



"The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education. Science & Technology is now dominates almost every field of our activities in summary, The faculties (Science stream) of GEMS Arts & Science college have made an excellent attempt to bring about this book *Homo-Scientia* covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts. I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts."

Dr. Balagopalan Unni



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**GEMS ₹ 570**

Layout and design: Selen Azharian

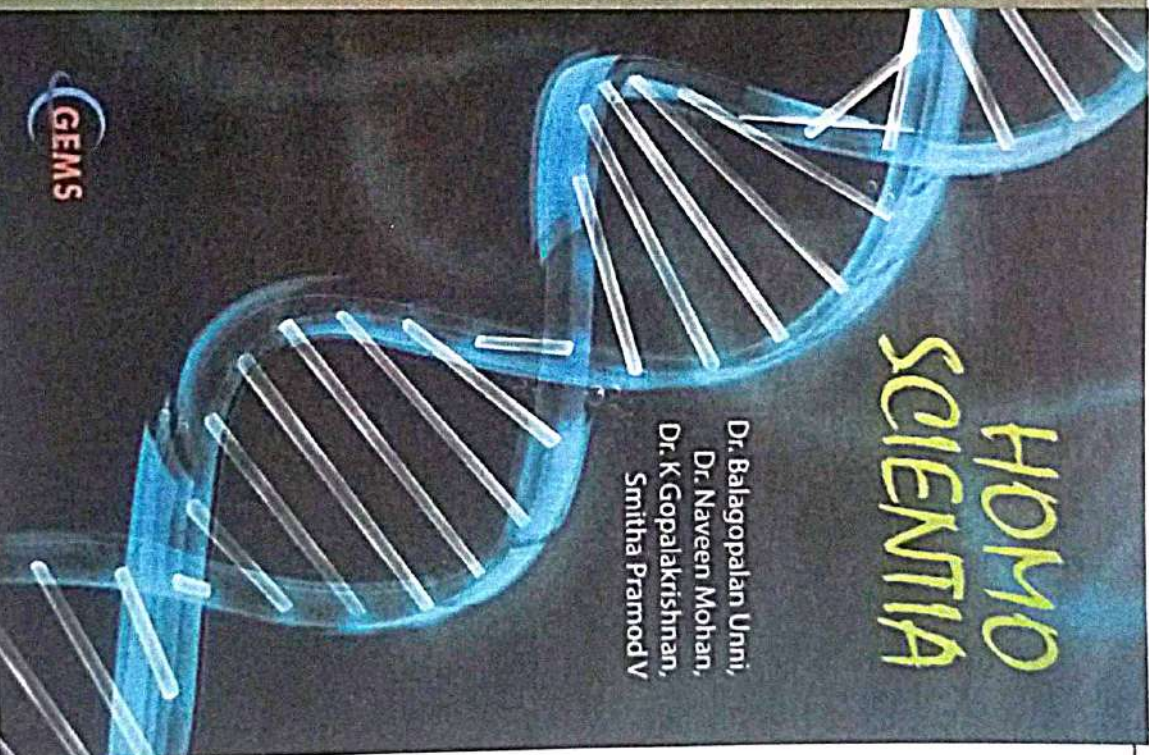


ISSN 978-81-967332-1-3

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# HOMO SCIENTIA

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# HOMO SCIENTIA



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**ENGLISH LANGUAGE**

**Book of Gems Science Association  
Science/Articles**

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Dr.K.Gopalakrishnan, Smitha Pramod V  
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**First Published September 2023**

**PUBLISHER**

**GEMS ARTS AND SCIENCE COLLEGE**

**An ISO 9001:2015 Certified Institution**

**(Affiliated to University of Calicut and UGC Recognized**

**Under Section 2(F) of UGC Act 1956)Registration No:**

**KI/2019/0242803(NGO-DARPAN) NITI AAYOG,**

**GOVERNMENT OF INDIA)**

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# Brief Biography

**Dr. B.G.Unni, (Balagopalan Unni) Ph.D**  
(Allahabad central University)  
FRES (London), FIANSc , FISAgBc, FICCE

Former Chief Scientist and Area Coordinator (Biotechnology & Biological Sciences) DADD and Fulbright Fellow retired from CSIR service in 2015 after 38 years of research career at CSIR North East Institute of Science & Technology Jorhat Assam. Appointed at Assam down town University as Director-Research in March 2015 and continued up to June 2019 and then re-designated as Adviser Research in August 2019). Back in Kerala, Dr.Unni is appointed as Director Academic & Research at GEMS College of Arts & Science affiliated to University of Calicut from August 2019. Both the positions are on honorary basis to strengthen the institutions in research areas. He did his BSc Biology (1972-74, Ewing Christian College, Alld University), MSc in Biochemistry(1974-76)(Second Rank) and Ph.D in Biochemistry from Allahabad University(1976-80) and PDF in Molecular Biology from Texas A&M University, USA(1988-91). Dr. Unni is specialized in Biochemistry, Molecular Biology, and Biotechnology and well established in his area of research and completed more than 40 years of research in both basic and applied fields of research. Dr.Unni got more than 130 research papers, 190 abstracts, 35 papers in proceedings, 7 patents, 1 technology. 18 chapters in books, edited 3 books and 29 students




  
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received PhD degrees under his guidance and supervision. Dr. Unni had completed more than 20 projects sponsored by Commonwealth Science Council, London, Ministry of Non conventional Energy Sources, Department of Non conventional Energy Sources Govt of India, North Eastern Council Govt of India, Department of Science & Technology, Department of Biotechnology, Central Silk Board, GB Pant Institute of Himalayan Environment and Development, CSIR and DRDO, Ministry of Defense, Govt of India during his scientific tenure at CSIR NEIST. Dr Unni received- Fulbright Travel Award/ Fellowship (USA) Dr. B.M. Das Memorial Science award, Hebrew University Award , H.R. Cama Memorial Travel Award, COSTED Travel Award, DAAD- fellowship-Germany, Well Mark International Scholarship (USA) & Technology award in life sciences by CSIR, Govt of India . Best Fulbright Alumni Chapter Leader-South Asia Selected by the United States Education Foundation In India ( USIEF), New Delhi .Nominated to represent India at the International Fulbright Scholars meet at Marrakech, Morocco- Nominated by United States Education Foundation In India, New Delhi . Dr. Unni is in the editorial board of more than eight indexed journal in the country .Dr.Unni was nominated to various state and central committees such as High power committee for development of sericulture activities Muga, Eri, Tassar and Mulberry in Assam nominated by Governor of Assam, .Expert in the area of non mulberry sericulture, Ministry of Textiles, Advisory Board, Post graduate Biotechnology programme, Academic Council, Assam Agricultural University, Research Council, Central Silk Board, Ministry of Textiles , DBT's Nominee for Biosafety Committee , Vice President SBC (India) Indian Institute of Science Bangalore, Vice President Indian Academy of Neuro-sciences, Member Fulbright Academy of Science & Technology, USA, Board of studies- Botany Nagaland University and Biotechnology Saugar University Madhya Pradesh., Fellow, Indian Academy of Neurosciences & Indian Society of Agricultural Biochemists, Fellow Royal Entomological Society, London UK and Scientific




  
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Advisor International Foundation of Science, Sweden, Member,  
Board of Studies Raiganj University ( 2017----), Member  
Research Review committee Tea Board of India (2016-2019),  
Member Advisory Committee Cancer Research Advisory  
Board, North East Cancer Hospital & Research Institute ( 2017-  
-) President, Tea Improvement Consortium, Ltd, Tocklai Assam  
( 2018-2020) .

Dr.Unni visited USA, Germany, Israel, Jordan, France,  
Morocco ,UK, Thailand ,Jordan, Singapore , China and UAE  
under various exchange program.



  
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## Preface

I am very happy to learn that, the GEMS Arts & Science College is bringing out a series of books written by the faculty in this academic year. The college is occupying a very important position among the colleges in Kerala, the same way the college is having unique standing in both academic and research fronts too. This is because of the excellent management, faculties and the best performances of the students.. I have full confident that in the course of time, and with the sincere commitment and dedication of the faculties , students and with management , the college will attain high level perfection and excellence and became a model college in the state of Kerala

This book entitled " Homo Scientia" had comprehensive research topics in various aspects in the topics of cyber security, biotechnology, microbiology and geology. A brief description about the cybersecurity, the protection of computer set up such as hardware, software data from several threats have been described in the chapter. The best practices for deploying and managing IPS network security tools have been explored. The integration of intrusion prevention system (IPS) solutions, adherence to security policies, regular updates, monitoring and the implementation of incident response procedures are considered to be the essential components of a comprehensive network security framework. The risk management in cyber security, various cyber-attack kinds, malware, and some strategies to tackle these attacks are also explained by the authors. A comprehensive overview of the evolution of computer graphics, exploring the advancements in hardware, software, algorithms, and techniques that have propelled the field from its early pixel-based beginnings to the current state of realism etc also described. Optical character recognition has been extensively investigated in the past few years, and has been proven that high recognition rates can be achieved in specific




  
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application scenarios using some standard and well-studied methods such as neural network, support vector machine (SVM), etc. The possibility of learning an appropriate set of features for designing optical character recognition (OCR) has been investigated

Biotechnology is an interdisciplinary science using modern technologies to construct biological processes in research, agriculture, formulation of pharmaceutical products and other related fields. The better understanding of advances in plant genetic resources, genome modifications, omics technologies to generate new solutions for food security under changing environmental scenarios etc have been discussed in this chapter. The increasing demand for food had a great impact on the agriculture sector to address the various challenges associated with crop productivity. The tremendous advancement in plant research helps in understanding plant biology for sustainable food security, functional ecosystems, crop improvement and human health. One of the sustainable farming techniques is the use of fertilizer at nano level. Nanomaterials that enhance plant nutrition could be considered as an alternative to the conventional chemical fertilizers. one chapter covered the importance of nano fertilizer to enhance metabolic processes in plants and reviewed the concerns in developing nanotechnological methods in the future. Metabolomics has now emerged as a powerful tool for the comprehensive analysis of metabolites within biological systems. One of the chapters provides a review on metabolomics, encompassing its methodologies, applications, potential impact on personalized medicine, and discusses further the need for advancements in analytical technologies. The antifungal activity of mangroves, particularly *Rhizophora* species are one of the main sources for fungicidal compounds due to the presence of high concentration of phenols. The antifungal activity of *Rhizophora* species has been elucidated, and could be further utilized as biocontrol agents for fungal disease in agricultural crops. One of the chapters discussed the species identification and its impact on economical and ecological level in the species like Nutmeg, one of the important medicinal plants that had a greater attention, however, it was very difficult to differentiate the sexual identity



  
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in the seedling stages. But the protein content screening among the studied plantlets had differentiated the sexes in the species as explained by the author.

AI (Artificial Intelligence) or machine intelligence enables farmers to enhance the quality and ensure a quick go-to market strategy for crops, and adoption of these algorithms to improve food industries. Artificial intelligence (AI) has also the potential to revolutionize education, from personalized learning to assessment and grading. Additionally, AI-powered tools can provide greater accessibility to students with disabilities, while also enabling more engaging and interactive content. AI continues to develop and become more prevalent in education, towards responsible and equitable implementation. However the negative and positive part of the AI may also be looked into.

The chapters related to microbiological aspects have also been incorporated in this book. Carbapenem-resistant *A. baumannii* (CRAB), bacteria that cause multi-infections in humans and resistant to multiple drugs too. The study attempted to isolate and characterize the bacterial species from the clinical specimens using biochemical techniques. The enzyme, carbapenemase produced by the bacteria was isolated and determined by different assays. Another study identified the antibacterial, antioxidant and anticancer activities of *Ganoderma lucidum* by various chromatographic techniques. Anticancer activity was also assessed on HeLa cell lines using MTT assay and DPPH assay. In one of the chapters, the author discussed L-asparaginase, one of the widely exploited enzymes for the treatment of acute lymphoblastic leukemia (ALL). Also attempted to isolate and characterize the enzyme from soil samples collected from different locations at Kerala. The study indicated that soils can provide a rich source for L-asparaginase which has got ample application in pharmaceutical industries.

The studies on various geological aspects with respect to different geographical areas in Kerala soil has been included in the book. The vertical geochemical variation and elemental mobility of the lateritic terrain in the Makkaraparamba of Malappuram District, Kerala has been very well investigated. Under extremely oxidizing and leaching conditions, laterite



  
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soil transformed into a variety of rocks and further developed into stable secondary product in the existing humid tropical and subtropical environments. The hydrogeological conditions in Kumbala- Kaliyar river basin, Kasaragod district, Kerala was assessed by means of Vertical Electrical Sounding (VES). The digital spatial data output of the present study would be much helpful for planning and management of surface and sub-surface water resources of Kasaragod River basin in which the Kasaragod township is centrally located

The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education. Science & Technology is now dominates almost every field of our activities. In summary, The faculties ( Science stream) of GEMS Arts & Science college have made a n excellent attempt to bring about this book "Homo Scientia". covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts..I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts.

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**UNRAVELING  
THE SECRETS OF SEX  
DETERMINATION  
OF NUTMEG PLANTS:  
A COMPREHENSIVE STUDY ON  
THE MECHANISMS GOVERNING  
THE GENDER IDENTIFICATION**

**Ranjusha V P**  
Assistant Professor  
PG Department of General Biotechnology

**ABSTRACT**

It was claimed that the study of sexual identity in nutmeg seedlings would be a highly important and serious undertaking. As a result, we employed protein separation as a criterion in sex identification and it was successfully recognised. Various ways have been discovered, but they are not yet extensively utilised by the local farmers. The younger the industry gets, the more difficult it will be to identify genders in nutmeg. Protein studies will help to lessen these challenges with gender identification. The distinctions in morphology and protein between the two nutmeg genders are discussed in this article. The same-aged male and female nutmeg trees were used to harvest the plant samples. Shade drying was used to get rid of the phenol content in the leaf and bark samples that were collected. Each sample's protein content was calculated using a standardised procedure. Protein content can be determined mathematically and graphically. Male and female samples could be distinguished from one another and from one another's proteins using SDS PAGE. Through this research, we can also ascertain how proteins develop during their growth and which proteins are present at each step.

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## INTRODUCTION

The Banda Islands of Indonesia, also referred to as the Spice Islands, are the source of nutmeg. Nux Muscat, which translates as musky nut in Latin, is the origin of the word nutmeg. Other names include Jatiphala, *M. oramata*, nux moschata, nutmeg, nutmeg flower, flower seed, black cumin, nigella seed, small fennel flower, and black caraway. Any of the numerous tree species in the genus *Myristica* are known as nutmeg trees. For every 20 female grafts in the field, a male graft may be placed. The most significant commercially significant species of the evergreen tree, *Myristica* the Banda Islands in Indonesia's Moluccas, often known as the Spice Islands. Nutmeg and mace, two spices made from the fruit, are key products of the nutmeg tree. Native to the Banda Islands in Indonesia, the common or fragrant nutmeg, *Myristica fragrance*, is also grown on Penang Island in Malaysia and in the Caribbean, particularly in Grenada. Kerala, a state in southern India, also has it growing there. Papuan nutmeg, *M. argentea* from New Guinea, and *M. malabarica* from India are two additional nutmeg species.

Nutmeg doesn't have any significant physiological or neurological effects at low dosages, but it can have psychedelic effects at high quantities. Nutmeg contains myristicin, a monoamine oxidase inhibitor and psychotropic compound, when it is freshly ground from whole nutmegs. Convulsions, palpitations, nausea, eventual dehydration, and generalised bodily discomfort may all occur from Myristicin poisoning. It is also said to have a potent deliriant effect. Nutmeg which is an economically valuable commercial product. The female plant has only the capacity for fruiting. During the seedling stage have 50 % chance to produce male tree. So this study will lead to great significance in nutmeg industry for their commercial production. The chemical components of the 50% nutmeg extract are unknown, however their concentration in the extract appears to be lower than in the nutmeg. However, early phytochemical tests were carried out in accordance with Jenkins et al.

In Unani medicine, *Myristica fragrans* Houtt (nutmeg) has been cited as being helpful in the treatment of male sexual dysfunction. In the current study, various animal models were

  
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used to assess the potential adverse effects and acute toxicity of a 50% ethanolic extract of nutmeg as well as its aphrodisiac properties. Since nutmeg can improve blood flow and stimulate the cardiovascular system, many people think it may help with heart issues. Additionally, it aids in digestion, relieves gas and stomach aches, as well as flatulence, vomiting, and diarrhoea. It also stimulates appetite. Additionally, nutmeg can aid with respiratory issues like a cold-related cough. It is frequently a component of cough syrups. Asthma is said to respond favourably to it. Nutmeg has a number of health advantages, however it should only be consumed in amounts no greater than the recommended minimum as it can be poisonous and lead to major health issues. Never eat more than 30 grammes (about 6 teaspoons) every day. Nutmeg is a food that is high in nutrients including calories, carbs, proteins, and dietary fibre. Vitamins A, C, and E are very abundant in it. Additionally, it contains minerals including calcium, copper, iron, magnesium, manganese, zinc, and phosphorus, as well as phytonutrients like carotene-B and crypo-xanthin B. The other abundant nutrients in nutmeg include moisture (14.3%), ether extract (36.4%), fibre (11.6%), volatile oil (6-16%), starch (4.6-24.24.2%), pentosans (2.25%), furtural (1.5%), and pectin (0.6%). Due to the volatile oil's taste and healing properties. The primary components of nutmeg oil are d-prinene and d-camphene, and it is a fluid that is mobile, colourless, and pale yellow. Commercial nutmeg bitter is made from the plant, and the highly aromatic fat is crushed and heated or steamed before pressing.

## METHODOLOGY

### Sample collection and Preparation

Nutmeg fresh plant samples were collected from the places Puzhakkattiri and Anakkayam in the district of Malappuram. The samples which are taken from the 10-year aged male and female nutmeg trees. Mature leaves, Inter leaves, Tender leaves, Bark of the tree was collected. Shade dries the samples about two to three weeks and fine powdered the samples. Stored under sterile condition.



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### Estimation of Protein

To determine the concentration of proteins by Lowry's method. BSA stock solution (1mg/ml), Analytical reagents: (a) 50 ml of 2% sodium carbonate mixed with 50 ml of 0.1 N NaOH solutions (0.4 gm in 100 ml distilled water.), (b) 10 ml of 1.56% copper sulphate solution mixed with 10 ml of 2.37% sodium potassium tartarate Solution. Prepare analytical reagents by mixing 2 ml of (b) with 100 ml of (a). Folin - Ciocalteu reagent solution (1N) Dilute commercial reagent (2N) with an equal volume of water on the day of use (2 ml of commercial reagent + 2 ml distilled water).


### Test Sample Preparation

1ml protein sample was mixed with 72%TCA, Vortex mix the sample for 10 minute at room temperature. Centrifuge at 3000 rpm for 30 minute, Taken the pellet and dissolved 2N NaOH. Keep it in water bath for 10 minute at 1000C.and back to room temperature, Make up the solution to 5 ml with distilled water. Add 1ml of freshly prepared complex reagent. Incubate at room temperature for 10 min. Add 0.1 ml folin reagent and mix well, incubate 30-60 min at room temperature.

### SDS PAGE

Put the glass plate together as the manufacturer instructed. As previously said, make the separating gel solution. Add APS and TEMED last, and carefully stir to prevent bubble formation (Dissolving gel). With a pipette, distribute the gel solution across the glass plates, leaving roughly 1/4 of the space empty for the stacking gel. Resolving gel should be carefully covered with water, and you should wait for it to polymerize (30 minutes). When polymerization is finished, a distinct boundary between the gel surface and the solution on top will be seen. Throw away the water Use double-distilled water to gently wash. Stacking gel solution should be pipetted carefully to prevent bubble formation (prepare as above; add APS and TEMED last). Put combs in. Give the gel at least 60 minutes to polymerize. Remove combs with caution. Place the gel into the electrophoresis tank, add fresh 1X Tris-glycine-SDS Buffer to the tank (bottom and top reservoirs), and make sure the gel wells are completely covered. The samples are prepared by grinding them in sample



  
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buffer, removing the supernatant, diluting it in accordance with the estimated protein concentration, and incubating them at 850°C for 3 minutes. Then, they are loaded. Set a suitable voltage of 200 v at 30 a. When the dye front hits the flowing gel, turn up the power. Use a shaker to stain the gel for about an hour. Destain the gel with a distaining solution after staining. Watch the bands.

## RESULTS

Experiment with an objective sex determination in nutmeg through protein separation done at Agricultural Research station, Anakayam.

The protein content of leaf and bark extracts were estimated and presented in Table 1.

Table 1. Estimated protein content

Plant Part Protein Content ,  $\mu\text{g} / \text{ml}$

Plant Part	protein Content , $\mu\text{g} / \text{ml}$	
	Male plant	Female plant
Tender leaf	950 $\mu\text{g} / \text{ml}$	772.7 $\mu\text{g} / \text{ml}$
Mature leaf	700 $\mu\text{g} / \text{ml}$	527 $\mu\text{g} / \text{ml}$
Inter leaf	1072.7 $\mu\text{g} / \text{ml}$	750 $\mu\text{g} / \text{ml}$
Bark	776.4 $\mu\text{g} / \text{ml}$	550 $\mu\text{g} / \text{ml}$

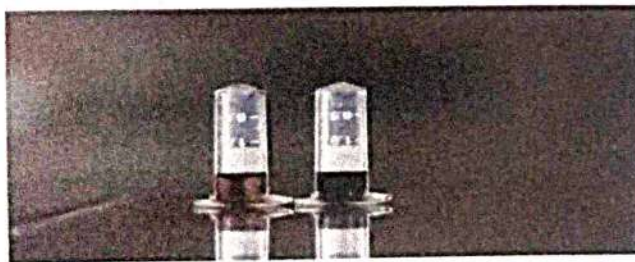


Fig. 1: Leaf extract nutmeg plant

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During the fifth stage of the test sample preparation there is a visible color difference present in the mature leaf extract of male and female nutmeg plant (Fig. 1) During the study a great significance has been observed in the test sample preparation. A clear color difference in male and female leaf extracts. When extracts kept for long time the intensity of colour will be increased.

According to crude protein estimated and each samples loaded into 12% SDS PAGE. In male and female leaf there is a uniform banding observed in 45,000 Da protein banding area based on 6500-200000Da protein marker (fig.3). The banding was more clearly visible in mature and interleaf's of male and female sample than bark and tender leafs. Based on this experiment can also been determined that there is a detailed banding difference in proteins during the maturation of leaf from the younger stage (fig 3)

The developmental study in male leaf based on banding in SDS PAGE four protein bands not developed in male tender leaf when compared to mature and inter leaf. In the case of female leaf there is a clear protein development form tender to mature leaf. (fig.2) In the study of mature leaf of male and female genders proteins could be clearly differentiated and the banding difference was noted (table 2) and (fig 1). The band difference was noted based on the protein marker and male and female plant difference were identified and also determined the protein difference during the growth of plant (table 2).

Table 2. Proteins which are separated from nutmeg plant sample

Molecular weights (da)	Male mature leaf	Female mature leaf	Male inter leaf	Female inter leaf	Male tender leaf	Female tender-leaf	Male bark	Female bark
200,000								
116,000								



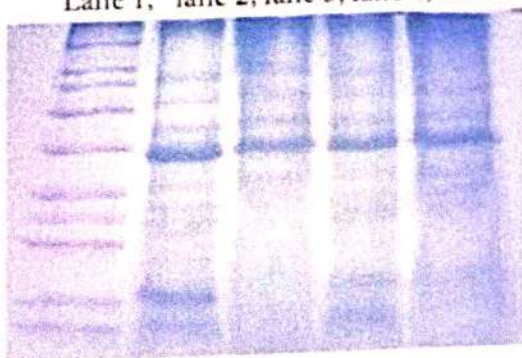
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97,000							*	*
66,000	*	*	*				*	*
53,000	*	*	*	*				
43,000	*	*	*	*	*	*	*	*
36,000	*	*	*	*				
29,000	*		*	*			*	*
24,000	*		*		*	*		
20,000	*		*		*			
14,200	*		*		*	*		
6,500								

\*indicating presence of protein bands in SDS PAGE

Protein separation of mature and intermediate leaf  
in both gender

Lane 1, lane 2, lane 3, lane 4, lane 5



- Lane 1 – protein marker
- Lane 2 – male mature leaf
- Lane 3 – female mature leaf
- Lane 4 – male inter leaf
- Lane 5 – female inter leaf

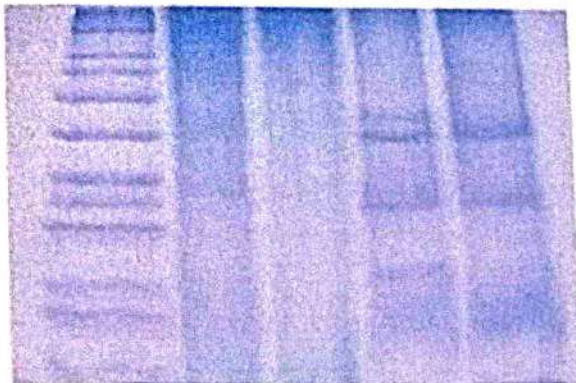


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## Protein separation in tender leafs

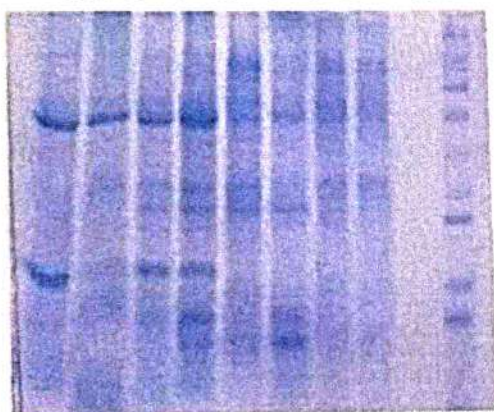
Lane 1, lane 2, lane 3, lane 4, lane 5



- Lane 1 – protein marker
- Lane 4 – male tender leaf
- Lane 5 – female tender leaf

**Fig. 3: Different samples from nutmeg**

1 2 3 4 5 6 7 8 M



- 1 - Male mature leaf
- 2 - Female mature leaf
- 3 - Male interleaf
- 4 - Female interleaf
- 5 - Male tender
- 6 - female tender leaf
- 7 - Male bark
- 8 - Female bark
- 9 - Marker protein

## CONCLUSION

Fragrant rich nutmeg is one of the highly prized spices known since antiquity for its aromatic, aphrodisiac, and curative properties. Since ancient times, nutmeg has been used as a remedy for various ailments or to improve health in general.




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Although the culinary value of this magical spice is well-known, its medicinal and therapeutic values are mostly unheard of. This reveal established that *Myristica fragrans* has a lot of food values and health benefits which can be harnessed by the rural populace as well as its numerous industrial applications in liqueurs, soap production and cosmetics. From identically aged male and female nutmeg trees, plant samples were taken. Shade drying was used to eliminate the phenol content of collected leaf and bark samples. Utilising a conventional technique, the protein content of each sample was calculated. A mathematical and graphical method can be used to determine protein content.

The difference between the male and female samples, as well as the differences in their proteins, could be clearly distinguished by SDS PAGE. This study allows us to identify the proteins present at each stage of their development and how they develop during their growth. Comparing genomic research, SDS PAGE was the most popular approach. Differential bands between several nutmeg samples can be precisely identified facilitated by protein separation. It was claimed that the study of sexual identity in nutmeg seedlings would be a highly important and serious undertaking. As a result, we employed protein separation as a criterion in sex identification and it was successfully recognised. Various ways have been discovered, but they are not yet extensively utilised by the local farmers. The younger the industry gets, the more difficult it will be to identify genders in Nutmeg. Protein studies will help to lessen these challenges with gender identification. The distinctions in morphology and protein between the two nutmeg genders are discussed in this article.



  
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