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DIVERSITY OF KERALA'S WILD EDIBLES AND INDIGENOUS CROPS

BRIC - Rajiv Gandhi Centre for Biotechnology (RGCB)
Thycaud, Poojappura, Trivandrum - 695014

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Guidance:

- **Prof. Chandrabhas Narayana**
  Director, RGCB, Thiruvananthapuram
- **Dr.Anish N P**
  Deputy Registrar, Project Coordinator
- **Dr. Manoj Kumar**
  Deputy General Manager, Project Coordinator
- **Dr. Archana S**
  Manager Veterinary Services, RGCB, Project Coordintor

Authors

- **Ms. Anu Theresa Antony**, Project Associate
- **Ms. Roshni S**, Project Associate
- **Ms. Mariya Mary Gigi**, Project Associate
- **Ms. Deepthi Mohan**, Project Associate

Photography

- **Mr. Rajesh K.T**, Project Assistant
- **Mr. Jishnu Janardhanan**, Project Assistant
- **Mr. Shyam Sankaran**, Project Assistant

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Forward

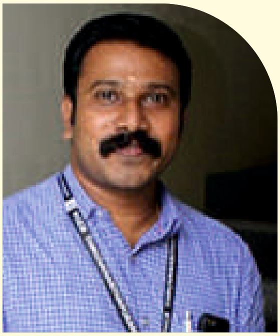
In the rapidly evolving landscape of global agriculture and biodiversity, the intricate relationship between traditional knowledge and conservation has never been more critical. This publication serves as a compelling record of the cultural and ecological significance of wild edibles and indigenous crops within the diverse ecosystems of Kerala. I am truly impressed by the depth and breadth of research captured in this work.

The pages ahead unravel the rich diversity of plant varieties that have sustained Kerala's tribal communities for generations, highlighting how these species not only nourish the body but also enrich the soul. Each chapter meticulously documents the multifaceted roles these plants play in local diets, cultural practices, and economic sustainability. The emphasis on sustainable harvesting practices presents a robust framework for maintaining both biodiversity and traditional livelihoods in the face of modern challenges, including climate change and urbanization.

Moreover, the meticulous attention to scientific methodologies employed in studying the genetic variation of species like Dioscorea and Cassava enhances the credibility and importance of this work. The integration of indigenous wisdom with contemporary conservation strategies presents an innovative roadmap for future research and action.

This booklet invites readers to appreciate and engage with the local flora that underpins Kerala's identity. It underscores the urgent necessity of conserving these biological resources while honoring the cultural practices that surround them. I encourage everyone—from policy-makers to educators, researchers, and the general public—to delve into this work and join the critical mission of preserving our planet's rich biodiversity for generations to come.

Prof. Chandrabhas Narayana
Director
BRIC-RGCB



Dr. Anish N P

Dr. Manoj P

Preface

The book "Diversity of Kerala's Wild Edibles and Indigenous Crops" highlights the critical role of biodiversity conservation, specifically focusing on various plant species integral to the cultural and nutritional landscape of Kerala's tribal communities. This book aims to bridge the gap between traditional knowledge and modern conservation efforts, illustrating how plants like Dioscorea, Taro, Cassava, Sweet Potatoes, and Bananas not only provide essential nutrition but also embody cultural heritage. Through meticulous documentation and exploration of these plant species, it emphasizes the necessity of preserving traditional practices, promoting sustainable harvesting, and maintaining genetic diversity.

The book underscores the urgency of protecting indigenous knowledge amidst globalization and the encroachment of modern agricultural practices. It advocates for a holistic approach that combines scientific research with local community involvement to enhance food security, nurture cultural identities, and contribute to the ecological health of the region.

By setting the tone for the chapters that follow, the book invites readers to appreciate the intricate relationship between native species and Kerala's tribal communities, fostering a deeper understanding of their significance in both ecological and cultural contexts.

Introduction

The conservation of wild edibles among the tribal communities of Kerala is both a cultural and ecological necessity. These plants are integral to the diets and culinary practices of these communities and embody traditional knowledge that has developed over generations. By preserving and promoting wild edibles, tribal groups uphold their heritage and identity while ensuring food security and nutrition. Maintaining biodiversity is critical, as these plants play a significant role in the overall ecological health of the region. Wild edibles are not merely sources of nutrition; they represent a deep-rooted cultural heritage. Their diversity reflects a dynamic interplay between humans and nature, supporting various wildlife species and promoting a balanced ecosystem essential for ecological stability. Conserving these species is crucial for maintaining genetic diversity, which enhances adaptability and resilience against climate change and environmental degradation. Protecting wild edibles also aids in the conservation of their habitats, preserving the myriad forms of life that rely on these ecosystems.

Amidst increasing globalization and modern agricultural practices, the risk of losing this invaluable knowledge and the plants themselves is alarming. In response, the Rajiv Gandhi Centre for Biotechnology (BRIC-RGCB) has conducted a comprehensive study on the diversity of native varieties utilized by tribal populations in Kerala, advocating for their conservation through community involvement. The RGCB's efforts represent a timely intervention to document and preserve the biodiversity of wild edibles. Using an integrated approach that includes personal interviews and group discussions, the RGCB team engaged with tribal communities to gather their indigenous knowledge about these plants. This initiative not only aims to collect valuable information but also fosters respect and collaboration between researchers and traditional knowledge holders. By identifying the botanical sources of wild edibles, the RGCB has laid the groundwork for a comprehensive conservation strategy to safeguard this biodiversity. Its interventions are crucial in promoting the conservation and sustainable use of these resources. In addition to traditional cultivation techniques, rigorous scientific analysis supports these conservation efforts. Detailed morphological studies of selected crops provide insights into their physical traits, while genetic analyses enhance our understanding of diversity within wild edible species. Nutritional assessments further highlight the health benefits these plants offer, reinforcing their significance for food security and nutrition in tribal societies. The collaboration between traditional ecological knowledge and scientific research exemplifies a holistic conservation approach, where indigenous practices complement modern methodologies. The RGCB has analyzed the nutritional and genetic profiles of various tubers and rice varieties and explored sustainable harvesting methods. Furthermore, the institute focuses on capacity-building programs that empower tribal communities by equipping them with the knowledge and skills needed to manage their natural resources sustainably. These efforts ensure that Kerala's rich biodiversity is preserved for future generations while supporting the livelihoods of local communities.

Community engagement is crucial to effective conservation strategies, highlighting the importance of involving tribal people in the process. By fostering partnerships and encouraging participation in decision-making, conservation efforts become more meaningful and impactful. Notably, the RGCB has collaborated with local bodies in Idukki, Wayanad, and Thiruvananthapuram districts to ensure that conservation initiatives align with community needs and sustainable development goals. A key aspect of this strategy is the establishment of dedicated conservation plots. Recognizing the need for effective preservation, the RGCB initiated the creation of three conservation plots with the active involvement of tribal communities. These plots function as living gene banks for wild edibles, allowing tribal farmers to cultivate traditional varieties using sustainable practices. This approach not only aims to restore and protect the genetic diversity of wild edibles but also supports the economic viability of tribal communities by providing access to native crops with potentially higher market value. Overall, this participatory approach empowers local communities while enhancing the resilience of their ecosystems.

The biodiversity conservation efforts undertaken by BRIC-RGCB focus on traditional agricultural practices, the documentation of native species, and the promotion of ethnic foods across selected districts in Kerala. Extensive field surveys of paddy farmers in Wayanad District documented 45 traditional paddy varieties, many of which have been neglected in cultivation due to challenges such as seed availability and gaps in processing technology. To address these issues, RGCB established a field gene bank covering 7.5 hectares, distributed seeds to farmers, and introduced a rubber-bushed huller at a community processing center, thereby enhancing both the quality of rice produced and the livelihoods of 35 tribal families. In addition to rice, RGCB has promoted traditional black pepper and wild edibles, establishing nurseries for their conservation and propagation, as well as documenting 26 traditional black pepper varieties.

In conclusion, the conservation of wild edibles among Kerala's tribal communities is vital for preserving cultural identity and ecological health. Initiatives by the RGCB, which integrate traditional knowledge with scientific research, not only protect biodiversity but also enhance local livelihoods through community engagement. Establishing conservation plots and field gene banks empowers tribal people to manage their resources sustainably, ensuring the survival of both plants and traditional practices. As we address challenges like globalization and climate change, these efforts underscore the importance of safeguarding wild edibles for future generations, fostering harmony between culture and nature.

Dioscorea diversity & its cultural significance:

OVERVIEW OF DIOSCOREA DIVERSITY

Kerala is renowned for its rich biodiversity and vibrant tribal communities. Dioscorea, commonly known as yams, plays a significant role in the agricultural and cultural landscape of the State. The diverse range of Dioscorea species cultivated in Kerala, such as various cultivars of Dioscorea alata, D. esculenta, D. bulbifera, D. pentaphilla etc, not only serve as essential dietary staples but also contribute to the socio-economic fabric and cultural identity of local populations. The cultivation and consumption of these tuberous plants are deeply intertwined with traditional agricultural practices, reflecting sustainable farming methods that have been passed down through generations.

Yams are highly valued for their nutritional content, rich in carbohydrates and dietary fiber, making them a primary energy source for many tribal communities. They are prepared in numerous culinary forms, including boiling and roasting, enriching the region's gastronomic diversity. Furthermore, Dioscorea species are prominent in local folklore and cultural rituals, symbolizing a strong connection between the tribes and their land. The planting and harvesting of yams often coincide with communal events and festivals, emphasizing cultural milestones and community solidarity.

Additionally, the folk taxonomy surrounding Dioscorea among Kerala's tribes reflects a wealth of traditional ecological knowledge, encompassing cultivation, harvest cycles, medicinal uses, and morphological identification. Such knowledge is crucial for preserving local biodiversity and promoting sustainable agricultural practices. The classification of yams is based on various attributes like color, size, and culinary uses, revealing the distinct preferences and practices across communities. However, the cultivation of Dioscorea faces challenges from land encroachment, modernization, and climate change, risking the erosion of traditional practices and biodiversity. Conservation initiatives that aim to preserve these traditional methods and the cultural heritage associated with Dioscorea are vital for ecological stability and the livelihoods of tribal populations.

Government and non-governmental organizations are increasingly supporting the marketing and promotion of Dioscorea products, which can enhance food security and uplift the economic conditions of communities. Furthermore, these species are recognized for their potential medicinal and nutritional properties, reinforcing the importance of their preservation not only for cultural significance but also for health benefits. The integration of traditional knowledge with modern conservation efforts provides a pathway toward sustainable agricultural practices that benefit both people and the environment. Overall, Dioscorea exemplifies the intersection of agricultural biodiversity, cultural heritage, and nutrition in Kerala, underscoring the need for conservation and community support.

CULTURAL IMPORTANCE OF DIOSCOREA IN TRIBAL COMMUNITIES

Dioscorea species, or yams, hold profound cultural significance among tribal communities in Kerala. These tubers are deeply embedded in social and cultural identities, featuring prominently in folklore, rituals, and traditional ceremonies as symbols of sustenance and connection to the land. Their cultivation and consumption are integral to community customs and practices, often highlighted during festivals where yams play a central role in traditional dishes.

The significance of Dioscorea extends beyond nutrition; the planting, harvesting, and preparation of yams embody the community's history, values, and collective identity. The diverse species are valued for their varied culinary uses and are incorporated into local diets, enhancing food security. The traditional ecological knowledge regarding these species also encompasses their medicinal properties, showcasing the rich heritage of tribal populations. This knowledge sustains nutritional needs and promotes biodiversity and sustainable agricultural practices within local areas.

Additionally, Dioscorea contributes to economic well-being, providing income through local markets while reinforcing cultural heritage. Thus, yams are vital not only as a food source but also as a symbol of identity for Kerala's tribal communities, ensuring the continuity of traditional practices and cultural expressions.

Yams are used in several tribal festivals and rituals. During harvest festivals like 'Onam' and 'Vishu', yams are featured prominently in traditional feasts like 'sadhya'. Some tribal communities offer yams to deities as part of rituals, symbolizing prosperity and gratitude. They also shared within the community during social gatherings, fostering a sense of unity.

The tribes in Kerala make a traditional dish known as "Thiruvathira puzhukku" during the festival of "Thiruvathira" in the Malayalam month of "Dhanu (december- january)."It is a healthy one-pot dish made with a mix of tubers and legumes. Dioscorea is used along with Elephant foot yam, Banana, Colocasia, Cassava, Sweet potato, Chinese potato, Chickpea, Cow pea and Horse gram for the preparation of this dish. Ettangadi" is the local term for all of the ingredients.

NUTRITIONAL SIGNIFICANCE OF DIOSCOREA

Dioscorea, or yams, holds substantial nutritional value, particularly in Kerala, where they serve as a dietary staple. Rich in carbohydrates, yams are a crucial energy source, significantly contributing to the caloric intake of communities that rely on them. They also provide essential vitamins and minerals, including vitamin C, B vitamins, and potassium, along with dietary fiber, which supports overall health and aids digestion.

The complex carbohydrates in yams offer a steady release of energy, making them an excellent choice for maintaining satiety and stabilizing blood sugar levels. Their culinary versatility—whether boiled, roasted, or included in traditional dishes and desserts—enhances their adaptability within local diets. Moreover, the nutritional profile of Dioscorea not only supports food security but also aligns with traditional medicine, as various species are believed to offer health benefits. Thus, Dioscorea is integral to both food value and the nutritional well-being of Kerala's communities.

The cultivars grown for food mainly from D. alata species. D. esculenta and D. bulbifera are the other domesticated varieties. The use of other species as food has declined rapidly in recent decades and these wild tubers are not in cultivation as well. The utilization of some Dioscorea spp. such as D. hispida and D. tomentosa has been hindered due to the presence of high fiber and bitter taste. But sometimes tribal people used these tubers after processing such as soaking, boiling and roasting.

DIOSCOREA LAND RACES	CARBOHYDRATE %	PROTEIN %	VIT C mg	CALCIUM mg/100g	POTTASSIUM mg/100g
D. wallichi(Kattu kizhangu)	18.36	2.39	BLQ	14.4	492.8
D. wallichi(Neduvan kizhangu)	14.14	4.61	BLQ	9.1	152.0
D.esculenta(Mullan kizhangu)	13.88	1.62	BLQ	5.7	168.2
D.esculenta(Mukkizhangu)	14.61	2.5	BLQ	11.1	219.9
D.alata(Idukki)	20.07	2.85	BLQ	6.3	333.5
D.pentaphylla(Nooran kizhangu)	15.77	4.24	BLQ	2.6	261.1
(D.esculenta)Cheru kizhangu 1	24.65	1.94	BLQ	7.4	312.9
(D.esculenta)Cheru kizhangu 2	25.63	2.55	BLQ	17.1	465.6
Pal kizhangu	23.76	0.93	BLQ	9.5	541.0
(D.esculenta)Nanakizhangu	24.2	2.43	BLQ	22.7	413.2
Sweet potato	25.0	0.73	BLQ	21.9	306.5
Enji kachil(D. alata)	27.3	0.87	BLQ	3.8	271.5
Arrow root	22.26	3.12	BLQ	12.8	516.3

TRADITIONAL ECOLOGICAL KNOWLEDGE & SUSTAINABLE PRACTICES

Traditional Ecological Knowledge (TEK) is fundamental to the cultivation of Dioscorea, particularly among the tribal communities of Kerala. These practices, rooted in generations of experience, demonstrate a profound understanding of local ecosystems. Farmers typically prepare the land with traditional tools—such as plows and hoes—which promotes soil aeration and health. They enhance soil fertility by incorporating organic matter, like compost and cow dung, creating a nutrient-rich environment for Dioscorea growth. Planting is carefully timed during the monsoon season to leverage natural rainfall. Additionally, tribal farmers often engage in intercropping, combining Dioscorea with crops like rice or pulses, optimizing land use while fostering improved soil health and biodiversity.

Weed management is achieved through manual weeding and mulching, thereby minimizing the reliance on chemical herbicides and promoting a healthier ecosystem. Pest and disease control combines traditional remedies and manual removal, reflecting a deep commitment to sustainability. Harvesting is done with meticulous care to avoid damaging the tubers, and post-harvest practices prioritize cool, dry storage to extend shelf life. These sustainable agriculture methods underscore a respect for nature and resilience against climate change, ensuring food security while preserving cultural heritage. Ultimately, these practices illustrate how traditional knowledge systems can inform modern sustainable agriculture, aiding in contemporary environmental challenges and supporting the livelihoods of local populations.

ROLE OF DIOSCOREA IN TRADITIONAL MEDICINE

Dioscorea species, hold significant importance in traditional medicine among Kerala's tribal communities. These tubers are valued for their various health benefits, including anti-inflammatory and diuretic properties. Due to their rich nutritional profile, yams enhance overall health and wellness. Tribal practitioners are knowledgeable about the medicinal uses of distinct Dioscorea varieties, integrating them into remedies for various ailments. Preparation methods, such as boiling, soaking, or roasting, are employed to enhance their therapeutic properties. This extensive traditional knowledge, passed down through generations, highlights the connection between Dioscorea, cultural heritage, and the surrounding natural environment, positioning these tubers as both a staple food and essential components of holistic health practices.

ECONOMIC IMPACT OF DIOSCOREA CULTIVATION

The cultivation of Dioscorea significantly impacts the economy of Kerala, particularly for tribal communities. It provides a stable income source, thereby enhancing livelihoods and contributing to poverty alleviation in rural areas. The growing demand for Dioscorea, owing to its nutritional benefits, opens new market opportunities for value-added products like fortified snacks and gluten-free options. Strengthening yam cultivation through cooperatives enhances community bargaining power and ensures fair prices for their produce. Sustainable agricultural practices associated with Dioscorea further contribute to long-term community resilience and food security. Research focused on developing disease-resistant and high-yield Dioscorea varieties can bolster productivity, while initiatives to preserve traditional cultivation methods sustain cultural heritage. Consequently, Dioscorea serves not only as a vital dietary staple but also as a pathway to economic empowerment in Kerala's agricultural landscape.

CONSERVATION NEEDS FOR DIOSCOREA DIVERSITY

Conservation of Dioscorea diversity is crucial for maintaining ecological balance and cultural heritage among Kerala's tribal communities. Essential conservation needs include documenting traditional agricultural practices and folk taxonomy related to Dioscorea species, as this knowledge is vital for sustaining biodiversity and preserving indigenous knowledge systems. Engaging local communities as stewards of the land promotes the sustainable management of Dioscorea crops. Conservation programs must address threats posed by land encroachment and modernization, which can lead to the erosion of traditional farming practices and varieties. Implementing conservation strategies will help protect the genetic diversity of Dioscorea species, ensuring resilience against climate change. Additionally, raising awareness about the ecological and economic importance of Dioscorea can garner broader support for conservation initiatives. Promoting sustainable agricultural practices that enhance soil health and biodiversity will contribute to the long-term viability of Dioscorea cultivation, benefiting both the environment and the communities that rely on these vital resources.

FOLK NOMENCLATURE & LOCAL CLASSIFICATION SYSTEMS

Tribal communities classify Dioscorea diversity in a culturally transmitted way of naming pattern, i.e. folk taxonomical identification. The folk nomenclature and local classification systems of Dioscorea among Kerala's tribal communities reflect a sophisticated comprehension of biodiversity, deeply rooted in cultural practices and ecological knowledge. The numerous names for Dioscorea varieties within folk taxonomy reflect the large genetic diversity of Dioscorea Understanding this system of classification is important not only due to its ethno-botanical implications but also because the skills with which tribals recognize and manage the species diversity.

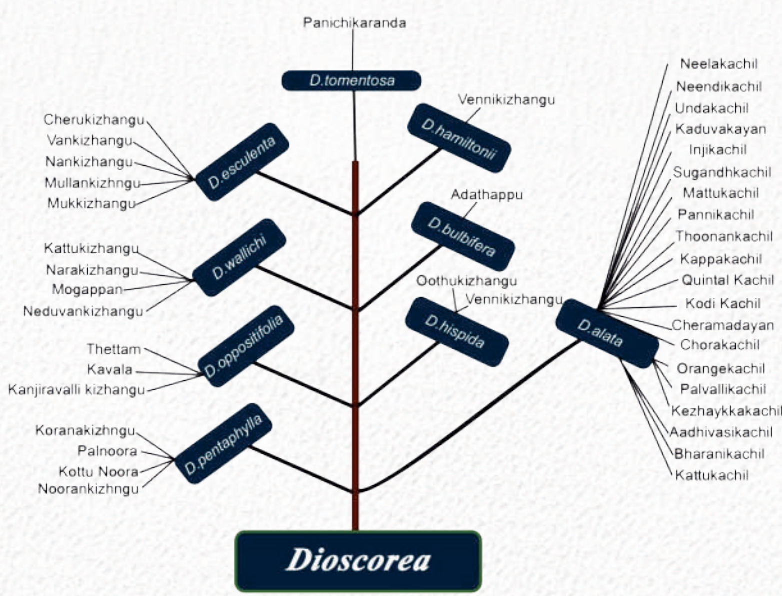
The underlying assumption that folk taxonomy represents is need to be scientifically studied. Because, by comparing morphological phenotypes with folk taxonomy of Dioscorea, it was observed that a lack of consistency in this taxonomy among the tribal communities in different districts. Varietal names were varied among regions, among communities, and even among families. In fact, they may underestimate or overestimate the actual Dioscorea diversity. Therefore comparing whether farmers coherently classify their own plant collections vis-a-vis actual genetic differences is necessary.

These systems categorize Dioscorea species based on attributes such as morphological characteristics (e.g., tuber color, size, shape, and texture) as well as culinary and medicinal properties. Some yams hold ceremonial importance, used in cultural rituals and festivals. The classification often considers seasonal availability, recognizing different species based on their growth cycles and market presence. This folk taxonomy is passed down through generations.

Sl. No.	Scientific name	Cultivar Local Names	District
1	*Dioscorea oppositifolia*	Thettam	Idukki
		Kavala	Tvpm
		Kanjiravalli kizhangu	Wayanad
2	*Dioscorea pentaphylla*	Nooran	Idukki, tvpm
		Kottu noora, paalnoora, korana kizhangu	wayanad
3	*Dioscortea wallichi*	Kaattu kizhangu	Idukki
		Naara kizhangu, mogappan	Wayanad
		Neduvan kizhangu	Tvpm
4	*Dioscorea bulbifera*	Adathappu	Idukki, wayanad, tvpm
5.	*Dioscorea esculenta* varieties	Cherukizhangu	Idukki, wayanad, tvpm
		Van kizangu	Idukki , wayanad
		Nana kizhangu	Idukki, wayanad, tvpm
		Mullan kizhangu	Idukki
		Mukkizhangu	Wayanad, tvpm

6	*Dioscorea hispida*	Venni kizhangu	Idukki
		Oothu kizhangu	Tvpm
7	*Dioscorea tomentosa*	Chavan kizhangu	Idukki
		Panichikaranda	Wayanad
		Nooli	Tvpm
8	*Dioscorea hamiltonii*	Venni kizhangu	Wayanad
9	*Dioscorea alata*	Kachil	Idukki, wayanad, tvpm
10	*Dioscorea sps*	Mandhal	Idukki

VERNACULAR NAMES VS SCIENTIFIC COUNTER PARTS



CULTIVATION PRACTICES & HARVESTING

Dioscorea is propagated using tuber pieces. Yams are best planted during the pre-monsoon period which is known as ‘Kumbham’ (March–May) and harvested in malayalam month ‘Thulam’ (October- November). During the time of harvest some tubers are stored for next season planting. In the time of planting, cut tubers into pieces, each with at least one eye or bud. Allow the pieces to heal for 2–3 days before planting to prevent rotting. Planting is done in beds or in ridges or in mounts. During planting Maintain a spacing of 60–75 cm between plants and 75–90 cm between rows. Yams are ready for harvest 7–10 months after planting. Look for yellowing and drying of vines and leaves as a sign of maturity. Carefully dig out tubers to avoid damage.

GENOTYPING OF WILD DIOSCOREA SPECIES FROM TRIBAL REGIONS OF KERALA

The present study investigates the genetic diversity of wild Dioscorea species utilized by tribal communities in Kerala, India, using fluorescently labelled inter-simple sequence repeat (F-ISSR) markers. A total of 44 Dioscorea landraces from eight species were analyzed. Out of 38 ISSR primers screened, eight exhibited polymorphism. The genetic diversity parameters, including Nei's genetic distance and Shannon's information index, were evaluated using PopGene software. The study highlights the efficiency of ISSR markers in resolving taxonomic ambiguities, supporting conservation strategies, and contributing to breeding programs for genetic enhancement of Dioscorea species.

METHODOLOGY OF GENOTYPING: SAMPLE COLLECTION & DNA ISOLATION

Tender leaf samples of Dioscorea species were collected from tribal settlements in Wayanad, Idukki, and Thiruvananthapuram districts of Kerala. The genomic DNA was isolated using the modified CTAB method. DNA integrity and purity were assessed through 1% agarose gel electrophoresis and Nanodrop spectrophotometry (A260/A280 ratio of ~1.8).

PCR AMPLIFICATION USING FLUORESCENT ISSR MARKERS

A total of 38 ISSR primers were initially screened, of which eight polymorphic primers were selected for further analysis. The PCR reactions were performed using 6-FAM labeled primers in a 10 L reaction volume containing 100 ng of template DNA, PCR cycling conditions included an initial denaturation at 95 C for 5 min, followed by 35 cycles of denaturation at 95 C for 30 s, primer-specific annealing, extension at 72 C for 60 s, and a final extension at 72 C for 7 min.

FRAGMENT ANALYSIS & GENOTYPING

Fragment analysis was conducted using an Applied Biosystems 3730xl DNA analyzer with POP7 polymer. GeneMapper 6.0 software was used to analyze the fragment data, with binary scoring (1 = presence, 0 = absence) applied for genetic diversity analysis.

OBSERVATIONS: GENETIC DIVERSITY & POLYMORPHISM ANALYSIS

The analysis of 44 Dioscorea accessions revealed substantial genetic variability. The eight polymorphic primers generated a total of 36 polymorphic bands, with primer (GA)6CC exhibiting the highest polymorphism (six bands) and primer (CA)6AC yielding the lowest (two bands). The percentage of polymorphic loci varied from 26% to 99% across species. Dioscorea oppositifolia exhibited the highest genetic diversity (0.2892), while D. alata showed the highest percentage of polymorphism (99%).

SIGNIFICANCE OF ISSR MARKERS IN DIOSCOREA GENOTYPING

ISSR markers offer a high-resolution approach to assess genetic diversity. The use of fluorescent labeling enhances marker sensitivity, enabling more accurate detection of polymorphisms. Compared to conventional ISSR, fluorescent ISSR (F-ISSR) markers produce a higher number of bands and provide precise size discrimination. The findings of this study demonstrate that ISSR-assisted genotyping can effectively resolve folk taxonomic ambiguities, particularly in cases where the same landrace is known by different names among tribal communities.

PHYLOGENETIC RELATIONSHIPS & CLUSTER ANALYSIS

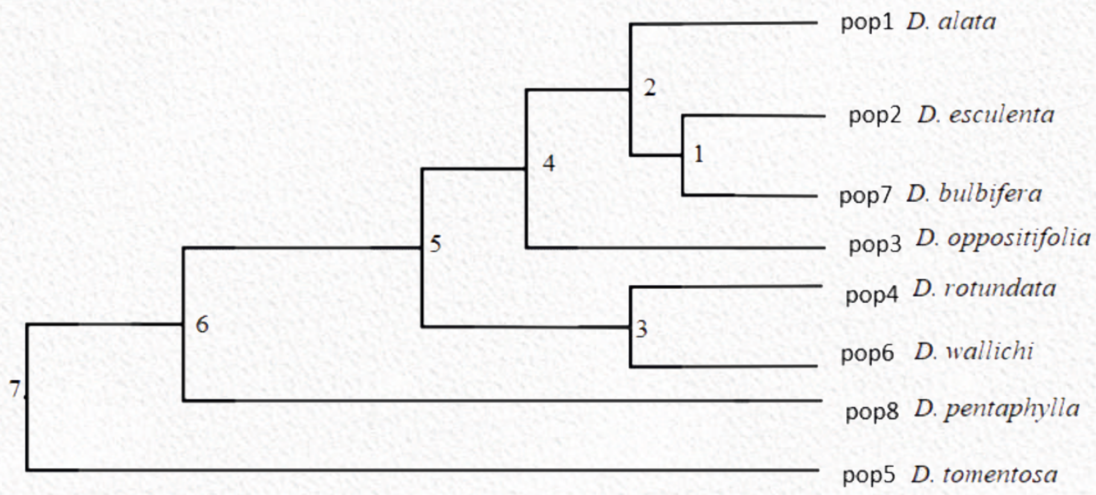
Nei's genetic distance analysis indicated the highest genetic divergence between D. tomentosa and D. rotundata (0.5379). UPGMA dendrogram clustering grouped D. oppositifolia and D. wallichi into one cluster, whereas D. esculenta and D. pentaphylla formed another. The exotic species D. rotundata was the most genetically distinct, forming a separate cluster. This clustering aligns with prior reports on Dioscorea genetic variability.

Sl No.	Population	N	Na	Ne	I	h	P%
1	*D. alata*	17	1.909	1.1286	0.4394	0.2686	99
2	*D. esculenta*	9	1.8571	1.4040	0.3914	0.1078	85.71
3	*D. bulbifera*	4	1.4286	1.1295	0.1688	0.2321	42.86
4	*D. oppositifolia*	4	1.8571	1.3022	0.3939	0.2892	84.57
5	*D. rotundata*	4	1.5223	1.3030	0.2592	0.1775	43.02
6	*D. wallichi*	3	1.2857	1.1223	0.1362	0.0856	28.57
7	*D. pentaphylla*	3	1.7143	1.4007	0.3989	0.2679	71.43
8	*D. tomentosa*	2	1.100	1.111	0.1262	0.0875	26.3

Table. Genetic diversity parameters of Dioscorea spp. were N – Sample size; Na – Observed number of alleles; Ne – Effective number of alleles; I – Shannon's information index; h – Gene diversity; P% - Percentage of polymorphic loci.

	D. alata	*D. esculenta*	*D. bulbifera*	*D. oppositifolia*	*D. rotundata*	*D. wallichi*	*D. pentaphylla*	*D. tomentosa*
D. alata	****	0.9604	0.9426	0.845	0.8087	0.8855	0.9501	0.6943
D. esculenta	0.0405	****	0.9259	0.9	0.7776	0.9705	0.9774	0.8057
D. bulbifera	0.0592	0.077	****	0.8086	0.8539	0.889	0.8781	0.6922
D. oppositifolia	0.1684	0.1053	0.2124	****	0.713	0.9395	0.8478	0.8639
D. rotundata	0.2123	0.2515	0.1579	0.3383	****	0.7394	0.6883	0.5839
D. wallichi	0.1216	0.0299	0.1176	0.0624	0.302	****	0.9145	0.8415
D. pentaphylla	0.0512	0.0229	0.13	0.1652	0.3736	0.0894	****	0.8042
D. tomentosa	0.3648	0.216	0.3679	0.1463	0.5379	0.1725	0.218	****

Table. Similarity and distance matrix expressed as Nei's coefficient among the eight genotypes of Dioscorea as revealed by eight ISSR primers

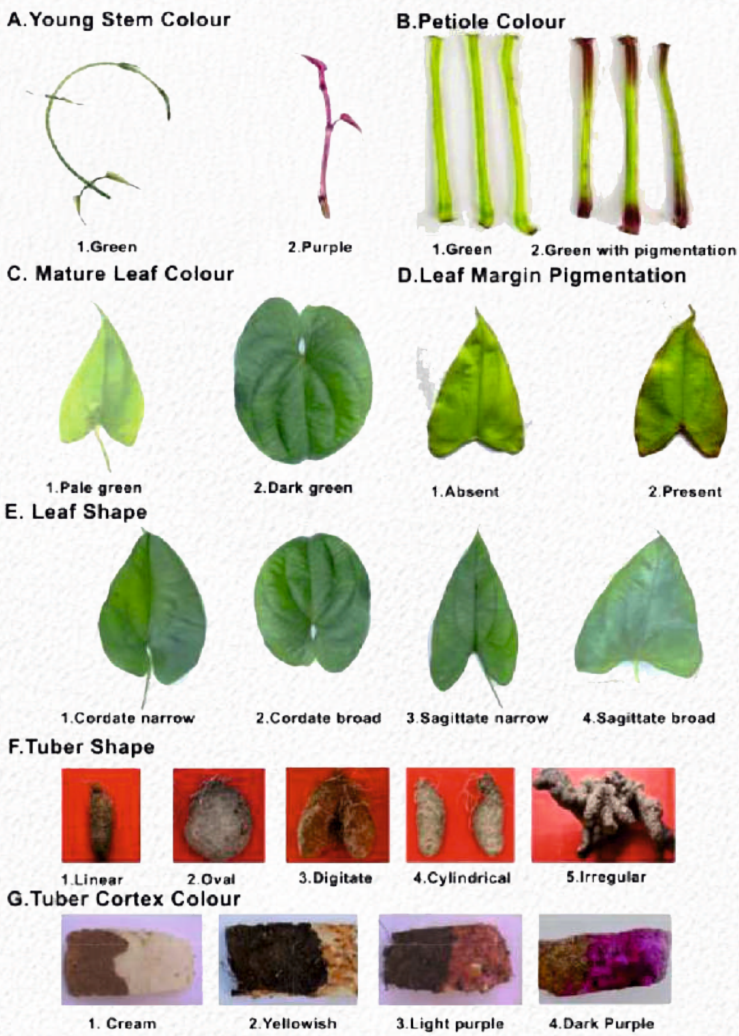


Dendrogram Based Nei's (1972) Genetic distance: Method = UPGMA --Modified from NEIGHBOR procedure of PHYLIP Version 3.5

IMPLICATIONS FOR CONSERVATION & BREEDING

Molecular marker-assisted studies play a pivotal role in conservation strategies for underutilized crops like Dioscorea. The genetic data generated can guide the selection of superior genotypes for breeding programs, ensuring the preservation of valuable genetic traits such as disease resistance and high nutritional content. Future studies integrating genome-wide markers and phenotypic trait analysis will further elucidate the adaptive potential of wild Dioscorea species.

This study underscores the utility of F-ISSR markers in characterizing the genetic diversity of wild Dioscorea species. The observed polymorphism and genetic clustering provide a framework for species conservation and crop improvement. The findings contribute to a deeper understanding of Dioscorea genetics, facilitating informed breeding decisions and the sustainable use of tribal plant genetic resources.

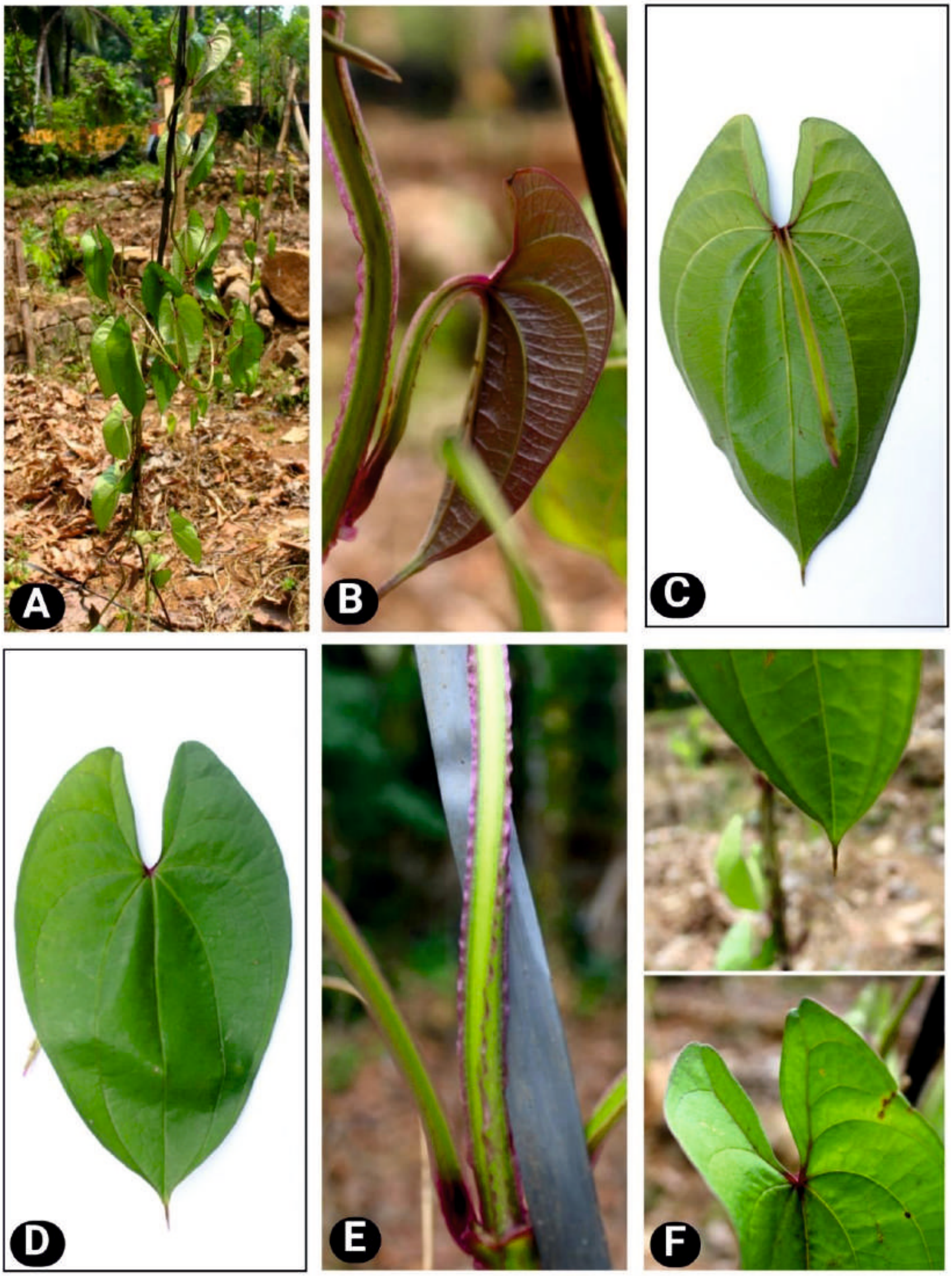


Morphological Parameters for Dioscorea Varieties: Protection of Plant Varieties and Farmer's Rights Authority (PPV & FRA) Government of India

CHORA KACHIL (*Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Purple
Young fully open leaf colour	Purple
Presence of wings	present
Colour of wings	Green with purple margin
Mature stem colour	Light green with purple wing
Direction of twining	Right
Petiole colour	Green with pigmentation
Petiole length (cm)	9 cm
Mature leaf colour	Dark green
Leaf shape	Cordate narrow
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping
Length of leaf	19 cm
Width of leaf	11 cm
Length of sinus	5 cm
Distance between leaflobes	3.5 cm
Leaf apex	Long tapering / caudate

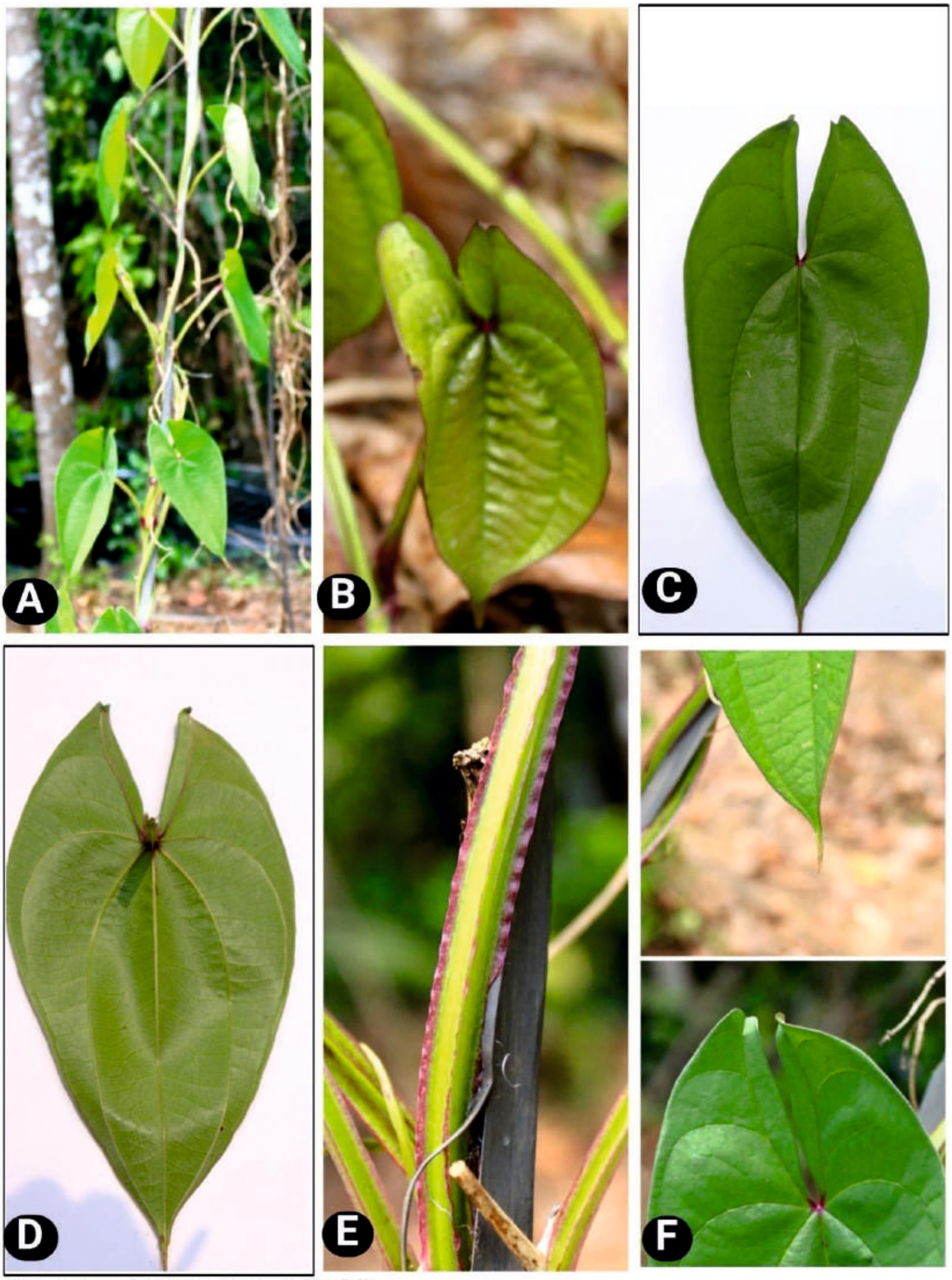


***Dioscorea alata* var. chorakachil**
A)Plant Habbit B) Young leaf C) Dorsal side of mature leaf
D) Ventral side of mature leaf E) Mature stem F) Leaf tip & Leaf base

ORANGE KACHIL (*Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Light brown
Presence of wings	Present
Colour of wings	Green with purple margin
Mature stem colour	Light green with purple wing
Direction of twining	Right
Petiole colour	Green with pigmentation
Petiole length (cm)	9 cm
Mature leaf colour	Dark green
Leaf shape	Sagittate narrow
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping
Length of leaf	18 cm
Width of leaf	9 cm
Length of sinus	5 cm
Distance between leaf lobes	2.5 cm
Leaf apex	Long tapering/caudate

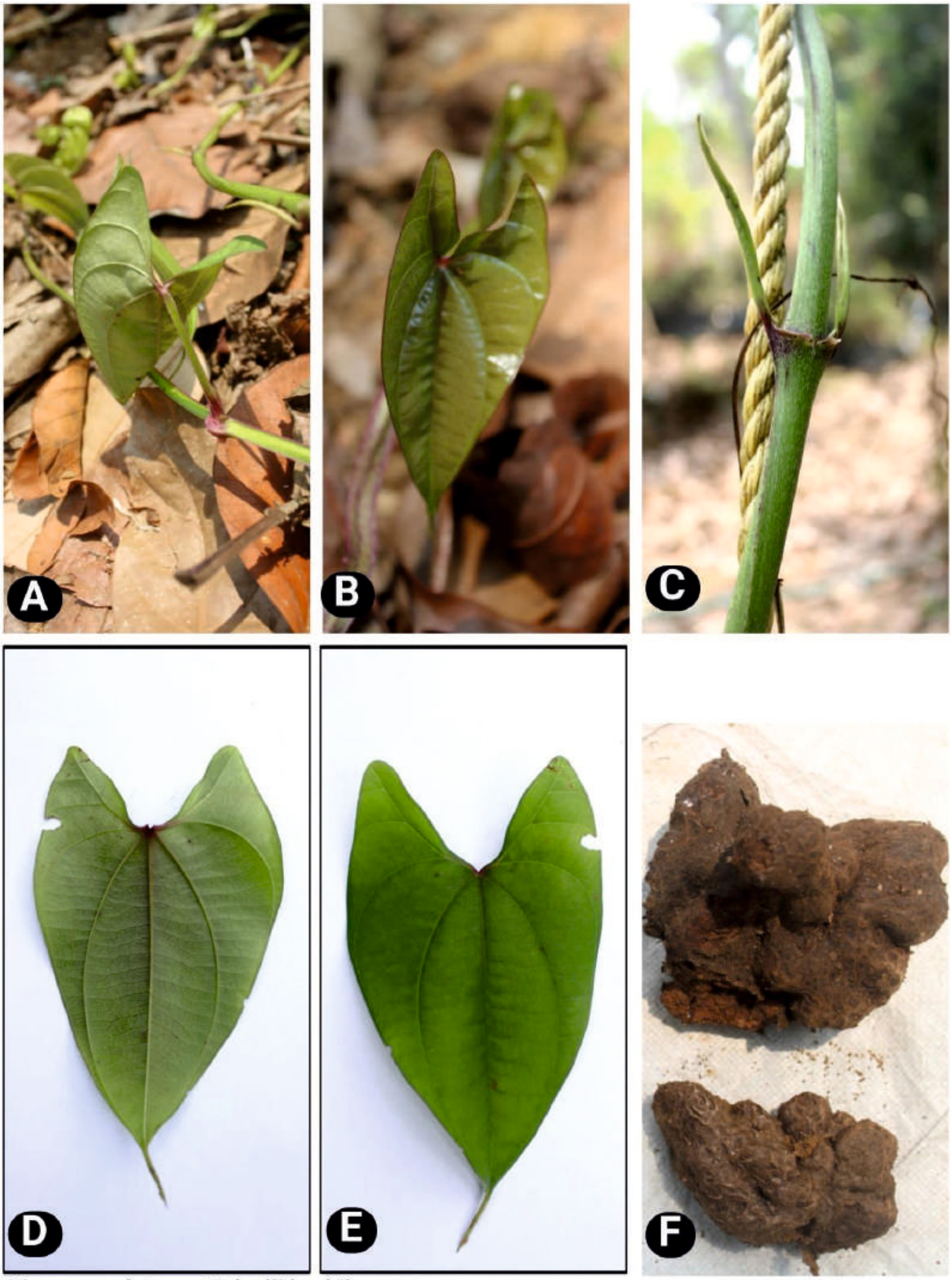


Dioscorea alata var. Orange kachil
A)Plant Habbit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Mature stem F) Leaf tip & Leaf base

PALVALLI KACHIL (*Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Light Green with purple wings
Young fully open leaf colour	Green
Presence of wings	Wings absent at maturity, round stem
Mature stem colour	Green
Direction of twining	Right
Leaf Petiole colour	Green with pigmentation
Leaf Petiole length (cm)	8 cm
Mature leaf colour	Dark green
Leaf shape	Sagittate broad
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping, broad sinus
Length of leaf	13 cm
Width of leaf	9 cm
Length of sinus	3 cm
Distance between leaf lobes	7 cm
Leaf apex	Long tapering/ caudate
Aerial tubers	Present
Aerial tuber cortex colour	yellow
Aerial tuber flesh colour	Cream



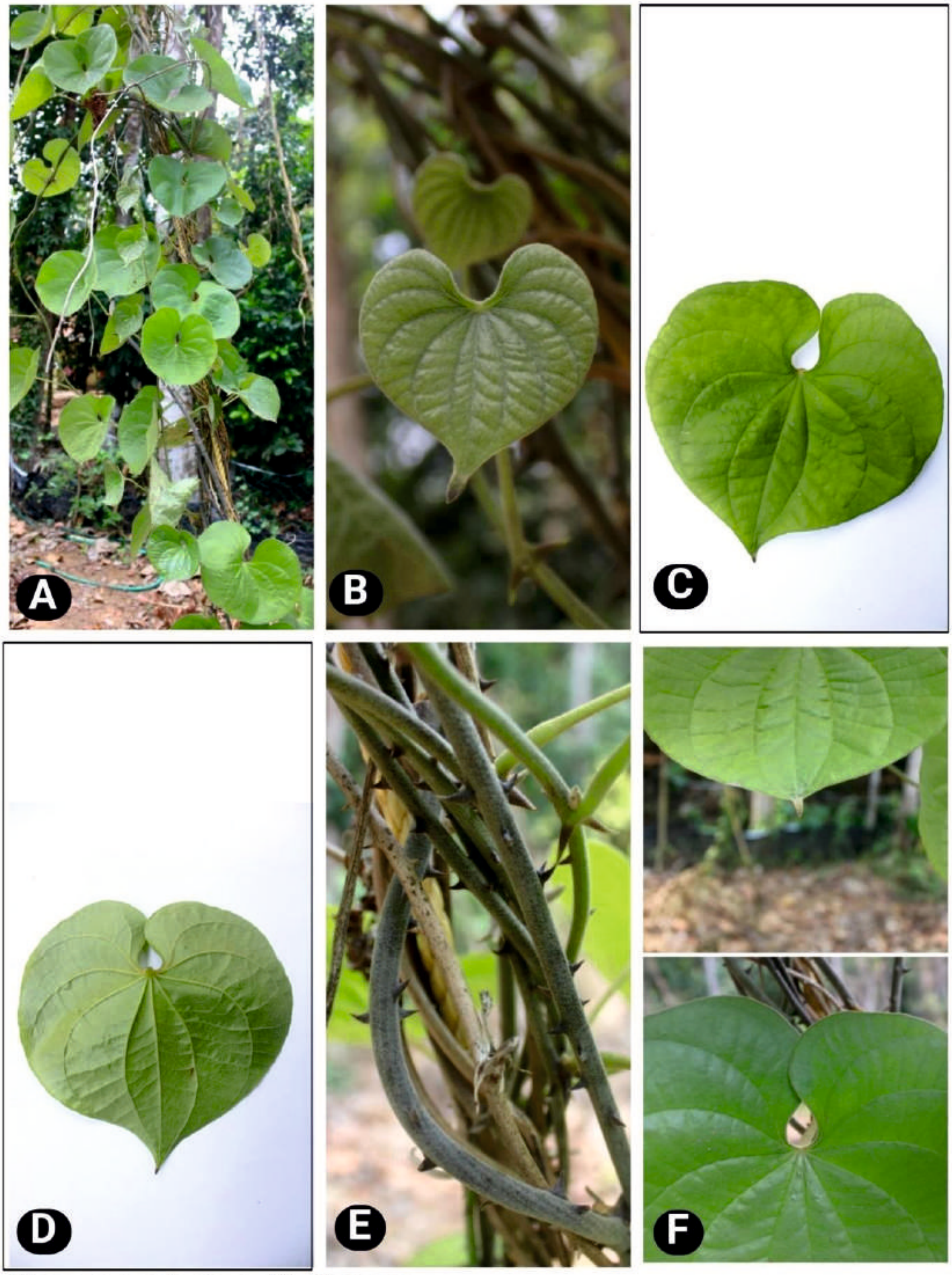
Dioscorea alata var. Palvalli kachil
A)Plant Habbit B) Young leaf C) Mature stem
D) Dorsal side of mature leaf E) Ventral side of mature leaf F) Aerial tubers

VAN KIZHANGU *(Dioscorea esculenta)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Green
Presence of wings	Absent, round stem
Mature stem colour	Brownish green with hairs
Direction of twining	Left
Petiole colour	Green
Petiole length (cm)	9 cm
Mature leaf colour	Green
Number of nerves on leaf	11
Leaf shape	Cordate broad
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Overlapping
Length of leaf	14 cm
Width of leaf	14 cm
Length of sinus	4 cm
Leaf apex	Pointed

Root and stem possess thorns for protection., small hairs present on both stem and leaf, large tuber



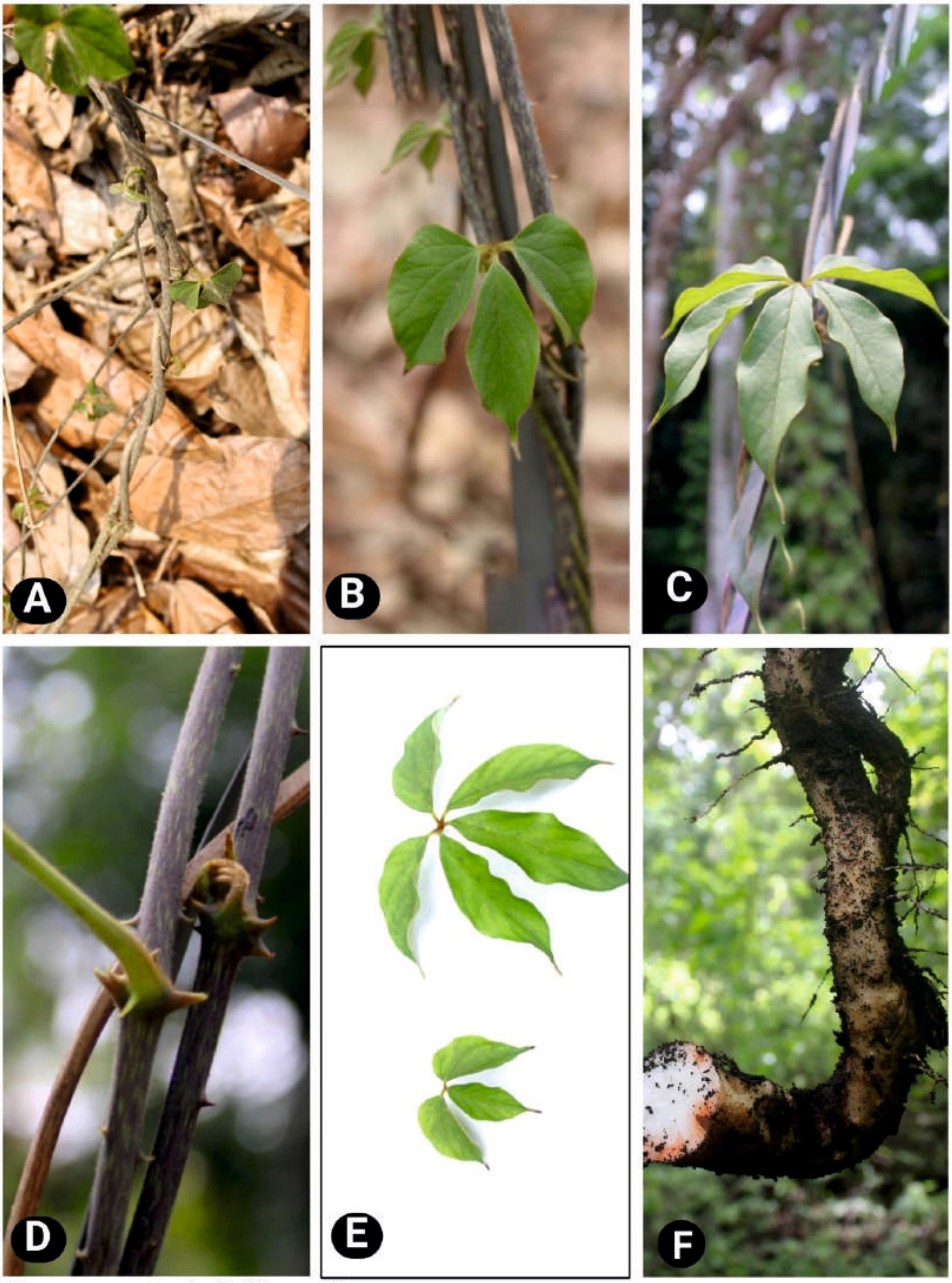
_Dioscorea escul_anta var. Vankizhangu
A)Plant Habbit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Mature stem F) Leaf tip & Leaf base

NOORAN *(Dioscorea pentaphylla)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green with black spots
Young fully open leaf colour	Green
Presence of wings	Wings absent, round stem
Mature stem colour	Dark brown coloured stem with green spots
Direction of twining	Left
Leaf Petiole colour	Green
Leaf Petiole length (cm)	6 cm
Mature leaf colour	Dark green
Number of leaflets	5 in mature leaf and 3 in young leaf
Shape of single leaflet	Obovate
Leaf margin pigmentation	Absent
Length of leaf	12 cm
Width of leaf	3cm
Leaf apex	Acuminate
Leaf base	Acute

Compound leaf, mature leaf 5 foliate and young leaf 3 foliate, white hairs present on leaf and stem, thorns present on stem, dark brown coloured stem with green spots.

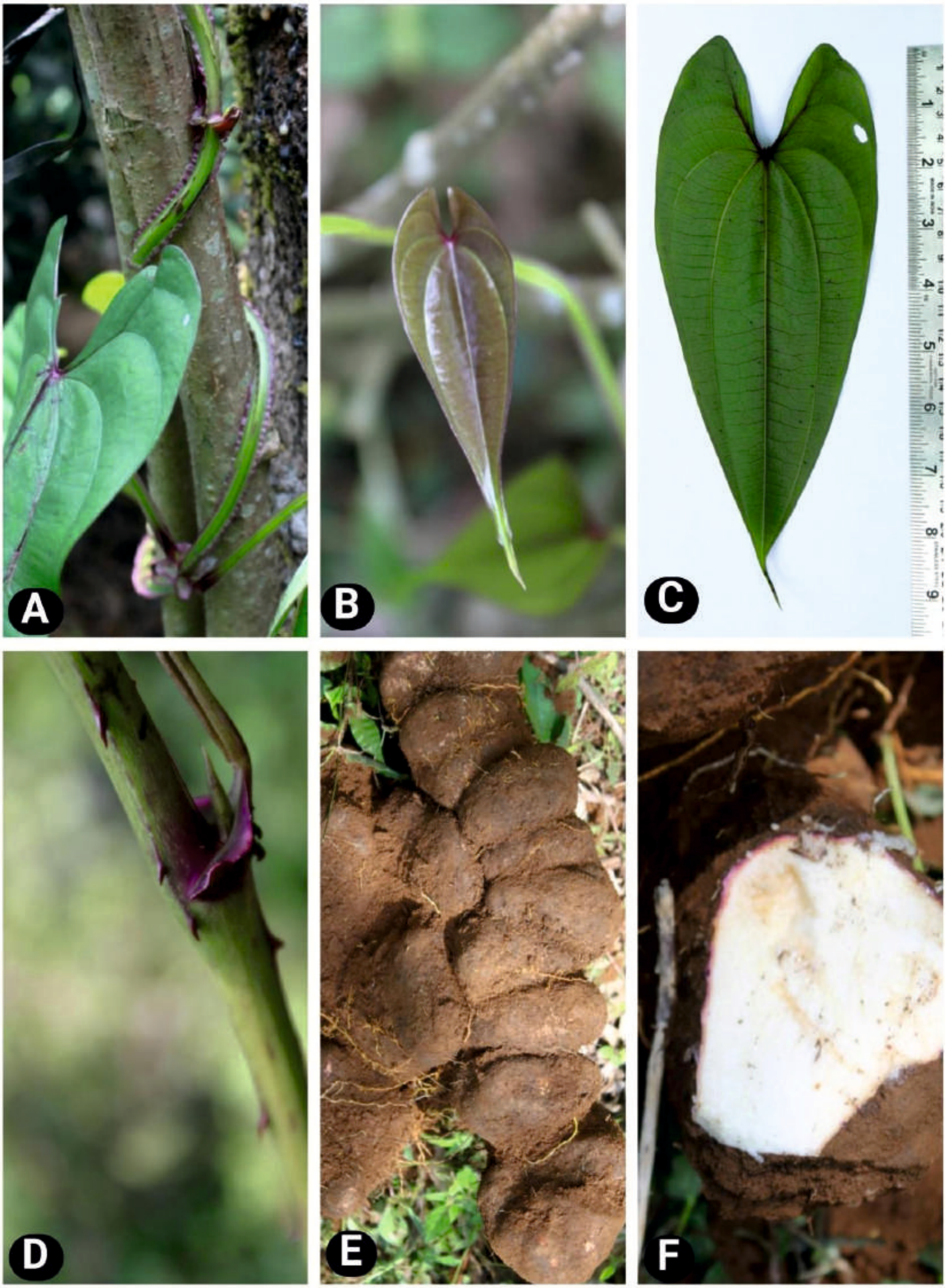


*Dioscorea penta*phylla (Nooran)
A)Plant Habbit B) Young leaf C) Mature leaf
D)Mature stem E) Ventral side of mature leaf F) Dorsal side of mature leaf

KADUVAKKAYYAN KACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Purple
Presence of wings	present
Colour of wings	Green with purple margin
Mature stem colour	Light green with purple wing
Direction of twining	Right
Petiole colour	Green with pigmentation
Petiole length (cm)	8 cm
Mature leaf colour	Dark green
Leaf shape	Sagittate narrow
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping
Length of leaf	25 cm
Width of leaf	10 cm
Length of sinus	6 cm
Presence of prickles	Present
Leaf apex	Long tapering / caudate
Tuber skin colour	Dark brown
Tuber cortex colour	Yellow
Tuber flesh colour	White
Shape of tuber	Irregular
Presence of hair on tuber	Sparse
Cross section of tuber	Amorphous

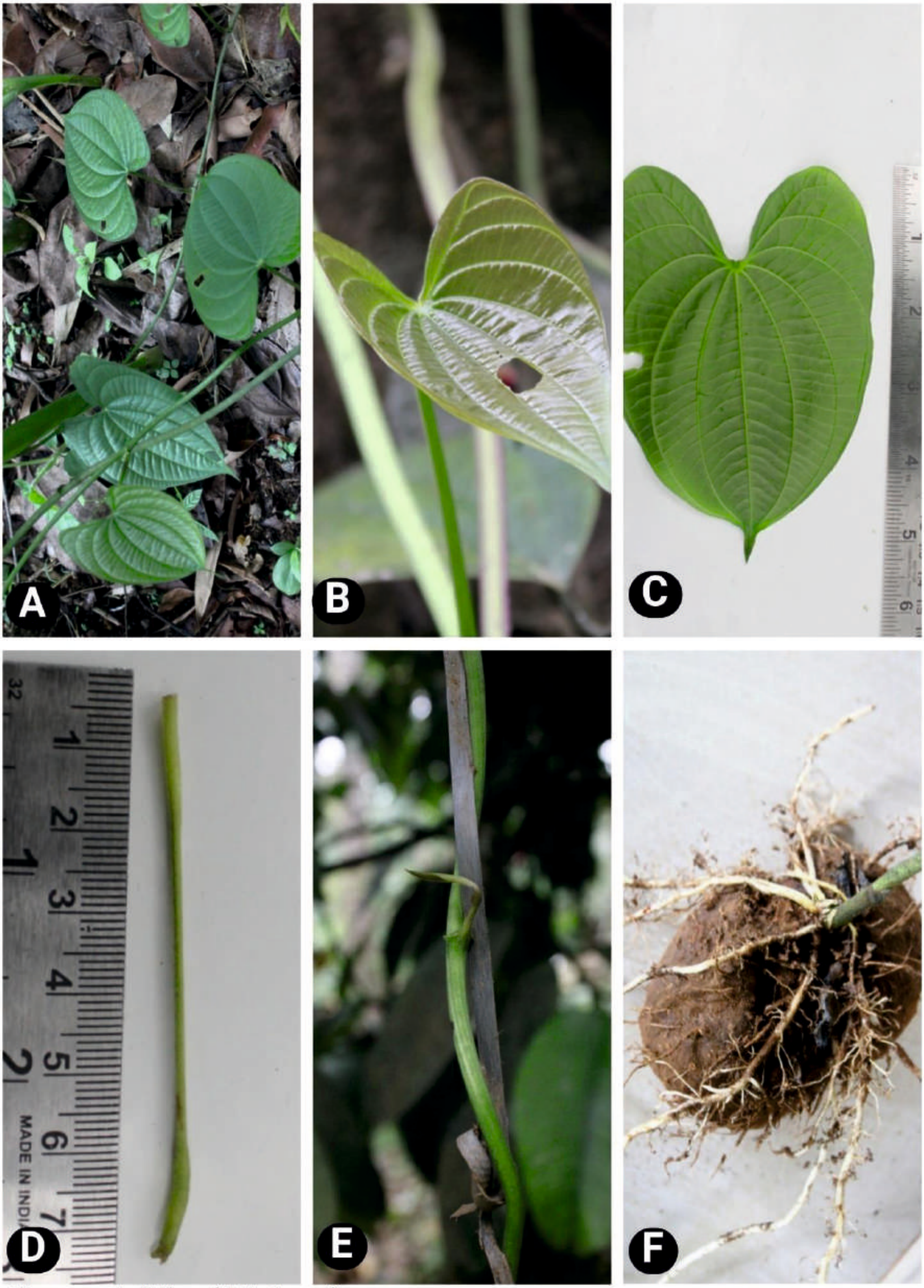


Dioscorea alata var. Kaduvakayyan
A)Plant Habbit B) Young leaf C) Dorsal side of mature leaf
D) Mature stem E) Tuber F) Cross section of tuber

ADATHAPPU *(Dioscorea bulbifera)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Purplish green
Presence of wings	Absent, Round stem
Presence of wings on petiole	Present
Mature stem colour	Green
Direction of twining	Left
Petiole colour	Green
Petiole length (cm)	6 cm
Mature leaf colour	Dark green
Leaf shape	Broadly ovate
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping
Length of leaf	12 cm
Width of leaf	9 cm
Length of sinus	3 cm
Presence of prickles	Absent
Leaf apex	Pointed
Tuber skin colour	Soil colour
Presence of hair on tuber	Sparse
Tuber flesh colour	White
Shape of tuber	Globose



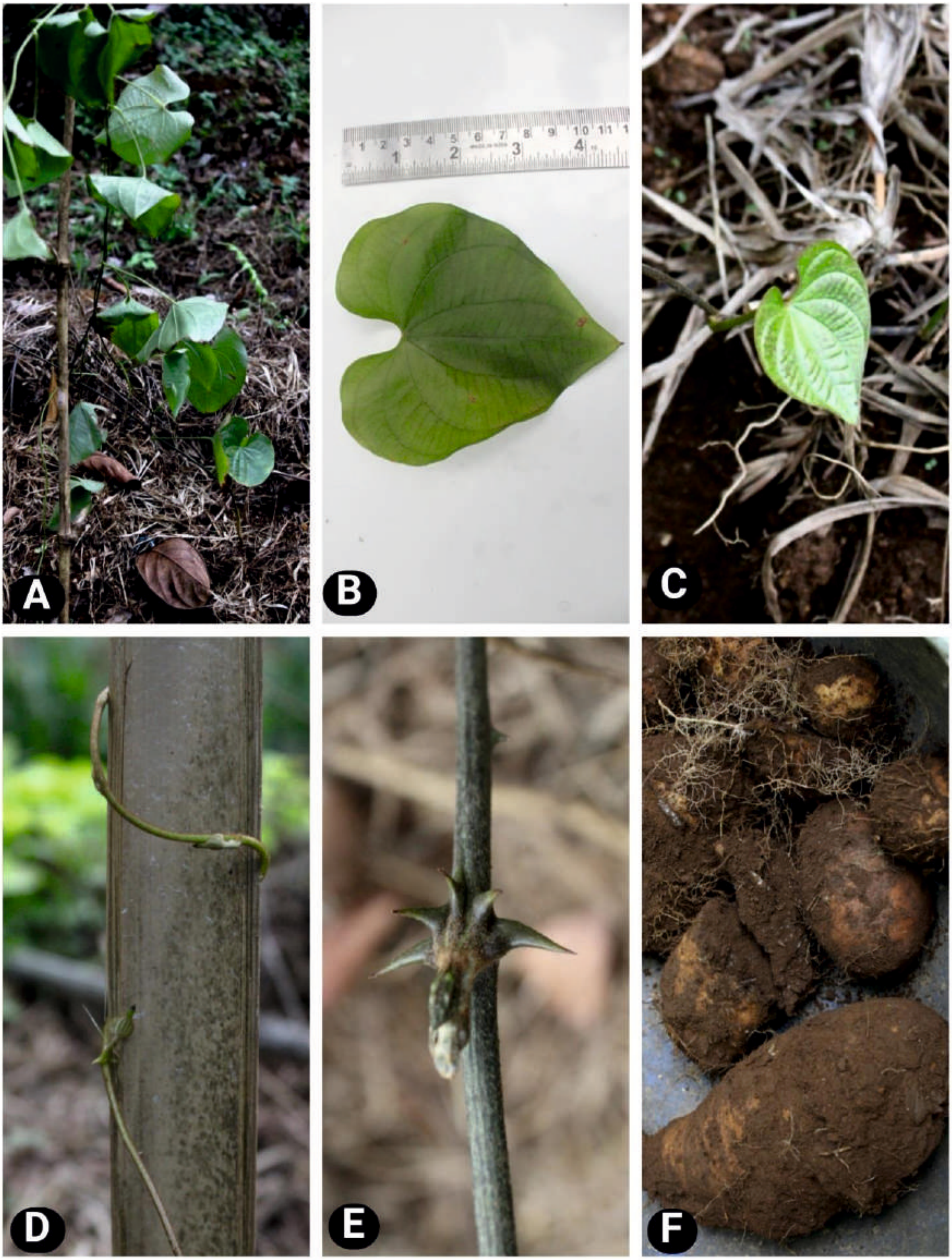
*Dioscorea bulbi*fera (Adathapp)
A)Plant Habit B) Young leaf C) Ventral side of mature leaf
D) Leaf petiole E) Spinning habit F) Tuber

MULLAN KIZHANGU *(Dioscorea esculenta)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Green
Presence of wings	Absent, round stem
Mature stem colour	Dark green
Direction of twining	Left
Petiole colour	Green
Petiole length (cm)	7 cm
Mature leaf colour	Green
Number of nerves on leaf	9
Leaf shape	Cordate
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non- Overlapping
Length of leaf	12 cm
Width of leaf	14 cm
Length of sinus	3 cm
Leaf apex	Pointed
Presence of prickles	Present
Shape of tuber	

Root and stem possess thorns for protection., small hairs present on stem, large tuber when compared with cherukizhangu.

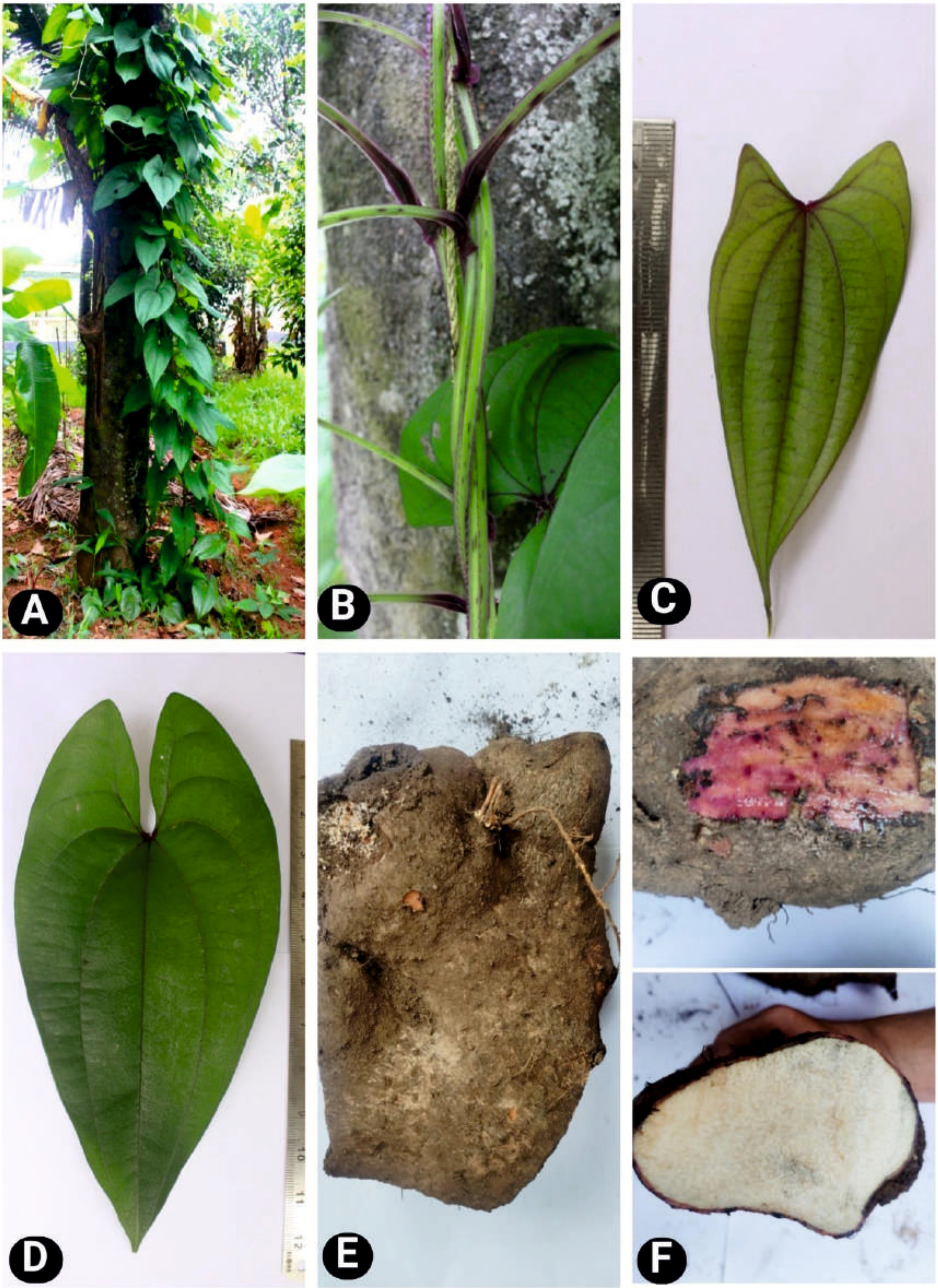


***Dioscorea alata* var. chorakachil**
A)Plant Habit B) Ventral side of mature leaf C) Young leaf
D) Spinning Habit E) Mature stem F) Tubers

NEELA KACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Purple
Young fully open leaf colour	Dark green
Presence of wings	present
Colour of wings	Green with purple margin
Mature stem colour	Light green with purple wing
Direction of twining	Right
Petiole colour	Green with pigmentation
Petiole length (cm)	15 cm
Mature leaf colour	Dark green
Leaf shape	Sagittate narrow
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping
Length of leaf	30 cm
Width of leaf	16 cm
Length of sinus	8 cm
Presence of prickles	Absent
Leaf apex	Long tapering / caudate
Tuber skin colour	Dark brown
Tuber cortex colour	Dark purple
Tuber flesh colour	Off White
Shape of tuber	Cylindrical
Presence of hair on tuber	Sparse
Cross section of tuber	Granular

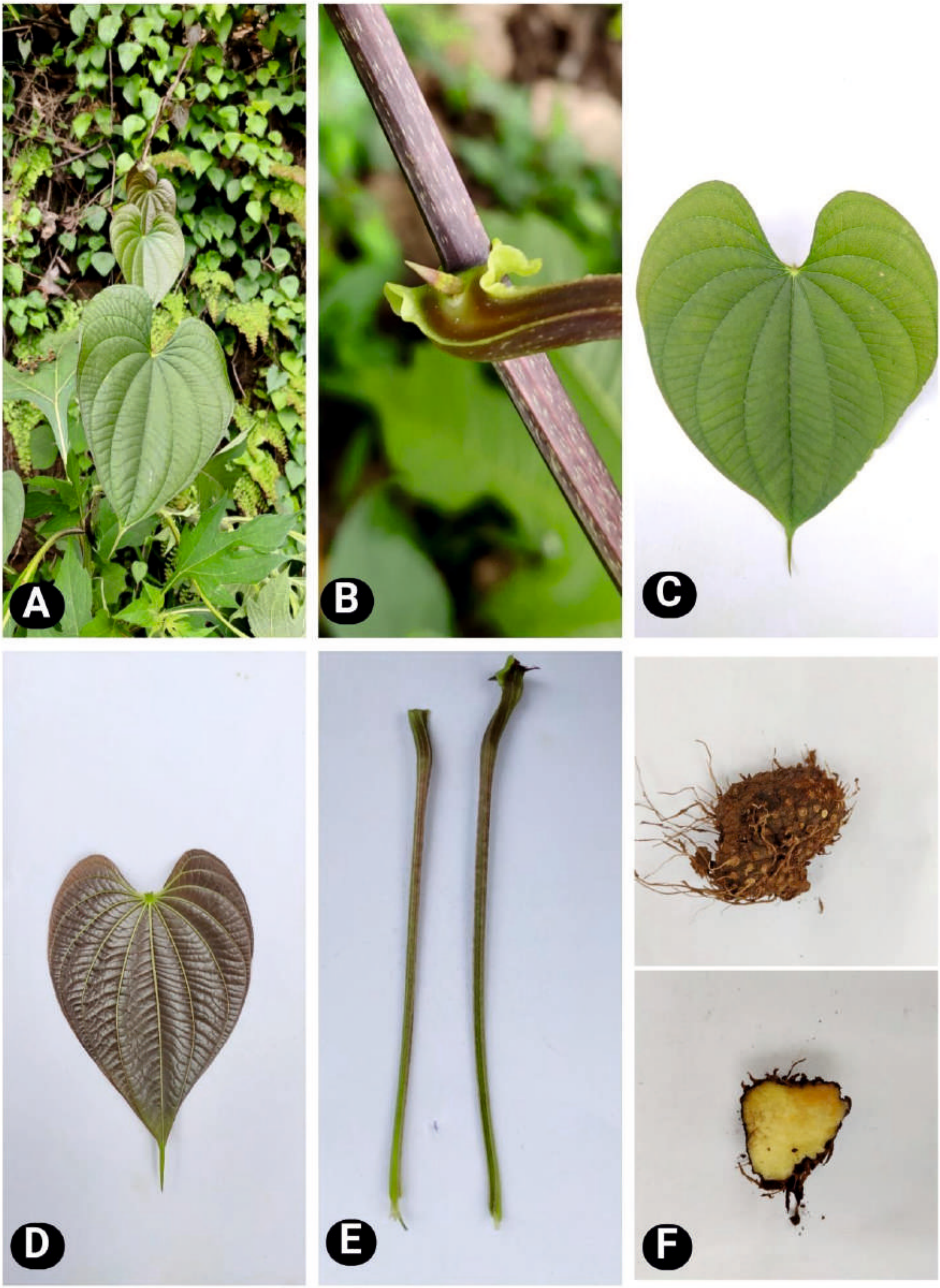


Dioscorea alata var. Neela kachil
A)Plant Habbit B) Spinning habbit C) Young leaf
D) Ventral side of mature leaf E) TuberF) Cortex colour & Cross section of tuber

KATTU ADATHAPPU *(Dioscorea bulbifera)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Light brown
Young fully open leaf colour	Brownish green
Presence of wings	Absent, round stem but wings present in the junction between petiole and main stem.
Presence of wings on petiole	Absent
Mature stem colour	Dark brown
Direction of twining	Left
Petiole colour	Brown
Petiole length (cm)	16 cm
Mature leaf colour	Dark green
Leaf shape	Broadly ovate
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping
Length of leaf	21 cm
Width of leaf	17 cm
Length of sinus	4 cm
Presence of prickles	Absent
Leaf apex	Pointed
Tuber skin colour	Soil colour
Presence of hair on tuber	Present, Sparse
Tuber flesh colour	Yellow
Shape of tuber	Globose

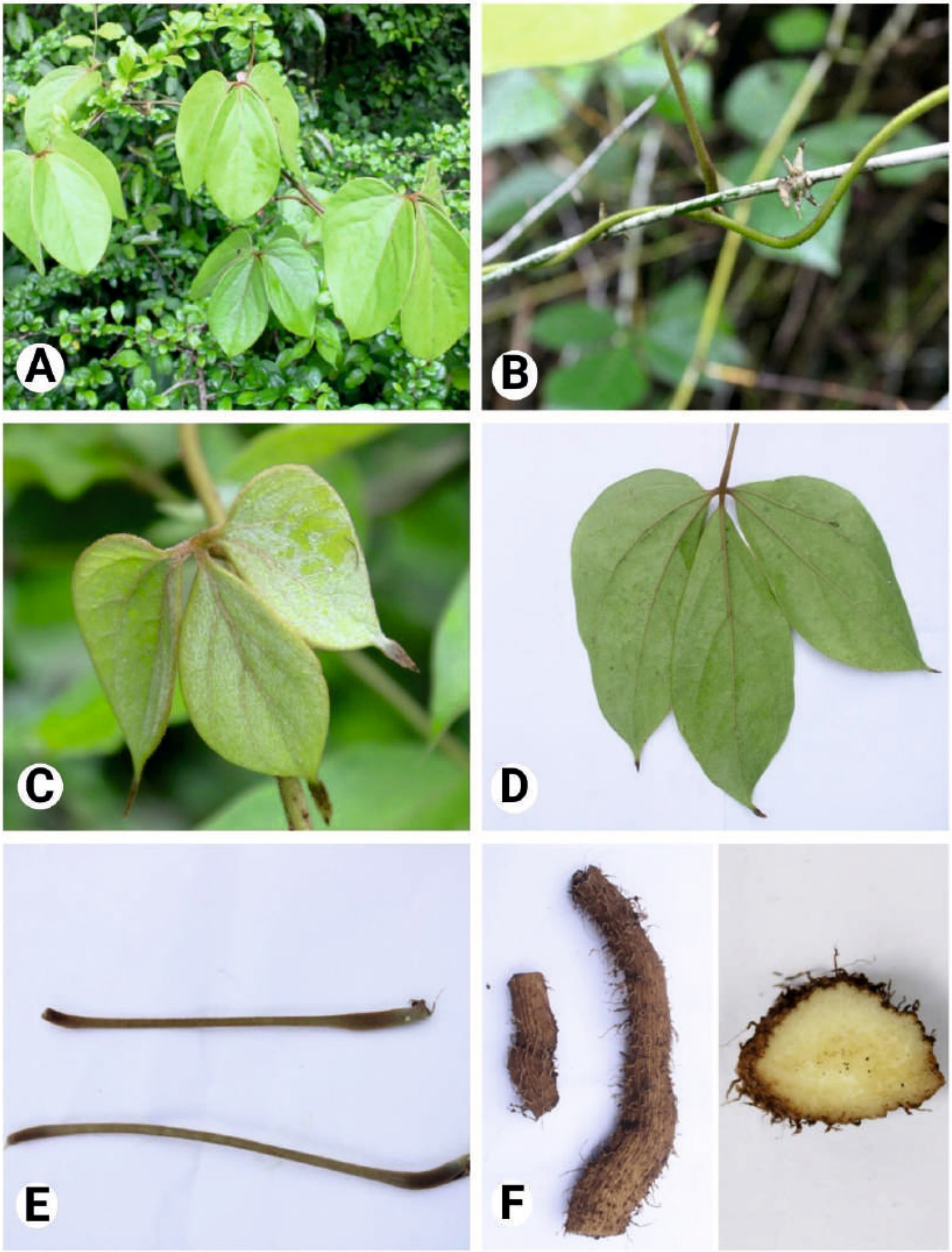


Dioscorea Bulbifera var. Kattu adathapp
A)Plant Habbit B) Wing C) Ventral side of mature leaf
D) young leaf E) Petiole F) Tuber & Cross section of tuber

CHAVAN KIZHANGU *(Dioscorea tomentosa)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Light brown
Young fully open leaf colour	Light green
Presence of wings	Absent, round stem
Leaf arrangement	Compound, 3 sub equal Leaflets
Mature stem colour	Brown, tomentose
Direction of twining	Left
Petiole colour	Green with pigmentation
Petiole length (cm)	14 cm
Mature leaf colour	Green, tomentose
Leaf shape	Broadly ovate
Leaf margin pigmentation	Absent
Leaf position	Alternate
Length of leaf	15 cm
Width of leaf	10 cm
Presence of bulbils	Absent
Presence of prickles	Present
Leaf apex	Acuminate, brown coloured
Tuber skin colour	Brown
Tuber cortex colour	cream
Tuber flesh colour	Cream
Shape of tuber	Elongated
Presence of hair on tuber	Sparse
Cross section of tuber	Amorphous



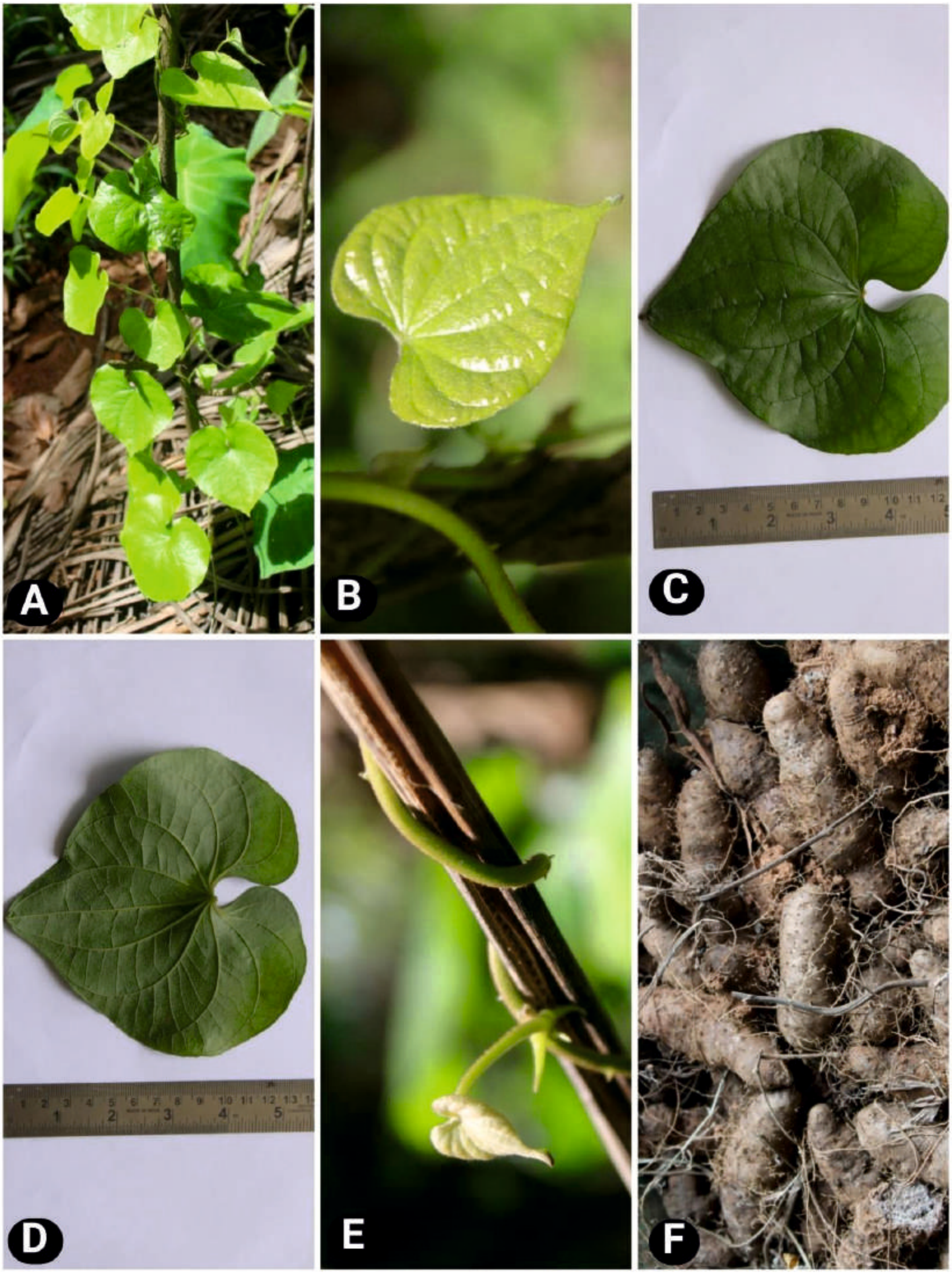
Dioscorea tomentosa (Chavan kizhang)
A)Plant habit B) Spinning Habit C) Young Leaf
D) Ventral side of mature leaf E) Leaf Petiole F) Tuber&cross section of tuber

CHERUKIZHANGU *(Dioscorea esculenta)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Green
Presence of wings	Absent, round stem
Mature stem colour	Brownish green with hairs
Direction of twining	Left
Petiole colour	Green, thorns present
Petiole length (cm)	8 cm
Mature leaf colour	Green
Number of nerves on leaf	12
Leaf shape	Cordate broad
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Overlapping
Length of leaf	13 cm
Width of leaf	13 cm
Length of sinus	4 cm
Leaf apex	Pointed
Tuber shape	cylindrical
Tuber flesh colour	White
Tuber cortex colour	White
Hairiness of tuber	sparse

stem possess thorns for protection., small hairs present on both stem and leaf

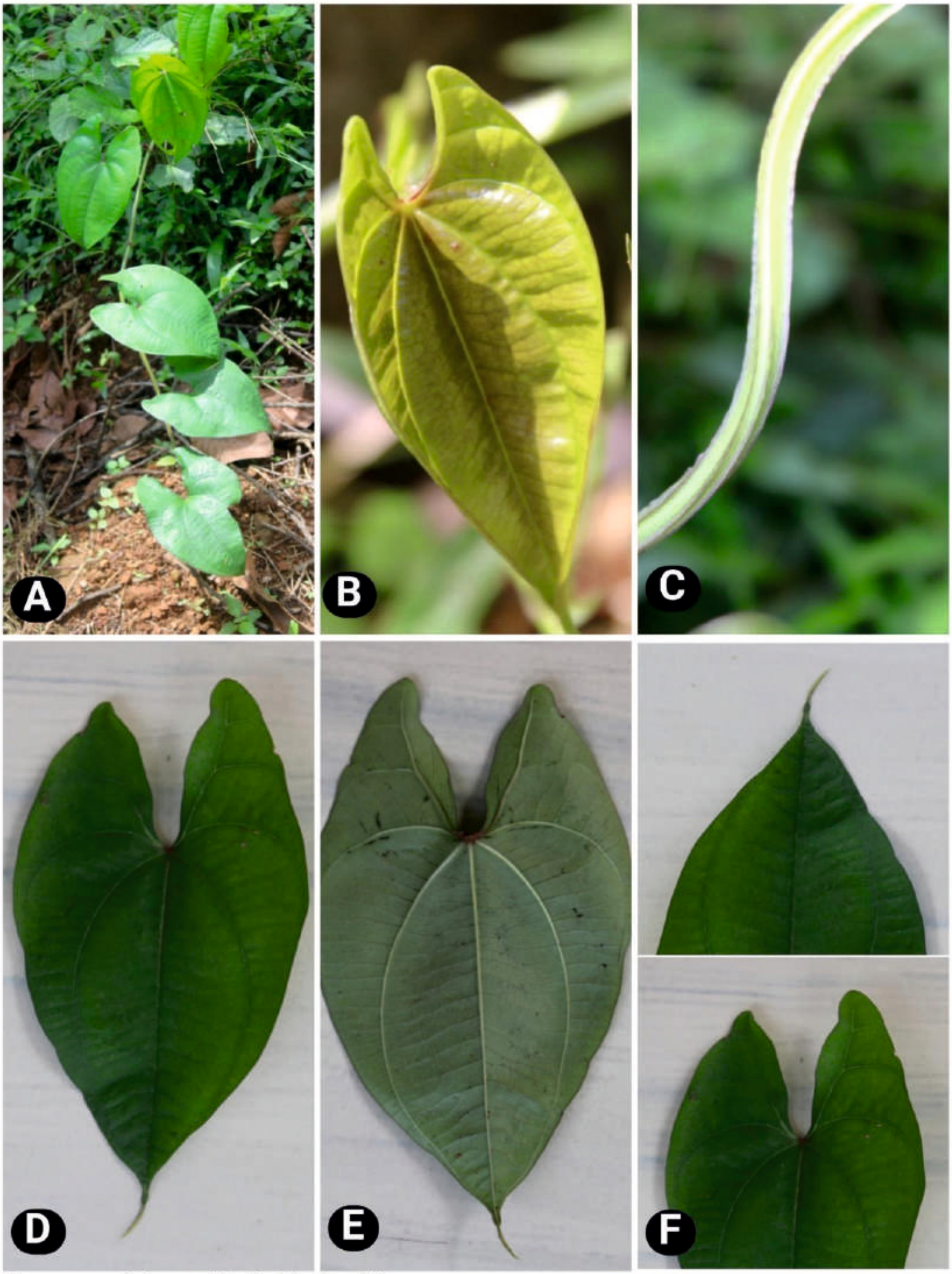


***Dioscorea esculenta* var. Cherukizhangu**
A)Plant Habit B) young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) spinning habit F) Tuber

KEZHAYKKA KACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Purple
Young fully open leaf colour	Brownish green
Presence of wings	present
Colour of wings	Green with purple margin
Mature stem colour	Light green with purple wing
Direction of twining	Right
Petiole colour	Green with pigmentation
Petiole length (cm)	8.5 cm
Mature leaf colour	Dark green
Leaf shape	Cordate narrow
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping
Length of leaf	20 cm
Width of leaf	12 cm
Length of sinus	6.5 cm
Presence of prickles	Absent
Leaf apex	caudate

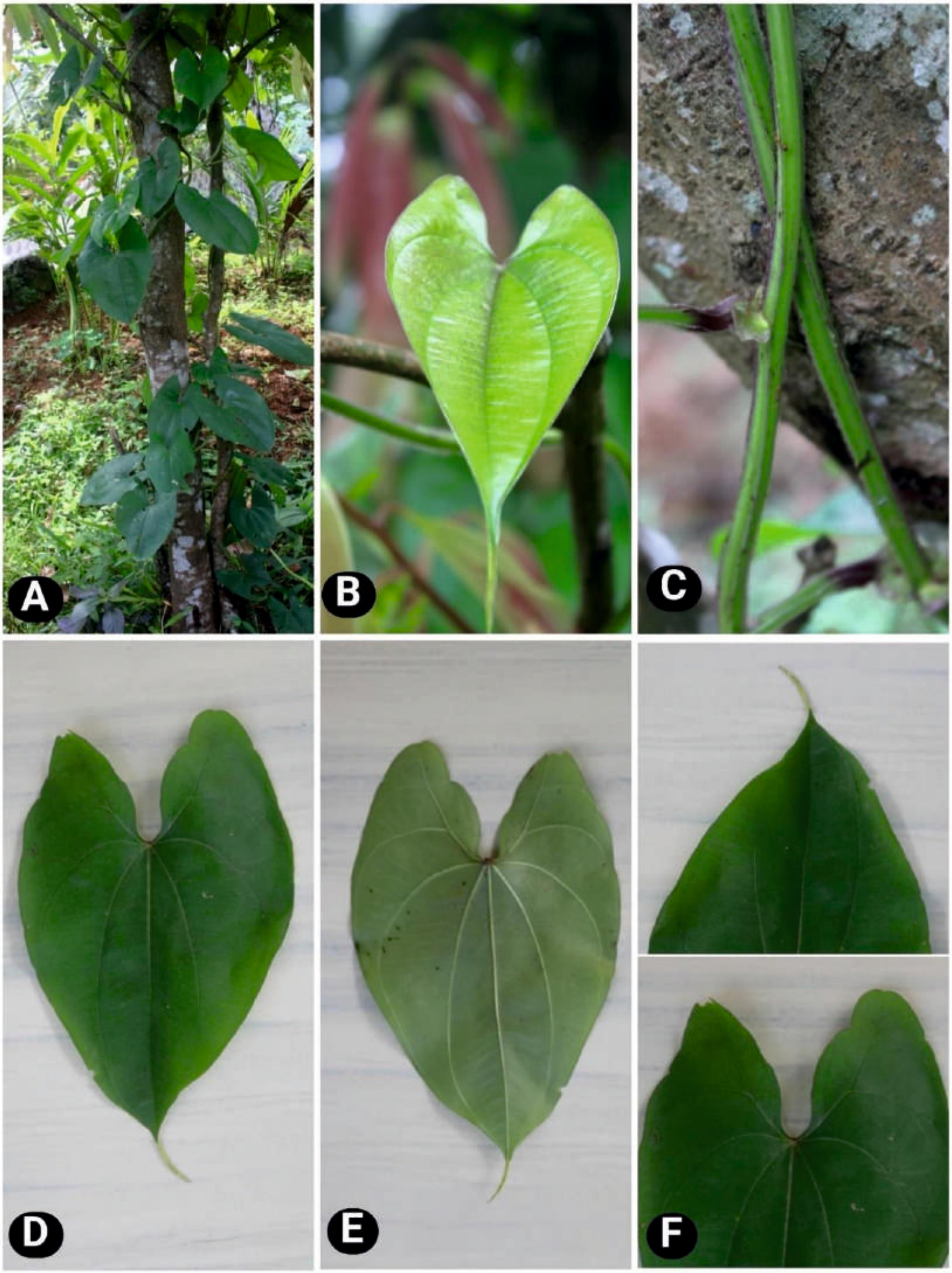


Dioscorea alata var. Kezhykka kachil
A)Plant Habit B) Young leaf C) Stem (Spinning habit)
D) Ventral side of mature leaf E) Dorsal side of mature leaf F) Leaf tip and leaf base

AADHIVASI KACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Light green
Presence of wings	present
Colour of wings	Green with purple margin
Mature stem colour	Light green with purple wing
Direction of twining	Right
Petiole colour	Green with pigmentation
Petiole length (cm)	12 cm
Mature leaf colour	Dark green
Leaf shape	Cordate narrow
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping
Length of leaf	27 cm
Width of leaf	15 cm
Length of sinus	9 cm
Presence of prickles	Absent
Leaf apex	Long tapering

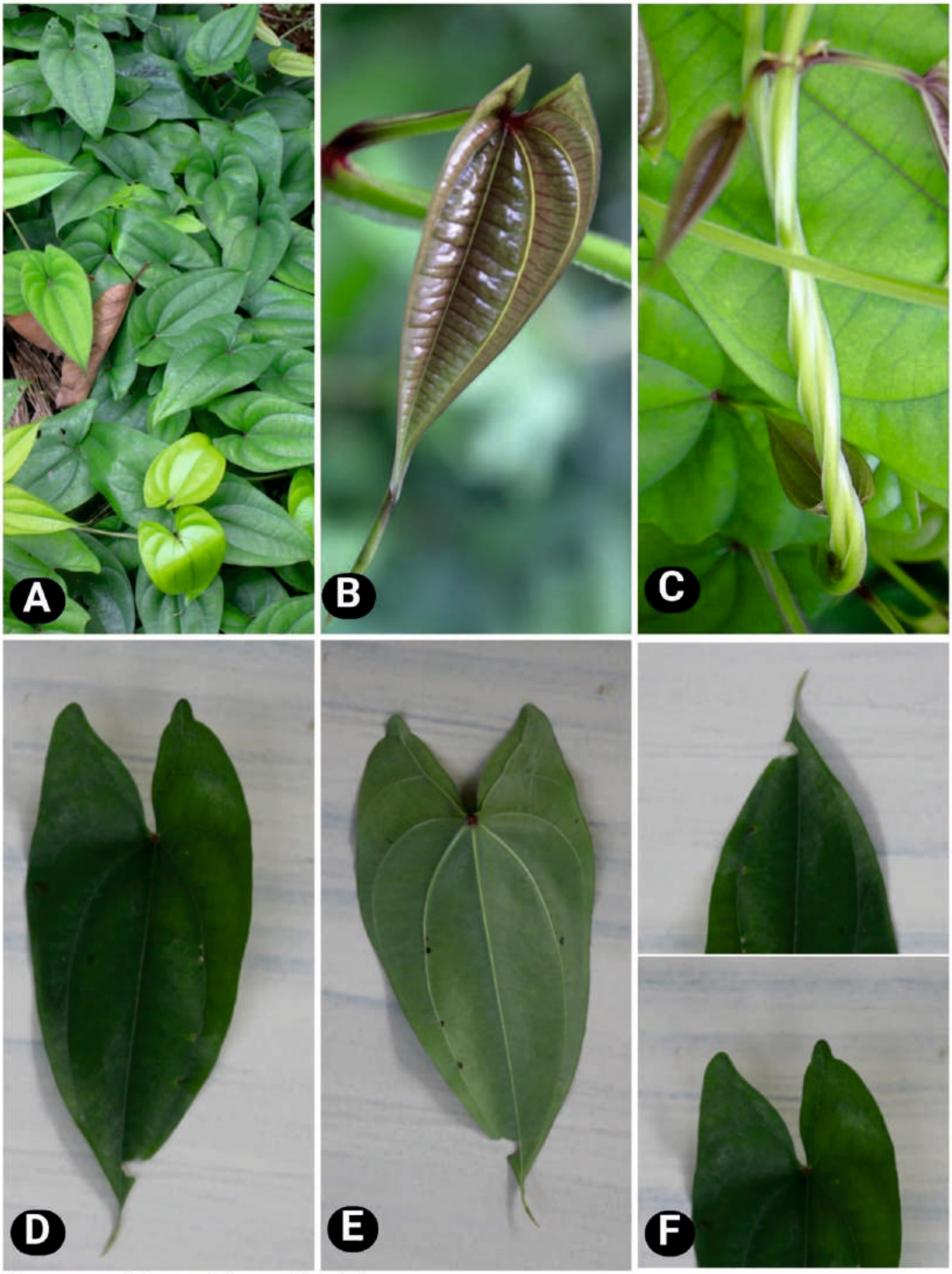


Dioscorea alata var. Adhivasi kachil
A)Plant Habit B) Young leaf C) Stem (Spinning habit)
D) Ventral side of mature leaf E) Dorsal side of mature leaf F) Leaf tip and leaf base

BHARANI KACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Brownish green
Presence of wings	present
Colour of wings	Green with purple margin
Mature stem colour	Light green with purple wing
Direction of twining	Right
Petiole colour	Green with pigmentation
Petiole length (cm)	11 cm
Mature leaf colour	Dark green, a purple spot present on the centre of leaf
Leaf shape	Sagittate narrow
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping
Length of leaf	21 cm
Width of leaf	9 cm
Length of sinus	7 cm
Presence of prickles	Absent
Leaf apex	Acuminate

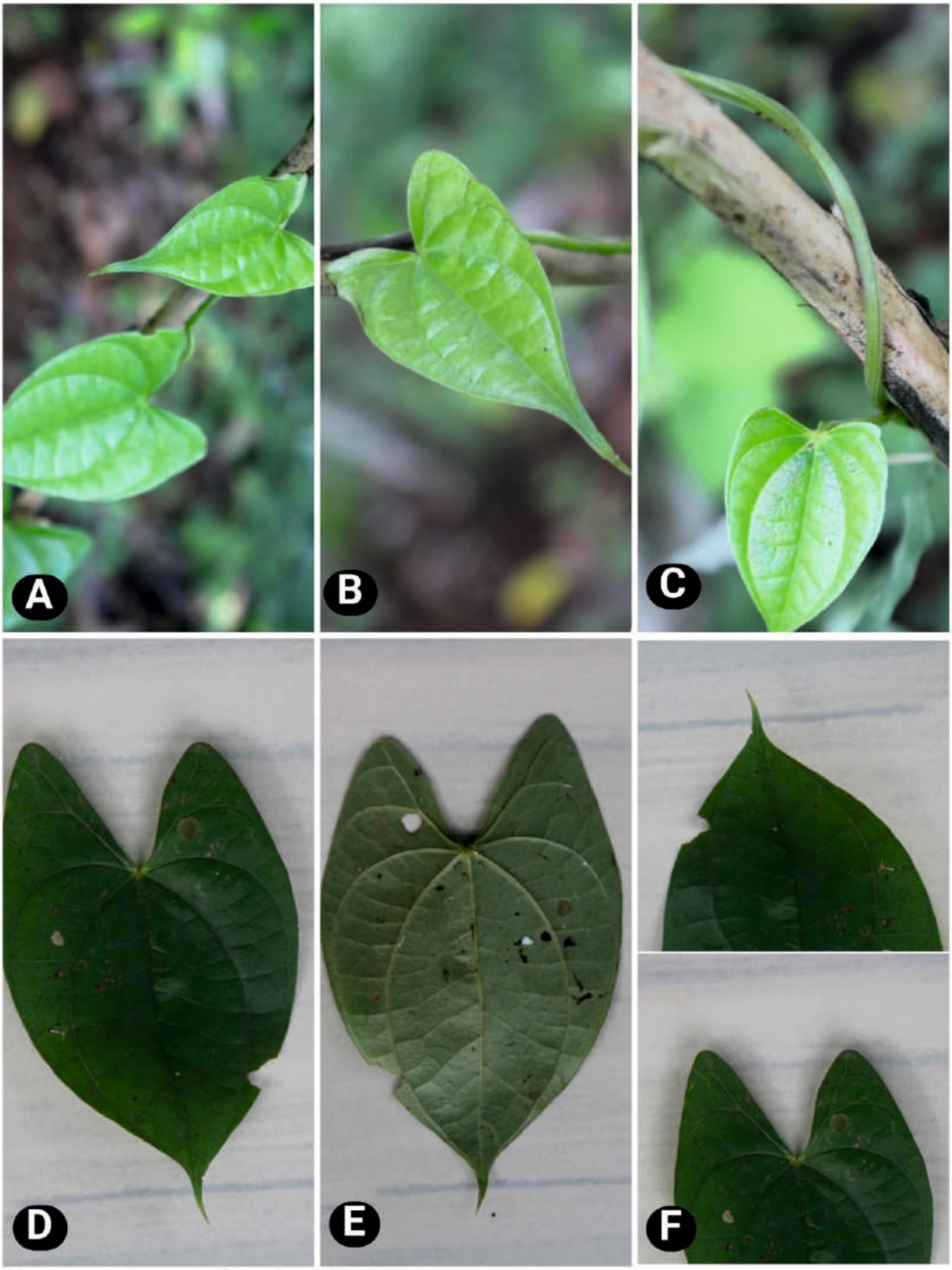


Dioscorea alata var. Bharani kachil
A)Plant Habit B) Young leaf C) Stem (Spinning habit)
D) Ventral side of mature leaf E) Dorsal side of mature leaf F) Leaf tip and leaf base

KATTU KACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Light green
Presence of wings	Present
Colour of wings	Green
Mature stem colour	Dark Green
Direction of twining	Right
Petiole colour	Green
Petiole length (cm)	7 cm
Mature leaf colour	Dark green
Leaf shape	Cordate narrow
Leaf margin pigmentation	Absent
Leaf lobes in a Leaf	Non overlapping
Length of leaf	16 cm
Width of leaf	9 cm
Length of sinus	5 cm
Presence of prickles	Absent
Leaf apex	Acuminate



Dioscorea alata var. Kattu kachil
A)Plant Habit B) Young leaf C) Stem (Spinning habit)
D) Ventral side of mature leaf E) Dorsal side of mature leaf F) Leaf tip and leaf base

VENNI KIZHANGU *(Dioscorea hispida)*

MORPHOLOGICAL CHARACTERISTICS

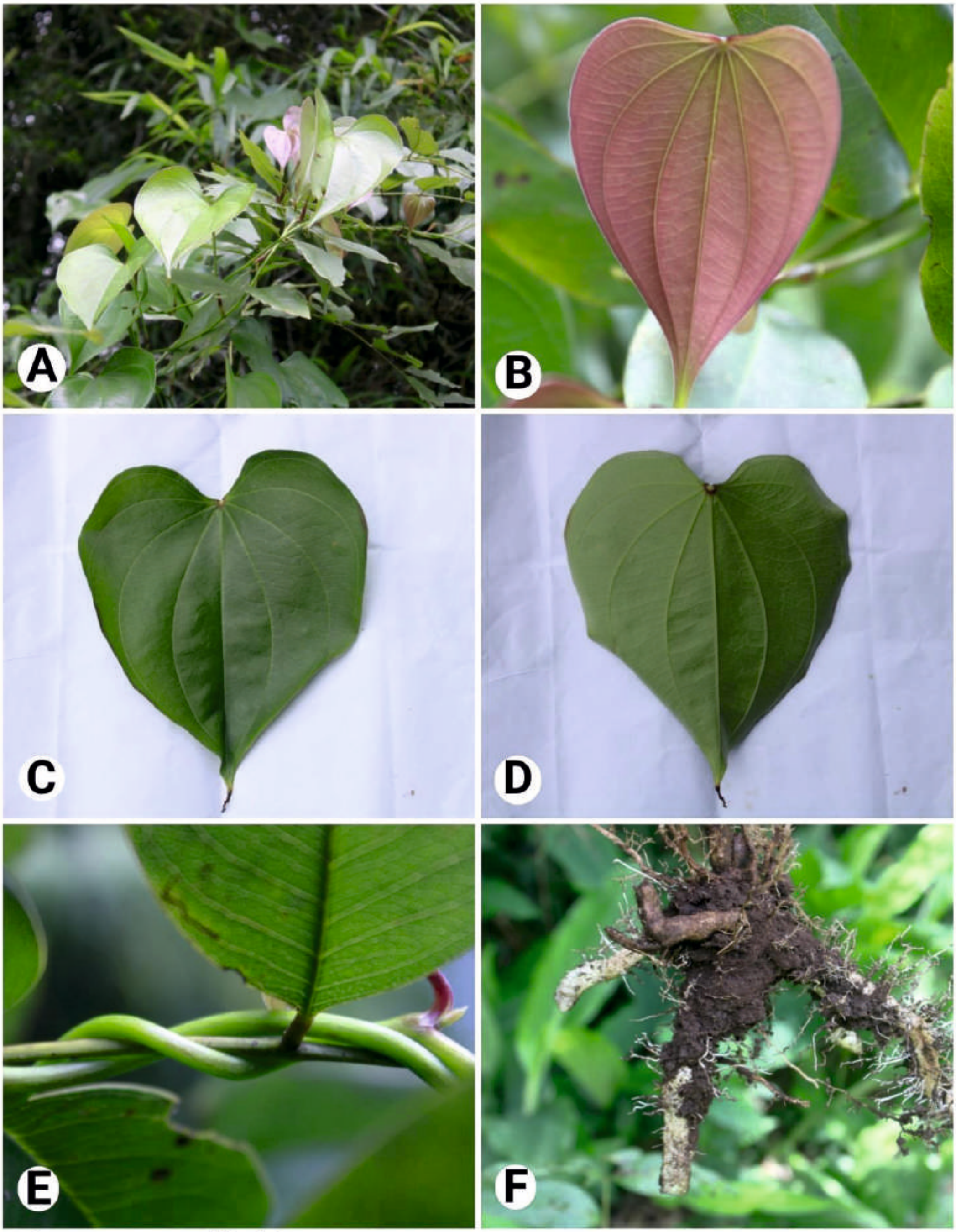
CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Light green
Presence of wings	Absent, round stem
Leaf arrangement	Compound, 3 sub equal leaflets
Mature stem colour	Light Brown, with prickles
Direction of twining	Left
Petiole colour	Green
Petiole length (cm)	9 cm
Mature leaf colour	Green, glabrous
Leaf shape	obovate
Leaf margin pigmentation	Absent
Leaf position	Alternate
Length of leaf	16 cm
Width of leaf	10 cm
Presence of bulbils	Absent
Presence of prickles	Present
Leaf apex	Acuminate
Tuber skin colour	Brown
Tuber cortex colour	cream
Tuber flesh colour	Light yellow
Shape of tuber	Globose
Presence of hair on tuber	Roots present, dense
Cross section of tuber	Amorphous

Dioscorea hispida
A)Plant Habit B) Young leaf C) Stem
D) Ventral side of mature leaf E) Tuber F) Cross section of tuber

KAATTU KIZHANGU *(Dioscorea wallichi)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Light red
Presence of wings	Absent, round stem
Leaf arrangement	Simple
Mature stem colour	Green
Direction of twining	Right
Petiole colour	Green with purple wings
Petiole length (cm)	9 cm
Mature leaf colour	Green
Leaf shape	ovate
Leaf margin pigmentation	Absent
Leaf position	Alternate
Length of leaf	12 cm
Width of leaf	8 cm
Presence of bulbils	Absent
Presence of prickles	Absent
Leaf apex	Acuminate
Tuber skin colour	Brown
Tuber cortex colour	cream
Tuber flesh colour	White
Shape of tuber	Cylindrical
Presence of hair on tuber	Roots absent,
Cross section of tuber	Fibrous and soft

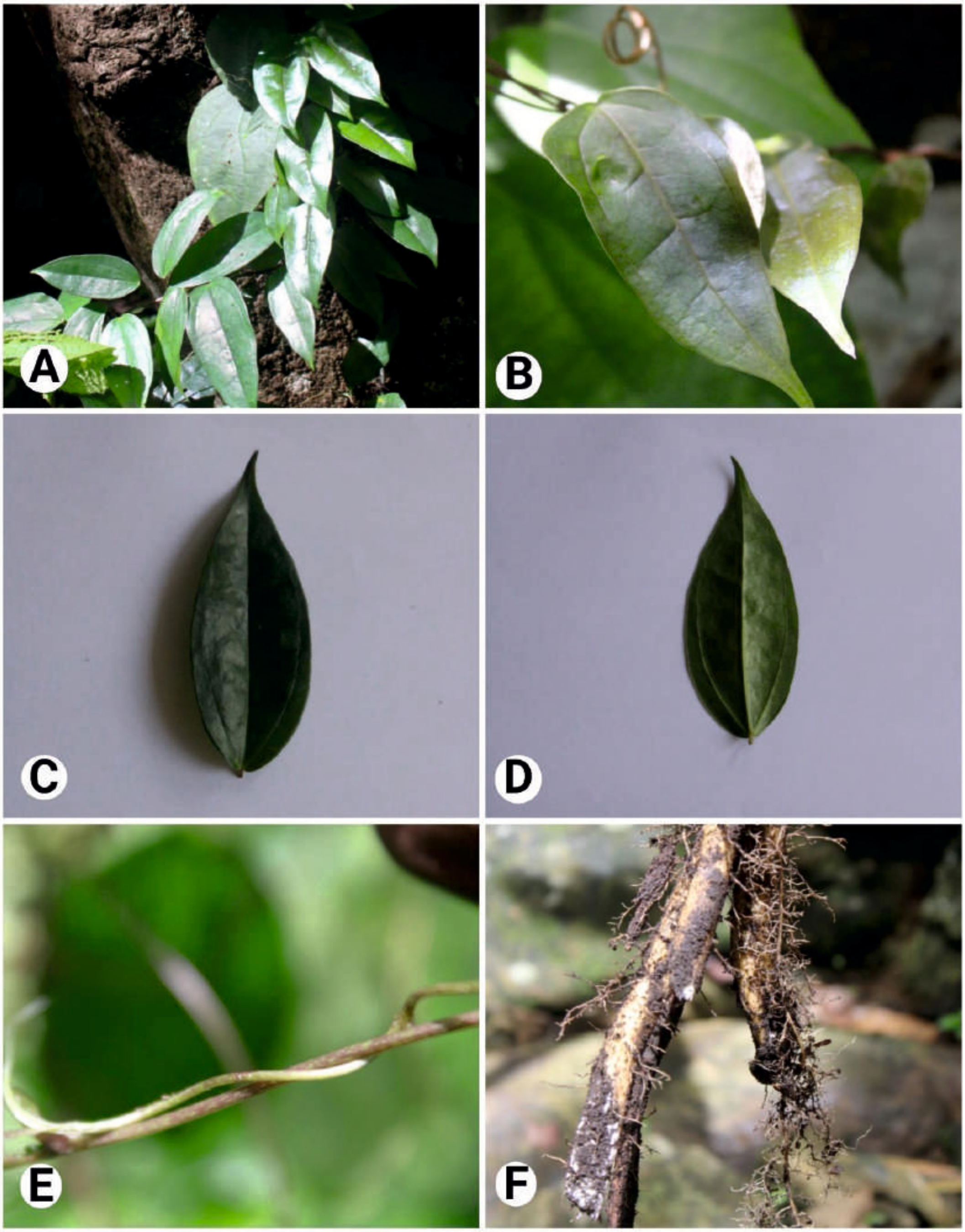


Dioscorea wallichi
A)Plant habit B) Young leaf C) Ventral side of mature leaf D) Dorsal side of mature leaf E) Spinning Habbit F) Tuber

MANTHAL *(Dioscorea sps)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Green
Young fully open leaf colour	Green
Presence of wings	Absent, round stem
Leaf arrangement	Simple
Mature stem colour	Brownish Green
Direction of twining	Right
Petiole colour	Green
Petiole length (cm)	3 cm
Mature leaf colour	Dark Green
Leaf shape	Lanceolate
Leaf margin pigmentation	Absent
Leaf position	Alternate
Length of leaf	15 cm
Width of leaf	6 cm
Presence of bulbils	Absent
Presence of prickles	Absent
Leaf apex	Acuminate
Tuber skin colour	Cream
Tuber cortex colour	cream
Tuber flesh colour	Yellowish cream
Shape of tuber	Cylindrical / elongated
Presence of hair on tuber	Roots present, sparse
Cross section of tuber	Granular

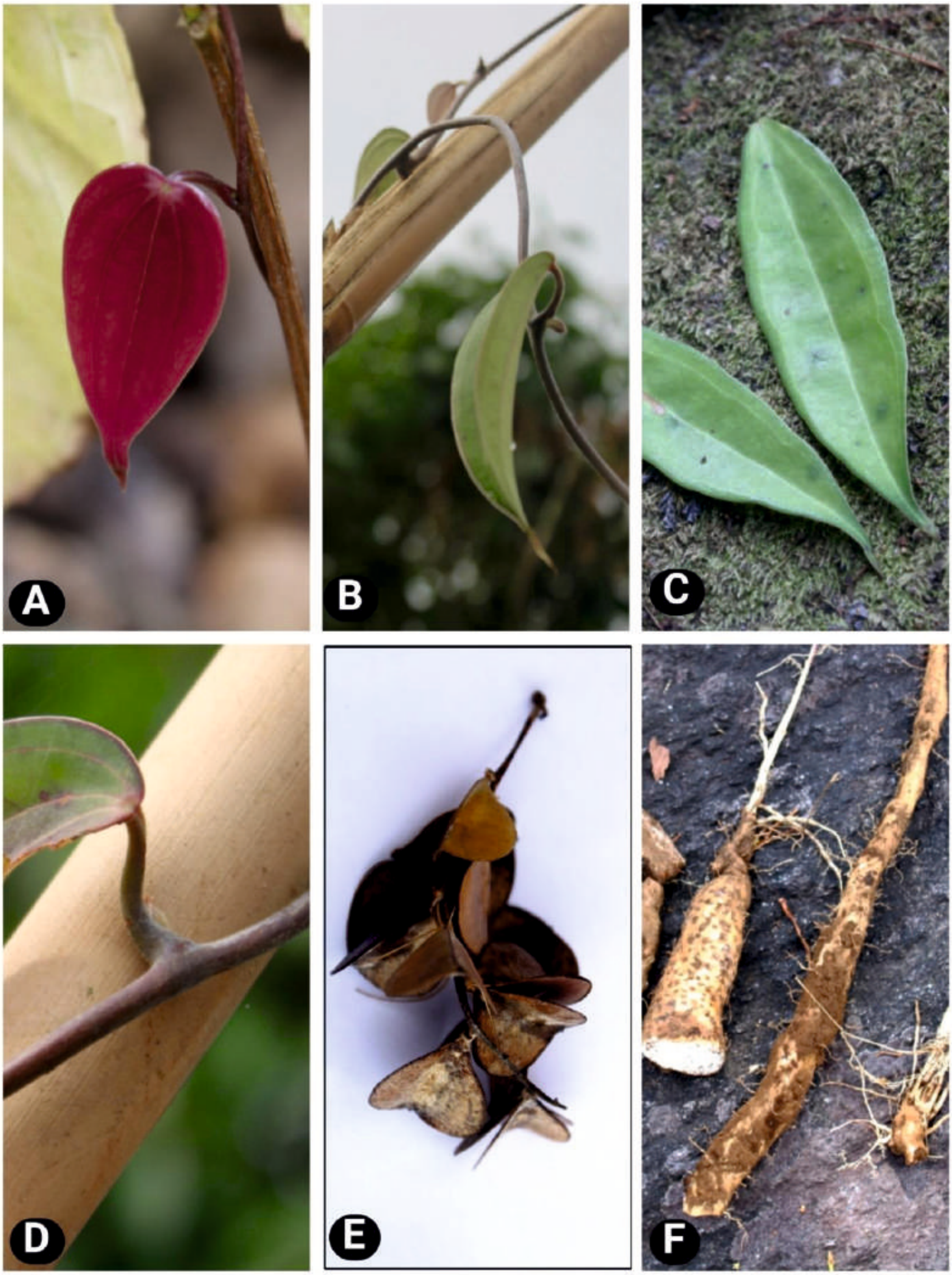


***Dioscorea sps* (*var.* Manthal)**
A)Plant habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Stem (Spinning Habit) F) Tuber

THETTAM *(Dioscorea oppositifolia)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Young stem colour	Red purple
Young fully open leaf colour	Red , bronze-coloured spots present in young leaf
Arrangement of leaf	Opposite
Petiole colour	Red
Petiole length (cm)	1-1.5 cm
Mature leaf colour	Dark green
Leaf shape	Narrow elliptical, 3 nerved
Leaf base shape	Acute
Leaf length	11-12 cm
Leaf width	3-4 cm
Leaf margin	Slightly wavy
Leaf mid rib colour	Light green
Distance between leaf nodes	14 cm
Hairs/roots on tuber	Small hairs present
Tuber shape	Long, narrow
Tuber cortex colour	Light brown
Tuber flesh colour	Crème



Dioscorea oppositifolia var. Thettam

A)Yound Leaf B) Vine with leaf C) mature leaf D) Mature Stem E) Plant seed F) Tubers

NEENDIKACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Colour of young leaf	Green with purple shades
Colour of mature leaf	Green
Colour of petiole of adult plant	Green with 2 ends purple
Shape of leaf	Cordate broad
Colour of wing of petiole	Purple
Colour of young plant at base	Green
Colour of young plant at top	Green
Wing colour of young plant	Purple
Presence of thorn	Absent
Presence of wing on stem	Present
Presence of bulbils	Present
Petiole length	n=19.5 cm
Leaf length	n=20.5 cm
Leaf width	n=16.5 cm
Type of leaf	Simple
Leaf blade colour	Purple
Direction of twinning	Right
Depth of sinus	n=3.5 cm
Distance between leaf lobes	n=6 cm
Direction of twining	right

NeendiKachil

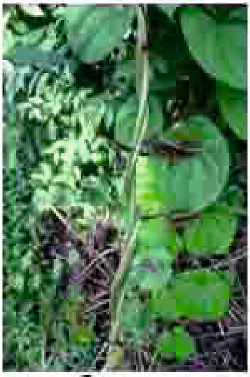
Habitat

Leaf

Dorsal Side

Petiole

Young Leaf



Stem

INJI KACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

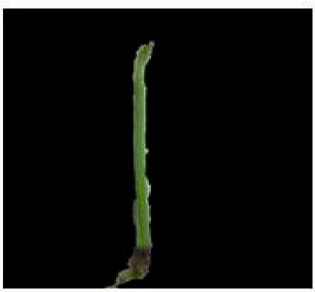
CHARACTERISTICS	STATE
Tuber shape	Oval
Tuber cortex colour	Pink colour with yellow shades
Tuber flesh colour	Cream colour with pink patches
Hairs/roots on tuber	Medium
Tuber appearance of cross section	Granular
Tuber oxidation	Present
Colour change 5 minutes after cutting	Yellow patches
Colour of young leaf	Pale green
Colour of mature leaf	Fully green
Colour of petiole of adult plant	Green with purple base
Leaf shape	Cordate narrow
Colour of wing of petiole	Purple
Colour of young plant at base	Purple
Colour of young plant at top	Green
Wing colour of young plant	Purple
Presence of thorn	Absent
Presence of wings on stem	Present
Presence of bulbils	Present
Petiole length	12 cm
Leaf length	19.5 cm
Leaf width	12 cm
Depth of sinus	6 cm
Type of leaf	Simple
Direction of twinning	Right

Injikachil

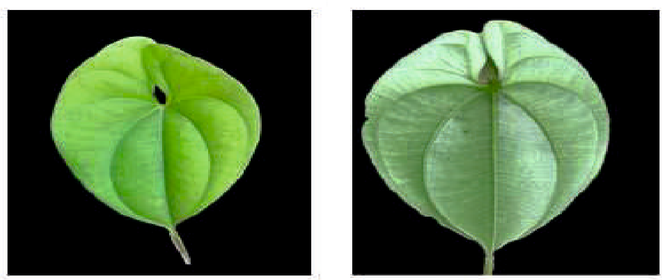
Habitat

Leaf

Dorsal Side



Petiole



Young leaf

Tuber

After Cutting

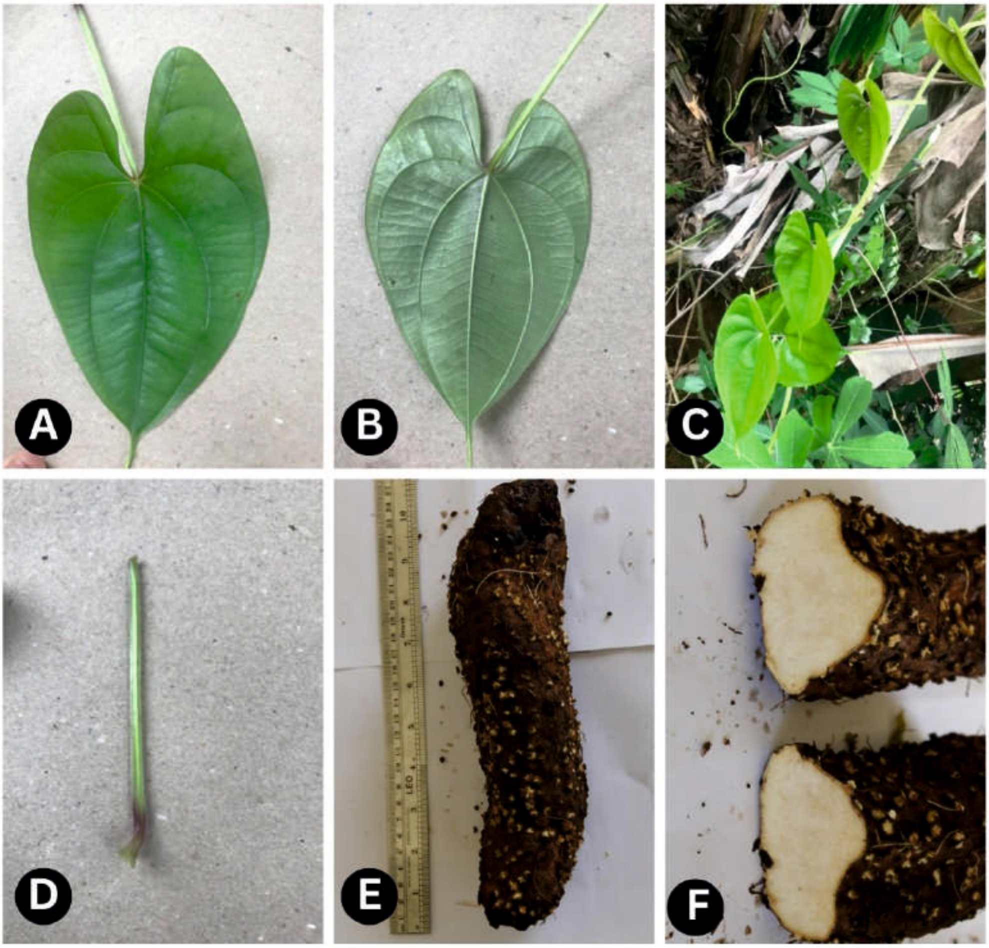
After 5 Minutes

Skin

MATTUKACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Tuber shape	Oval
Tuber cortex colour	Green
Tuber flesh colour	Yellow
Hairs/roots on tuber	Absent, Smooth surface
Tuber appearance of cross section	Granular
Tuber oxidation	Present
Colour change 5 minutes after cutting	Dark yellow shades
Colour of young leaf	Green
Colour of mature leaf	Fully green
Colour of petiole of adult plant	Green with purple base
Leaf shape	Cordate narrow
Colour of wing of petiole	Green
Colour of young plant at base	Purple
Colour of young plant at top	Green
Wing colour of young plant	Green
Presence of thorn	Absent
Presence of wing on stem	Present
Presence of bulbils	Present
Petiole length	10 cm
Leaf length	14 cm
Leaf width	8 cm
Depth of sinus	4 cm
Type of leaf	Simple

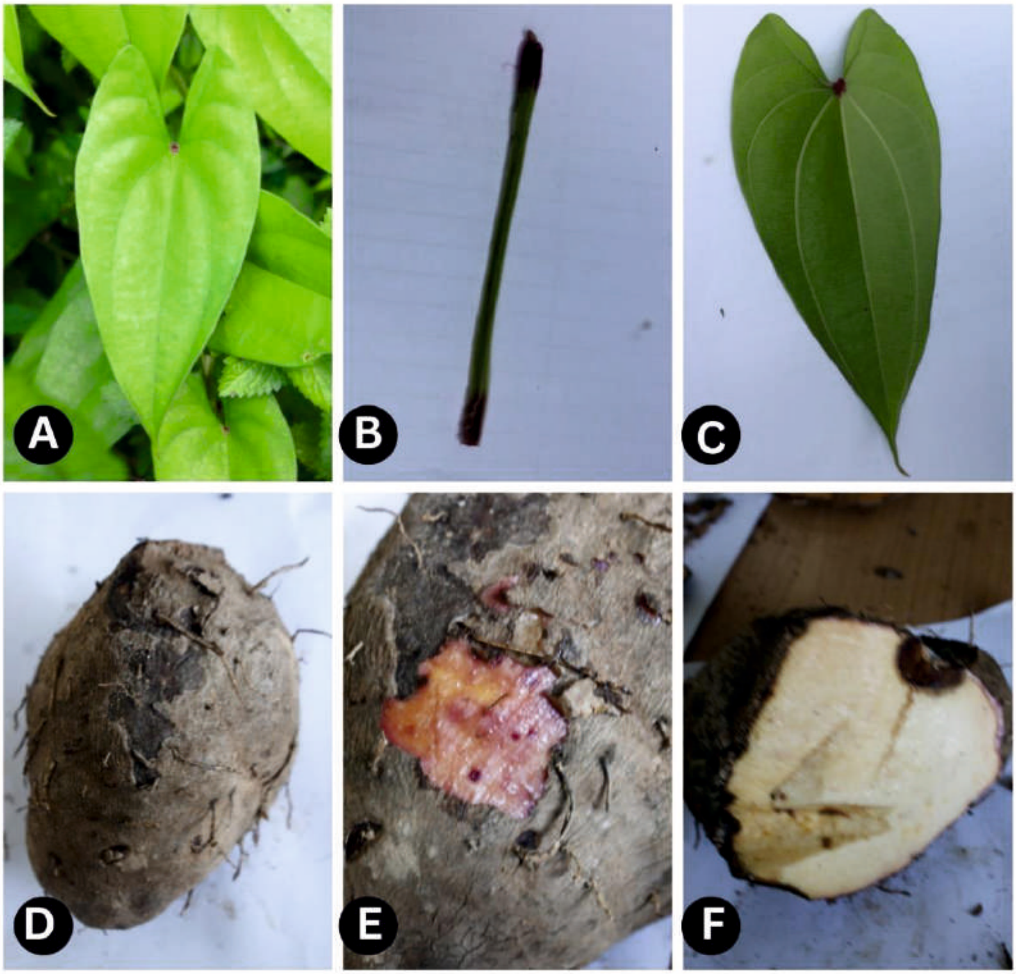


Dioscorea alata **(Mattu kachi*l*)**
A)Ventral side , B) Dorsal side , C) Habit , D) Petiole , E) Tuber , F) Cross-section

PANNIKKACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Leaf shape	Sagittate narrow
Colour of wing of petiole	Purple
Colour of young plant at base	Purple
Colour of young plant at top	Green
Wing colour of young plant	Purple
Presence of thorn	Absent
Presence of wing on stem	Present
Presence of bulbils	Present
Petiole length	9 cm
Leaf length	14 cm
Leaf width	6 cm
Depth of sinus	5 cm
Type of leaf	Simple
Direction of twinning	Right
Petiole colour	Green with both ends purple
Mature leaf colour	Pale green
Leaf margin pigmentation	Purple
Leaf apex	Pointed
Direction of twining	Right



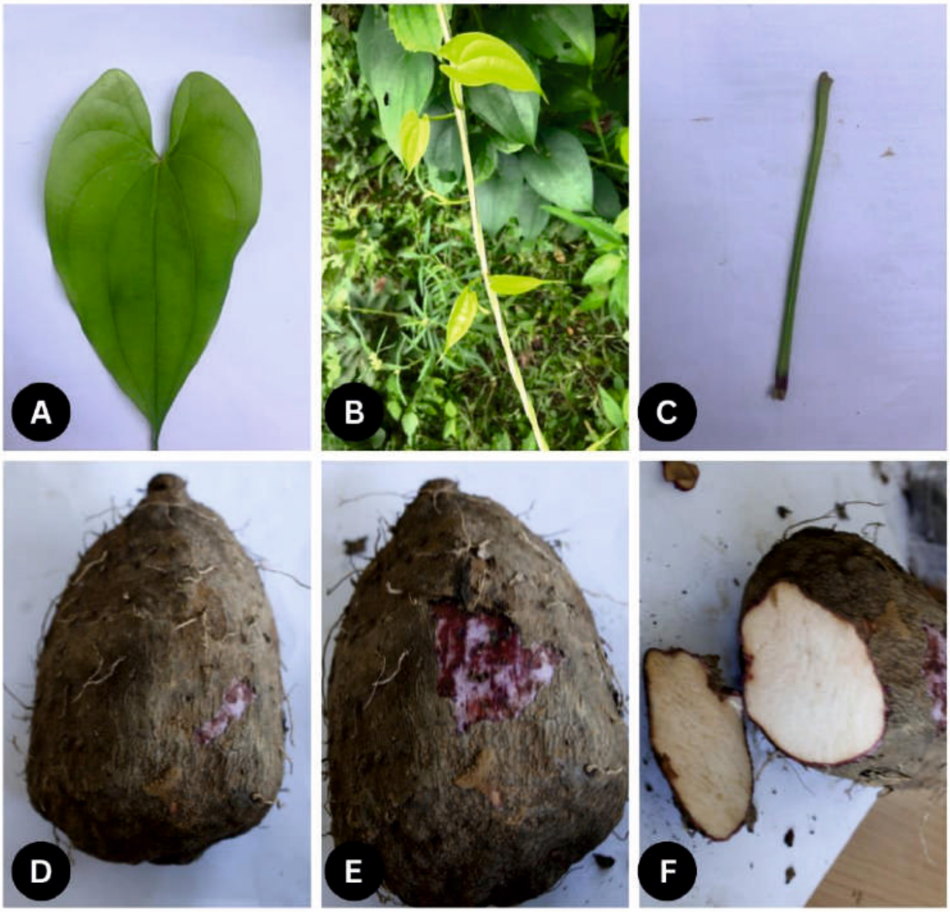
Dioscorea alata **(Panni kachil)**

A) Habit , B) Petiole , C) Dorsal side , D) Tuber , E) Tuber cortex , F) Cross section

THNAN KACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Colour of young leaf	Green
Colour of mature leaf	Yellowish green
Colour of petiole of adult plant	Yellowish green
Shape of leaf	Cordate broad
Colour of wing of petiole	Green
Colour of young plant at base	Green
Colour of young plant at top	Green
Wing colour of young plant	Green
Presence of thorn	Absent
Presence of wing on stem	Absent
Presence of bulbils	Present
Petiole length	n=20.5cm
Leaf length	n=20 cm
Leaf width	n=13.5cm
Type of leaf	Simple
Leaf blade colour	Green
Direction of twinning	Right
Depth of sinus	n=4.2 cm
Distance between leaf lobes	n= 0 cm



Dioscorea alata (Thunan kachil): A) Ventral side of leaf , B) Habit , C) Petiole , D) Tuber , E) Tuber cortex , F) Cross-section

MOGAPPAN *(Dioscorea wallichii)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Colour of young leaf	Purple
Colour of mature leaf	Fully green
Colour of petiole of adult plant	Green with 2 ends purple
Shape of leaf	Cordate broad
Colour of wing of petiole	No wings
Colour of young plant at base	Green
Colour of young plant at top	Purple
Wing colour of young plant	No wings
Presence of thorn	Absent
Presence of wing on stem	Absent
Presence of bulbils	Absent
Petiole length	n=8 cm
Leaf length	n=11 cm
Leaf width	n=9cm
Type of leaf	Simple
Leaf blade colour	Purple
Depth of sinus	n=1.5 cm
Distance between leaf lobes	n= 2 cm
Direction of twining	Right

Mogappan

Habitat

Leaf

Dorsal Side

Petiole

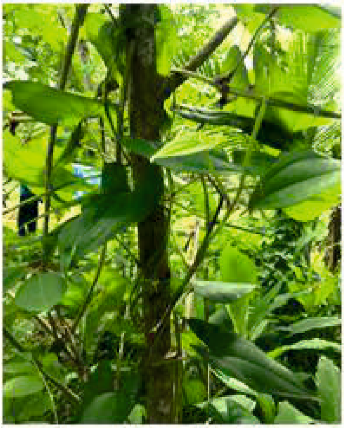
Young Stem

KAPPA KACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Colour of young leaf	Green
Colour of mature leaf	Green
Colour of petiole of adult plant	Green with 2 ends purple
Shape of leaf	Sagittate narrow
Colour of wing of petiole	Purple
Colour of young plant at base	Green
Colour of young plant at top	Green with purple
Wing colour of young plant	Purple
Presence of thorn	Absent
Presence of wing on stem	Present
Presence of bulbils	Present
Petiole length	n=18.5cm
Leaf length	n=18 cm
Leaf width	n=10.5cm
Type of leaf	Simple
Leaf blade colour	Green
Direction of twinning	right
Depth of sinus	n=3.2 cm
Distance between leaf lobes	n= 5.5 cm

KappaKachil



Habitat

Leaf

Dorsal Side

Petiole

QUINTAL KACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Colour of young leaf	Green
Colour of mature leaf	Green
Colour of petiole of adult plant	Green with 2 ends purple
Shape of leaf	Sagittate narrow
Colour of wing of petiole	Purple
Colour of young plant at base	Green
Colour of young plant at top	Green with purple
Wing colour of young plant	Purple
Presence of thorn	Absent
Presence of wing on stem	Present
Presence of bulbils	Present
Petiole length	n=9.5cm
Leaf length	n=21cm
Leaf width	n=10 cm
Type of leaf	Simple
Leaf blade colour	Purple
Direction of twinning	right
Depth of sinus	n=3.2 cm
Distance between leaf lobes	n= 3.5 cm

Quintal Kachil

Habitat

Leaf

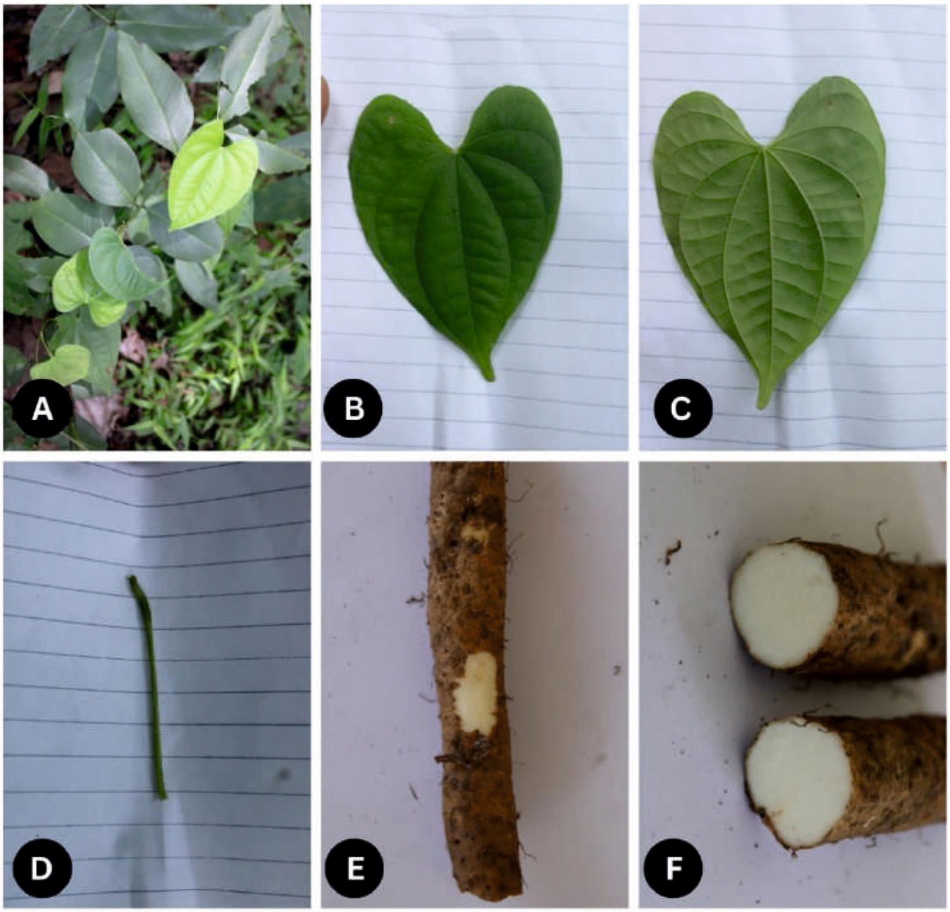
Dorsal Side

Petiole

VENNIKKIZHANG *(Dioscorea hamiltonii)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Colour of young leaf	Pale green
Colour of mature leaf	Green
Colour of petiole of adult plant	Green with both ends purple
Shape of leaf	Cordate broad
Colour of wing of petiole	No wings
Colour of young plant at base	Brown
Colour of young plant at top	Green
Wing colour of young plant	No wings
Presence of thorn	Absent
Presence of wing on stem	Absent
Presence of bulbils	Absent
Petiole length	n=14 cm
Leaf length	n=16.5 cm
Leaf width	n=12.5 cm
Type of leaf	Simple
Leaf blade colour	Green
Depth of sinus	n=8 cm
Distance between lobes	n=15 cm
Direction of twining	right
Tuber shape	Linear
Tuber cortex colour	Cream
Tuber flesh colour	Cream
Hairs/roots on tuber	Sparse
Tuber appearance of cross section	Granular
Tuber oxidation	Low
Colour change 5 minutes after cutting	Pale yellow patches

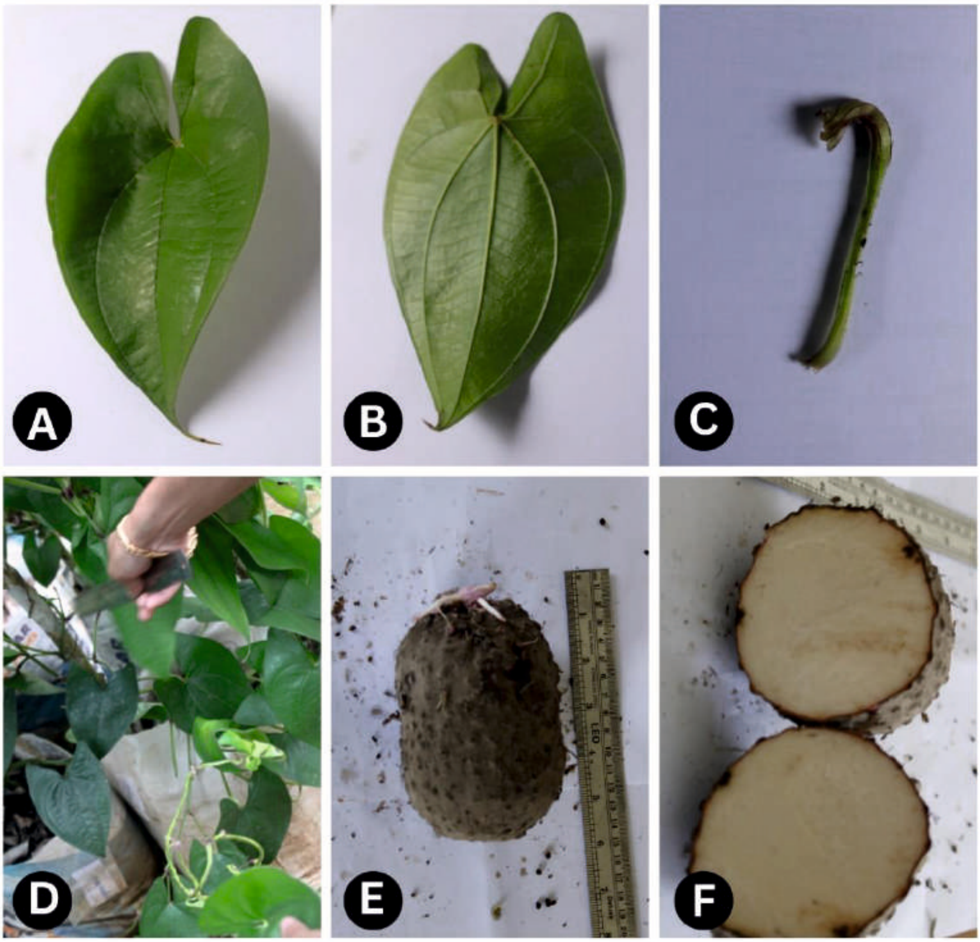


Dioscorea sps (Venni kizhangu)
A) Habit , B)Ventral side , C) Dorsal side , D) Petiole , E) Tuber , F) Cross-section

UNDAKACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Colour of young leaf	Pale Green
Colour of mature leaf	Green
Colour of petiole of adult plant	Green with purple base
Shape of leaf	Sagittate broad
Colour of wing of petiole	Colourless
Colour of young plant at base	Green
Colour of young plant at top	Green
Wing colour of young plant	Colourless
Presence of thorn	Absent
Presence of wing on stem	Present
Presence of bulbils	Present
Petiole length	n=8 cm
Leaf length	n=17 cm
Leaf width	n=10 cm
Type of leaf	Simple
Leaf blade colour	Green
Direction of twinning	right
Depth of sinus	n=4 cm
Distance between leaf lobes	n=2 cm
Tuber shape	Oval
Tuber cortex colour	Reddish orange
Tuber flesh colour	Creamy white
Hairs/roots on tuber	Sparse
Tuber appearance of cross section	Amorphous
Tuber oxidation	Present
Colour change 5 minutes after cutting	Creamy white with brown spots



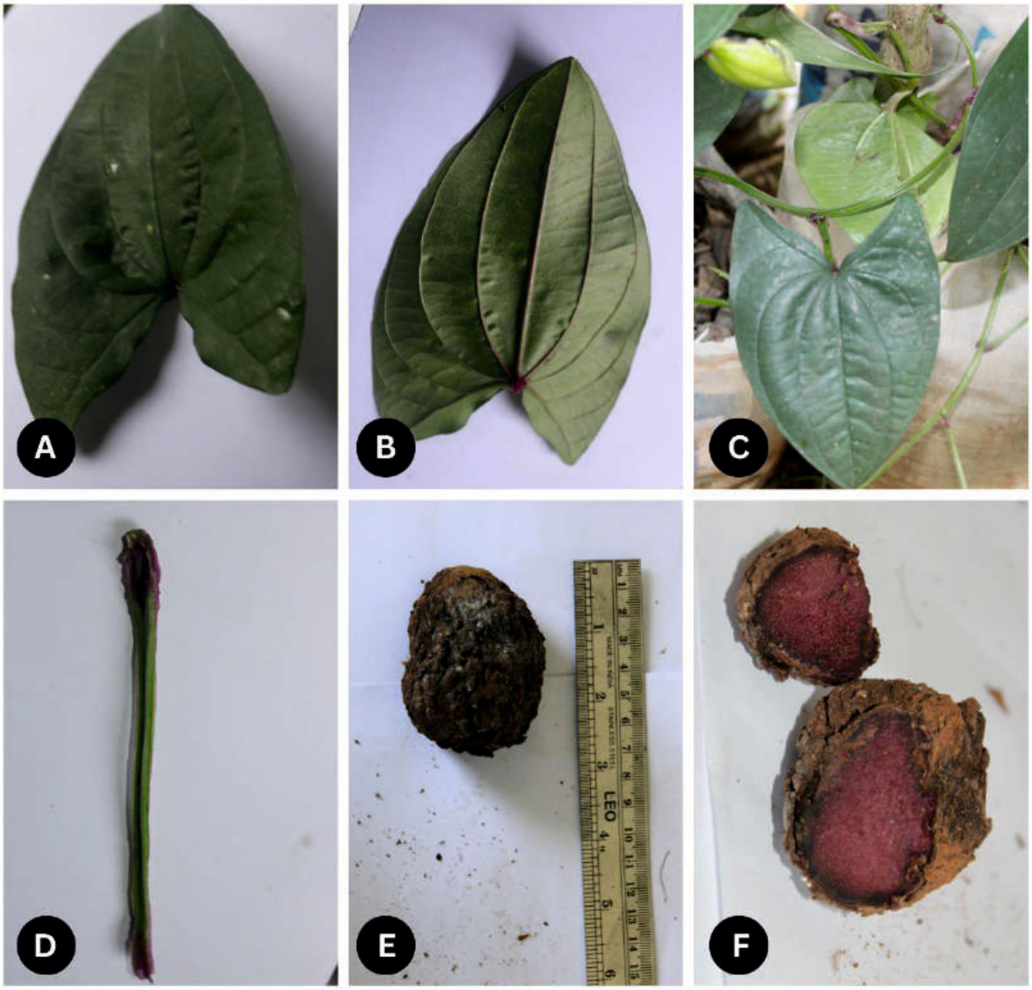
Dioscorea alata **(Unda Kachil)**

A) Ventral , B)Dorsal , C) Petiole , D) Habit , E) Tuber , F) Cross-section

SUGANDHAKACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Colour of young leaf	Green
Colour of mature leaf	Green
Colour of petiole of adult plant	Green with two ends purple
Shape of leaf	Sagittate broad
Colour of wing of petiole	Purple
Colour of young plant at base	Green
Colour of young plant at top	Green
Wing colour of young plant	Purple
Presence of thorn	Absent
Presence of wing on stem	Present
Presence of bulbils	Present
Petiole length	n=15 cm
Leaf length	n=20 cm
Leaf width	n=11 cm
Type of leaf	Simple
Leaf blade colour	Purple
Direction of twinning	right
Depth of sinus	n=6 cm
Distance between leaf lobes	n=8 cm
Tuber shape	Oval
Tuber cortex colour	Purple
Tuber flesh colour	Purple
Hairs/roots on tuber	Sparse
Tuber appearance of cross section	Granular
Tuber oxidation	Absent
Colour change 5 minutes after cutting	No colour change



Dioscrea alata **(Sugandha kachil)**

A)Ventral side , B) Dorsal side , C) Habit , D) Petiole , E) Tuber , F) Cross-section

KODIKACHIL *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

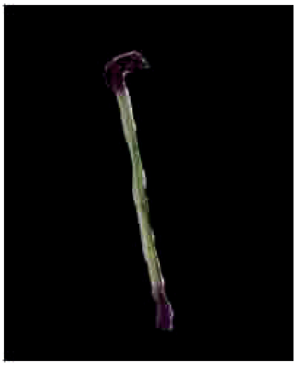
CHARACTERISTICS	STATE
Colour of young leaf	Greenish purple
Colour of mature leaf	Green with pink spot at centre
Colour of petiole of adult plant	Green with two ends purple
Shape of leaf	Sagittate narrow
Colour of wing of petiole	Purple
Colour of young plant at base	Green
Colour of young plant at top	Green
Wing colour of young plant	Purple
Presence of thorn	Absent
Presence of wing on stem	Present
Presence of bulbils	Present
Petiole length	n=8 cm
Leaf length	n=12 cm
Leaf width	n=7 cm
Type of leaf	Simple
Leaf blade colour	Purple
Direction of twinning	right
Depth of sinus	n=2.5cm
Distance between leaf lobes	n=0 cm

Kodikachil

Habitat

Leaf

Dorsal Side



Petiole

Stem

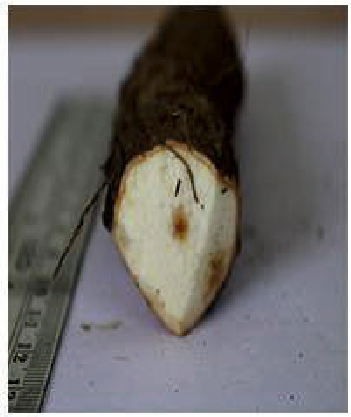
CHERAMADAYAN *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Tuber shape	Cylindrical
Tuber cortex colour	Pinkish yellow
Tuber flesh colour	Creamy white
Hairs/roots on tuber	Sparse
Tuber appearance of cross section	Amorphous
Tuber oxidation	Present
Colour change 5 minutes after cutting	Creamy white with brown spots

Cheramadayan

Tuber



After Cutting

After 5 mintues

Skin

ARIKIZHANG *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Colour of young leaf	Pale green
Colour of mature leaf	Green
Colour of petiole of adult plant	Green
Shape of leaf	Sagittate broad
Colour of wing of petiole	Purple
Colour of young plant at base	Green
Colour of young plant at top	Pale green
Wing colour of young plant	Purple
Presence of thorn	Absent
Presence of wing on stem	Present
Presence of bulbils	Present
Petiole length	n=6cm
Leaf length	n=12 cm
Leaf width	n=7.5 cm
Type of leaf	Simple
Leaf blade colour	Green
Direction of twinning	right
Depth of sinus	n= 2cm
Distance between leaf lobes	n= 4 cm

Arikizhangu

Habitat

Leaf

Dorsal Side

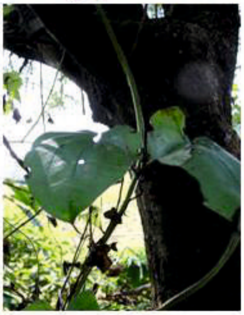
Petiole

KUPPUNTHI *(Dioscorea alata)*

MORPHOLOGICAL CHARACTERISTICS

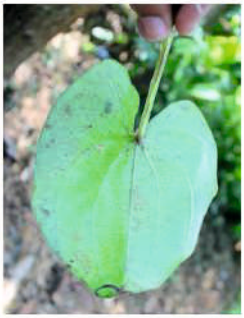
CHARACTERISTICS	STATE
Colour of young leaf	Green
Colour of mature leaf	Green
Colour of petiole of adult plant	Green with two ends purple
Shape of leaf	Sagittate broad
Colour of wing of petiole	Purple
Colour of young plant at base	Green
Colour of young plant at top	Green
Wing colour of young plant	Purple
Presence of thorn	Present
Presence of wing on stem	Present
Presence of bulbils	Absent
Petiole length	n=23 cm
Leaf length	n=16 cm
Leaf width	n=11 cm
Type of leaf	Simple
Leaf blade colour	Green
Direction of twinning	Anti-clockwise
Depth of sinus	n=7 cm
Distance between leaf lobes	n=5.5 cm
Tuber shape	Conical
Tuber cortex colour	Purple
Tuber flesh colour	Light purple
Hairs/roots on tuber	Sparse
Tuber appearance of cross section	Granular
Tuber oxidation	present
Colour change 5 minutes after cutting	Brown colour

Kuppundhi

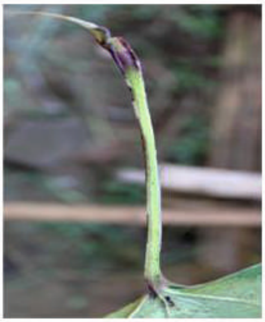


Habitat

Leaf

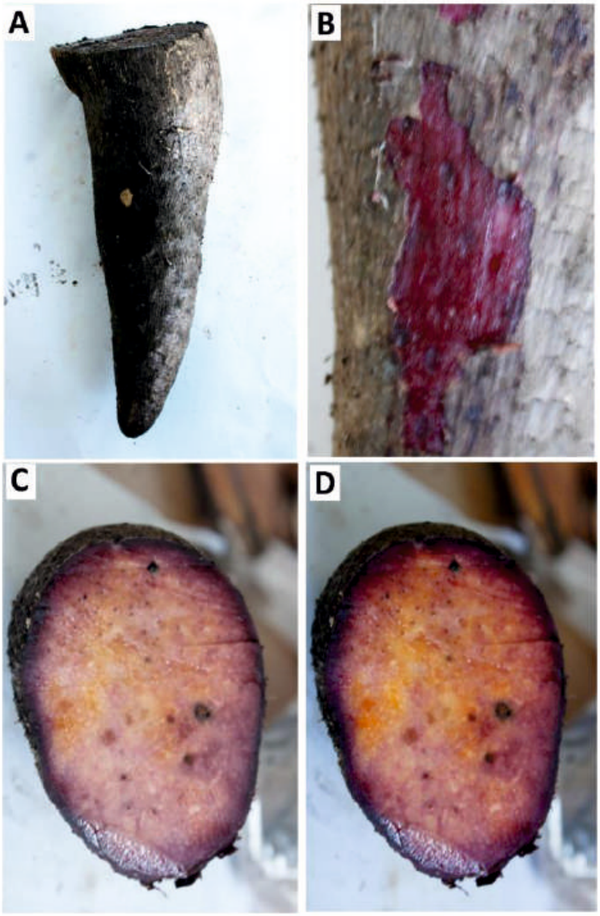


Dorsal Side



Petiole

Stem



KUPPUNDHI : A.Tuber B.Skin
C.After cutting D. After 5 Minutes

VELANGAL *(Dioscorea spp)*

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Colour of young leaf	Green
Colour of mature leaf	Green
Colour of petiole of adult plant	Green with two ends purple
Shape of leaf	Cordate narrow
Colour of wing of petiole	No wings
Colour of young plant at base	Green
Colour of young plant at top	Green
Wing colour of young plant	Purple
Presence of thorn	Present
Presence of wing on stem	Absent
Presence of bulbils	Absent
Petiole length	n=9 cm
Leaf length	n=11 cm
Leaf width	n=7 cm
Type of leaf	Simple
Leaf blade colour	Green
Direction of twinning	right
Depth of sinus	n=1 cm
Distance between leaf lobes	n=2 cm
Tuber shape	Linear
Tuber cortex colour	White
Tuber flesh colour	White
Hairs/roots on tuber	Sparse
Tuber appearance of cross section	Granular
Tuber oxidation	No oxidation
Colour change 5 minutes after cutting	No change

Vellangal

Habitat

Leaf

Dorsal Side

Petiole

Stem

Tuber

Taro: Bridging Cultural Heritage and Modern Conservation Efforts

Taro (Colocasia esculenta) is an important root vegetable primarily cultivated in tropical and subtropical regions. In Kerala, it is referred to as “chembu.” As a member of the Araceae family, taro is valued for its starchy underground tubers, known as corms. The plant is characterized by its large, heart-shaped leaves, and it produces corms in various colors, including white, purple, and yellow. Taro thrives in warm, wet environments with rich, well-drained soils, often found in flooded fields or marshy areas.

Nutritionally, taro is rich in carbohydrates, fiber, potassium, and essential vitamins, making it a staple food for many communities. Beyond its dietary value, taro has cultural significance in various societies, where it is celebrated in ceremonial dishes and symbolizes fertility and tradition. The integration of taro into local customs and festivities highlights its importance not just as a food source but also as a cultural emblem that strengthens community bonds.

Economically, taro supports the farmers, providing livelihoods and contributing to local and national economies. Its genetic diversity enhances resilience against climate change, enabling it to adapt to waterlogged conditions and contribute to food security. Acknowledging and promoting the multifaceted roles of taro in agriculture, nutrition, and culture is crucial for sustainable development and the preservation of agricultural diversity for future generations.

TARO DIVERSITY IN KERALA

In Kerala, taro (Colocasia esculenta), known as ‘Chembu’, holds noteworthy cultural, dietary, and economic importance. It is a staple in local cuisine, featuring prominently in dishes like ‘Chembu Thalu Curry, Madantha Curry Chembila Chammanthy and Chembu Puzhungiyathu which illustrate its versatility. The diverse varieties found in Kerala, such as, Vettu Chembu, Aanakomban,Neychembu, Makkalepotti, Nanachembu, Upperichembu, Thamarakannan, Kappa Chembu, Upperichembu 1, Pindalan Chembu, Kudavazha Chembu, Valan Chembu, Mukthakeshi, Kannan Chembu, Karinchembu, Cheruchembu, Chuvanna Chembu, Vella Chembu, Araya Chembu, Kattuchembu, Kudamakaran Chembu, Karuthakannan Chembu, Kula Chembu, Aattukannan Chembu, Choriyan Chembu, Podi Chembu, Kotta Chembu, Motta Chembu and Kuzhinirayan Chembu , each exhibit distinct morphological characteristics that enhance their culinary significance. Taro leaves are nutritious, abundant in vitamins A and C, dietary fiber, and minerals, contributing to digestion, heart health, and offering anti-inflammatory and antioxidant benefits.

Traditional cultivation practices among tribal communities in Kerala showcase a strong connection to sustainable agricultural methods and indigenous knowledge. These communities rely on taro for food security and use organic farming techniques alongside intercropping with rice to maintain soil fertility and adapt to climate variance. However, challenges including urbanization, land conversion, and the rise of commercial farming threaten traditional practice. In response, various government initiatives and NGOs promote sustainable agriculture and the conservation of local varieties. By recognizing the cultural importance and nutritional benefits of taro, Kerala can bolster community livelihoods while supporting biodiversity and sustainable practices. Preserving traditional cultivation methods is crucial for maintaining both the heritage of local communities and ecological balance in the region.

Urali tribal community in Kerala sundry the leaves and petiole of ‘karinchembu’ for future use. This process extends their shelf life, allowing them to be used during the seasons when fresh leaves and petioles are unavailable. The dried leaves and petioles are rehydrated and used in various dishes, such as chembu ila thoran and pulinkari. Properly dried leaves and petioles can last for up to 6- 12 months.

CULTURAL SIGNIFICANCE OF TARO

Taro holds cultural importance across diverse communities, particularly in mannan, urali, kani, kurichya, kuruma and paniya communities. It is a versatile staple food rich in carbohydrates, dietary fiber, and essential vitamins, prepared in various ways such as steaming, boiling, and baking. The reliance on taro fosters local diets and enhances social cohesion as families gather to share traditional meals.

Beyond its nutritional role, taro is rich in folklore, cultural practices, and spiritual significance. It often symbolizes sustenance, fertility, and abundance in numerous cultures, featuring prominently in myths and legends that emphasize its holiness and ancestral connections. Taro is integral to tribal rituals and festivals, celebrated through dances, songs, and community gatherings that reinforce cultural identities. In association with the religious events like, ‘Thiruvathira’ (dhanu/ December- January) and ‘kettunirakkal’ (vrishchikam/ November- december), tribes prepare recipes like ‘Thiruvathira puzhukku’ and ‘Asthram’ in which taro is one of the main ingredient. It illustrates how the cultivation and preparation of taro bridge generations, fostering a sense of belonging to the land. Through these diverse roles, taro emerges as a powerful symbol of cultural identity, resilience, and unity.

ECOLOGICAL IMPORTANCE OF TARO DIVERSITY

Taro (Colocasia esculenta) plays a vital role in biodiversity conservation due to its genetic diversity among various local varieties adapted to different environmental conditions. This diversity is crucial for resilience against pests, diseases, and climate change impacts, making taro essential in addressing agricultural challenges. Its cultivation supports diverse ecosystems, including wetlands, vital for habitat conservation and ecological balance. As part of agro ecosystems, taro enhances agro biodiversity, helping maintain ecosystem functions that support agricultural productivity and environmental health. Traditional cultivation practices, often involving sustainable methods like crop rotation and organic farming, improve soil health and minimize reliance on synthetic inputs. Taro's adaptability to wetland environments also contributes to water management and carbon sequestration, promoting ecological balance and climate change mitigation

NEED FOR CONSERVATION OF TARO VARIETIES

The conservation of taro (Colocasia esculenta) varieties is critical, primarily due to the numerous threats that endanger its biodiversity, such as climate change and urbanization. Rising temperatures negatively impact taro growth, while altered rainfall patterns can result in droughts or flooding, both harmful to this water-intensive crop. Urbanization leads to the loss of agricultural land as it is converted into urban areas, diminishing the space available for taro cultivation. Additionally, the proliferation of pests and diseases, exacerbated by climate change, poses a risk to traditional taro varieties, which often lack the resilience of high-yield commercial crops. These factors contribute to genetic erosion, as traditional farming practices decline in the face of economic pressures and monoculture.

Moreover, preserving indigenous knowledge and practices plays a vital role in the conservation of taro biodiversity. Traditional methods often promote the cultivation of diverse taro varieties, vital for enhancing food security and resilience. Indigenous farming techniques are usually more sustainable, protecting ecological balance and soil health while ensuring the crop's adaptability to changing environmental conditions. Furthermore, the cultural significance of taro within many indigenous communities underscores the importance of safeguarding these varieties and the associated knowledge. Such conservation efforts help maintain community identity and cultural integrity, provide valuable ecological insights, and empower local communities to take part in agricultural policies that prioritize biodiversity. Overall, prioritizing the conservation of taro varieties and indigenous farming knowledge is essential to combat the pressing challenges posed by climate change and urbanization.

ECONOMIC VALUE ADDITION OF TARO

Taro holds significant economic value through its integration into both traditional and modern markets. In traditional markets, taro is a staple for many indigenous and tribal communities, often sold at local farmers' markets, community gatherings, and cultural ceremonies. These settings not only provide direct consumption but also preserve the cultural significance surrounding the crop. In modern markets, the demand for taro is growing in urban grocery stores and e-commerce platforms, particularly among health-conscious consumers. Products like taro chips, flour, and even frozen taro items are gaining traction, showcasing a versatile appeal beyond local consumption.

For tribal communities, various income-generating opportunities exist through sustainable cultivation and value-added processing of taro. By adopting organic farming practices, tribal farmers can access premium prices for their produce. Cultural tourism also presents an avenue for income as communities promote taro in traditional dishes to attract visitors. By participating in farmers' markets and local festivals, tribal communities can further enhance visibility and consumer awareness around the nutritional benefits of taro, thereby forging resilient economies built on this vital crop.

MORPHOLOGICAL AND TAXONOMICAL ANALYSIS OF TARO

The morphological and taxonomical analysis of Taro varieties in Kerala is essential for several reasons. It aids in preserving biodiversity by identifying unique local varieties important for ecological balance and resilience against pests and diseases. Understanding these varieties also holds cultural significance, linking them to traditional culinary practices, which strengthens community identity. Furthermore, the analysis informs sustainable agricultural practices by helping farmers select suitable varieties for local conditions, ultimately enhancing food security.

MORPHOLOGICAL STUDY OF TARO

C. esculenta is a tall herb having tuberous or a stout short caudex, leafing and flowering together. Leaves are simple and have a stout petiole, ovate-cordate or sagittate-cordate, lamina peltate. Spadix is shorter than the petiole and much it is shorter than the spathe rather than slender. Appendix much shorter than the inflorescence, style very short; stigma discoid . It is erect, elongate conical or fusiform, subulate or abbreviate. Erect petiole is up to 1.2 m in length, with a dull and non-polished surface above, coloured or paler beneath. They are rarely glaucous. The leaf peduncle is shorter than the petiole. Spathe is pale yellow and measures 15 to 35 cm in length; tube greenish, oblong. The lamina is narrowly lanceolate, convolute, acuminate and curved slightly backwards in flower. Female inflorescence is short but male inflorescence is long, cylindrical and usually interposed neuters between the two. Seeds oblong, sulcate. Albumen copious; embryo axile. The plant stem is above ground and swollen slightly at the base of the leaf-sheaths, arising from a hard tapering rhizome; stolon's and a tuberous rhizome suckers are sometimes present. The sterile flower zone and the distal appendage shorter than the fertile zones. Fruit is a many-seeded berry, densely packed and forming a fruiting head. Seeds are ovoid to ellipsoid, less than 2 mm long, with copious endosperm (Acevedo et al., 2005).

CULTIVATION PRACTICES AND HARVESTING

In Kerala, taro, thrives due to the region's favorable climate and soil conditions. With its rich biodiversity and agricultural practices, Kerala offers an ideal environment for cultivating different varieties of Colocasia. Colocasia cultivation involves planting corms in well-drained, fertile soil with ample sunlight and regular watering. It's important to maintain proper spacing between plants to allow for growth. Mulching helps retain moisture and suppress weeds. Regular fertilization promotes healthy growth, and harvesting is typically done when the leaves and tubers reach maturity. Taro is best planted during the pre-monsoon period which is known as 'Kumbham' (March–May) and harvested in 6- 8 months after planting. Yellowing and drying of leaves indicate maturity.

PAAL CHEMBU

(Xanthosoma sagitifolium)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS		STATE
Plant height		n=149.6 cm, Tall
Growth habit		Fasciate
Plant type		Spreading
Position of leaf		Erect apex down
Leaf number		7, Few
Leaf type		Simple
Leaf length		n=50.6 cm, Large
Leaf width	Higher	n=41.6 cm, Large
	Lower	n=8 cm, Large
Depth of sinus		12 cm
Shape of sinus		V shaped
Leaf colour	Dorsal	Green
	Ventral	Light green
Leaf main vein colour		Light green
Leaf vein pattern		Y pattern
Leaf blade colour		Green
Leaf blade margin pattern		Undulate
Shape of leaf tip		Pointed
Petiole colour		Light green
Petiole junction colour		Pale green
Petiole bent at lamina junction		Medium
Petiole length		71 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		37cm , High
Corm shape		Long round
Corm skin surface		Scales present
Corm skin colour		Brown
Degree of fibrousness		Sparse
Corm flesh colour		White
Corm flesh colour cutting after five minutes.		White colour with brown spots.
Corm cortex colour		White
Number of cormels		Few
Flowering		Present
Colour of flower	Spathe	Yellow
	Spadix	Yellow
Harvesting time		5-6 Months , intermediate
Edibility		Tubers

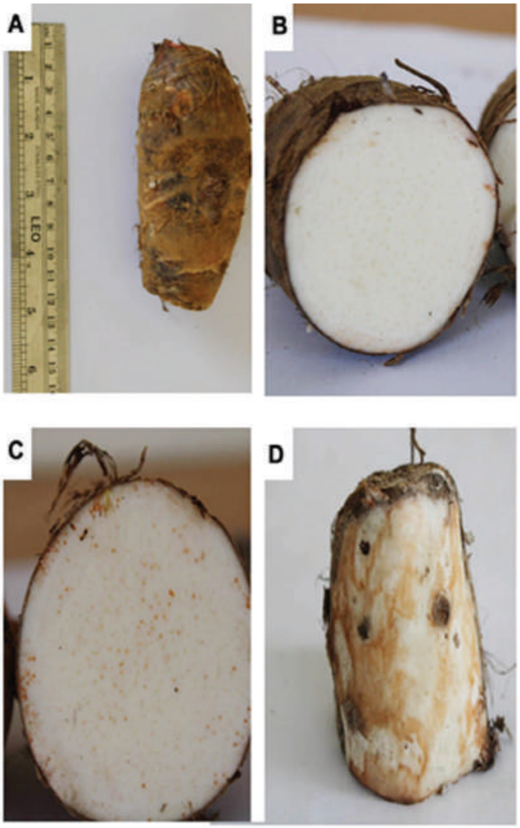
Palchembu

Habitat

Leaf

Dorsal Side

Petiole



A. Tuber B. After Cutting
C. After Five Minutes D. Skin

VETTU CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS		STATE
Plant height		n=130 cm, Tall
Growth habit		Fasciate
Plant type		Erect
Position of leaf		Cup shapded
Leaf number		n= 11, many
Leaf type		Simple
Leaf length		n=50 cm, Large
Leaf width	Higher	n=35.5 cm, Large
	Lower	n=5 cm, Large
Depth of sinus		n= 5 cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Pale green
	Ventral	Green
Leaf main vein colour		Dark green
Leaf vein pattern		V pattern
Leaf blade colour		Purple
Leaf blade margin pattern		Sinuate
Shape of leaf tip		Slightly pointed
Petiole colour		Blackish purple
Petiole junction colour		Purple
Petiole bent at lamina junction		High
Petiole length		n= 40 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		n= 65 cm
Edibility		Tuber, immature petiole and leaves.
Corm shape		Conical
Corm skin surface		Scales and fibrous present
Corm skin colour		Dark brown
Degree of fibrousness		Intermediate
Corm flesh colour		White
Corm flesh colour cutting after five minutes.		White colour with pale yellow spots.
Corm cortex colour		Purple
Number of cormels		Few
Flowering		Present
Colour of flower	Spathe	Yellow
	Spadix	Yellow
Harvesting time		5-6 Months , intermediate
Edibility		Tubers

Vettu Chembu

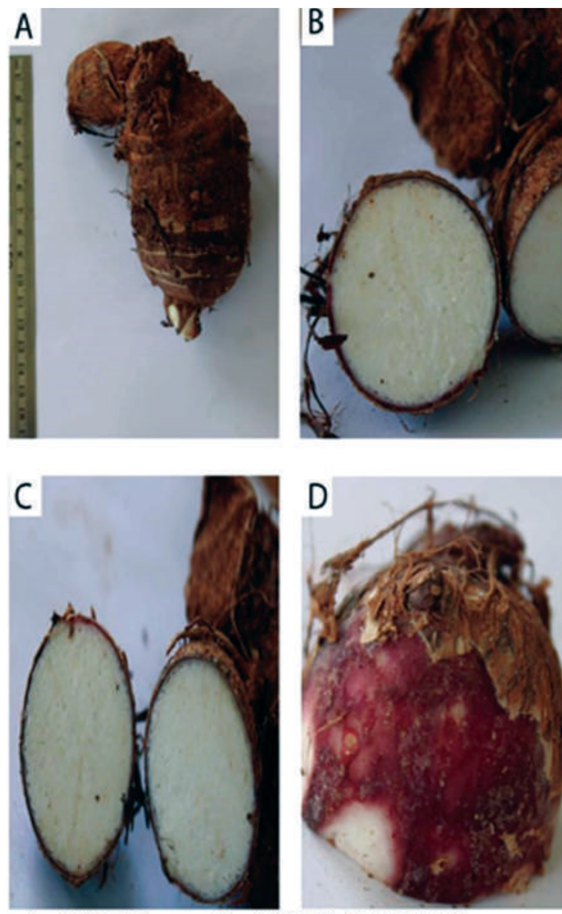
Habitat

Leaf

Dorsal Side

Petiole

Petiole Juncation



A. TUBER B. AFTER CUTTING
C. AFTER FIVE MINUTES D. SKIN

ANAKOMBAN

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERISTICS

Corm shape	Long round
Corm skin surface	Scales and fibrous present
Corm skin colour	Dark brown
Degree of fibrousness	Intermediate
Corm flesh colour	White
Corm flesh colour cutting after five minutes.	White colour with brown spots.
Corm cortex colour	White with orange shades
Number of cormels	Few
Harvesting time	5-6 Months , intermediate
Edibility	Tubers, petiole

CHARACTERISTICS		STATE
Plant height		n=95 cm, Medium
Growth habit		Fasciate
Plant type		Erect
Position of leaf		Erect apex down
Leaf number		n= 3, low
Leaf type		Simple
Leaf length		n=40 cm, Large
Leaf width	Higher	n=30.5 cm, Large
	Lower	n=9 cm, Large
Depth of sinus		n= 9 cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Pale green
	Ventral	Pale green
Leaf main vein colour		Pale green
Leaf vein pattern		V pattern
Leaf blade colour		Green
Leaf blade margin pattern		Undulate
Shape of leaf tip		pointed
Petiole colour		Pale green
Petiole junction colour		Pale green
Petiole bent at lamina junction		Low
Petiole length		n= 30 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		n= 35 cm
Edibility		Tuber, immature petiole and leaves.

Habitat

Leaf

Dorsal Side

Petiole

Petiole Juncation

. TUBER B. AFTER CUTTING
. AFTER FIVE MINUTES D. SKIN

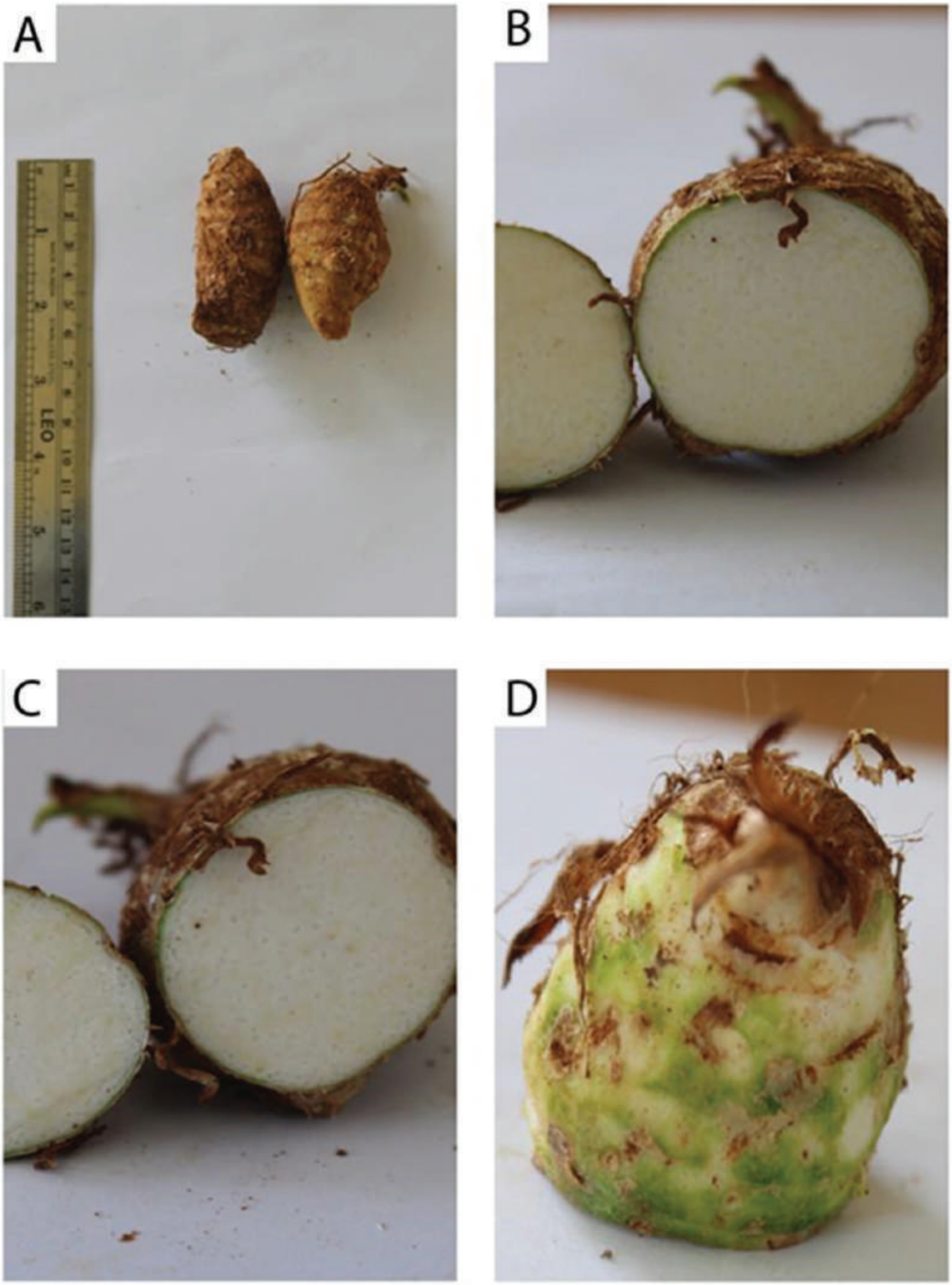
ARATTUPUZHA KANNAN

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERISTICS:

CHARACTERISTICS	STATE
Corm shape	Cylindrical
Corm skin surface	Fibrous
Corm skin colour	Light brown
Degree of fibrousness	Low
Corm flesh colour	White
Corm flesh colour cutting after five minutes.	White colour with pale yellow spots.
Corm cortex colour	Green
Number of cormels	Medium
Harvesting time	5-6 Months , intermediate
Edibility	Tubers, petiole

Araattupuzha Kannan



A. TUBER B. AFTER CUTTING
C. AFTER FIVE MINUTES D. SKIN

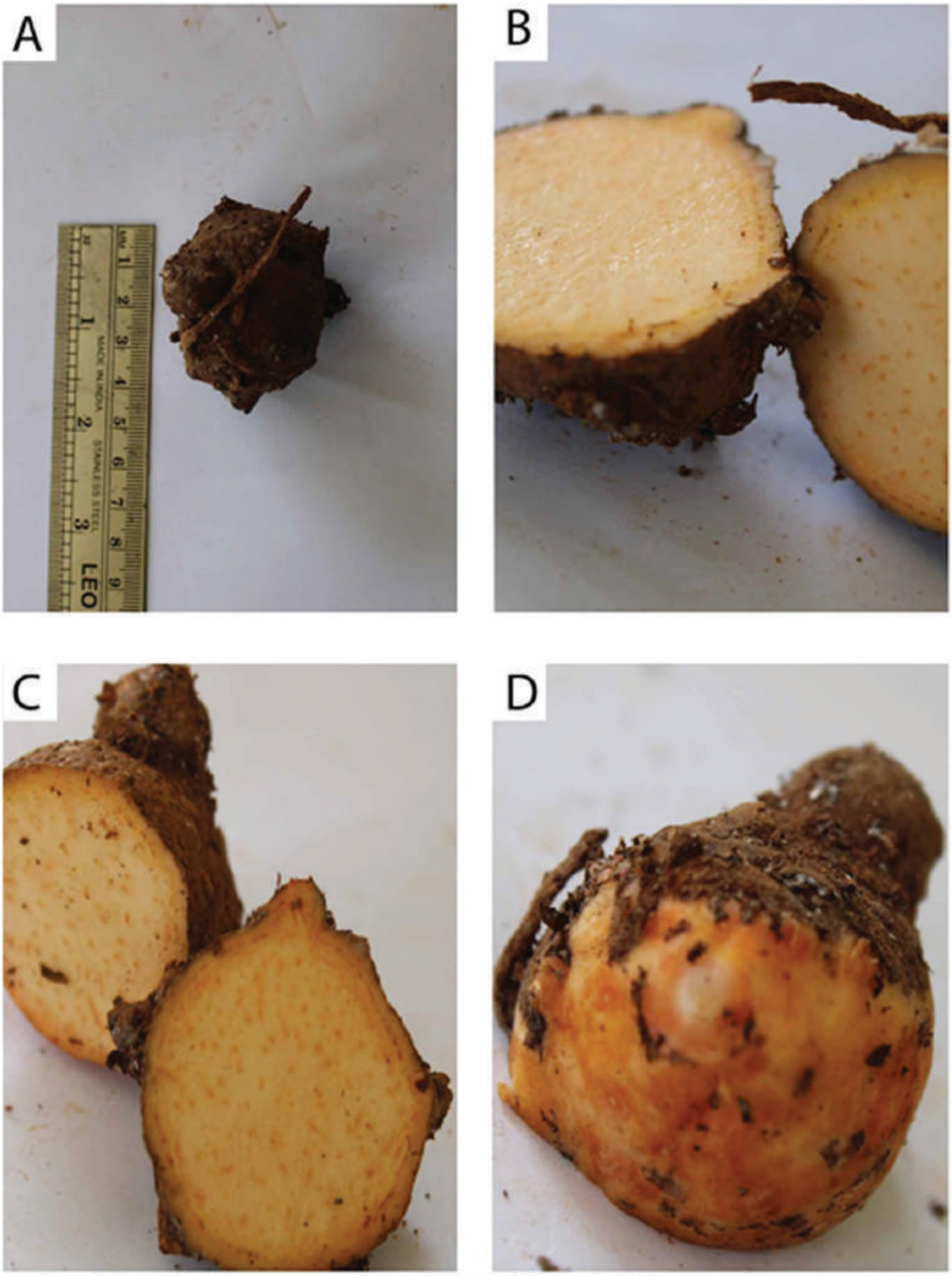
NEYCHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Corm shape	Conical
Corm skin surface	Scales present
Corm skin colour	Dark brown
Degree of fibrousness	Low
Corm flesh colour	Creamy yellow
Corm flesh colour cutting after five minutes.	Light orange
Corm cortex colour	Reddish orange
Number of cormels	Medium
Harvesting time	5-6 Months , intermediate
Edibility	Tubers

Ney Chembu



A. TUBER B. AFTER CUTTING
C. AFTER FIVE MINUTES D. SKIN

MAKKALEPOTTI

Colocasia esculenta

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS		STATE
Plant height		n=63.3cm, Medium
Growth habit		Fasciate
Plant type		Spreading
Position of leaf		Erect apex up
Leaf number		5, Few
Leaf type		Simple
Leaf length		n=30.3 cm, Large
Leaf width	Higher	n=18.3cm, Large
	Lower	n=8 cm, Large
Depth of sinus		9cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Light green
	Ventral	Light green
Leaf main vein colour		Light green
Leaf vein pattern		V pattern
Leaf blade colour		Light green
Leaf blade margin pattern		Sinuate
Shape of leaf tip		Rounded
Petiole colour		Light green
Petiole junction colour		Pale green
Petiole bent at lamina junction		Medium
Petiole length		41 cm large
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		34 cm, High
Corm shape		Cylindrical
Corm skin surface		Scales and fibrous present
Corm skin colour		Brown
Degree of fibrousness		Sparse
Corm flesh colour		White
Corm flesh colour cutting after five minutes.		No colour change
Corm cortex colour		White
Number of cormels		Many
Flowering		Absent
Harvesting time		Within 5 months , early
Edibility		Tubers, petiole

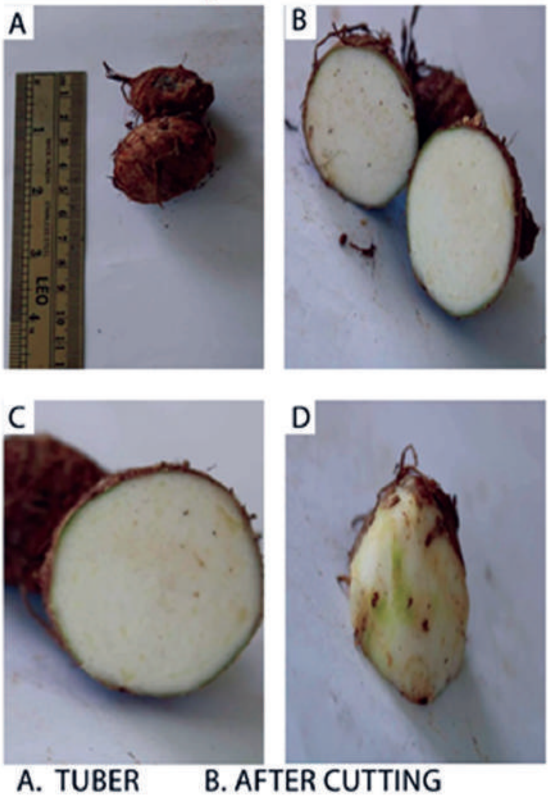
Makkalepotti

Tuber

Habitat

Leaf

Petiole



A. TUBER B. AFTER CUTTING
C. AFTER FIVE MINUTES D. SKIN

NANACHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS		STATE
Plant height		n=81 cm, Intermediate
Growth habit		Fasciate
Plant type		Spreading
Position of leaf		Cup shaped
Leaf number		6, Few
Leaf type		Simple
Leaf length		n=46.3 cm, Large
Leaf width		Higher 22.6 cm, Large
		Lower 7 cm, Large
Depth of sinus		10 cm
Shape of sinus		V shaped
Leaf colour	Dorsal	Green
	Ventral	Light green
Leaf main vein colour		Yellowish green
Leaf vein pattern		V pattern
Leaf blade colour		Green
Leaf blade margin pattern		Sinuate
Shape of leaf tip		Slightly pointed
Petiole colour		Light green
Petiole junction colour		Pale green
Petiole bent at lamina junction		Low
Petiole length		28.3 cm, Medium
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		20cm , Medium
Corm shape		Conical
Corm skin surface		Scales and fibrous present
Corm skin colour		Dark brown
Degree of fibrousness		Sparse
Corm flesh colour		White
Corm flesh colour cutting after five minutes.		No colour change
Corm cortex colour		Dark green
Number of cormels		Low
Flowering		Absent
Harvesting time		5-6 Months , intermediate
Edibility		Tubers

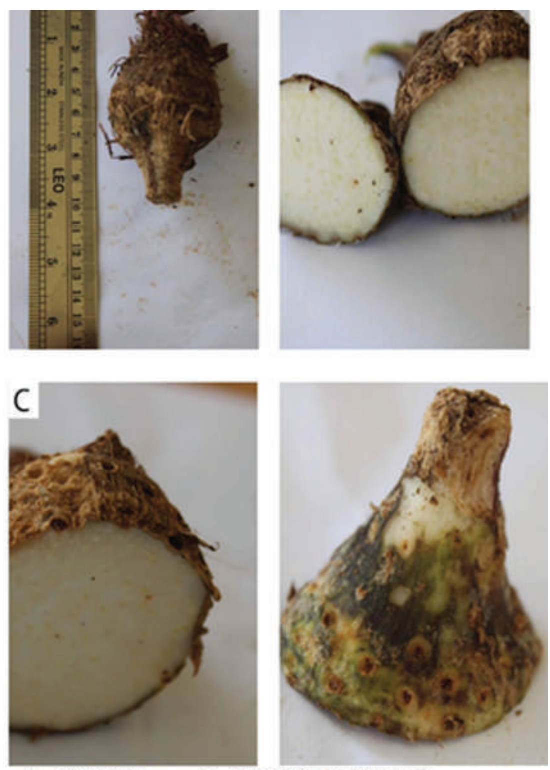
Nanachembu

Habitat

Leaf

Dorsal Side

Petiole



A. TUBER B. AFTER CUTTING
C. AFTER FIVE MINUTES D. SKIN

UPPERI CHEMBU TYPE 2/ CHEERACHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS		STATE
Plant height		n=83cm, Medium
Growth habit		Fasciate
Plant type		Spreading
Position of leaf		Erect apex up
Leaf number		5, Few
Leaf type		Simple
Leaf length		n=29.6 cm, Large
Leaf width	Higher	n=32 cm, Large
	Lower	n=5.6cm, Large
Depth of sinus		6 cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Yellowish green
	Ventral	Light green
Leaf main vein colour		Dark green
Leaf vein pattern		V pattern
Leaf blade colour		Green
Leaf blade margin pattern		Undulate
Shape of leaf tip		Pointed
Petiole colour		Light green
Petiole junction colour		Pale green
Petiole bent at lamina junction		Low
Petiole length		71 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		35cm, High
Edibility		Petiole, leaf

Upperichembu Type 2

Habitat

Leaf

Petiole

Petiole Junction

MARAN CHEMBU/ IYYA CHEMBU

(Alocasia macrorrhizos)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS		STATE
Plant height		n=72cm, medium
Growth habit		Fasciate
Plant type		Erect
Position of leaf		Erect apex down
Leaf number		5, Few
Leaf type		Simple
Leaf length		n=29.6 cm, Large
Leaf width	Higher	n=32 cm, Large
	Lower	n=5.6cm, Large
Depth of sinus		7 cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Green
	Ventral	Light green
Leaf main vein colour		Green
Leaf vein pattern		V pattern
Leaf blade colour		Green
Leaf blade margin pattern		Undulate
Shape of leaf tip		Slightly round
Petiole colour		Light green
Petiole junction colour		Pale green
Petiole bent at lamina junction		Low
Petiole length		31 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		49cm , High
Edibility		Only for external use to cure ring worm

Maranchembu

Habitat

Leaf

Dorsal Side

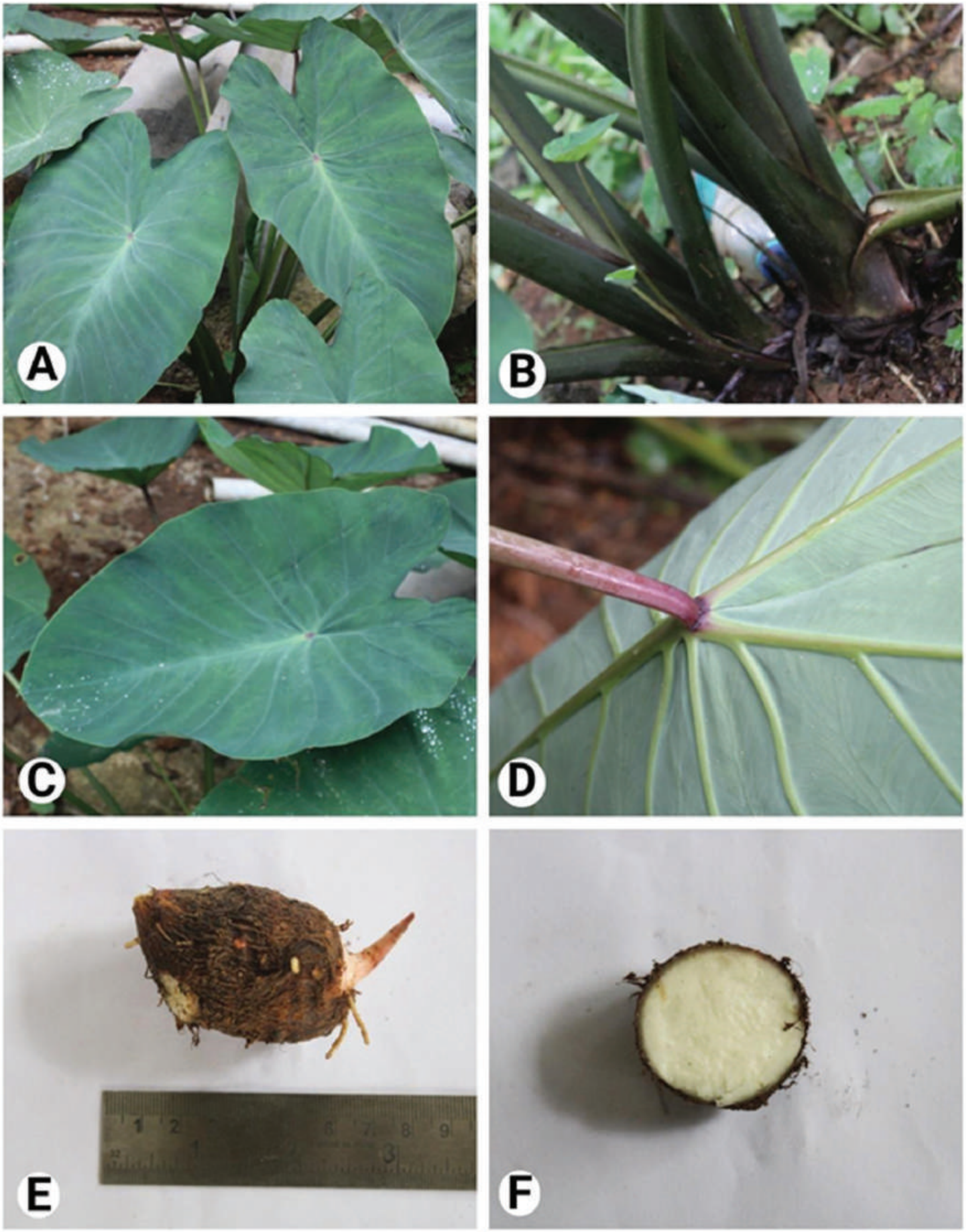
Petiole

THAMARAKANNAN CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS`STATE		
Plant height		70 cm, medium
Growth habit		Fasciate
Plant type		Spreading
Position of leaf		Erect apex down
Leaf number		4, Few
Leaf type		Simple
Leaf length		60 cm, Large
Leaf width	Higher	46 cm,
	Lower	11 cm,
Depth of sinus		9 cm
Shape of sinus		Ushaped
Leaf colour	Dorsal	Green
	Ventral	Light green
Leaf main vein colour		Green
Leaf vein pattern		V pattern
Leaf blade colour		Purple
Leaf blade margin pattern		Sinuate
Shape of leaf tip		Slightly rounded
Petiole colour		Green with light purple colour
Petiole junction colour		Purple
Petiole bent at lamina junction		Low
Petiole length		55 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		60cm, High
Flowering		Present
Colour of flower	Spathe	Yellow
	Spadix	Yellow
Harvesting time		5-6 Months, intermediate
Edibility		Tubers, petiole



*Colacasia esculen*ta var. Thamarakannan
A)Plant habit B) Petiole Sheath C) Ventral side of mature Leaf
D) Dorsal side of mature Leaf E) Tuber F) Cross section of tuber

KAPPACHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS STATE		
Plant height		67 cm, medium
Growth habit		Fasciate
Plant type		Spreading
Position of leaf		Erect apex down
Leaf number		5, Few
Leaf type		Simple
Leaf length		48 cm, Large
Leaf width	Higher	29 cm,
	Lower	4cm,
Depth of sinus		17cm
Shape of sinus		V shaped
Leaf colour	Dorsal	Green
	Ventral	Light green
Leaf main vein colour		Blackish purple
Leaf vein pattern		Y pattern
Leaf blade colour		Purple
Leaf blade margin pattern		Undulate
Shape of leaf tip		Slightly rounded
Petiole colour		Blackish purple
Petiole junction colour		Blackish Purple
Petiole bent at lamina junction		High
Petiole length		40 cm
Presence of anthocyanin pigmentation in leaf vein		Present
Sheath length		37cm , High
Flowering		Present
Colour of flower	Spathe	Yellow
	Spadix	Yellow
Harvesting time		5-6 months, intermediate
Edibility		Tubers,petiole, leaf

Kappachembu

Habitat

Leaf

Dorsal Side

Petiole

Petiole Junction

UPPERI CHEMBU TYPE 1 /Cheera chembu type

(Colocasia gigantean)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS		STATE
Plant height		n=90 cm, Medium
Growth habit		Non fasciate
Plant type		Spreading
Position of leaf		Erect apex down
Leaf number		n= 5, low
Leaf type		Simple
Leaf length		n=45 cm, Large
Leaf width	Higher	n=38 cm, Large
	Lower	n=17 cm, Large
Depth of sinus		n= 6.5 cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Dark green
	Ventral	Pale green
Leaf main vein colour		Pale green
Leaf vein pattern		Y pattern
Leaf blade colour		Pale green
Leaf blade margin pattern		Sinuate
Shape of leaf tip		Slightly round
Petiole colour		Pale green
Petiole junction colour		White
Petiole bent at lamina junction		Absent
Petiole length		n= 45 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		n= 6 cm
Edibility		Leaves and petiole

Upperichembu Type1

Habitat

Leaf

Dorsal Side

Petiole

Petiole Junction

PINDALAN CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS		STATE
Plant height		n=235 cm, Very tall
Growth habit		Non fasciate
Plant type		Erect
Position of leaf		Erect apex down
Leaf number		n= 2, low
Leaf type		Simple
Leaf length		n=91 cm, Large
Leaf width	Higher	n=78 cm, Large
	Lower	n=18 cm, Large
Depth of sinus		n= 9 cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Dark green
	Ventral	Pale green
Leaf main vein colour		Dark green
Leaf vein pattern		V pattern
Leaf blade colour		Purple
Leaf blade margin pattern		Sinuate
Shape of leaf tip		Slightly round
Petiole colour		Green with puple shade
Petiole junction colour		Purple
Petiole bent at lamina junction		Intermediate
Petiole length		n= 96 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		n= 88 cm
Edibility		Tuber and petiole

Pindalan Chembu

Habitat

Leaf

Dorsal Side

Petiole

Petiole Junction

KUDAVAZHA CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS		STATE
Plant height		n=60 cm, tall
Growth habit		Nonfasciate
Plant type		Erect
Position of leaf		Erect apex down
Leaf number		n= 7, medium
Leaf type		Simple
Leaf length		n=41 cm, intermediate
Leaf width	Higher	n=38 cm, intermediate
	Lower	n=5 cm, intermediate
Depth of sinus		n= 5 cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Pale green
	Ventral	Green
Leaf main vein colour		Pale green
Leaf vein pattern		V pattern
Leaf blade colour		Blackish Purple
Leaf blade margin pattern		Undulate
Shape of leaf tip		Slightly pointed
Petiole colour		Purple
Petiole junction colour		Red
Petiole bent at lamina junction		Absent
Petiole length		n= 51 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		n= 9 cm
Edibility		Tuber and petiole and leaf

Kudavazhachembu

Habitat

Leaf

Dorsal Side

Petiole

Petiole Junction

VALAN CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS		STATE
Plant height		n=120 cm, tall
Growth habit		Non fasciate
Plant type		Spreading
Position of leaf		Cupshaped
Leaf number		n= 10, many
Leaf type		Simple
Leaf length		n=29 cm, intermediate
Leaf width	Higher	n=20.5 cm, intermediate
	Lower	n=2cm, intermediate
Depth of sinus		n= 4 cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Pale green
	Ventral	Green
Leaf main vein colour		Pale green
Leaf vein pattern		Y pattern
Leaf blade colour		green
Leaf blade margin pattern		Undulate
Shape of leaf tip		Pointed
Petiole colour		Green with purple tinge
Petiole junction colour		Some leaf purple colour, some leaf green colour
Petiole bent at lamina junction		Absent
Petiole length		n= 44 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		n= 30 cm
Edibility		Tuber and petiole

ValanChembu

Habitat

Leaf

Dorsal Side

Petiole

Petiole Junction

Tuber

MUKTHAKESHI

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS		STATE
Plant height		n=45 cm, Medium
Growth habit		Non fasciate
Plant type		Erect
Position of leaf		Erect apex down
Leaf number		n= 3, low
Leaf type		Simple
Leaf length		n=30 cm, medium
Leaf width	Higher	n=23 cm medium
	Lower	n=3 cm
Depth of sinus		n= 2.5 cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Pale green
	Ventral	Green
Leaf main vein colour		Green
Leaf vein pattern		V pattern
Leaf blade colour		Brown
Leaf blade margin pattern		Undulate
Shape of leaf tip		Slightly pointed
Petiole colour		Purple
Petiole junction colour		Purple
Petiole bent at lamina junction		Intermediate
Petiole length		n= 29cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		n= 16 cm
Edibility		Tuber

Mukathakeshi

Habitat

Leaf

Dorsal Side

Petiole

Petiole Junction

Tuber

KANNAN CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

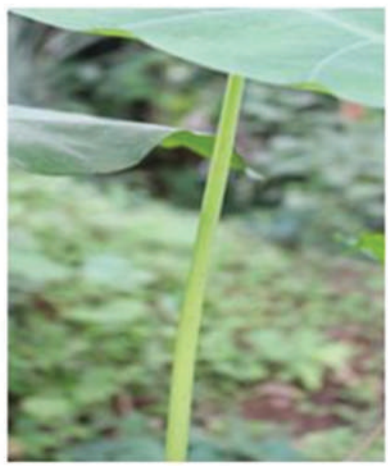
CHARACTERISTICS		STATE
Plant height		n=50 cm, Intermediate
Growth habit		Non fasciate
Plant type		Spreading
Position of leaf		Erect apex down
Leaf number		n= 12, many
Leaf type		Simple
Leaf length		n=34 cm, medium
Leaf width	Higher	n=30 cm, medium
	Lower	n=3 cm,
Depth of sinus		n= 5 cm
Shape of sinus		Wide U shaped
Leaf colour	Dorsal	Green
	Ventral	Pale green
Leaf main vein colour		Pale green
Leaf vein pattern		V pattern
Leaf blade colour		Blackish Purple
Leaf blade margin pattern		Undulate
Shape of leaf tip		Slightly round
Petiole colour		Pale green
Petiole junction colour		Purple
Petiole bent at lamina junction		Intermediate
Petiole length		n= 40 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		n= 10 cm
Edibility		Tuber and petiole

Kannanchembu

Habitat

Leaf

Dorsal Side



Petiole

Petiole Junction

Tuber

KARICHEMBU/ NEELACHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTIC		STATE
Plant height		n=50 cm, medium
Growth habit		Non fasciate
Plant type		Erect
Position of leaf		Erect apex down
Leaf number		n= 2, low
Leaf type		Simple
Leaf length		n=23 cm, small
Leaf width	Higher	n=17 cm, small
	Lower	n=2.4cm, small
Depth of sinus		n= 5 cm
Shape of sinus		U shaped
Leaf colour	Dorsal	Green
	Ventral	Green with bluish tinge
Leaf main vein colour		Dark blue
Leaf vein pattern		Y pattern
Leaf blade colour		Blackish blue
Leaf blade margin pattern		Undulate
Shape of leaf tip		Pointed
Petiole colour		Blackish purple
Petiole junction colour		Cream
Petiole bent at lamina junction		Intermediate
Petiole length		n= 46 cm
Presence of anthocyanin pigmentation in leaf vein		Present
Sheath length		n= 4 cm
Edibility		Tuber and petiole

Karichembu

Habitat

Leaf

Dorsal Side

Petiole

Petiole Junction

Tuber

CHERUCHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTIC	STATE	
Plant height		n=56 cm, medium
Growth habit		Non fasciate
Plant type		Erect
Position of leaf		Erect apex down
Leaf number		n= 3, low
Leaf type		Simple
Leaf length		n=45 cm, medium
Leaf width	Higher	n=35 cm, medium
	Lower	n=5 cm, medium
Depth of sinus		n= 7 cm
Shape of sinus		V shaped
Leaf colour	Dorsal	Yellowish green
	Ventral	Green
Leaf main vein colour		Green
Leaf vein pattern		V pattern
Leaf blade colour		Brown
Leaf blade margin pattern		Sinuate
Shape of leaf tip		Rounded
Petiole colour		Yellowish green
Petiole junction colour		Red
Petiole bent at lamina junction		High
Petiole length		n= 26 cm
Presence of anthocyanin pigmentation in leaf vein		Absent
Sheath length		n= 24 cm
Edibility		Tuber and petiole

Cheruchembu

Habitat

Leaf

Dorsal Side

Petiole

Petiole Junction

CHUVANNA CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

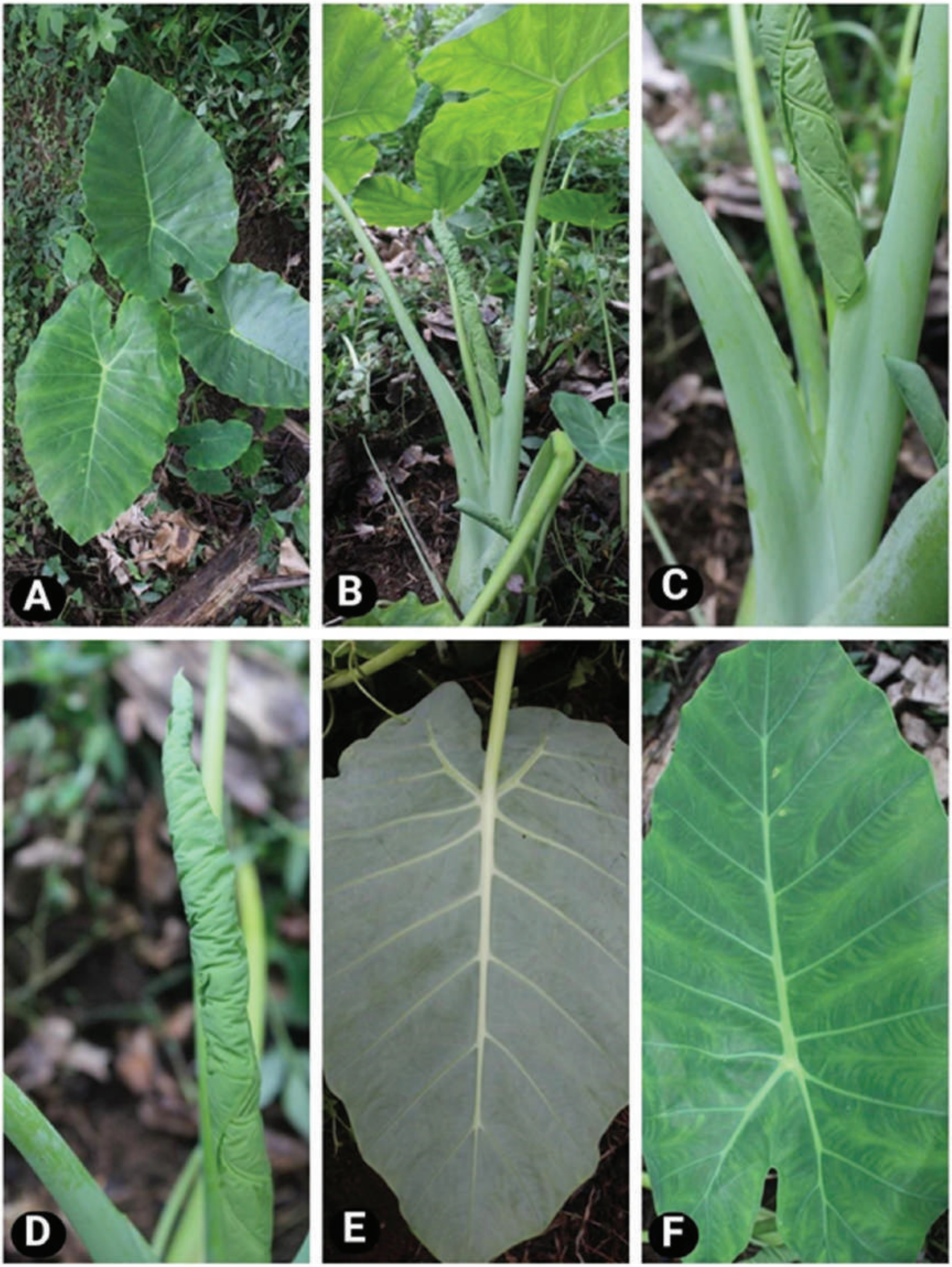
CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	fascitate
Plant type	spreading
Position of leaf	erect apex down
Leaf number	few, 5- 10
Leaf length	large 30 cm
Leaf width	large 25 cm
Depth of sinus	13 cm
Leaf colour	dark green
Leaf main vein colour	Green
Leaf vein pattern	v type
Leaf blade colour	dark green
Leaf blade margin pattern	sinuate margin
Shape of leaf tip	Pointed
Petiole colour	light green
Petiole junction colour	Yellow
Petiole bent at lamina junction	Intermediate
Petiole length	large greater than 30 cm
Sheath length	High

VELLA CHEMBU/ CHEERA CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Tall
Growth habit	non- fascitate
Plant type	Erect
Position of leaf	cup shaped
Leaf number	Few
Leaf length	Large
Leaf width	Large
Depth of sinus	8 cm
Leaf colour	light green
Leaf main vein colour	light green
Leaf vein pattern	V type
Leaf blade colour	light green
Leaf blade margin pattern	sinuate margin
Shape of leaf tip	slightly round
Petiole colour	light green
Petiole junction colour	Yellow
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	High



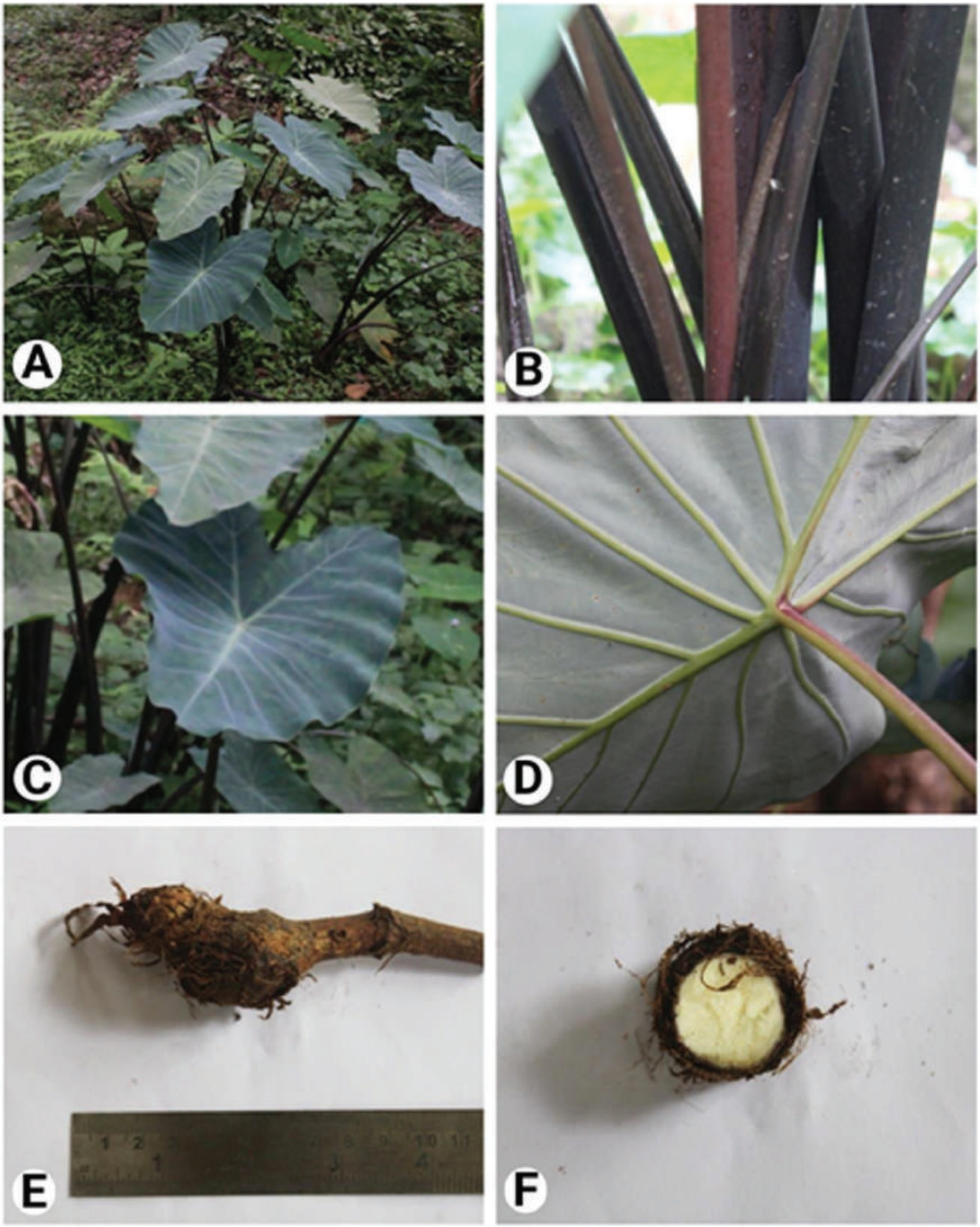
Colacasia esculenta var. vellachembu
A)Plant Habit B) Position of leaf C) Petiole Sheath D) Young leaf
E) Dorsal side of mature leaf F) Ventral side of mature leaf

ARAYA CHEMBU/ THADA CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Erect
Position of leaf	Erect apex down
Leaf number	Many
Leaf length	large 50 cm
Leaf width	large 30 cm
Depth of sinus	11 cm
Leaf colour	Dark green
Leaf main vein colour	Green
Leaf vein pattern	Y type
Leaf blade colour	dark green
Leaf blade margin pattern	Undulate margin
Shape of leaf tip	Intermediate
Petiole colour	Purple
Petiole junction colour	Purple
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	High
Corm shape	Cylindrical
Corm skin surface	Fibrous
Corm skin colour	Dark brown
Degree of fibrousness	Dense
Corm flesh colour	Creamish White
Number of cormels	Low



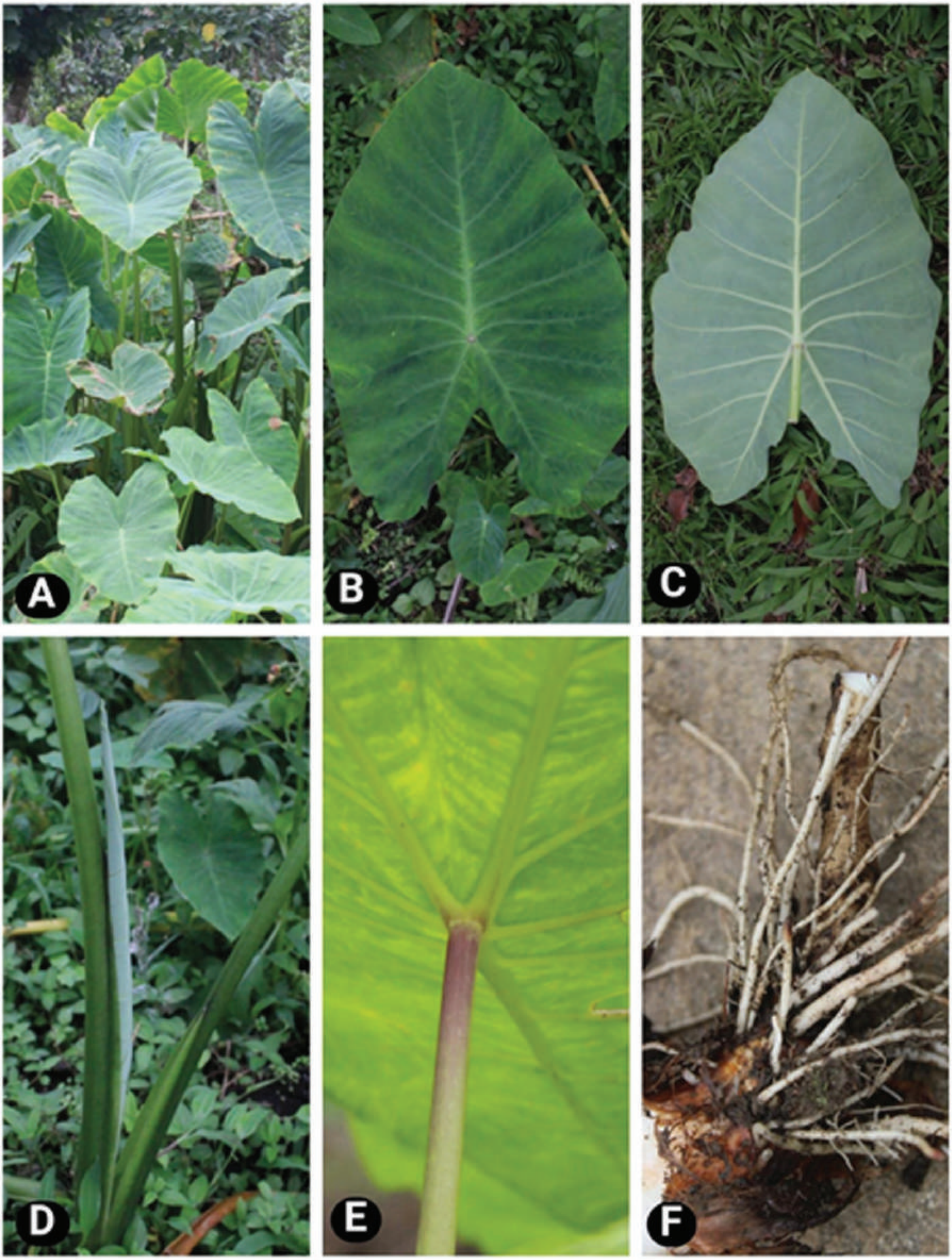
*Colacasia esculen*ta var. Arayachembu
A)Plant habit B) Petiole Sheath C) Ventral side of mature Leaf D) Dorsal side of mature Leaf E) Tuber F) Cross section of tuber

KATTU CHEMBU/ VELI CHEMBU

Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Spreading
Position of leaf	Erect apex down
Leaf number	Many
Leaf length	large 39 cm
Leaf width	large 25 cm
Depth of sinus	8 cm
Leaf colour	dark green
Leaf main vein colour	Green
Leaf vein pattern	V type
Leaf blade colour	dark green
Leaf blade margin pattern	Undulate margin
Shape of leaf tip	Slightly round
Petiole colour	Green with purple tip
Petiole junction colour	Purple
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium
Corm shape	Tube like small tuber
Corm skin surface	Smooth
Corm skin colour	Cream
Degree of fibrousness	Absent
Corm flesh colour	White
Number of cormels	Low



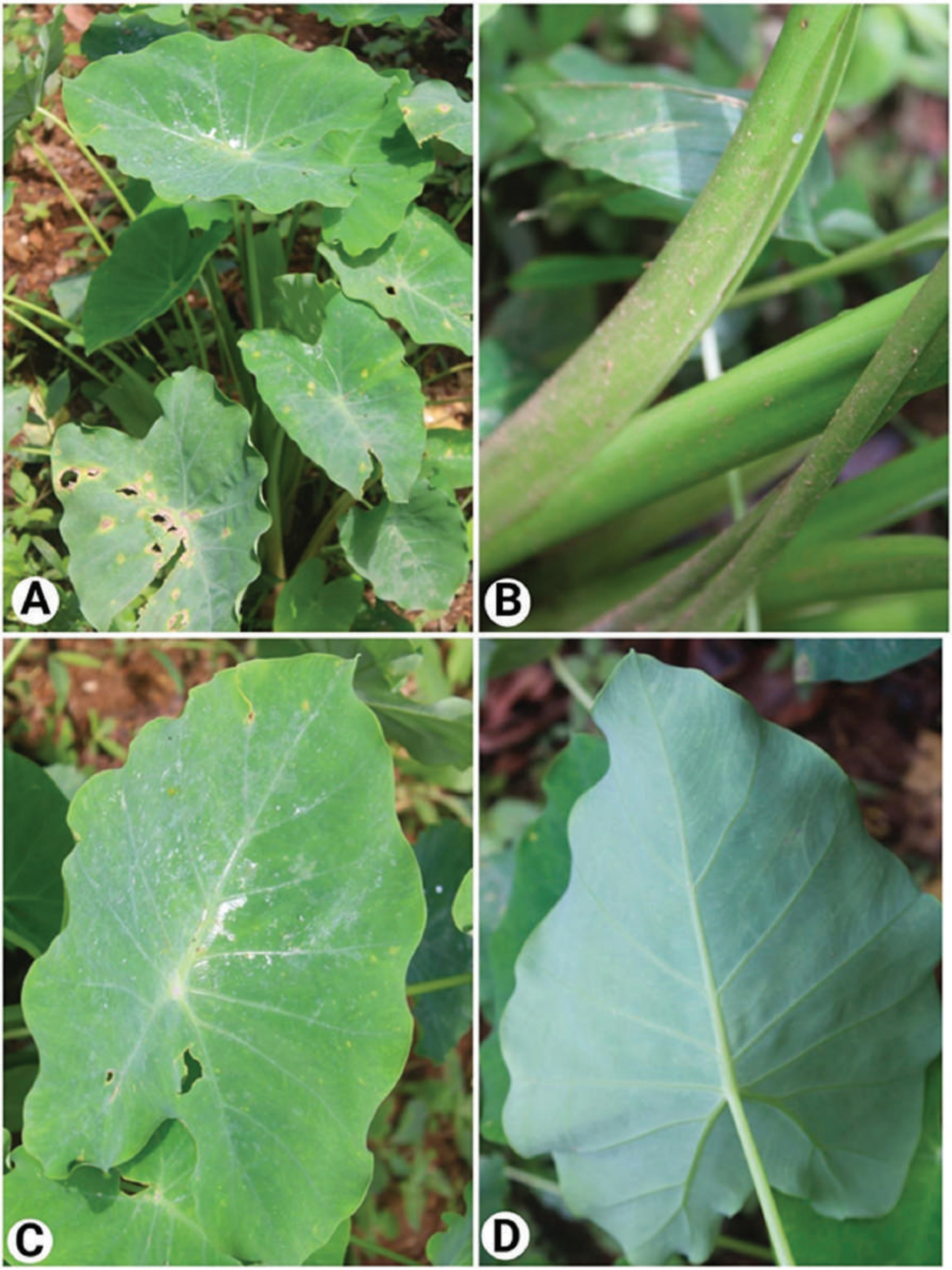
*Colacasia escul*enta var. velichembu / kattuchembu
A)Plant Habit B) Ventral side of mature leaf C) Dorsal side of mature leaf
D) Petiole Sheath E) Petiole F) Tuber

KUDAMALARAN CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Non Fascitate
Plant type	Erect
Position of leaf	Cup shaped
Leaf number	Few
Leaf length	large 30 cm
Leaf width	Large 23 cm
Depth of sinus	7 cm
Leaf colour	Green
Leaf main vein colour	Green
Leaf vein pattern	V type
Leaf blade colour	Green
Leaf blade margin pattern	Sinuate margin
Shape of leaf tip	Slightly pointed
Petiole colour	Green
Petiole junction colour	Green
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium



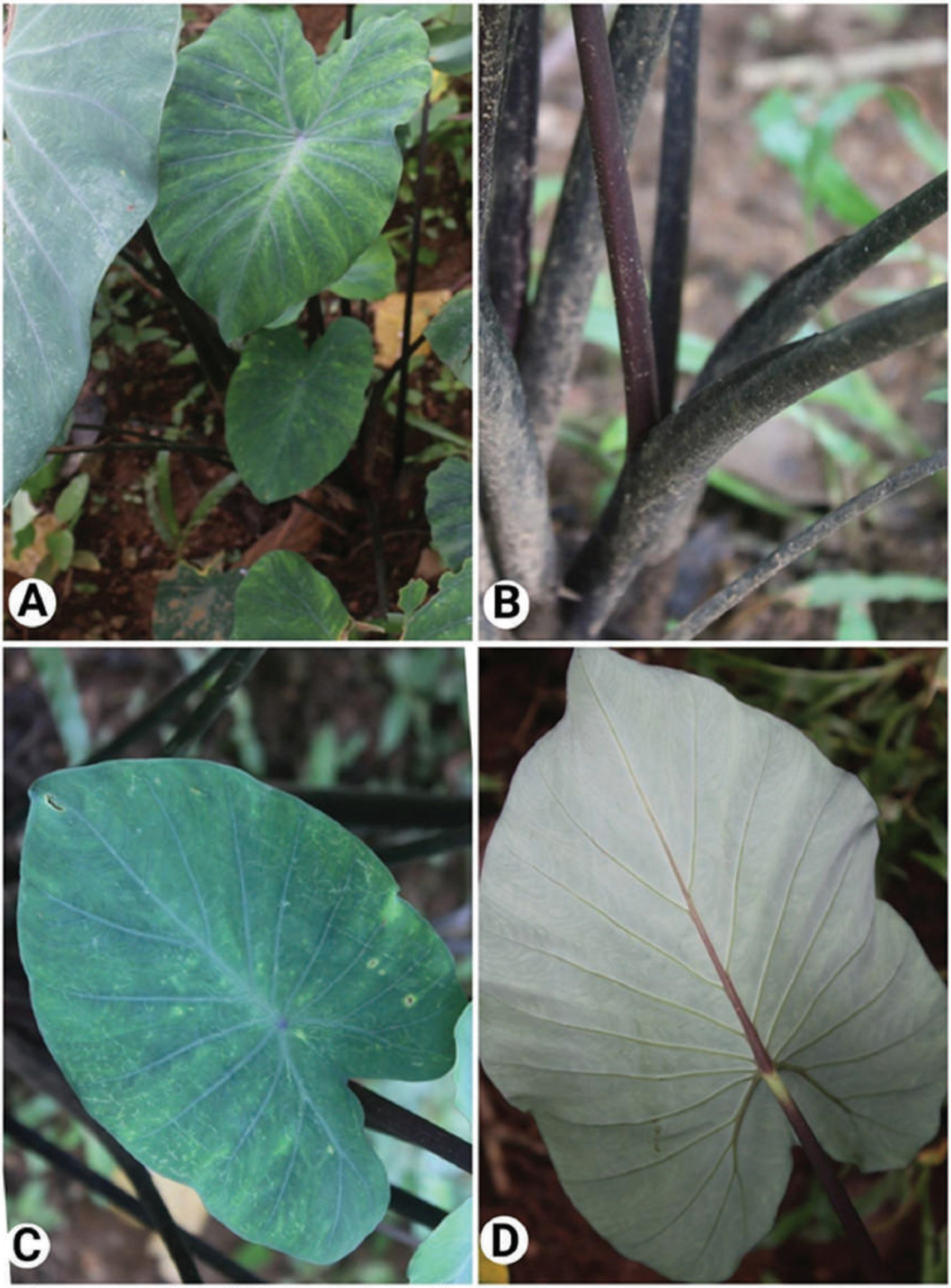
Colacasia esculenta (Var.kudamalaran)
A) Habit B) Mature stem C) Ventral side of mature Leaf D) Dorsal side of mature leaf

KARUTHA KANNAN CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Erect
Position of leaf	Erect apex down
Leaf number	Many
Leaf length	large 30 cm
Leaf width	large 23 cm
Depth of sinus	8 cm
Leaf colour	dark green
Leaf main vein colour	Purple
Leaf vein pattern	V type
Leaf blade colour	dark green
Leaf blade margin pattern	Undulate margin
Shape of leaf tip	Slightly round
Petiole colour	Blackish purple
Petiole junction colour	Purple
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium



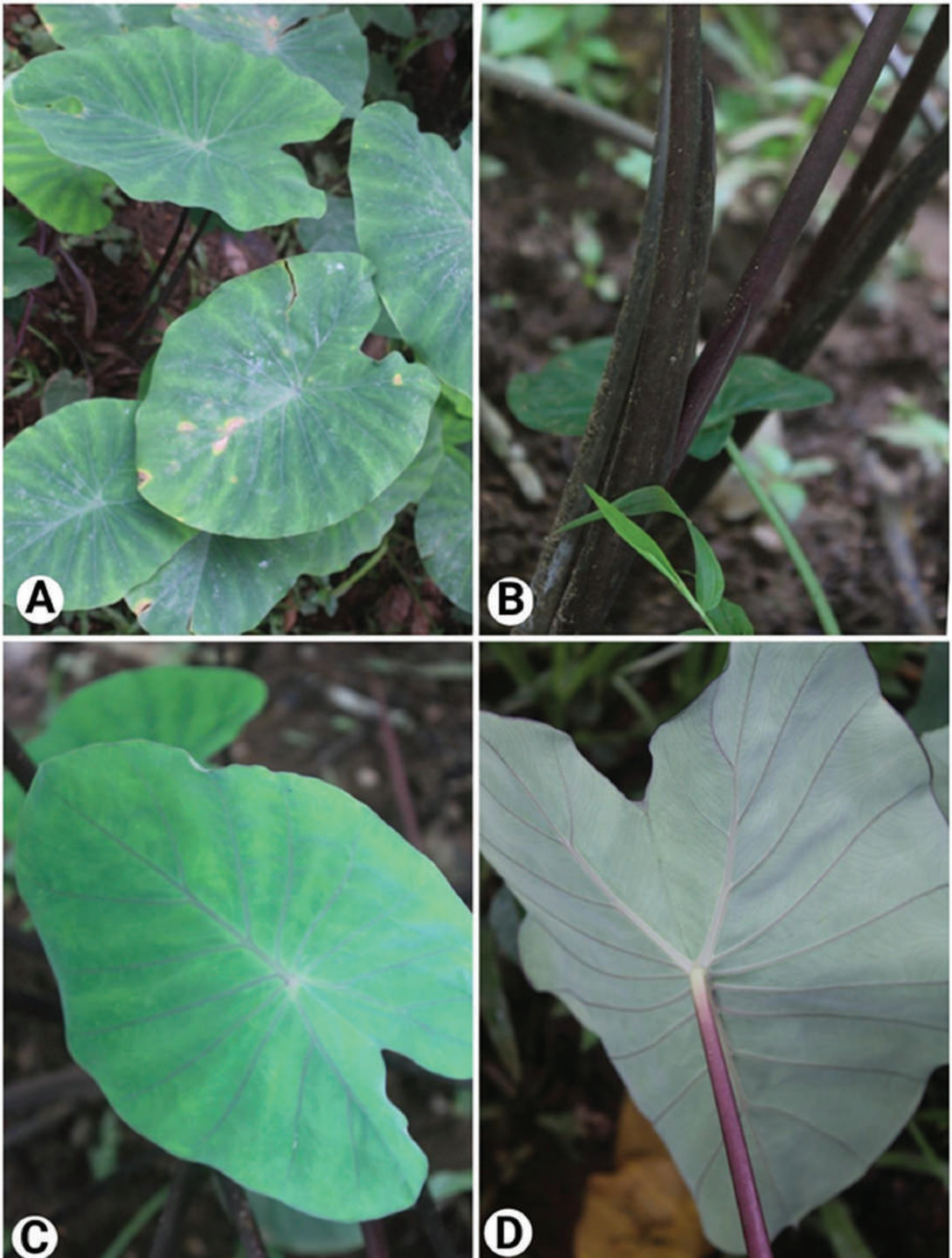
Colacasia esculenta (Var.Karuthakannan)
A) Habit B) Mature stem C) Ventral side of mature Leaf D) Dorsal side of mature leaf

KULA CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Erect
Position of leaf	Erect apex down
Leaf number	Many
Leaf length	large 28 cm
Leaf width	large 23 cm
Depth of sinus	5 cm
Leaf colour	dark green
Leaf main vein colour	Purple
Leaf vein pattern	V type
Leaf blade colour	dark green
Leaf blade margin pattern	Undulate margin
Shape of leaf tip	Round
Petiole colour	Purple
Petiole junction colour	Purple
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium



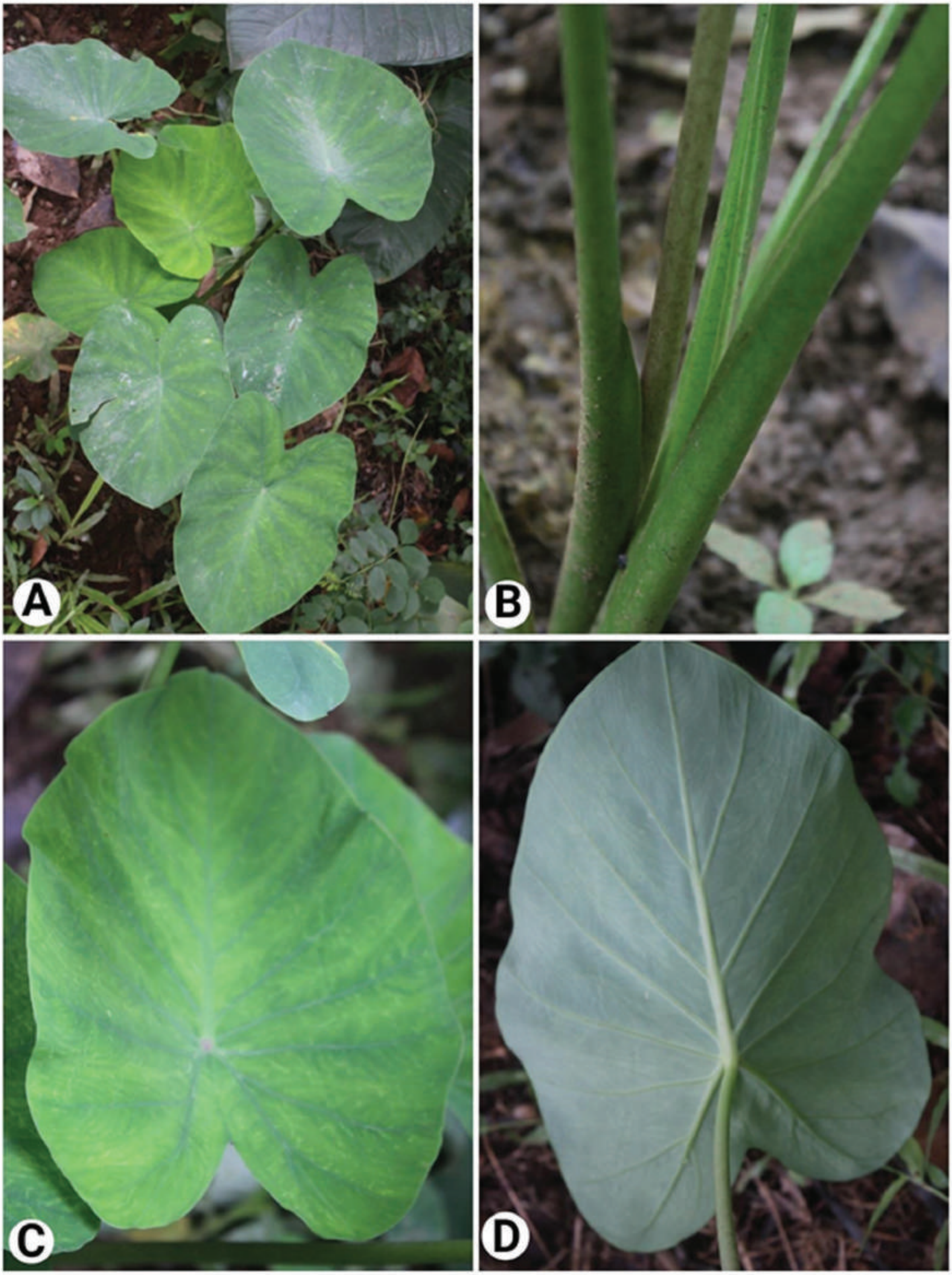
Colacasia esculenta (Var. Kulachembu)
A) Habit B) Mature stem C) Ventral side of mature Leaf D) Dorsal side of mature leaf

AATTU KANNAN CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Erect
Position of leaf	Cup shaped
Leaf number	Many
Leaf length	large 30 cm
Leaf width	large 22 cm
Depth of sinus	5.5 cm
Leaf colour	Green
Leaf main vein colour	Green
Leaf vein pattern	V type
Leaf blade colour	Green
Leaf blade margin pattern	Undulate margin
Shape of leaf tip	Round
Petiole colour	Green
Petiole junction colour	Green
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium



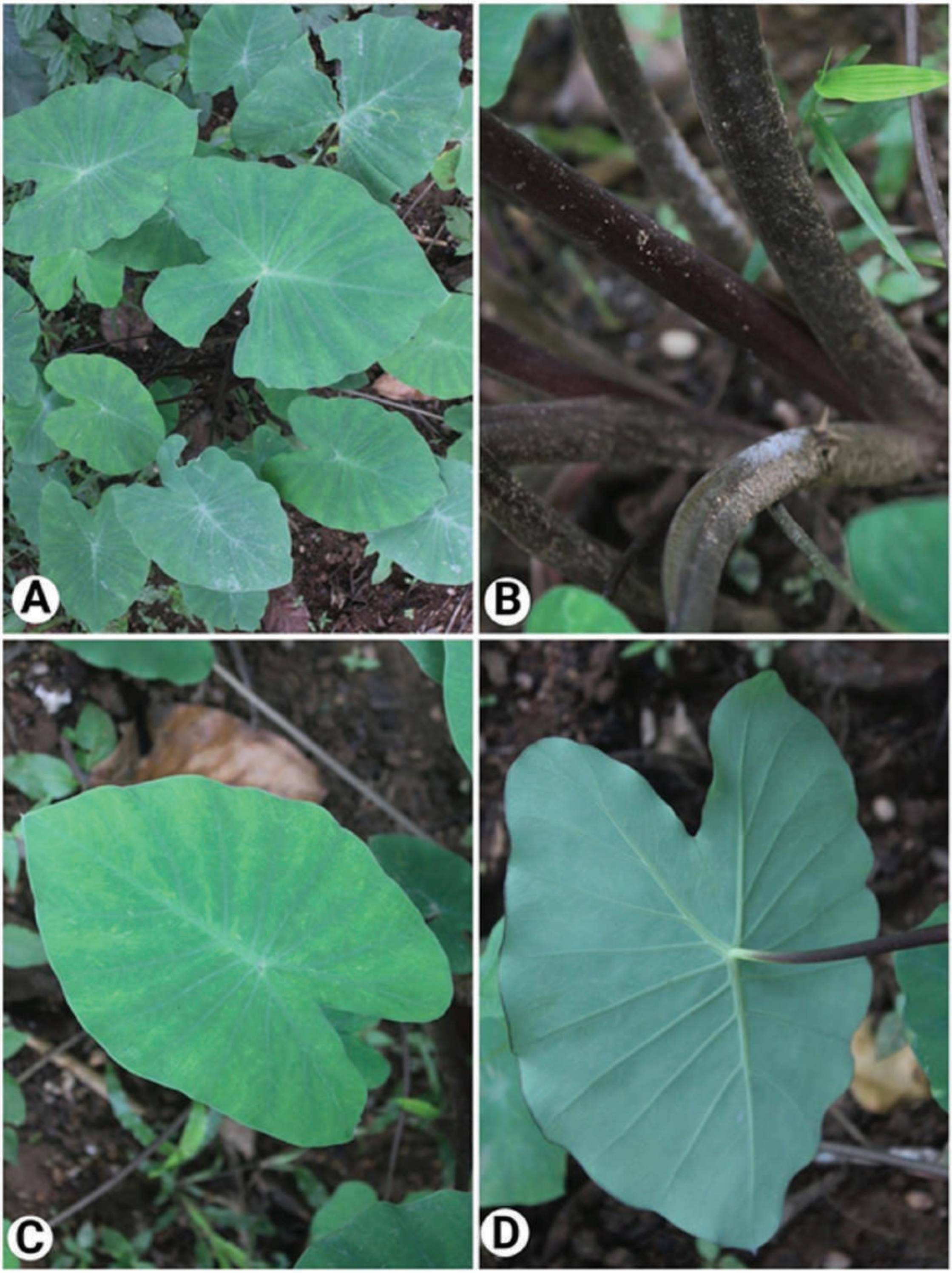
Colacasia esculenta (Var. Attukannan)
A) Habit B) Mature stem C) Ventral side of mature Leaf D) Dorsal side of mature leaf

CHORIYAN CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Erect
Position of leaf	Erect apex down
Leaf number	Many
Leaf length	Large 24 cm
Leaf width	Large 18 cm
Depth of sinus	6.5 cm
Leaf colour	Green
Leaf main vein colour	Green
Leaf vein pattern	V type
Leaf blade colour	Green
Leaf blade margin pattern	Undulate margin
Shape of leaf tip	Slightly pointed
Petiole colour	purple
Petiole junction colour	Green
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium



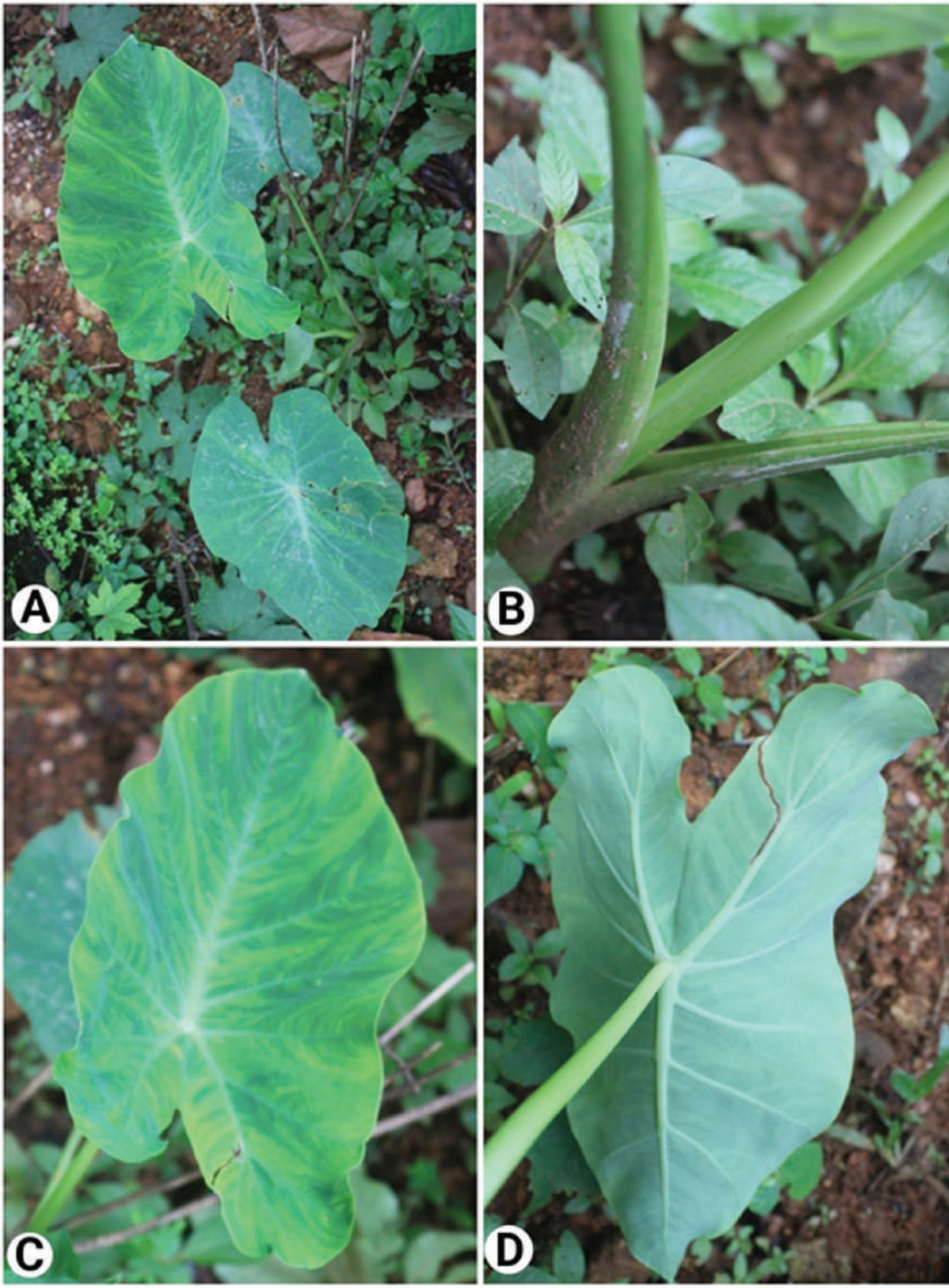
Colacasia esculenta (Var. Choriyan chembu)
A) Habit B) Mature stem C) Ventral side of mature Leaf D) Dorsal side of mature leaf

PODI CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Erect
Position of leaf	Cup shaped
Leaf number	Many
Leaf length	large 26 cm
Leaf width	large 17 cm
Depth of sinus	5 cm
Leaf colour	Green
Leaf main vein colour	Green
Leaf vein pattern	V type
Leaf blade colour	dark green
Leaf blade margin pattern	Undulate margin
Shape of leaf tip	Slightly pointed
Petiole colour	Green
Petiole junction colour	Green
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium



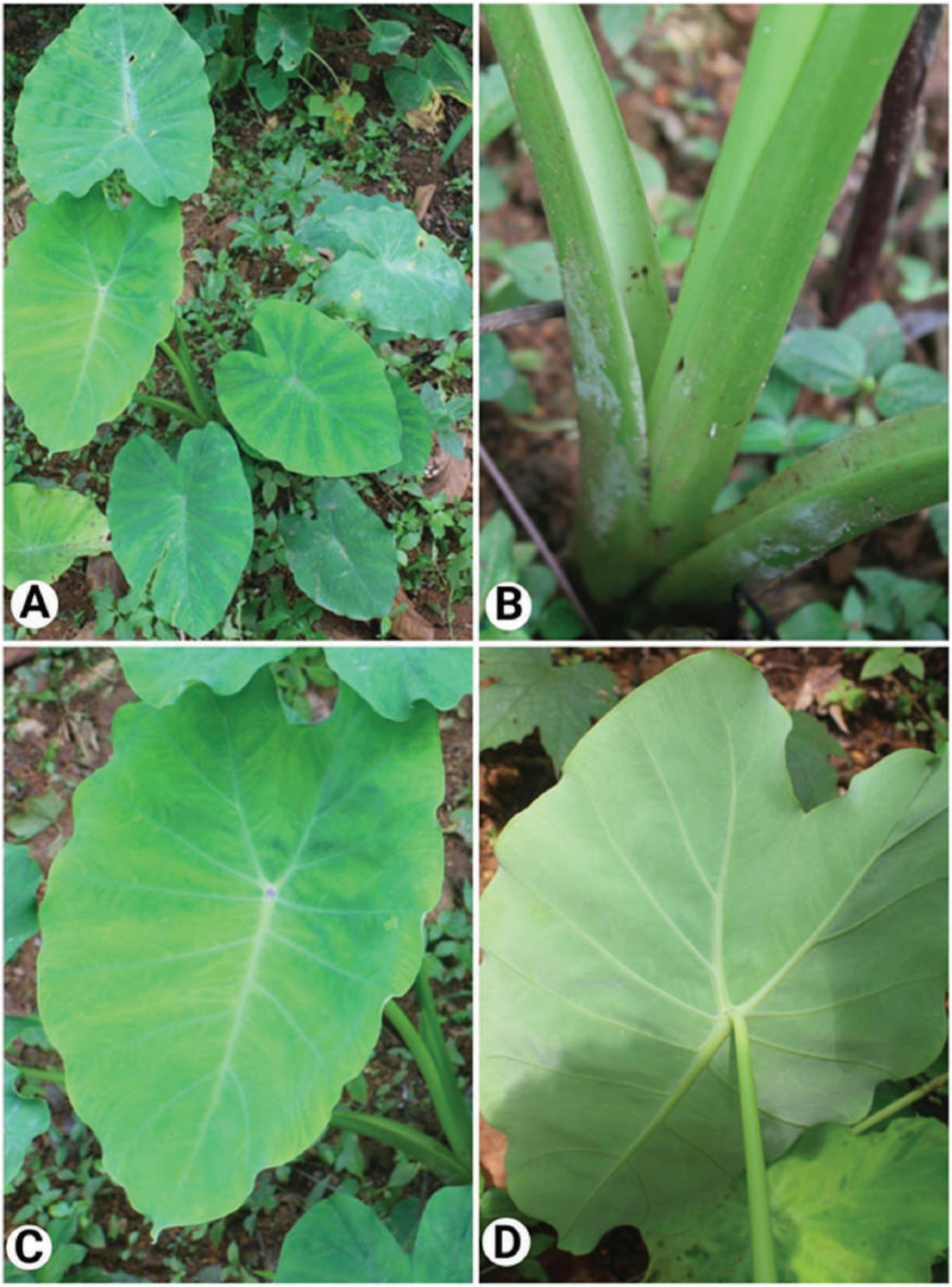
Colacasia esculenta (Var. Podi chembu)
A) Habit B) Mature stem C) Ventral side of mature Leaf D) Dorsal side of mature leaf

KOTTA CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Spreading
Position of leaf	Erect apex down
Leaf number	Many
Leaf length	large 37 cm
Leaf width	large 24 cm
Depth of sinus	7 cm
Leaf colour	Green
Leaf main vein colour	Green
Leaf vein pattern	V type
Leaf blade colour	Green
Leaf blade margin pattern	Sinuate margin
Shape of leaf tip	Slightly round
Petiole colour	Green
Petiole junction colour	Green
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium



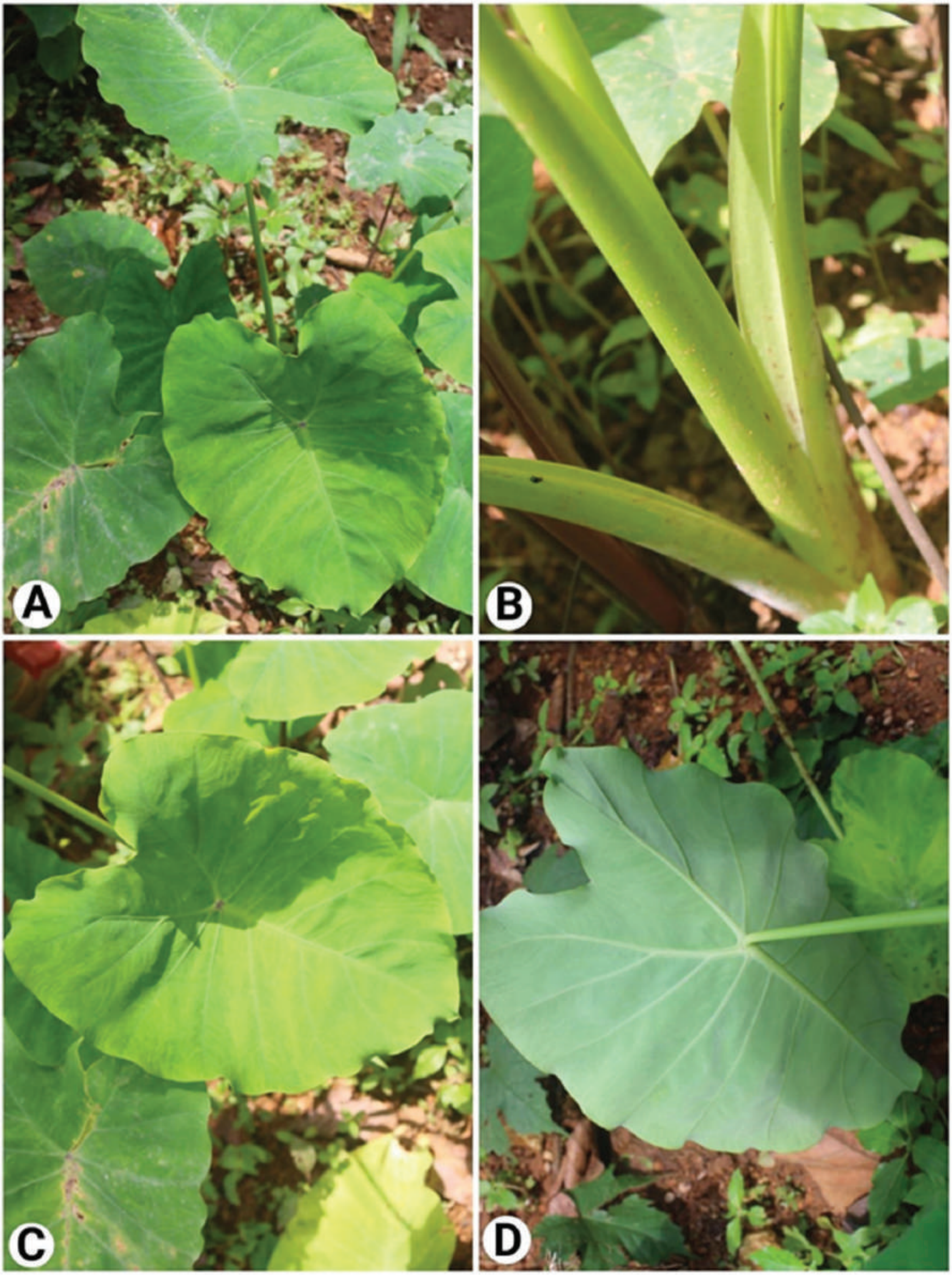
Colacasia esculenta (Var. Kotta chembu)
A) Habit B) Mature stem C) Ventral side of mature Leaf D) Dorsal side of mature leaf

CHEMBAN CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Spreading
Position of leaf	Erect apex down
Leaf number	Many
Leaf length	large 25 cm
Leaf width	large 18 cm
Depth of sinus	5.5 cm, broad sinus
Leaf colour	Green with a purple spot
Leaf main vein colour	Green
Leaf vein pattern	V type
Leaf blade colour	Light green
Leaf blade margin pattern	Undulate margin
Shape of leaf tip	Slightly round
Petiole colour	Green
Petiole junction colour	Green
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium



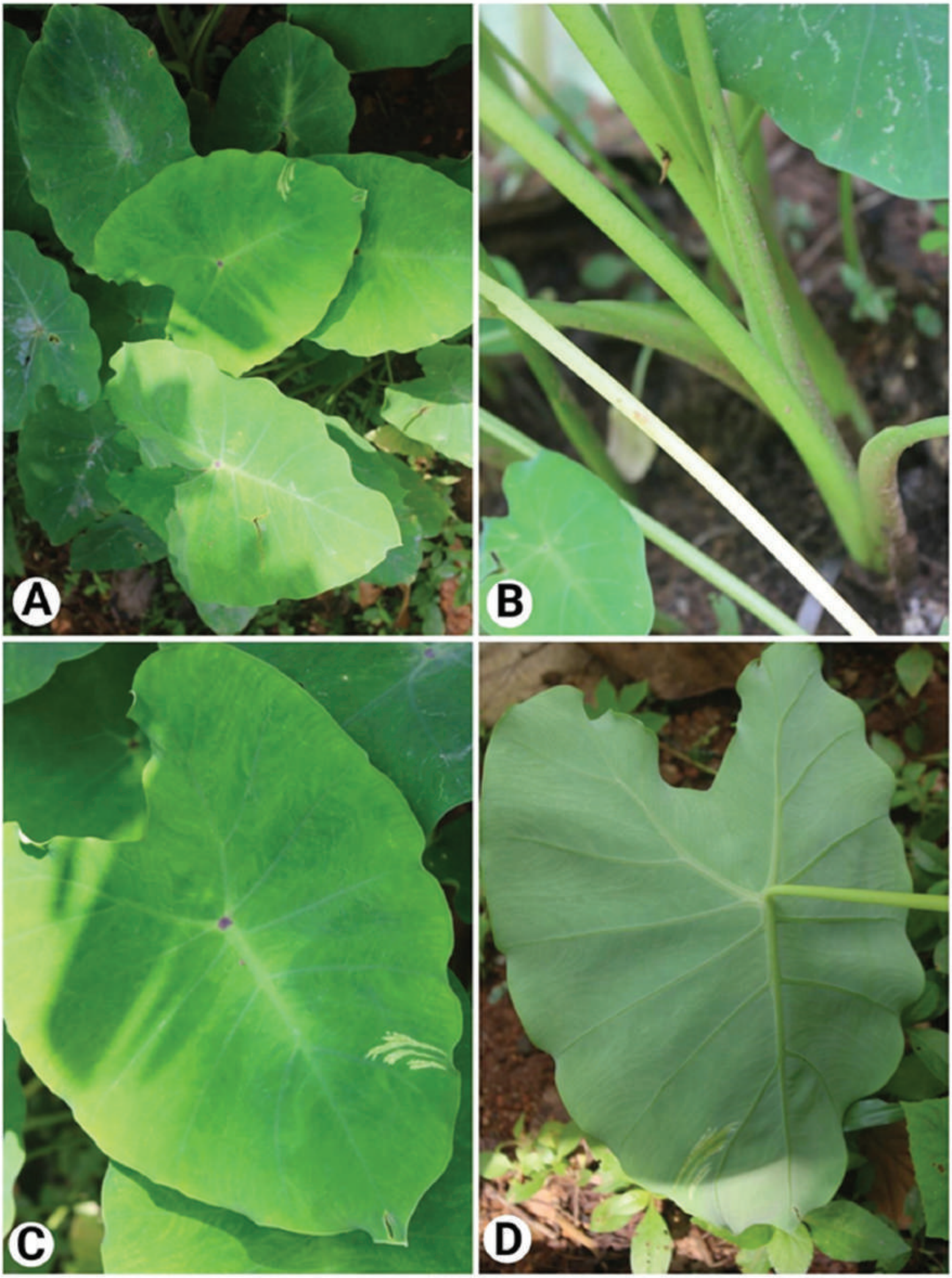
Colacasia esculenta (Var. Chemban chembu)
A) Habit B) Mature stem C) Ventral side of mature Leaf D) Dorsal side of mature leaf

MOTTA CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Spreading
Position of leaf	Erect apex down
Leaf number	Many
Leaf length	large 52 cm
Leaf width	large 37 cm
Depth of sinus	5 cm, broad sinus
Leaf colour	Green
Leaf main vein colour	Green
Leaf vein pattern	V type
Leaf blade colour	Light green
Leaf blade margin pattern	Sinuate margin
Shape of leaf tip	Slightly pointed
Petiole colour	Green
Petiole junction colour	Green
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium



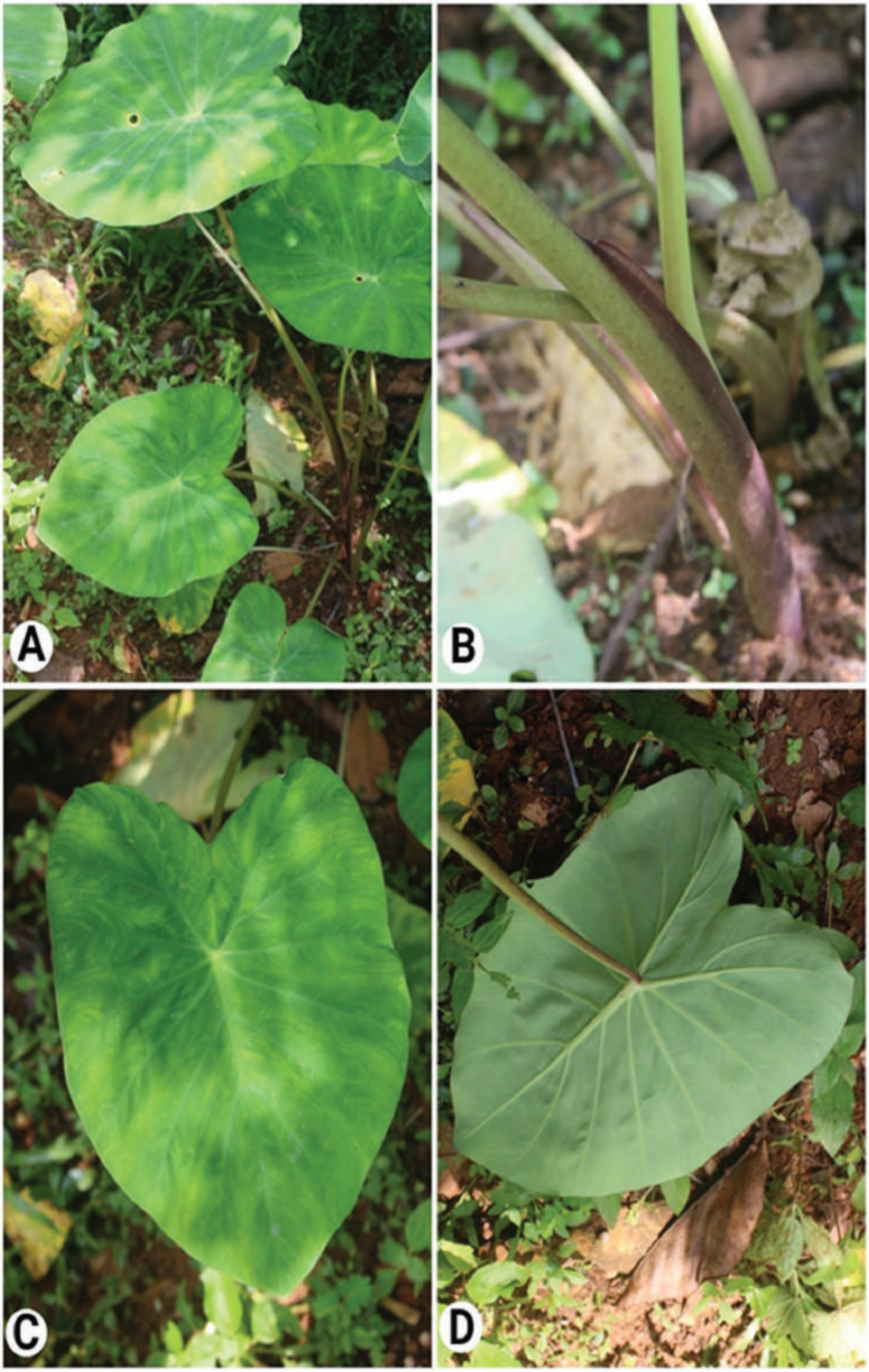
Colacasia esculenta (Var. Motta chembu)
A) Habit B) Mature stem C) Ventral side of mature Leaf D) Dorsal side of mature leaf

KUZHINIRAYAN CHEMBU

(Colocasia esculenta)

MORPHOLOGICAL CHARACTERESTICS

CHARACTERISTICS	STATE
Plant height	Medium, 50- 80 cm
Growth habit	Fascitate
Plant type	Erect
Position of leaf	Cup shaped
Leaf number	Many
Leaf length	large 33 cm
Leaf width	large 26 cm
Depth of sinus	8 cm, broad
Leaf colour	Green
Leaf main vein colour	Green
Leaf vein pattern	V type
Leaf blade colour	Light green
Leaf blade margin pattern	Undulate margin
Shape of leaf tip	Slightly round
Petiole colour	Purplish green
Petiole junction colour	Green
Petiole bent at lamina junction	Low
Petiole length	Large
Sheath length	Medium



Colacasia esculenta (Var. Kuzhinirayan)
A) Habit B) Mature stem C) Ventral side of mature Leaf D) Dorsal side of mature leaf

Exploring the Cultural, Economic, and Genetic Aspects of Cassava Diversity

1. MORPHOLOGICAL CHARACTERISATION OF CASSAVA

Manihot esculenta commonly known as Cassava or Tapioca is one of the major tuber crop in Kerala. It belongs to the family Euphorbiaceae. It is a woody shrub harvested mainly for its starchy roots. Farmers are cultivating cassava as mono crop and as inter crop across Kerala. In Kerala's rich culinary tradition, cassava occupies a prominent place, featuring in a wide array of dishes cherished by locals. Cassava played a significant role to overcome food shortage among the tribal communities of Kerala.

Some of the important characteristics used to determine different varieties included pubescence on apical leaves, colour of first fully expanded leaf, predominant shape of central leaf lobe, number of leaf lobes, leaf vein colour, petiole colour, mature leaf colour, young stem colour, colour of mature stem: exterior, orientation of petiole, growth habit of stem, branching pattern, tuber rind colour, tuber flesh colour etc.

1. Cultivation and harvesting

Farmers typically propagate cassava through stem cuttings, planting them directly in the field during the monsoon season. The crop requires minimal inputs and management, making it an attractive option for tribal farmers in Kerala. Crop is ready for harvesting in 10-11 months after planting. Short duration varieties can be harvested in 6-7 months. Delayed harvest results in deterioration of quality of tubers.

2. Staple Food Source

Cassava serves as a primary food source for many tribal communities in Kerala. Its ability to thrive in nutrient-poor soils and withstand drought conditions makes it a reliable crop in remote, forested areas where agricultural resources are limited. Various tribal communities prepare unique dishes using cassava, which are deeply rooted in their culinary traditions. Tribes consume cassava in boiled form, as chips, or processed into flour. It often substitutes for rice during lean periods, ensuring food security and preventing hunger. Cassava-based dishes are served during tribal festivals, where food preparation is a collective activity, reinforcing community bonds.

3. Nutritional benefits

Cassava is a rich, affordable source of carbohydrate. Cassava is a source of resistant starch, which can boost a person's gut health by helping nurture beneficial gut bacteria. Tapioca starch is gaining attention as a source of gluten-free flour to make bread and other baked products that are suitable for people with intolerance to gluten.

4. Economic Importance

Cassava cultivation holds substantial economic importance for the tribal communities of Kerala, as it contributes to their livelihoods and sustains local economies. Cassava requires low initial investment and is resilient to poor soil conditions, making it an accessible crop for economically marginalized tribal farmers. Many tribal families cultivate cassava as a cash crop. The surplus is sold in local markets or to industries, especially for tapioca starch production. Some tribal communities process cassava into chips, flour, or sago, providing an additional income stream.

5. Cultural significance

Cassava has found a place in the cultural traditions and rituals of tribal communities. It is commonly included in feasts and festivals, symbolizing sustenance and abundance. The cultivation and preparation of cassava often involve collective efforts, fostering a sense of community and mutual support among tribal members.

6. Environmental Sustainability

Cassava cultivation is well-suited to the traditional farming practices of Kerala's tribes, who often rely on shifting agriculture or mixed cropping. Its ability to grow in marginal lands without heavy chemical inputs aligns with their sustainable agricultural methods. Moreover, cassava plants help prevent soil erosion, which is particularly beneficial in the hilly terrains where many tribes reside.

7. Traditional varieties in Kerala

The tribal communities of Kerala primarily grow traditional cassava varieties that are well-adapted to the local soil and climatic conditions. These varieties are often low-yielding but highly resilient and require minimal inputs. Pathinettu kappa, Aambakkadan, Ramanthala, Karuthathandan etc. are some varieties commonly cultivated by the farmers in Kerala.

Cassava continues to serve as a symbol of resilience, sustainability, and cultural identity for the tribal communities of Kerala. Its versatility as a food source, economic asset, and cultural element demonstrates the deep interdependence between the indigenous people and their natural environment. Despite modern challenges such as dietary shifts, loss of traditional knowledge, and market-driven agriculture, cassava remains an enduring aspect of tribal life. Promoting the cultivation and consumption of cassava not only ensures food security but also encourages sustainable agricultural practices that align with Kerala's ecological framework. Furthermore, revitalizing traditional dishes and knowledge systems related to cassava can strengthen cultural heritage and foster a sense of pride and identity among tribal communities.

8. Genotyping of Cassava Varieties in Kerala's Tribal Regions

This study investigates the genetic diversity of cassava (Manihot esculenta Crantz) varieties cultivated by tribal communities in Kerala, India, using fluorescently labeled inter-simple sequence repeat (F-ISSR) markers. A total of 23 cassava landraces were analyzed, and genetic relationships were evaluated using molecular marker-based genotyping. Out of 22 ISSR primers screened, 15 displayed polymorphism, producing a total of 72 bands, with 49 polymorphic markers. The genetic diversity was assessed using PopGene software, and a phylogenetic tree was constructed based on Nei's genetic identity matrix. The findings demonstrate the efficiency of ISSR markers in distinguishing cassava genotypes, offering valuable insights for conservation strategies and breeding programs.

METHODOLOGY

Sample Collection and DNA Isolation

Tender leaves of cassava varieties were collected from tribal settlements in Idukki district, Kerala, and genomic DNA was isolated using the modified CTAB method. The DNA quality was evaluated using agarose gel electrophoresis and Nanodrop spectrophotometry (A260/A280 ratio of ~1.8).

PCR Amplification Using Fluorescent ISSR Markers

A total of 22 ISSR primers were screened, of which 15 showed polymorphism. PCR amplification was performed using 6-FAM labeled primers in a reaction mixture containing 100 ng of template DNA, 10 pM primer, 5 L AmpliTaq Gold 360 Master Mix, and 0.2 L enhancer. The PCR program included initial denaturation at 95 C for 5 min, followed by 35 cycles of denaturation at 95 C for 30 s, primer-specific annealing, extension at 72 C for 60 s, and a final extension at 72 C for 7 min.

Fragment Analysis and Genotyping

Fragment analysis was conducted using an Applied Biosystems 3730xl DNA analyzer with POP7 polymer. The reaction mix included 2 L PCR product, 8.8 L Hi-Di formamide, and 0.2 L LIZ600 size standard. The samples were denatured at 95 C for 5 min before automated capillary electrophoresis. GeneMapper 6.0 software was used for binary scoring (1 = presence, 0 = absence) of genetic markers.

Genetic Diversity and Polymorphism Analysis

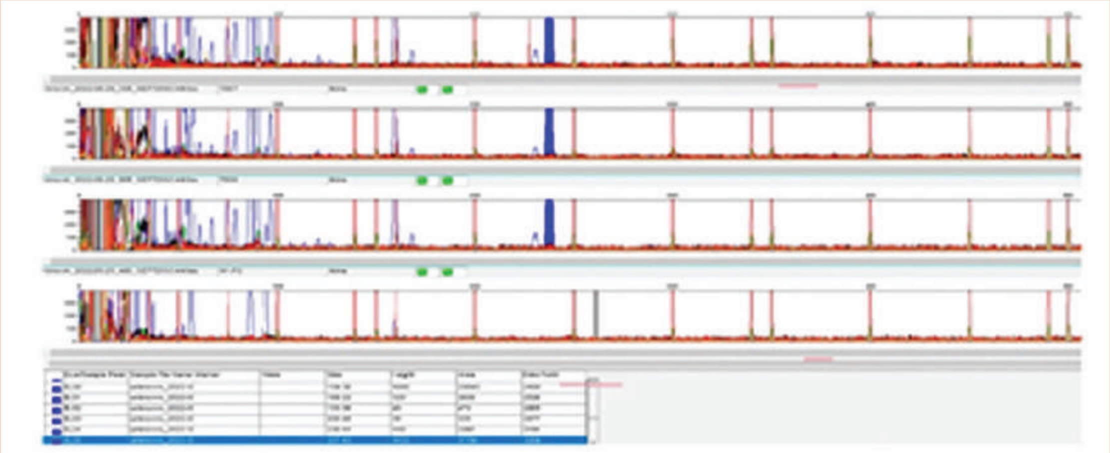
ISSR marker analysis revealed a high degree of genetic variation among cassava varieties. A total of 49 polymorphic markers were identified, with an average of 17 polymorphic bands per primer. The percentage of polymorphic loci ranged from 43% to 89%, highlighting substantial genetic diversity.

Significance of ISSR Markers in Cassava Genotyping

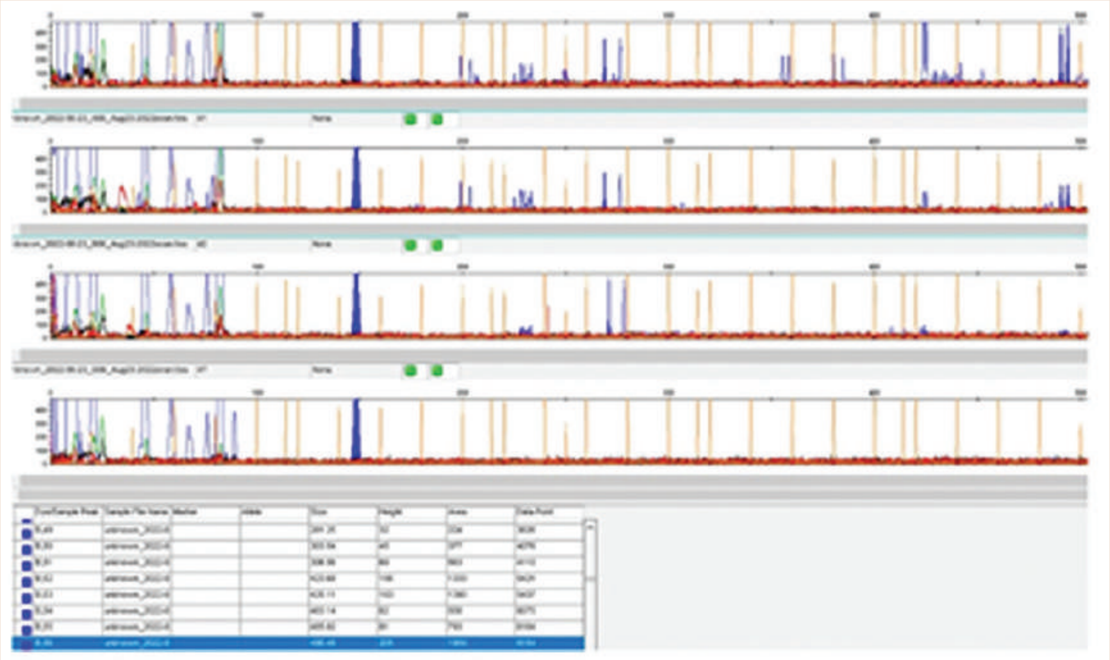
Fluorescent ISSR markers proved highly efficient in detecting genetic polymorphisms among cassava landraces. Compared to conventional ISSR methods, F-ISSR provides higher resolution and increased sensitivity. This study underscores the effectiveness of ISSR markers in resolving taxonomic ambiguities and guiding conservation strategies for genetic resource management.

Phylogenetic Relationships and Cluster Analysis

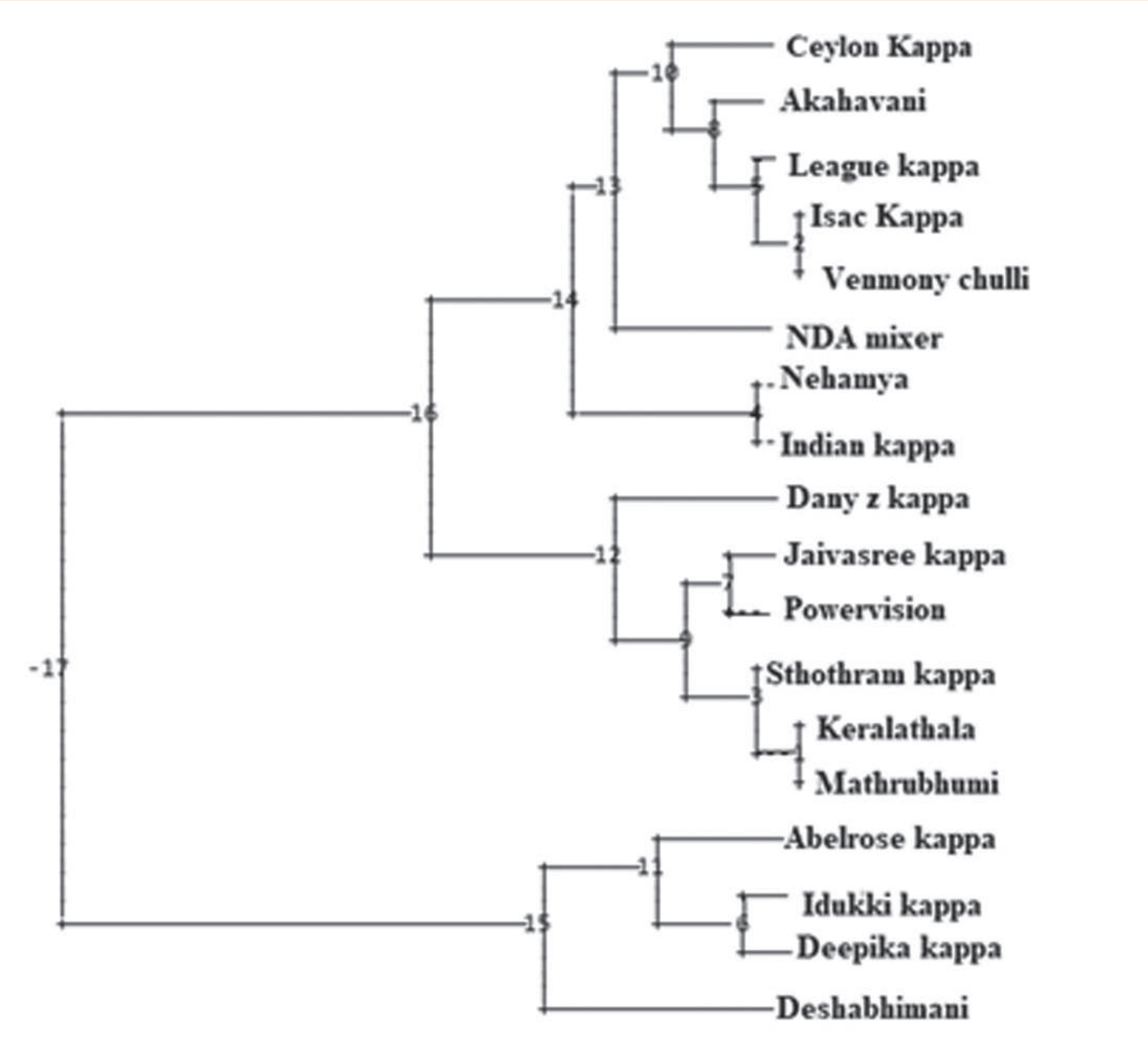
Nei's genetic distance analysis grouped cassava varieties into five major clusters, indicating distinct genetic relationships. The highest genetic similarity was observed between varieties belonging to the same cluster, while Kariveppu kappa and Etha kappa showed genetic distinctiveness. The clustering pattern aligned with morphological traits and adaptation strategies of these varieties.



Fragment analysis result used for scoring to generate statistical data for genetic diversity study (size standard used Rox500)



Fragment analysis result used for scoring to generate statistical data for genetic diversity study (size standard used Liz600)



The dendrogram result showing 17 farmers varieties and one traditional variety being grouped in 5 clusters based on the similarity distance matrix data

Pop id	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	****	0.9876	0.8376	0.9753	0.9758	0.9666	0.8977	0.9492	0.9805	0.9285	0.9390	0.9390	0.9868	0.9784	0.9785	0.9575	0.9467	0.9782
2	0.0124	****	0.9003	0.9905	0.9707	0.9776	0.9469	0.9730	0.9660	0.9736	0.9703	0.9703	0.9939	0.9854	0.9574	0.9324	0.9221	0.9527
3	0.1772	0.1050	****	0.9197	0.8544	0.9214	0.9870	0.9617	0.8330	0.9680	0.9729	0.9729	0.9078	0.9203	0.7596	0.6994	0.7586	0.7520
4	0.0250	0.0095	0.0837	****	0.9635	0.9643	0.9671	0.9767	0.9511	0.9786	0.9804	0.9804	0.9966	0.9940	0.9512	0.9148	0.9325	0.9455
5	0.0245	0.0298	0.1574	0.0372	****	0.9682	0.9080	0.9479	0.9955	0.9230	0.9453	0.9453	0.9668	0.9642	0.9613	0.8927	0.8712	0.9225
10	0.0340	0.0227	0.0819	0.0364	0.0323	****	0.9429	0.9890	0.9726	0.9563	0.9788	0.9788	0.9754	0.9776	0.9039	0.8585	0.8668	0.8966
11	0.1079	0.0545	0.0131	0.0334	0.0966	0.0588	****	0.9774	0.8847	0.9906	0.9901	0.9901	0.9539	0.9601	0.8470	0.7909	0.8335	0.8347
12	0.0521	0.0274	0.0391	0.0236	0.0535	0.0111	0.0228	****	0.9435	0.9782	0.9970	0.9970	0.9802	0.9868	0.8846	0.8380	0.8754	0.8838
13	0.0197	0.0346	0.1828	0.0502	0.0045	0.0278	0.1225	0.0582	****	0.9048	0.9335	0.9335	0.9621	0.9596	0.9566	0.8974	0.8759	0.9273
14	0.0741	0.0268	0.0325	0.0216	0.0801	0.0447	0.0095	0.0220	0.1001	****	0.9867	0.9867	0.9699	0.9671	0.8828	0.8475	0.8619	0.8763
15	0.0629	0.0301	0.0274	0.0198	0.0563	0.0214	0.0100	0.0030	0.0688	0.0133	****	1.0000	0.9775	0.9840	0.8825	0.8285	0.8657	0.8740
16	0.0629	0.0301	0.0274	0.0198	0.0563	0.0214	0.0100	0.0030	0.0688	0.0133	0.0000	****	0.9775	0.9840	0.8825	0.8285	0.8657	0.8740
17	0.0133	0.0061	0.0967	0.0034	0.0338	0.0249	0.0472	0.0200	0.0386	0.0306	0.0228	0.0228	****	0.9974	0.9543	0.9258	0.9436	0.9568
18	0.0219	0.0147	0.0831	0.0060	0.0364	0.0226	0.0407	0.0133	0.0412	0.0334	0.0161	0.0161	0.0026	****	0.9391	0.9017	0.9357	0.9415
19	0.0218	0.0435	0.2749	0.0500	0.0395	0.1011	0.1660	0.1227	0.0444	0.1247	0.1250	0.1250	0.0468	0.0628	****	0.9738	0.9388	0.9819
20	0.0434	0.0700	0.3575	0.0891	0.1135	0.1526	0.2345	0.1768	0.1082	0.1655	0.1881	0.1881	0.0771	0.1035	0.0265	****	0.9612	0.9918
22	0.0547	0.0811	0.2763	0.0699	0.1378	0.1430	0.1822	0.1330	0.1325	0.1486	0.1442	0.1442	0.0580	0.0664	0.0631	0.0396	****	0.9819
23	0.0220	0.0485	0.2850	0.0560	0.0806	0.1092	0.1807	0.1236	0.0755	0.1321	0.1347	0.1347	0.0442	0.0603	0.0183	0.0083	0.0183	****

Table. Cassava land races showing diversity (below****) /Similarity (above ***) matrix

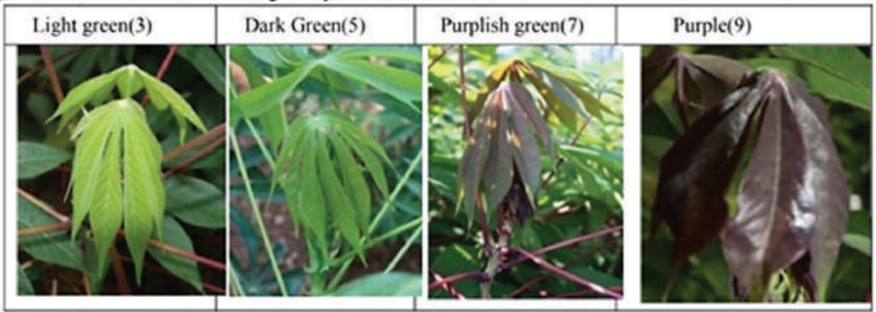
Implications for Conservation and Breeding

The genetic data generated from ISSR markers can facilitate the selection of superior genotypes for breeding programs. The observed genetic diversity suggests potential sources of desirable traits such as disease resistance and high yield. Future studies integrating genome-wide markers and phenotypic trait analysis can further enhance cassava conservation and improvement efforts.

Conclusion on genotypic study

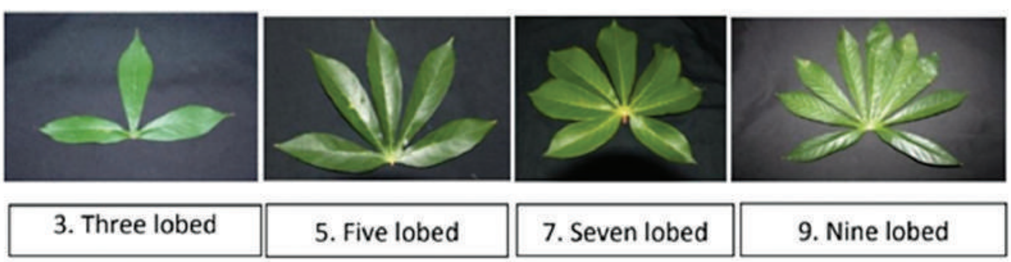
This study highlights the utility of F-ISSR markers in assessing the genetic diversity of cassava varieties in Kerala's tribal regions. The results provide a framework for cassava conservation and breeding programs aimed at sustainable agricultural practices. The integration of molecular marker-based genotyping with traditional knowledge enhances efforts to preserve and utilize local genetic resources effectively.

A Colour of first fully expanded leaf:

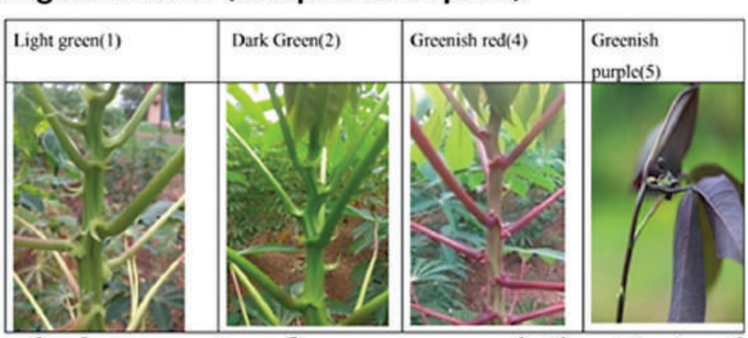


B Colour of mature stem-:

C Predominant number of leaf lobes:



D Young stem colour (at top 20 cm of plant):



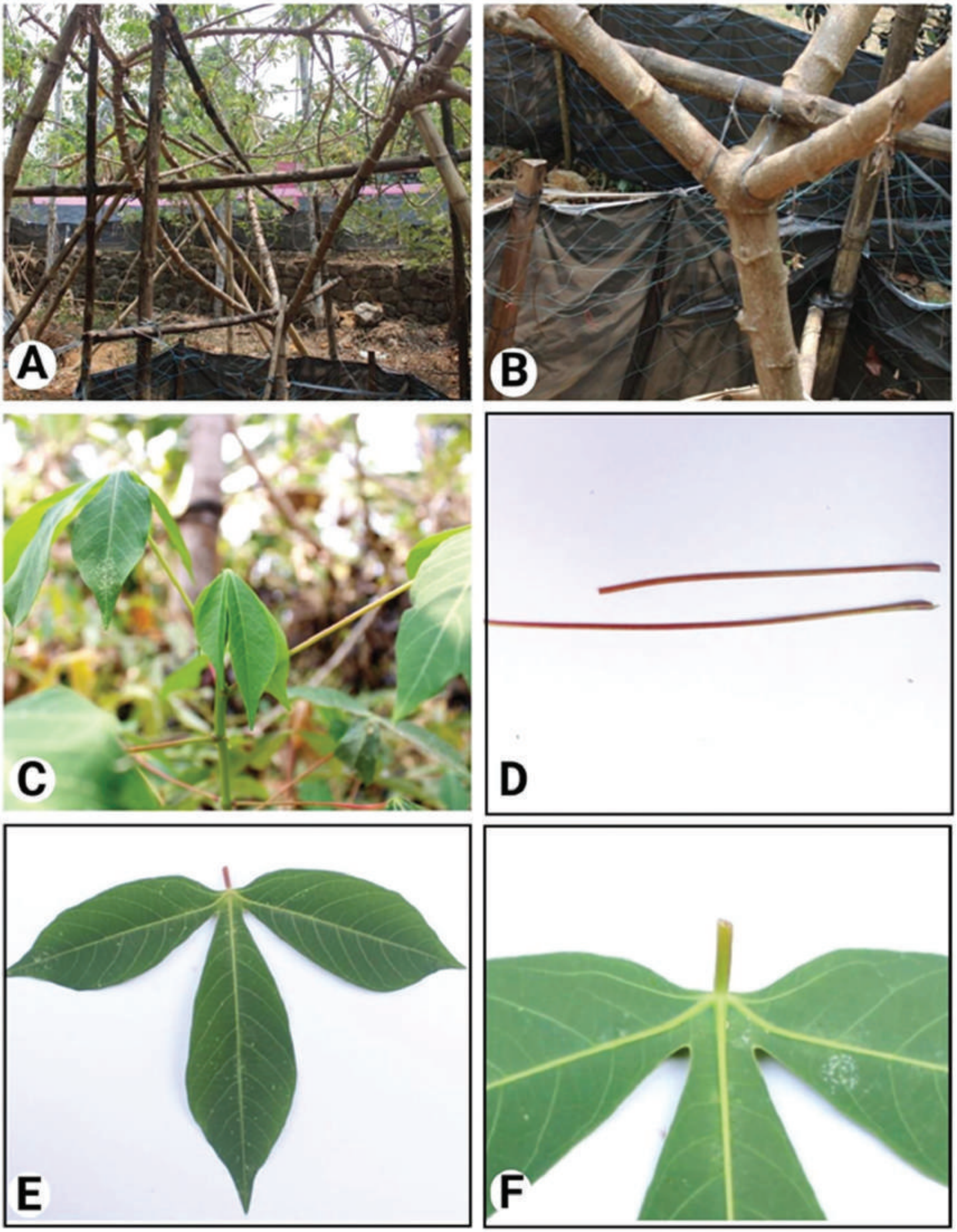
Morphological parameters for cassava varieties: Protection of Plant Varieties and Farmer's Rights Authority (PPV&FRA), Government of India

KANTHARIPPADAPPAN

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Glabrous
Colour of first fully expanded leaf	Dark Green
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Reddish Cream
Mature leafcolor	Dark Green
Predominant number of leaflobes	Three lobed
Length of central leaflobe (cm)	10 cm
Width of central leaflobe (cm) (at max. width)	4 cm
Leaf lobemargin	Smooth
Petiole length(cm)	Short (<25)
Leaf vein colour	Green
Orientation of Petiole	Inclined upwards
Young stemcolour (at top 20 cm of plant)	Dark Green
Prominence offoliage scars	Prominent
Colour of maturestem: exterior	Light brown
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



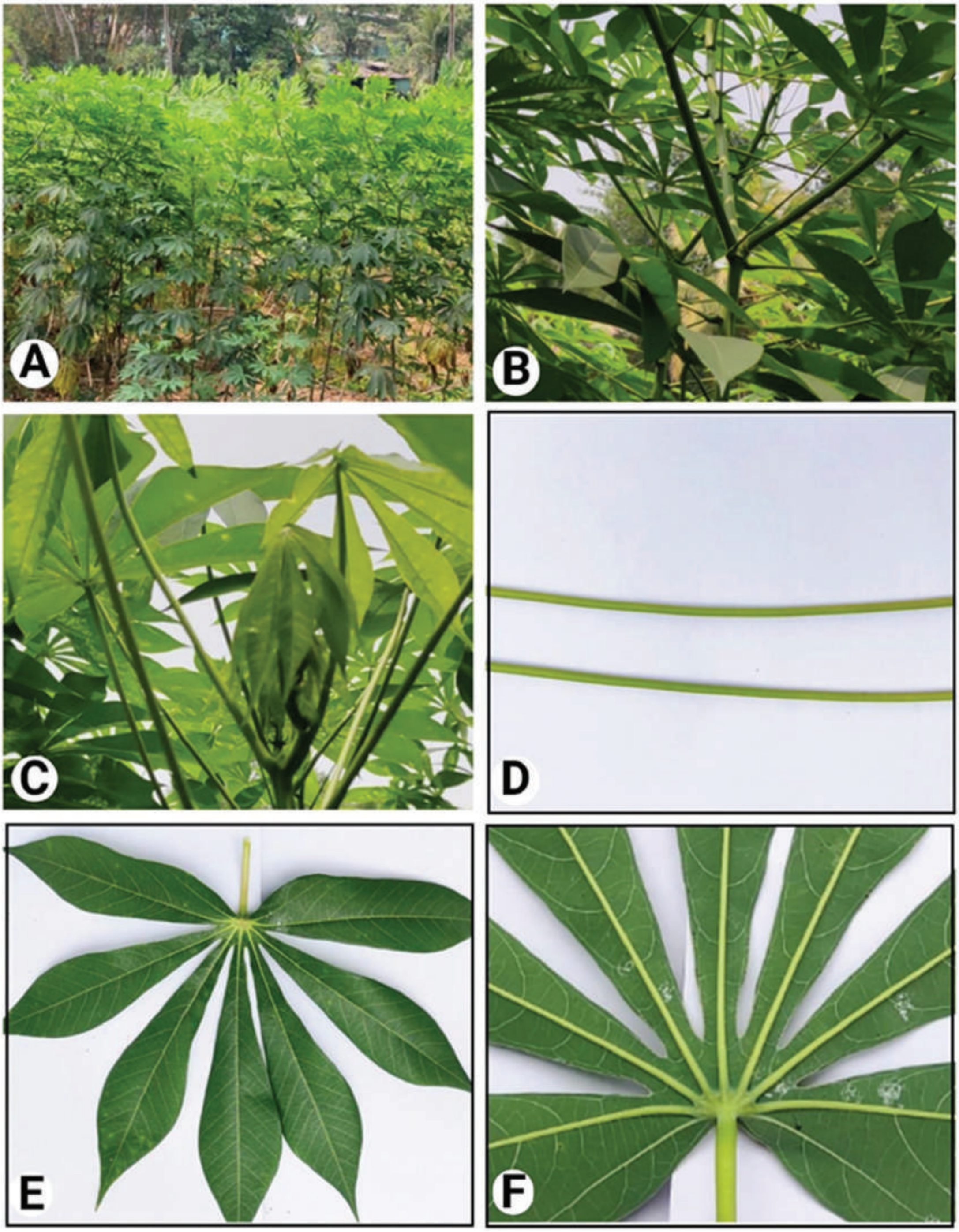
Manihot esculenta var. Kantharipadappan
A)Plant habit B) Branch habit C) Young Leaf
D) Leaf Petiole E) Ventral side of mature leaf F) Leaf vain

KARUTHATHANDAN

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Glabrous
Colour of first fully expanded leaf	Dark Green
Predominant shape of centralleaf lobe	Obovatelanceolate
Petiole colour	Green
Mature leafcolor	Dark Green
Predominant number of leaflobes	Seven lobed
Length of central leaflobe (cm)	20 cm
Width of central leaf lobe (cm) (at max. width)	5 cm
Leaf lobemargin	Smooth
Petiole length(cm)	Medium (25-35))
Leaf vein colour	Green
Orientation ofpetiole	Horizontal
Young stemcolour (at top 20 cm of plant)	Dark Green
Prominence offoliage scars	Prominent
Colour of maturestem: exterior	Grey
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Erect
Plant height (cm)	Tall
Plant branchingHabit	Single



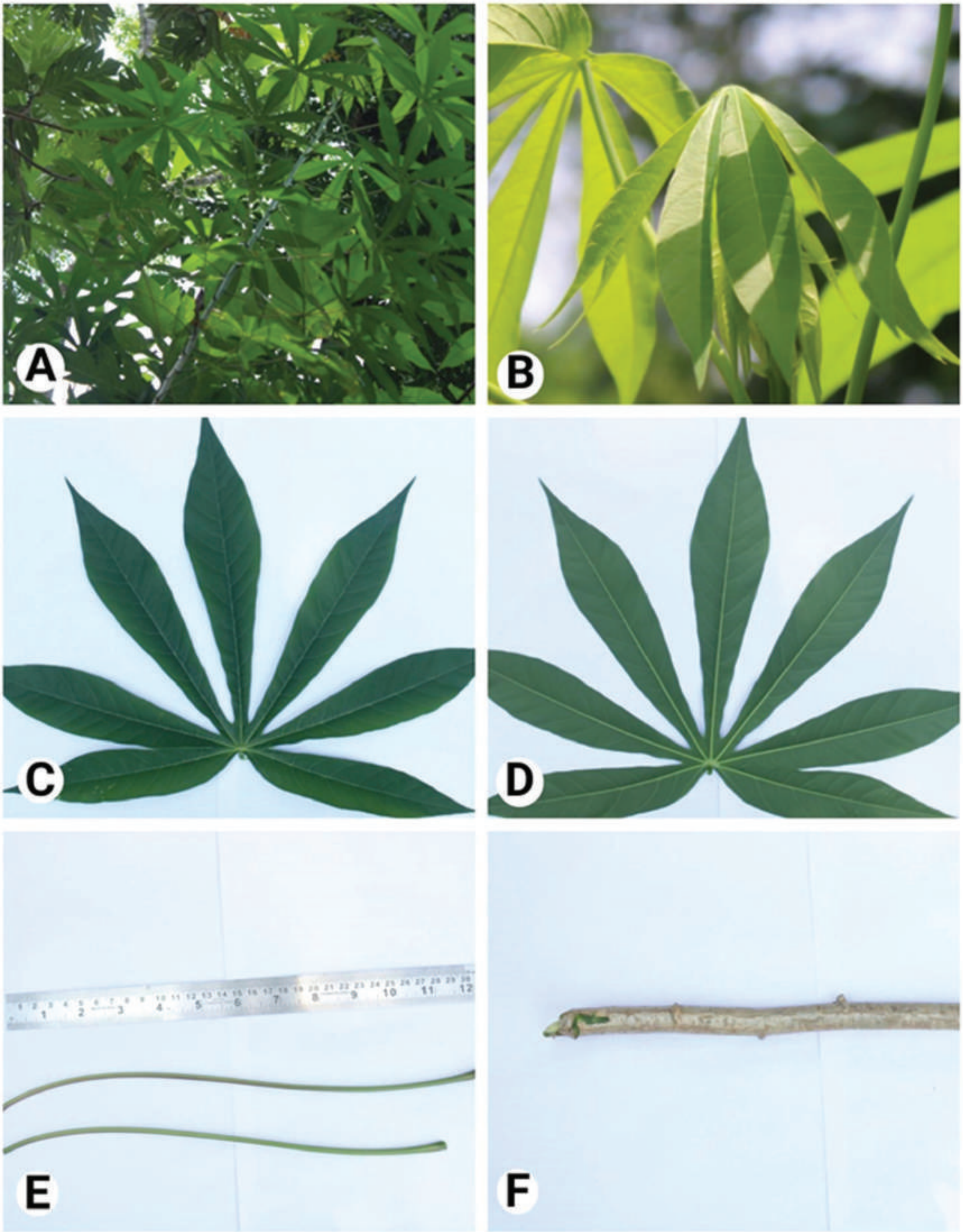
Manihot esculenta var. Karuththa thandan
A)Plant habit B) Branch habit C) Young Leaf
D) Leaf Petiole E) Ventral side of mature leaf F) Leaf

CURRYVEPPU KAPPA

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Glabrous
Colour of first fully expanded leaf	Light Green
Predominant shape of centralleaf lobe	Elliptic Lanceolate
Petiole colour	Green
Mature leafcolour	Dark Green
Predominant number of leaf lobes	Seven lobed
Length of central leaflobe (cm)	24 cm
Width of central leaflobe (cm) (at max. width)	5 cm
Leaf lobe margin	Smooth
Petiole length(cm)	30, medium
Leaf vein colour	Green
Orientation ofpetiole	Horizontal
Young stemcolour (at top 20 cm of plant)	Light Green
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	Grey
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



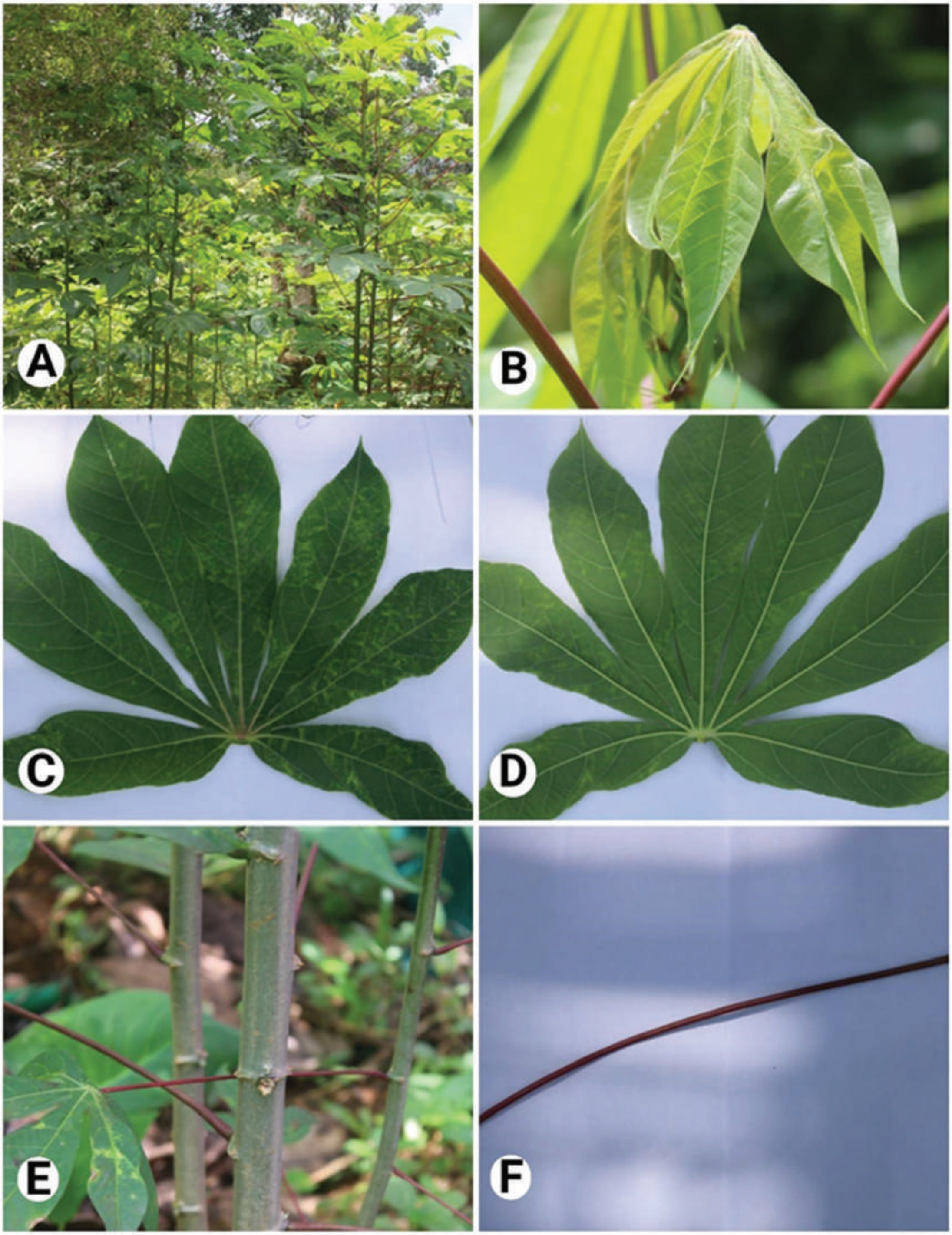
Manihot esculenta var. curryveppu kappa
A)Plant habit B) young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) leaf petiole F) Mature stem

MALABAR VELLA

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Light Green
Predominant shape of central leaf lobe	Lanceolate
Petiole colour	Red
Mature leaf colour	Dark Green
Predominant number of leaflobes	Seven lobed
Length of central leaflobe (cm)	18 cm
Width of central leaflobe (cm) (at max. width)	5 cm
Leaf lobemargin	Smooth
Petiole length(cm)	28, medium
Leaf vein colour	Green
Orientation ofpetiole	Inclined upwards
Young stemcolour (at top 20 cm of plant)	Light Green
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	Grey
Stem: distance between leaf scars	Medium
Growth habit of Stem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



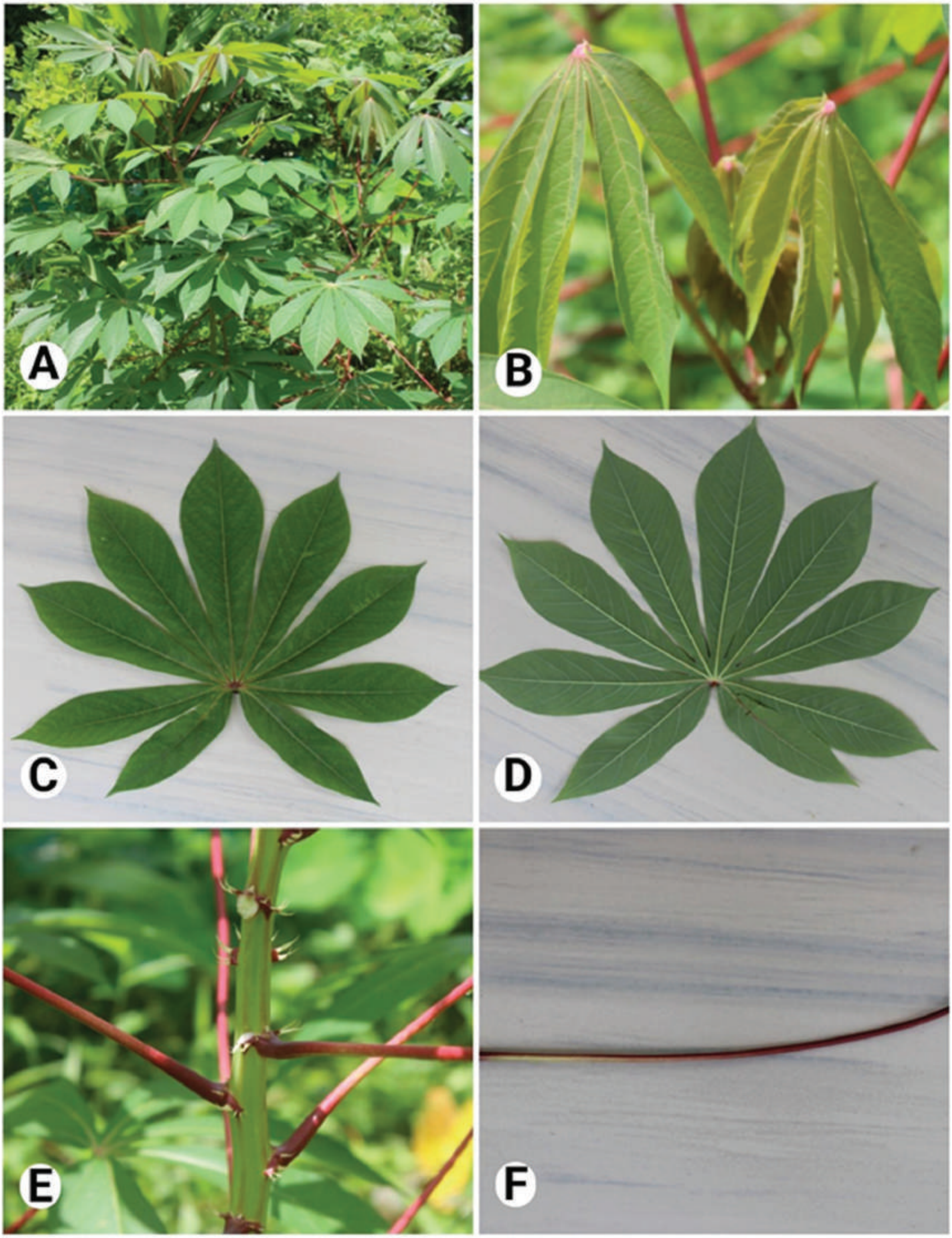
Manihot esculenta var. Malabar vella
A)Plant habit B) Young leaf C) Ventral side of mature leaf D) Dorsal side of mature leaf E) Stem F) Petiole

QUINTAL KAPPA 1

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Purplish Green
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Red
Mature leaf color	Dark Green
Predominant number of leaflobes	Nine lobed
Length of central leaflobe (cm)	22 cm
Width of central leaf lobe (cm) (at max. width)	6.5 cm
Leaf lobemargin	Smooth
Petiole length(cm)	33, medium
Leaf vein colour	Green
Orientation ofpetiole	Inclined upwards
Young stemcolour (at top 20 cm of plant)	Light Green
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	Light brown
Stem: distance between leaf scars	Medium
Growth habit of Stem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



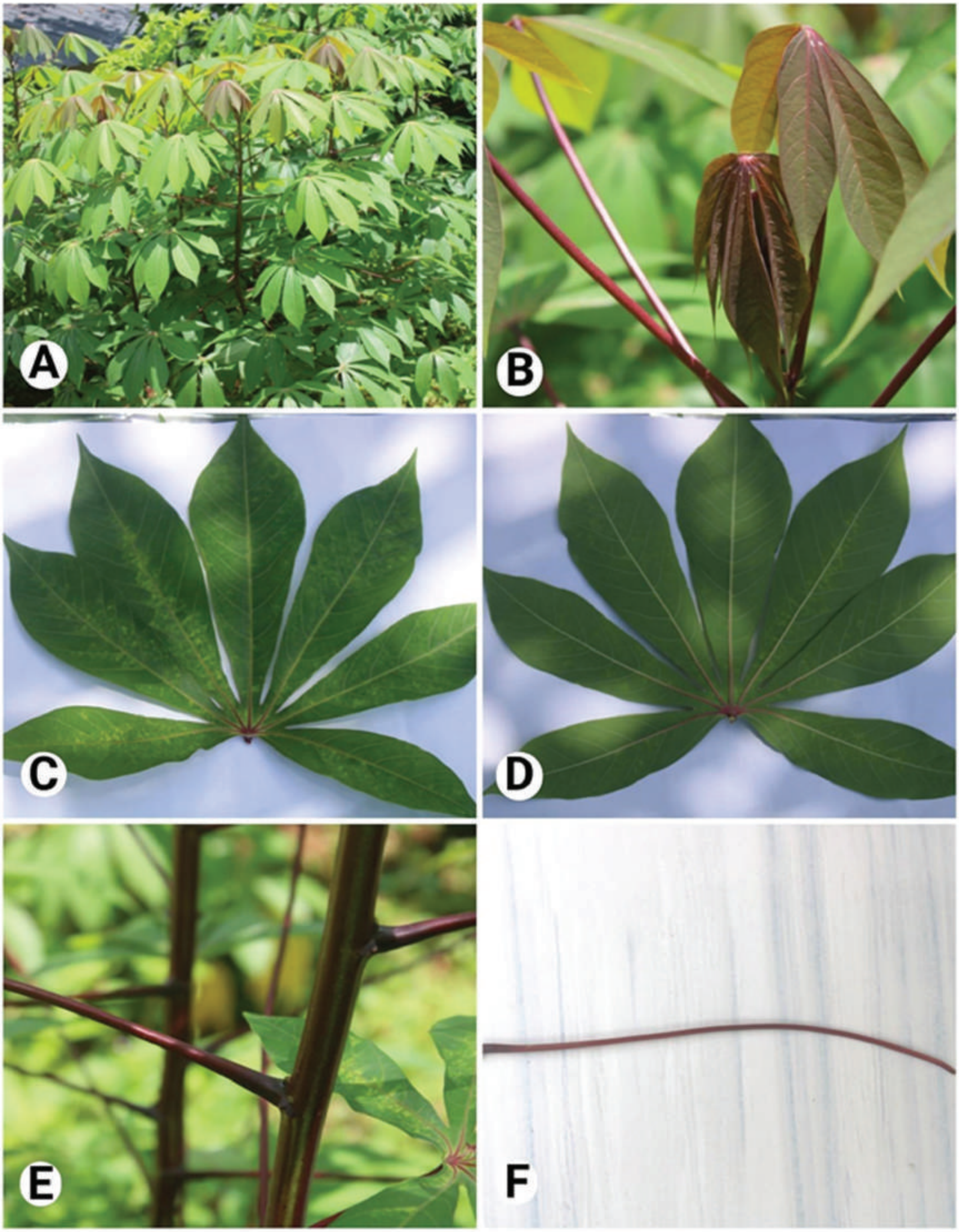
***Manihot esculenta* var. Quintal kappa 1**
A)Plant habit B) Young leaf C) Ventral side of mature leaf D) Dorsal side of mature leaf E) Stem F) Petiole

QUINTAL KAPPA 2

(Manihotesculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Purple
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Purple
Mature leaf color	Dark Green
Predominant number of leaflobes	Seven lobed
Length of central leaflobe (cm)	17 cm
Width of central leaflobe (cm) (at max. width)	5.5 cm
Leaf lobemargin	Smooth
Petiole length (cm)	33, medium
Leaf vein colour	Partially reddish
Orientation ofpetiole	Inclined upwards
Young stemcolour (at top 20 cm of plant)	Greenish purple
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	Dark brown
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



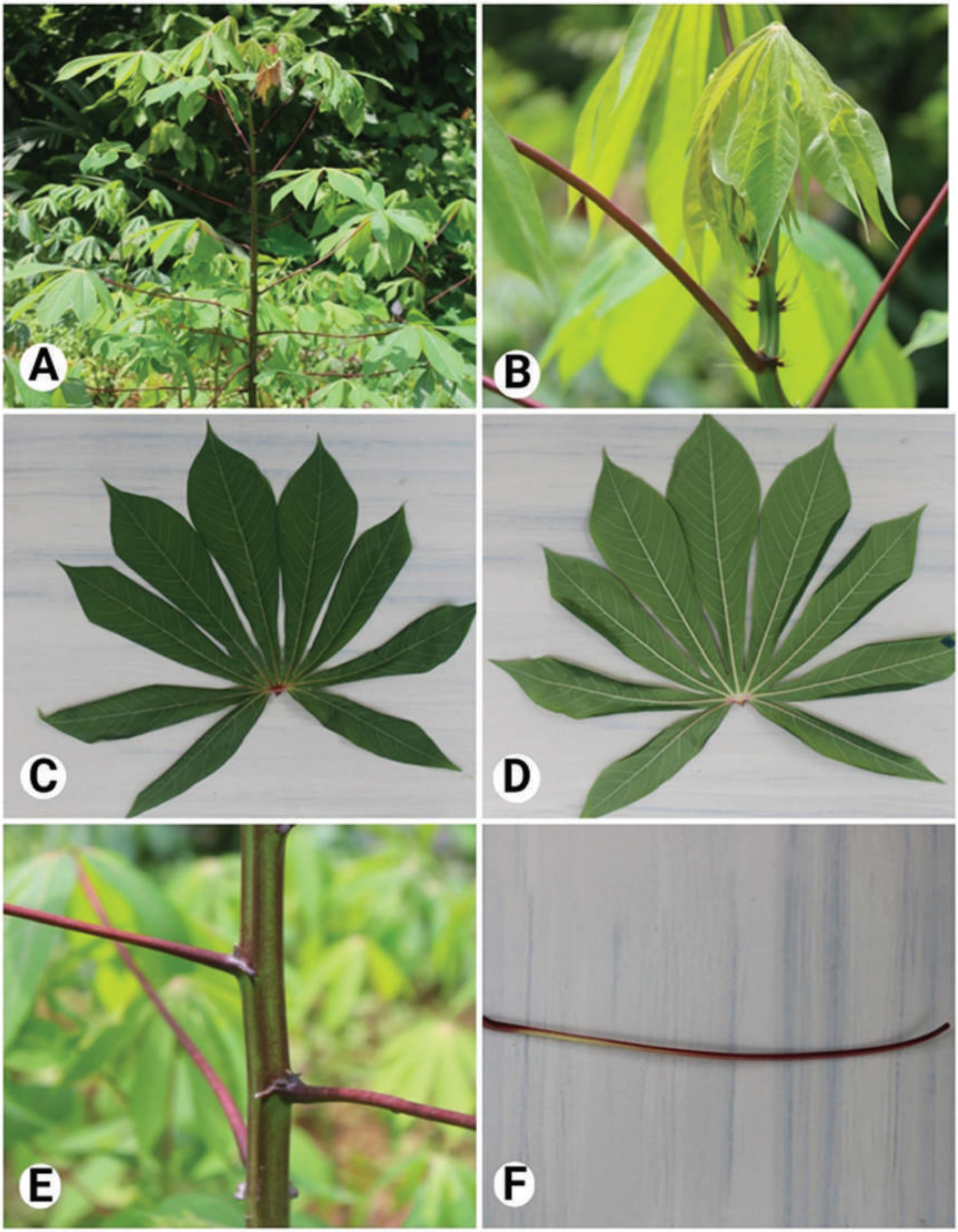
Manihot esculenta var. Quintal kappa 2
A)Plant habit B) Young leaf C) Ventral side of mature leaf D) Dorsal side of mature leaf E) Stem F) Petiole

RAMANTHALA KAPPA

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Green
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Purple
Mature leaf color	Dark Green
Predominant number of leaflobes	Nine lobed
Length of central leaflobe (cm)	25 cm
Width of central leaflobe (cm) (at max. width)	7 cm
Leaf lobe margin	Smooth
Petiole length (cm)	39, long
Leaf vein colour	Green
Orientation ofpetiole	Inclined upwards
Young stemcolour (at top 20 cm of plant)	Green
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	Dark brown
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



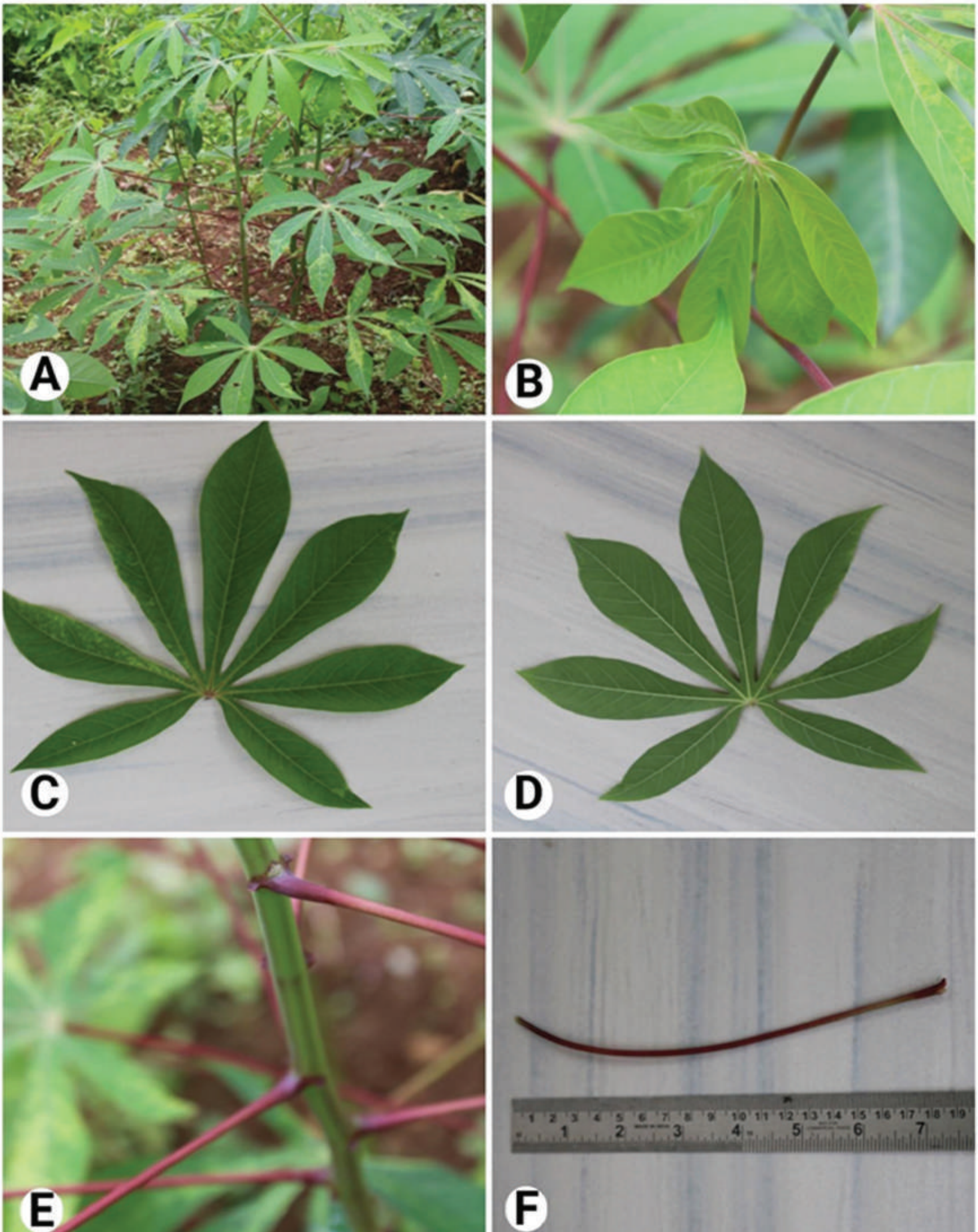
Manihot esculenta var. Ramanthala
A)Plant habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Stem F) Petiole

PAMBAKUDA KAPPA

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Green
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Red
Mature leaf color	Dark Green
Predominant number of leaflobes	Seven lobed
Length of central leaflobe (cm)	15 cm
Width of central leaf lobe (cm) (at max. width)	4.5 cm
Leaf lobemargin	Smooth
Petiole length(cm)	19, short
Leaf vein colour	Green
Orientation ofpetiole	Horizontal
Young stemcolour (at top 20 cm of plant)	Green
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	Grey
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



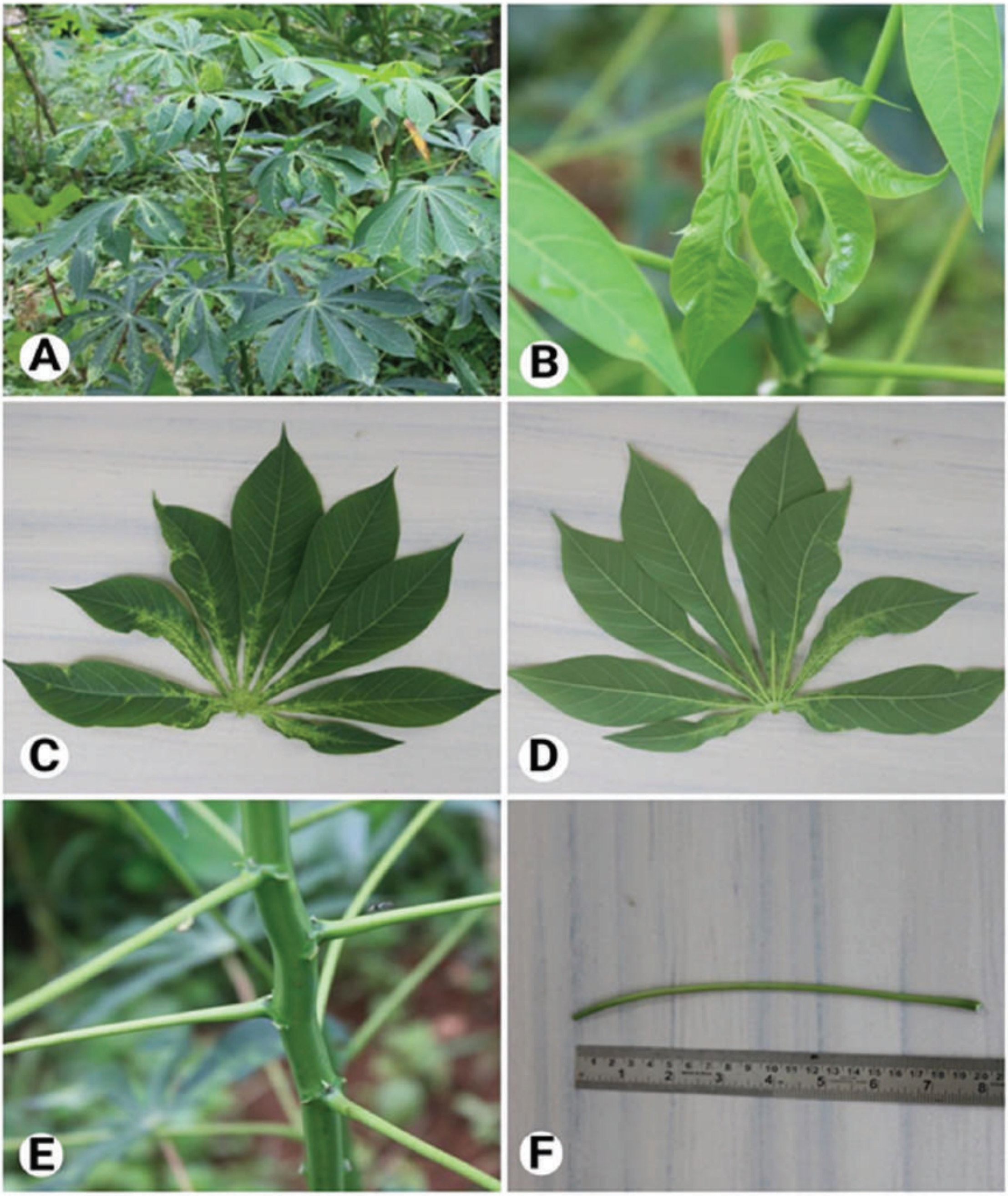
Manihot esculenta var. Pambakuda
A)Plant habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Stem F) Petiole

AARUMASA KAPPA

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Light Green
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Green with red tip
Mature leafcolor	Dark Green
Predominant number of leaflobes	Seven lobed
Length of central leaflobe (cm)	19 cm
Width of central leaflobe (cm) (at max. width)	5 cm
Leaf lobemargin	Smooth
Petiole length(cm)	21, short
Leaf vein colour	Green
Orientation ofpetiole	Horizontal
Young stemcolour (at top 20 cm of plant)	Green
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	Dark green
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



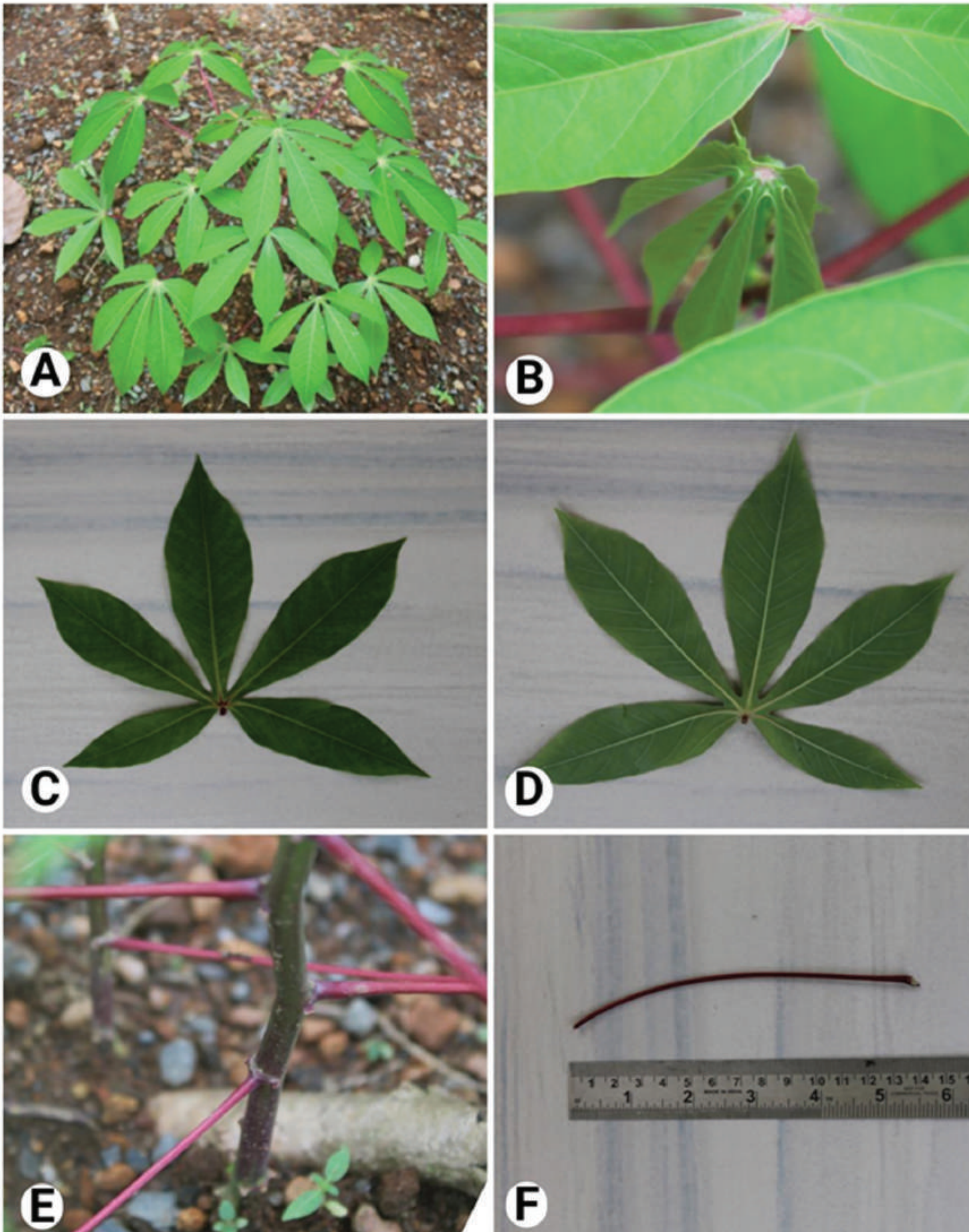
Manihot esculenta **var. Aarumasa kappa**
A)Plant habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Stem F) Petiole

EETHA KAPPA

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Green
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Red
Mature leaf color	Dark Green
Predominant number of leaflobes	Five lobed
Length of central leaflobe (cm)	12 cm
Width of central leaflobe (cm) (at max. width)	3.5 cm
Leaf lobemargin	Smooth
Petiole length(cm)	15 short
Leaf vein colour	Green
Orientation ofpetiole	Horizontal
Young stemcolour (at top 20 cm of plant)	Green
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	light brown
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



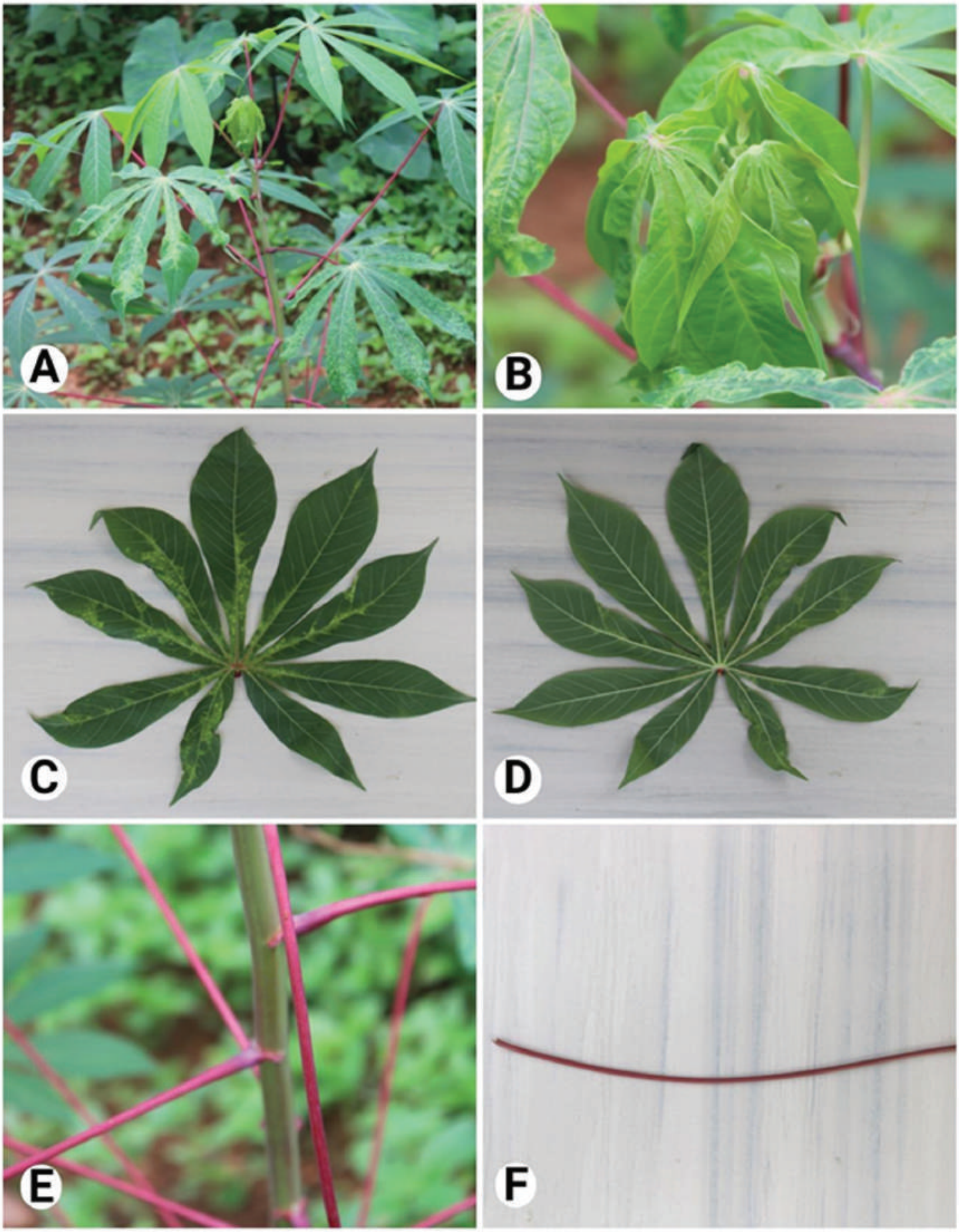
Manihot esculenta var. Eetha kappa
A)Plant habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Stem F) Petiole

NALUMASA KAPPA

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Green
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Red
Mature leaf color	Dark Green
Predominant number of leaf lobes	Nine lobed
Length of central leaflobe (cm)	20 cm
Width of central leaf lobe (cm) (at max. width)	6 cm
Leaf lobemargin	Smooth
Petiole length (cm)	38, long
Leaf vein colour	Green
Orientation ofpetiole	Inclined upwards
Young stemcolour (at top 20 cm of plant)	Green
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	Grey
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



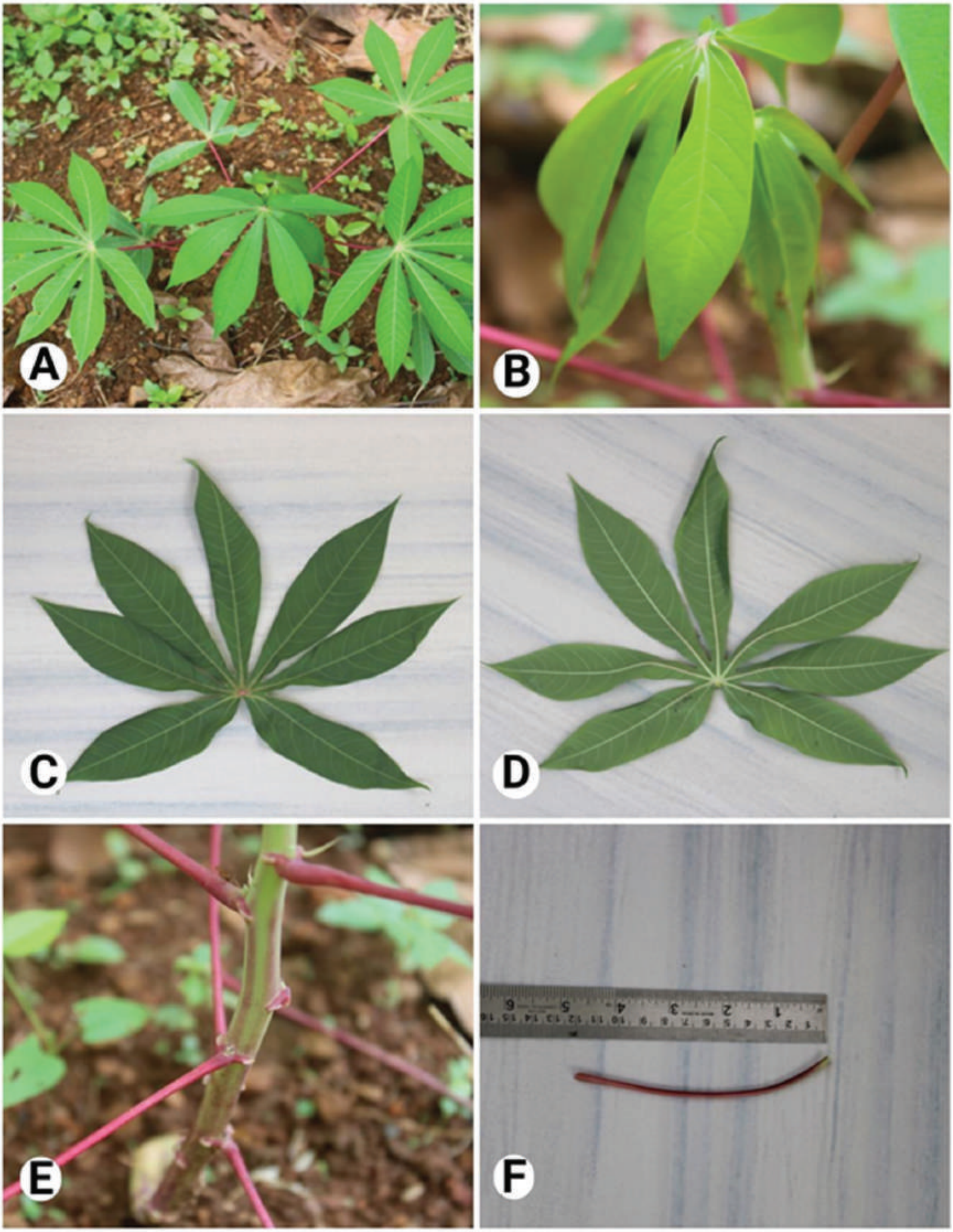
Manihot esculenta var. Nalumasa kappa
A)Plant habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Stem F) Petiole

ROTTI KAPPA

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Green
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Red
Mature leaf color	Dark Green
Predominant number of leaflobes	Seven lobed
Length of central leaflobe (cm)	17 cm
Width of central leaf lobe (cm) (at max. width)	4 cm
Leaf lobe margin	Smooth
Petiole length(cm)	13, short
Leaf vein colour	Green
Orientation ofpetiole	Horizontal
Young stemcolour (at top 20 cm of plant)	Green
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	Rose colour
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



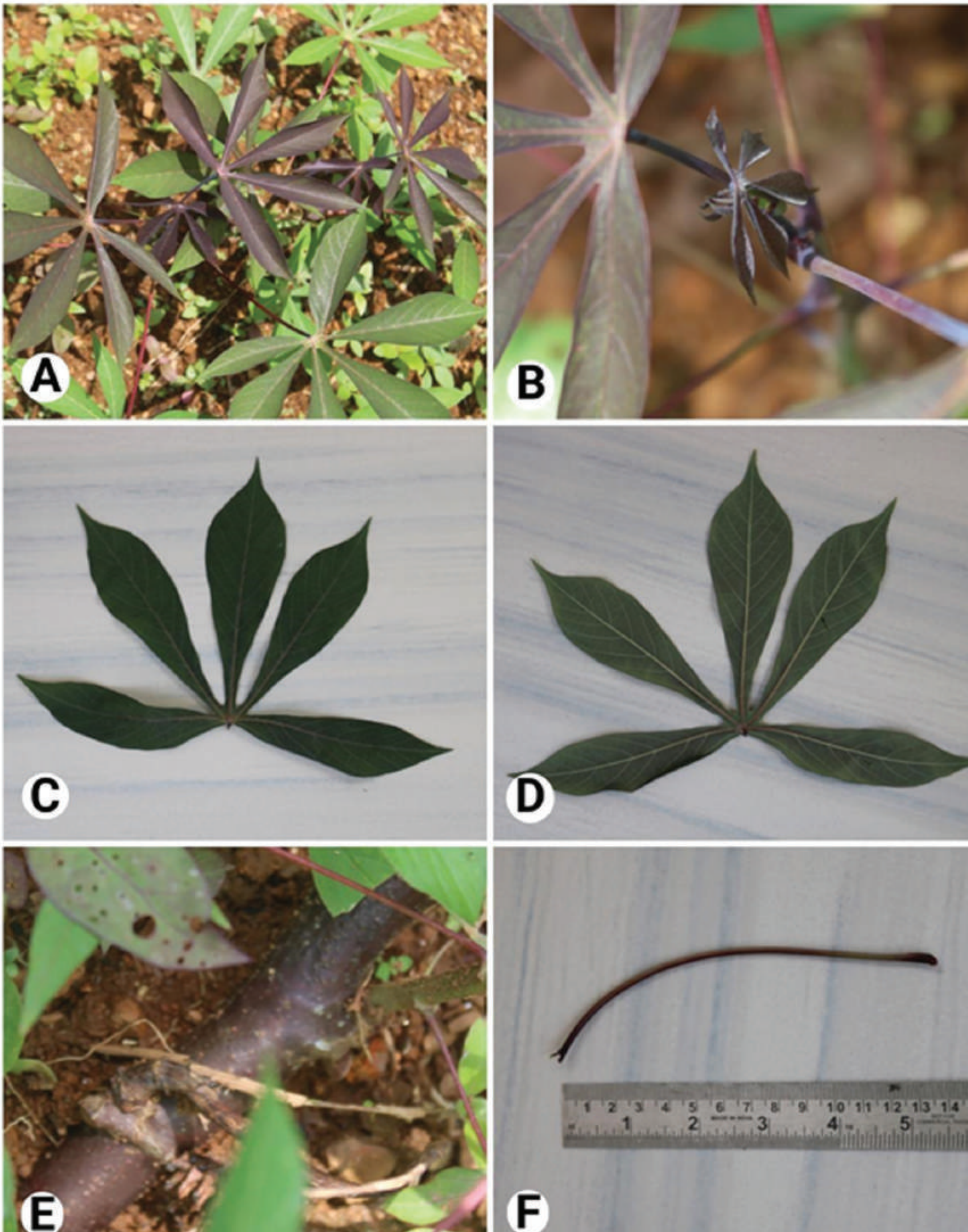
Manihot esculenta var. Rotti kappa
A)Plant habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Stem F) Petiole

VIOLET KAPPA

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Purple
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Purple
Mature leaf color	Dark Green
Predominant number of leaf lobes	Five lobed
Length of central leaflobe (cm)	16 cm
Width of central leaf lobe (cm) (at max. width)	4.5 cm
Leaf lobe margin	Smooth
Petiole length (cm)	16, short
Leaf vein colour	Green
Orientation ofpetiole	Horizontal
Young stemcolour (at top 20 cm of plant)	Ppurple
Prominence offoliage scars	Semi Prominent
Colour of maturestem: exterior	Dark brown
Stem: distance between leaf scars	Medium
Growth habit ofStem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branchingHabit	Trichotomous



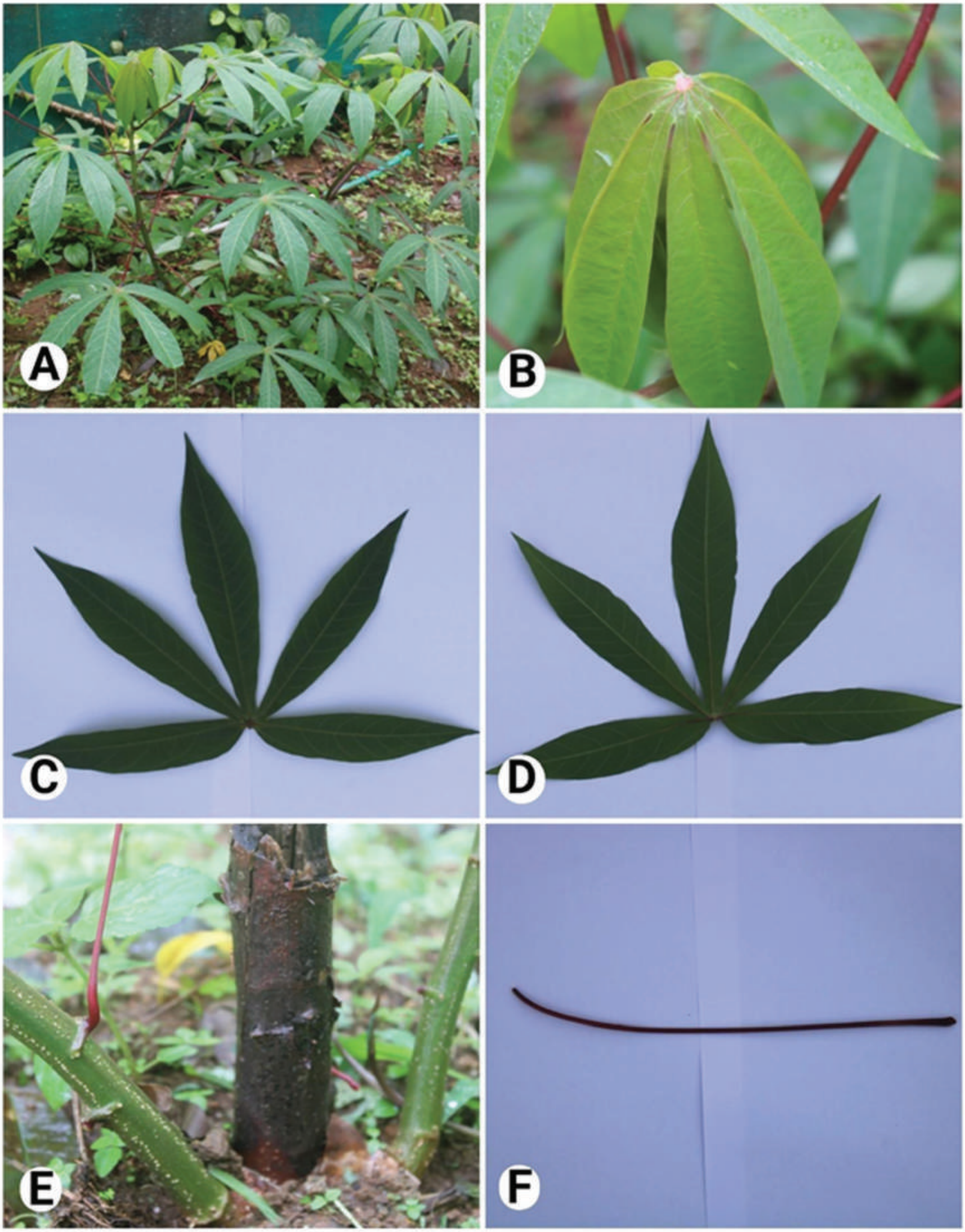
Manihot esculenta var. Violet kappa
A)Plant habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Stem F) Petiole

SILON KAPPA

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATES
Pubescence on apical leaves	Moderate
Colour of first fully expanded leaf	Light Green
Predominant shape of centralleaf lobe	Lanceolate
Petiole colour	Red
Mature leaf color	Dark Green
Predominant number of leaf lobes	Five lobed
Length of central leaf lobe (cm)	27 cm
Width of central leaf lobe (cm) (at max. width)	6 cm
Leaf lobe margin	Smooth
Petiole length (cm)	30, medium
Leaf vein colour	Light Green
Orientation of petiole	Inclined upwards
Young stemcolour (at top 20 cm of plant)	purple
Prominence offoliage scars	Semi Prominent
Colour of mature stem: exterior	Grey
Stem: distance between leaf scars	Medium
Growth habit of Stem	Straight
Plant type	Semi- spreading
Plant height (cm)	Medium
Plant branching Habit	Dichotomous



Manihot esculenta (var. silon kappa)
A)Plant habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Mature Stem F) Petiole

AMBAKKADAN

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS

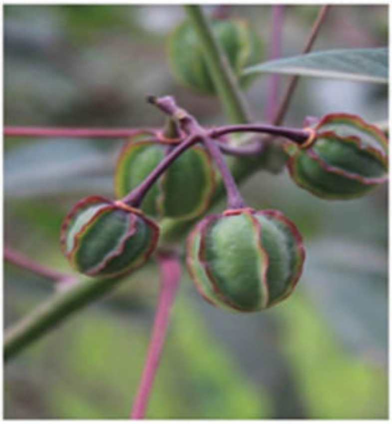
CHARACTERISTICS	STATES
Pubescence on apical leaves	Medium
Colour of first fully expanded leaf	Light green
Predominant shape of central leaf lobe	Obovate-Lanceolate
Petiole colour	Red
Mature leaf colour (dorsal)	Light green
Predominant number of leaf lobes	Seven lobed
Length of central leaf	21 cm, long
Width of central leaf lobe	6 cm, broad
Leaf lobe margin	Smooth
Petiole length	33 cm
Leaf vein colour	Green
Orientation of petiole	Inclined upwards
Young stem colour	Greenish red
Colour of mature stem : exterior	Light brown
Growth habit of stem	Straight
Plant type	Semi-spreading
Plant height	223 cm, tall
Plant branching habit	Trichotomous
Plant canopy	Open
Fruit	Present
Crop maturity	Medium

Ambakkadan

Habitat

Leaf

Dorsal Side



Fruit

Petiole

Stem

KOCHULANNAN

(Manihot esculenta)

MORPHOLOGICAL CHARACTERISTICS:

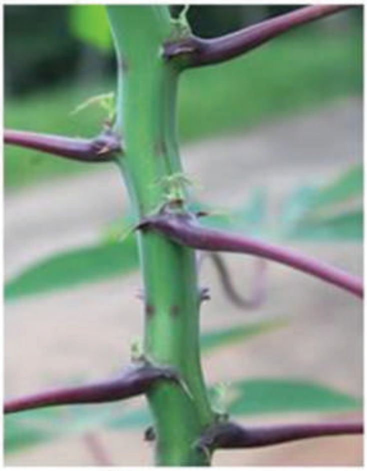
CHARACTERISTICS	STATES
Pubescence on apical leaves	Glabrous
Colour of first fully expanded leaf	Light green
Predominant shape of central leaf lobe	Lanceolate
Petiole colour	Red
Mature leaf colour (dorsal)	Dark green
Predominant number of leaf lobes	Seven lobed
Length of central leaf	25 cm, long
Width of central leaf lobe	5 cm, broad
Leaf lobe margin	Smooth
Petiole length	36 cm, long
Leaf vein colour	Partly reddish
Orientation of petiole	Horizontal
Young stem colour	Greenish red
Colour of mature stem : exterior	Grey
Growth habit of stem	Zigzag
Plant type	Erect
Plant height	165 cm, medium
Plant branching habit	Single
Plant canopy	Compact
Fruit	Present
Crop maturity	Late

Kochulannan

Habitat

Leaf

Dorsal Side



Stem

Petiole

Young Leaf

Diversity in Sweet Potato Varieties

Ipomoea batatas is commonly known as sweet potato belongs to the family Convolvulaceae Sweet potato is expected to play a vital role in combating the food shortages and malnutrition that may increasingly occurs as a result of population growth and pressure on land utilization. The colour of the stem and leaves varies from green to purple due to anthocyanin pigmentation. The texture, sweetness, size and shape of the tubers vary with different varieties.

The intensity of yellow or the orange colour of this root vegetable plant is related to beta carotene content. The purple flesh naturally contains good number of anthocyanins and it exhibit highest antioxidant activity in comparison to other variety of sweet potato. Sweet potato can be categorized into two different groups depending on the texture they have when they cooked in firm, dry and mealy others are soft and moist. In both kinds taste is starchy and sweet; the different verities have different unique taste.

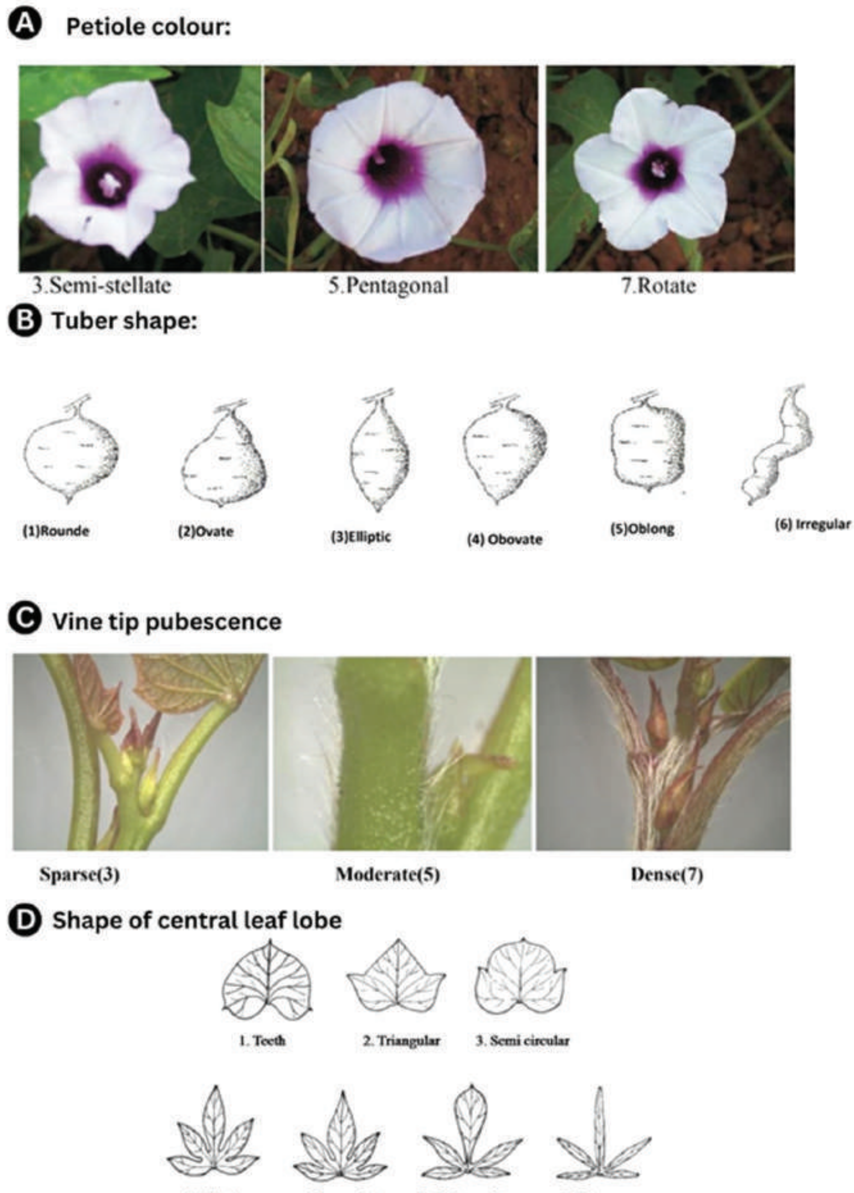
CULTIVATION AND HARVESTING

It is a short cycle crop which usually matures in (3-4) months and may be grown two or three times in a year. Sweet potatoes grow best in warm, humid climates with temperatures between 21–26 C. Well-drained, sandy-loam or loamy soils with a pH of 5.5–6.5 are ideal. Sweet potatoes are usually propagated using vine cuttings.

NUTRITIONAL BENEFITS

Sweet potatoes decrease the risk of obesity, diabetes and heart disease. Sweet potatoes contain almost twice as much fibre as other types of potatoes. Contributing close to 7 grams of fibre per serving, they make an excellent starchy addition to any meal. Sweet potato is considered to be one of the highly nutritious foods. The high fibre content gives them a "slow burning" quality. It maintaining a low sodium intake is essential to lowering blood pressure. Rich in beta-carotene may play a protective role against prostate cancer. Sweet potatoes are a great source of B6 vitamins, which are breakdowns the homo cysteine compounds, a substance that contributes to the hardening of blood vessels and arteries. Consume sweet potatoes or extracts from sweet potatoes help to control blood glucose level.

Sweet potatoes have long been intertwined with the cultural, nutritional, and economic lives of Kerala's tribal communities. These tuber crops thrive in the region's tropical climate and are especially important to the tribal population for their adaptability, nutritional value, and economic viability.



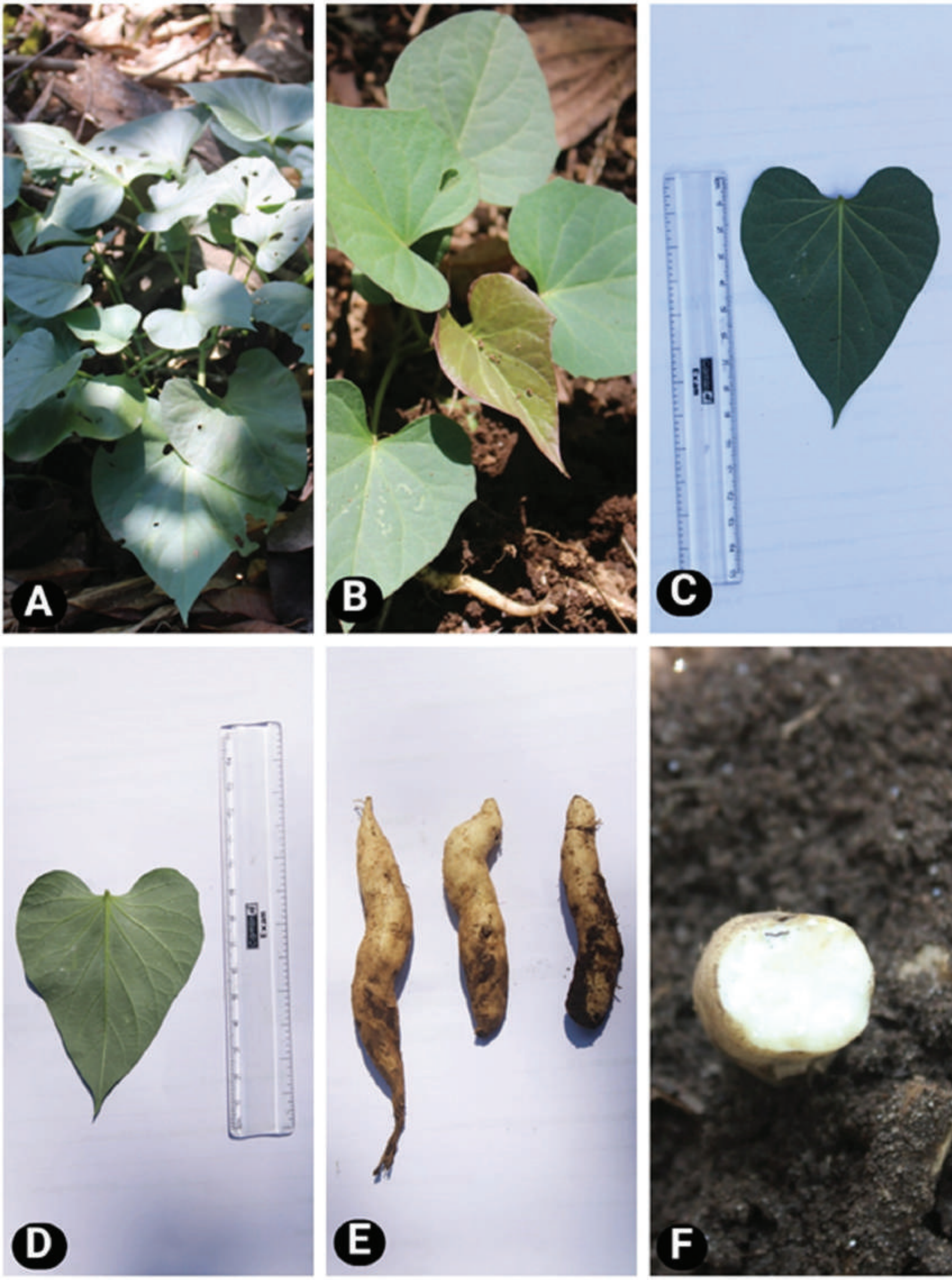
Morphological parameters for ippomea varieties: protection of plant varieties and farmer's rights authority (PPV&FRA), government of India

MADHURA KIZHANGU VARIETY 1

(Ipomoea batatas)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Plant growth habit	Spreading
Young vine colour	Green
Vine pigmentation	Green
Arrangement of leaf	Alternate
Young leaf colour	Brownish green
Mature leaf colour	Dark green
Petiole colour	Dark green
Petiole length (cm)	10 cm
Leaf shape	Triangular
Leaf lobe type	No lateral lobes
Shape of central leaf lobe	Absent
Leaf length	10 cm
Leaf width	07 cm
Leaf margin	Wavy
Abaxial leaf vein pigmentation	Green
Hairs/roots on tuber	Absent
Tuber shape	Irregular
Tuber: predominant skin colour	Crème
Tuber flesh colour	Creamish white



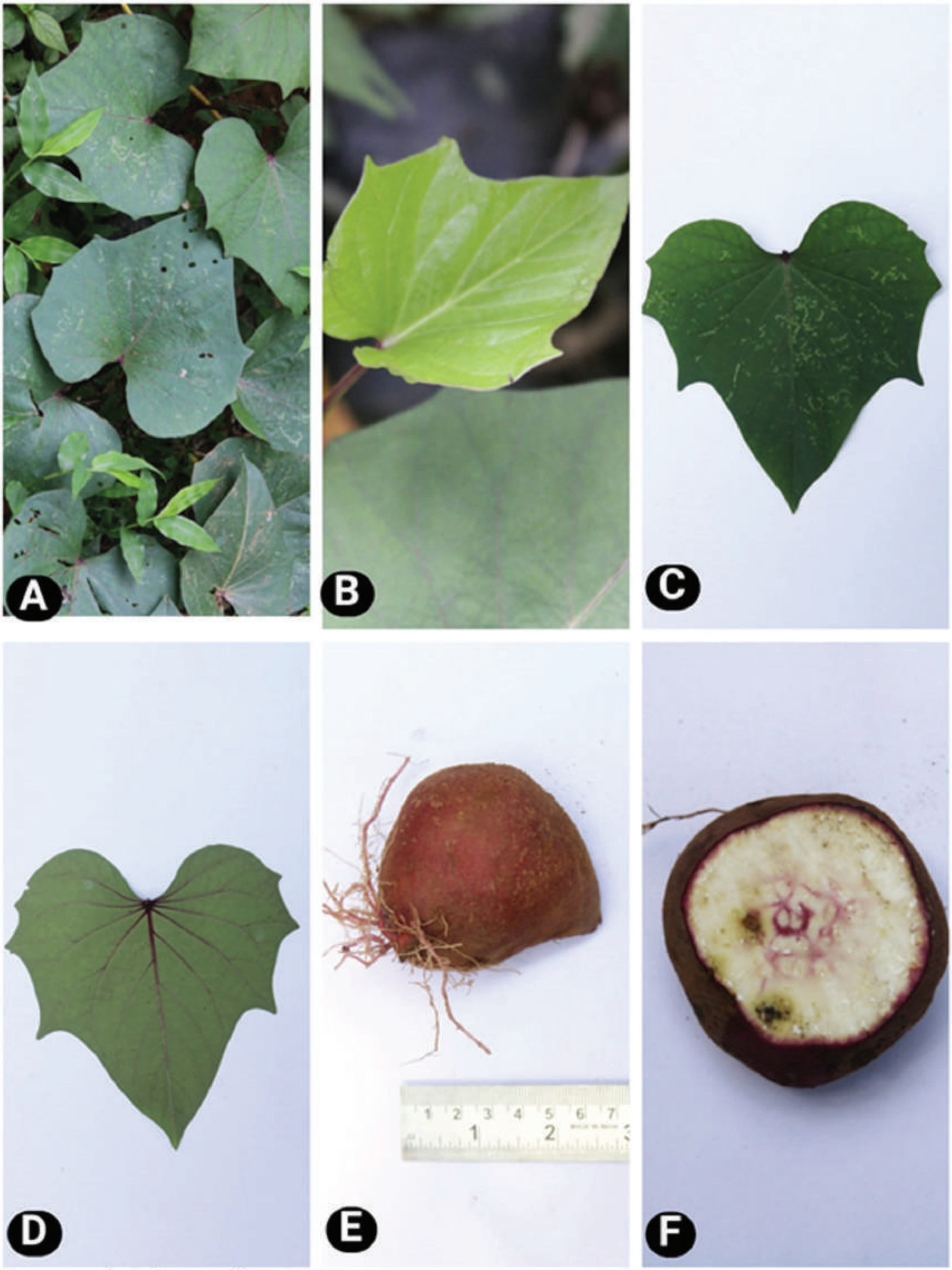
Ipomoea batatas (Madurakizhang)
A) Plant Habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of Mature leaf E) Tuber F) Cross section of tuber

MADHURA KIZHANGU VARIETY 2

(Ipomoea batatas)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Plant growth habit	Spreading
Young vine colour	Purple
Vine pigmentation	Purple
Arrangement of leaf	Alternate
Young leaf colour	Light green
Mature leaf colour	Dark green
Petiole colour	Dark green
Petiole length (cm)	15 cm
Leaf shape	Triangular
Leaf lobe type	Very slight teeth
Shape of central leaf lobe	Teeth
Leaf length	13 cm
Leaf width	12 cm
Leaf margin	Serrate
Abaxial leaf vein pigmentation	Purple
Hairs/roots on tuber	Absent
Tuber shape	Obovate
Tuber: predominant skin colour	Purple red
Tuber flesh colour	Cream With purple pigmentation



Ipomoea batatas var.2

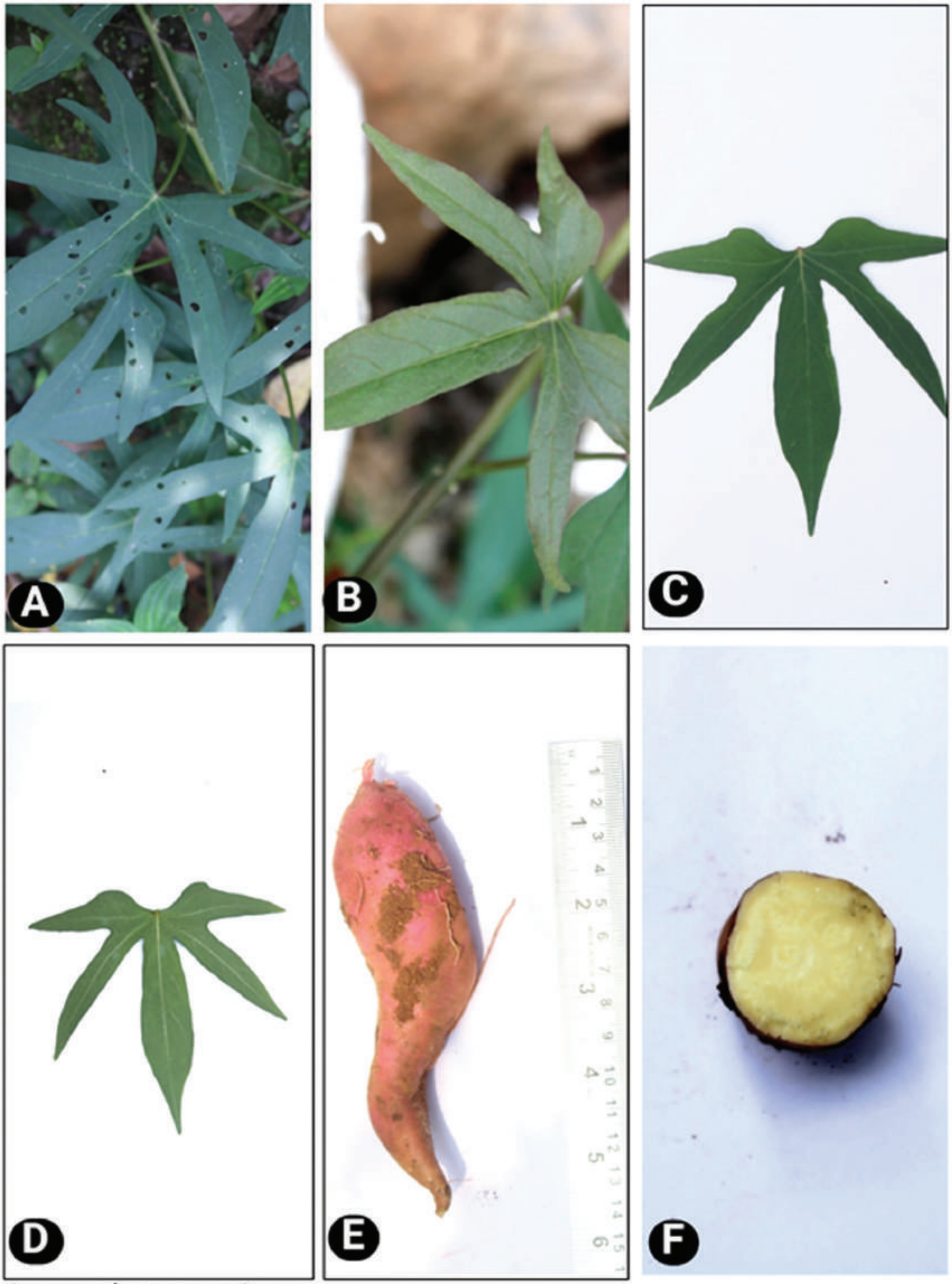
A) Plant Habit B) Young leaf C) Ventral side of mature leaf D) Dorsal side of Mature leaf E) Tuber F) Cross section of

MADHURA KIZHANGU VARIETY 3

(Ipomoea batatas)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Plant growth habit	Spreading
Young vine colour	Green
Vine pigmentation	Green
Arrangement of leaf	Alternate
Young leaf colour	Brownish green
Mature leaf colour	Dark green
Petiole colour	Green
Petiole length (cm)	18 cm
Leaf shape	Lobed
Leaf lobe type	Deep lobed
Shape of central leaf lobe	Elliptic
Leaf length (leaflet)	12 cm
Leaf width (leaflet)	2.5 cm
Leaf margin	Even
Abaxial leaf vein pigmentation	Green
Hairs/roots on tuber	Absent
Tuber shape	Irregular
Tuber: predominant skin colour	Pink
Tuber flesh colour	Cream



Ipomoea batatas var.3

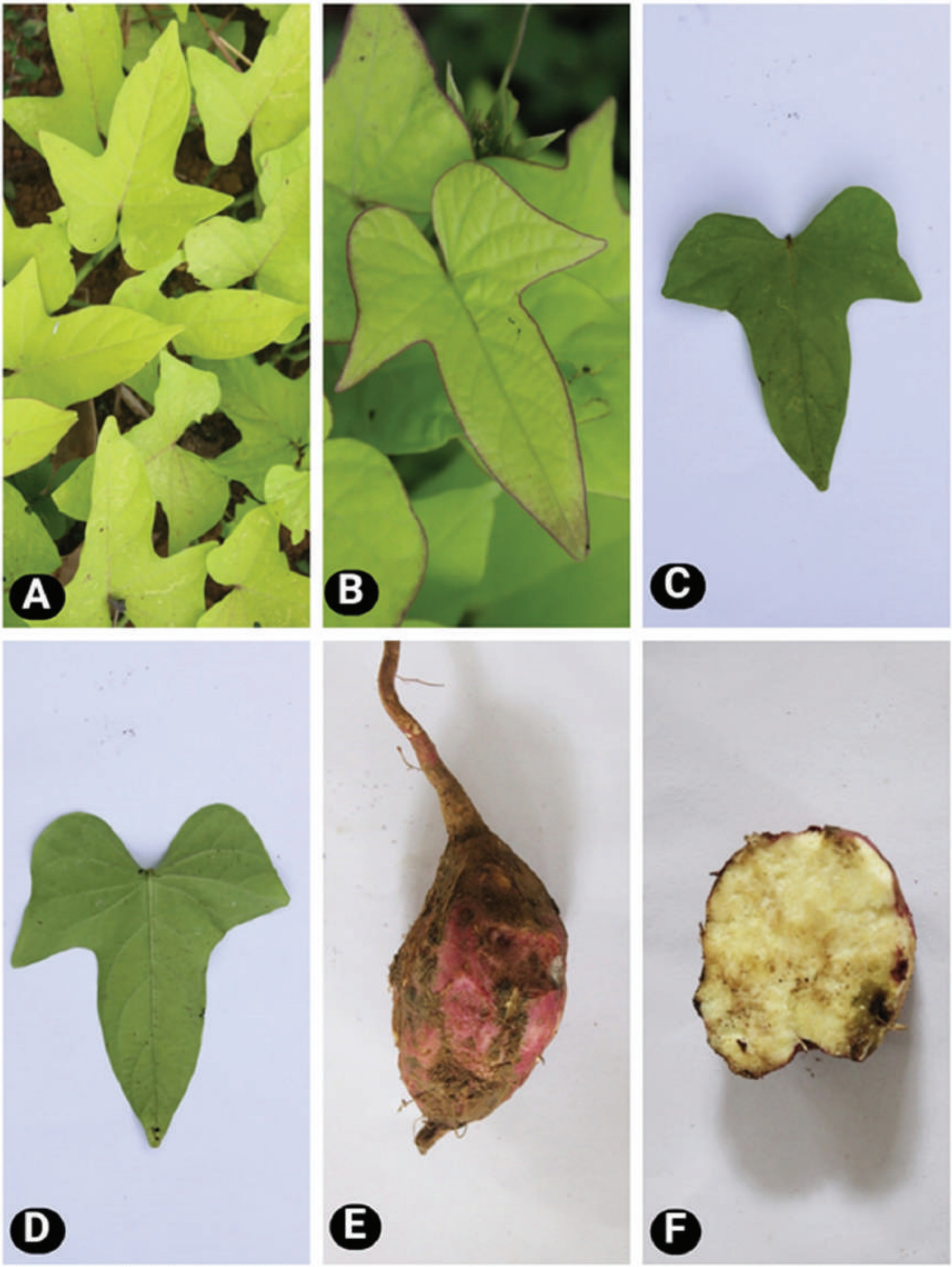
A) Plant Habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of Mature leaf E) Tuber F) Cross section of tuber

MADHURA KIZHANGU VARIETY 4

(Ipomoea batatas)

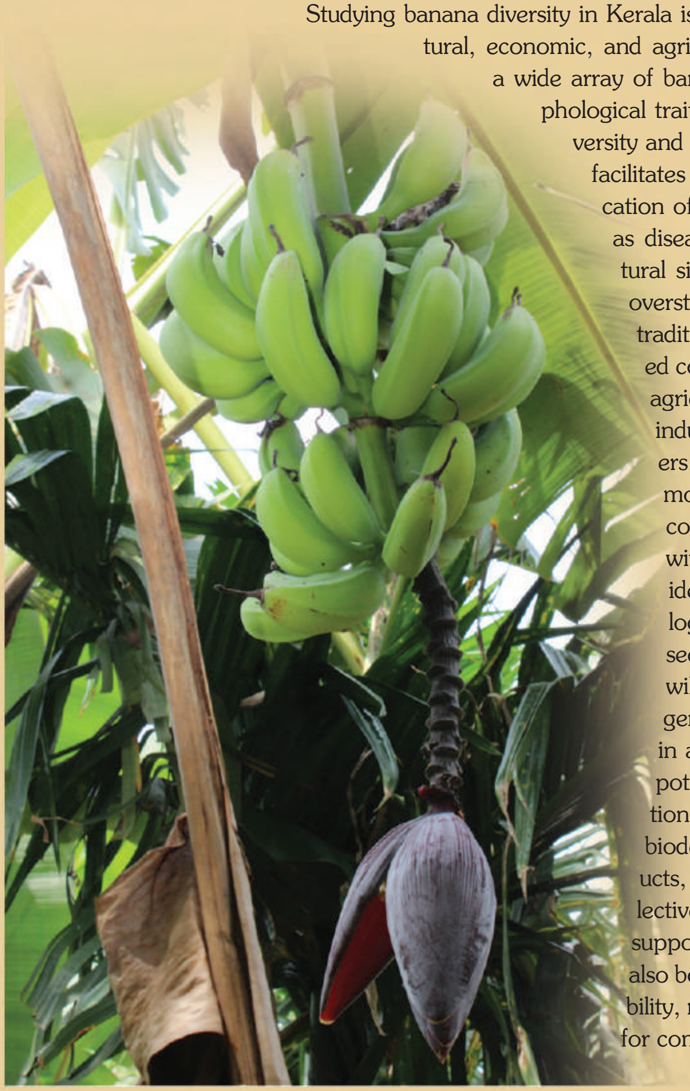
MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Plant growth habit	Spreading
Young vine colour	Light green
Vine pigmentation	Green
Arrangement of leaf	Alternate
Young leaf colour	Green with purple edge
Mature leaf colour	Yellow green
Petiole colour	Green
Petiole length (cm)	10 cm
Leaf shape	Lobed
Leaf lobe type	Moderate lobed
Shape of central leaf lobe	Elliptic
Leaf length	13 cm
Leaf width	11 cm
Leaf margin	Even
Abaxial leaf vein pigmentation	Green
Hairs/roots on tuber	Absent
Tuber shape	Elliptic
Tuber: predominant skin colour	Pink
Tuber flesh colour	Yellow



Ipomoea batatas var.4
A) Plant Habit B) Young leaf C) Ventral side of mature leaf
D) Dorsal side of Mature leaf E) Tuber F) Cross section of tuber

Banana Diversity and Cultural Significance in Kerala An Exploration of Varieties, Practices, and Economic Impact



Studying banana diversity in Kerala is pivotal due to its profound ecological, cultural, economic, and agricultural implications. The state is home to a wide array of banana cultivars, each exhibiting unique morphological traits that contribute to the region's rich biodiversity and nutritional value. Understanding these traits facilitates crop improvement by aiding in the identification of desirable characteristics for breeding, such as disease resistance and yield potential. The cultural significance of bananas in Kerala cannot be overstated, as they play a vital role in local cuisine, traditions, and festivals, representing a deep-seated connection between the community and their agricultural practices. Economically, the banana industry sustains the livelihoods of many farmers, and understanding market trends through morphological traits can help producers meet consumer preferences effectively. Additionally, with the increasing impacts of climate change, identifying resilient varieties through morphological studies is essential for ensuring food security. The preservation of traditional and wild banana varieties is critical to preventing genetic erosion and promoting sustainability in agriculture. Furthermore, there is significant potential for value addition through the production of nutraceuticals, ready-to-eat products, and biodegradable products from banana by-products, which can stimulate the local economy. Collectively, the study of banana diversity not only supports the agricultural landscape of Kerala but also bolsters its cultural heritage and economic stability, making it an endeavor of utmost importance for communal development and sustainability.

BANANA DIVERSITY IN KERALA

Banana in Kerala is exceptionally rich, encompassing various species and varieties that thrive in the region's tropical climate and fertile soil. Among the most notable banana varieties are Nendran, a popular cooking banana renowned for its large size and suitability for dishes like fritters and chips, and Njalipoovan, which is smaller favoured for its sweet taste as a snack. Kappapazham, also known as the "Red Banana," is cherished for its unique reddish skin and nutritional value, while other varieties like Robusta contribute to the region's agricultural biodiversity. This variety not only showcases the adaptability of bananas to local conditions but also highlights their significance in the local culinary landscape and agricultural economy.

Bananas hold profound cultural importance in Kerala, impacting local cuisine, traditions, and religious ceremonies. They serve as staple ingredients in traditional dishes, particularly the cooking varieties used in savory recipes, while also symbolizing prosperity and fertility in tribal cultures. Bananas are integral to significant life rituals, including marriages and childbirth ceremonies, where they are used to invoke blessings. During festivals and religious observances, bananas are offered to deities and featured in communal feasts, thus reinforcing social connections. Additionally, they find representation in folklore, art, and literature, embodying the deep-rooted ties between the people and their land. In essence, bananas are woven into the very fabric of Kerala's cultural identity, symbolizing abundance and the harmonious relationship between the community and nature.

Many tribal communities use bananas as a remedy for digestive issues. The fruit's high fiber content is known to ease constipation, and it is also often used in remedies for diarrhea. Ripe bananas are considered soothing for the stomach.

ECONOMIC IMPACT

The economic impact of banana cultivation in Kerala is significant, influencing both local livelihoods and broader economic dynamics. Banana farming plays a crucial role in providing sustainable livelihoods for many farmers in Kerala, enhancing food security and income stability. The state's favorable geographical and climatic conditions have established it as a key hub for diverse banana varieties, which are integral to the local economy. The banana production value chain includes stages such as cultivation, harvesting, processing, and marketing, with minimal post-harvest processing and emerging opportunities for value-added products like banana chips and flour, enhancing marketability. Local markets facilitate connections between farmers and consumers, while challenges in logistics and distribution can impact efficiency, suggesting that new technologies and direct-to-consumer sales could boost profitability. However, farmers face significant challenges, including disease threats like Panama disease and the bunchy top virus, environmental risks from climate change, market fluctuations, and competition from monoculture practices that undermine prices of traditional varieties. The limited access to advanced agricultural techniques and research funding further hinders yield optimization and resilience. Addressing these challenges is essential for sustaining growth in this vital sector, and collaborative efforts among farmers, government bodies, and research institutions are necessary to improve and ensure the long-term viability of banana farming in Kerala.

CONSERVATION AND SUSTAINABILITY

Conservation and sustainability of banana diversity in Kerala are vital due to threats posed by climate change and diseases. The banana production significantly contributes to the economy and provides livelihoods for many farmers, emphasizing the importance of ongoing conservation efforts to preserve indigenous and traditional banana varieties. These initiatives include research into disease-resistant strains and sustainable farming practices that promote agro-ecological methods, reduce chemical inputs, and support mixed cropping systems. Bananas hold immense cultural significance, being integral to local cuisine, rituals, and community celebrations, symbolizing prosperity and fertility. Maintaining a diverse gene pool is crucial for food security and resilience against market fluctuations, pests, and climate impacts. Furthermore, the integration of bananas into tribal agricultural practices underscores their role in nutrition and cultural identity, thereby highlighting the need for a comprehensive approach to preserve banana diversity and ensure sustainable agricultural practices in the region.

RESEARCH AND DEVELOPMENT

Research and development on banana diversity in Kerala is essential due to the state's rich agricultural heritage and the ecological and economic significance of bananas. Ongoing studies focus on the unique traits of various banana cultivars, such as Nendran, Poovan, and Kadali, to enhance productivity and resilience against pests and climate change. Agricultural universities and institutions play a crucial role in advancing cultivation techniques and educating farmers on sustainable practices, while community initiatives promote the conservation of local banana varieties, ensuring cultural and nutritional richness. This holistic approach, which encompasses scientific research, education, and active community participation, is vital for maintaining genetic diversity, enhancing food security, and supporting the livelihoods of local farmers, ultimately contributing to Kerala's economy and cultural identity.

CULTURAL SIGNIFICANCE

In tribal communities, banana plants or fruits are sometimes used as offerings during festivals and rituals to seek blessings or protection from deities. For example, during harvest festivals, bananas are commonly offered to local gods and spirits in the hope of ensuring a good harvest in the future. In some tribal cultures, a banana plant is used as a symbol of fertility and prosperity. It is sometimes part of traditional ceremonies, and planting a banana tree is believed to bring good fortune or protection to a family or community.

NUTRITIONAL PROFILE OF BANANAS

Bananas hold significant nutritional and cultural importance in Kerala. Here, the bananas are consumed both raw and cooked. Varieties like Nendran (plantain) are used in traditional dishes, while other varieties are eaten fresh as a snack or part of meals. Given their nutritional benefits, bananas are commonly recommended for children, athletes, and individuals recovering from illness. They provide a quick energy boost and are gentle on the stomach. An overview of the nutritional profile of bananas, is given below:

1. **Carbohydrates: Bananas are primarily composed of carbohydrates, mainly in the form of sugars (glucose, fructose, and sucrose) and dietary fiber. They provide a quick source of energy.**

2. **Vitamins:**

- Vitamin C: Important for immune function, skin health, and antioxidant properties.
- Vitamin B6: Essential for metabolism, brain health, and the production of neurotransmitters.

3. **Minerals:**

- Potassium: Bananas are well-known for their high potassium content, which is crucial for heart health, blood pressure regulation, and muscle function.
- Magnesium: Supports various biochemical reactions in the body and contributes to muscle and nerve function.

4. **Dietary Fiber:** This helps with digestive health, can aid in maintaining healthy cholesterol levels, and contributes to satiety.

5. **Low in Fat:** Bananas are virtually fat-free, making them a healthy choice for snacks and meals.

Bananas are nutritionally rich and culturally significant in Kerala. Their health benefits, culinary versatility, and economic importance make them a staple in the local diet and a vital part of life in the region.

Nutritional analysis of traditional banana varities

Traditional Banana Varieties	Carbohydrate %	Protein%	Crude fiber%	Potassium mg/100g
Monthen banana	76.95	7.78	1.21	2048.0
Charapoovan	75.51	3.14	1.26	839.0
Kunnan kaya	75.4	8.6	1.32	1851.0
Chemmatti chengathali	76.0	9.2	1.27	3469.0
Karakannen	80.6	6.9	1.3	985
Poomkalli	76.8	8.7	1.25	1724
Mannan	75.2	9.7	1.18	1752
Kasthuri monthen	77.6	7.8	1.27	2474.0

Upon comparing the nutritional analysis of 8 traditional banana varieties, it is evident that all bananas are rich in carbohydrates, protein, crude fiber, and potassium. Among them, Karakannen is exceptionally high in carbohydrates, containing about 80.6%. Mannan and Chemmetti Chengathali are particularly rich in protein, with levels of 9.7% and 9.2%, respectively. Additionally, all banana varieties are abundant in crude fiber. Chemmetti Chengathali stands out for its potassium content, which is significantly higher than other varieties, at approximately 3469.0 mg/100g.

Traditional Banana Varieties

A)Kunna Kaya, B)Monthan Kaya, C) Charapoovan, D)Chemmatti Chegadhali, E) Poomkalli , F) Karakannan, G) Mannan, H) kasthuri monthen

CULTIVATION PRACTICES AND HARVESTING

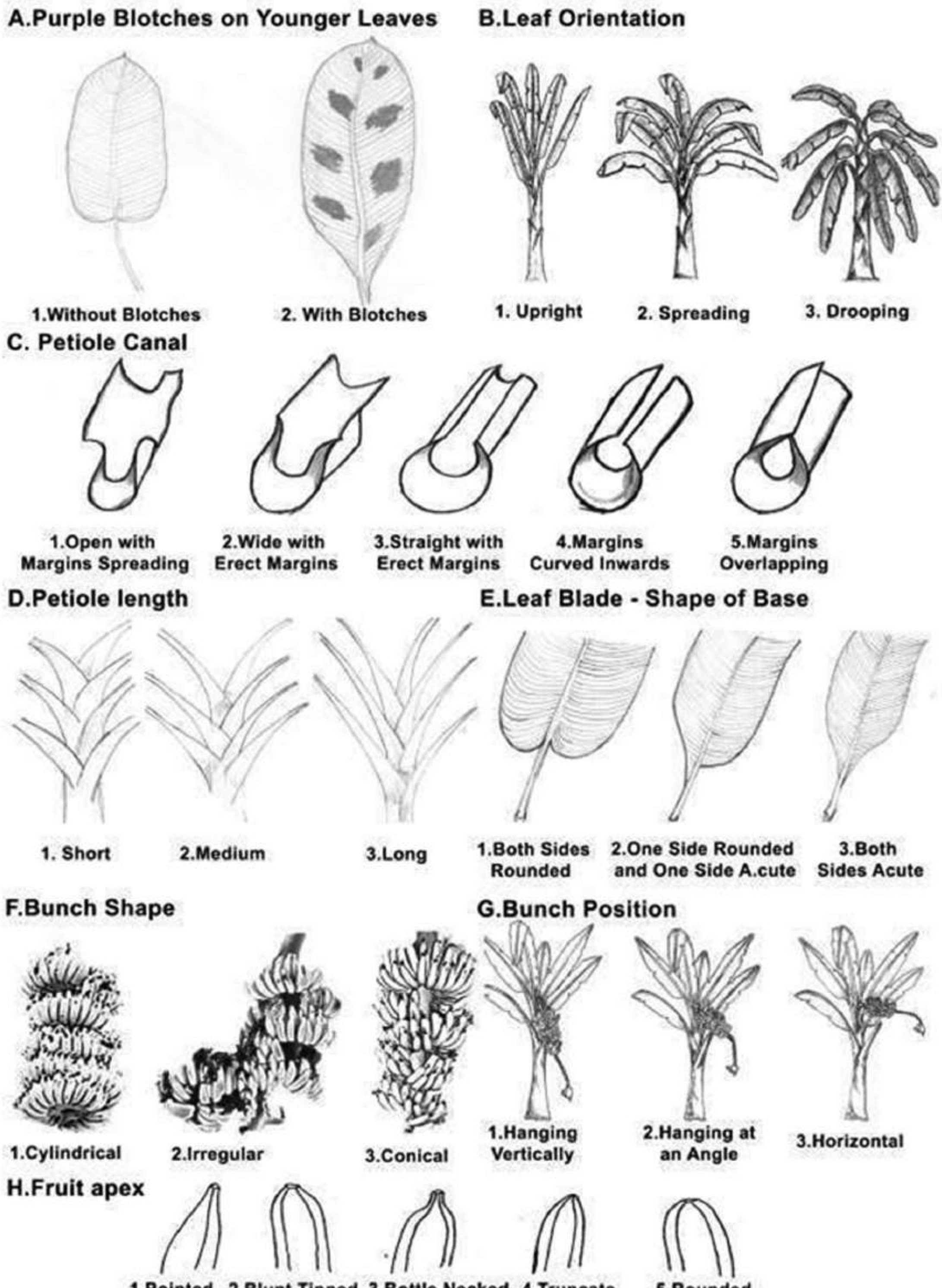
In the tribal communities of Kerala, banana cultivation is an important agricultural activity, not only for food security but also as a source of income. Bananas are typically propagated through suckers (offshoots from the parent plant). These suckers are selected from healthy banana plants and transplanted into prepared pits. The process of propagation is done carefully to ensure that the new plants are healthy and free from diseases. Banana plants need adequate space to grow. In tribal farming systems, farmers typically plant banana suckers with a spacing of about 1.5 to 2 meters apart, depending on the variety and the available land. Bananas require frequent watering, especially during the early growth stages. In tribal regions, where irrigation infrastructure might be limited, rainwater is crucial for banana farming. In some areas, traditional irrigation methods such as rainwater harvesting or small canals from nearby streams are used. The typical harvesting period for bananas is about 9–12 months after planting, depending on the variety and local climate conditions. After harvesting, the banana bunches are often hung in a cool, shaded area to ripen naturally. Some tribal communities use traditional methods like covering the bananas with banana leaves to speed up the ripening process.

FUTURE OUTLOOK FOR BANANA DIVERSITY AND CULTURAL HERITAGE IN KERALA

The future outlook for banana diversity and cultural heritage in Kerala is promising, driven by increased awareness of conservation efforts and sustainable agricultural practices. With the state's rich agricultural heritage, various traditional banana varieties such as Nendran, Poovan, etc. have immense cultural significance, being integral to local cuisine, festivals, and rituals. The ongoing initiatives for conserving genetic diversity are crucial for enhancing resilience against climate change and pests, thus ensuring both ecological sustainability and economic stability for farmers. As the market for organic and unique banana products is expanding, there are strong opportunities for value addition through processing and diversification, making bananas not only a staple food but also a vital part of Kerala's cultural identity and its economy.

GENOTYPING OF BANANA

Genotyping is a crucial approach for assessing genetic diversity and identifying variations among different banana (Musa spp.) varieties. In this study, a total of 34 banana varieties were subjected to genotyping using molecular markers to understand their genetic relationships and variability. The morphological characterization of these varieties were also conducted. Inter Simple Sequence Repeat (ISSR) markers were employed for molecular characterization, and Polymerase Chain Reaction (PCR) was performed on all 34 samples using different primers. Among these, PCR data from seven primers were selected for further analysis. The amplification results were analyzed using GeneMapper software, which facilitated the interpretation of allele sizes and banding patterns. Following the analysis, scoring of the obtained data was carried out based on the interpreted results to assess genetic similarities and differences among the studied banana varieties. This genotyping approach provides valuable insights into the genetic structure of banana populations, aiding in conservation strategies and the development of improved cultivars with desirable traits.



Morphological Parameters for Banana Varieties:Protection of Plant Varieties and Farmers Rights' Authority(PPV & FRA)Government of India

VANNAN/ MANNAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Straight with erect margins
Petiole length	Medium
Leaf blade-shape of base	One side rounded and other side acute
Bunch shape	Cylindrical
Bunch position	Hanging at an angle
Rachis orientation of male phase	Hanging vertically
Rachis- prominence of bract scars	Strong
Male bud	Present
Male bud shape	Rounded
Style shape	Straight
Bract behaviour –curling	Revolute
Fruit shape	Slightly curved
Transverse section of fruit	Slightly ridges
Fruit apex	Bottle necked
Persistence of floral organs	Present

Vannan

Habitat

Fruit

Petiole

Rachis

PACHACHINGAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

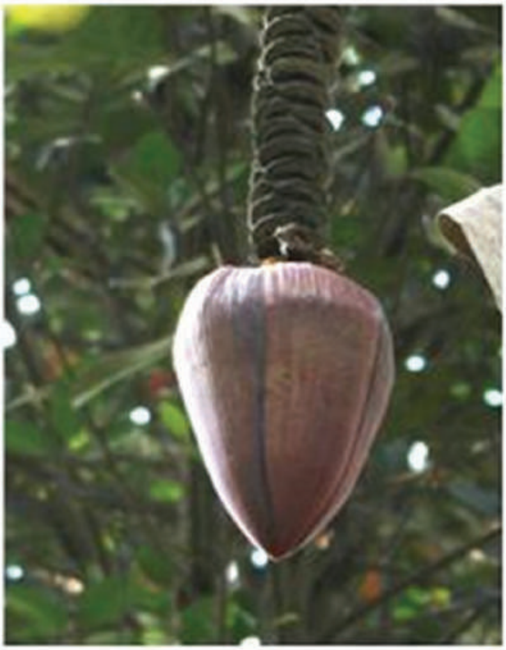
CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Upright
Petiole canal	Margins curved inward
Petiole length	Short
Leaf blade-shape of base	One side rounded and other side acute
Bunch shape	Conical
Bunch position	Hanging at an angle
Rachis- prominence of bract scars	Weak
Male bud	Present
Male bud shape	Ovoid
Style shape	Curved under the base
Bract behaviour -curling	Revolute
Fruit shape	Slightly curved
Fruit apex	Truncate
Persistence of floral organs	Present

Pachachingan

Habitat

Fruit

Petiole



Rachis

ADAYKKA POOVAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

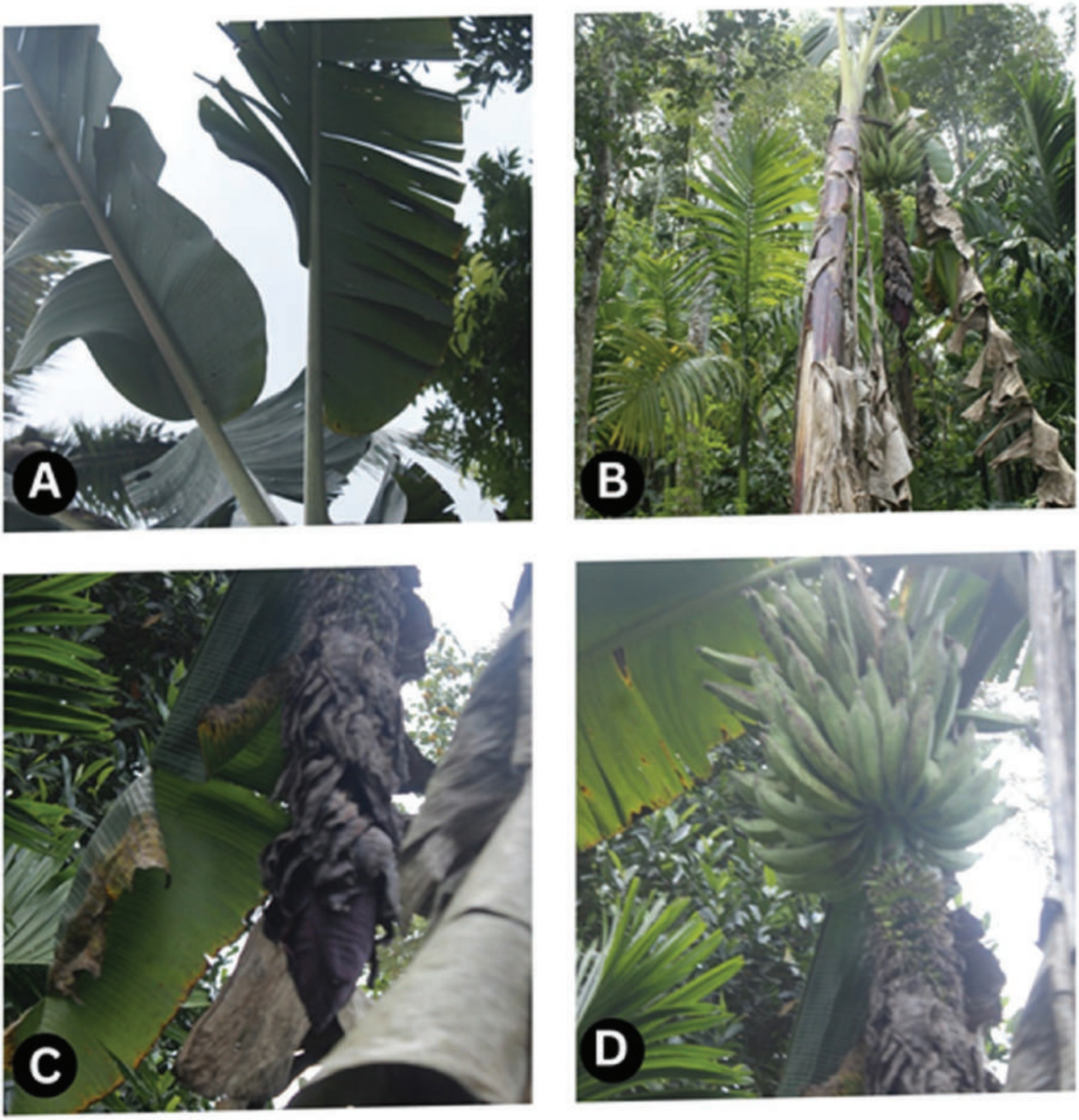
CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margine curved inwards
Petiole length	Long
Leaf blade-shape of base	One side rounded and other side acute
Bunch shape	Cylindrical
Bunch position	Hanging at an angle
Rachis orientation of male phase	Hanging vertically
Rachis- prominence of bract scars	Moderate
Male bud	Present
Male bud shape	Lanceolate
Style shape	Straight
Bract behaviour -curling	Revolute
Fruit shape	Slightly curved
Fruit apex	Bottle necked
Persistence of floral organs	Present

AATTUNENTHRA

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Upright
Petiole canal	Margins curved inward
Petiole length	Medium
Leaf blade-shape of base	Both side rounded
Bunch shape	Cylindrical
Bunch position	Hanging vertically
Rachis- prominence of bract scars	Moderate
Male bud	Degenerative
Male bud shape	Lanceolate
Style shape	Straight
Bract behaviour -curling	Revolute
Fruit shape	Straight
Fruit apex	Bottle necked
Persistence of floral organs	Present
Rachis orientation of male phase	Hanging vertically



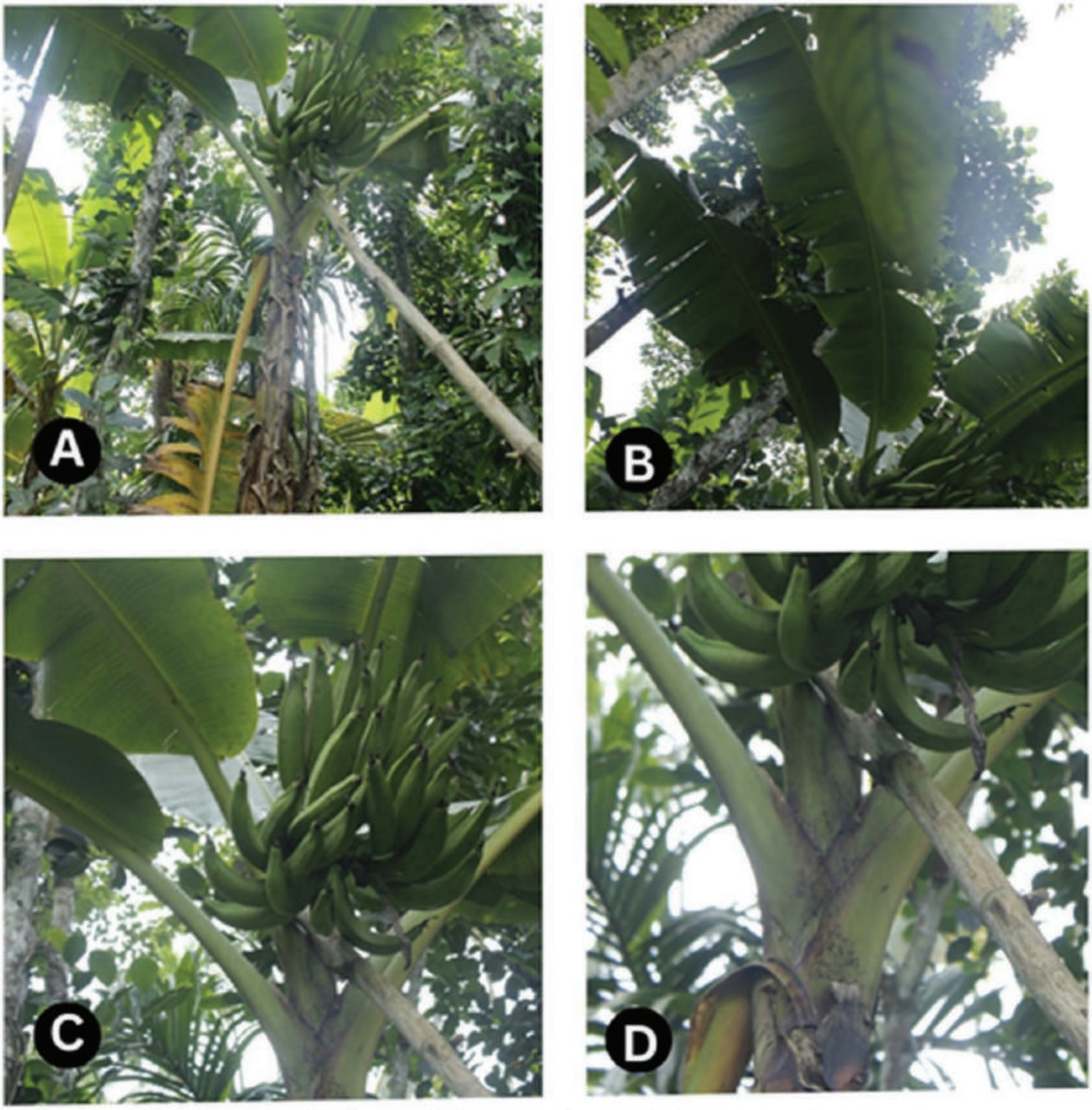
Musa sps.(Attunedra): (A)Leaf petiole (B)Habit (C) Male inflorescence (D)Bunch

CHUNDILLA NENTHRA

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margins curved inward
Petiole length	Medium
Leaf blade-shape of base	One side rounded and one side acute
Bunch shape	Cylindrical
Bunch position	Horizontal
Fruit shape	Slightly curved
Fruit apex	Pointed
Persistence of floral organs	Present
Rachis orientation of male phase	Curved with vertical end



***Musa* sps.(Chundilanendra): (A)Habit (B)Sucker (C) Bunch (D)Petiole**

MANJAPPOOVAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Straight with erect margin
Petiole length	Medium
Leaf blade-shape of base	Both side rounded
Bunch shape	Cylindrical
Bunch position	Hanging vertically

Manjapoovan

Habitat

Leaf

Petiole

CHUNDILLAKANNAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margin curved inwards
Petiole length	Long
Leaf blade-shape of base	Both sides acute
Bunch shape	Cylindrical
Bunch position	Horizontal
Rachis- orientation of male phase	Inclined at an angle
Rachis- prominence of bract scars	Moderate
Male bud	Degenerative
Male bud shape	Lanceolate
Style shape	Straight
Bract behaviour	Non- revolute
Fruit shape	Straight
Fruit apex	Pointed
Persistence of floral organs	Present

Chundilakannan

Habitat

Fruit

Young Plant

Petiole

MALAMPOOVAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Wide with erect margines
Petiole length	Medium
Leaf blade-shape of base	Both side rounded

Malampoovan

Habitat

Leaf

Dorsal Side

Petiole

CHARAPPOOVAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margin curved inwards
Petiole length	Medium
Leaf blade-shape of base	Both side rounded
Bunch shape	Cylindrical
Bunch position	Hanging vertically
Rachis- prominence of bract scars	Weak
Male bud	Present
Male bud shape	Ovoid
Style shape	Straight
Bract behaviour -curling	Revolute
Fruit shape	Straight
Fruit apex	Bottle necked
Persistence of floral organs	Present
Rachis orientation of male phase	Hanging vertically

Charapoovan

Habitat

Fruit

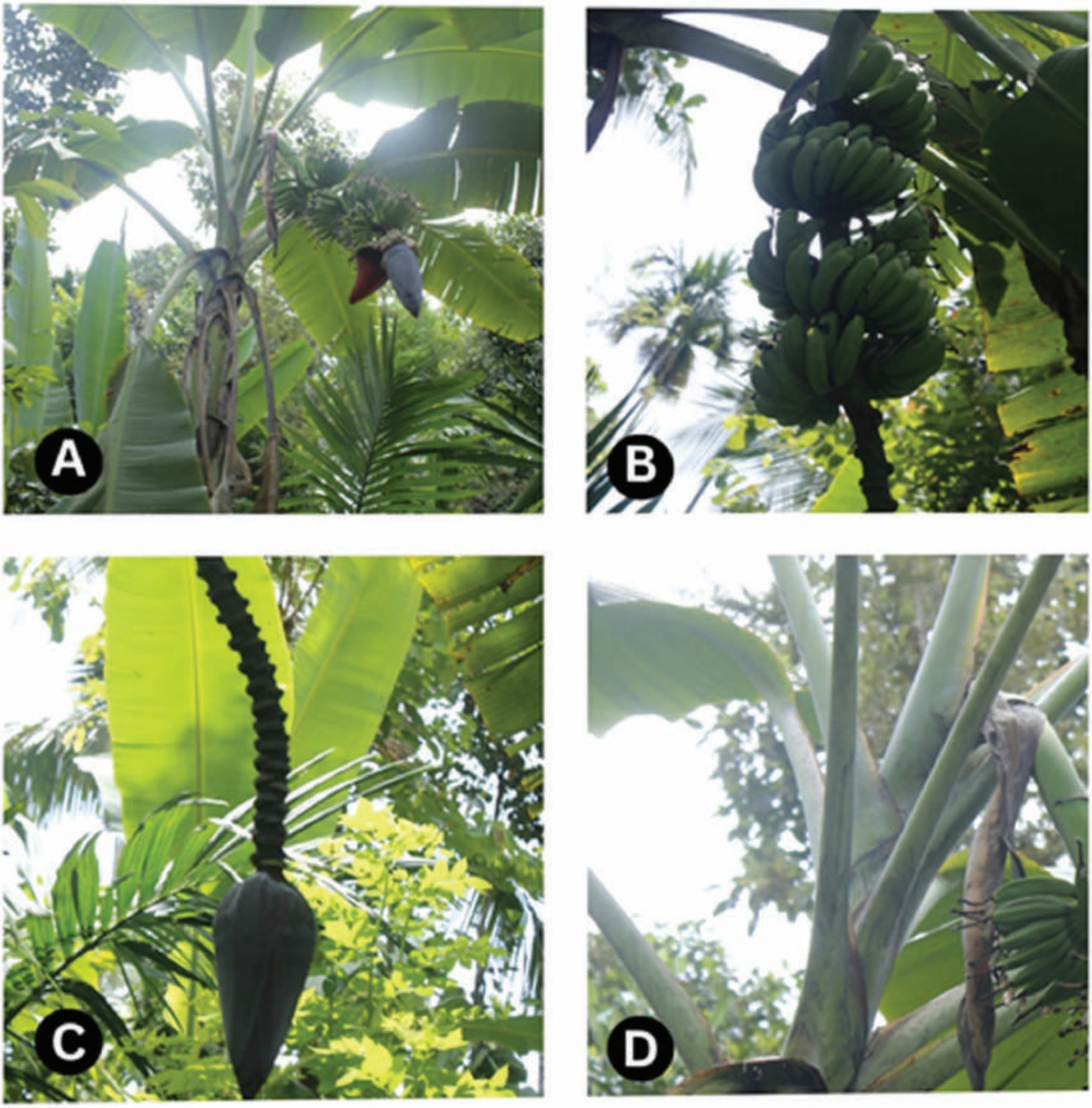
Petiole

Young Plant

NADAN POOVAN/ PODIPOOVAN

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margin curved inwards
Petiole length	Medium
Leaf blade-shape of base	One side rounded and one side acute
Bunch shape	Cylindrical
Bunch position	Hanging at an angle
Rachis- prominence of bract scars	Moderate
Male bud	Present
Male bud shape	Lanceolate
Style shape	Straight
Bract behaviour -curling	Revolute
Fruit shape	Straight
Fruit apex	Blunt tipped
Persistence of floral organs	Present
Rachis orientation of male phase	Curved with vertical end



Musa sps.(Nadanpoovan): (A) Habit (B) Bunch (C) Male inflorescence (D) Petiole

WAYANADAN KALLUVAZHA

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	wide with erect margins
Petiole length	Medium
Leaf blade-shape of base	Both side acute
Bunch shape	Conical
Bunch position	Hanging vertically
Rachis orientation of male phase	Hanging vertically
Rachis- prominence of bract scars	Moderate
Male bud	Present
Male bud shape	Lanceolate
Style shape	Straight
Bract behaviour -curling	Non-revolute
Fruit shape	Straight
Fruit apex	Bottle necked
Persistence of floral organs	Present

Wayanadan Kallu Vazha

Habitat

Fruit

Rachis

Petiole

AMRUTHASAGAR

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	With blotches
Leaf orientation	Spreading
Petiole canal	wide with erect margins
Petiole length	Short
Leaf blade-shape of base	One side rounded and other side acute
Bunch shape	Cylindrical
Bunch position	Hanging at an angle
Rachis orientation of male phase	Curved with vertical end
Rachis- prominence of bract scars	Strong
Male bud	Present
Male bud shape	Ovoid
Style shape	Straight
Bract behaviour -curling	Revolute
Fruit shape	Slightly curved
Fruit apex	Truncate
Persistence of floral organs	Present

Amrutha Sagar

Habitat

Fruit

Rachis

Petiole

POONKALLI

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margins overlapping
Petiole length	Short
Leaf blade-shape of base	Both side rounded
Bunch shape	Cylindrical
Bunch position	Hanging at angle
Rachis orientation of male phase	Horizontal with inclined end
Rachis- prominence of bract scars	Moderate
Male bud	Present
Male bud shape	Lanceolate
Style shape	Curved under stigma
Bract behaviour -curling	Non-revolute
Fruit shape	Slightly curved
Fruit apex	Bottle necked
Persistence of floral organs	Present

Pookali

Habitat

Fruit

Rachis

Petiole

ADUKKAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	With blotches
Leaf orientation	Spreading
Petiole canal	Margins curved inwards
Petiole length	Long
Leaf blade-shape of base	Both sides rounded
Bunch shape	Cylindrical
Bunch position	Hanging at an angle
Rachis orientation of male phase	Hanging vertically
Rachis- prominence of bract scars	Moderate
Male bud	Present
Male bud shape	Lanceolate
Style shape	Straight
Bract behaviour -curling	Revolute
Fruit shape	Straight
Fruit apex	Bottle necked
Persistence of floral organs	Present

Adukkan

Habitat

Fruit

Rachis

Petiole

CHAVANIPPOOVAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margins overlapping
Petiole length	Long
Leaf blade-shape of base	Both sides rounded
Bunch shape	Conical
Bunch position	Hanging at an angle
Rachis orientation of male phase	Horizontal with inclined end
Rachis- prominence of bract scars	Moderate
Male bud	Present
Male bud shape	Lanceolate
Style shape	Straight
Bract behaviour -curling	Non-revolute
Fruit shape	Straight
Fruit apex	Bottle necked
Persistence of floral organs	Present

Chavanipoovan

Habitat

Fruit

Rachis

Petiole

MYSORE ETHAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Upright
Petiole canal	wide with erect margins
Petiole length	Short
Leaf blade-shape of base	Both sides rounded
Bunch shape	Cylindrical
Bunch position	Hanging at an angle
Rachis orientation of male phase	Horizontal with inclined end
Rachis- prominence of bract scars	Weak
Male bud	Present
Male bud shape	Ovoid
Style shape	Straight
Bract behaviour -curling	Non-revolute
Fruit shape	Slightly curved
Fruit apex	Bottle necked
Persistence of floral organs	Present

Mysore Ethan

Habitat

Fruit

Rachis

Petiole

KARPOORAVALLI

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margins curved inwards
Petiole length	Medium
Leaf blade-shape of base	Both side rounded
Bunch shape	Conical
Bunch position	Hanging at an angle
Rachis orientation of male phase	Horizontal with inclined end
Rachis- prominence of bract scars	Strong
Male bud	Degenerative
Male bud shape	Lanceolate
Style shape	Straight
Bract behaviour -curling	Revolute
Fruit shape	Straight
Fruit apex	Pointed
Persistence of floral organs	Present

Karpooravali

Habitat

Fruit

Rachis

Petiole

MANJA VAZHA

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margins overlapping
Petiole length	Medium
Leaf blade-shape of base	Both sides rounded
Bunch shape	Conical
Bunch position	Hanging vertically
Rachis orientation of male phase	Hanging vertically
Rachis- prominence of bract scars	Weak
Male bud	Present
Male bud shape	Ovoid
Style shape	Straight
Bract behaviour -curling	Non-revolute
Fruit shape	Slightly curved
Fruit apex	Rounded
Persistence of floral organs	Present

Manjavazha

Habitat

Fruit

Rachis

Petiole

VELIPADATHI

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Upright
Petiole canal	Margins curved inwards
Petiole length	Long
Leaf blade-shape of base	Both sides acute
Bunch shape	Conical
Bunch position	Horizontal
Rachis orientation of male phase	Horizontal with inclined end
Rachis- prominence of bract scars	Strong
Male bud	Present
Male bud shape	Ovoid
Style shape	Straight
Bract behaviour -curling	Revolute
Fruit shape	Slightly curved
Fruit apex	Blunt tipped
Persistence of floral organs	Absent

Velipadathi

Habitat

Fruit

Rachis

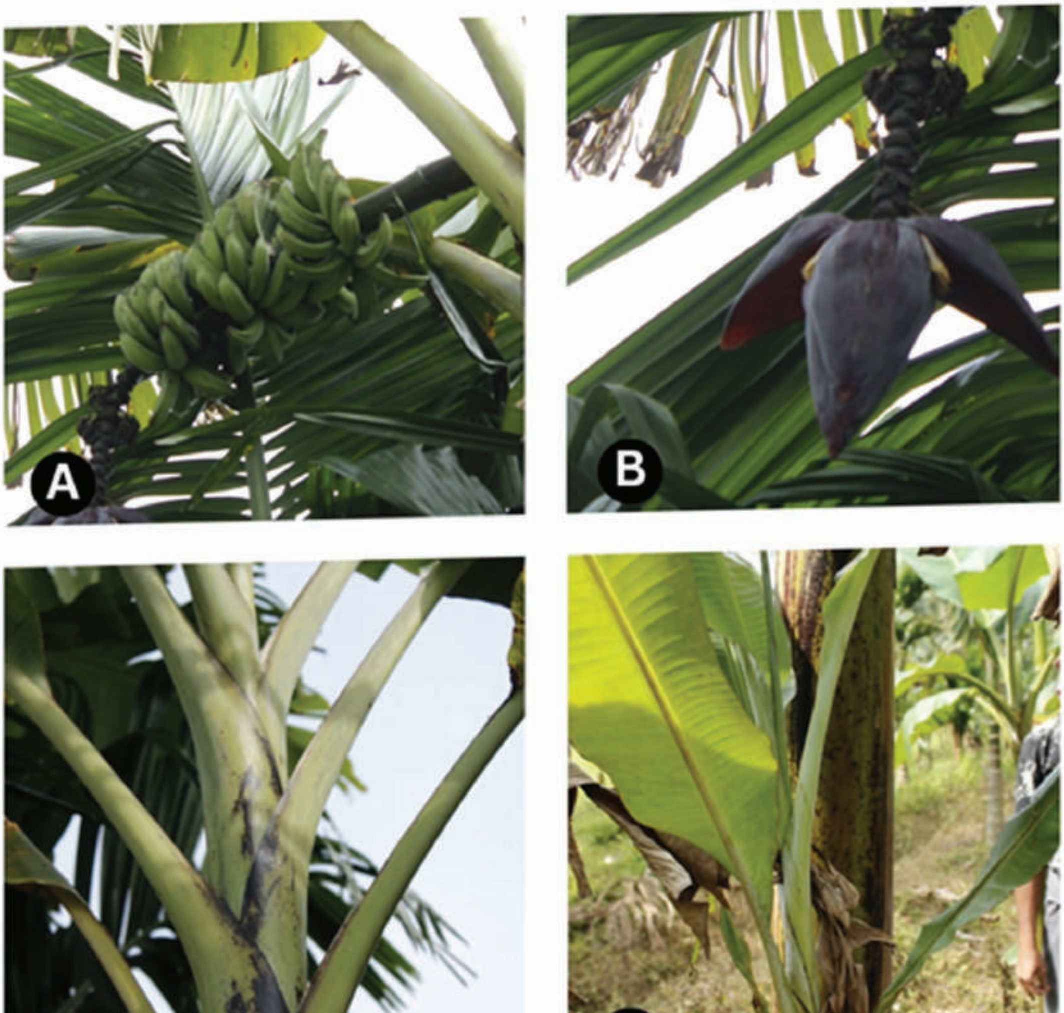
Petiole

KALI

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Straight with erect margins
Petiole length	Medium
Leaf blade-shape of base	One side rounded and other side acute
Bunch shape	Conical
Bunch position	Hanging at an angle
Rachis orientation of male phase	Horizontal with inclined end
Rachis- prominence of bract scars	Weak
Male bud	Present
Male bud shape	Rounded
Style shape	Curved under the base
Bract behaviour -curling	Non revolute
Fruit shape	Straight
Fruit apex	Bottle necked
Persistence of floral organs	Present



Musa **sps.(kali): (A)Bunch (B) Male inflorescence (C)Petiole (D)Sucker**

MONTHAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margins overlapping
Petiole length	Long
Leaf blade-shape of base	One side rounded and other side acute
Bunch shape	Conical
Bunch position	Hanging at an angle
Rachis orientation of male phase	Curved with vertical end
Rachis- prominence of bract scars	Weak
Male bud	Present
Male bud shape	Ovoid
Style shape	Straight
Bract behaviour –curling	Non revolute
Fruit shape	Straight
Fruit apex	Blunt tipped
Persistence of floral organs	Present

Monthan

Habitat

Fruit

Rachis

Petiole

VETTAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Straight with erect margins
Petiole length	Medium
Leaf blade-shape of base	One side rounded and other side acute
Bunch shape	Conical
Bunch position	Hanging vertically
Rachis orientation of male phase	Hanging vertically
Fruit shape	Slightly curved
Fruit apex	Rounded
Persistence of floral organs	Present

Vettan

Habitat

Fruit

Petiole

MATTI

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Straight with erect margins
Petiole length	Long
Leaf blade-shape of base	Both side acute
Bunch shape	Conical
Bunch position	Horizontal
Rachis orientation of male phase	Horizontal with inclined end
Rachis- prominence of bract scars	Moderate
Male bud	Present
Male bud shape	Lanceolate
Style shape	Straight
Bract behaviour -curling	Revolute
Fruit shape	Slightly curved
Fruit apex	Pointed
Persistence of floral organs	Absent

Matti

Habitat

Fruit

Rachis

Petiole

KUNNHAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Purple blotches on younger leaves	Without blotches
Leaf orientation	Spreading
Petiole canal	Margins overlapping
Petiole length	Long
Leaf blade-shape of base	Both sides rounded
Bunch shape	Conical
Bunch position	Hanging at an angle
Rachis orientation of male phase	Horizontal with inclined end
Rachis- prominence of bract scars	Moderate
Male bud	Present
Male bud shape	Lanceolate
Style shape	Curved under stigma
Bract behaviour -curling	Non revolute
Fruit shape	Slightly curved
Fruit apex	Bottle necked
Persistence of floral organs	Present

Kunnhan

Habitat

Fruit

Rachis

Petiole

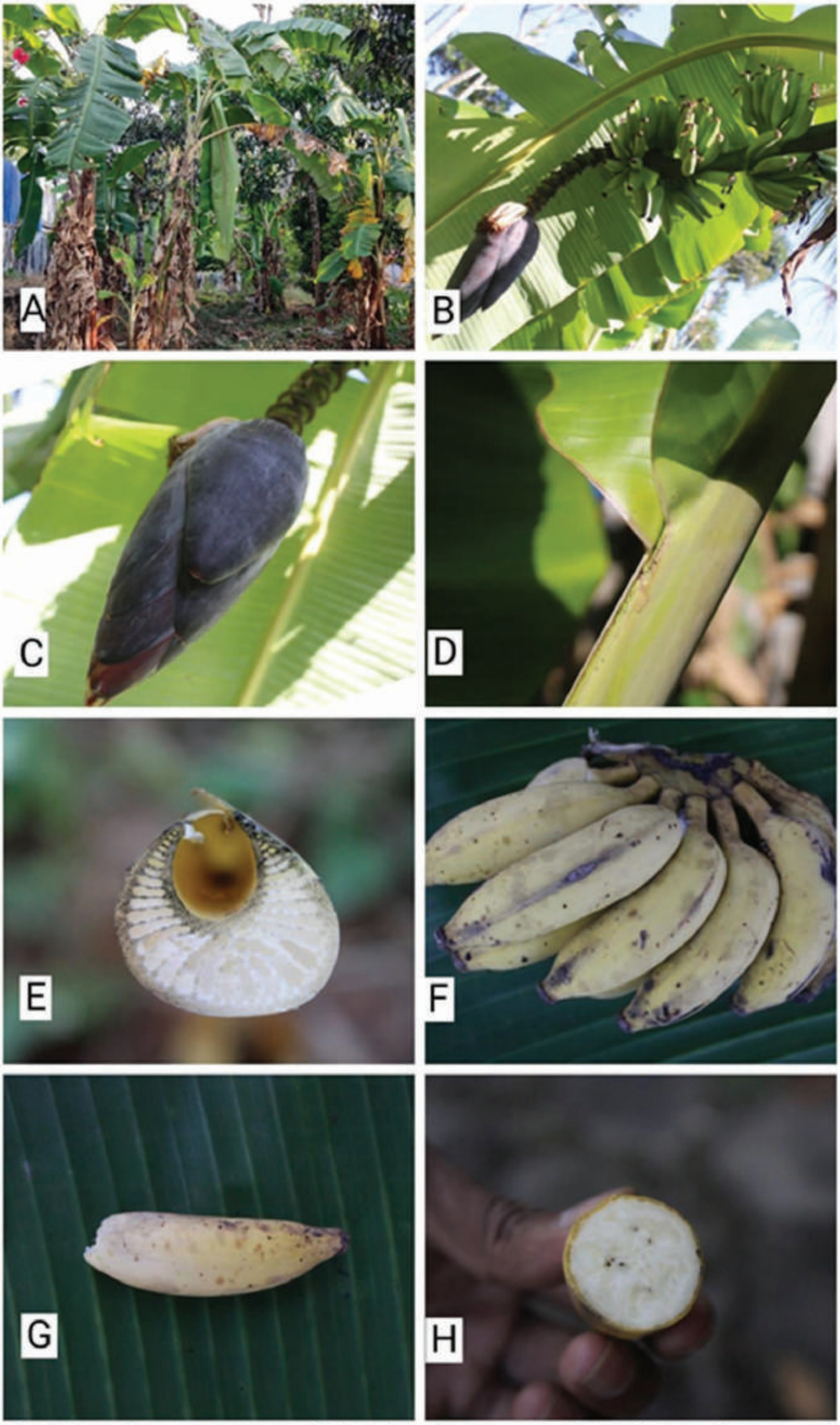
NJALIPOOVAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Pseudostem length (m)	Medium
Pseudostemcolour	Red
Purple blotches on younger leaves	Absent
Colour of the under surface of cigar leaf	Green
Leaf orientation	Spreading
Petiole canal	Margins overlapping
Petiole length (cm)	Medium
Leaf blade- shape of base	One side rounded and one side acute
Peduncle colour	Green
Peduncle pubescence	Absent
Fruit length (cm)	Medium, 8 cm
Fruit shape	Slightly curved
Transverse section of fruit	Rounded
Fruit apex	Bottle necked
Persistence of floral organs	Absent
Fruit pedicel attachment at ripeness	Medium
Pedicel surface	Glabrous
Pedicel length (cm)	Long
Peel colour before ripening	Green
Adherence of peel	Medium
Waxiness of the fruit	Not waxy
Peel colour at full ripeness	Golden yellow
Fruit pulp colour at ripeness	Cream
No. of hands per bunch	Many
No. of fingers per hand	Many

NJALI POOVAN (*Musa sp.*)



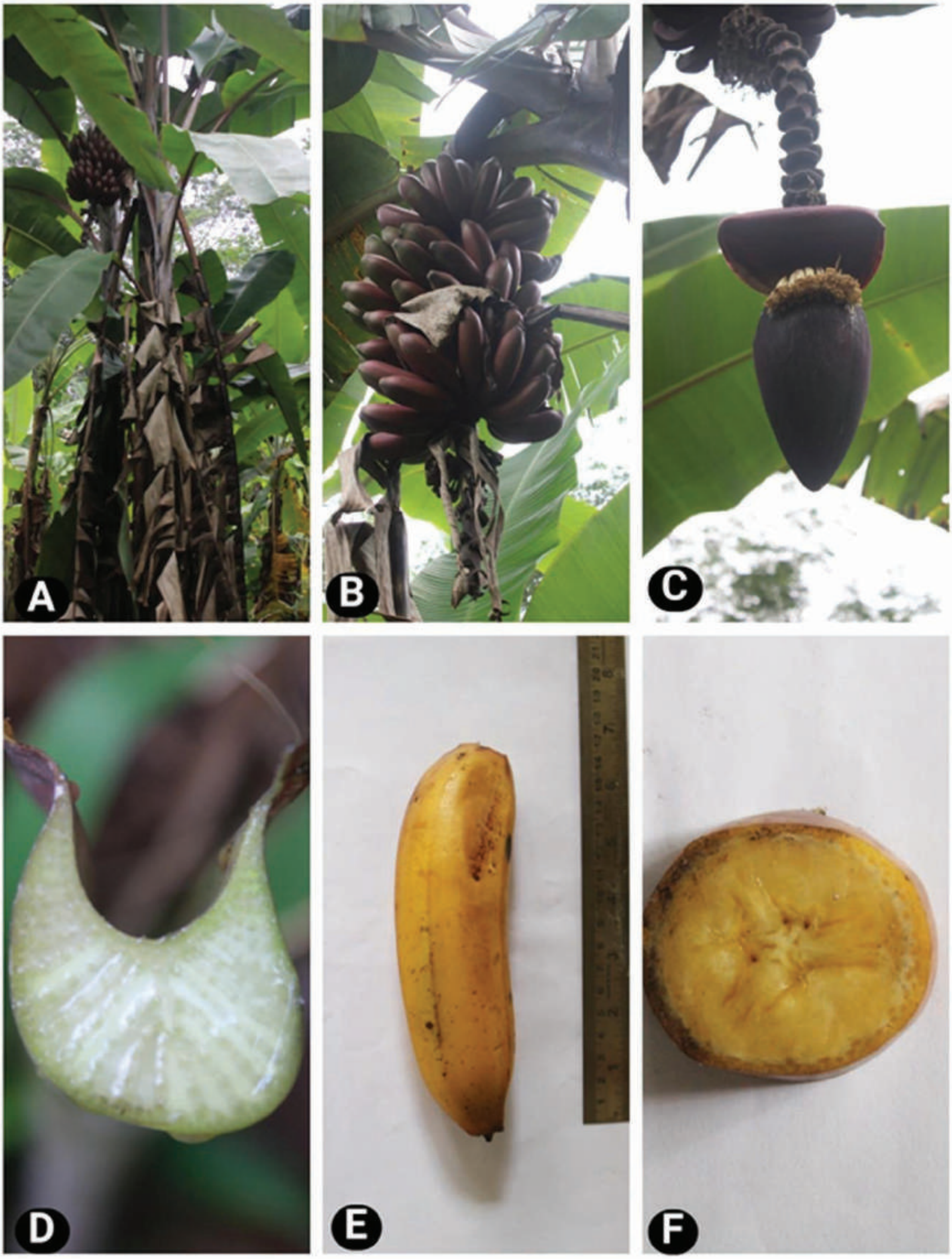
A) Habbit B) Unripened Bunch C)Male inflorescence D) Leaf Base Shape
E)Petiole canal F) Ripened Hand G) Ripened Fruit H)Transverse section of fruit

CHENKADHALI

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Pseudostem length (m)	Long
Pseudostemcolour	Red
Purple blotches on younger leaves	Absent
Colour of the under surface of cigar leaf	Green
Leaf orientation	Upright
Petiole canal	Wide with erect margins
Petiole length (cm)	Medium
Leaf blade- shape of base	One side rounded and one side acute. Both sides acute in younger stage.
Peduncle colour	Red
Bunch shape	Irregular
Fruit length (cm)	Long , 18 cm
Fruit shape	Straight at the distal part
Transverse section of fruit	Rounded
Fruit apex	Blunt tipped
Persistence of floral organs	Absent
Fruit pedicel attachment at ripeness	Medium
Pedicel surface	Glabrous
Pedicel length (cm)	Long
Peel colour before ripening	Purplish red
Adherence of peel	Medium
Waxiness of the fruit	waxy
Peel colour at full ripeness	Red orange
Fruit pulp colour at ripeness	Yellow
No. of hands per bunch	Few
No. of fingers per hand	Many
Bunch position	Hanging at an angle
Male bud shape	Ovoid
Rachis: prominence of bract scars	Strong
Rachis : orientation of male phase	Curved with vertical end



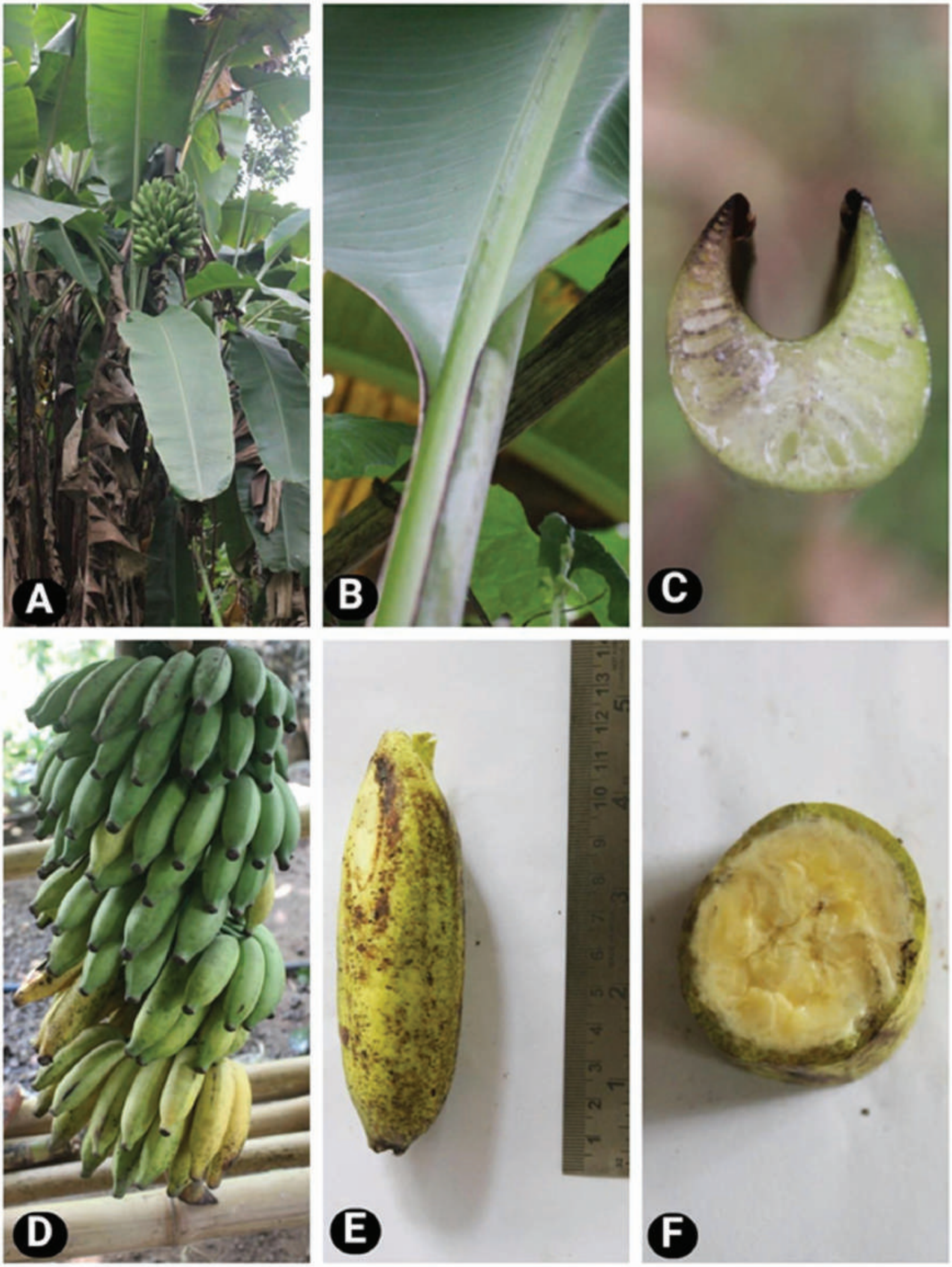
Chenkadhali *(Musa sp.)*
A)Plant Habit B) Matured Bunch C) Male bud
D) Petiole canal E) Ripened Fruit F) Cross section of fruit

POOJA KADHALI

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Pseudostem length (m)	Medium
Pseudostemcolour	Green
Purple blotches on younger leaves	Absent
Colour of the under surface of cigar leaf	Green
Leaf orientation	Spreading
Petiole canal	Straight with erect margins
Petiole length (cm)	Medium
Leaf blade- shape of base	One side rounded and one side acute.
Peduncle colour	Green
Bunch shape	Cylindrical
Fruit length (cm)	Medium , 12 cm
Fruit shape	Straight
Transverse section of fruit	Rounded
Fruit apex	Blunt tipped
Persistence of floral organs	Present
Fruit pedicel attachment at ripeness	Medium
Pedicel surface	Glabrous
Pedicel length (cm)	Short
Peel colour before ripening	Green
Adherence of peel	Medium
Waxiness of the fruit	Non waxy
Peel colour at full ripeness	Pale yellow
Fruit pulp colour at ripeness	Cream
No. of hands per bunch	Medium
No. of fingers per hand	Many
Bunch position	Hanging at an angle



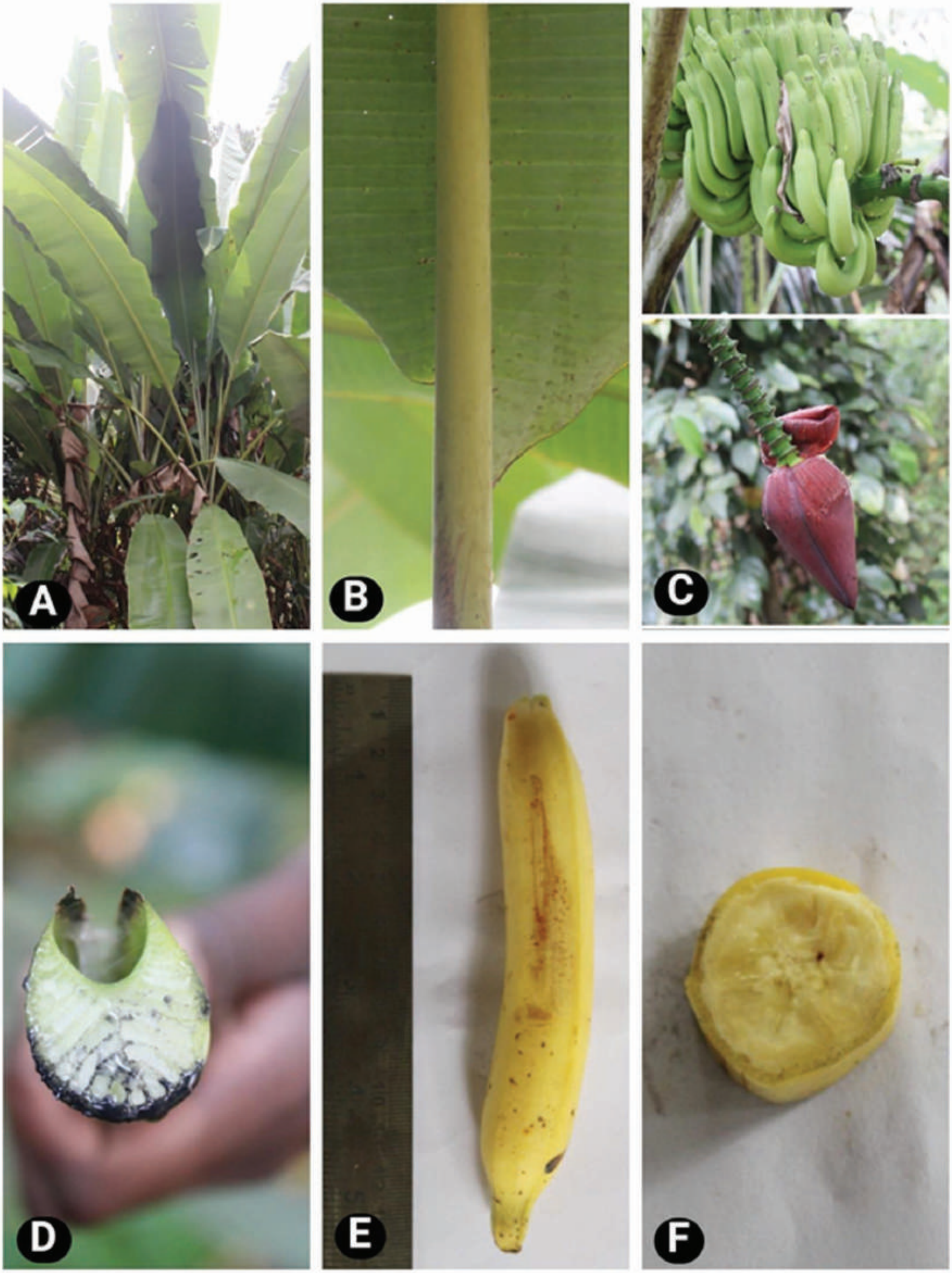
Pooja kadhali (*Musa sp.*)
A)Plant Habit B) Leaf base C) Petiole canal
D) Ripened Bunch E) Ripened Fruit F) Cross section of fruit

SUGANDHI

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Pseudostem length (m)	Long
Pseudostemcolour	Green
Purple blotches on younger leaves	Absent
Colour of the under surface of cigar leaf	Green
Leaf orientation	Upright
Petiole canal	Margin curved inwards
Petiole length (cm)	Long
Leaf blade- shape of base	One side rounded and one side acute.
Peduncle colour	Green
Bunch shape	Cylindrical
Fruit length (cm)	Medium , 14 cm
Fruit shape	Slightly curved
Transverse section of fruit	Slightly ridges
Fruit apex	Bottle necked
Persistence of floral organs	Absent
Fruit pedicel attachment at ripeness	Medium
Pedicel surface	Glabrous
Pedicel length (cm)	Long
Peel colour before ripening	Pale green
Adherence of peel	Medium
Waxiness of the fruit	Non waxy
Peel colour at full ripeness	Pale yellow
Fruit pulp colour at ripeness	Cream
No. of hands per bunch	Few
No. of fingers per hand	Many
Bunch position	Hanging at an angle
Male bud shape	Ovoid
Rachis: prominence of bract scars	Moderate
Rachis : orientation of male phase	Horizontal with inclined end



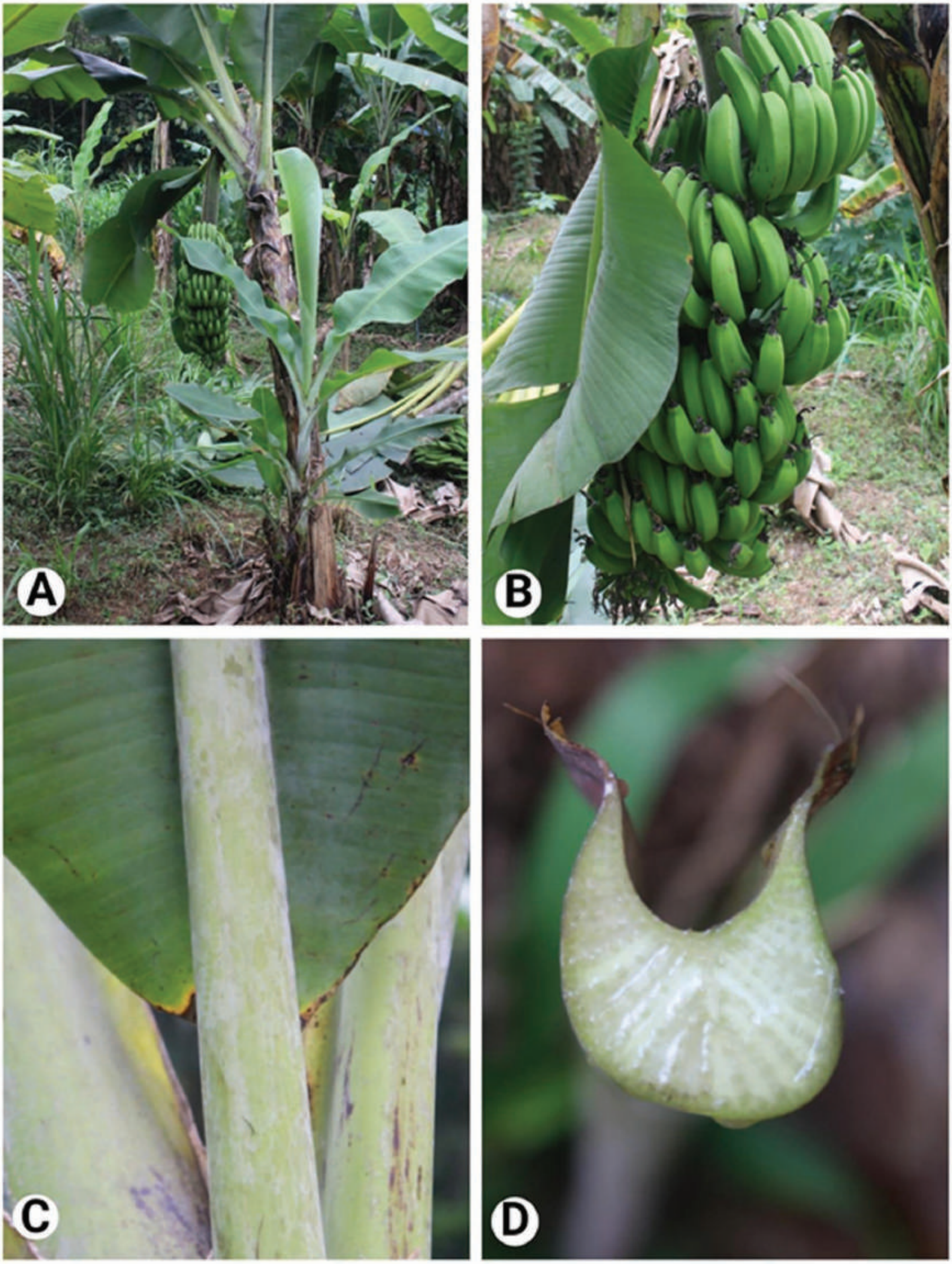
Sugandhi (Mu*sa sp.)*
***A)P*lant Habit B) Leaf base C) Matured fruit and male bud**
D) Leaf canal E) Ripened Fruit F) Cross section of fruit

ROBUSTA

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Pseudostem length (m)	Short
Pseudostemcolour	Green
Purple blotches on younger leaves	Absent
Colour of the under surface of cigar leaf	Green
Leaf orientation	Upright
Petiole canal	Wide with erect margins
Petiole length (cm)	Long
Leaf blade- shape of base	Acute
Peduncle colour	Green
Bunch shape	Cylindrical
Fruit length (cm)	Medium , 14 cm
Fruit shape	Straight
Transverse section of fruit	Slightly ridges
Fruit apex	Blunt tipped
Persistence of floral organs	Absent
Fruit pedicel attachment at ripeness	Medium
Pedicel surface	Pubescent
Pedicel length (cm)	Medium
Peel colour before ripening	Pale green
Adherence of peel	Medium
Waxiness of the fruit	Non waxy
Peel colour at full ripeness	Green
Fruit pulp colour at ripeness	Cream
No. of hands per bunch	Many
No. of fingers per hand	Many
Bunch position	Hanging vertically
Male bud shape	Ovoid
Rachis: prominence of bract scars	Moderate
Rachis : orientation of male phase	Hanging vertically



Robusta (Musa *sp.*)
***A)* Habit B) Bunch C) Leaf base D) Leaf canal**

PALEMKODAN

(Musa sps)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Pseudostem length (m)	Long
Pseudostemcolour	Green
Purple blotches on younger leaves	Absent
Colour of the under surface of cigar leaf	Green
Leaf orientation	Spreading
Petiole canal	Margins overlapping
Petiole length (cm)	Medium
Leaf blade- shape of base	Round
Peduncle colour	Green
Bunch shape	Cylindrical
Fruit shape	Slightly curved
Fruit apex	Bottle necked
Persistence of floral organs	Absent
Peel colour before ripening	Ash green
Waxiness of the fruit	Non waxy
No. of hands per bunch	Medium
No. of fingers per hand	Many
Bunch position	Hanging vertically
Male bud shape	Lanceolate
Rachis: prominence of bract scars	Moderate
Rachis : orientation of male phase	Hanging vertically

Palayankodan (*musa sp.*)
A)Habit B) leaf base C) Leaf canal
D) Bunch E) Ripened Fruit F) Cross section of fruit

Jackfruit: A Multifaceted Resource for Kerala's Tribal Communities

MORPHOLOGICAL STUDIES OF JACKFRUIT VARIETIES (ARTOCARPUS HETREROPHYLLUS)

Artocarpus heterophyllus, commonly known as Jackfruit is an evergreen tree belongs to Moraceae family. It is revered for its nutritional value; economic potential, cultural importance, and ecological role. Jackfruit has remained a critical resource, providing sustenance, livelihood, and identity to the tribal communities of Kerala. It is considered to be an underutilized fruit where most of the fruits get wasted due to ignorance, lack of post-harvest technology and gaps in supply chain systems. Tribal communities in Kerala use fruit, leaves, seed, rind and petiole of Jackfruit for the preparation of various recipes. Jackfruit contains more protein, calcium, iron, vitamins and other essential nutrients when compared to other fruits.

Common classification in India is one having small fibrous soft and spongy flakes with sweet carpels, this is known as koozha. The other variety is crunchy but not as sweet as koozha, this is called varikka. Several other varieties have been identified but they all have some common characters to these two varieties. Other than them an intermediate variety is also common in Kerala known as Navarikka. It has flakes with lower half of koozha and upper half of varikka. Unda chakka is a variety that got the name from its small size and round shape; it can exhibit property of either koozha or varikka depending on the parent tree. Here we analysed the morphological characters of 5 jack fruits that are available in Idukki, Wayanad and Thiruvananthapuram districts. Season of availability of ripe jackfruit in Kerala is from March to May. Post-harvest losses and market gluts are usual problems encountered during the season. Jackfruit is considered as an underutilised fruit in Kerala considering its large scale production, meagre utilization in processing sector and huge post-harvest losses.

JACKFRUIT AS A STAPLE FOOD

For many tribal communities in Kerala, especially those living in remote and forested areas like Wayanad and Idukki, jackfruit is an essential food source. The fruit, which is native to the region, provides a nutritious and versatile food option that can be consumed in multiple ways. Jackfruit is a rich source of carbohydrates, vitamins, and minerals. The flesh is a good source of vitamin C, potassium, and fiber, while the seeds contain proteins and micronutrients like magnesium and calcium. This makes jackfruit a valuable food resource, especially in areas where access to other fresh produce may be limited. The fruit is eaten in several forms, such as ripe jackfruit, which is sweet and eaten raw, and unripe or green jackfruit, which is often cooked as a vegetable. The seeds are also consumed, roasted, boiled, or processed into flour, further adding to the versatility of this food.

ECONOMIC IMPORTANCE

For many tribal communities, jackfruit is not just a food source but also a source of income. It grows abundantly in the region, especially in tropical climates, and provides a steady income through, the Sale of Fruit and from by-products. Surplus jackfruit is sold in local markets, providing tribal farmers with a source of income. The fruit is often sold fresh, or processed into value-added products like dried jackfruit, flour and chips. Tribals also utilize the leaves and wood of the jackfruit tree for other purposes, contributing to household economies. The wood is used for construction, furniture, and tools, while the leaves can be used for wrapping food or for traditional handicrafts. Tribal communities involved in these small-scale processing activities benefit not only through direct sales but also through entrepreneurial opportunities and employment in rural areas.

CULTURAL IMPORTANCE

The jackfruit is deeply embedded in the cultural traditions and practices of Kerala's tribal communities. Its presence in local rituals, folklore, and daily life highlights its cultural significance. For many tribal groups, jackfruit is more than just a food crop; it is an integral part of their cultural identity. Jackfruit is often being used in offerings to deities or during feasts. Traditional recipes featuring jackfruit, passed down through generations, form an important part of the culinary heritage. The harvest and consumption of jackfruit often coincide with important cultural events, festivals, and feasts in these communities. The process of harvesting jackfruit and preparing it for consumption is often a communal activity, fostering social bonds among tribal members. Whether it's plucking ripe fruits, peeling and processing them, or sharing meals, these activities strengthen the sense of community and mutual support.

CULTIVATION AND HARVEST

Jackfruit trees are adaptable to a variety of soil types, making them well-suited for the agroforestry systems practiced by tribal farmers. They are often grown alongside other crop. Jackfruit tree requires minimal inputs and can grow in marginal lands; it is an ideal crop for sustainable farming practices, reducing the need for chemical fertilizers and pesticides. The jackfruit harvest season is typically from ,March to July. The harvest of jackfruit is often a communal event in tribal communities. People come together to share the work of harvesting, processing, and preparing the fruit, which strengthens social ties.

HEALTH BENEFITS

Jackfruit offers several health benefits due to its nutritional content. It is an excellent source of dietary fiber, antioxidants, and vitamin C, which can help boost the immune system, improve digestion, and protect against chronic diseases.

Jack fruit has diverse medicinal uses especially anti-oxidant, anti-inflammatory, antimicrobial, anticancer and anti-fungal activity. Jackfruit is reported to possess many medicinal properties. The phenolic compounds isolated from jackfruit are reported to exhibit anti-inflammatory effect (Prakash et al.,2009). The prenylflavonoids present in jackfruit had shown strong antioxidant properties [43] and is expected to act against lipid peroxidation of biological membranes (Ko FN et al.,1998). The hot water extract of mature leaves are utilized in Ayurvedic treatment for hyperglycemia and diabetes. The flavonoids present in the extract have been identified to be responsible for the nontoxic hypoglycemic action (Chandrika et al.,2006).

METHODOLOGY USED FOR THE MORPHOLOGICAL CHARACTERIZATION

To document the morphological characteristics of jackfruit, we followed the crop guidelines provided by the protection of plant varieties and farmer's rights authority (Ppv&Fra), shape, leaf base shape, fruit shape, flake shape, fruiting position and fruit clustering habit.

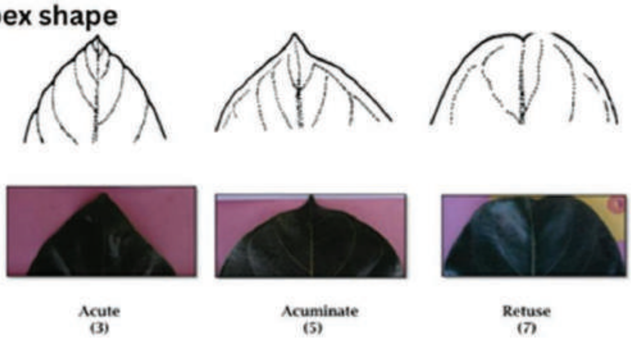
POTENTIAL FOR VALUE ADDITION

Jackfruit has immense potential for economic development, especially in tribal regions where opportunities for industrialization are limited. Beyond traditional uses, the commercialization of jackfruit is gaining momentum. Processed products such as jackfruit flour, jackfruit chips, dried jackfruit and jackfruit-based snacks have become popular, especially with the growing global interest in plant-based foods. Tribal communities, with the right support and training, can capitalize on the growing demand for these value-added products.

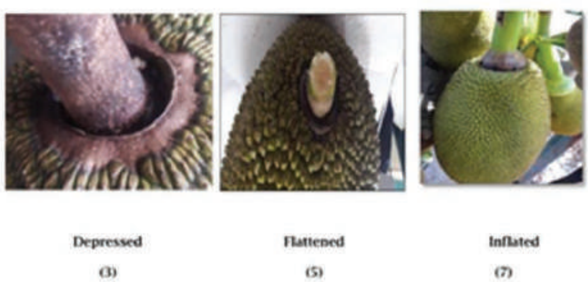
Jackfruit has an enduring and multifaceted role in the lives of Kerala's tribal communities. It is not only a vital food source that nourishes the body but also a significant economic asset that provides livelihoods and sustenance. Furthermore, it plays an essential role in conservation practices, helps maintain cultural identity, and offers immense potential for value addition in the future. By fostering sustainable practices and promoting value-added products, jackfruit can continue to enrich the lives of Kerala's tribal communities, ensuring their cultural, economic, and ecological well-being for generations to come.

A Tree crown shape

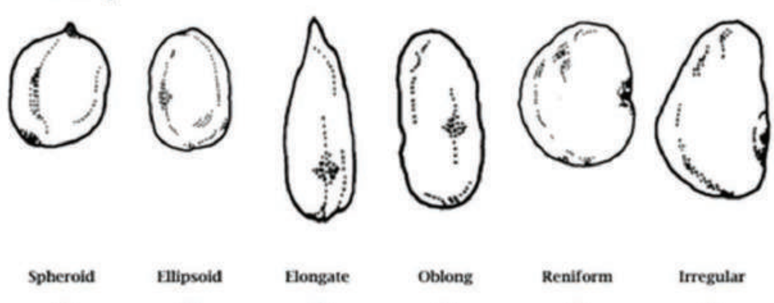
B Leaf apex shape



C Stalk attachment to fruit



D Seed shape



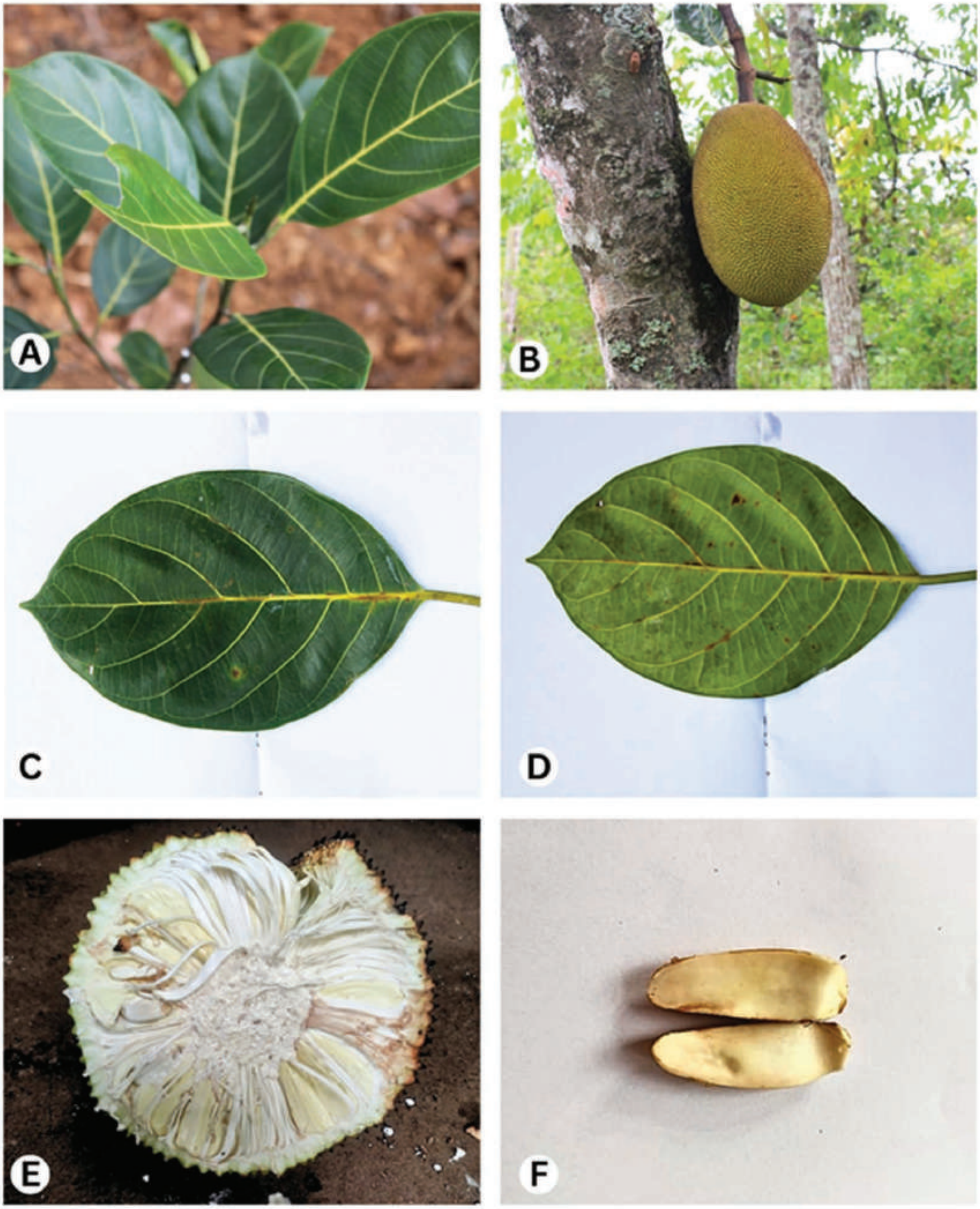
Morphological parameters for jackfruit varieties: Protection of Plant Varieties and Farmer's Rights Authority (PPV&FRA), Government of India

VARIKKA

(Artocarpus heterophyllus)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Tree Crown Shape	Elliptical
Leaf Blade: Length	medium
Leaf Blade: Width	Broad
Leaf Blade Shape	Obovate
Leaf Apex Shape	Acuminate
Leaf Base Shape	Oblique
Leaf Orientation	Erect
Leaf posture	Revolute
Upper leaf surface	Smooth
Fruiting position	Trunk, primary and secondary branches
Fruit Clustering Habit	Cluster



***Artocarpus heterophyllus* Var. Varikka**

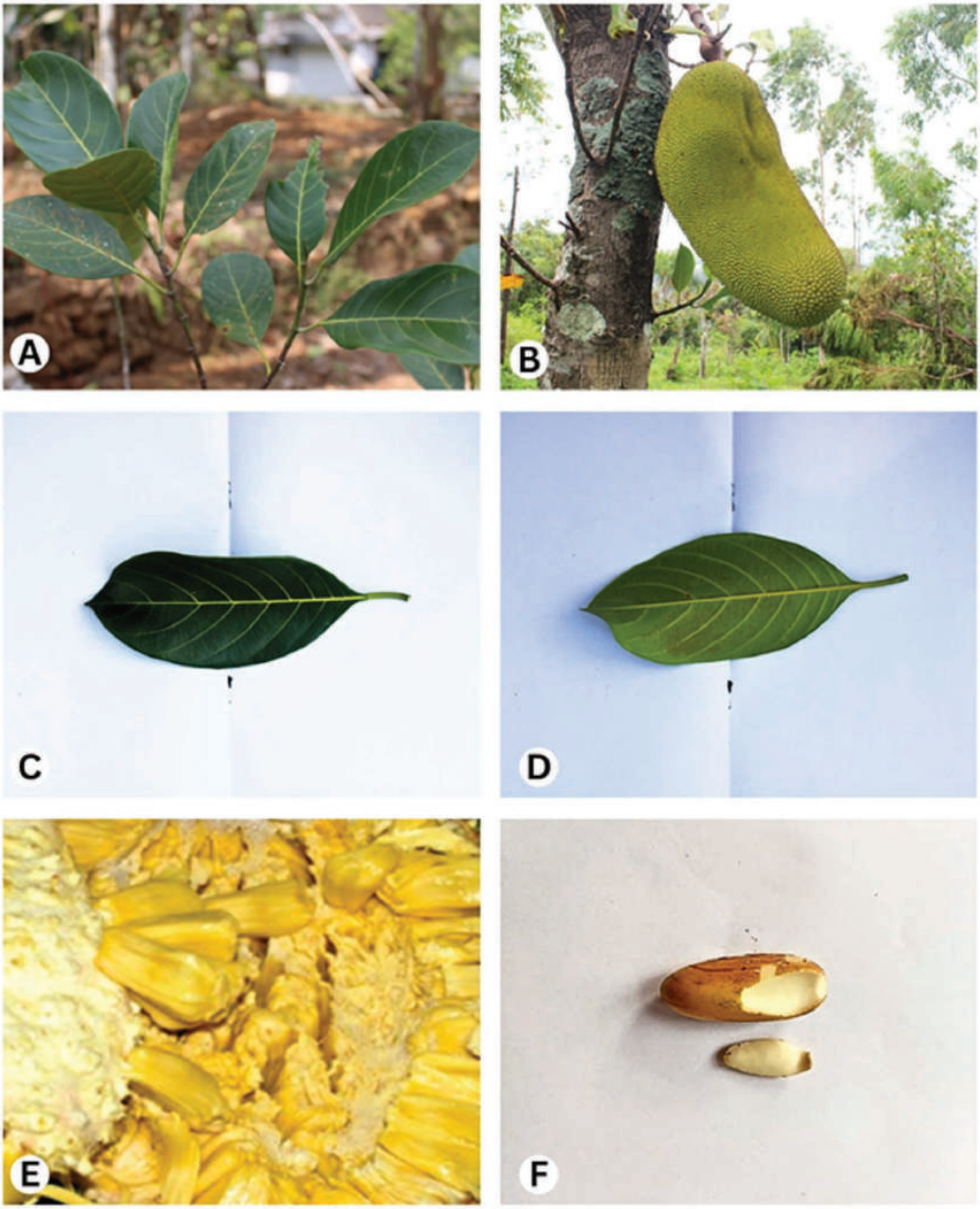
A)Leaf orientation B)Fruit C)Ventral side of leaf D)Dorsal side of leaf E)Cross section of fruit F)Seed

KOOZHA

(Artocarpus heterophyllus)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Tree Crown Shape	Elliptical
Leaf Blade: Length	medium
Leaf Blade: Width	medium
Leaf Blade Shape	Oblong
Leaf Apex Shape	Acute
Leaf Base Shape	Oblique
Leaf Orientation	Erect
Leaf posture	Conduplicate
Upper leaf surface	Smooth
Fruiting position	Trunk, primary and secondary branches
Fruit Clustering Habit	Solitary



Artocarpus heterophyllus **Var. koozha**

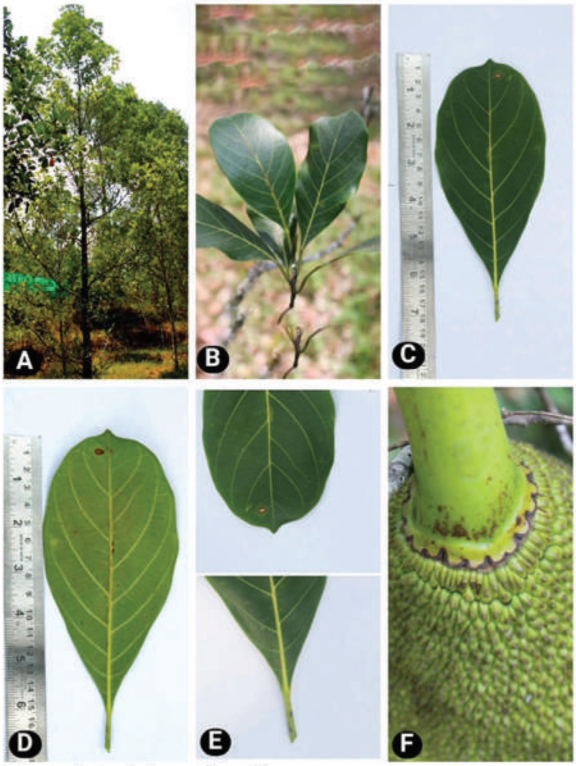
A)Leaf orientation B)Fruit C)Ventral side of leaf D)Dorsal side of leaf E)Cross section of fruit F)Seed

THEN VARIKKA

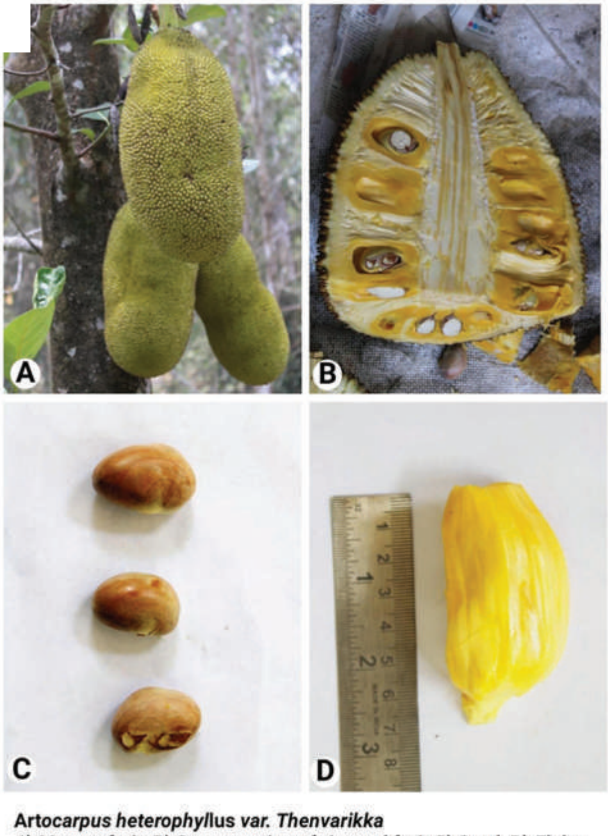
(Artocarpus heterophyllus)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Tree Crown Shape	Elliptical
Leaf Blade: Length	medium
Leaf Blade: Width	Medium
Leaf Blade Shape	Elliptical
Leaf Apex Shape	Acuminate
Leaf Base Shape	Oblique
Leaf Orientation	Erect
Leaf posture	Revolute
Upper leaf surface	Smooth
Fruiting position	Trunk, primary and secondary branches
Fruit Clustering Habit	Cluster
Fruit shape	Oblong
Stalk attachment to fruit	Flattened
Latex exudation at harvest of mature fruits	Low
Ripe fruit peel colour	Brown
Fruit peel surface	Spiny
Shape of spine	Pointed
Spine density	Dense
Ripe fruit rind colour (inner rind)	White
Ripe fruit rind thickness	Thick
Individual flake length	Medium (7cm)
Flake thickness	Thick
Flake shape	Cordate
Flake colour	Yellow group
Seed shape	Ellipsoid
Seed colour	Cream
Ripe fruit size	Medium
Flake texture	Firm
Fruit sweetness	High



Artocarpus heterophyllus var. Thenvarikka
A)Plant Habit B) Leaf orientation C) Ventral side of mature leaf
D) Dorsal side of mature leaf E) Leaf tip and leaf base. F) Stock attachment to fruit



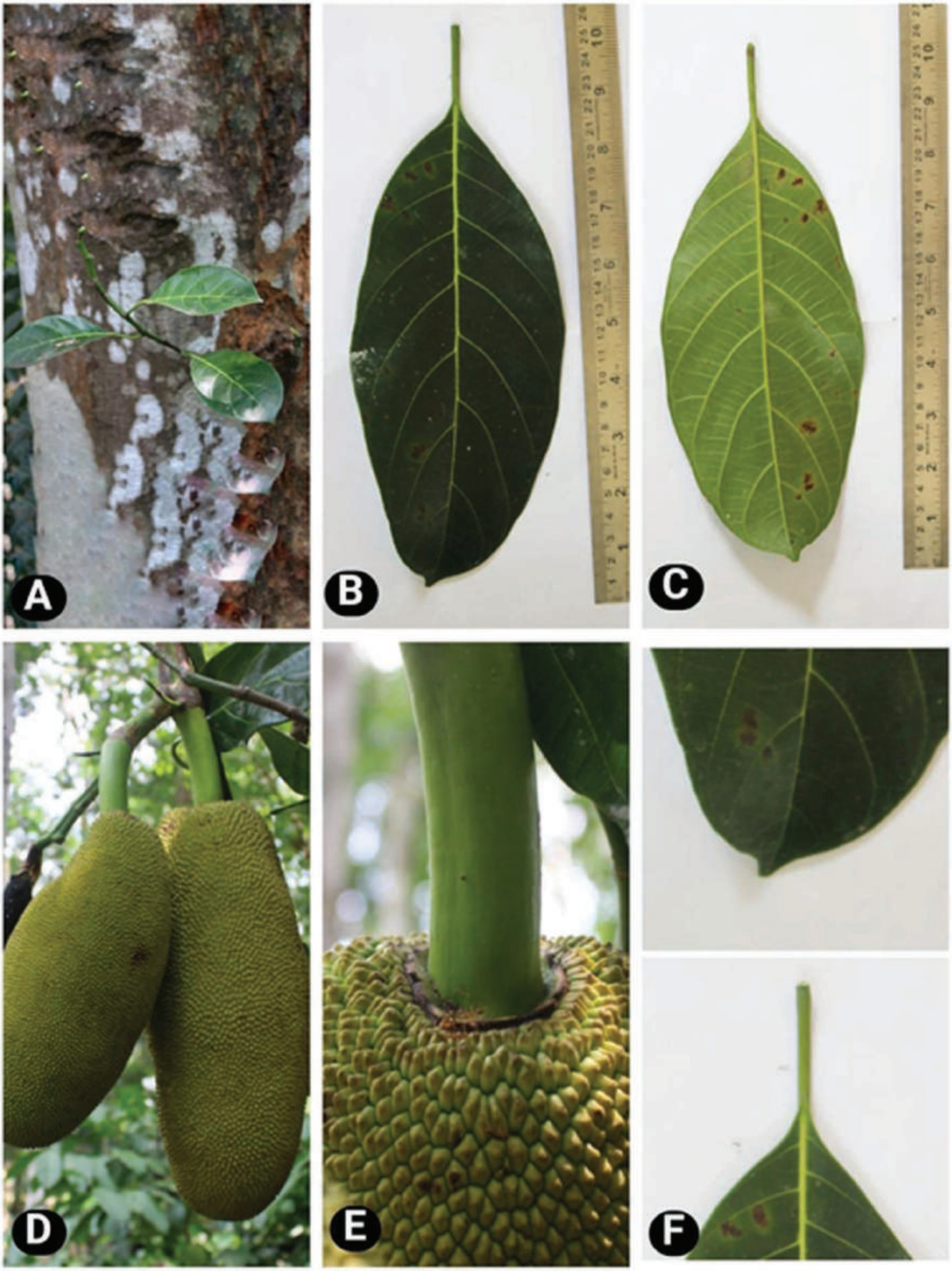
Artocarpus *heterophyllus var. Thenvarikka*
A) Mature fruit B) Cross section of ripened fruit C) Seed D) Flake

NAVARIKKA

(Artocarpus heterophyllus)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Tree Crown Shape	Elliptical
Leaf Blade: Length	Long
Leaf Blade: Width	Broad
Leaf Blade Shape	Elliptical
Leaf Apex Shape	Acuminate
Leaf Base Shape	Oblique
Leaf Orientation	Erect
Leaf posture	Flattened
Upper leaf surface	Smooth
Fruiting position	Trunk, primary and secondary branches
Fruit Clustering Habit	Cluster
Stalk attachment to fruit	Depressed



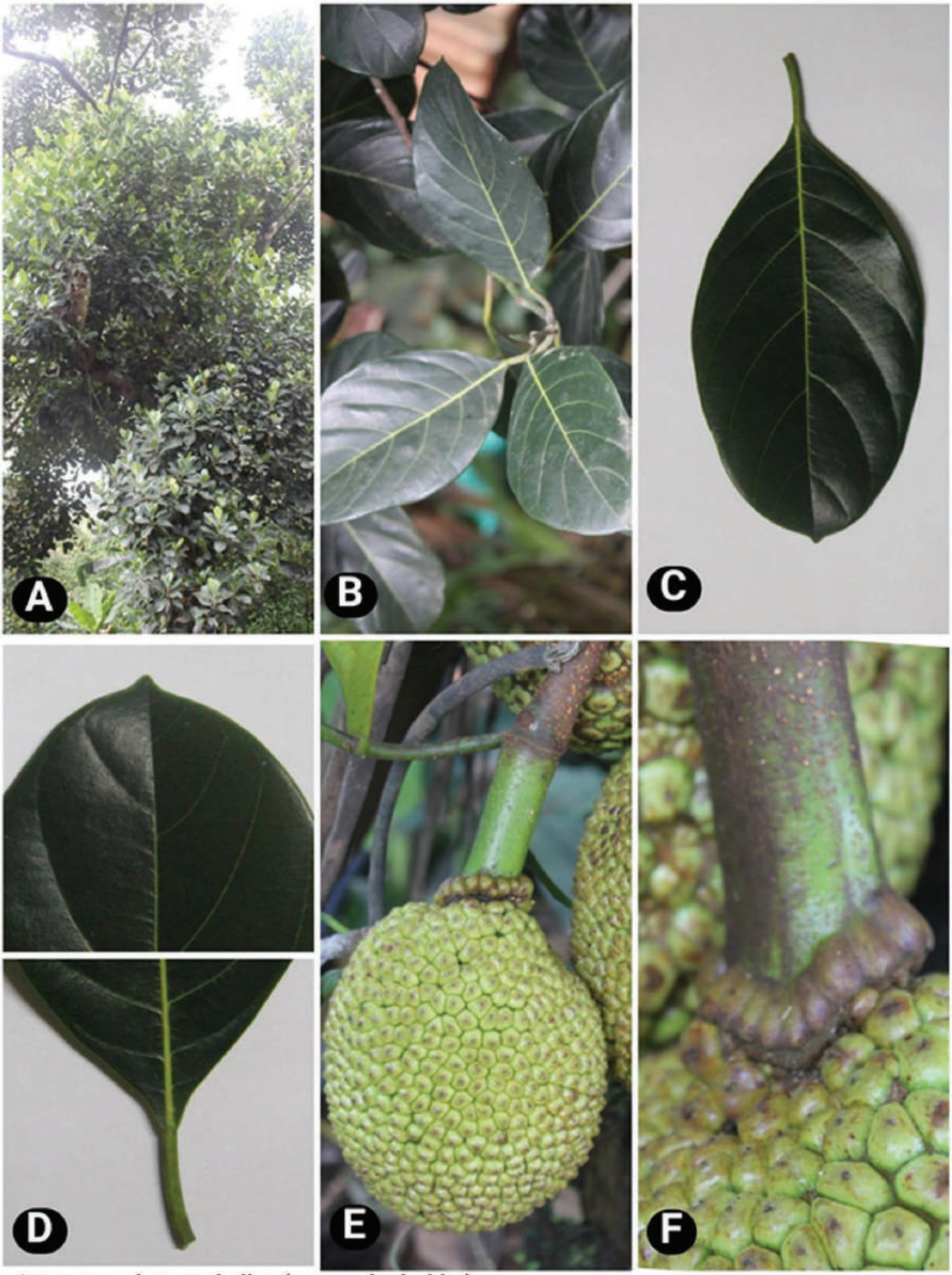
Artocarpus heterophyllus var. Nanvarikka
A) Leaf orientation B) Ventral side of mature leaf C) Dorsal side of mature leaf
D) Mature fruit E) Stock attachment to fruit F) Leaf tip and leaf base

UNDA CHAKKA

(Artocarpus heterophyllus)

MORPHOLOGICAL CHARACTERISTICS

CHARACTERISTICS	STATE
Tree Crown Shape	Elliptical
Leaf Blade: Length	Medium, 14
Leaf Blade: Width	Medium , 7
Leaf Blade Shape	Elliptical
Leaf Apex Shape	Acuminate
Leaf Base Shape	Oblique
Leaf Orientation	Erect
Leaf posture	Flattened
Upper leaf surface	Smooth
Fruiting position	Trunk, primary and secondary branches
Fruit Clustering Habit	Cluster
Fruit shape	Spheroid
Stalk attachment to fruit	Inflated
Fruit peel surface	Spiny
Shape of spine	Flat
Spine density	Sparse



Artocarpus heterophyllus (var. undachakka)
A)Plant Habbit B) Leaf arrangement C) Dorsal side of mature leaf
D) Leaf base and leaf tip E)mature fruit F) stock attachment to fruit

Sustainable Conservation Model for Traditional Paddy Landraces

Paddy landraces are locally adapted varieties of rice that have been cultivated and refined by local farmers over generations. Unlike modern high-yield varieties, traditional paddy landraces maintain a diverse genetic pool that allows them to thrive in specific environmental conditions and to exhibit resilience against pests, diseases, and climate challenges. These landraces are often characterized by unique traits such as grain color, taste, cooking quality, and resilience to fluctuating environmental conditions.

The importance of traditional paddy landraces lies not only in their contributions to biodiversity but also in their role in food security. With growing concerns about the impacts of climate change, the genetic diversity inherent in paddy landraces provides essential resources for breeding programs aimed at developing new varieties that can withstand changing climatic conditions. Additionally, traditional landraces often have cultural relevance, playing a critical role in local culinary traditions, festivals, and agricultural practices, thus fostering community identity and heritage.

HISTORICAL CONTEXT AND CULTURAL SIGNIFICANCE

Wayanad district in Kerala, is renowned for its rich agricultural heritage and diverse ethnic communities. The region's distinct geographical features, including hills and varied microclimates, have enabled the cultivation of numerous traditional paddy landraces. These landraces have historically supported farmers, providing sustenance and economic stability while influencing the local way of life, socio-economic structures, and community relationships. Culturally, the traditional paddy landraces are deeply woven into the identity of the local population, manifesting in festivals, rituals, and culinary practices. Activities such as transplanting, harvest celebrations, and seed saving are cherished traditions passed down through generations, enriching the community's connection to the land. In essence, the preservation of these paddy varieties is vital for biodiversity, food security, and maintaining the cultural heritage of Wayanad, underscoring the importance of conservation efforts and sustainable agricultural practices.

CHALLENGES FACING TRADITIONAL PADDY LANDRACES

The primary challenges in cultivating traditional paddy include a lack of seed availability, technological gaps in processing, and insufficient exploration of market potential. The shift towards monoculture and high-yield variety (HYV) crops has resulted in a decline in the cultivation of traditional paddy landraces, as farmers often prioritize economic returns over biodiversity, diminishing the number of traditional varieties grown. Additionally, the use of chemical fertilizers and pesticides in modern agricultural practices negatively impacts soil health and local ecosystems, which are essential for the sustainability of traditional paddy varieties. Furthermore, increasing commercialization and global market demands pressure farmers to adopt high-yield practices instead of self-sustaining agricultural methods, leading to the neglect of indigenous crops.

Climate change has resulted in variable weather patterns, leading to erratic rainfall, increased temperatures, and extreme weather events that adversely affect traditional paddy landraces adapted to specific local conditions. Water scarcity, caused by changes in rainfall and water availability, complicates the growth of these varieties that rely on specific water conditions, particularly in regions dependent on seasonal rainfall. Additionally, rising temperatures and shifting climatic patterns can increase pest and disease pressure, further threatening the survival of traditional varieties that lack resistance to such challenges.

The traditional paddy farming practices in Wayanad face significant challenges due to a generational shift, as younger populations migrate to urban areas for better opportunities, resulting in a loss of knowledge about heirloom varieties. The cultural heritage linked to these practices is at risk of erosion, threatening local farming festivals, rituals, and communal knowledge transfer. Moreover, traditional agricultural knowledge is often undervalued in modern agricultural policies and educational systems, leading to neglect and potential extinction of valuable paddy landraces.

Addressing these challenges requires a multifaceted approach that includes promoting sustainable agricultural practices, strengthening local knowledge systems, and integrating traditional varieties into modern agricultural frameworks. Efforts should also focus on raising awareness of biodiversity's importance among farmers and the wider community to help preserve Wayanad's rich agricultural heritage.

SUSTAINABLE CONSERVATION STRATEGIES

Sustainable conservation refers to managing and protecting biodiversity, particularly in the context of paddy landraces, ensuring that present needs do not compromise future generations' ability to meet their own needs. This involves preserving genetic diversity within traditional rice varieties to enhance resilience against pests and climate change, utilizing agro-ecological practices such as mixed cropping and organic farming to protect the environment, and promoting soil health through techniques like contour farming and composting. Efficient water management strategies, such as alternate wetting and drying, are vital for optimizing water use, while adaptation strategies enhance climate resilience through practices like staggered planting. Community involvement is crucial, engaging local farmers in decision-making to respect traditional knowledge, while ensuring economic viability by supporting farmers through market access and income diversification. Further, the initiative emphasizes the importance of research, education, and public awareness to foster community support for conservation, ultimately integrating environmental stewardship, economic viability, and social equity to ensure food security and resilience for future generations.

Conserving paddy landraces is vital for crop biodiversity, food security, and sustainable agriculture, necessitating a combination of in-situ and ex-situ conservation strategies, along with community involvement. In-situ methods include managing agro-ecosystems that integrate traditional varieties through techniques like crop rotation and intercropping, establishing protected areas for native paddy varieties, supporting traditional farming practices, encouraging on-farm seed banks, and involving communities in participatory plant breeding programs. Ex-situ techniques involve establishing seed banks for long-term preservation, creating field gene banks, documenting and characterizing landraces, and investing in research for informed conservation. Community engagement is essential and can be achieved through awareness campaigns, community seed saving initiatives, local stewardship programs, participatory research, and collaboration with NGOs and government bodies. This multifaceted approach, which blends traditional knowledge with modern strategies, is crucial for maintaining resilient and sustainable agricultural systems while preserving genetic diversity.

ESTABLISHMENT OF A FIELD GENE BANK FOR TRADITIONAL RICE VARIETIES

RGCB has conducted extensive field visits and engaged directly with paddy farmers in Wayanad District, documenting the details of traditional paddy varieties and their associated cultural practices. The team studied the morphological features of these varieties and collected seeds. During the survey, 44 traditional paddy varieties were mapped in the district. It is evident that most of these varieties are underutilized and not regularly cultivated. Recognizing the need to conserve this native paddy germplasm, initiated the establishment of a field gene bank as a reliable model for ex-situ conservation, involving local community participation. Seeds from 19 traditional paddy varieties were distributed to selected farmers, who received support for field preparation and cultivation activities. Approximately 7.5 hectares of land have been designated as a field gene bank for traditional paddy varieties in the Thavinjal and Vellamunda panchayats of Wayanad District. Plots were prepared to ensure that each variety is sown separately and properly labeled. Careful harvesting was conducted to prevent the mixing of varieties, with seeds reserved for the next cropping season. Farmers were also encouraged to multiply these varieties in the following season and return some of the seeds to the donor.

SEED BANK AND RICE MUSEUM

RGCB established a seed bank cum rice museum in Wayanad district, Kerala. The storage of paddy seeds is imperative for the conservation of traditional paddy varieties. Seed bank for paddy is multifaceted, addressing both the immediate and long-term needs of agriculture, food security, biodiversity, and climate resilience. Paddy varieties, especially traditional and indigenous ones, possess unique genetic traits that might be lost if not conserved. Seed banks serve as repositories for these varieties, helping to maintain genetic diversity, which is critical

for breeding new varieties with improved traits such as resistance to pests, diseases, drought, or flooding and to prevent genetic erosion, which can occur when farmers switch to monocultures or over-rely on a few commercial varieties. It also helps to preserve varieties that are adapted to specific environmental conditions, ensuring that farmers can access resilient seeds. Seed banks promote sustainable farming practices by ensuring that farmers have access to high-quality, regionally adapted seeds that can be grown with minimal reliance on chemical inputs. They encourage the use of locally adapted, organic, or drought-resistant varieties, which can reduce the need for fertilizers and pesticides and support agroecological farming practices that focus on maintaining soil health and biodiversity. Many traditional paddy varieties hold significant cultural value, and seed banks help preserve these varieties for future generations. This can be important for safeguarding cultural heritage in regions where specific rice varieties have historical, culinary, or cultural significance and promoting biodiversity by conserving indigenous species that might otherwise be lost to commercialization and industrial agriculture.

RESEARCH AND DEVELOPMENT INITIATIVES

Paddy land races, traditional rice varieties adapted to specific regions, are essential for food security and agricultural sustainability due to their genetic diversity, which aids in breeding programs and adapting crops to climate change. The genetic diversity in these varieties enhances resilience to climate challenges such as drought and flooding, aids in developing pest and disease-resistant strains, and can offer higher nutritional value, contributing to the fight against malnutrition.

ECONOMIC VIABILITY OF TRADITIONAL PADDY LANDRACES

Traditional paddy landraces, known for their unique genetic traits and adaptability to local environments, offer significant economic opportunities in today's agricultural landscape through market niches and value-added products, as well as agro-tourism initiatives. Producers can target niche markets emphasizing organic, non-GMO, and heirloom products, appealing to consumers willing to pay a premium for sustainably grown and traditional crops. Additionally, traditional varieties often boast superior nutritional profiles, making them attractive to health-conscious consumers and health-focused eateries. Emphasizing the cultural heritage of these products enhances their marketability by connecting consumers to their history and authenticity. Local and specialty markets provide avenues for higher profit margins, while the growing international demand for gourmet traditional varieties presents export opportunities. To further capitalize on these landraces, producers can develop value-added products such as rice flour and specialty meals, utilizing innovative, sustainable packaging to attract eco-conscious buyers. Agro-tourism can create additional revenue streams by offering educational farm tours, workshops on traditional farming and cooking, and immersive experiences for visitors, all bolstering community engagement and support. Festivals celebrating the harvest can promote local culture and enhance market visibility. Ultimately, the economic viability of traditional paddy landraces relies on leveraging these unique traits through innovative marketing and farm-based initiatives, ensuring sustainability for crops and communities alike while preserving agricultural biodiversity and promoting cultural heritage.

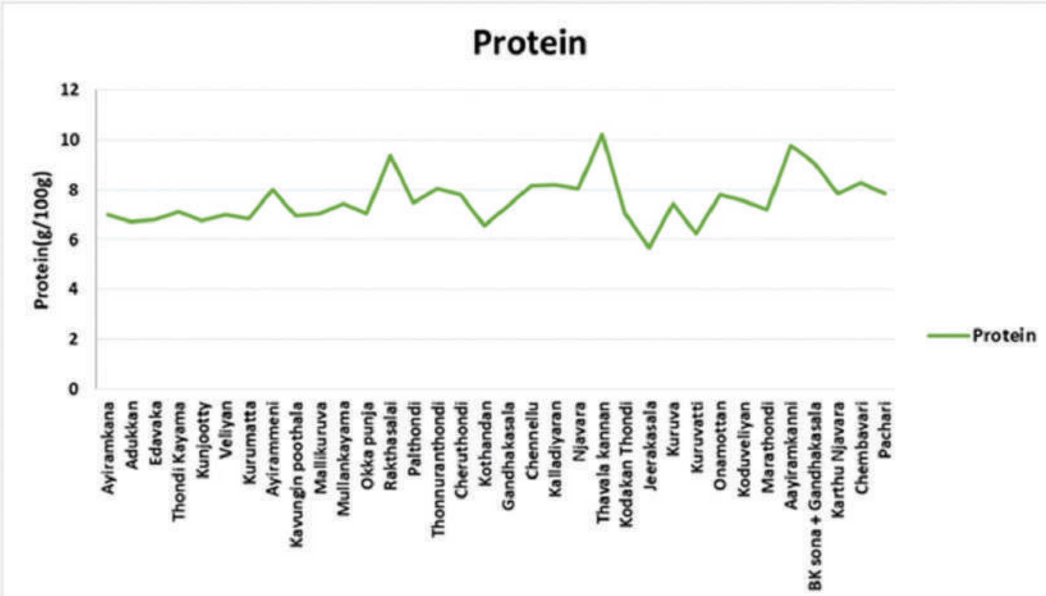
COMMUNITY ENTERPRISE ON TRADITIONAL PADDY PROCESSING

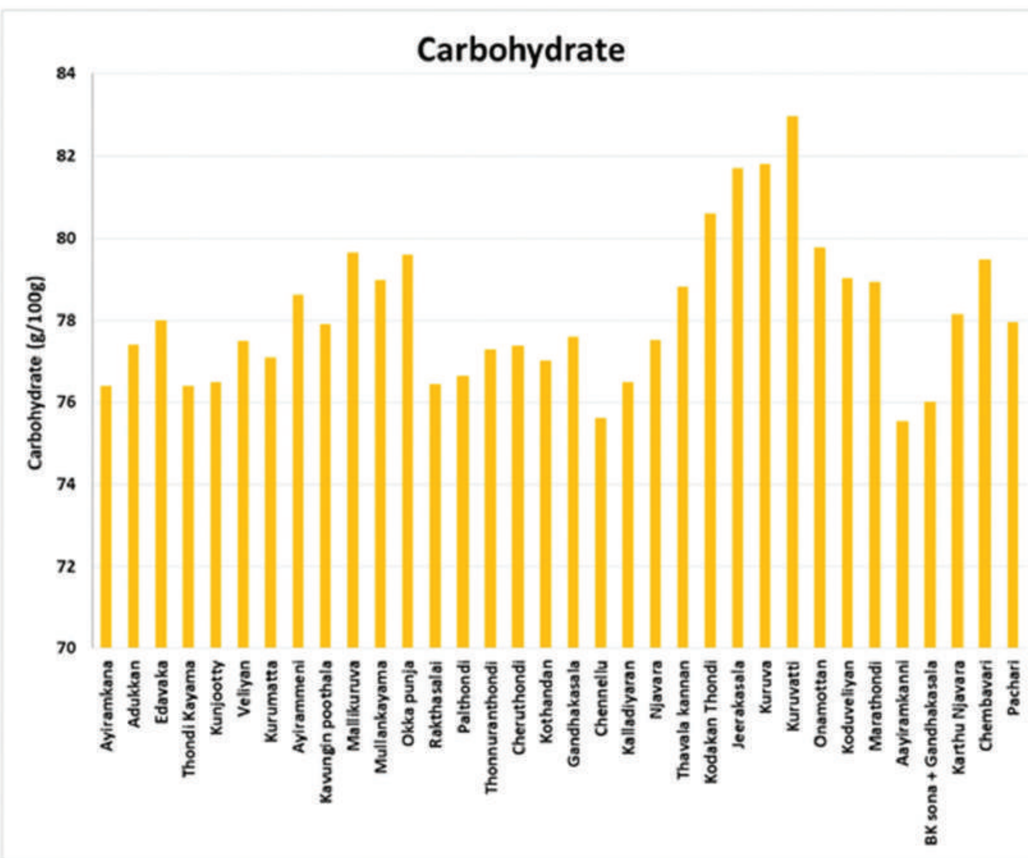
In order to attract the Farmers to paddy cultivation, for their lively hood improvement to make them aware of nutritional value of traditional rice and to protect the valuable genetic resources and associated traditional wisdom, RGCB established a paddy processing unit with rubberized huller in Wayanad district, Kerala.

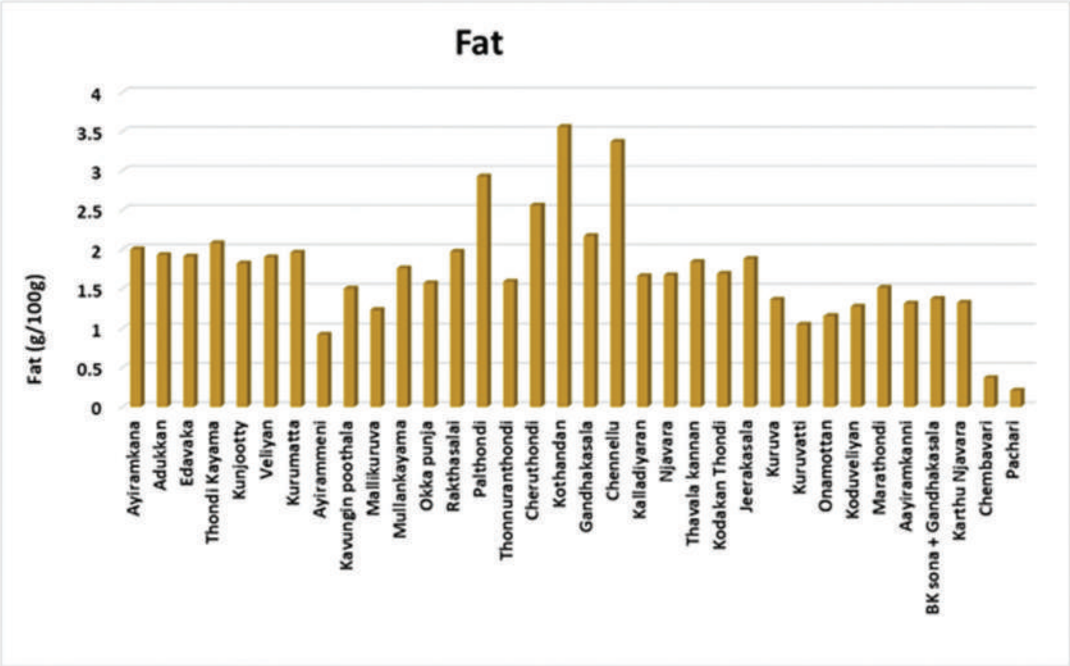
NUTRITIONAL VALUE AND HERITAGE SIGNIFICANCE

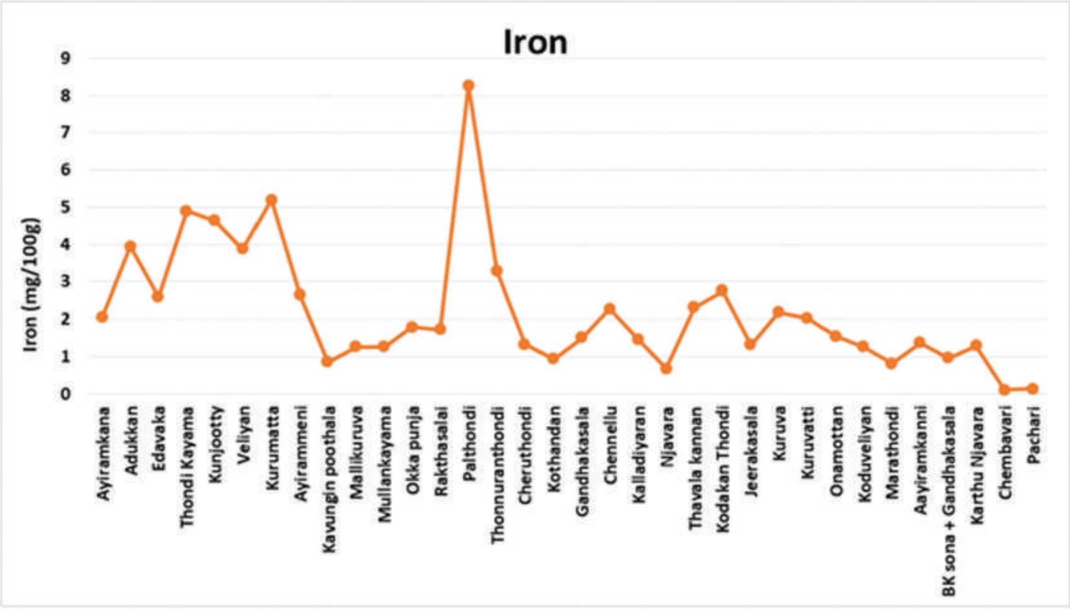
Rice serves as a staple food for nearly half of the world's population, providing significant contributions to dietary energy, protein, and fat. Despite its importance, rice contains smaller quantities of essential micronutrients. The nutritional value of rice varies across its different layers, which include the outer hull, caryopsis, aleurone, sub-aleurone, and endosperm, along with the embryo. Traditional rice varieties, often rich in nutrients, are integral to tribal medicinal practices. However, the health benefits and nutritional profiles of these varieties remain largely unexplored due to a lack of comprehensive data. Hence, the nutritional profiles of traditional rice cultivated by tribal communities in Wayanad were conducted.

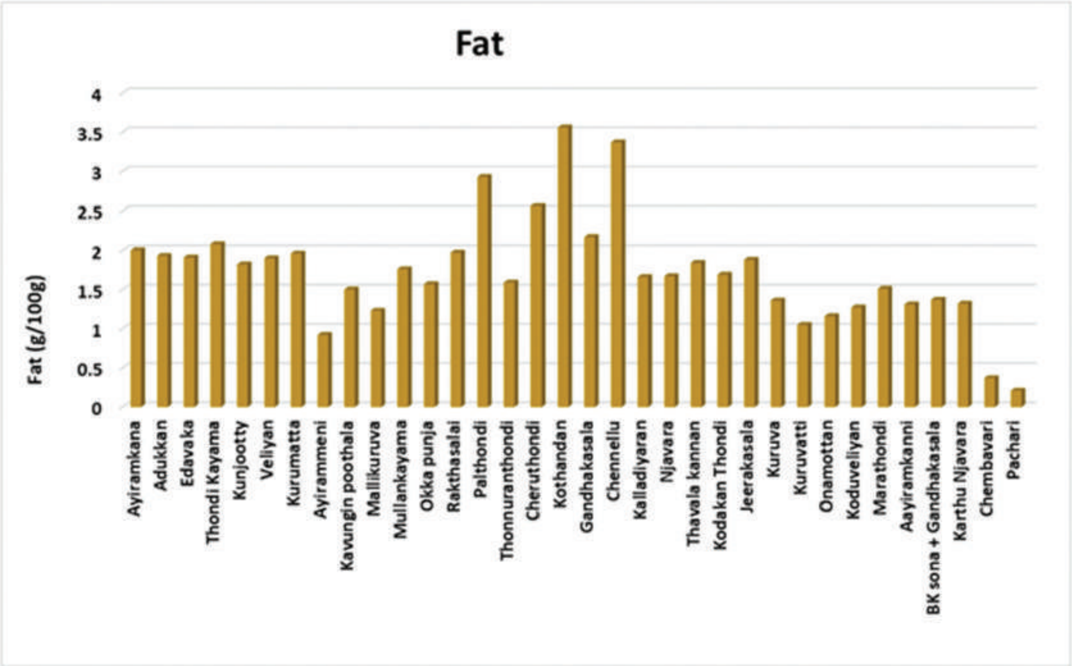
The nutritional analysis of 34 samples of traditional paddy varieties from Wayanad revealed distinct differences in their nutrient profiles. Jeerakasala exhibited the lowest protein content at 5.68 g/100g, while Thavala Kannan had the highest at 10.2 g/100g. Kuruvatti was noted for high carbohydrate levels (75.53 g/100g), contrasting with Aayiramkanni, which had comparatively lower levels. Essential minerals such as iron, magnesium, and fats were found at low levels market samples of Pachari and Chembavari, but higher concentrations were noted in Palthondi, Thondikayama, and Kothandan. Moisture content across all samples ranged from 7.42% to 13.5%, and calcium and fiber were abundant in Mullankayama, while low levels were observed in Karthu Nyavara and Marathondi. The total caloric content ranged from 345 to 373 Kcal/100g, with significant variations in zinc content, highest in Aayiramkana and lowest in Njavara. Additionally, sodium and potassium levels were low in Pachari but higher in Aayirammeni and Kurumatta. Overall, these traditional tribal landraces exhibited richer nutrient profiles compared to commonly available market varieties, highlighting their potential for improved market value and promoting their cultivation.

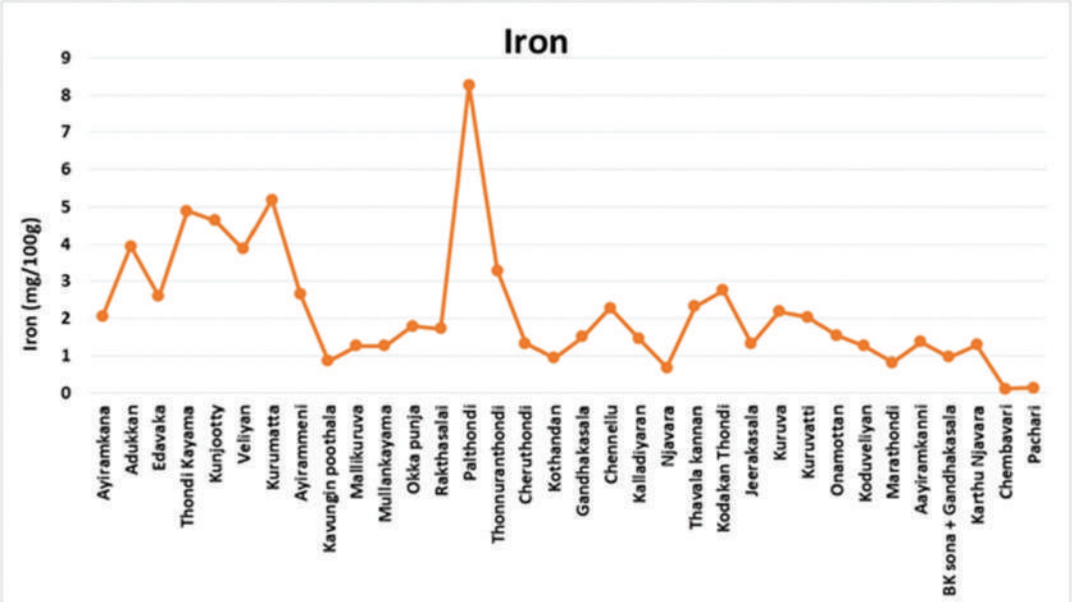

Protein
Protein(g/100g)
12
10
8
6
4
2
0
Protein
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari

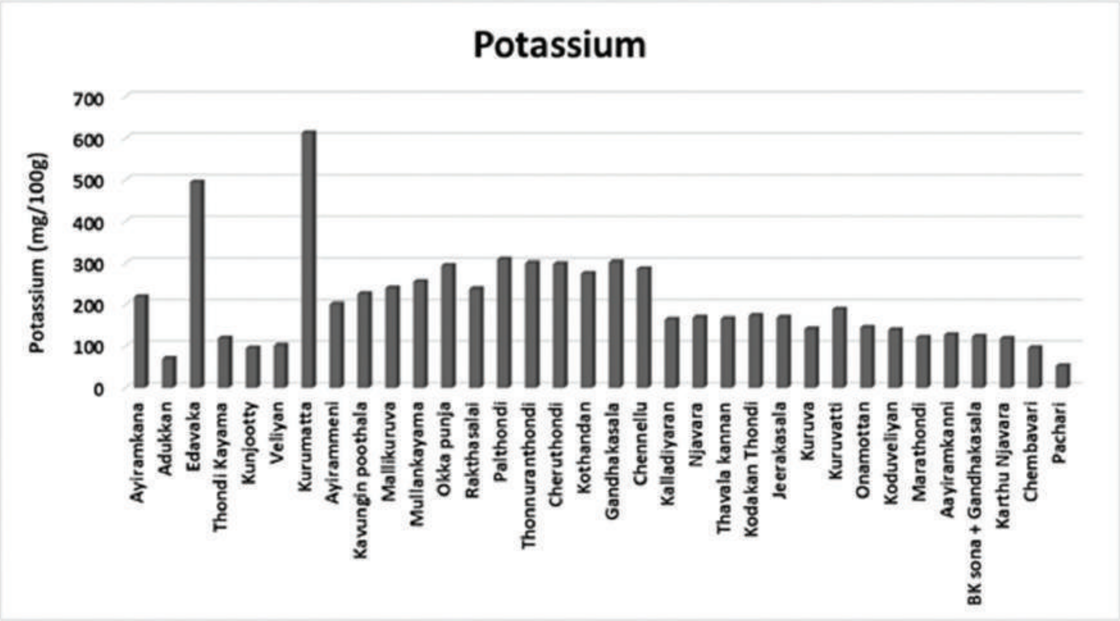

Carbohydrate
Carbohydrate (g/100g)
84
82
80
78
76
74
72
70
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari

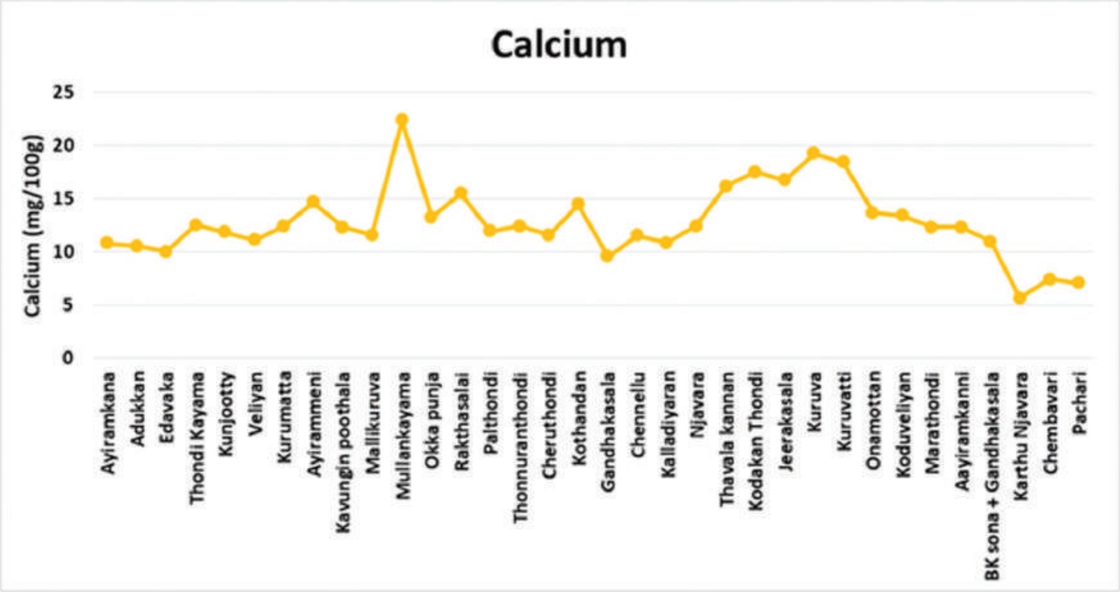

Fat
Fat (g/100g)
4
3.5
3
2.5
2
1.5
1
0.5
0
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari

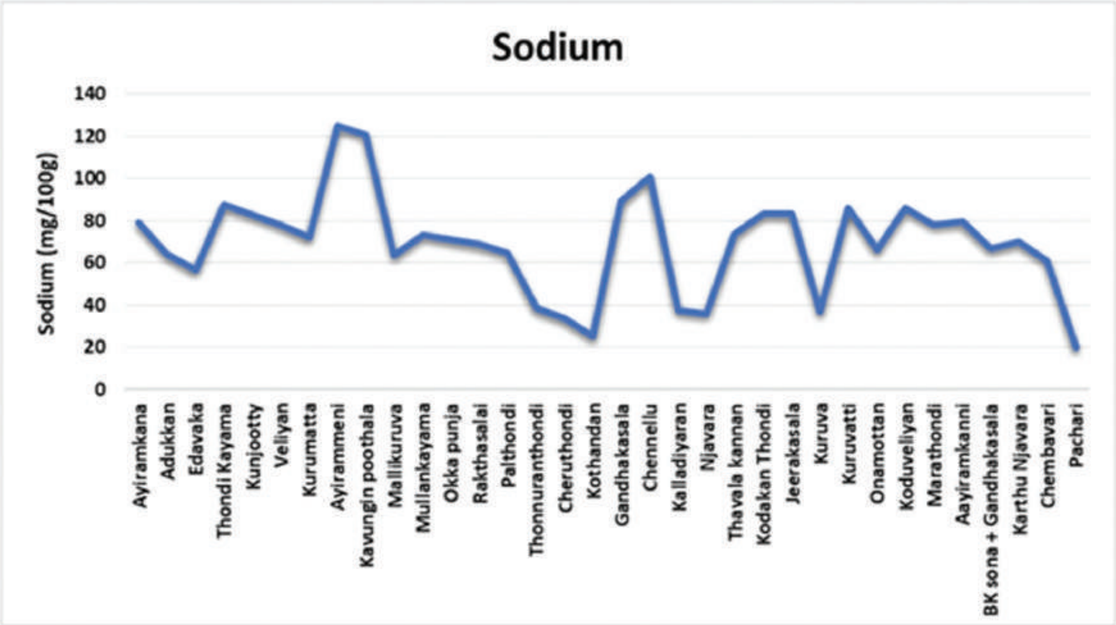

Iron
Iron (mg/100g)
9
8
7
6
5
4
3
2
1
0
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari

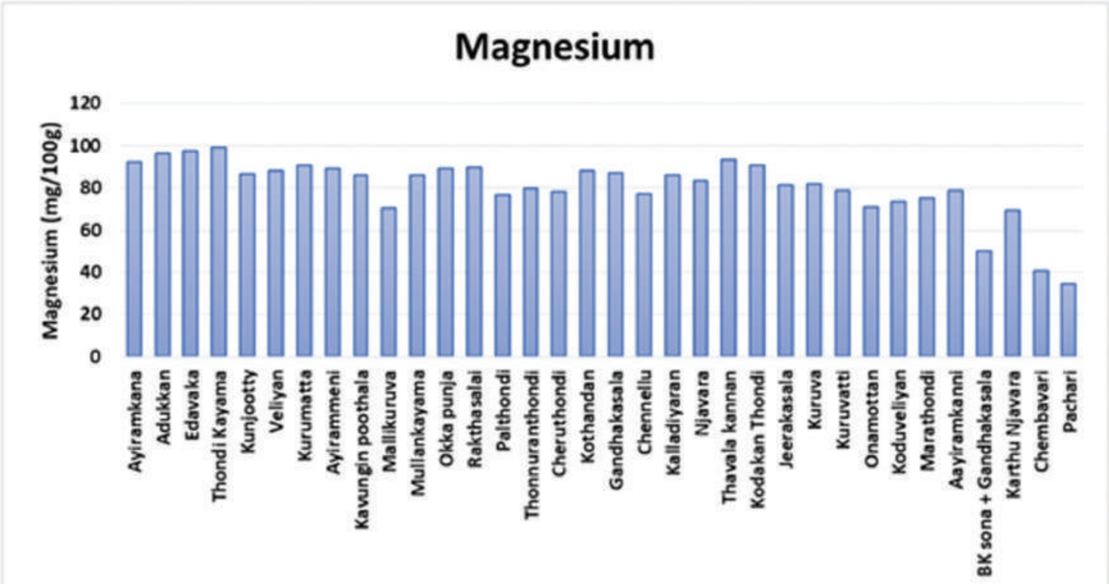

Fat
Fat (g/100g)
4
3.5
3
2.5
2
1.5
1
0.5
0
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari

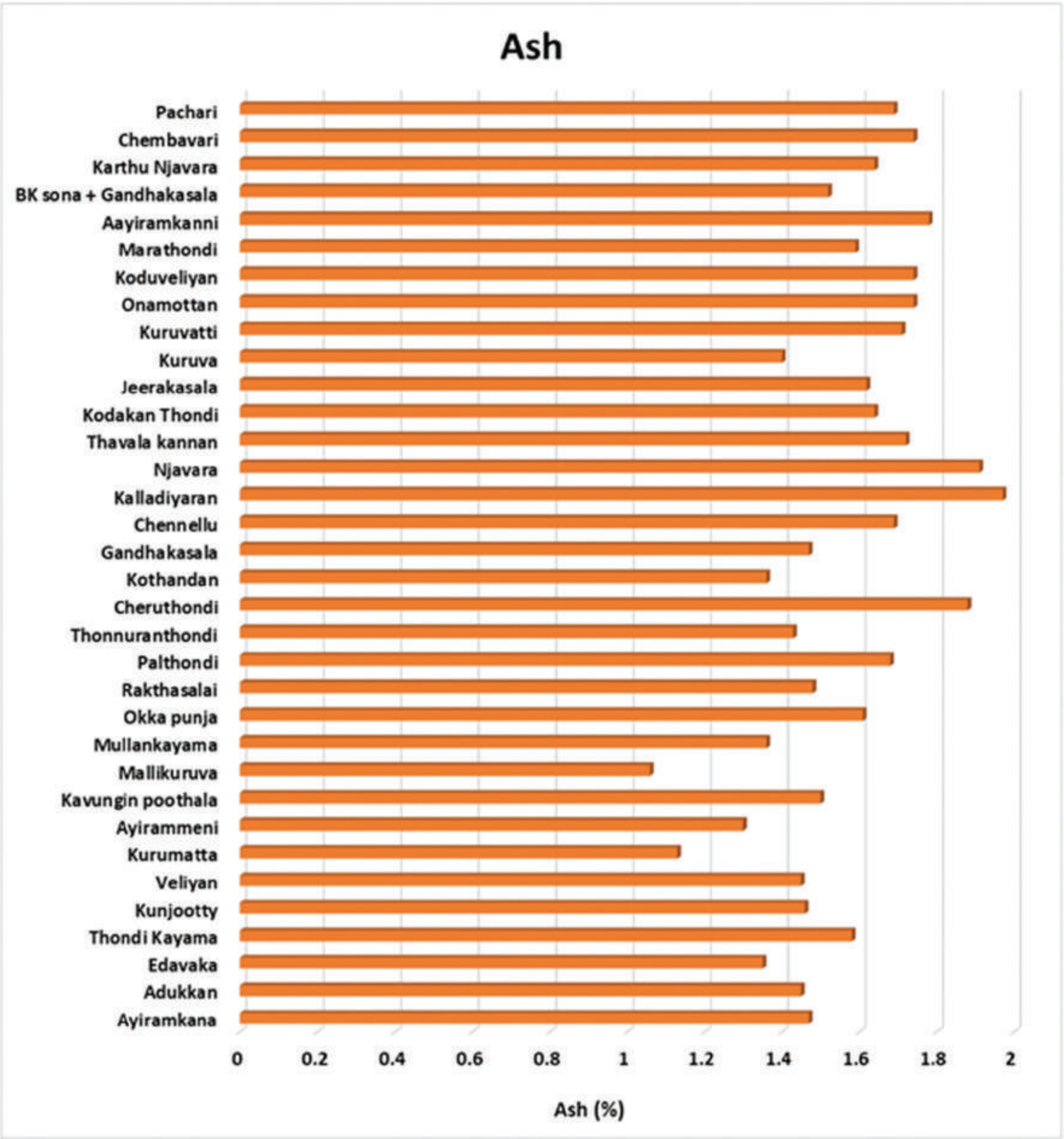

Iron
Iron (mg/100g)
9
8
7
6
5
4
3
2
1
0
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari

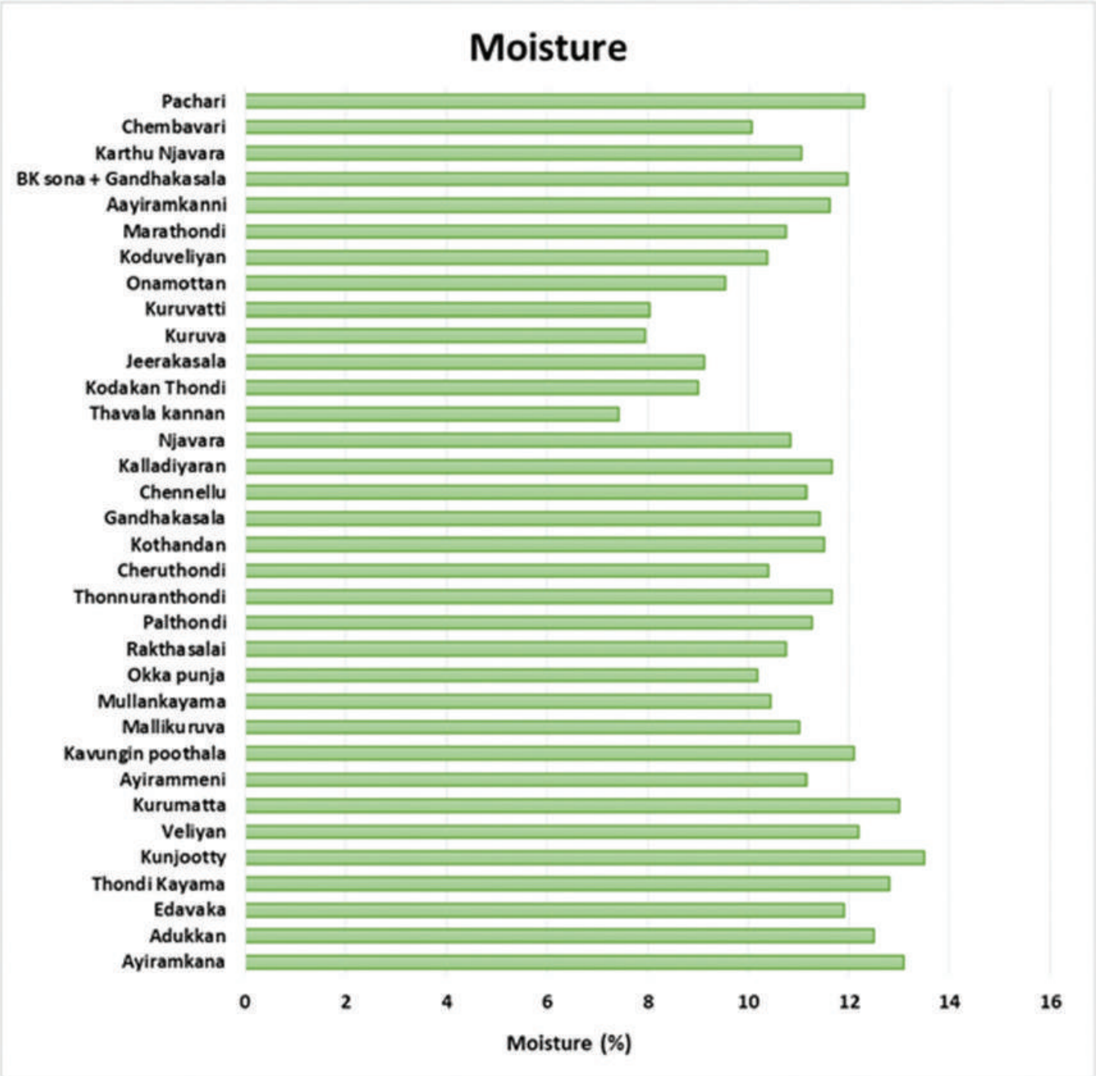

Potassium
Potassium (mg/100g)
700
600
500
400
300
200
100
0
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari

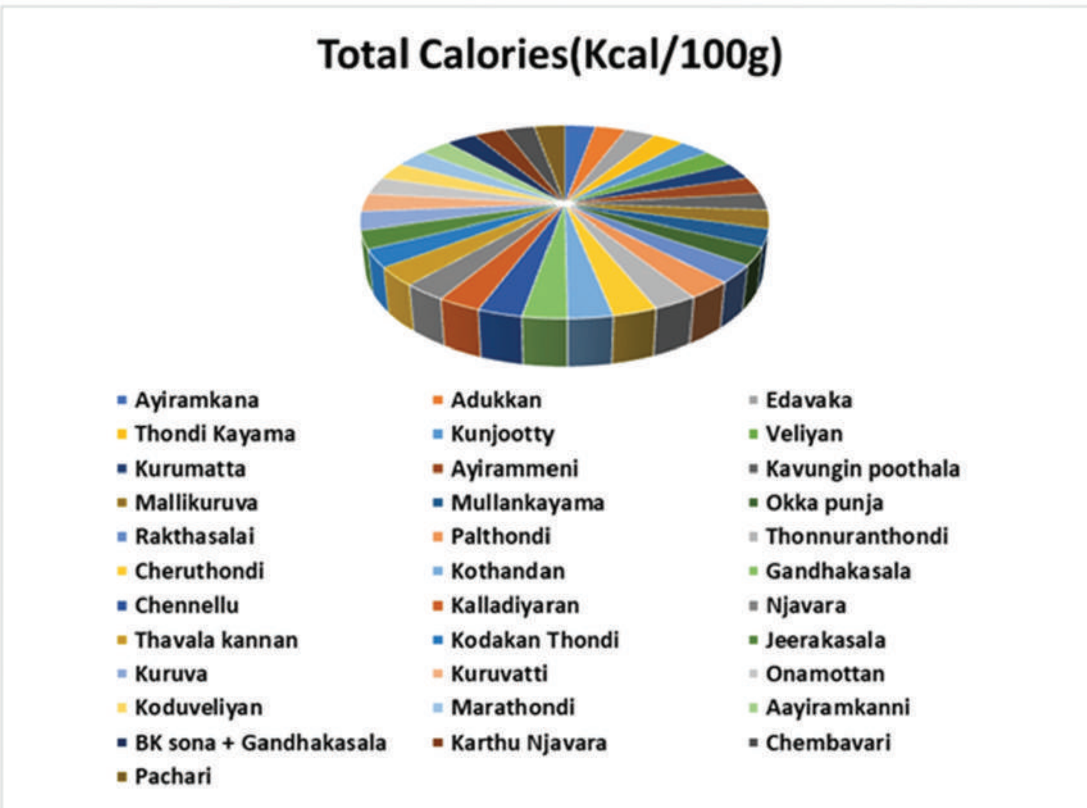

Calcium
Calcium (mg/100g)
25
20
15
10
5
0
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari


Sodium
Sodium (mg/100g)
140
120
100
80
60
40
20
0
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari

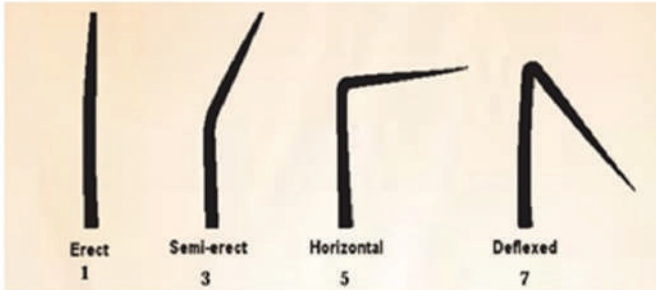

Magnesium
Magnesium (mg/100g)
120
100
80
60
40
20
0
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari


Ash
Pachari
Chembavari
Karthu Njavara
BK sona + Gandhakasala
Aayiramkanni
Marathondi
Koduveliyan
Onamottan
Kuruvatti
Kuruva
Jeerakasala
Kodakan Thondi
Thavala kannan
Njavara
Kalladiyaran
Chennellu
Gandhakasala
Kothandan
Cheruthondi
Thonnuranthondi
Palthondi
Rakthasalai
Okka punja
Mullankayama
Mallikuruva
Kavungin poothala
Ayirammeni
Kurumatta
Veliyan
Kunjootty
Thondi Kayama
Edavaka
Adukkan
Ayiramkana
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Ash (%)

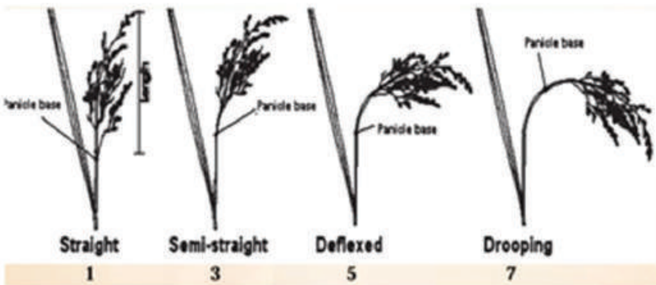

Moisture
Pachari
Chembavari
Karthu Njavara
BK sona + Gandhakasala
Aayiramkanni
Marathondi
Koduveliyan
Onamottan
Kuruvatti
Kuruva
Jeerakasala
Kodakan Thondi
Thavala kannan
Njavara
Kalladiyaran
Chennellu
Gandhakasala
Kothandan
Cheruthondi
Thonnuranthondi
Palthondi
Rakthasalai
Okka punja
Mullankayama
Mallikuruva
Kavungin poothala
Ayirammeni
Kurumatta
Veliyan
Kunjootty
Thondi Kayama
Edavaka
Adukkan
Ayiramkana
0
2
4
6
8
10
12
14
16
Moisture (%)


Total Calories(Kcal/100g)
Ayiramkana
Adukkan
Edavaka
Thondi Kayama
Kunjootty
Veliyan
Kurumatta
Ayirammeni
Kavungin poothala
Mallikuruva
Mullankayama
Okka punja
Rakthasalai
Palthondi
Thonnuranthondi
Cheruthondi
Kothandan
Gandhakasala
Chennellu
Kalladiyaran
Njavara
Thavala kannan
Kodakan Thondi
Jeerakasala
Kuruva
Kuruvatti
Onamottan
Koduveliyan
Marathondi
Aayiramkanni
BK sona + Gandhakasala
Karthu Njavara
Chembavari
Pachari

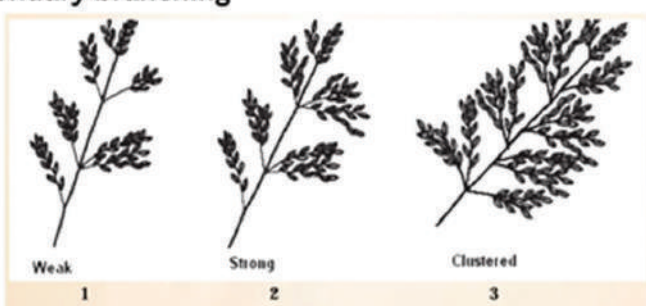
A Flag leaf



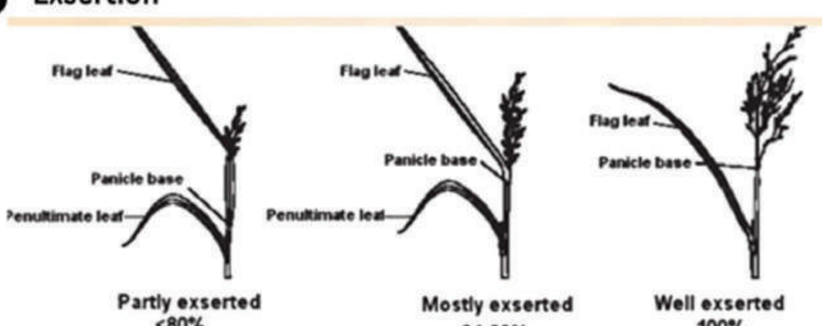
B Curvature of main axis



C Secondary branching



D Exsertion



Morphological parameters for Paddy varieties: Protection of Plant Varieties and Farmer's Rights Authority (PPV&FRA), Government of India

ADUKKAN

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	180 days
Culture methods	Transplanting (Parichunadeel)
Grain yield	900 kg/ acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Oval to oblong
Color of seed	Straw color
Preservation methods	Jute sack
Nutritional quality	Rich in Bran, High starch content
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Light brown
Plant height	65 cm
Length of grain	50 mm

AAYIRAM KANA

(Oryza sativa)

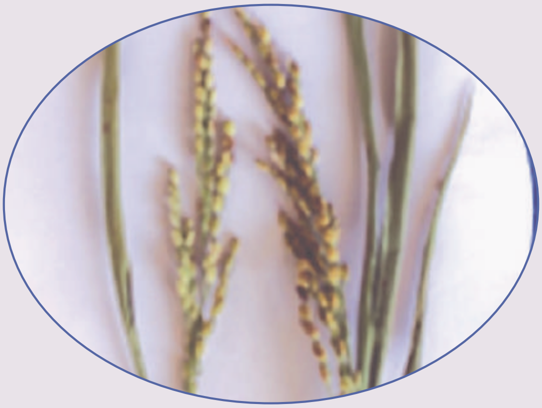
MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	180 days
Culture methods	Chettuvitha, Podivitha
Grain yield	1125 kg/ acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw color
Preservation methods	Jute sack
Nutritional quality	Nil
Pest and disease resistance capacity	No
Leaf blade colour	Green
Panicle type	Intermediate
Seed coat colour	Light brown
Plant height	85 cm
Length of grain	50 mm

KOTHANDAN

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS



TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	150-160 days
Culture methods	Field cultivation
Grain yield	900 kg/ acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long round
Color of seed	Straw color
Preservation methods	Jute sack
Nutritional quality	Nil
Pest and disease resistance capacity	No
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Light brown
Plant height	65 cm
Length of grain	50 mm

AAYIRAM MENI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	125 days
Culture methods	Transplanting (Parichunadeel)
Grain yield	1000 kg/ acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long
Color of seed	Straw color
Preservation methods	Jute sack
Nutritional quality	Rich in nutrients
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Straw coloured
Plant height	140 cm
Length of grain	70 mm

GANDHAKASHALA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja, Punja
Growth before harvesting	120-160 days
Culture methods	Transplanting (Pari- chunadeel),Chettuvitha
Grain yield	1000 kg/ acre
Colour of rice	White
Aromatic rice	Yes
Shape of rice	Round
Color of seed	Golden color
Preservation methods	Jute sack
Nutritional quality	Rich in proteins,Vitamins and Carbohydrates
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Golden yellow
Plant height	150 cm
Length of grain	45 mm

MALLIKURUVA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	150 -155 days
Culture methods	Transplanting (Parichuna deel), Chettuvitha
Grain yield	1000 kg/ acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw color
Preservation methods	Jute sack, Drying
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Straw coloured
Plant height	100 cm
Length of grain	65 mm

MULLAN KAYAMA

(Oryza sativa)

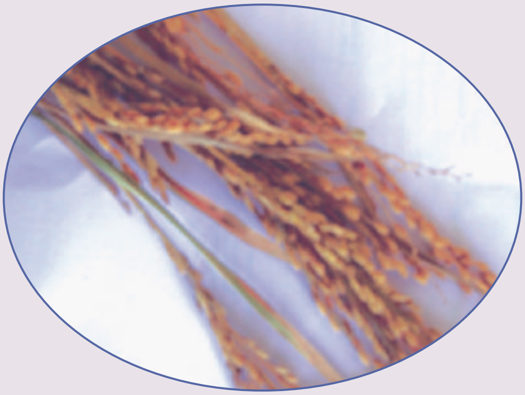
MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	160-180 days
Culture methods	Transplanting (Parichunadeel),Vitha
Grain yield	900 kg/ acre
Colour of rice	White
Aromatic rice	Yes
Shape of rice	Round
Color of seed	Straw color
Preservation methods	Jute sack, Pathayam
Nutritional quality	Rich in proteins and vitamins
Pest and disease resistance capacity	Yes, Highly resistant to fungal and bacterial
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Straw coloured
Plant height	120 cm
Length of grain	16 mm

VALICHOORI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

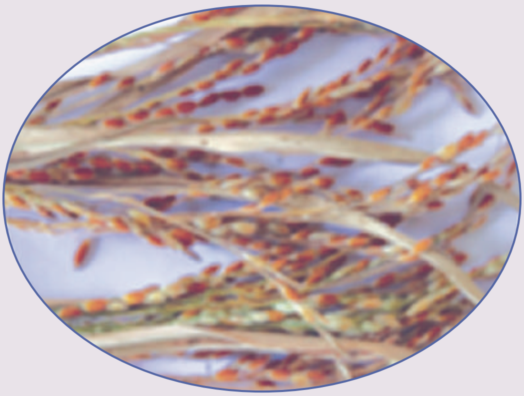


TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	150 days
Culture methods	Parichunateel
Grain yield	1000 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw color
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Straw coloured
Plant height	107 cm
Length of grain	90 mm

RAKTHASHALI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS



TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	140-160
Culture methods	Parichunateel
Grain yield	925 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long
Color of seed	Golden
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good, Rich in vitamins and Antioxidants
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Golden colour
Plant height	100 cm
Length of grain	80 mm

KAVUNGINPOOTHALA

(Oryza sativa)

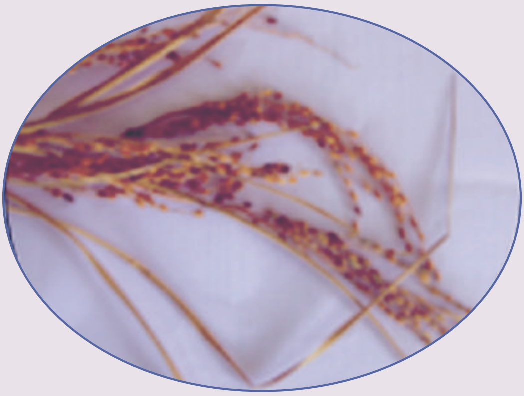
MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	120
Culture methods	Parichunadeel
Grain yield	300 kg/acre
Colour of rice	White
Aromatic rice	No
Shape of rice	Long
Color of seed	Straw coloured
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Straw coloured
Plant height	108 cm
Length of grain	70 mm

URINIKKAYAMA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS



TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	150 days
Culture methods	Njattadi, Podivitha, Chettuvitha
Grain yield	1300kg/acre
Colour of rice	White
Aromatic rice	Yes
Shape of rice	Round
Color of seed	Straw color
Preservation methods	Jute sack, Pathayam
Nutritional quality	No
Pest and disease resistance capacity	No
Leaf blade colour	Green
Panicle type	Intermediate
Seed coat colour	Straw coloured
Plant height	102 cm
Length of grain	70 mm

KALLADIYARAN

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	120 days
Culture methods	Parichunadeel, Podivitha,Chettuvitha
Grain yield	1600 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw color
Preservation methods	Jute sack, pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Panicle type	Intermediate
Seed coat colour	Straw coloured
Plant height	100cm
Length of grain	90 mm

JEERAKASHALA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	140-150
Culture methods	Parichunadeel
Grain yield	1000 kg/acre
Colour of rice	White
Aromatic rice	Yes
Shape of rice	Long
Color of seed	Straw coloured with golden lines
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Straw coloured
Plant height	95 cm
Length of grain	70 mm

VELIYAN

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja, Puncha
Growth before harvesting	120-210 days
Culture methods	Parichunadeel
Grain yield	1000 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Browncoloured
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Open
Seed coat colour	Brown coloured
Plant height	136 cm
Length of grain	90 mm

THONDI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	120 days
Culture methods	Parichunadeel,Vitha
Grain yield	1000 kg/ acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long and round
Color of seed	Straw coloured
Preservation methods	Jute sack, Komma
Nutritional quality	Good, Rich in vitamin B
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Intermediate
Seed coat colour	Straw coloured
Plant height	105 cm
Length of grain	70 mm

KARUVACHI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	140-150 days
Culture methods	Parichunadeel
Grain yield	900 kg/ acre
Colour of rice	Light red
Aromatic rice	No
Shape of rice	Long round
Color of seed	Straw colored
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Light brown
Plant height	65 cm
Length of grain	50 mm

EDAVAKA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	120-130 days
Culture methods	Parichunadeel, Chettuvitha, Podivitha
Grain yield	2500 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw color
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Straw colored
Plant height	107cm
Length of grain	100 mm

CHENNELU

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	120
Culture methods	Parichunadeel
Grain yield	1500 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw colored
Preservation methods	Jute sack, pathayam
Nutritional quality	Good
Pest and disease resistance capacity	yes
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	50mm

CHOMALA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	120
Culture methods	Parichunadeel
Grain yield	1300 kg/acre
Colour of rice	Sandal colored
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw colored with brown dots
Preservation methods	Jute sack, pathayam
Nutritional quality	Good
Pest and disease resistance capacity	yes
Leaf blade colour	Green
Seed coat colour	Straw colored with brown dots
Length of grain	50mm

NAVARA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	70 days
Culture methods	Podivitha
Grain yield	1500 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round and long
Color of seed	Black coloured
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Black coloured
Plant height	107cm
Length of grain	50 mm

CHERUTHONDI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	120 days
Culture methods	Podivitha, Parichunadeel
Grain yield	1000 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round and long
Color of seed	Straw colored
Preservation methods	Jute sack komma
Nutritional quality	Good, Rich in vitamin
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Straw colored
Length of grain	60 mm

THONNOORAM THONDI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	120 days
Culture methods	Podivitha, Parichunadeel, Chettuvitha
Grain yield	1500 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round and long
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	50 mm

PAALTHONDI (MATTA)

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	120 days
Culture methods	Parichunadeel
Grain yield	1100 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	40 mm

ONAMOTTAN

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	120 days
Culture methods	Parichunadeel, Podivitha
Grain yield	1400 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	70 mm

MARATHONDI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	120-150 days
Culture methods	Parichunadeel
Grain yield	1500 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	80 mm

KANALI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

Type of paddy	Traditional
Harvest time	Nanja
Growth before harvesting	120-140 days
Culture methods	Parichunadeel
Grain yield	1500 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Light brown colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Light brown colored
Length of grain	60 mm

KUNJOOTTY

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	120-140 days
Culture methods	Parichunadeel
Grain yield	1500 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Light brown colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Light brown colored
Length of grain	60 mm

KURUVA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	150 days
Culture methods	Parichunadeel
Grain yield	1000 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	50 mm

KURUVATTY

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	125 days
Culture methods	Parichunadeel
Grain yield	2600 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long Round
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	70 mm

CHUVANNA CHETTADI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	120-150 days
Culture methods	Parichunadeel
Grain yield	1400 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	80 mm

THAVALAKKANNAN

Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	120-150 days
Culture methods	Parichunadeel
Grain yield	1400 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	70 mm

KODUVELIYAN

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	160 days
Culture methods	Parichunadeel
Grain yield	800 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long Round
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	70 mm

JEERAKACHEMBAVU

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	120-130 days
Culture methods	Seed drum,natural methods.
Grain yield	500 kg/acre
Colour of rice	White
Aromatic rice	No
Shape of rice	Long Round
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	60 mm

CHATAYAN VELUMBALA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	140-150 days
Culture methods	Parichunadeel
Grain yield	1500 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long Round
Color of seed	Straw colored
Preservation methods	Jute sack
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	50 mm

KARUTHA NAVARA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	120 days
Culture methods	Njattadi, Chettu vitha, Podi vitha
Grain yield	800 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long
Color of seed	Straw colored with brown lines
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Panicle type	Compact
Seed coat colour	Straw colored
Length of grain	100 mm

SINDOOR MANI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	150-160 days
Culture methods	Parichunateel
Grain yield	1700 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long
Color of seed	Straw colored
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	90 mm

RAJAKAYAMA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

Type of paddy	Traditional
Harvest time	Nanja
Growth before harvesting	140 -145 days
Culture methods	Parichunateel
Grain yield	1500 kg/acre
Colour of rice	Slight white
Aromatic rice	No
Shape of rice	Long
Color of seed	Brown colored
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	80 mm

CHERIYA KUNJAN

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	130 -135 days
Culture methods	Parichunateel
Grain yield	1300 kg/acre
Colour of rice	Orange
Aromatic rice	No
Shape of rice	Round
Color of seed	Straw color with reddish tinge
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	Yes
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	70 mm

AAYIRAM KANNI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	180 days
Culture methods	Parichunateel
Grain yield	1700 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long and Round
Color of seed	Straw color
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	100 mm

KURUMATTA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	180 days
Culture methods	Parichunateel
Grain yield	1500 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long and Round
Color of seed	Straw color
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw colored
Length of grain	90 mm

MULLAN PUNCHA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	**TRADITIONAL**
Harvest time	Nanja
Growth before harvesting	120-140 days
Culture methods	Parichunateel
Grain yield	1600 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long and Round
Color of seed	Brown colour with lines
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Brown colored
Length of grain	85 mm

MULLAN CHANNA

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	120 days
Culture methods	Parichunateel Vitha
Grain yield	650 kg/acre
Colour of rice	White
Aromatic rice	Yes
Shape of rice	Long and Round
Color of seed	Straw color
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw color
Length of grain	80 mm

CHETTUVELIYAN

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	180 days
Culture methods	Parichunateel Chettuvitha,Podivitha
Grain yield	1800 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long and Round
Color of seed	Straw color with brown lines
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw color
Length of grain	90 mm

KODAKAN THONDI

(Oryza sativa)

MORPHOLOGICAL CHARACTERISTICS

TYPE OF PADDY	TRADITIONAL
Harvest time	Nanja
Growth before harvesting	180 days
Culture methods	Parichunateel,vitha
Grain yield	1500 kg/acre
Colour of rice	Red
Aromatic rice	No
Shape of rice	Long and Round
Color of seed	Straw color
Preservation methods	Jute sack, Pathayam
Nutritional quality	Good
Pest and disease resistance capacity	No
Leaf blade colour	Green
Seed coat colour	Straw color
Length of grain	55 mm

Traditional Black Pepper Varieties: Agricultural Pillar of Kerala's Tribal Communities

MORPHOLOGICAL CHARACTERIZATION OF TRADITIONAL BLACK PEPPER VARIETIES

Piper nigrum, commonly known as black pepper, is a flowering vine belongs to the family Piperaceae. Kerala, often referred to as the “Spice Garden of India,” is renowned for its production of black pepper. It is a native of Western Ghats of Kerala and more than a hundred cultivars with highly variable characters exist. But only a few of them have been identified as economically productive. Black pepper is cultivated for its matured dried fruits which are the most widely used spice in the world and is often referred to as the “king of spices.”

Black pepper holds profound cultural significance in the lives of tribal communities in Kerala. Beyond its economic value, it is deeply intertwined with their traditions, rituals, and social practices. Black pepper cultivation is the major source of income and employment for many tribal communities in Kerala. In earlier days, the tribal farmers have mostly cultivated the traditional pepper varieties, which showed high resistance to disease and other environmental stress conditions. However, with the advent of new hybrid varieties, the traditional varieties began to disappear and the existence of some of the traditional varieties is currently not even traceable.

ORIGIN OF NAMES OF DIFFERENT CULTIVARS

Several cultivars of black pepper are traditionally associated with tribal communities. These cultivars are often named based on their origin, the communities that developed or cultivated them, or their unique traits. Tribal communities in Kerala have played a vital role in selecting, propagating, and preserving these varieties. Cultivars such as ‘Kanikkaran’ and ‘Arayakodi’ got their names from tribal communities named Kani and Mala Arayan respectively.

GROWTH REQUIREMENTS

Black pepper is a crop of hot humid tropics and its characteristic climatic requirements are, high rainfall, uniform temperature and high relative humidity. Well distributed rainfall ranging from 1000 to 3000 mm is required for its proper growth and development. The optimum temperature for its growth is around 20-30 degree celsius. In addition, drainage status and moisture holding capacity of the soil are also important. Long spells of dry weather are always harmful. Hence, an ideal variety should be able to yield better under limited moisture availability and should be responsive to irrigation, producing optimum yields when irrigation is given during critical stages. The Western Ghats provide the ideal climate and soil for pepper vines, with abundant rainfall, moderate temperatures, and well-drained soil.

CULTIVATION AND HARVESTING

Tribal farmers often use organic and traditional farming methods, which help preserve soil fertility and ensure the pepper’s high quality. Stem cuttings and rooted cuttings from runner shoots are mainly used for propagation. Terminal shoots can also be used. Planting Usually done at the beginning of the monsoon season (May–June) to ensure sufficient water availability. Black pepper takes 2–3 years after planting to start producing fruit. The fruit is harvested when the berries start to turn red or greenish-yellow

CULTURAL SIGNIFICANCE AND MEDICINAL USES

Black pepper is deeply embedded in Kerala’s culture, cuisine, and traditional Ayurvedic practices. Black pepper is deeply rooted in tribal medicinal practices: Used to treat colds, coughs, and digestive issues. It is often combined with other herbs in traditional remedies. Black pepper is included in daily diets for its immunity-boosting properties and as a protection against seasonal illnesses. Black pepper is sometimes used in tribal rituals and as an offering in religious practices.

ECONOMIC LIVELIHOOD

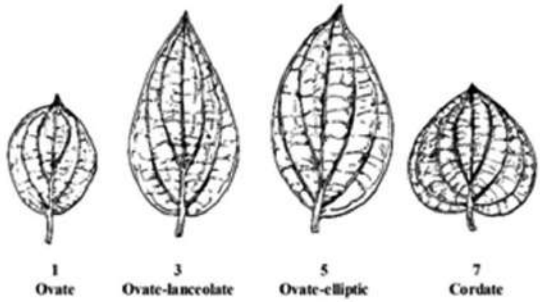
Black pepper plays a crucial economic role in the lives of Kerala's tribal communities, serving as a primary or supplementary source of income and contributing to their overall economic well-being. Many grow black pepper on small plots of land or intercropped with other crops.

ROLE IN TRIBAL CUISINE

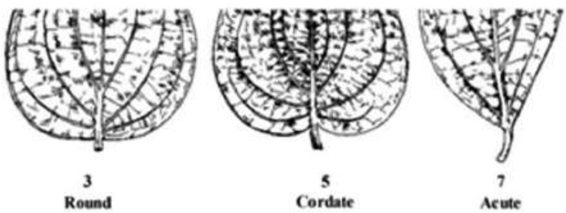
Pepper is a key ingredient in tribal cooking, used to add flavour to their dishes. It is often combined with forest produce like tubers, and meats to create traditional recipes. Tribes use black pepper in food preservation, especially for meats, due to its antimicrobial properties.

In essence, black pepper is far more than just a spice for the tribal communities of Kerala—it represents their connection to the land, their traditions, and their shared cultural identity. Its continued cultivation and use are a testament to their sustainable lifestyle and deep-rooted heritage.

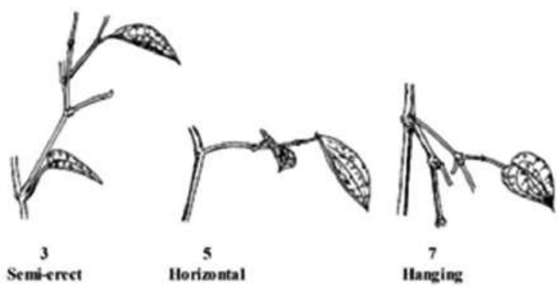
A **Leaf : Lamina shape**



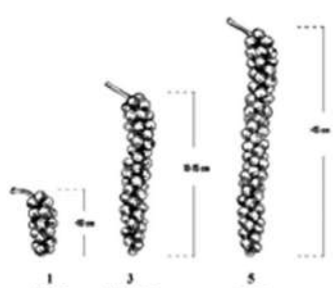
B **Leaf: Base shape**



C **Lateral branch pattern**



D **Spike: Length**



Morphological parameters for pepper varieties: Protection of Plant Varieties and Farmer's Rights Authority (PPV&FRA), Government of India

THOTTAMUNDI

Piper nigrum

1	Length of leaf	Less than 10 cm, short
2	Width of leaf	5.5 cm, medium
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Wavy
6	Leaf petiole length	2 cm
7	Lateral branches	Semi erect
8	Length of spike	Less than 10 cm, short
9	Spike proliferation	Absent, solitary spikes
10	Spike setting	Medium loose spike set- ting
11	Spike twisting	Present
12	Shape of berry	Round
13	Shoot tip colour	Light purple

NEELAMUNDI

Piper nigrum

1	Length of leaf	10 – 16 cm, medium
2	Width of leaf	7- 10 cm, medium
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	2 cm
7	Lateral branches	Semi erect
8	Length of spike	10- 15 cm, medium
9	Spike proliferation	Absent, solitary spikes
10	Spike setting	Compact spike setting
11	Spike twisting	Absent
12	Shape of berry	Oval
13	Shoot tip colour	Light purple

MARAM PEDATHI

Piper nigrum

1	Length of leaf	10- 16 cm, medium
2	Width of leaf	7-10 cm, medium
3	Leaf lamina shape	Ovate lanceolate
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	1.5 cm
7	Lateral branches	Hanging
8	Length of spike	10- 15 cm, medium
9	Spike proliferation	Absent, solitary spikes
10	Spike setting	Compact setting
11	Spike twisting	Absent
12	Shape of berry	Oval
13	Shoot tip colour	Light green

VATTA MUNDI

Piper nigrum

1	Length of leaf	10-16 cm
2	Width of leaf	7-10 cm
3	Leaf lamina shape	Ovate
4	Leaf base shape	Round
5	Leaf margin	Even
6	Leaf petiole length	2cm
7	Lateral branches	Horizontal
8	Length of spike	Less than 10 cm
9	Spike proliferation	Absent, solitary spikes
10	Spike setting	Compact setting
11	Spike twisting	Absent
12	Shape of berry	Round
13	Shoot tip colour	Light purple

VELLA MUNDI

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	7-10cm, medium
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	2cm
7	Lateral branches	Hanging
8	Length of spike	Less than 10cm, short
9	Spike proliferation	Absent, solitary spikes
10	Spike setting	Loose setting
11	Spike twisting	Present
12	Shape of berry	Round
13	Shoot tip colour	Light green

KARIMUNDA

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	7-10cm, medium
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	1.5 cm
7	Lateral branches	Hanging
8	Length of spike	Less than 10 cm, short
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Medium loose setting
11	Spike twisting	Absent
12	Shape of berry	Oval
13	Shoot tip colour	Light purple

KALLUGAL KODI

Piper nigrum

1	Length of leaf	10- 16 cm, medium
2	Width of leaf	11 cm , medium
3	Leaf lamina shape	Ovate
4	Leaf base shape	Round
5	Leaf margin	Even
6	Leaf petiole length	2 cm
7	Lateral branches	Horizontal
8	Length of spike	Greater than 15 cm, long
9	Spike proliferation	Absent, solitary spikes
10	Spike setting	Compact spike setting
11	Spike twisting	Present
12	Shape of berry	Oval

MANJA MUNDI

Piper nigrum

1	Length of leaf	10- 16 cm, medium
2	Width of leaf	Greater than 10 cm, broad
3	Leaf lamina shape	Ovate
4	Leaf base shape	Cordate
5	Leaf margin	Even
6	Leaf petiole length	2 cm
7	Lateral branches	Horizontal
8	Length of spike	10- 15 cm, medium
9	Spike proliferation	Absent, solitary spikes
10	Spike setting	Compact setting
11	Spike twisting	Absent
12	Shape of berry	Round
13	Shoot tip colour	Light green

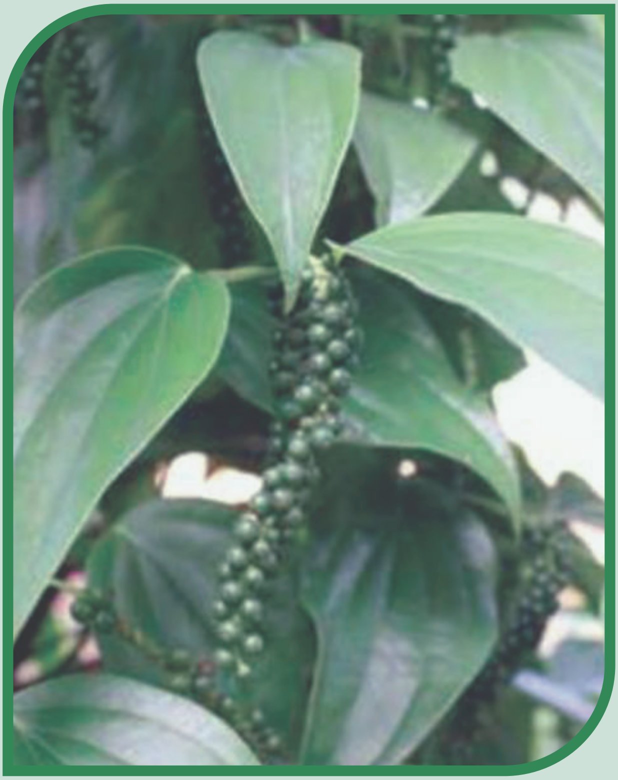
KUTHIRA VALI

Piper nigrum

1	Length of leaf	Greater than 16 cm, long
2	Width of leaf	7- 10 cm, medium
3	Leaf lamina shape	Ovate lanceolate
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	2.5 cm
7	Lateral branches	Hanging
8	Length of spike	10- 15 cm, medium
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Compact spike setting
11	Spike twisting	Absent
12	Shape of berry	Oval

THULAM MUNDI

Piper nigrum



1	Length of leaf	10- 16 cm
2	Width of leaf	7-10 cm
3	Leaf lamina shape	Ovate lanceolate
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	2 cm
7	Lateral branches	Semi erect
8	Length of spike	Less than 10 cm
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Medium loose spike set- ting
11	Spike twisting	Absent
12	Shape of berry	Round
13	Shoot tip colour	Light purple

MALA MUNDI

Piper nigrum

1	Length of leaf	18cm, long
2	Width of leaf	7-10cm, medium
3	Leaf lamina shape	Ovate- lanceolate
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	3cm
7	Lateral branches	Horizontal
8	Length of spike	Less than 10cm, short
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Compact spike setting
11	Spike twisting	Absent
12	Shape of berry	Round

JEERAKA MUNDA

Piper nigrum

1	Length of leaf	10-16 cm, medium
2	Width of leaf	Less than 7cm, narrow
3	Leaf lamina shape	Ovate lanceolate
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	1.5cm
7	Lateral branches	Hanging
8	Length of spike	Less than 10cm, short
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Medium loose spike set- ting
11	Spike twisting	Absent
12	Shape of berry	Round
13	Shoot tip colour	Light green

KOCHU KANIKKARAN

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	Less than 7cm, narrow
3	Leaf lamina shape	Ovate lanceolate
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	1.5cm
7	Lateral branches	Semi-erect
8	Length of spike	10-15cm, medium
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Compact spike setting
11	Spike twisting	Absent
12	Shape of berry	Oval

AMBBARA MUNDI

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	7 cm, medium
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	2 cm
7	Lateral branches	Horizontal
8	Length of spike	Less than 10 cm, short
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Medium loose spike set- ting
11	Spike twisting	Absent
12	Shape of berry	Round
13	Shoot tip colour	Light green

KARIMUNDA

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	Less than 7 cm, narrow
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	2 cm
7	Lateral branches	Semi erect
8	Length of spike	Less than 10 cm, short
9	Spike proliferation	Absent, solitary spike
10	Spike setting	compact spike setting
11	Spike twisting	Absent
12	Shape of berry	Round
13	Shoot tip colour	Light purple

VALIYA KARIMUNDA

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	7-10 cm, medium
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	2.5 cm
7	Lateral branches	Horizontal
8	Length of spike	10-15 cm, medium
9	Spike proliferation	Absent, solitary spike
10	Spike setting	compact spike setting
11	Spike twisting	Absent
12	Shape of berry	Oval
13	Shoot tip colour	Light purple

KUMBHA KODI

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	7-10 cm, medium
3	Leaf lamina shape	Ovate lanceolate
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	2 cm
7	Lateral branches	Horizontal
8	Length of spike	10-15 cm, medium
9	Spike proliferation	Absent, solitary spike
10	Spike setting	compact spike setting
11	Spike twisting	Absent
12	Shape of berry	Round
13	Shoot tip colour	Light green

KOTTANADAN

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	7-10 cm, medium
3	Leaf lamina shape	Ovate
4	Leaf base shape	Round
5	Leaf margin	Even
6	Leaf petiole length	1.5 cm
7	Lateral branches	Horizontal
8	Length of spike	10-15 cm, medium
9	Spike proliferation	Absent, solitary spike
10	Spike setting	compact spike setting
11	Spike twisting	Absent
12	Shape of berry	Round
13	Shoot tip colour	Light green

NARAYA KODI

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	7-10 cm, medium
3	Leaf lamina shape	Ovate
4	Leaf base shape	Round
5	Leaf margin	Even
6	Leaf petiole length	1.5 cm
7	Lateral branches	Horizontal
8	Length of spike	10-15 cm, medium
9	Spike proliferation	Absent, solitary spike
10	Spike setting	compact spike setting
11	Spike twisting	Absent
12	Shape of berry	Round
13	Shoot tip colour	Light purple

ZEBRA MUNDI

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	7-10 cm, medium
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	1.5 cm
7	Lateral branches	Horizontal
8	Length of spike	Less than 10 cm, short
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Medium loose spike setting
11	Spike twisting	Absent
12	Shape of berry	Oval
13	Shoot tip colour	Light green

AANA CHEVIYAN

Piper nigrum

1	Length of leaf	More than 16cm, Long
2	Width of leaf	More than 10 cm, broad
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	1.5 cm
7	Lateral branches	Horizontal
8	Length of spike	10-15 cm, medium
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Loose spike setting
11	Spike twisting	Absent
12	Shape of berry	Round
13	Shoot tip colour	Light green

ARIMUNDI

Piper nigrum

1	Length of leaf	More than 16 cm, long
2	Width of leaf	More than 10 cm, broad
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	2 cm
7	Lateral branches	Horizontal
8	Length of spike	10-15 cm, medium
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Loose spike setting
11	Spike twisting	Absent
12	Shape of berry	Oval
13	Shoot tip colour	Light green

ARAKULAM MUNDI

Piper nigrum

1	Length of leaf	More than 16cm, long
2	Width of leaf	7-10 cm, medium
3	Leaf lamina shape	Ovate lanceolate
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	1.5 cm
7	Lateral branches	Semi erect
8	Length of spike	Less than 10 cm, short
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Loose spike setting
11	Spike twisting	Absent
12	Shape of berry	Oval
13	Shoot tip colour	Light purple

VELLANAMBAN

Piper nigrum

1	Length of leaf	More than 16 cm, long
2	Width of leaf	7-10 cm, medium
3	Leaf lamina shape	Ovate lanceolate
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	2 cm
7	Lateral branches	Hanging
8	Length of spike	Less than 10 cm, short
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Loose spike setting
11	Spike twisting	Absent
12	Shape of berry	Oval
13	Shoot tip colour	Light green

CHEGANOOR KODI

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	7-10 cm, medium
3	Leaf lamina shape	Ovate elliptical
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	1 cm, short
7	Lateral branches	Horizontal
8	Length of spike	Less than 10 cm, short
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Medium loose spike setting
11	Spike twisting	Absent
12	Shape of berry	Oval
13	Shoot tip colour	Purple

IRUMANIYAN

Piper nigrum

1	Length of leaf	10-16cm, medium
2	Width of leaf	7-10 cm, medium
3	Leaf lamina shape	Ovate lanceolate
4	Leaf base shape	Acute
5	Leaf margin	Even
6	Leaf petiole length	1.5 cm
7	Lateral branches	Horizontal
8	Length of spike	Less than 10 cm, short
9	Spike proliferation	Absent, solitary spike
10	Spike setting	Loose spike setting
11	Spike twisting	Absent
12	Shape of berry	Oval
13	Shoot tip colour	Purple

CONSERVATION AND SUSTAINABLE HARVESTING OF MEDICINAL PLANTS

Medicinal plants constitute an important component of the plant resource spectrum of Kerala. Recent analysis shows that out of the estimated 4600 flowering plants in Kerala, about 900 possess medicinal values. Of these, 540 species are reported to occur in forest ecosystems. Over 150 species of plants that are either indigenous or naturalized in Kerala are used in the Indian system of medicine like Ayurveda and Sidha. The rural folk and tribal communities make use of about 2000 species of leser known wild plants for various medicinal uses. About 60 to 65% of plants required for Ayurvedic medicine and almost 80% of plants used in Sidha medicine are found in the forests of Kerala (Kerala forest department, 2010).

The relevance of medicinal plants in Kerala is being felt with the increasing number of people turning towards the traditional medicines and this is happening especially because of the growing number of people suffering from side effects and allergies caused by modem medicines. The growing demand for traditional medicines means growing demand for medicinal plants. Beyond their medicinal value, these plants contribute significantly to Kerala's economy. The growing global demand for herbal medicines, Ayurvedic formulations, and natural cosmetics has positioned Kerala as a major supplier of medicinal plant-based products. The state's tribal communities and rural populations also depend on the collection and trade of medicinal plants for their livelihood. This demand leads to over-harvesting of the natural resources and threatening their sustainability.

The increasing commercial importance of medicinal plants and the economic weakness of the gatherers lead to unsustainable harvest practices. Further, many collectors are unskilled in proper harvesting techniques. Most of the collectors are not aware of such things and the rest are not far sighted enough to care for future availability. The prime reason for such negligence is the poor economic status of the collectors. Their share in the value of medicinal plants is small, especially since no value addition takes place at the collectors' level (Annie & Meera, 2003).

The destruction and degradation of natural habitats and over exploitation of medicinal plants have led to diminished supply of these valuable raw materials. The poor availability has also resulted in adulteration of raw drug. An example is that of Kuvalam (*Aegle marmelos*) which is of very rare occurrence in Kerala forests. The roots of *Toddalia asiatica* and species of *Limonia* are collected in large quantities and sold as Kuvalam. One of the effective ways to check the use of adulterants is to cultivate the much needed drug plants (Nambiar *etal*, 1985).

90% of the medicinal plants collected for industrial utilisation are from the wild. Conservation is possible only through controlled and sustainable harvesting. Availability of the medicinal plants can determine the long-term maintenance of the traditional health care systems. Most of these plant species are typical of the forest ecosystems and their extinction can affect the environment. Many tribal communities in Kerala still depend on these plants for their sustenance and for medicinal purposes. So the conservation and sustainable harvesting of medicinal plants in Kerala is vital for preserving biodiversity, supporting traditional medicine, safeguarding livelihoods, and promoting economic growth.

MEDICINAL PLANTS USED BY THE TRIBAL COMMUNITIES OF KERALA

The tribal communities of Kerala have an intrinsic connection to the nature. They have been using medicinal plants for centuries, and have a rich legacy of traditional healthcare practices that have been handed down through the generations. Their traditional use of medicinal plants plays a vital role in both their health and cultural identity. Tribal communities play a crucial role in the preservation and use of these plants. Their deep knowledge of local flora, has allowed them to live in harmony with nature for centuries.

Many tribal healers or "Vaidhyas" are the primary healthcare providers in their communities, they have vast knowledge about the therapeutic benefits of numerous plants and they have been employing them for a variety of diseases for ages. These tribal healers play a critical role in healthcare, especially in remote areas where access to modern medical facilities may be limited. The tribal healthcare system is deeply intertwined with the cultural and spiritual practices of the communities, often blending medicinal plants with rituals and prayers.

In summary, the relationship between tribal communities and medicinal plants in Kerala is a vital aspect of both cultural heritage and biodiversity conservation. These communities are the custodians of valuable traditional knowledge that holds potential for both local healthcare and global scientific research.

RGCB tribal heritage project team established 4 medicinal plant processing units in Idukki and Thiruvananthapuram districts to promote traditional healthcare practices and sustainable use of medicinal herbs for income generation and healthcare services. These units focuses on sustainable harvesting and primary processing of medicinal plants to preserve biodiversity, empower local communities, and support ecosystem health, safeguarding indigenous knowledge and ensuring a continuous supply of natural remedies for future generations.

SUSTAINABLE COLLECTION OF MEDICINAL PLANTS

Sustainable collection is a process designed to conserve natural resources for the future without their depletion. Sustainability means meeting the needs of the present while considering the needs of future generations.

Sustainable harvesting of medicinal plants is a crucial practice that ensures the preservation of biodiversity. Because of the lack of knowledge about the importance of sustainable harvesting, many tribes have been practicing destructive harvesting for generations, leading to the depletion and endangerment of plant species and potentially impacting biodiversity and traditional knowledge. The project team created awareness among tribal communities and promote the collection of medicinal plants in a sustainable way.

GENERAL GUIDELINES FOR SUSTAINABLE COLLECTION OF MEDICINAL PLANTS

Preparation for the trip

1. Prepare the necessary tools for collecting plants such as knives, scissors, shovel, axe, bags, containers, etc.
2. Record information such as the name of the collector, name of the plant, quantity, location, etc.
3. Carry the collection permit from the Forest Department

IMPORTANT THINGS TO REMEMBER

1. Collect only fully grown parts of medicinal plants.
2. Do not collect the entire plant from an ecosystem. Keep at least 30-40% of the plants.
3. Collect only the required parts of medicinal plants. Do not destroy the mother plant.
4. Do not cut branches/twigs of trees to collect parts of plants.
5. Do not collect medicinal plants from roadsides, beaches, sewage etc.
6. Store medicinal plants that need to be dried after collection.
7. Ensure that the plant parts are completely dry before storing.
8. Do not dry two or more herbs close together to avoid mixing of medicinal plants.

CRITERIA FOR COLLECTING MEDICINAL PLANTS

1. Find the time when the main components that give medicinal properties to plants are highest and collect medicinal plants only during these times.
2. Choose the right weather for collecting each medicinal plant, this will prevent conditions such as mold growth and dehydration in the plant.
3. Identify the desired medicinal plants, avoid diseased plants, and ensure that the plants to be collected have not been sprayed with pesticides or herbicides.
4. Avoid collection methods that may threaten the natural growth of the plants and ensure that the plants have not been damaged in any way.
5. It should be ensured that weeds or poisonous plants are not mixed with the collected medicinal plants.
6. The equipment used for collection and the containers in which they are stored should be sterilized.

METHODS FOR COLLECTING ROOTS OF MEDICINAL PLANTS.

1. Collect only the roots of fully grown plants.
2. While collecting the roots, dig them moderately, at a distance of 30 cm from the trunk.
3. Collect only the lateral roots of the medicinal plants, making sure that the taproot is not damaged. The pit should be covered well after collection, otherwise the plant may get infected and be attacked by other organisms.

METHODS FOR COLLECTING BARK

1. Do not collect bark from immature trees/plants, collect from branches instead of the main trunk
2. Do not collect bark when the tree has new branches.
3. Use a blade/bush knife to separate the bark into long vertical pieces.
4. Avoid removing the bark completely around the tree in a circle.
5. Collect the bark in small pieces and keep some of the bark to protect the tree, otherwise it will cause the tree to dry out.

METHODS FOR COLLECTING LEAVES, FLOWERS AND SEEDS

1. Collect only from fully grown and disease-free plants or trees
2. Do not collect all the leaves, flowers and seeds of a plant at once.
3. Do not cut the plants or branches while collecting leaves, flowers and seeds.
4. Pluck individual leaves and avoid using sharp pruning shears or scissors to pluck leaves
5. Prune branches at regular intervals to improve the quality and quantity of leaves.

METHODS FOR COLLECTING PLANT STAINS, GLUES AND OILS

Preparation for the trip

1. Prepare the necessary tools for collecting plants such as knives, scissors, shovel, axe, bags, containers, etc.
2. Record information such as the name of the collector, name of the plant, quantity, location, etc.
3. Carry the collection permit from the Forest Department

IMPORTANT THINGS TO REMEMBER

1. Make vertical cuts only in certain parts of the tree. Do not collect them continuously from the same tree.
2. Collect them only during the right season.
3. Collect tree sap and glue only in suitable containers.
4. Cover the wound with cow dung after collection

Adathoda vasica

Cardiospermum helicacabum

Biophytum sensitivum

Calotropis gigantea

Azadirachta indica

Saraca asoca

Aerva lanata

Alstonia venenata


Aloe barbadensis

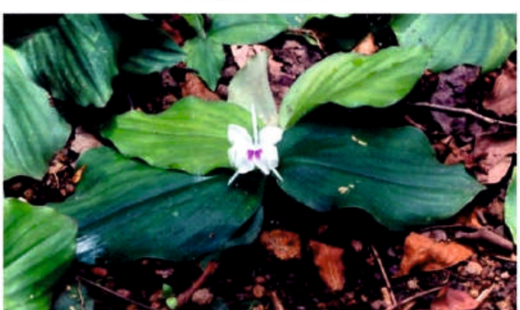

Coleus zeylanicus

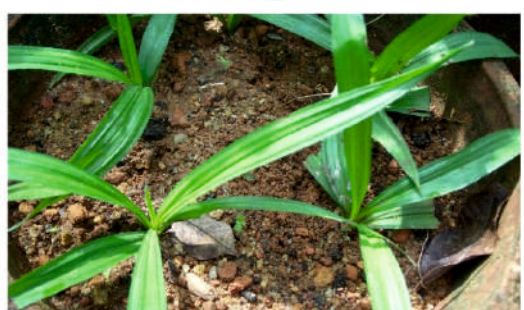

Vitex negundo


Sida cordifolia


Eclipta alba


Ensete superbum


Kaempferia galanga


Curculigo orchioides

Gloriosa superba

Thottea siliquosa

Alpinia calcarata

Acalypha indica

Myxopyrum smilacifolium

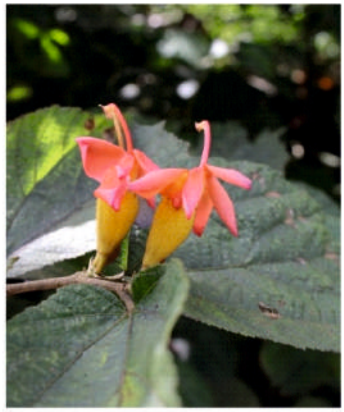
Rauvolfia serpentina

Hemidesmus indicus

Hemigraphis alternata

Diploclisia glaucescens

Ricinus communis



Helicteres isora

Muraya koenigie

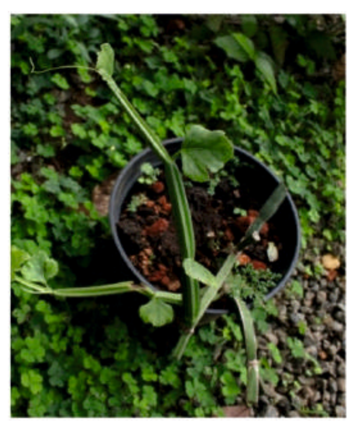
Heracleum candolleanum

Chrysopogon zizanioides

Elephantopus scaber

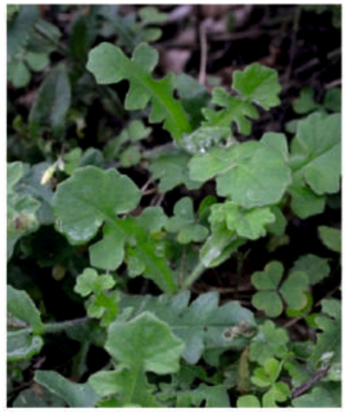
Moringa oleifera

Euphorbia hirta



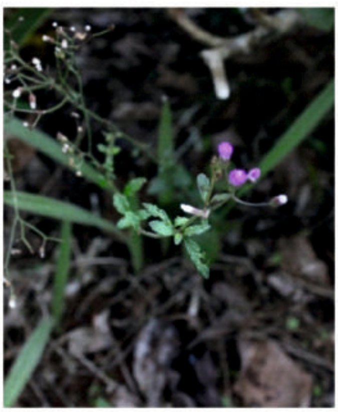
Cissus quadrangularis

Phyllanthus niruri



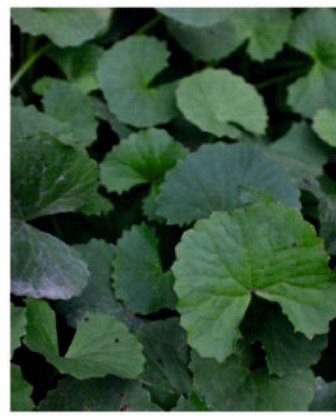
Emilia sonchifolia

Mimosa pudica



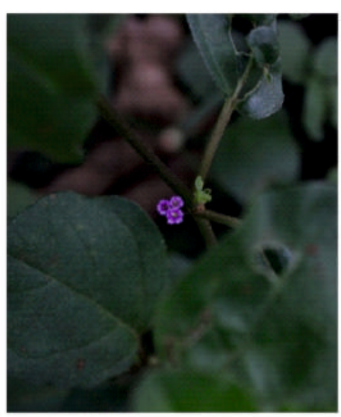
Vernonia cinerea

Solanum nigrum



Centella asiatica

Glycosmis pentaphylla



Boerhavia diffusa

Leucas aspera

WILD EDIBLES USED BY THE TRIBAL COMMUNITIES OF KERALA

Tribal communities in Kerala have traditionally relied on nature for sustenance. These communities have extensive knowledge of wild edible plants. The use of wild edibles is not only a means of survival but also plays a crucial role in maintaining their cultural heritage and ecological balance. Wild fruits and vegetables play a crucial role in the diet of these tribal communities, providing essential nutrients, medicinal benefits, and seasonal sustenance. These fruits are often foraged from forests and are deeply ingrained in tribal food culture.

Wild fruits and vegetables providing vital vitamins, minerals, and antioxidants. Many of these foods possess medicinal properties that help in managing, digestive disorders, and other lifestyle diseases.

Many tribal communities include wild fruits and vegetables in religious ceremonies and festivals. Fruits are offered in tribal worship and harvest celebrations. They offer fruits to forest deities before consumption as a token of gratitude to nature.

Their ethical foraging techniques and cultural practices ensure the forests continue to provide for generations to come. Foraging skills are passed down through generations among tribal communities. The process is guided by deep ecological knowledge, ensuring sustainability and minimal harm to nature. They know exactly when and where different wild fruits ripen. They time their foraging to maximize yield without harming the plant's natural cycle. Some fruits are harvested in small quantities to allow regeneration, ensuring long-term sustainability. Many tribes follow a "first-for-the-forest" rule, ensuring that birds and animals get their share of the fruit before humans collect them. They avoid plucking unripe fruits and instead shake tree branches gently to collect only those that naturally fall.

Some wild fruits and vegetables are often sun-dried or pickled to extend their shelf life. , fermentation, and pickling are other methods of preserving these foods for off-seasons, ensuring year-round food security. They use bamboo baskets and dried banana leaves to store fruits and preserving their freshness. Knowledge about fruit-bearing trees and their locations is often kept within the community to prevent over-harvesting by outsiders.

Many of these traditional food sources are disappearing because of deforestation, habitat destruction, and modernization. Younger generations are gradually shifting toward commercially available foods, leading to a decline in indigenous knowledge. Additionally, commercial exploitation of forests for agriculture threatens the availability of many wild fruits and vegetables. Recognizing and preserving these wild edibles is crucial not just for the well-being of tribal communities, but for the protection of Kerala's rich biodiversity and traditional food heritage.

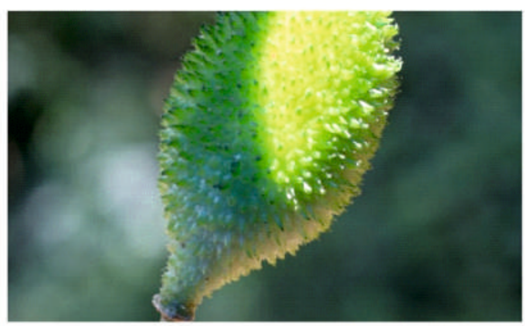
Elaeagans latifolia

Physalis angulata

Hibiscus subdariffa

Flacourtia jangomas

Baccaurea Courtallensis



Momordica dioica

Artocarpus hirsutus

Passiflora foetida

Spondias dulcis

Solanum torvum

Aporosa cardiosperma

Ficus craterostoma

Flacourtia montana

Glycosmis pentaphylla

Phyllanthus acidus

Grewia tilifolia

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DIVERSITY OF KERALA'S WILD EDIBLES AND INDIGENOUS CROPS

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