

*Research Paper*

## Evidences for Plant Utilization, Spice Trade and Paleo-environment from Peat Formation of Pattanam Archaeological Site

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Pattanam, a small village in Ernakulam district of Kerala state, India, located on the Periyar river delta, invites the attention of researchers of various disciplines for its recent archaeological discoveries of maritime features. Large number antiquities of foreign – origin excavated from here suggests that, this area had trade relationship with the Mediterranean world, and probably was a part of ancient spice trade network. A single trench was excavated as part of archaeological excavation in 2015 by the Kerala Council for Historical Research, Thiruvananthapuram. Examination of peat samples, which was found as a layer of 3-5 cm at a depth of 320-325 cm, under the sandy layers representing iron age (BC 5 – 10<sup>th</sup> century) yielded a diverse spectrum of botanical specimens such as thorns, seeds, fruits, floral parts, leaves, stems, barks, wood and plant resins. The paleo-environment and plant utilization of the area were represented by the archaeobotanical specimens resemble Coconut, Indian cotton tree, Indian coral tree, *Zanthoxylon* sps., Amla etc. The presence of macrobotanical specimens resemble morphologically to Black pepper, Cardamom, Clove, Sesame etc., point towards the ancient spice trade activity in the region as mentioned in the ancient literatures. Diversity of the discovered ethnographically important botanical specimens suggested human plant interactions, trade activities and paleo-environment of this area in the ancient times.

**Keywords:** Pattanam; Archaeobotany; Paleo-environment; Plant Utilization; Spice Trade

### Introduction

#### *Pattanam Archaeological Site - An Overview*

Pattanam (10°09.434'N, 76°12.587'E), a small village, 25 km north of Kochi city in Kerala is located on the delta of river Periyar, one of the largest rivers of Kerala. This hamlet is situated in the northern bank of Periyar Thodu (a tributary of River Periyar). River Periyar has a major role in the cultural evolution of Kerala region. Various megalithic sites situated on the Periyar river basin indicated the flourished human habitation dependent on this river. Moreover it acted as transportation and commutation media between the coastal lands with the eastern highlands of Central Kerala. In Sangam literature, it regarded as “Chulli” river, where the “Roman vessels coming with gold for black pepper beat white foams” (Cherian *et al.*, 2009).

The area presently consists of criss-cross water channels, which have rich mangrove vegetation on its banks. There are some discontinuous patches of water bodies as well, which could be the remnants of paleo-channels. Towards the western side, the area transforms into lagoon like in nature where, the people practice a kind of rice cultivation, popularly known as “Pokkali” in which the plants are mostly submerged in water. Some lagoonal parts have been transformed into prawn culture fields. All over this area, the mangroves are growing abundantly. The western boundary is a backwater called Thathappilli Lake, which separates Pattanam from northern part of Vypin Island.

#### *Spice Trade – The World, India and Pattanam Site*

Kerala (erstwhile Malabar) coast of South West India

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was popular for spice trade even centuries before Christ. It had flourished during centuries just before and after the beginning of the Common Era, when the trade with the Roman Empire got intensified. The history of prehistoric spice trade would be incomplete without mentioning the ancient port of Muziris, an inland port situated in the banks of River Periyar, near to its drain to the Arabian Sea. It was considered to be one of the most important spice trade hubs of classical era, from where tropical spices like Black Pepper and Cardamom were believed to be exported to other countries. Muziris, or Muciri Pattanam constantly appears in testimonies of South Indian Sangam as well as Greko-Roman literature.

Till 2007, there was no recorded archaeological evidence for the maritime activities on the west coast of Kerala other than few recoveries of Roman coins, although the literature evidences were plenty regarding it. Muziris was traditionally believed to have situated somewhere around Kodungalloor. But, serious archaeological studies never happened other than some purposeless hypotheses. In the archaeological excavation conducted by Kerala Council for Historical Research (KCHR), in Pattanam Village (10 km south of Kodungallur) in 2007, both port (wharf and canoe) and maritime (foreign ceramics, adornments etc.) features had been revealed. The archaeological evidences obtained from the site proclaim the cultural linkage of this area with the Mediterranean, Red Sea, West Asia, Ganga Delta, Coromandal coast and South-East Asian regions (Cherian *et al.*, 2009). Evidences from the same context suggested that this could have been the major port of Indian Ocean littoral, for spice trade especially black pepper (*Piper nigrum*) and Cardamom (*Elettaria cardamomum*). Hence it is widely assumed that, the Pattanam archaeological site have potential to be a part of the ancient city of Muziris.

The earlier field sampling for paleoethnobotanical study was carried out by MD Kajale by briefly visiting excavations carried out by KCHR during 2007, 2008 and 2009 seasons. Subsequently Kajale and Cherian (2010) briefly reported preliminary botanical finds during IWGP symposium held in Wilhelmshafen, Germany

### ***The Present Laboratory Study***

Study of the spice trade in a Botanical perspective is

a scientific approach to understand the lifestyle, foreign contacts and environment of ancient world in materialistic manner. The contemporaneous sites of Muziris, which were once the part of ancient spice trade network, such as Berenike and Myos-Hormos in Egypt have already undergone detailed archaeobotanical studies (Cappers, 2006; Zielinski, 2011; Van der Veen and Morales, 2015). The discovery of Indian spices and other plant products from these geographically distant regions materialistically establish the idea of a Spice Route. Understanding the paleo-environment, ecology and climate of Pattanam archaeological site is further useful for explaining the physical factors that reflected in the anthropological activities of the ancient time, which facilitated spice trade.



**Fig. 1: Pattanam: Geographical position**

## **Materials and Methods**

### ***Methodology of Excavation***

The excavation progressed in Locus based method. It was accomplished by assigning sequential numbers to each human natural activity context encountered

in the trench. Such a unit is known as locus. It represents a single and discrete action that occurred in the past. This method helps to understand the human activities that happened in a contemporaneous point of time period (Anonymous, 2013).

Majority of plant remains of the past had been degraded immediately once it came in contact with the soil. In Pattanam, the soil was wet, low pH and microbiologically active. The decomposer microorganisms acted on it and digested the tissues of the plant specimen into simpler macro molecules and compounds. Hence, in an archaeological context like Pattanam, the possibility of preservation of botanical remains was majorly based on: i. Carbonization (charring) and ii. Waterlogged condition.

The partially degraded and charred botanical micro-remains and macro-remains were separated from the soil particles. Generally the organic substances having lesser density compared to soil were separated by buoyancy (floatation technique).

### **Description of Peat Layer**

Peat was collected in bulk from a depth of 309-325 cm from three adjacent sites in the trench in layer of 3-5 cm thickness. Peat formed by partially decayed vegetation or organic matter of the past gets accumulated over hundreds of years. The chronology of the peat layer is currently under investigation making use of inferences from geological processes of site formation as well as by comparing with the radiocarbon dating results of peat and other cultural layers of trenches.

Stratigraphical position of the peat layer in the season was observed as (from top to bottom): Cultural layers → Yellowish Sandy layer → Grayish Sandy layer (Rich in Mica) → Peat → Dark Grayish Sand. During the end of May, the onset of South-West Monsoon rain season, the water table was nearly 260 cm. Further excavation was difficult as the sides of the trench were sliding down. A sub trench was taken in the middle of the trench, where the water was filling inside within a short time. Using a motor pump, the water was constantly pumped out and excavation was proceeded further.

### **Results**

The peat layer was rich in various plant parts such as

thorns, seeds, fruits, leaves, small aquatic plants, floral parts, bark and wood, plant resins etc. It was also rich in mica. The bulk of the material was unidentifiable as being shapeless probably due to water activity. Ethnobotanical specimens were found in the peat layer which was not a common feature, in the archaeological contexts.

A bulk of the peat consisted of botanical remains which could not be identified properly. A site survey was conducted to collect possible analogs of the archaeobotanical remains around the site. This included survey of various ecosystems such as lagoons, mangrove vegetation, mangrove associated vegetation, sacred groove etc. But it was found that many of these plant species were not present in the vicinity of the site. Later the area under survey was widened to include various farther ecosystems also.

### **Paleo- Environment Representatives**

#### ***Zanthoxylon sp. (Family: Rutaceae)***

It is locally known as “Mullilam” or “Mullilavu”. Presence of this plant was represented by its seeds and specialized woody thorns, which was not completely carbonized. Seeds were obtain in good numbers and retained their specific surface ornamentation. The thorns were big and complete, with basal thick portion had concentric rings in it and sharp toward the end (Fig. 2A, Table 1).

#### ***Indian Coral Tree (Erythrina sps. Family: Fabaceae)***

It is locally called as “Murikku”. The sharp thorns that closely resembled the modern counterpart were observed from the peat layer. Its basal portion was quite rounded and smooth in texture (Fig. 2B, Table 1).

#### ***Silk Cotton Tree (Bombax ceiba L. Family: Bombacaceae)***

It is known in Malayalam as *Panjimaram*– cotton tree. The big woody thorns, with “concentric” rings in the projected conical face represented the presence of this plant in the botanical aggregates of peat (Fig. 2C, Table 1).

#### ***A Cucurbit (Family: Cucurbitaceae)***

A seed of a cucurbit plant was observed from the

botanical aggregates from the peat layer. (Fig. 2D, Table 1). Its specific shape and the ornamentation specific to this plant group suggested this seed was of a cucurbitaceous plant. It has the size of ivy gourd seed but hard and opaque.

**Table 1: Potential paleo-environmental representatives of Pattanam archaeological site**

Archaeobotanical specimen resembling	Plant parts
<i>Zanthoxylon</i> sps.	Thorns, seeds
Indian coral tree	Thorn
Silk cotton Tree	Thorn
A cucurbit	Seed

### Evidence of Natural Environment and Anthropogenic Plant Utilization

There were some botanical specimens which are part of present environment and having significant ethnobotanical utilities in food, medicines, aesthetic uses etc.

#### *Coconut (Cocos nucifera L., family: Areaceae)*

Kernel fragments of Coconut were collected from the peat layer. Some of these fragments were carbonized (Fig. 2E, Table 2).

**Table 2: Ethnobotanically significant archaeobotanical remains**

Archaeobotanical specimen resembling:	Plant parts
Coconut	Kernel
Indian goose berry	Seed parts
Indian Jujube	Stone
Cliff Banana	Whole seed
Frankincense	Resin crimps

#### *Indian Gooseberry (Phyllanthus emblica L. Family: Phyllanthaceae)*

Some seed parts were collected from the peat layer showed close resemblance with that of dried gooseberries (Fig. 2F, Table 2). These were 3 in number with length of 0.4-0.5 mm, comparable with the dry goose berry seeds available from the herbal vendors.

#### *Cliff Banana (Ensete superbum (Roxb.), Family: Musaceae)*

It is popularly known as “*Kalluvazha*” in the vernacular language Malayalam. Three complete seeds and some seed fragments were collected from the peat layer. Many of these fragments looked as if they were broken to take the powdery endosperm, which has the medicinal property (Fig. 2G, Table 2).

#### *Jujube (Ziziphus jujuba Mill., Family: Rhamnaceae)*

In the language Malayalam, it is called “*Izhanthakka*”. Two seeds of this plant group were identified from the peat layer. These were complete and found to be retained the characteristic morphological features (Fig. 2H, Table 2).

#### *Frankincense (Boswellia sp, Family: Burseraceae)*

A good number of solidified resin pieces, of various sizes were found in the peat layer. It was wine red in colour and retained the characteristic fragrance of incense. It was the identified botanical specimen, collected in the largest quantity from the peat formation of this trench (Fig. 2I, Table 2).

#### *Rice (Oryza sativa L. Family: Poaceae)*

Presence of rice samples in Pattanam archaeological context was represented by a single whole grain (Fig. 2J, Table 2). Moreover grain impressions were found in the bricks obtained from the cultural layers. Remnants of rice husk also were present inside the brick blocks.

### Spice Trade: Direct Indications

#### *Pepper (Piper nigrum L. Family: Piperaceae)*

In the excavation of 2015, two mineralized specimens, one carbonized specimen and some fragments that resemble black pepper were obtained (Fig. 2K, Table 3).

#### *Cardamom (Elettaria cardamomum M. Family: Zingiberaceae)*

A mineralized cardamom- capsule like specimen (larger size than the present varieties), a seed-like and some carbonized specimen that had similar

morphological characters of cardamom were also observed (Fig. 2L, Table 3).

### ***Sesame (Sesame indicum L. Family: Pedaliaceae)***

A carbonized material was recovered from the peat layer which resembled sesame. It had a bigger size and dissimilar surface features when compared to the modern counterpart (Fig. 2M, Table 3).

**Table 3: Direct indications of spice trade**

Archaeobotanical specimen resembling:	Part	Other archaeological sites in the spice route
Black pepper	Berry, parts of berry	Berenike, Quseir-al-Qadim (Egypt).
Cardamom	Capsule, seed	Quseir-al-Qadim (Egypt)
Sesame	Seed	-
Cloves	Dried flower bud	-
“Chilli”	Fruit	-

### ***Clove (Syzygium aromaticum L. Merr.&L.M. Perry Family: Myrtaceae)***

Specimens that morphologically resembled dried clove buds were collected from the peat layer (Fig. 2N, Table 3). It was in a mineralized state. Towards the “neck” portion, it shows a bend. It was 1.8 cm long-longer than the clove buds available in the spice shops.

### ***“Chilli” (Capsicum frutescens L., Family: Solanaceae)***

There was one specimen among the botanical aggregates from Pattanam Archaeological site resembling “Birds Eye Chilli” (*Capsicum frutescens* L.) (Fig. 2O, Table 3) morphologically. The size was matching with the dried chilli (Length: 1.9 cm, Width: 0.7cm) collected from the premises of Indian cardamom Research Institute, Myladumpara.

### **Spice Trade: Indirect Indications**

Besides Indian gooseberry, frankincense, rice and coconut, there are some other commodities obtained from the peat layer which may substantially support the concept of idea of trade connections.

### ***Grapes (Vitis vinifera L. Family: Vitaceae)***

A mineralized botanical specimen resembling the tip of pedicel of the grape fruit was observed in the peat layer of Pattanam (Fig. 2P, Table 4). It was 0.2-0.3 mm in width and comparable with the dried grapes obtained from the market.

**Table 4: Indirect indications of spice trade**

Archaeobotanical specimen resembling:	Part	Other archaeological sites in the spice route
Indian gooseberry	Seed part	Berenike (Egypt)
Frankincense	Resin	Berenike (Egypt)
Rice	Charred grain	Berenike, Quseir-al-Qadim (Egypt)
Coconut	Kernel fragments	Berenike, Quseir-al-Qadim (Egypt)
Grapes	Fruit stalk tip	Berenike (Egypt)
Watermelon	Half seed	Berenike (Egypt)

### ***Watermelon (Citrullus lanatus (Thunb.) Matsumura & Nakai Family: Cucurbitaceae)***

A specimen closely resemble half seed of watermelon was collected from this context (Fig. 2Q, Table 4). Its outer surface found to be smooth and shiny. Morphology was matching with the watermelon seeds, that available from the market.

## **Discussion**

### ***Peat Layer and Chronology***

Peat layer was found below 60 cm thick sand layer. The sand layer deposit was considered as the iron age paleobeach ridge/dune. Iron objects, coarse red ware and other typical Megalithic potteries were found out in other trenches of the site, during previous year excavations (Cherian *et al.*, 2009). AMS (Atomic Mass Spectroscopy) C<sup>14</sup> Dating of two charcoal samples from the lowermost layers of the iron age layer shows 1300-200 BC and 2500 BC to 100 AD with average age falls before 500 BC (Cherian *et al.*, 2009).

### ***Peat Layer – As an “Archive” of Ancient Botanical Remains***

The preservation of a botanical specimen in an

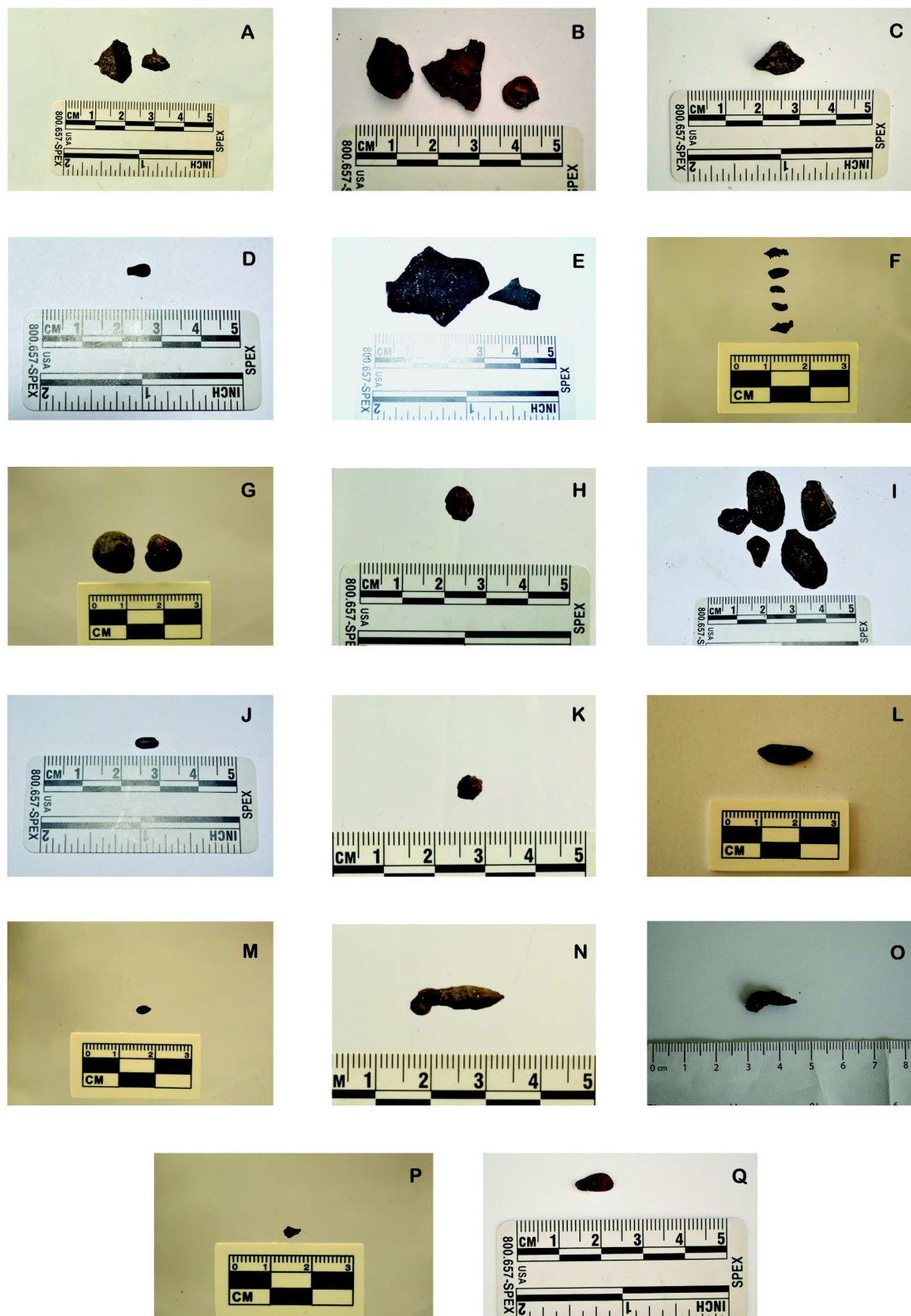


Fig. 2: Archaeobotanical Remains: Archaeobotanical remains resembling (from right to left): Figures A. *Zanthoxylon* sps. thorn, B. Indian coral tree thorn, C. Cotton tree thorn, D. Cucurbit seed, E. Coconut kernel fragments F. Indian gooseberry seed parts G. Cliff banana seed, H. Jujube seed, I. Frankincense, J. Rice grain, K. Black pepper berry, L. Cardamom capsule, M. Sesame grain, N. Cloves bud dried, O. "Chilli fruit resembling specimen" P. Grape pedicel part, Q. Water melon seed

archaeological context depends on favorable condition, in which either the plant material has to be changed in a way it became less affected by the decomposer microflora in the soil or, there must be an environment in which no microorganism can exist (sterile condition). Carbonization (charring), desiccation and mineralization are an example for the former and the water logging condition is for the latter. In the case of the peat layer, almost all the samples were in partially to completely carbonized condition. Moreover, the peat was formed because of an anaerobic environment, formed by sealing of the botanical aggregates in clayey sand layers in waterlogged condition. This prevents the growth and action of the decomposer microflora in the soil and water. Partially carbonized materials got preserved partly because of acidic and anaerobic conditions.

#### ***Peat Layer – As an Evidence for Paleo Environment and Plant Utilization***

Peat formation seemed to have occurred in this site by the accumulation of botanical specimens followed by its accidental “sealing”. A number of plant taxons presently in the site or near the site or in a geographical distant area were identified from the peat aggregate. Such species can be considered as proxies of the paleo-environment that existed at the time of peat formation (or creation of the anaerobic condition). In the case of Pattanam, it gives additional information regarding the site formation processes due to the presence of thick layers of sand in between the cultural layers from where majority of the antiquities were obtained and the peat layer. Accumulation and preservation of these plant materials found to be non-specific, which means not confined to a particular taxon. So it can be considered as a representation of the paleo-environment.

The present day representatives of Genus *Zanthoxylon* were not present in the vicinity of the archaeological site. It was observed in good numbers in Peechi forest, Thrissur, Kerala, almost 70 km away from the site. Some species of *Zanthoxylon* are being used as spice in various parts of the world (Medhi *et al.*, 2013).

One Silk Cotton tree was present almost 100 m away from the trench validating its encounter from the archaeological context. Indian coral trees were not observed in the vicinity of the trench, but found

some 2 km farther. According to the native residents, this plant was present uniformly in the site till some decades before. The cucurbit seed looked like an undomesticated ivy gourd seed, due to its morphological resemblance but much harder, woody and oblique.

In the case of plant specimens which can be considered as evidence for both natural environment and anthropogenic plant utilization, we consider 3 probabilities for their presence in this archaeological context: 1. They can be part of natural environment, 2. Brought to the site by natural agents or 3. By anthropological activities. But boundaries between these 3 chances are very narrow, as the utilization history of these plant specimens are old-dated, which is evident from traditional medicinal practices, literature and so on.

Coconut tree is present in plenty numbers in the vicinity of the archaeological site. Many scholars consider *C. nucifera* or coconut as a non-endogenously originated species. But it has a greater role in the culture of Kerala especially in rituals, cuisines, medicines etc. It was considered as “*Kalpavriksha*”, the Celestial Tree, as every part of this plant is utilized.

The plant Indian Goose berry in vernacular language (*Malayalam*) is known as “*Nellikay*” and the tree “*Nelli*”. Abundance of place names suffixed or prefixed with “*Nelli*” (eg. *Thirunelli*, *Nelliyampathi* ect.) in Kerala indicates its wide presence in the local ecosystems. It is an important ingredient in the Ayurvedic medicinal system. However, no goose berry tree was presently observed in the vicinity of the archaeological site.

Cliff banana plant is a lithophyte. It shows well developed geophytic adaptations under rocky habitats, where it grows and produces viable seeds (Vasundharan *et al.*, 2015). This plant is locally known as “*Kalluvazha*” (Stone banana) and has medicinal properties.

Indian Jujube, is a common finding in archaeological records of many sites over the subcontinent (Pokharia *et al.*, 2015; Pokharia *et al.*, 2011). Being a stone, it is resistant to degradation to a greater extent. It was available in packets in the form of pickle in vendor shops. Necklaces for ritualistic

purposes made up of jujube stones were found in herbal shops of this area. Although in the present days, it has not been observed to be used for common dietary purposes, it was available from the shops as an important ingredient of Ayurvedic formulation.

Being frankincense is an impervious and chemically inert plant resin, it can resist the physical or microbial degradation. Either frankincense could be exogenous trade product or endogenous forest product. Some types of frankincense are found in Kerala like *Boswellia serrata* (Rameshkumar, 2014) But absence of frankincense from upper layers supports the possibility to be traded from outside. It might have role, other than aromatic incense, as packing material, preservative or ritual element.

#### ***Peat Layer and Ancient Spice Trade***

It is clear that a vast majority of traded items of the ancient world were botanical commodities. In the case of South India, it was mainly the products of natural vegetation of this area, such as black pepper, cardamom etc. Along with these costly items some other commodities have also crossed the sea. So one can say, the spices grown in the wild of Malabar coast was the main driving force for traders to reach here neglecting the risks of transmarine sail. The spice trade had accelerated once the direction of the monsoon wind was understood. The demand on the western world was high, as a huge numbers of ships anchored in the Malabar Coast. At the same time, some commodities of exotic origin had reached here and the natives were introduced with it. The influence of the traders and other foreigners from the west sea made irreversible cultural transformations in the Kerala society. As this geographical area was “sealed” by the eastern mountains of Western Ghats, and the sea in the west, it became the “experimental laboratory” of various cultures. The changes in the culture altered the plant utilization by change in food habits, tastes and medicinal knowledge. It made the localites to be fond of the products of exotic plant species. It is kind of complicated cyclic process, which influences ecology, mindset, tastes and cultural processes of this area.

Since the area was under the constant influence of the river Periyar especially during monsoons, some distant plant parts (floating seeds, woody parts) could also possibly be deposited at the site. At once these

become the part of the botanical assemblage, it represents a broader geographical area, rather than the limits of archaeological site. Hence, it can be considered as the representation of “paleo-environment of the area” more than the paleo-environment of the site.

Almost 7.5 kg of Pepper was found in an Indian pottery vessel at *Berenike* (in Egypt), a site contemporaneous to Pattanam (Cappers, 2006). Excavations of Quseir-al-Qadim (Ancient *Myos Hormos* - Egypt) in the Red Sea coast so produced substantial amounts of black pepper (Van der Veen and Morales, 2015). These two ports were important intermediary stations on the way from Malabar Coast to Alexandria, and further Mediterranean region. Black pepper has a wide distribution in Kerala and able to grow from the highlands to the sea level. But cardamom is still restricted to some areas of the Western Ghats. It regularly grows in the highlands preferably at an altitude range 600-1600 mean sea level (Murugan *et al.*, 2012). So it could be brought to the site through River Periyar or land routes, and further shipped across the sea.

Sesame was already known in archaeological records of North India, such as Ahichchhtra (Pokharia *et al.*, 2015) and Kanmer (Pokharia *et al.*, 2011). But here the surface micromorphology differs from the modern counterparts. In the case of the Clove-resembling sample, just a morphological similarity is not enough to state its presence, and the evidence of clove-trade was not yet known from any of the archaeological contexts or literatures.

“The presence of chilli fruit” was found to be controversial as the genus *Capsicum* is considered to be “New World” (American continent) origin (Moscone *et al.*, 2007). There is no historical document available for the trade relation of the Malabar Coast with American continent during the flourishing phase of Pattanam. As in the case of clove, no scientific studies are available to reach a conclusion. Hence the presence of chilli in the Pattanam archaeological context remains mysterious and could have been accidental inclusion in the deposit.

Coconut remains were unearthed from the archaeological excavation of *Berenike*, which is a contemporaneous archaeological site and part of ancient spice route had yielded coconut remains



(Zielinski, 2011). Quseir-al-Qadim, another similar ancient port of the red-sea also had yielded evidences of coconut (Van der Veen, 2015). If we consider the maritime connection of that time, we are able to see that, it probably had been exported from the South India. It is still growing widely in coastal areas of Kerala.

Presence of Indian gooseberry is significant as a marker for spice trade as it had been excavated from the prehistoric site of Berenike (Van der Veen and Morales, 2014), a contemporary site of Pattanam. It may have been used by the sailors to protect themselves from scurvy disease during the long journey from India to Egypt, (Cappers, 2006) as it is an important dietary source of Vitamin C.

Rice was found in Berenike and Quseir-al-Qadim (Van der Veen and Morales, 2014) in the archaeological context. Rice cultivation also has a long history in South West India as frequently mentioned in Sangam Literatures. It is the staple food of the people belonging to the site, just like any another part of Kerala. Paddy cultivation, in “*Pokkali*” mode is still practiced in the western lagoonal parts of the site. The paddy husks were found preserved inside the bricks obtained from the cultural levels of Pattanam, indicating its cultivation practice in that period in the vicinity of the site.

One frankincense tree is growing on the vicinity of the site. Frankincense trees are growing in the Western Ghats. But interestingly the frankincense resins were collected only from the lower layers of the excavation trench, i.e. the older layers, along with the peat layer. It indicates to another concrete possibility to be an indication of the relation with the South Arabia, where the frankincense trees are growing naturally and resins are collected and exported especially to the Roman Empire. So it can be considered as an indication for spice trade, as it implies the trade links with the Middle East.

Seeds of watermelon were identified from the archaeological site of Berenike (Egypt) (Zielinski, 2011). Seed part resembling specimen was collected from the peat layer from Pattanam. Egypt is believed to be one of the first lands it was cultivated and later diffused to various Mediterranean lands, shortly after (according to antiquities and literary sources) (Paris, 2015). So find of watermelon in the Pattanam

archaeological site points to the connection between above mentioned areas. Grapes also connected with Mediterranean region. Berenike had yielded grape seeds in the archaeological context (Zielinski, 2011). Presence of grapes in the context of Pattanam is an indication of the relationship with the Middle-East region.

### ***Paleo-Environment and Present Day Society***

As plants and its utilization influence the human life and society life, paleo-environment has a major role in the development of the society. According to the archaeological evidences, Pattanam exhibits urban characteristics. It denotes a developing society which also had intercultural contacts with foreign markets and trade which was well evidenced by plethora of non-local ceramics and other antiquities (Cherian *et al.*, 2009). Intercultural contacts has a major role in shaping of present day society of Kerala.

### **Conclusion**

Paleo-environment might have played a major role in plant utilization of this particular region by influencing the people in food, aesthetic and ritualistic habits in the human history. As the major commodity of the trade in ancient times was raw or processed plant-originated specimen, the environment of that time may have influenced the economy and cultural advancement of the society. Since, the extended trade links had accelerated the process of intermingling of distant cultures, it could have resulted in the formation of new cultural identities and life styles. It also introduced new plant species and their utilization. It changes the local environment. It is a kind of complicated cyclic process.

Spices especially black pepper and cardamom were a good example for utilization of the local vegetation, which created extended trade and cultural networks for South West India with geographically distant located regions. Pattanam is an archaeological site which yields archaeological evidence of almost 3 millenia. Antiquities of faraway region indicated its trade links extending from Western Europe to Asia-Pacific region. The peat formation that found below the cultural layers indicating Iron Age, bears a huge plethora of archaeobotanical remains, those are able to speak about the environment, plant utilization and trade activity of that time period. The botanical

remains include the specimens resembling the local vegetation including indigenous spices and other commodities and some exogenous plant products. Some of the indigenous plants especially spices have reportedly appeared in the archaeological contexts of distant places like Berenike and Myos-Hormos in Egypt.

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