiandrogen and is an oral medication that is used for the treatment of prostate cancer. Its chemical name is (*RS*)-N-[4-cyano-3-(trifluoromethyl) phenyl]-3-[(4-fluorophenyl) sulfonyl]-2-hydroxy-2-methyl-propanamide. BCT as such is a racemic mixture, but most of its pharmacological activity is attributed to its *R* enantiomer. A single, simple and selective method for the estimation of *R* enantiomer of BCT in human plasma was validated using external standard method. The drug was separated from its *S* enantiomer on Ultron ES OVM chiral column under isocratic conditions consisting of 12.5mM ammonium formate buffer and ethanol (75:25, v/v), with a total run time of 15 minutes and detected by tandem mass spectrometry with negative ionization mode. Complete baseline separation between both the enantiomers was obtained with excellent precision and accuracy for *R* BCT, thus supporting stereo specific pharmacokinetic studies of the active enantiomer. Linearity in plasma was observed over the concentration range 10.020 – 601.200 ng/mL. Stability was evaluated under different conditions including bench top, processed sample, freeze and thaw, autosampler and long term.

Keywords: *R* Bicalutamide; Chiral; LC-MS/MS; Human Plasma; Validation

INTRODUCTION:

Chiral drugs continue to be a significant force in the global pharmaceutical market as chirality significantly influences a drug's biological and pharmacological properties. Stereochemistry impacts decisions made in the absorption, distribution, metabolism, excretion, and toxicity stages of drug discovery [1]. Stereoselective methods have been employed to study enantioselective metabolic profiling of the active components from Herbal Medicines as well *in vitro* and *in vivo* in recent years [2]. Chiral drugs make up 40-50% of the market today. The extension of patent protection for drugs manufactured from enantiomers is an important factor that is driving growth of chiral intermediates in pharmaceuticals. For some drugs, only one enantiomer is effective that would, in theory, only require half the effective dose of a 50/50 racemic mixture. In this context, chirality has become a major theme in the design, discovery, development and marketing of new

drugs [3-5]. Enantiomers of a chiral drug may work differently in the body [6].

Bicalutamide (BCT) under the trade name of Casodex® is one of the leading non-steroidal anti-androgens used for the treatment of prostate cancer [7-8]. This drug competes with testosterone and dihydrotestosterone for binding sites on the prostate and other androgen-sensitive tissues and has little or no agonist activity [9]. The drug is well tolerated and has very few side-effects [10]. BCT as such is a racemic mixture, but most of its pharmacological activity is attributed to its *R* enantiomer.

Regulatory authorities implied guidelines that clearly state that the development of an enantiopure drug should be preferred, while it also has to be demonstrated that the developed drug is indeed enantiopure. The United States Food and Drug Administration (FDA) issued guidelines and policies in 1992 concerning the development of stereoisomeric drugs (enantiopure and racemic drugs) [11]. FDA urged the pharmaceutical industries to evaluate enantiopure drugs alongside racemic drugs as new candidates for the future. Further, world scientific and regulatories bodies (European Union, Canada, Japan) released guidelines for the development and manufacture of enantiopure drugs [12]. The regulatory review for marketing approval/safety and efficacy and for patenting is independent, and differs country by country. Guidelines on the investigation of chiral active substances were issued by a commission of the European countries in 1994 and by Canadian Government in 2000. The importance of evaluating the behaviour of stereoisomers was further highlighted in FDA regulatory document in 2005. Based on case-to case study, the U.S. Food and Drug Administration allowed single enantiomers of certain drugs to be marketed under a different name than the racemic mixture. Also case-by-case, the United States Patent Office has granted patents for single enantiomers of certain drugs [13].

As a result, there is an increasing demand for the separation and isolation of chiral pharmaceuticals. Chiral drug candidate, whether a single enantiomer, or a mixture of enantiomers, require relatively more analytical information than achiral drug candidates. This information can be derived from enantioselective spectroscopic and chromatographic techniques. Chiral analytical methods require proper development and validation to ensure accurate results. Chiral liquid chromatography coupled with tandem mass spectrometry is an important analytical tool for separation and quantification of drug enantiomers.

A thorough review of literature reveals that no validated liquid chromatography - tandem mass spectrometric analytical method for the quantification of BCT enantiomers in biological fluids, has been published in the literature except our own work [14]. However,

the methods for the enantiomeric separation of BCT and its related compounds based on chiral HPLC and other analytical methods [15-31] have been published in the past by several authors.

It was necessary to develop a simple, precise and sensitive method for the determination of *R* BCT in human plasma using LC-MS/MS technique which allows quantification of active enantiomer in presence of inactive enantiomer, without any obstruction from inactive enantiomer. The present work comes up with a simple, sensitive and precise isocratic reversed-phase HPLC-MS/MS method for the determination of *R* enantiomer of BCT in human plasma with a quantification limit sufficiently low to support stereoselective pharmacokinetic studies.

EXPERIMENTAL:

Materials and Chemicals

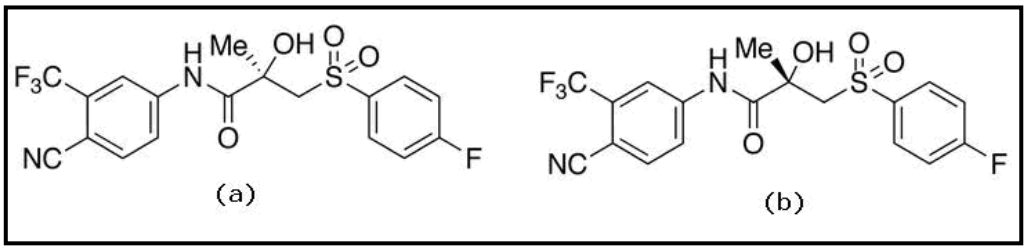


Figure 1: Chemical Structures of (a) *R* BCT, (b) *S* BCT

Reference standard of *R* BCT and *S* BCT (Fig. 1) with 100% purity were purchased from Synfine Research. The HPLC grade solvents viz. methanol, ethanol, acetonitrile and methyl tertiary butyl ether (MTBE) were purchased from J.T. Baker INC. LC-MS grade ammonium formate and glacial acetic acid were procured from Fluka. HPLC grade water was procured from E. Merck Ltd. Blank human blood was collected with Na Heparin as anticoagulant from healthy and drug free volunteers. Plasma was separated by centrifugation at 3000 RPM at 10°C, and stored at –20°C.

Instrumentation and Analytical Conditions:

The chromatographic separation and quantification was achieved by a liquid chromatography system, HTC PAL (Leap Technologies) with Finnigan Surveyor MS pump and coupled with mass spectrometer, TSQ Quantum Ultra (Thermo Electron Corporation). The chiral column, Ultron ES OVM (150 x 4.6 mm, 5µ) from Shinwa Chemicals was used for separation of *R* BCT from *S* BCT. Mobile phase of 12.5mM ammonium formate with ethanol in the ratio of 75:25 (*v/v*) was pumped isocratically at flow rate of 0.5 mL/min. Auto sampler temperature was set at 4^0C and the injection volume was 10µL. The column oven temperature was

maintained at ambient temperature and the total LC run time was 15 min.

The MS/MS system was operated in the single reaction monitoring (SRM) mode for monitoring the transition of the deprotonated molecular ion *m/z* 429.20 to the product ions *m/z* 185.06 and 254.99 for *R* BCT. CE was optimized at 43 and 13 respectively for both the product ions with tube lens of 104 and scan width of 0.010. The instrument response was optimized for *R* BCT by infusing a constant flow of a solution of the drug dissolved in mobile phase.

Electrospray ionization (ESI) was performed in the negative ion mode. The capillary temperature was set to 350^0C with spray voltage of 3500. Sheath gas pressure was set at 80.0 with an auxillary gas pressure of 15.0. Skimmer offset was set at 10.0. The instrument was interfaced with computer running LC Quan software.

Preparation of standards and quality control samples:

Stock solution of *R* BCT was prepared by dissolving the test compound in methanol to obtain 1000 µg/mL concentration. Stock solution of *R* BCT prepared was serially diluted to prepare working solutions in required concentration range with diluent methanol: water (80:20, v/v). Two separate stock solutions of *R* BCT were prepared for bulk spiking of calibration curve and quality control samples for the method validation experiment. The calibration standards and quality control (QC) samples were prepared by spiking 5% of the total plasma volume with working solutions. Calibration standards were prepared at concentration of 10.020, 20.040, 50.100, 100.200, 200.400, 300.600, 501.000 and 601.200 ng/mL. Similarly, quality control samples (QC's) were prepared at three different concentrations namely, 30.048 (LQC), 250.400 (MQC) and 450.720 (HQC) ng/mL. Sufficient calibration standards and quality control samples were prepared to validate the method. Aliquots of the standards and quality controls were stored at -20 °C until used for validation runs.

Sample preparation:

200 µL plasma samples was taken in polypropylene Tarson tubes and 5 mL Methyl tertiary butyl ether was added to it. The contents were vortexes to mix for 15 min on shaker and centrifuged for 15 minutes at 3500 RPM. After centrifugation 4.0 mL of organic layer was transferred to evaporation tubes and evaporated to dryness under a gentle stream of nitrogen at 40^0C. After complete evaporation, the samples were reconstituted with 500µL of mobile phase. 10 µL of the sample was injected into the LC-MS/MS system through the auto sampler.

Method Validation:

Validation experiments of the method were carried out according to USFDA guidelines [32].

Selectivity:

Selectivity was performed using 10 different sources of blank plasma comprising of 6 normal, two hemolysed and two lipemic. These blank plasma samples were processed as per the extraction method and their response was assessed at the retention time of the analytes and the internal standards with six LLOQ samples for *R* BCT (prepared from the screened blank plasma, which had the least interference).

Carry Over:

Carryover effect was evaluated to ensure that the rinsing solution used to clean the injection needle and port is able to avoid any carry forward of injected sample in subsequent runs. The design of the experiment comprised blank plasma, LLOQ, upper limit of quantitation (ULOQ) followed by blank plasma to check for any possible interference due to carryover.

Linearity and lower limit of quantification:

The linearity of the method was determined by analyzing three standard plots associated with an eight-point standard calibration curve. Calibration of the standard curve was done by calculating weighted linear regression from peak area of analyte. The obtained values of slope (m) and intercept (b) were used in the equation y = mx + b to calculate the concentration of the quality controls (x) from the measured peak area (y). Each calibration curve was analyzed individually by using least square weighted ($1/X^2$) linear regression. Several regression types were tested and the linear regression (weighted with $1/concentration^2$) was found to be the simplest regression. The lowest standard on the calibration curve was accepted as the lower limit of quantitation (LLOQ), if the analyte response was at least five times more than that of drug free (blank) extracted plasma. The deviation of standards other than LLOQ from the nominal concentration should not be more than ±15.0% and for LLOQ it should not be more than ±20.0%.

Precision and Accuracy L:

The intra-batch and inter-batch accuracy and precision were determined by replicate analysis of the three quality control levels on three different days. In each of the precision and accuracy batches, six replicates at each quality control level were analysed. Mean and standard deviation (SD) were obtained for calculated drug concentration over these batches. Accuracy and precision were calculated in terms of accuracy and coefficient of variation (% CV) respectively.

Recovery :

Absolute recoveries of the analytes were determined at the three different quality control levels viz. LQC, MQC and HQC, by comparing the peak areas of the extracted plasma samples with those of the un extracted standard mixtures (prepared in the elution solution at the same concentrations as the extracted samples) representing 100% recovery.

Stabilities:

Stability experiments were conducted to evaluate different conditions that plasma samples may encounter during sample shipment as well as pre- and post-processing such as several freeze-thaw cycles and short term storage of plasma samples at room temperature. All stability results were evaluated by measuring the area response of stability samples against freshly prepared comparison samples with identical concentration. Stock solutions and working solutions of analyte were checked for short term stability at room temperature and long term stability at 2–8^{0}C. The solutions were considered stable if the deviation from nominal value was within ±10.0%. For extracted sample conditions such as Auto sampler stability, processed sample stability (at room temperature), bench top stability (at room temperature), and freeze–thaw stability at 3 and 5 freezing (at -20^{0}C) and thawing (not warming) at room temperature cycles were performed at LQC and HQC using six replicates at each level. Long term stability of spiked plasma samples stored at −20^0 C was also studied at both these levels. The samples were considered stable if the deviation from the mean calculated concentration of freshly thawed quality control samples was within ±15.0%.

RESULTS AND DISCUSSIONS

Separation of enantiomers:

In order to quantify *R* BCT, the major challenge was to separate it from its *S* enantiomer. To resolve BCT enantiomers stock solutions of *R* BCT and *S* BCT were prepared separately. The stock solutions were further diluted to get spiking solutions, which were spiked separately and as mixture and injected on different type of columns. Columns used included HPLC grade columns as well as chiral columns. In order to support pharmacokinetic or bioequivalence studies complete separation of both the enantiomers was desirable. Hence, protein based column (Ultron ES-OVM) was used which showed good resolution and separation for BCT enantiomers Fig.02.

To find the best eluting solvent system, various combinations of ethanol / methanol / acetonitrile along with buffers (ammonium trifluoroacetate /acetic acid, ammonium formate /formic acid, ammonium acetate / acetic acid, ammonium bicarbonate / ammonium hydroxide) having different ionic strengths (1–10 mM) in the pH range of 3.0–10.0 and volume ratios were tested. Commonly used solvents in MS/MS analysis like methanol and acetonitrile showed poor resolution on this protein based column. Hence, ethanol was selected as an elution solvent. For better peak shape and higher response, the buffer selected for this study was 12.5mM Ammonium formate because of its

volatilization and compatibility to MS. The effect of pH was also studied in the range of 3.5 to 6.5, by adding acetic acid. The result displayed no notable changes on the separation, retention time and signal response on lowering the pH range. Different column temperatures were also tested from 25^0C to 45^0C, and concluded that the resolution improved with ambient column temperature. Based upon these results, the mobile phase composition was set at 12.5mM ammonium formate buffer: ethanol, (75:25, v/v).

Method Validation: Selectivity:

In the negative ESI mode, deprotonated molecule at *m/z* 429.20 was observed as the most abundant ion for BCT enantiomers. During daughter ion scan, fragment of 429.20 ⟶ 254.99 and 429.20 ⟶ 185.06 were observed as predominant fragments. Both of these fragments were selected for further analysis.

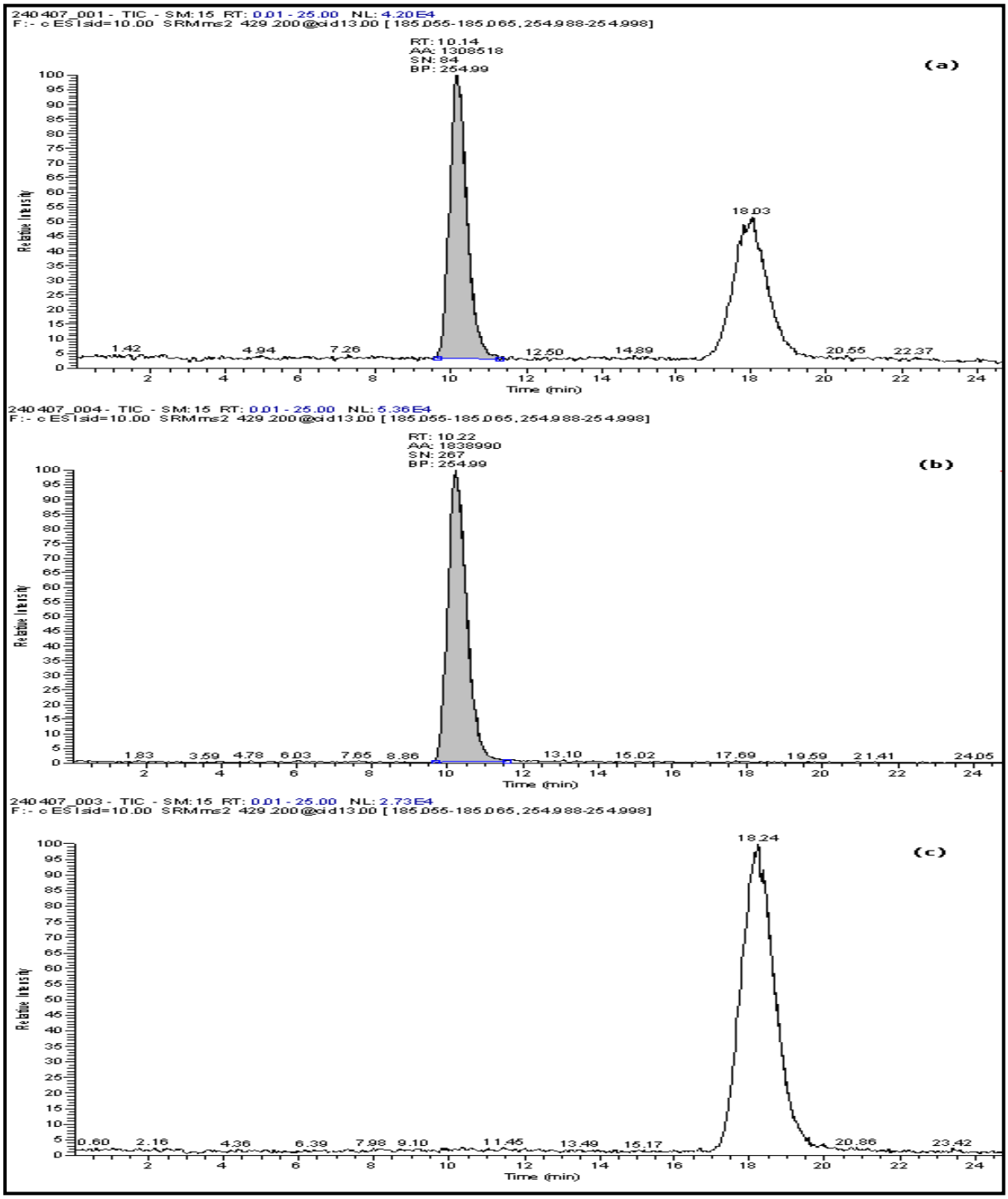
In this analysis an internal standard was not selected because of unavailability of deuterated standards of BCT. Most of the commonly used internal standards were found incompatible with the mobile phase used. Hence, throughout the validation, external standard method was used.

Selectivity of the method was assessed by comparing the chromatograms of blank plasma samples from 10 different sources with the corresponding LLOQ samples. Typical chromatograms of a blank plasma sample and a blank plasma sample spiked with *R* BCT at LLOQ level is shown in Fig. 03. Percent interference observed was less than 0.00% at RT and MRM of *R* BCT.

Carry Over : Carry over was evaluated at less than 1.32% at RT and MRM of *R* BCT with 10µL injection volume, which shows that the rinsing solution of Ethanol-Water (40:60 v/v) was good enough to clean the injection needle and port.

Linearity: The linearity was evaluated based on the average of eight calibrators analyzed on three separate days. Acceptable linearity was achieved in the range of 10.020–601.200 ng/ml for *R* BCT. The correlation coefficient (R^2) was greater than 0.99 in all validation batches.

Precision and Accuracy : The back-calculation results for all calibration standards showed 0.74%-7.88% RSD and 91.84% to 108.37% accuracy for *R* BCT for all three validation curves as summarized in Table 1. The precision and accuracy of the method were determined by analyzing six replicates of QC samples at low (30.048 ng/ml, LQC), medium (250.400 ng/ml, MQC), and high levels (450.720 ng/ml, HQC) for *R* BCT in three separate batches, Table 2. The precision was in the range of 10.11%–12.84% RSD and the accuracy was in the range of 95.73%–97.91% over the three concentration levels evaluated in all.



igure 2: Typical Chromatograms of BCT enantiomers on Ultron ES OVM Column, (a) Mixture of *R* BCT and *S* BCT, (b) *R* BCT and (c) *S* BCT

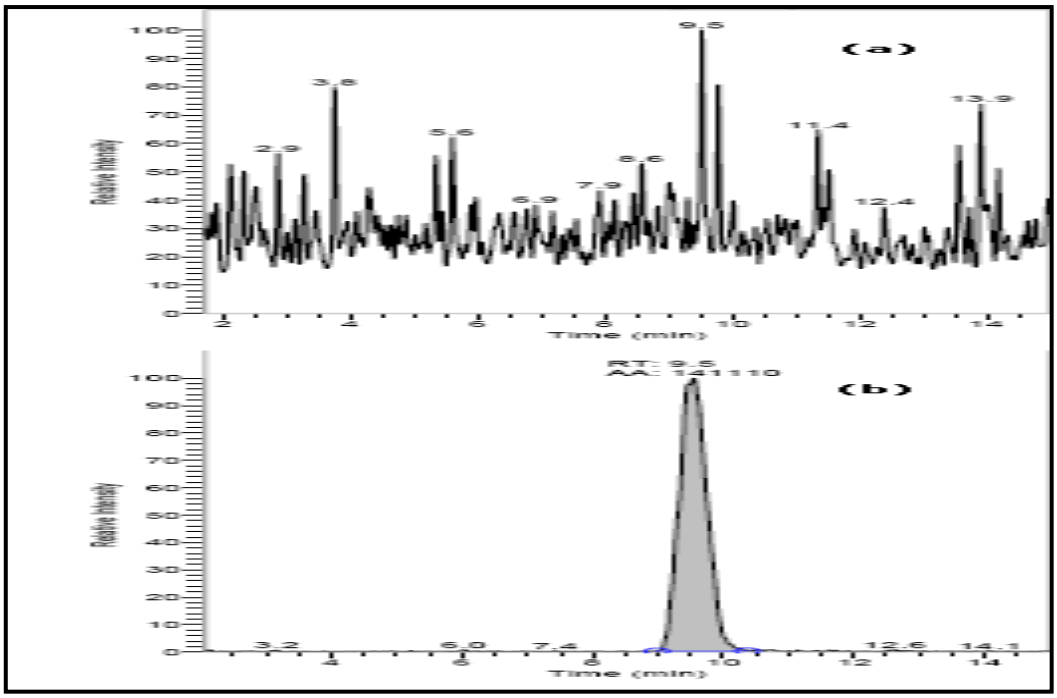


Figure 03: Chromatograms of a) Blank Matrix and b) *R* BCT at LLOQ level.

In three batches, these results demonstrate that the method provides excellent precision and accuracy even without an internal standard.

Recovery

The mean absolute recoveries of *R*-BCT determined at 30.048, 250.400 and 450.720 ng/mL were 78.3% (RSD 1.3% & 4.1%), 79.2% (RSD 1.8% & 5.3%) and 75.4% (RSD 2.4% & 4.7%), respectively.

Stabilities

Plasma stability data is shown in Table 3. A stock solution of R BCT was stable for 24 h at room temperature and 7 days at refrigerated temperature. Bench top, processed sample and autosampler stability revealed that *R* BCT was stable in plasma for at least 6 h at room temperature and processed samples were stable for at least 5 h at room temperature and 24 h in auto sampler at 10°C. It was confirmed that repeated freezing and thawing (five cycles) of spiked plasma samples at LQC and HQC level did not affect the stability of *R* BCT and was found stable for minimum five freeze and thaw cycles. The long term stability results also indicated that *R* BCT was stable in human plasma for up to 62 days at a storage temperature of -20°C.

Table 1: Precision and accuracy of calibration standards

Standard ID	Nominal Concentration (ng/mL)	Back calculated concentration (ng/mL)			Mean	S.D ±	% CV	% Nominal
		P & A I	P & A II	P & A III				
STD 1	10.020	9.660	9.941	9.256	9.619	0.3443	3.58	96.00
STD 2	20.040	21.847	20.800	22.507	21.718	0.8608	3.96	108.37
STD 3	50.100	46.975	45.937	53.033	48.648	3.8325	7.88	97.10
STD 4	100.200	108.450	109.301	110.066	109.272	0.8084	0.74	109.05
STD 5	200.400	188.007	192.301	187.311	189.206	2.7026	1.43	94.41
STD 6	300.600	273.169	273.596	281.484	276.083	4.6823	1.70	91.84
STD 7	501.000	485.577	488.366	463.087	479.010	13.8601	2.89	95.61
STD 8	601.200	667.131	671.948	601.614	646.898	39.2907	6.07	107.60
	r^2	0.9913	0.9922	0.9908				
	Slope	24412.8	23808.3	29270.9				
	Intercept	-45011.0	2779.2	-3978.0				

Table 2: Precision and accuracy of quality control samples

	LQC	MQC	HQC
Nominal concentration (ng /mL)	30.048	250.400	450.720
Range (ng/mL)	24.038-36.058	212.840-287.960	383.112-518.328
P & A I	27.820	225.156	391.810
	30.475	254.476	426.548
	30.032	245.436	463.124
	36.737	255.929	441.059
	34.451	261.491	512.230
	30.828	278.616	540.419
P & A II	25.600	208.721	369.436
	25.844	262.043	412.645
	30.063	238.052	452.233
	26.844	242.181	426.603
	34.961	238.240	495.111
	29.470	294.901	422.842
P & A III	24.131	256.370	438.923
	26.369	271.662	NRV
	24.972	230.833	440.901
	25.731	233.631	387.499
	31.767	206.425	332.299
	33.444	205.411	381.663
Mean	29.419	244.976	431.491
S.D ±	3.7760	24.7687	52.5944
%CV	12.84	10.11	12.19
% Nominal	97.91	97.83	95.73

Table 3 Stability of *R* BCT under various conditions.

	LQC	HQC
	(30.048 ng/mL)	**(450.720 ng/mL)**
Bench top stabiliy (room temperature, 6 h), *N*=6		
RSD%	10.75	9.45
%Accuracy	96.49	98.78
Freeze-Thaw stability (5 Cycles, -20^{0}C), *N*=6		
RSD%	13.85	8.42
%Accuracy	99.60	95.98
Autosampler stability (10^{0}C, 24 H), *N*=6		
RSD%	9.52	9.45
%Accuracy	98.87	98.78
Processed sample stability (room temperature, 5 H), *N*=6		
RSD%	8.72	7.26
%Accuracy	97.62	98.19
Long term stability (-20^{0}C, 62 D), *N*=6		
RSD%	10.35	10.52
%Accuracy	96.42	97.67

CONCLUSION:

A simple and selective method for the estimation of *R* BCT enantiomer in human plasma was developed and validated using high-performance liquid chromatographic separation and electrospray ionization tandem mass spectrometric detection in negative mode. The validated method can be applied to pharmacokinetic studies for selective estimation of *R* BCT enantiomer. The sample preparation using liquid-liquid extraction was straightforward, simple, and cost friendly. The bio analytical assay yields highly reproducible chromatographic and statistical results when quantifying *R* enantiomer of BCT and provides an accurate and precise format for analyzing subject samples obtained from clinical studies.

ACKNOWLEDGEMENTS:

Authors are grateful to Dr. Satish Sawant, Dr. Ashutosh Pudage and Mr. Siddheshwar Patankar of Accutest Research Laboratories (I) Pvt. Ltd, Navi Mumbai for the support, facility and infrastructure support rendered to carry out the proposed research work.

REFERENCES:

[1] Jozwiak K, Lough WJ, Wainer IW, Eds. Drug stereochemistry: Analytical methods and pharmacology (Drugs and the pharmaceutical sciences), CRC Press, 3rd ed. 2012.

[2] Xiaowen W, Su Z. Stereoselective metabolic and pharmacokinetic Analysis of the chiral active components from herbal medicines. Curr Pharm Anal 2010; 6(1): 39-52.

[3] Lin GQ, You QD, Jie-Fei Cheng JF, Eds. Chiral drugs: Chemistry and biological action, Wiley; 1st ed. 2011.

[4] Caner H, Groner E, Levy L, Agranat I. Trends in the development of chiral drugs. Drug Discov Today 2004; 9(3): 105-10.

[5] Stinson SC, Chiral pharmaceuticals. Chem Eng News 2001; 79(40): 79-97.

[6] Gulati V. Differential properties of enantiomers of commercially available racemates. J Indian Med Assoc 2007;105(4): 173-74, 176.

[7] Khatik GL, Kaur J, Kumar V, Tikoo K, Nair VA, 1,2,4-Oxadiazoles: a new class of anti-prostate cancer agents, Bioorg. Med. Chem. Lett, 2012, 22, 1912-1916.

[8] Tucker H, Amide derivatives, 1987, US Patent 4,636,505.

[9] Singh SM, Gauthier S, Labrie F, Androgen receptor antagonists (antiandrogens): structure-activity relationships, Curr. Med Chem, 2000, 7, 211–224.

[10] Blackledge GR, Clinical progress with a new antiandrogen, CasodexTM (bicalutamide), Eur. Urol, 1996, 29, 96–104.

[11] FDA's Policy statement on the development of new stereoisomeric drugs (Sereoisomeric Drugs Policy) Fed Regist 1992; 57: FR22249.

[12] Agranat I, Cancer H. Intellectual property and chirality of drug. Drug Discov Today 1999; 4(7): 313-21.

[13] Srinivas NR, Barbhaiya RH, Midha KK. Enantiomeric drug development: Issues, considerations, and regulatory requirements. J Pharm Sci 2001; 90: 1205-15.

[14] Pradhan VR, Pudage A, Patankar S, Sawant S, Rathnam MV, Validation of chiral liquid chromatography-tandem mass spectrometric method for the estimation of bicalutamide enantiomers in human plasma: application to a Bioequivalence study. Int. J. of Bioassays, 2013, 02 (09): 1210-1222.

[15] Clarke GS, The validation of analytical methods for drug substances and drug products in UK pharmaceutical laboratories, J. Pharm. Biomed. Anal, 1994, 12, 643-652.

[16] Hsu HC, Chien CS, Validation of analytical methods: a simple model for HPLC assay methods, J. Food and Drug Analysis, 1994, 2, 161-176.

[17] Rao RN, Raju AN, Nagaraju D, An improved and validated LC method for resolution of bicalutamide enantiomers using amylose tris-(3,5-dimethylphenylcarbamate) as a chiral stationary phase, J. Pharm. Biomed. Anal, 2006, 42, 347-353.

[18] Torok R, Bor A, Orosz G, Lukacs F, Armstrong DW, Peter A, Determination of Bicalutamide in Biological fluids, J. Chrom. A, 2005, 1098, 75-81.

[19] Matheus R, Arnal H, Uzeategui E, Cardona R, Inform. Med, 2003, 5, 101.

[20] Matheus R, Arnal H, Uzeategui E, Cardona R, Inform. Med, 2003, 5, 225.

[21] Tyrrell CJ, Denis L, Newling D, Soloway M, Channer K, Cockshott ID, Casodex 10–200 mg daily, used as monotherapy for the treatment of patients with advanced prostate cancer, An overview of the efficacy, tolerability and pharmacokinetics from three phase II dose-ranging studies Casodex Study Group, 1998, Eur Urol, 33, 39–53.

[22] Cockshott ID, Oliver SD, Young JJ, Cooper KJ, Jones DC, The effect of food on the pharmacokinetics of the bicalutamide ('Casodex') enantiomers, Biopharm. Drug Dispos. 1997, 18, 499-507.

[23] James KD, Ekwuribe NN, Syntheses of enantiomerically pure (R)- and (S)-bicalutamide, Tetrahedron, 2002, 58, 5905-5908.

[24] Bargmannleyder N, Tambut'e A, Caude M, A comparison of LC and SFC for cellulose- and amylose-derived chiral stationary phases, Chirality, 1995, 7, 311-325.

[25] Tucker H, Chesterson GJ, Resolution of the nonsteroidal antiandrogen 4′-cyano-3-[(4-fluorophenyl)sulfonyl]-2-hydroxy-2-methyl-3′-(trifluoromethyl)-propionanilide and the determination of the absolute configuration of the active enantiomer, J. Med. Chem, 1988, 31, 885-887.

[26] Smith AA, Parimalakrishnan S, Kannan K, Manavalan R, Bicalutamide quantification in human plasma by high-performance liquid chromatography: Application to bioequivalence study, Biosci. Biotech. Research Asia, 2007, 4, 247-252

[27] Szeman J, Gerloczy A, Csabai K, Szejtli J, Kis GL, Su P, Chau RY, Jacober A, High-performance liquid chromatographic determination of 2-

hydroxypropyl-γ-cyclodextrin in different biological fluids based on cyclodextrin enhanced fluorescence, J. Chrom. B, 2002, 774, 157-164.

[28] Smith AA, Manvalan R, Kannan K, Rajendiran N, Determination of Bicalutamide in formulation and biological fluids based on cyclodextrin enhanced fluorescence, J. Appl. Chem. Res, 2009, 9, 24-32.

[29] Rao RN, Raju AN, Narsimha R, Isolation and characterization of process related impurities and degradation products of bicalutamide and development of RP-HPLC method for impurity profile study, J. Pharm. Bio. Med. Anal, 2008, 46, 505-519.

[30] Saravanan G, Rao BM, Ravikumar M, Suryanarayana MV, Someswararao N, Acharyulu PVR, A stability-indicating LC assay method for bicalutamide, Chromatographia, 2007, 66, 219-222.

[31] Sharma K, Pawar GV, Giri S, Rajagopal S, Mullangi R, Development and validation of a highly sensitive LC-MS/MS-ESI method for the determination of bicalutamide in mouse plasma: application to a pharmacokinetic study, Biomed. Chromatogr, 2012, 12:1589-1595.

[32] Online document CDER (Center for Drug Evaluation and Research), Guidance for Industry: Bioanalytical Method Validation, US FDA, 2001, http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/UCM070107.pdf.

CALLUS INDUCTION IN *VIGNA RADIATA* (L.) WILCZEK FROM ASEPTICALLY GERMINATED SEEDLINGS.

Ketan Thatte*

Department of Biotechnology, B. N. Bandodkar College of Science, Thane, Mhararashtra.

*Author for correspondence: Ketanthattr84@gmail.com

ABSTRACT:

The tissue culture is practiced now days for cultivation of medicinal, aromatic plants and agricultural crops. *Vigna radiata* (L.) Wilczek is one of the important leguminous plants. The present study deals with the callus induction using various plant growth regulators from various explants. The seeds were aseptically germinated on Agar water medium and nodal explants were then used for callus induction using various combinations of auxin and cytokinin in M.S. medium. Best callusing response was observed in presence of cytokinin BAP at 1mg/l. The callus was used further for organogenesis.

Key words: Plant tissue culture, Aseptic seed germination, Callus, Organogenesis.

Introduction:

Leguminous plants are rich source of proteins and hence nutritionally very important. These plants are therefore used in many studies for better improvement through plant tissue culture. The plants belonging to the family Leguminoseae are difficult to propagate through tissue culture techniques. *Vigna radiata* (L.) Wilczek is one of the important pulse crops in India. In present study, the attempts were made to induce the callusing from various explants using various combinations of auxin and cytokinin with MS medium.

Materials and Methods:

Seeds of *V. radiata* were obtained from local market and these were used for aseptic seed germination. Seeds were washed under continuous flashing of running tap water for 30 min and then treated with a solution of the Tween 20 (5% v/v) for 10 min. The seeds were soaked in sterile distilled water for eight hours. The soaked seeds were then sterilized with 70% ethyl alcohol for 30 seconds. Then rinsed with sterile distilled water and finally surface sterilized with $HgCl_2$ (0.1% w/v) for 10 min. Lastly, the seeds were washed three times with autoclaved distilled water and were germinated on agar water medium and half strength solid MS medium containing 3.0%

sucrose (w/v) and 0.8% agar (w/v) (Hi-media Co., Mumbai, India) at 25° C to 28° C in the dark for the first 2 days and then transferred to a 16 h photoperiod of cool- white fluorescent light intensity 1200 lux.

Callus induction and maintenance

Primary leaves were excised from 7 days old seedlings, cut into 0.3–0.5 cm^2 segments and internodal segments of aseptically germinated seedlings of size 1 cm^2 were cultured on MS medium with 3% sucrose, 0.8% agar, and different concentrations of 2,4-D, IAA and BAP in for callus induction. The cultures were then incubated at 25° C to 28° C under an 8 hrs light/ 16 hrs dark photoperiod with a light intensity of 1200 lux. The callusing was started after 12 days of inoculation and the pattern of the growth of callus was observed.

Results and Discussion:

The results revealed that a high variation in callus induction and plantlet regeneration ability was demonstrated by varieties, explants and hormone under present study. Half strength MS medium was found to be advantageous over agar water medium. Out of 44 seeds inoculated, 26 seeds germinated on 4^{th} day of incubation generating seed germination response of 59.09%. The leaf primordia and internodal segments then subcultured on MS medium supplemented with IAA (1 mg/l) + BAP (0.5 mg/l) and MS medium with 2,4-D (1.0 mg/l). After 2 weeks of incubation; out of 32 tubes inoculated for callus induction, initiation of callus was observed in 24 tubes generating 75% response. But it was observed that the MS medium supplemented with 2,4-D (1.0 mg/l) did not support the callus growth further (Figure1A). Whereas the MS medium containing BAP (0.5 mg/l) supported the callus growth and it proliferate further within 3 weeks of incubation (Figure1B). It is interesting to note that the media devoid of BAP failed to induce any callus from leaf or nodal explants. It reveals that for the induction of callus from various explants, cytokinin might be indispensable.

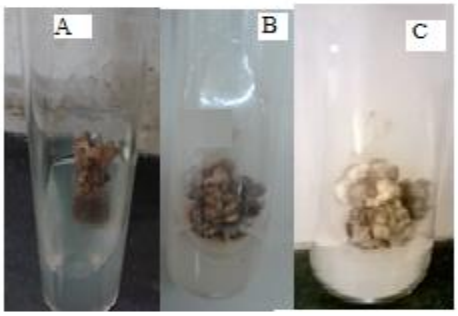


Figure 1 stages of callus growth.

Initially the calli was found to be dark brown in colour and hard. Subsequent subculturing of callus on BAP containing media revealed the change in callus morphology. The vigorous proliferation was observed within 2 weeks of incubation under 8 hrs of light and 16 hrs of darkness at 25° C. Friable calli was developed which was creamish to pale yellow in colour (Figure1C). These results were in accordance with the study conducted by Khatun *et al*

(2008). They reported the induction of callus in Mungbean from various explants. Regeneration was achieved only from cotyledon calli at afrequency of 62.50% on 5 mg/l BAP and 0.05 mg/l NAA.

Nazim *et al* in 2012 also reported the similar results for in *vitro* regeneration of Mungbean using leaf and cotyledon explants.

The callus is further subcultured on MS medium containing NAA (1.5 mg/l) with adenine sulphate for organogenesis.

Conclusion:

The present study revealed that the cytokinins play very important role in callus induction. The vigorous callus proliferation was observed using nodal segments cultured on BAP containing MS medium over the combination of various auxins and cytokinins together. Further attempts will be made to standardize the in vitro organogenesis.

Acknowledgement:

The author is thankful to Dr. Mrs. Pejaver, Principal, B. N. Bandodkar College of Science, Dr. Mrs. Kalpita Mulye Head, Biotechnology department, Mrs. Jayashree Pawar for her constant support and motivation in the field of research.

References:

Amutha S., Ganapathi A. and Muruganantham M. (2003) *In vitro* organogenesis and plant formation in *Vigna radiata* (L.) Wilczek. *Plant Cell Tiss. Org. cult.*, 72(2): 203-207.

Avenido R.A. and Hautea D.M. (1990) In vitro organogenesis and flowering in mungbean (*Vigna radiata* l.). *Philipp. J. Crop. Sci*., 15 (3): 169-173.

Hoque M.I., Zahan M.M. and Sarker R.H. (2007) *In vitro* Plant Regeneration in Mungbean (*Vigna radiata* (L.) Wilczek). *Plant Tissue Cult. & Biotech.*17 (2):209-216.

Khatun M. K., Haque M. S., Islam S.and Nasiruddin K. M. (2008) *In Vitro* regeneration of mungbean (*Vigna radiata* l.) from different explants. *Progress. Agric.* 19(2): 13-19.

Nazim T., Hasanuzzaman M., Biswas B. K., Arifuzzaman M.and Azad A.K. (2012) *In vitro* regeneration of mungbean (*Vigna radiata* L.) using leaf and cotyledon explants. *Bangladesh research publications journal* 6 (3): 258-263.

STUDENTS CORNER

Available online www.vpmthane.org

J BNB -2014

STUDY OF SALIVARYAMYLASE ACTIVITY IN DIFFERENT HUMAN SUBJECTS

Dhanwantari Dhoke, Neha Chaudhari, Snehal Gawas, Bhagyashree Redkar , Ankita Patil

Guiding Teacher: Dr. R. P. Athalye

Department of Zoology, B.N. Bandodkar College of Science, Thane, 400601

ABSTRACT

Salivary amylase activity was studied in different human subjects of age 17 to 18 years, using Lugol's iodine method. All volunteers were females. The activity varied significantly from individual to individual. When tested in case of same subjects, the effect of chewing of sugar and salt there was increase in the activity of salivary amylase.

INTRODUCTION

Amylase is an enzyme that catalyses the breakdown of starch into sugars. Amylase is present in human saliva, where it begins the chemical process of digestion.

Foods that contain much starch but little sugar, such as rice and potato, taste slightly sweet as they are chewed because amylase turns some of their starch into sugar in the mouth. The pancreas also makes amylase (alpha amylase) to hydrolyse dietary starch into disaccharides and trisaccharides which are converted by other enzymes to glucose to supply the body with energy. Plants and some bacteria also produce amylase. As diastase, amylase was the first enzyme to be discovered and isolated by Anselme Payen in 1833. All amylases are glycoside hydrolases and act on α-1, 4-glycosidic bonds.

History: In 1831, Erchard Friedrich Leuchs (1800-1837) described the hydrolysis of starch by saliva, due to the presence of an enzyme in saliva, "ptyalin", and an amylase.

The modern age of enzymes began in 1833, when French chemists Anselme Payen and Jean-Francois Persoz isolated an amylase complex from germinating barley and named it "diastase". In 1862, Alexander Jakulowitsch Danilewsky (1838-1923) separated pancreatic amylase from trypsin. Carbohydrates are an energy rich food source. Amylase is thought to have played a key role in human evolution in allowing humans an alternative to fruit and protein. A duplication of the pancreatic amylase gene developed independently in humans and rodents, further suggesting its importance. The salivary amylase levels found in the human lineage are six to eight times higher in humans than in chimpanzees, which are mostly fruit eaters and ingest little starch relative to humans.

Uses: Amylases find use in bread making and to breakdown complex sugars, such as starch (found in flour), into simple sugars.

Yeast then feeds on these simple sugars and converts them into the waste products of alcohol and carbon dioxide. This imparts flavor and causes the bread to rise, while amylases are found naturally in yeast cells, it takes time for the yeast to produce enough of these enzymes to breakdown significant quantities of starch in the bread. This is the reason for long fermented dough's such as sour dough. Modern bread making techniques have included amylase (often in the form of malted barley) into bread improver, thereby making the process faster and more practical for commercial use.

Alpha and beta amylases are important in brewing beer and liquor made from sugars derived from starch. In fermentation, yeast ingests sugars and excretes alcohol. In beer and some liquor, the sugars present at the beginning of fermentation have been produced by "mashing" grains or other starch sources (such as potatoes). In traditional beer brewing, malted barley is mixed with hot water to create a "mash", which is held at a given temperature to allow the amylases in the malted grains to convert the barleys starch into sugars. Different temperatures optimize, the activity of alpha or beta amylase, resulting in different mixtures of fermentable and unfermentable sugars.

In the present study salivary amylase activity in different individuals of same age group was assessed.

MATERIALS AND METHODS:

Glassware: Beakers - 50 ml, 100 ml, 250ml, 1 ml Pipettes, Glass tubing's, Cavity Tiles, Test tubes.

Chemicals: Lugol's Iodine, Phosphate Buffer Solution – pH 6.7,1% Starch solution, Saliva sample.

Miscellaneous: Distilled Water, pH paper.

1) Preparation of starch - 1g starch was added to 30ml distilled water. The mixture was boiled to cook the starch, then cooled and diluted to 100ml using distilled water.

2) Study subjects – The salivary amylase activity was studied in case of college student volunteers of age 17 to18 years.

3) Preparation of sample – First mouth was rinsed with tap water, then with distilled water. Then 25ml of distilled water was taken in mouth, moved from side to side for 4 times, and collected in a beaker. This was used as sample for salivary amylase.

4) Amylase activity was studied using Lugol's iodine method. The solutions were mixed as 1ml of 1% starch + 1ml of pH 6.7 buffer + 1ml of salivary amylase sample (mix). The mixture was tested for presence of starch by adding a drop of reaction mixture in a drop of Lugol's iodine placed on cavity tile. The test was done immediately after mixing the solution and then after every 1 minute, till the iodine did not develop blue colour, the achromatic point, which indicated total digestion of starch. The time required for total digestion of starch for each sample was noted. The experiment was repeated for 5 times on each subject.

5) In the similar manner experiments were done on same subjects to study effect of chewing sweet (sugar) or salt. The material (sugar or salt) was chewed for 5 minutes, then mouth was rinsed 3 times using water, then after 5 minutes saliva sample was collected in the same manner as described earlier.

Observation table:

Subject Number	Age	Sex	Time required for starch digestion (normal condition) in min.	Time required for starch digestion (after chewing of salt)in min.
1	17	F	4	4
2	18	F	6	5
3	18	F	10	9
4	17	F	12	10
5	18	F	15	12

RESULTS AND DISCUSSION:

The table shows that the time required for starch digestion by salivary amylase showed lot of fluctuations from individual to individual. The minimum time required was 4 minutes whereas the maximum was 15 minutes. Chewing of sugar or salt slightly lowered the time required for starch digestion indicating faster action of enzyme amylase, suggesting activation of enzyme or increased quantity of enzyme. In the present study all the volunteer subjects were females. It will be interesting to study the amylase activity on male subjects as well and also on different age groups of both sexes. It will also be possible to estimate units of enzymes if glucose formed at the end of the reaction is colorimetrically estimated.

ACKNOWLEDGEMENT

Thanks to, Dr. R. P. Athalye and principal, Dr. (Mrs.) M.K.Pejaver for support.

REFERENCES:

Robert Hill and Joseph Needham, *The Chemistry of Life: Eight Lectures on the History of Biochemistry* (London, England: Cambridge University Press, 1970).

http://www.merck.com/mmpe/print/sec02/ch015/ch015b.html

Maton, Anthea; Jean Hopkins, Charles William McLaughlin, Susan Johnson, Maryanna Quon Warner, David LaHart, Jill D. Wright (1993).*Human Biology and Health*. Englewood Cliffs, New Jersey, USA: Prentice Hall.

Ramasubbu, N.; Paloth, V.; Luo, Y.; Brayer, G. D.; Levine, M. J. (1996) "Structure of Human Salivary α-Amylase at 1.6 Å Resolutions: Implications for its Role in the Oral Cavity". *Acta Crystallographica Section D Biological Crystallography* **52** (3): 435–446.

STUDY OF ANT BEHAVIOR

AMEYA SOPARKAR, RASHMI JADHAV and R. P. ATHALYE

DEPARTMENT OF ZOOLOGY, B. N. BANDODKAR COLLEGE OF SCIENCE, CHENDANI BUNDER ROAD, THANE-400601 (M.S.)

ABSTRACT:

Behaviour of black ants (identification not confirmed) was studied by isolating a few ants from their colony and keeping them in a test tube. The ants initially showed a state of panic. Then they settled into groups. Few ants moved between the groups probably working as link ants to communicate between the groups. When a dead moth was introduced into the test tube the ants got attracted to it and tried to drag the moth along the trail (probably made by link ants). However they did not know where to take it.

KEY WORDS:

Link ants, State of panic, State of coordination, State of rest.

INTRODUCTION:

Communication in ants is an important area of study. It is primarily accomplished through chemical messages called *pheromones*. Chemical messengers in ants are more developed as compared to the other related species. A pheromone may be non-volatile (lasts longer) or volatile (does not last longer) depending upon its function. Pheromones help differentiating invaders from members of its own colony. They are also helpful in attacking invaders, alerting other members of the colony in case of danger.

In present study communication in ants (identification not confirmed) were studied by separating the ants and keeping them in a test tube from their colony and were kept in test tube. The way they reacted in this situation was studied.

MATERIALS AND METHODS:

A test-tube containing sugar was kept near a natural ant colony and few ants attracted to the sugar were trapped in the test-tube and they were transferred in another test-tube containing some water covered by cotton and the opening was blocked using a cotton plug (figure 1). Touching the ants directly with hands was avoided to reduce the risk of loss of pheromone responsible for identity or change in its form.

Later, a dead moth was introduced near the cotton inside the tube. The mode of attack and the way in which the ants tried to carry their prey was observed. The study was repeated 5-6 times on the ants of same colony and also on the ants of different colonies.

Figure 1 Ants isolated in a test tube.

Red – ants Blue- water orange –cotton

RESULTS AND DISCUSSION:

Initially, when the ants were transferred into the test-tube containing water covered with cotton they went into a *State of Panic*. It is a state in which possibly the ants want to know what has happened to them? Who are along with them? Is there any way to run back towards the nest and many more beyond our thinking and beyond our understanding. This stage depends upon the intensity of the signals produced.

The pheromone released during *State of Panic* should remain in the test-tube, the alarming signal should remain and the *State of Panic* should last forever. However this is not seen. The *State of Panic* came to an end after 15 minutes and the state of coordination begun where the ants started coordinating with each other.

A thing noticed was, the ants formed groups even in the test-tube. Out of 10 ants 4 ants were in Group1 and rested near the cotton covering the water while 2 ants of Group2 rested near the cotton plug at the opening and the rest 4 ants continuously kept changing their groups (probably for exchange of information). They were probably the link ants. The role of *link ants* is important here, as they possibly help in exchange of information regarding food, work to be done, way to identify an ant from its own colony, etc. Thus they help in coordination. They also change group after regular time intervals and also after any emergency alert alarm raised artificially.

The ants in the state of rest do not show any locomotion but show some movement. They rub the secreted pheromone with the help of their legs onto their body to maintain group identity. This scent, however changes with time (it may be volatile). When the isolated ants reintroduced after a long time in their own natural colony, the residents of the colony did not remember them and killed them. In some other ant types however, the isolated ants were reintroduced in the colony, were accepted by the colony members. This might be due to strong scent or memory of the ants in natural colony.

When a dead moth was introduced in the tube towards the cotton at the lower position, the obvious behavior of the ants to attack the prey was seen. 2 ants (*link ants*) were engaged in making new chemical path or trail towards the opening but they had to stop as the opening was blocked by cotton plug.

When we tried to mix two such sets of different test tubes, of same colony, they showed the same behaviour of state of panic leading to new group formation, where the groups were large.

It will be interesting to do similar studies on different identified species of ants.

ACKNOWLEDGEMENTS:

We would like to express our sincere gratitude to "science square" of our college for motivation and support during working for this project.

REFERENCES:

Bert Hölldobler and E.O. Wilson "The Ants" Publisher Harvard University Press, 1990

Internet reference-

sciencedaily.com

STUDENTS CORNER

Available online www.vpmthane.org

J BNB -2014

BIOCOMPOST

Jyoti Vasant Yadav

Supervisor Teacher: Dr. Anita S. Goswami-Giri

Department of Biochemistry, B.N Bandodkar collage of science Thane-400 601.MS India

Abstract:

In bio composting, biomolecule are the core part that are significantly transforms from matter to compost. In this paper, waste material were collected from daily activities of cooking composting were done in the pots. Process of bio composting has been carried out and it was used terrace garden. Also, noticing our college campus bio composting plants as reference.

Key words: waste material; Process bio composting

INTRODUCTION:

Composting is mixture of different types of organic matter**,** such as fallen leaves, fruits peels and or manure, mulch, vegetable waste. That are transforming of organic material (plant matter) through decomposition into soil like material called Bio-Compost. It has profound influence on the chemical and biological characteristics of soil that are directly reflect in the change in total C, O, organic N, extractable K content and water retention of light textured soil. Thus, to improve soil fertility for better crop production and water conservation need to intervene composition of organic matter. [1]

Chemical composition of bio-compost:

Carbohydrates (sugar, starch, hemi-cellulose), Proteins(amino acids, amines) Fats(oils, waxes) resins, Alcohols, aldehydes, ketones, Compounds containing ring structure, Alkaloids and compounds with organic base-pyrimidine and purines, Miscellaneous substances like antibiotics, auxins, vitamins, enzymes and pigments etc. Nutritive Elements in different Organic Matters is shown table 1. [3]

Table 1 Nutritive Elements in different Organic Matters**.**

ORGANIC MATTER	NUTRITIVE VALUE (%)		
	NITROGEN	PHOSPHATE	POTTASSIUM
Cow dung manure	2.5	0.2	0.5
Compost urban	1.8	1.0	1.4
Compost rural	0.5	0.15	0.5
Night soil	5.5	4.0	2.0
Groundnut cake	7.3	2.5	2.0
Castor cake	4.3	2.4	2.3
Neem cake	5.2	1.0	1.8
Sludge	3.5	4.0	0.6

Types of Organic Matter:[1]

There are mainly three types of Organic Matter

A. Livestock and human waste

1. Farmyard manure

2. Poultry manure

B. Byproduct of agro -waste industries

1. Industrial waste material

2. Sugar factory waste

3. Oil cake and bio gas slurry

C. Plants waste

1. Crop residue

2. Tree residue and aquatic weeds

3. Urban and rural waste

4. Sewage sludge

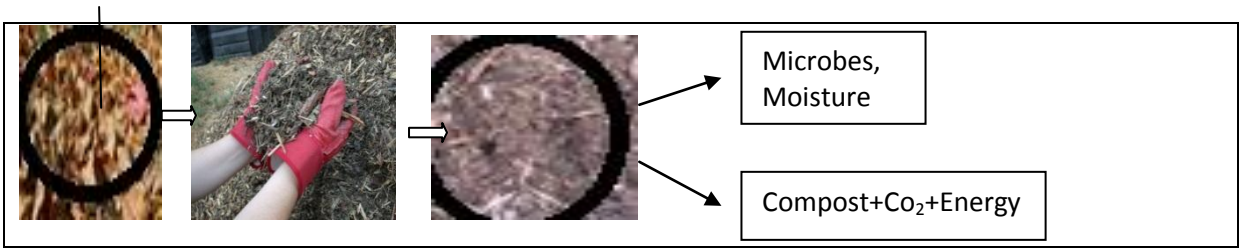
Types of composting: [2]

1. Anaerobic composting*:* This is composting without air. This is low maintenance since you simply throw it in a pile and wait a couple years.

2. Aerobic composting: This means to compost with air. High nitrogen waste (like grass clippings or other green material) will grow bacteria that will create high temperatures (up to 160 degrees).

3. Vermicomposting: This is most beneficial for composting food waste. Along with red worms, this includes composting with bacteria, fungi, insects, and other bugs. Red worms eat the bacteria, fungi, and the food waste, and then deposit their castings. Oxygen and moisture are required to keep this compost healthy.

Process of bio-composting:



Types of Composting based application Industrial systems: -Industrial composting systems are increasingly being installed as a waste management alternative to landfills, along with other advanced waste processing system.

Agriculture: In agriculture, windrow composting is used. It is the production of compost by piling organic matter or biodegradable waste, such as animal manure and crop residues, in long rows. This method is suited to producing large volumes of compost.

Home: Home composting is the simplest way to compost. At home, composting is generally done by using composting bins. Other methods include trench composting and sheet composting. It is a small scale process and requires less outlay of capital and labor.

Status: [1]

A. Environmentally responsible, Keeps biodegradable waste out of landfills and sewage plants, Alternative to burning, gives you a vibrant garden without chemical fertilizers.

B. Saves money acts as learning tool. An early stage as mulch keeps weeds from growing and help to retain moisture that are beneficial minerals depart into soil. A later stage for soil amending it enriches soil.

C. Removes /reduces need for chemical fertilizers that leach into our ground water.

Acknowledgement: Authors are gratefully acknowledged to the Vidya Prasarak Mandal, Thane, and Principal, B. N. Bandodkar College of Science and Dr A S. Goswami-Giri for encouragement of students

REFERENCES:

1. Wikipedia
2. http://northwestredworms.com/compost.aspx
   http://en.wikipedia.org/wiki/Compost
3. http://www.benefits-of-recycling.com/typesofcomposting/
4. E-books

lambert academic publishing Biocomposting of Agro-Waste Residues by Phosphate Solubilizing,2013

lambert academic publishing,Microbial Production Technology,2012

HOW TO DEVELOP SOFTWARE

Priyanka Shinde

Department of Information Technology, B.N Bandodkar collage of science Thane-400 601.MS

Abstract: Software was developed for depending on program required .

1] How to Develop Software:

1) Get the requirements. Once you know the software you plan to develop, the first step is to get the proper requirements. (Depending on the program, this may involve purchasing various requirements for your software.)

2) Write the code. Once all the requirements or parts for using creation of software are installed, then the next step is to write the software code. (When writing be sure to take your time and proof your work.) There are several languages you could choose from to develop your source code for basic software. Visual Basic (VB) is easiest language to develop your source code for basic software.

3) Find the pre-written code that will help you develop the software. Use websites like FreeVBcode.com to find pre-written code that will work with your software.

4) When the code is written and saved the final step is to test the code. To do this, enter the data and run the program just as you would with any other software. If you find any technical problem, write them down and go back and rewrite that part of the code.

5) Consider copyrighting your software. If you think your software is unique, you may want to consider copyrighting it. The copyrighting process is long and tedious, but it will protect your ideas and work from being used by someone else for financial gain.

2] Process of Software: Once the software has loaded, the system is able to execute software. This involves passing instructions from the application software, through the system software to the hardware or product or machine.

The software receives the instructions as machine mode. Each instruction causes the product to carry out an operation like moving data or altering the control flow of instructions.

3] Purpose of creating Software:

1) Application software uses the computer system to perform useful work or provide entertainment functions beyond the basic operations of the computer itself.

2) Systems software is designed to operate the computer hardware, to provide basic functionality and to provide a platform for running application software.

4] How many people are involved in development of software?

a) Manager:

Manager defines business issue that often have significant,

b**) Project Manager:**

Project manager motivate and control the works who do the software work.

c) Engineer:

Engineer plan the model of software and made or create a sample model.

d) **Customers:** Specify the requirement for the software to be developed.

Acknowledgement: Authors are gratefully acknowledged to the Vidya Prasarak Mandal, Thane, and Principal, B. N. Bandodkar College of Science and Dr A S. Goswami-Giri for encouragement of students.

COMPARISON OF TRIPHULA EXTRACT IN DIFFERENT SOLVENTS

Pooja V. Jagasia* and Anita Rai

Department of Chemistry, B.N Bandodkar collage of science Thane-400 601.MS India

Abstract:

Triphula Tablets were analysed for tannin contents. The phenolic component is responsible for antioxidant activity. The amount of tannin was analysed by Folin Denis method. Tannic acid was used as standard compound. The maximum tannin content was found in the 50% ethanol extract.

Key words: Triphula Tablets, Tannin content, Folin Denis reagent, Tannic acid

INTRODUCTION:

Triphala, the well-known traditional Ayurvedic formulation, makes an excellent skin tonic. It is one of the most popular Ayurvedic medicinal herbs, prescribed by a number of Ayurvedic practitioners. Triphala literally means 'three fruits'. The three fruits contained in Triphala are Amalaki (Indian Gooseberry), Haritaki (Indian Gallnut or Terminalia chebula), and Bibhitaki (Beleric Myrobalan or Terminalia bellerica). Since Triphala is tridoshic - equally balancing for Vata, Pitta and Kapha - it is beneficial for all skin types. Triphala nourishes the skin, both directly and indirectly. Amla (Indian gooseberry), one of the three ingredients in Triphala, is the richest known natural source of Vitamin C. Apart from the rich source of Vitamin C, Triphala also contains calcium - an important nutrient that helps enhance skin clarity and brings dull, tired skin to life. Triphala Rasayana is beneficial is promoting ojas, the finest product of digestion that prevents the occurrence of many diseases, creates luster and make the skin exude its natural glow and radiance. It nourishes both the body and the mind, thereby promoting longevity of life. Therefore, Triphala Rasayana is very much beneficial for adults and children alike. The Rasayana is especially beneficial for eyes. In case one has problems in eye sight, opting for Triphala Rasayana would be the best bet. The Rasayana creates a balance in the cholesterol level, by removing ama from the fat tissue. It helps in the purification of urinary tract, thereby helping the prevention of urinary tract diseases. It also strengthens and cleanses the liver, which is one of its main functions. This ensures that the liver, one of the important parts of the body, stays healthy. It can also be said that the consumption of Rasayana prevents diseases related to the functioning of liver. The medicine also helps the management of weight. Thus, it is beneficial for people, who want to loose weight. It enhances the thirteen agnis (digestive fires), especially the main digestive fire in the stomach. Triphala Rasayana is

helpful in pacifying Kapha and Pitta. If taken on a regular basis, the Rasayana can be a powerful anti-aging medicine. People suffering from skin inflammation, heat, infection, obesity will find the consumption of Triphala Rasayana as beneficial. Diseases such as fatigue and anemia can be effectively cured by the regular consumption of Triphala Rasayana, if taken according to the prescribed doses.

MATERIALS AND METHODS:

Preparation of standard tannic acid solution

Standard solution of tannic acid was prepared by dissolving 100 mg in 100 ml distilled water. Fresh solutions were prepared for each test.10 ml of the standard solution was diluted to 100 ml.1-10 ml aliquot were used for the analysis.

CHEMICALS AND INSTRUMENTS

Folin Denis reagent, Tannic acid, anhydrous sodium carbonate, methanol and UV spectrophotometer (Shimadzu).

Preparation of Folin-Denis reagent

To 750 ml of water, 100 gm of sodium tungstate was added, 20 gm of phosphomolybdic acid and 50 ml of 85% phosphoric acid were also added.The whole mixture was refluxed for 2 hrs. It was cooled and diluted to 1000 ml.

PREPARATION OF THE EXTRACTS

A. Hydro alcohol extract:

The powdered triphula tablet was extracted with 100 ml of 50% alcohol for 24 hours.

B. Acetone water extract:

The powdered triphula tabletwas extracted with 100 ml of 70% acetone for 24hours,

C. AQUEOUS EXTRACT: The powdered triphula tablet was extracted with 250 ml of water, refluxed for about 4 hrs

PROCEDURE FOR DETERMINATION OF TOTAL PHENOLIC CONTENTS

The amount of total phenolic in extracts was determined with the Folin-Denis reagent . Tannic acid was used as a standard and the total tannins were expressed as mg/g tannicacid equivalents (TAE). Concentration of 0.01, 0.02, 0.03, 0.04 and 0.05 and 0.06 mg/ml of tannic acid were prepared in water. 1 ml of each sample was diluted to 10 ml and 1 ml was introduced into test tubes and mixed with 0.5 ml of a Folin-Denis reagent and 1ml of saturated sodium carbonate. The tubes allowed to stand for 30 minutes at room temperature before the absorbance was at read at 760nm spectrophotometrically. All determination was performed in triplicate. The Folin-Denis reagent is sensitive to reducing compounds including polyphenols, thereby producing a blue color upon reaction. This blue colour is measured spectrophotometrically.

0.5 ml of the extract was diluted to 10 ml and 1 ml was taken for the analysis .

Results and discussion: Table1

Tannic acid ppm	Absorbance
5	0.12
10	0.21
15	0.30
20	0.39
25	0.47
30	0.55

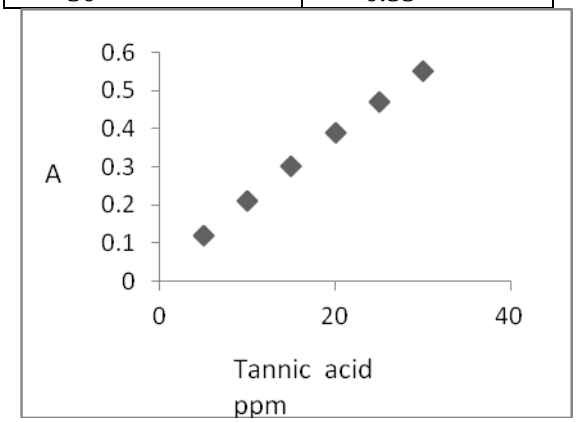


Table2		
Solvent	Absorbance	µg/cm^3.
50% ethanol	0.30	60
70%acetone	0.27	52
Reflux	0.25	50

Figure 1: Calibration curve

CONCLUSION: The amount of total tannins was determined with the Folin-Denis reagent. Tannic acid was used as a standard compound and the total tannins were expressed as mg/g tannis acid equivalents. The maximum tannin content was found in the ethanolic extract 60 µg/cm^3.

Acknowledgement The authors would like to acknowledge the Principal, Dr.(Mrs.) M.K. Pejaver, B.N. Bandodkar College of Science for providing the necessary facilities to carry out the present work.

References:

1. Ayurvedic Pharmacopoeia Committee. The Ayurvedic Formulary of India, Part I. 2 nd English ed. New Delhi: Controller ofPublications;2003.

2. Jagetia GC, Baliga MS, Malagi KJ, Kamath S. The evaluation of the radio protective effect of Triphala (an ayurvedic rejuvenating drug) in the mice exposed to g-radiation. Phytomedicine 2002;9:99-108.

3.Srikumar R, Parthasarathy NJ, Manikandan S, Narayanan GS, Sheeladevi R. Effect of Triphala on oxidative stress and on cell-mediated immune response against noise stress in rats. Mol Cell Biochem 2006;283:67-74.

4.Kumari N, Kumar P, Mitra D, Prasad B, Tiwary BN, Varshney L. Effects of ionizing radiation on microbial decontamination, phenolic contents, and antioxidant properties of triphala. J Food Sci 2009;74:M109-13.

5. Rasool M, Sabina EP. Anti-inflammatory effect of the Indian Ayurvedic herbal formulation Triphala on adjuvant-induced arthritis in mice. Phytother Res 2007;21:889.

6.Sabu MC, Kuttan R. Anti-diabetic activity of medicinal plants and its relationship with their antioxidant property. J Ethnopharmacol 2002;81:155-60.

LIFE CYCLE OF COMMON MORMON BUTTERFLY

Bhagyashree Utangale, Sonia Benjamin, Sumaiya Syed

Department of environmental science

B.N. Bandodkar College of Science, Thane

INTRODUCTION:

Month: September end.; Season: Post monsoon period.

The common mormon (*Papilio polytes*) is a species of swallowtail butterfly (papilionidae family). This species prefers to feed on flowers of lantana (*lantana camara*), ixora (*ixora coccinea*) and jatropha (*jatropha curcas*). The larval host plants for common mormon includes lemon and curry leaves plant and citrus plants of rutaceae family.

DESCRIPTION:

MALE: The male is of only one morph (form). It is black in colour with white spots on the hind wings.

FEMALE: The female is polymorphic and it has 3 morphs.

- Form *cyrus:* This form is similar to the male except that it has red crescents.
- Form *stichius:* This form mimics the common rose butterfly.
- Form *romulus:* This form mimics the crimson rose butterfly.

LIFECYCLE:

The lifecycle described below is on the basis of personal observations made by authors.

The life cycle of a butterfly is most fascinating in nature. It starts with an egg stage.

DAY 1: A female common mormon butterfly laid an egg singly at the underside of the leaf of a lemon plant. It was initially bright yellow in colour and the colour started darkening after a day.	
DAY 4: A small caterpillar hatched from the egg. It was hardly visible and did not show any movement for a few hours. After this resting period the caterpillar fed voraciously on the leaves of lemon plant. The caterpillar grows very fast and goes through various instars.	
DAY 11: The later instar looked like bird dropping. This is mainly to protect itself from being eaten by the predators such as birds, spiders and grasshoppers.	
Day 17: After molting the caterpillar turned green in colour. A black band with an eye-spot on each side on the 4th and 5th segments can be seen.	
Day 24 PREPARING FOR PUPA FORMATION: The caterpillar attached itself to a stem and takes form of a comma shape.	

Day 25: PUPA FORMED. The pupa is the stage which is non motile. The caterpillar stops feeding and is encased in a chrysalis, in which it undergoes metamorphosis.	
Day 33: While spending a few days in the chrysalis the caterpillar underwent miraculous changes. On the 33rd day the colour of the pupa changed and it became dark in colour. Within hours the pupa turned completely dark and now the wings of the butterfly were also visible through the pupa.	 **DARKENED PUPA**

A QUEEN WAS BORN... BEGINNING OF A NEW STORY… THE LIFE!!

A female common mormon of the form Romulus emerged from the pupa at about 2.40pm. After emerging it sat on the empty chrysalis in order to expand and harden its wings, as they need to dry their wings to fly effortlessly. Within an hour the butterfly was ready to fly in its own new world.

BUTTERFLY EMERGED

EMPTY CHRYSALIS

The life cycle of a butterfly can be beautifully shown from these following lines:

A fuzzy little caterpillar, curled up on the leaves..

Spun her little chrysalis, and then fell fast asleep..

While she was sleeping, she dreamed that she could fly...

Later when she woke up, she was a butterfly.

ACKNOWLEDGEMENT:

The authors gratefully acknowledge Dr. Mrs. Poonam Kurve , Mr. Ashutosh Joshi and Mr. Dilip Shenai , from department of environmental science for their guidance and support.

REFERENCE:

Butterflies of Mumbai- By Nelson Rodriguez

http://www.boardwalknb.com/html/butterflies/8.html

http://www.slideshare.net/gueste8a6f7/life-cycle-of-a-butterfly-4126795

http://animaldiversity.ummz.umich.edu/accounts/Papilio_polytes/

http://www.flickr.com/photos/somnathpaldas2/5112511869/in/photostream/

SPECTROSCOPIC AND CHROMATOGRAPHIC STUDY OF AQUATIC PLANTS.

Vrushali Bamane

Guiding Teacher: Anita S. Goswami-Giri

Department of Biochemistry, B.N.Bandodkar College of Science, Thane - (W)-400 601

Lotus :-

Kingdom: plantae

Order : proteales

Family : nelundonaceae

Genus: nelumbo

Species: N.nucifera

Also known as Indian lotus, sacred lotus, beam of India or simpy lotus is plant in monotipic family nelundonaceae. From ancient time the lotus has been a divine symbol in ancient tradition represent the virtues of sexual purity and attatchment hindu revers It with the divinity Vishnu and Lakshmi often portrayed on a pink lotus in iconography. Vishnu is often describing as the lotus eyed one. Its unfolding petals suggest the expansion of souls.

Hydrilla verticillata-hydrocharitaceae **Floating plant with no attachment to the mud or bottom**

Nelumbo nucifura-nelumbonaceae
Plant rooted in the mud or muck

Lotus grows from mud but it is unstained .Lotus rootlets are sweet tangy flavours. This is a abundant source of biomass so it is known as bioremediation. Due to rapid growth it is a challenge to study in it.In Buddhist symbolism, the lous represents purity of body, speech and mind. As if floating above the muddy water of attachment. According to legend Gautam Buddha was born with the ability to walk and lotus flowers blooed everywhere he stepped

Lotus is native to tropical Asian countries and also of Queensland in Australia, it is commonly cultivates in water gardens. It is also national flower of India and Vietnam.Reports suggest that lotus has remarkable ability to regulate temperate of its flower to within a narrow range just as humans and other warm-blooded animals do.

- Natural ambiance-social aspects

Environment pollution-maintains aquatic ecosystem

This abundant source of biomass is a known bioremediation hyperaccumulator of Hg, Cd, Cr, Pb, and as such can be used in phytoremediation

large leaves are used as a wrap for food

roots" (rhizomes) are all edible

Seed paste used in pastries

Powder of stamens is used in herbal tea for fragrance

Extracts:

Leaf and stem of hydrilla and lotus plant was collected from Bandodkar College campous.

Decay and fresh parts were used to check that analysis.

Stem and leaf were crushed separately in mortar and pestle with distilled water.

After this the mixture was filter with the help of muslin cloth.

All this prepared extract was refrigerated for analysis.

Uses 1. Stamens can be dried and made into fragment herbal tea called 'Lianhua cha' in Chinese, used to impart scent to leaves.

2. Roots are edible and also used in traditional Asian herbal medicine.

3. Large leaves are used for food.

Rf value-

Decay hydrilla leaf : 4.3/6.5=0.661

Fresh hydrilla leaf : 4/6.5=0.615

Decay hydrilla stem : 3.9/6.5=0.600

Fresh hydrilla stem : 3.5/6.5=0.538

Decay lotus leaf : 3.7/6.5=0.538

Fresh lotus leaf : 3.8/6.5=0.584

Decay lotus stem : 4.5/6.5=0.692

Fresh lotus stem : 3.4/6.5=0.600

Decay hydrilla leaf			
peak	**abs**	**valley**	**abs**
1040	-0.022	1086.5	-0.036
1021	-0.017	1035	0.022
678.5	0.282	1010.5	0.02
435	0.578	634.5	0.163
		399.5	0.547

Decay lotus leaf			
peak	**abs**	**valley**	**abs**
673	0.133	657	0.121
648.5	0.123	643.5	0.122
253	4	244	3.95
232	4	222.5	3.962
215.5	4	206.5	3.935
200	4		

Decay piestia leaf			
peak	**abs**	**valley**	**abs**
676	0.674	657	0.633
650	0.637	639.5	0.631
374	4	244	3.934
231	4	215	3.938

decay hydrilla stem			
peak	**abs**	**valley**	**abs**
678	0.018	633.5	-0.054
435	0.21	424.5	0.202
416	0.205	401	0.195
200	4	193.5	3.893

decay lotus stem			
peak	**abs**	**valley**	**abs**
678	0.365	659.5	0.348
252.5	4	243.5	3.962
234	4	224.5	3.96

fresh piesta leaf			
peak	**abs**	**valley**	**abs**
674	0.074	657	0.63
649	0.063	641.5	0.63
269	3.385	250.5	2.516
224	4	214.5	3.987

fresh hydrilla leaf			
peak	**abs**	**valley**	**abs**
677.5	0.38	634	0.225
434.5	0.812	423.5	0.79
416	0.797	399.5	0.773

fresh lotus leaf			
peak	**abs**	**valley**	**abs**
671	0.27	662	0.268
271	4	266.5	3.839
257.5	4	250	3.881
237.5	4	225.5	3.977
219.5	4	213	3.985

long grass decay stem			
peak	**abs**	**valley**	**abs**
1093.5	0.055	1089	0.053
1059.5	0.073	1550.5	0.071
1025	0.083	1021.5	0.083
679	0.298	658.5	0.285
206.5	4	200	3.908

				209	4						
fresh hyrilla stem				**fresh lotus stem**				**long grass decay leaf**			
peak	abs	valley	abs	peak	abs	valley	abs	peak	abs	valley	abs
676	676	676	676	651.5	-0.039	639	-0.0422	671	0.135	662	0.134
				228.5	4	223.5	3.966				
				217.5	4	210.5	3.966				

peak	abs	valley	abs	peak	abs	valley	abs	peak	abs	valley	abs
1040	-0.022	1086.5	-0.036	673	0.133	657	0.121	676	0.674	657	0.633
1021	-0.017	1035	0.022	648.5	0.123	643.5	0.122	650	0.637	639.5	0.631
678.5	0.282	1010.5	0.02	253	4	244	3.95	374	4	244	3.934
435	0.578	634.5	0.163	232	4	222.5	3.962	231	4	215	3.938
		399.5	0.547	215.5	4	206.5	3.935				
				200	4						

decay hydrilla stem				**decay lotus stem**				**fresh piesta leaf**			
peak	abs	valley	abs	peak	abs	valley	abs	peak	abs	valley	abs
678	0.018	633.5	-0.054	678	0.365	659.5	0.348	674	0.074	657	0.63
435	0.21	424.5	0.202	252.5	4	243.5	3.962	649	0.063	641.5	0.63
416	0.205	401	0.195	234	4	224.5	3.96	269	3.385	250.5	2.516
200	4	193.5	3.893	218.5	4	205.5	3.896	224	4	214.5	3.987
								204.5	4	193.5	3.969

fresh hydrilla leaf				**fresh lotus leaf**				**long grass decay stem**			
peak	abs	valley	abs	peak	abs	valley	abs	peak	abs	valley	abs
677.5	0.38	634	0.225	671	0.27	662	0.268	1093.5	0.055	1089	0.053
434.5	0.812	423.5	0.79	271	4	266.5	3.839	1059.5	0.073	1550.5	0.071
416	0.797	399.5	0.773	671	0.27	662	0.268	1025	0.083	1021.5	0.083
				257.5	250			679	0.298	658.5	0.285
				237.5	225.5	3.977		206.5	4	200	3.908

fresh hyrilla stem				219.5	213	3.985	long grass decay leaf
peak	abs	valley	abs	209			
676	0.201	639.5	0.164				
201.5	4						

fresh lotus stem				peak	abs	valley	abs
peak	**abs**	**valley**	**abs**	671	0.135	662	0.134
679.5	-0.021	656.5	-0.0422				
651.5	-0.039	639	-0.0422				

228.5	4		223.5	3.966	
		217.5	4		

Sea grass:

Sea grass are flowering plants from one of four families (posidoniaceae, zosteraceae, hydrocharitaceae), all in order alismatales (in class of monocotyledons), which grow in marine, fully saline environments.

Characteristcs of fresh water plants:

Water is plentiful during growing season

Wavelength of sunlight for photosynthesis is low for submerged plants

Concentration of carbondioxide dissolved is low.

Concentration of oxygen for underwater plant is low.

Mineral and nutrients are scarce or dilute.

Moving water (waves) can be damaging to the organs of the plant

Category of freshwater plants (A) Native aquatic plants

Native aquatic plants are an essential part of a frshwater ecosystem providing many benefits to wildlife as well ashuman benefits.

It provide natural habitat and refuge for aquatic animals.

Act as food sources for wildlife.

Recycle oxygen and carbondioxide.

Reduce wave action; preventing shoreline erosion and improving water clarify.

(B)Non–native aquatic plants:

Non- native aquatic plants are invasive.

They disrupt the ecosystem and create nuisance conditions in freshwater.

Once invasive plant gets well established, the density of plant growth not only degrades natural habitat but often recreational uses like fishing, boating etc.

Lotus and hydrilla plants belong to this category

HYDRILLA

Hydrilla has invasive qualities that make it a nuisance.

It has amazing reproductive capabilities that allow it to grow in almost any fresh water in variable conditions.

It can grow in low or high nutrient amount or a wide temperature tolerance.

When it invades in an area ecologically important native submerged plants are shaded out.

It greatly slows down water flow and clogs irrigation and flood control canals

It spreads rapidly to lake across likely to pose significant environmental challenges in the future.

Conclusion

TLC and spectroscopy method was used to do the analysis of hydrilla and lotus plant.

Further analysis is going on.

Acknowledgement: Authors are gratefully acknowledged to the Vidya Prasarak Mandal, Thane, and Principal,Dr M.K.Pejaver; B. N. Bandodkar College of Science, for science square activity running by college for encouragement of students.

STUDENTS CORNER

Available online www.vpmthane.org

J BNB -2014

BIOACCUMULATION OF HEAVY METALS IN WASTE WATER AQUATIC PLANT (HYDRILA) AND WATER ANALYSIS FROM THANE CREEK.

Vrushali Bamane

Guiding Teacher: Anita S. Goswami-Giri*

Department of Chemistry; B.N.Bandodkar College of Science, Thane - (W)-400 601

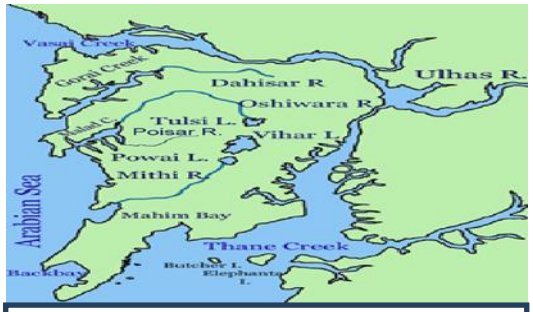
ABSTRACT:

Aquatic plants absorb heavy metals from the water; those rooted ones also from the bed material. Hence, from Thane creek; hydrila plant material was collected along with water and analyzed for its accumulation of heavy metal. Aslo attended chemical and physical parameter of aquatic plant.

Keyword: hydrila ; heavy metal; waste water

INTRODUCTION:

Thane Creek (73°14′E, 19°14′N-72°54′E, and 19° 17′N) is an inlet in the shoreline of the Arabian Sea that isolates the city of Mumbai from the Indian mainland.[1] It comprises the area between Mumbra Retibunder and the Mankhurd-Vashi Bridge. The creek is divided into two parts. The first part lies between Ghodbunder and Thane a section from where the ulhas river (72°55′E, 19°N-73°E, 19°15′N) flows from the north of Mumbai Island to meet the Arabian sea on the west. The second part of the waterway lies between the city of Thane and the Arabian Sea at Trombay before the Gharapuri islands. In the creek, number of an aquatic plant species are occupying including mangrove, hydrilla.[2]



Map of thane creek

Hydrilla verticillata-hydrocharitaceae

Hydrilla (Hydrochariraceae) is native to cool and warm looter the world in Asia, Europe, Africa and Australian with a sparse scattered distribution in Europe [2]. It is a perennial, which means the leaves and stems die when the weather gets cold, but the roots continue to live in the soil. When the weather gets warm again, the roots send up new stems and leaves. Hydrilla roots are called tubers, and look a lot like small potatoes. When Hydrilla stems get broken, the pieces can become new plants. Hydrilla can also spread when it produces flowers. Hydrilla flowers are tiny and white. They float on the surface, just above the water. It can become a big problem when it grows too fast in an area. It can become so thick that it is impossible to swim, fish, or operate a boat through it. Scientists have been working on ways to control Hydrilla.

Chemistry of water:

Water is a stable compound of oxygen and hydrogen. It is represented as H2O. It is also the only chemical on this planet that occurs naturally in all three states of matter i.e. solid, liquid and gaseous. Bonds between hydrogen and oxygen are covalent and the bond angle measurement of HOH is 104.50.

An aquatic plant is well known for accumulation of heavy metal from waste water affect metal fluxes through ecosystem. Bivalent metal ion is the source of industrial waste water. Waste water decreased activity of enzymes in aquatic plants visibly effecting toxicity appeared in minor plants as well as witting and drying of plants. Hence, hydrilla aquatic Plant present in thane creek near to Bandodkar Campus has been selected to study physiochemical characteristic along with heavy metal.

Material and methods:

Physical parameters of water were studied by measuring total dissolved solids in creek water. Total dissolved solid obtained by evaporation of H_2O.

Chemical parameters (TSS)

1) **Dissolved oxygen**:

Sample + 2 ml manganese sulphate = Brown ppt obtained. Precipitate dissolved in conc. H_2SO_4 and do mud used on H2O and soil analyzed.

2) **BOD:**

Do sample won kept in incubator for 5 days at KT analysis was done difference in before and after is measured.

3) **COD:** By using reflux method.
4) **Hardness water:**

It is measured by titrating against 0.01 M EDTA using Erichrome Black T**:** H is calculated by noting reading of red to sky blue.

5) **Alkalinity :**

Alkalinity was measured by titrating at against 0.02 ml H_2SO_4 using methyl orange yellow to orange red and alkalinity won calculated by using Formula

6) **Salinity:** titrating against $AgNO_3$.

7) **Heavy Metal:**

Aqueous plant material air dried powdered, weighing exactly 1 gm for detection of each metal. Powder treated with Nitric acid and Ag chloride (3:1) after evaporated all acid by adding H_2O boiled till solution get cleared and diluted with deionised water for the This sample won used on AAS .

Result and discussion:

Total Dissolved Solids (TDS):

Total dissolved solids denote mainly the various kinds of minerals present in the water. In natural waters, dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, sulphates, phosphates and nitrates of calcium, magnesium, sodium, potassium, iron and manganese and other cations. In polluted water, the concentration of other substances increases depending upon the type of pollution.

Concentration of dissolved solids is an important parameter in drinking water and other water quality standards. Water with higher dissolved solids content can also be used for human consumption without harmful physiological effects. The 1958 WHO International Standards set the permissible limit for dissolved solids as 500 mg/lit. and the excessive limit as 1500 mg/lit. In many parts of the world, water with dissolved solids concentration ranging from 2000 to 4000 mg/lit. are used with no physiological effects reported.

However it can be concluded that water with total dissolved solids content up to 1000 mg/lit.,are satisfactory for domestic uses.

Dissolved solids in industrial water are undesirable for many reasons. These form scales, cause foaming and deposition in boilers, accelerate corrosion and interfere with the colour and taste of the many finished products. Water with higher amount of dissolved solids than the permissible limits indicates unfitness of water for consideration of domestic purposes.[4] High total dissolved solids (TDS) measured in electrical conductivity in the majority of the area indicates the need for some type of water treatment for the removal of dissolved solids such as RO and ion exchange methods.[5]

Table 1 Chemical parameters of water

Sample	TDS gm/lit	TSS gm./lit	Hardness	Alkalinity gm/lit	Salinity	DO mg/lit	BOD	COD mg/lit
Nov 12	360	1.12	142.0	119.20	752	10.06	2.06	140
Dec 12	400	1.52	160.60	170.44	937.20	10.46	2.39	150
Jan 13	390	0.80	157.20	172.0	979.80	10.38	2.70	180
Feb 13	410	1.0	169.20	184.0	994.0	10.10	3.20	160

Total Hardness:

Natural water is classified into soft water and hard water. Soft water gives a good lather while hard water does not give lather easily with soap solution. Soaps generally consist of the sodium salts of long chain fatty acids such as oleic acid, Palmitic acid and stearic acid. The soap consuming capacity of water is mainly due to the presence of calcium and magnesium ions. These ions react with the sodium salts of long chain fatty acids present in the soap to form insoluble scum of calcium and magnesium, soap which does not possess any detergent value. Reaction of hard water with soap can be written as

$$2C_{17}H_{35}\,COONa + MgSO_4 \,(C_{17}\,H_{35}COO)_2.\,Mg + Na_2SO_4$$

Soap (soluble) Present in Magnesium soap, Sodium stearate in hard water (insoluble) Magnesium stearate

$$2C_{17}H_{35}COONa + CaCl_2 \;(C_{17}H_{35}COO)_2Ca \downarrow + 2\,NaCl$$

Soap (soluble) Present in Calcium soap Sodium stearate hard water (insoluble) Calcium stearate

Other metal ions such as Fe^{2+} , Mn^{2+} and Al^{3+} also react with the soap similarly, thus contributing to hardness but generally, these are present in natural waters in traces. Further, acids such as carbonic acid can also cause free fatty acid to separate from soap solution and thus contribute to hardness. However, in practice, the hardness of a water sample is usually taken as a measure of Ca^{++} and Mg^{++} content. [5].

Hardness has no adverse effects on health. However, some evidence has been given to indicate its role in heart disease [6]. The hard water is also not suitable for domestic use in washing, cleaning and laundering. However, the hardness may be advantageous in certain conditions. It prevents the corrosion in the pipes by forming a thin layer of scale and reduces the entry of heavy metals from the pipes in to the water.

Calcium:

The presence of calcium in water is mainly due to its passage through or over deposits of lime stone, dolomite, gypsum and other gypsiferous materials. Calcium is an essential element and human body requires approximately 0.7 to 2.0 gm. of calcium per day as food elements, the amount which cannot be supplied even by hard water. In fact, calcium deficiency is the most common nutritional problems in many parts of the world. However, water with high calcium content is undesirable for household uses such as washing, bathing and laundering because of the excessive consumption of soap and other clearing agents. Calcium in industrial waters is undesirable mainly due to the formation of scales. Calcium is essential for normal plant growth and is desirable in water for irrigation.[6]. Concentration of calcium is

reduced at higher level of pH due to its precipitation as CaCO3.

Magnesium:

Magnesium salts occur in sea water and estuary water (1400 ppm). Magnesium is an essential element for human beings. Magnesium salts act as cathartics and diuretics among animals as well as human beings. However, higher concentrations cause an unpleasant taste in water and shows laxative effect. Magnesium in industrial water is undesirable since it is the major scale forming cation. Magnesium is essential to normal plant growth. Calcium and magnesium ions in irrigation water tend to keep soil permeable and in good tilt [5]. Magnesium is also responsible for water interaction with the source rocks. Mg-Silicate minerals, chiefly amphiboles, Pyroxenes, olivine and biotite constitute the main source of Mg^{++}.[6].

Dissolved Oxygen:

In natural and waste water, the dissolved oxygen levels depend on the physical, chemical and biological activities of the water bodies. The sources of dissolved oxygen in water are the autotrophic aquatic plants which as a result of photosynthesis evolve oxygen from where oxygen gets dissolved in water depending on salinity, temperature and water movement. The concentration of dissolved oxygen is more during monsoon and the least during summer. Low oxygen in water can

Table 2 Detection of heavy metals in water and aquatic plant. **(Hydrila metal)**

Mg/lit	Fe	Zn	Mn	Ni	Cr	Cd	Pb	Co	Ca	Mg
Nov12	12	0.45	3.5	0.44	0.61	0.024	0.3	0.10	1.21	0.08
Dec12	2.8	0.50	3.0	0.36	0.72	0.052	0,6	0.068	3.5	0.12
Jan 13	3	0.38	2.5	0.48	0.80	0.017	0.3	0.17	38	0.21
Feb13	3.8	0.60	2.8	0.43	0.72	0.16	0.7	0.06	40	0.16

Water sample

Mg/lit	Fe	Zn	Mn	Ni	Cr	Pb	Co	Ca	Mg
Nov 12	0.0	0.0	0.0	0.0	0.005	0.3	0.0	0.0	0.05
Dec 12	0.0	0.0	0.0	0.0	0.005	0.33	0.0	0.0	0.03
Jan 13	0.0	0.0	0.0	0.0	0.004	0.4	0.0	0.0	0.03
Feb 13	0.0	0.0	0.0	0.0	0.006	0.35	0.0	0.0	0.05

slaughter fish and other organisms present in water. More growth of microorganisms, plants and animals depletes oxygen. This depletion increases with increase in water depth.

Total Alkalinity: Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compounds of calcium, sodium and potassium. Alkalinity in

natural water is due to the free hydroxyl ions and hydrolysis of salts formed from weak acids and strong bases.

$$A^- + HOH \longrightarrow HA + OH^-$$

The determination of alkalinity provides an idea of the nature of salts present. If the alkalinity is equal to hardness, only calcium and magnesium salts are present. If the alkalinity is greater than hardness, it indicates the presence of basic salts sodium and potassium in addition to those of calcium and magnesium. If the alkalinity is lower than hardness, neutral salts of calcium or magnesium must be present that are not carbonates and usually these are sulphates. Alkalinity is an important parameter involved in corrosion control. Alkalinity itself is not harmful to human beings, still, water with less than 100 mg/litre values are desirable for domestic use.[7.]

Sodium:

Sodium is present in most natural waters from negligible to appreciable concentrations. It is important to check the salinity or total dissolved solids as a consideration in the use of the water. Sodium has important considerations with regard to irrigation water only. Regarding drinking and industrial purposes it is of minor importance. However, it has to be mentioned that excessive amount of sodium in drinking water is harmful to persons suffering from cardiac, renal and circulatory diseases. Determination of sodium is sometimes used to indicate the purity of water, for example, in steam condensates, the concentration of sodium indicates whether there is any carryover of water from boiler system in the steam.

Potassium: Potassium is an essential nutritional element, but in excessive amounts it acts as a cathartic. It is reported that foaming could be caused in boilers by more than 50mg/litre of potassium and sodium in the water. Though, low concentration of potassium in irrigation water is essential for plant nutrition, it must be maintained in a proper balance with other mineral nutrients for good plant development The main source of potassium in natural fresh water is from the weathering of rocks but the quantities increase in polluted water due to the disposal of waste water.

Aquatic plants absorb heavy metals from the water; those rooted ones also from the bed material. Generally, aquatic plants can accumulate high amounts of heavy metals [6]. In such a way, they reflect the toxicity of the water environment and may serve as a tool for the biomonitoring of contaminated waters. Hence chemical parameters have been analyzed is shown in table 1.

Mean values of heavy metals content in aquatic plants referring to thane creek sites as well as the values of heavy metals content in the water are presented in Table 2.

Hydrila	RF	λ MAX (nm)
Decay leaves	0.661	1040, 1021, 678.50, 435
Fresh leaves	0.615	677.50,434.50,416
Decay stem	0.600	678,435,416,200
Fresh stem	0.538	676,201.50

Table 3 showing RF values and λ Max (nm)

Conclusion:

Our findings provide a preliminary result requires involving a wider spectrum of localities, hydrophytes, and the data on heavy metals occurrence in the water and the aquatic plants, along with focusing on the relationships between the heavy metals contents in the water.

Acknowledgement: Authors are gratefully acknowledged to the Vidya Prasarak Mandal, Thane, and Principal, B. N. Bandodkar College of Science, for science square activity running by college for encouragement of students.

References:

1. Indrani Gupta, Shivani Dhage, A.A. handorkar, Anjali Srivastav Environmental Modelling & Software Volume 19, Issue 6, June 2004, Pages 571–579.

2. Predicting the potential invasive distributions of four alien plant species in North America. Peterson, A. Townsend, Papes, Monica. Weed Science v. 51 no. 6 (November/December 2003). p. 863-82003.

3. Cardwell, A.J., Hawker, D.W. and Greenway, M. (2002): Metal accumulation in aquatic macrophytes from southeast Queensland, Australia. – Chemosphere 48: 653-663.

4. WHO (2002), financial management of water supply and sanitation, World Health organization, Geneva.

5. Shrivastav Rohit and Choudhari Bindu, (1997), Drinking water quality in an average Indian city,A case study of Agra. (U.P.) , Poll Res. 16(1), 55-63.

6. Kejian Peng, Chunling Luo, Laiqing Lou, Xiangdong Li, Zhenguo Shen Bioaccumulation of heavy metals by the aquatic plants *Potamogeton pectinatus* L. and *Potamogeton malaianus* Miq. and their potential use for contamination indicators and in wastewater treatment Science of The Total Environment Volume 392, Issue 1, 15 March 2008, Pages 22–29.

7.Ole Vestergaard, Kaj Sand-Jensen Alkalinity and trophic state regulate aquatic plant distribution in Danish lakes Aquatic Botany Volume 67, Issue 2, June 2000, Pages 85–107

INVESTIGATIONS ON THE ECONOMIC IMPORTANCE OF COCONUT PALM (*COCUS NUCIFERA* L.)

Project submitted by: Tejal Ambre, Akshada More, Trupti Pawar, Seema Khavale and Moses Kolet*

*Guiding Teacher, corresponding author

ABSTRACT

Palms have always been close to humanity and their association with human civilizations can be traced back to ancient times. Palms such as the coconut (*Cocos nucifera* L.) enjoy status of economically important plantation crops. All parts of the tree are important, earning it the name of '*kalpavriksha*'. A survey of Coconut palms was carried out in the Chendani area of Thane, India, wherein over two hundred specimens in different stages of growth and development were recorded. Both tall as well as dwarf varieties were observed. The economic value of the tree is discussed. Considering the cultivation of coconut in the 4 southern states of India, its plantation in Maharashtra needs to be boosted up.

INTRODUCTION:

Members of the botanical family Arecaceae (Palmae), popularly known as the palms, have always been close to and have played an important part in human civilizations and feature as one of the most significant group of plants of economic importance to mankind. Their association with humanity can be traced back to ancient times, when they provided basic necessities of life (Balambal, 1993). In modern times also, palms contribute towards agro-horticultural economy, especially in the tropical region (Leaser, 2005). They are a part of socio-religious functions in India (Mahabale, 1982). Palms occur both in wild and cultivated habitats and have wide diversity in morphology (Riffle, 2008). Kulkarni and Mulani (2004) reported 96 species of palms in India. While all members of the palm family are valuable in some or the other way, palms such as the coconut (*Cocos nucifera* L.) enjoy status of economically important plantation crops (ICAR, 2000). India is a major producer of coconuts in the world.

The coconut palm is of common occurrence in the Konkan area under which the area of study falls; thriving near the sea coast (Pfleiderer, 1990). This palm has been cultivated in India since ancient times. All parts of this tree being useful to mankind, has earned it the name '*kalpavriksha*' or 'Tree of Heaven', one among the 5 legendary *devavrikshas*, the 'all giving trees' (Markrose, 2008). The roots, trunk, leaves, flowers, fruits, seeds, kernel, pulp, coconut milk, coconut water, oil, oil cake, shell, coir, wood and pith are valuable assets yielded by this tree which can be put to a vast multitude of uses in various fields of utility inclusive of their medicinal uses (Chopra *et al*., 1969; Agarwal, 1986; Tiwari and Pande, 2005; NISCAIR, 2010). The tree is valuable in horticulture and landscaping (Gopalaswamiengar, 1991), its nuts are part of socio-religious functions and rituals (Bhatla *et al*., 1984) and it is also a valuable source of pollen and nectar for honey bees (Alexander and Daniel, 2012).

MATERIALS AND METHODS:

A survey of Coconut (*Cocos nucifera* L.) palms was carried out in the Chendani area of Thane, India. The specimens were identified in the field and in the department of botany, B.N Bandodkar College of Science, using standard literature. The allied facts presented in the section of results and discussion, were compiled from different sources, duly cited in the references section.

RESULTS AND DISCUSSION:

Over two hundred specimens of Coconut palms were recorded in Chendani area of Thane. A majority of 187 specimens were documented from 'Jnanadweepa', Vidya Prasarak Mandal, Thane's college campus situated in the locality of study. Some were newly transplanted, some well settled and showing excellent growth, while many were the original specimens planted soon after establishment of the Thane college campus, in late 1960s and early 1970s. Both tall as well as dwarf varieties were observed. The morphological characters tallied with those reported by Thampan (1981) and Kirtikar and Basu (2007).

In cultivated habitats, the tree is usually planted in rows, or at perimeters of gardens or sometimes alongside avenues and paths as observed in the Thane college campus. The economic value of the palm is depicted in Table 1. The basic products of importance are its leaves, fruits, kernel, copra, seeds, roots and stem. All parts of the tree are valuable. A vast multitude of products are obtained from coconut palm and its basic products. The palm and its products also have several medicinal uses (Parrotta, 2001). The basic facts and information on this tree is presented in Table 2. The tall, unbranched, handsome tree with a crown of evergreen leaves has become synonymous with vacations at exotic tropical locations. Taking into consideration the large scale plantation of coconut in the four southern states of India, the cultivation in Maharashtra definitely needs to be beefed up.

CONCLUSION:

The investigation revealed a healthy population of coconut palms in Chendani area and Thane college campus. Both tall as well as dwarf varieties were observed. All the specimens recorded were healthy and actively growing; many also showed flowering and fruiting. There is no doubt that the palms investigated in the current study, along with the rich flora on the Jnanadweepa educational campus housing VPM's group of institutions, serve as green lungs for all the surrounding areas in the viscinity. Cultivation and plantation of coconut in Maharashtra needs to be increased.

Table 1 Utility of the Coconut palm (*Cocos nucifera* L.)

(Thampan, 1981; Kirtikar and Basu, 2007; NISCAIR, 2010)

Plant part/ product	Utility
Entire tree	Plantation crop, in private gardens and on sea shores, economically important
Root	Astringent, anthelmintic, infusion used as gargle in sore throat, diuretic, strengthens the gums, used to cure uterine diseases
Bark	Good for teeth; used in scabies
Wood	Used for cabinets, rural buildings, doors, windows, wall panels, handicrafts, particle boards Used as fuel wood Prescribed in treatment of piles
Leaves	Fibres used for mats hats, bags, baskets, brushes Midribs used for stiff brooms, bird cages, fish and lobster traps Used as thatching material for houses, huts and sheds Used for shading nurseries, as mulching, as fencing material Used in treatment of diabetes Petioles used as fuel
Flowers	Astringent, used in diabetes, swellings
Fruits	Aphrodisiac, diuretic, many products from fruit are obtained which are used in day to day life Used in treatment of diabetes Tender coconuts give sweet refreshing water and gelatinous kernel
Nuts	Immature nuts used as astringent, in sore throats of children, Ripe nuts used as seeds.
Coconut Copra	Diuretic, aphrodisiac Edible, used in culinary preparations, pastries and confectionery, Dry copra used for extraction of fatty oil,
Coconut milk	Used to treat debility, incipient phthisis, cachetic affections
Sap	Fresh sap i.e. neera is tonic, cooling Fermented toddy is a mild alcoholic drink
Coconut shell	It is largely used as a fuel and for production of charcoal Manufacture of curios, cups Alcoholic extract effective against skin infections Shell flour used as filler in plastics
Coconut water	Refreshing drink, quenches thirst, diuretic, used in fever and urinary disorders, it is sterile, non-pyrogenic, non-hemolytic, non-antigenic and non-toxic, blood purifier
Coconut oil	Employed in food products, soaps, cosmetics, salves, shampoos, shaving creams etc, used in urinary complaints, it promotes the growth of hair, popular remedy for tapeworm, also used as medicine in hair problems, loss of hair and head aches Ingredient of hair oils, promotes tanning of skin
Products	Copra (kernel), coconut milk, protein, oil, dessicated coconut, flour, coconut water, toddy and coir

Table 2 Basic Facts about the Coconut palm.(Thampan, 1981; NISCAIR, 2010)

Information	
Botanical name	*Cocos nucifera L.*
Family	Arecaceae (Palmae)
Vernacular names	Narikela, Nariyal, Dab, Narel, Naral, Kobbarichettu, Tenkaya, Narikelamu, Tennaimaram, Tenkai, Tengu, Thenna, Thenga, Narikelam
Origin	Not sufficiently known, various tropical countries claim to be its native country (origin), dwarf varieties introduced from Malaya.
Distribution	Tropical regions and cold regions, Prefers hot and humid climate and locations near sea coasts.
Habit	Evergreen tree, unbranched, stout Branching reported in exceptional, and extremely rare cases
Appearance	Attractive, high straight or curved, with crown of leaves
Requirements	Temperature 70^0-85^0F, rainfall 150-375cm. Best soil is rich alluvium with a good proportion of sand and coarser particles.
Growth	Tall, growing to a height of 80 ft (30-25 m) and more Dwarf varieties also occur
Expected Life Span	Variable; Tall varieties live and produce fruits up to 80 years while life expectancy of dwarf varieties is less
Flowers	Female flowers are larger than male, relatively few, 1 inch, long, globose, arising from base of panicle. Male flowers are numerous, small & sweet scented, arising from upper portions of panicle.
Fruits	Throughout the year
Propagation	By seeds
Progeny	Germinated from fruits, either direct plantation, nurseries or by fruits falling down from tree.

ACKNOWLEDGEMENTS:

Authors are gratefully acknowledged to the Vidya Prasarak Mandal, Thane, and Principal, B. N. Bandodkar College of Science, for encouragement.

REFERENCES:

Agarwal, V.S. 1986. Economic Plants of India. Kailash Prakashan, Calcutta. pp. 81.

Alexander, L. and Daniel, T. 2012. Establishing Bangalore urban city as a potential bee keeping locality in Karnataka with *Apis cerana indica* Fab.In.Biodiversity: Richness, uses, threats and conservation (T. Daniel, Ed.). Excel India Publishers, New Delhi. pp 66-71.

Balambal, V. 1993 Agriculture in the sangam age. In, Agriculture in Ancient India (V.V.Bedekar, Ed.). Itihas Patrika Prakashan, Thane. pp. 26-39.

Bhatla, N., Mukherjee, T. & Singh, G. 1984. Plants: Traditional worshipping. *Indian Journal of History and Science* 19 (1): 37-42.

Chopra, R.N., Chopra, I.C. and Varma, B.S. 1969. Supplement to Glossary of Indian Medicinal Plants. Publications and Information Directorate, CSIR, New Delhi. pp. 19.

Gopalswamiengar, K.S. 1991. Complete Gardening in India. GopalaswamyParthasarthy, Bangalore, India.pp. 544-553.

ICAR. 2000. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.

Kirtikar, K.R. and Basu, B.D. 2007. Indian Medicinal Plants, Vol. IV. International Book Distributors, Dehradun, India. pp. 2581-2585.

Leaser, D. 2005. Palm Trees: A Story in Photographs. Westwood Pacific Publishing, USA.

Mahabale, T.S. 1982. Palms of India. Monograph No.3. MACS, Pune, India. pp. 12-15.

Markrose, V.T. 2008. Coconuts in India. Coconut Research Center. www.coconutresearchcenter.org

NISCAIR. 2010, The Wealth of India, Raw Materials Vol. IV. CSIR, New Delhi. pp 91-115.

Parrotta, J.A. 2001. Healing Plants of Peninsular India. CABI Publishing, Wallingford, UK. pp 114-115.

Pfleiderer, I. 1990. The Life of Indian Plants. Royal Publications, Delhi. pp. 136-146.

Riffle, R.L. 2008. Pocket Guide to Palms. Timber Press Inc. USA. pp. 1-233.

Thampan, P.K. 1981. Handbook on Coconut Palm. Oxford and IBH Publishing Co., New Delhi. pp. 1-303.

Tiwari, L. and Pande, P.C. 2005. Traditional veterinary medicinal plants of Bhilangana valley of Tehri district, Uttaranchal Himalaya *Asian Agri-History* 9 (3): 253-262.

Editorial

MUSHROOMS AND FUNGI: THE CRYPTIC ENTITIES

While larger organisms can easily catch the attention and fancy of one and all, conservationists included, and are glorified; the minuscule microscopic microorganisms are largely ignored and even treated with disdain. The importance and necessity of conservation of microbial biodiversity has finally dawned upon conservationists and policy makers, having very recently come into limelight. The humble fungi, considered next to insects in terms of their overwhelming biodiversity, have become synonymous with the better known mushrooms which continue to fascinate botanists, mycologists and naturalists alike. The unannounced appearance of mushrooms, followed by an equally sudden disappearance have wrapped them a sense of intriguing and unravelled mystery. This very characteristic has placed an unseen and unique responsibility on microbial conservationists, for, who would ever miss these elusive entities that remain concealed in diverse substrata in their non-descript thin, thread-like mycelial forms for most part of the year, to appear as fruit bodies only for a few hours or days; just in case some of them vanish from the world, victim of the rapidly changing natural equations generated as a result of human activities and interference? No one would ever know of their extinction; leave alone protest, as majority of our microbial wealth remains undocumented. The case of the micro- fungi in various natural habitats is all the more critical as they ever remain hidden from human eyes; devotedly and tirelessly performing their respective specific jobs as assigned by mother nature. Loss of such unseen species due to disastrous upheavals brought about by human hands would almost certainly go unnoticed. Their unique niches in the web of life may be taken over by other opportunists and their specific functions be performed by general purpose ‘others’ or just plainly stop, resulting, in rare cases, in a cascading catastrophic effect for other dependent species, if any. The loss to biodiversity would however be permanent and irreparable. A species would be lost; wiped out even before it was fully known and studied from the region.

Documentation thus assumes great importance. Our knowledge on basic aspects of our own microbial and mycological wealth, its contributions to the ecological balance, specific functions performed, range of habitats, genera and species, life cycle patterns and specific requirements of individual species and individual profiles of microorganisms is woefully lacking and certainly not adequate. This, compounded by the fact that a vast majority of fungi are yet lying undiscovered, cuts a rather sorry figure on the knowledge domain front. Contemporary research pursued is by and large aimed at exploitation of the applied aspects of the species, and in the majority of cases, employing molecular characterization; with utter disregard to basic studies which continue to remain ignored, resulting in scattered and piecemeal information being available. A wholesome and holistic approach to basic and applied studies covering the different aspects of micro as well as macro fungi would do much good and contribute to knowledge banks and local biodiversity lists, many of which are not even attempted yet. Obtaining, documenting and maintaining of cultures from respective habitats, followed by development of growth or cultivation protocols would ascertain an assured future for the species in case of tragedy. Such worthy work has been pursued incessantly, with determined tenacity in some of our biodiversity hotspots, universities, research and culture collection centres and to some extent in colleges by workers who largely prefer to contribute their lot silently without fuss. This editorial is a tribute to all those engaged in such noble endeavours in the past and present and to those planning to take up such work.

Dr. Moses Kolet