PHYTOCHEMICAL ANALYSIS, ANTI-OXIDANT, AND ANTI-MICROBIAL ACTIVITIES OF CORM EXTRACTS OF *Amorphophallus paeoniifolius* AND *Colocasia esculenta*

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INTRODUCTION

Phytochemicals are biologically active, naturally occurring chemical compounds derived from plants. Phytochemicals occur in different plant parts including roots, stem, leaves, flowers, fruits, seeds etc. (Liu, 2004). They contribute towards aroma, color and flavor of plants. These compounds also have many biological properties like antioxidant activity, antimicrobial properties, stimulating immune system, alternation of hormone metabolism, anticancer property etc.

Based on their role in plant metabolism phytochemicals are mainly grouped into two, primary metabolites and secondary metabolites. Primary metabolites include amino acids, proteins, common sugars etc. while secondary metabolites include alkaloids, terpenoids, phenolic compounds, saponins, tannins, essential oils etc. (Hahn, 1998). Alkaloid is any class of naturally occurring organic nitrogen containing bases. They have diverse and important physiological effects on humans and other animals. They have various medicinal properties as well. They are used as analgesic, cardiac or respiratory stimulants, to treat arrythmias, common cold, sinusitis, hay fever, asthma etc. Terpenoids are also termed as terpenes. They constitute the largest and most diverse group of naturally occurring compounds. Based on the number of isoprene units they possess, they are classified as mono, di, tri, tetra and sesquiterpenes. They form a major constituent of essential oil obtained from plants. They possess wide range of medicinal properties among which anti-plasmodial activity is notable. They also act as anticancer and antidiabetic agents, hold anti-inflammatory, antiseptic, astringent, digestive, diuretic and many other properties. Phenolic compounds are a group of plant secondary metabolites. They are compounds that contain a phenol moiety. Phenol itself is a benzene ring that is substituted with a hydroxyl group. They are known to exhibit various biological activities such as antimicrobial, antioxidant and anti-inflammatory properties.

Chronic diseases such as cardiovascular diseases, diabetes and cancers are global health problems, and cause death and disability to millions of people. It has been demonstrated that fruits, vegetables and grains exert a protective effect against the development of the chronic diseases (Yamada *et al*, 2011; Mursu *et al*, 2014; Kruk, 2014). This protective role of plants can be mainly attributed to the phytochemicals in them, which are defined as bioactive non-nutrient compounds in fruits, vegetables, grains, and other plants (Wang *et al,* 2013).

Overproduction of oxidants in human body can cause an imbalance and lead to oxidative

damage to large biomolecules such as lipids, DNA, and proteins. This damage is responsible for the pathogenesis of several human diseases, including cardio vascular diseases, certain types of cancers, and ageing (Singh, *et al*, 2014). Thus, antioxidant phytochemicals could play an important role in the prevention and treatment of chronic diseases (Soobrattee, *et al*, 2005). Antioxidant means 'Against oxidation'. Any substance which at low concentration has the ability to delay or prevent the oxidation of a substrate is called antioxidant (Murthy, 2001). It plays an important role in preserving good quality of food as well as maintaining human health. They are also known as 'free radical scavengers' since they protect us from the damage caused by free radicals. Free radicals are waste materials produced by cells when body process food or reacts to the environment. If the body fails to remove free radicals efficiently it might cause oxidative stress. This might adversely affect the cells and proper functioning of the body. Free radicals are also known as reactive oxygen species. The production of free radicals in the body can be stimulated either by internal factors like inflammation or external factors like exposure to UV light, carcinogens etc. Antioxidants are believed to help to neutralize the free radicals in our bodies and there by boost our overall health. Flavonoids, flavones, catechins, polyphenols, phytoestrogens etc. are types of antioxidants obtained from plant- based foods.

Microbial resistance to antibiotics is one of the most serious public health problems, especially in developing countries where infectious diseases still represent a major cause of human mortality. Plants has served as an important source of traditional medicine for millennia. Antimicrobials can be defined as an agent that kills or stops the growth of microorganisms. They can be grouped according to the organism they primarily act against. They can be further subdivided into bactericidal agents which kill bacteria and bacteriostatic agents which slow down or stall bacterial growth. The mortality from bacterial infections have been reduced due to the discovery, development and use of antibacterial from 20th century. There are four major groups of antimicrobial compounds made by plants, they are phenolics and polyphenols, terpenoids and essential oils, lectins & polypeptides and alkaloids.

Phytochemicals are demonstrated to have antioxidant abilities as well as antimicrobial properties. The present study aims to evaluate the quantitative and qualitative evaluation of phytochemicals present in chloroform, ethanol and distilled water extracts of two plant samples *Amorphophallus paeoniifolius* (Dennst.) Nicolson and *Colocasia esculenta* (L.) Schott and

further to evaluate the in vitro antioxidant and anti-bacterial properties of various extracts.

PLANTS UNDER INVESTIGATION

***Amorphophallus paeoniifolius* (Dennst.) Nicolson**

Kingdom : plantae

Clade : Tracheophytes

Clade : Angiosperms

Clade : Monocots

Order : Alismatales

Family : Araceae

Genus : Amorphophallus

Species : *Amorphophallus paeoniifolius*

Fig. 1: *Amorphophallus paeoniifolius* (Dennst.) Nicolson plant and yam

Amorphophallus paeoniifolius, commonly called elephant foot yam, white spot giant arum is a tropical tuber crop primarily grown in Africa, South Asia, Southeast Asia and the tropical

pacific islands. It has high level of productivity. It's corms and smooth petiole are edible and contain many important minerals. When the leaves of the plant wither and die, the corm/tuber can be dug up and consumed. It is usually cooked and eaten as a vegetable. In many places it is smashed with salt and eaten with rice. The young unopened leaves and young petioles are also edible.

It grows well in hot (25-30°C) and humid (80-90%RH) climate. Hot and humid climate is required at initial stages of crop growth for profound growth whereas dry climates facilitate bulking at later stages. In India crop is traditionally cultivated in Andhra Pradesh, Gujarat, Maharashtra and Kerala.

MORPHOLOGY OF THE PLANT

Is a deciduous herbaceous aroid. The plant grows up to a height of 2.5 m there is no true stem above ground. Leaf stalk is solitary stem like fleshy and green speckled with attractive paler green spots or blotches. It arises from underground tuber and reach up to a height of 1.5- 2 m above ground level. Petiole holds up a single leaf like umbrella thus making the plant resemble a miniature tree

Leaf blade is divided into hundreds of small leaflets with the whole cluster reaching 1.5-3 m across. Leaflets are three lobed, each lobe divided into pinnatisect segment. Leaves die after blooming and regrow from tuber during next season.

Flowers are held on a single spadix crowned with large bulbous knob and encircled by a taller funnel shaped velvet like spathe. Spathe is dark brown to maroon on inner side and pale green with white spots on outer side. It has glossy wrinkled margins. Inflorescence reaches 40-50 cm tall. Female flowers are seen on lower part of spadix while male flowers are seen towards the top and the transitional zone in between.

Inflorescence emits a foul decaying smell which attracts pollinators and fades after pollination. Fruits are cylindrical barriers which turns from green to bright red color on maturation

Corm is hemispherical it reaches up to 30 cm in diameter and usually 5-10kg in weight. The outer side is dark brown in color with slight uneven surface and short hairs. Offsets may be seen around main tuber.

MEDICINAL IMPORTANCE

It has high medicinal properties and is used in many ayurvedic preparations. The tubers are considered to have pain killing anti-inflammatory, anti-flatulence, digestive, aphrodisiac, rejuvenating and tonic properties. Traditionally they are used to treat a wide range of conditions like against parasitic corms, inflammation, coughs, flatulence, constipation, anemia, hemorrhoids, fatigue etc.

Colocasia esculenta **(L.) Schott**

Kingdom : plantae

Clade : Tracheophytes

Clade : Angiosperms

Clade : Monocots

Order : Alismatales

Family : Araceae

Genus : Colocasia

Species : *Colocasia esculenta*

Fig. 2: *Colocasia esculenta* (L.) Schott plant and corm

Colocasia esculenta is a perennial herbaceous rod less plant native to tropical Asia. It has been widely cultivated through tropical and sub-tropical regions. It is commonly known as taro. Is mainly grown for its stem tubers and corms. The corms are edible and used to make a variety of dishes. In some regions the leaves are also used as food after cooking.

MORPHOLOGY OF THE PLANT

Colocasia esculenta is an erect perennial plant which grows up to 1.5m height. The roots are large tuberous rhizome and stolon with long internodes.

Leaves are simple. They grow in clumps from underground rhizome. Petiole is longer than lamina and reaches up to 85 cm in lengths. It is fleshy thick and almost cylindrical, glabrous green or tinged with purple or dark purple. The leaf blade is large about 85cm long and 50 cm wide. The base is sagittate or peltate with acute apex. Leaf lamina is green or purple stained leaf margin is entire main venation is palmate, trinerved at base.

Inflorescence is supported by a vertical stalk up to 50 cm height. It consists of a long erect membranous spathe.

Flowers are pale yellow to orange, 19 to 25 cm long, 2-5 cm wide, oblong, deciduous. The female flowers are arranged at the base of spadix reduced to one ovary obovate and unilocular mixed with staminodes. The middle part of spadix is sterile and male flowers at the upper part.

Fruits are small, bay with many seeds the development in nature is very rare.

MEDICINAL IMPORTANCE

Since very long period it is used in traditional medicine, especially in tropical and subtropical countries. Its curative properties have been used to treat ailments like asthma, arthritis, diarrhea, internal hemorrhage, neurological disorders, skin diseases etc. Extracts from the plant possess various pharmacological activities. This contribution provides important information about its ethnomedical uses. Particular attention was given to its analgesic, anti-inflammatory, anticancer and hypolipidemic effects.

AIMS AND OBJECTIVES

AIM OF THE STUDY:

The aim of the study is to evaluate the phytochemicals, (both quantitative and qualitative evaluation) present in three different extracts (distilled water, ethanol and chloroform) of *Amorphophallus paeoniifolius* (Dennst.) Nicolson and *Colocasia esculenta* (L.) Schott collected form the locality and also to study the *in vitro* antioxidant and anti-bacterial properties of various corm extracts of *Amorphophallus paeoniifolius* (Dennst.) Nicolson and *Colocasia esculenta* (L.) Schott.

OBJECTIVES OF THE STUDY:

- To estimate the preliminary qualitative phytochemicals, present in the different corm extracts of *Amorphophallus paeoniifolius* and *Colocasia esculenta.*
- To quantitatively analyse the phytochemicals in corm extracts samples under investigation.
- To determine the antioxidant activity in the corm extracts of *Amorphophallus paeoniifolius* and *Colocasia esculenta.*
- To analyse the antibacterial activity of various corm extracts.

REVIEW OF LITERATURE

Phytochemicals (from the Greek word 'phyto' meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans further than those attributed to macronutrients and micronutrients (Hasler and Blumberg,1999). They protect plants from disease and damage and contribute to the plant's colour, aroma and flavor. Plants are recognized in the pharmaceutical industry for their broad structural diversity as well as wide range of pharmacological activities. The biologically active compounds present in plants are called phytochemicals. They are derived from various parts of plants such as leaves, flowers, seeds, barks, roots and pulps. They are used as a source of direct medicinal agents (Banu and Catherine, 2015). According to the World Health Organization (WHO), a variety of drugs are obtained from different medicinal plants and about 80% of the world's developing population depends on traditional medicines for their primary health care needs (Fransworth, *et al*,1985,).

More than 4,000 phytochemicals have been cataloged and are classified by protective function, physical characteristics and chemical characteristics (Meagher and Thomson,1999). Plant-derived substances have recently become of great interest owing to their versatile applications. Medicinal plants are the richest bio-resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs. India is one of the most medicos culturally diverse countries in the world where the medicinal plant sector is part of a time-honored tradition that is respected even today. Traditional medicines derive their scientific heritage from rich experiences of ancient civilization. Hence, it is not surprising that traditional medicines claim comes for several "difficult to cure" diseases (Satyavati, 1982). India is well known for its rich traditional systems of medicine i.e., Siddha, Ayurveda, Unani and Amchi (Tibetan) besides a vast reservoir of living traditions in ethnomedicine. The earliest mention of the use of plants in medicine is found in the Rigveda, which was written between 4500 and 1600 BC. During British period due to Western culture, our traditional art of natural healing is disappeared. Now it is reappearing due to realization of its importance in curing diseases without any side effects.

Owing to the global trends towards improved quality of life, there is considerable evidence of an increase in demand for medicinal plant (Kotnis *et al*., 2004). Use of plants for treating various ailments of both man and animal is as old practice as man himself. India is the richly endowed with a wide variety of plants having medicinal value. These plants are widely used by all sections

of the society whether directly as folk remedies or indirectly as pharmaceutical preparation of modern medicine. In recent times, focus on plants research has increased all over the world and a large body of evidence collected to show immense potential of medicinal plants used in various traditional systems (Dahanukar, *et al*, 2000).

The phytochemicals, is involved in the plant defense against herbivory, pathogen attack, inter-plant competition and against abiotic stresses (Briskin, 2000; Ruba *et al*., 2013). These phytochemicals inadvertently protect humans against pathogens as anti-microbial medicines. Some phytochemicals are known to have therapeutic and prophylactic properties, provide nutrition for normal cell health and repairs, inhibit carcinogens and act as antioxidants (Ogunwenmo et al., 2007; Ngoci *et al*., 2011). Phytochemicals exerts their medicinal effects by acting synergistically or additively and this eliminates the problematic side effects associated with the predominance of a single xenobiotic compound, give the herbal drug(s) a broad spectrum of activity, as well as decreasing the chances of the pathogens developing resistance or adaptive responses (Briskin, 2000; Olila, *et al*., 2001). The plants selected for this investigation were *Amorphophallus paeoniifolius* (Dennst.) Nicolson and *Colocasia esculenta* (L.) Schott.

Amorphophallus paeoniifolius (Dennst.) Nicolson, known as Elephant foot yam is a highly potential tropical tuber crop of Araceae family. It is an important tuber crop of tropical and sub-tropical countries because of its yield potential and culinary properties (Ravindran and George, 2008). Elephant foot yam is widely grown and consumed in south eastern countries like India, Philippines, Malaysia, Indonesia. In India, it has gained the status of a cash crop due to its high production potential, market acceptability and lucrative economic returns with a production potential (Misra *et al*, 2002). It has a good source of protein as well as starch and is very popular as a vegetable in various Indian cuisines. In India, it is cultivated in Andhra Pradesh, West Bengal, Gujarat, Kerala, Tamil Nadu, Maharashtra, Uttar Pradesh, and Jharkhand (Misra *et al,* 2001). Amorphophallus is a perennial, terrestrial underground hemispherical depressed dark brown corm of approximately 20-25 cm in diameter which bears flowers and fruits in the month of April – May (Cooke, 1967; Yoganarsimshan SN, 1996). It bears leaves that are solitary which are 30-90 cm broad; Inflorescence consist of a foliar organ, the spathe, which usually envelops a stalk –like organ, the spadix. The flowers are tiny, monoecious and strongly reduced and are found at the base of the spadix. Raphides of the *Amorphophallus campanulatus* Blume (syn. paeonifolius) isolated

from tuber are pointed at one end and square at another end (Loy, 1994). It is tuberous stout indigenous herb used in ayurvedic medicine system for treating various human ailments (Singh and Wadhwa, 2014).

The tubers are a delicacy in food and rich in nutrients is much popular as a vegetable in various delicious cuisines. The tuberous roots of the plant possess blood purifier properties and have been used traditionally for the treatment of piles, abdominal disorders, tumors, enlargement of spleen, asthma and rheumatism (Kirtikar and Basu, 1989; Misra, R.S. and S. Sriram, 2001). They are traditionally used in arthralgia, elephantiasis, tumors, inflammations, hemorrhoids, hemorrhages, vomiting, cough, bronchitis, asthma, anorexia, dyspepsia, flatulence, colic, constipation, helminthiasis, hepatopathy, spleenopathy, amenorrhea, dysmenorrhoea, seminal weakness, fatigue, anemia and general debility. The tuberous roots of the plant have also been reported to possess tonic, stomachic and appetizer properties (Kirtikar and Basu, 1989).

Van *et al.,* (2020) studied the antioxidant capacity and flavonoid, terpenoid, polyphenol, polysaccharide contents of *Amorphophallus opertus* and *A. lanceolatus* tubers conducted using UV-Vis spectrometric assay UV/vin software V6 0.0. showed that *A. opertus* tuber contained several bioactive compounds such as quercetin, oleanolic acid, gallic acid with the polysaccharide content about 1.653 mg GE/g dry mass and strong antioxidant capacity (Van *et al.,* 2020). For a long period *Amorphophallus paeoniifolius* is used for the treatment of various chronic diseases. The plant was found to be a potent analgesic, anti-inflammatory, CNS depressant, antibacterial, antifungal and cytotoxic agent. The phytochemicals present in the plants are mainly steroids and flavonoids which are responsible for the actions (Dey *et al.,*2012). The phytochemical analysis and antibacterial potential of aqueous, ethanol and ethyl acetate extracts of *A. Paeoniifolius* was conducted against *klebsiella pneumoniae, Staphylococcus aureus, Pseudomonas aeruginosa* and *Bacillus subtilis.* Ethyl extract showed maximum activity for *Bacillus subtilis* and *Staphylococcus aureus* (7.5 and 7mm zone of inhibition). Aqueous extract showed maximum inhibition for *klebsiella pneumoniae*(2.75mm). Ethanolic extract showed the zone of inhibition of 3.75mm for *Staphylococcus aureus* and methanolic extract showed 4mm inhibition zone for *Pseudomonas aeruginosa* (Muthukumaran *et al.,*2016). Gold and silver nanoparticles were synthesized by mixing their respective precursors with tuber extract of *A. paeoniifolius* as the bio reducing agent. The antibacterial activity of the synthesized AuNPs and AgNPs were examined in Muller Hinton

agar against two gram positive and four-gram negative bacteria through disc diffusion method. AuNPs did not show any inhibitory effect while the AgNPs showed good inhibitory effect against both gram positive and gram-negative bacteria (Nayem *et al.,*2020). Silver nano particles were profitably synthesized from aqueous *Amorphophallus paeoniifolius* leaf extract at room temperature using one step and eco friend green synthesis. Antibacterial activity of *A. Paeoniifolius* leaf extract mediated AgNPs on *Bacillus subtilis* and *Klebsiella pneumoniae* using well diffusion method shows a clear inhibition zone around the well (Gomathi *et al.,*2019).

Antibacterial, antifungal and cytotoxic activity of amblyone, a triterpenoid isolated from *Amorphophallus campanulatus* (Roxb.) was conducted. Large zones of inhibition were observed in disc diffusion antibacterial scanning against four-gram positive bacteria *Bacillus subtilis, Bacillus megaterium, Pseudomonas aeruginosa* and *Salmonella typhi.* Small zones of inhibition were shown in antifungal screening against *Aspergillus flavur, A. niger* and *Rhizopus oryzae.* In cytotoxicity determination, LC50 of the compound against brine shrimp nauplii was 13.25 microgram /ml (Khan *et al.,*2008). The ethanol extract of *Amorphophallus paeoniifolius* was studied for the inhibition of lipid peroxidation estimated in terms of thiobarbituric acid reactive substances (TBARS) and the levels were reduced by 4.3% to 67.2% in a dose dependent manner. It was analysed for scavenging capacities based on 1,1 diphenyl 2 picrylhydrazyl 2 radical (DPPH) assay and the percentage of inhibition activity based on 2,2 azinobis-(3ethyl) benzothiozoline -6-sulfonate (ABTS) and Hydrogen peroxide. The extract showed a maximum of 68. % Of DPPH scavenging activity and maximum inhibition of 74% and 67% in case of ABTS and hydrogen peroxide (Angayarkanni *et al.,* 2010*).*The dose dependent cytotoxic and apoptosis inducing effects of the sub fractions of *Amorphophallus campanulatus* tuber methanolic extract (ACME) viz petroleum ether fraction (PEF), chloroform fraction (CHF), ethyl acetate fraction (EAF) and methanolic fraction (MEF) on the colon cancer cell line, HCT-15 was conducted. Antiproliferative effects were studied by MTT assay and apoptotic activity by DAPI, Annexin V-FICT and JC -1 fluorescent staining which indicated that sub fractions of ACME, CHF had potent cytotoxic and apoptotic activity (Ansil *et al.,*2014).

It is not only used as vegetables but recently several value-added products like Pickles, dried cubes. Chips, thickening agents etc. are also made which are gaining popularity. Preparation of osmodehydrated slices from fresh corm (Singh, 2012), and bread from flour of *Amorphophallus*

paeoniifolius corm which is a good source of both carbohydrate and protein. It is reported that Amorphophallus corm flour (20 %) could substitute wheat flour in bread preparation. Singh *et al* have shown the presence of enzymes and phytochemical in outer peel of *Amorphophallus paeoniifolius.* Their studies confirmed the presence of alkaloids, tannins, phenols, carbohydrates and fat. Methanol and chloroform extracts gave higher yield of phenol (4.4, 3.9) (mg/g) gallic acid per g extract powder respectively and proanthocyanidin (2.17, 1.62) (mg/g) gallic acid per g extract powder respectively as compared to aqueous and petroleum ether peel extracts (Singh *et al*, 2013). The therapeutic potency of the peel was also established by studying the antioxidative potential of these extracts by DPPH scavenging activity and phosphomolybdenum method. Thus, Jimik and (Amorphophallus) peel wastes have high value products and important medicinal constituents.

Taro, a common name for the corms and tubers of numerous genera of the family Araceae, is a source of edible corms of *Colocasia esculenta* (L.) Schott. It 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 (Kirtikar and Basu, 2005). 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, colored 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; stolons and a tuberous rhizome suckers are sometimes present.

Taro can be grown as a root crop, as a leafy vegetable, as an ornamental and as medicinal plant and it is not only used in times of food shortage (Paul *et al,* 2014; Mandal *et* al, 2013; Ivancic *et al,* 2004). Besides, Mandal *et al* (2013) and Melese *et al* (2014) described role of taro in food security, income generation and in earning foreign currency reported and the authors also reported as taro corms, leaves, and petiole are rich in carbohydrate, fiber and minerals and as it has been produced in Africa by small holder farmers and plays important roles in livelihood of many poor

people in less developed countries. Besides, Verma and Chao reported similarly as taro was cultivated in Asia by small scale farmers and used as staple food crop (Verma and Cho, 2010). On the other hand, taro peels and wastes used as an animal feed and use of its tops left after corms harvested for silage preparation.

The leaves of *Colocasia esculenta* (L.) Schott are low in calories, rich in proteins, dietary fiber and macronutrients. The high content of bioactive compounds and antioxidative potential of leaves renders several health benefits such as anticancer, antidiabetic and anti-inflammatory activity (Mitharwal *et al.,*2022). Phytochemical analysis of leaf extract of *Colocasia esculenta* in methanol, chloroform and ethanol with Soxhlet apparatus detected the presence of alkaloids, flavonoids, glycosides, saponins, terpenoids, oxalates, phenols etc. The antioxidant activity of extracts using DPPH method with ascorbic acid as standard showed DPPH scavenging activity of ascorbic acid to be 84% whereas it was 78.92% for ethanol, 76.46% for methanol and 72.46% for chloroform. (Keshav *et al.*,2019).

Nutritional analysis of *Colocasia esculenta* dried tubers showed that moisture content is 56.8%, ash content 1.22%, carbohydrate 3000mg/100 gm, protein 824 mg/100gm and starch 2700mg/ 100mg. Phytochemical analysis revealed the presence of alkaloids, glycosides, flavonoids, terpenoids, saponins and phenols. The tubers are applied locally to painful rheumatic joints, to treat tuberculosis and pulmonary congestion. Alkaloids are also used in medicine for reducing fever and headache. Glycosides are naturally cardioactive drugs used in the treatment of congestive heart failure. Flavonoids are free radical scavengers, super antioxidants and have strong anti – inflammatory action (Krishnapriya and Suganthi, 2017). The young leaves and roots of *Colocasia esculenta* are rich in vitamin C as well as starch. It contains calcium, phosphorus, thiamine, riboflavin, niacin, oxalic acid, calcium oxalate, sapotoxin and flavones, apigenin and luteolin. Phytochemical screening also showed the presence of alkaloids, glycosides, flavonoids, terpenoids, saponins, oxalates and phenols. Traditionally it has been used for the treatment of various ailments such as asthma, arthritis, diarrhea, internal hemorrhage, neurological disorders and skin disorders (Sudhakar *et al.,*2020).

C. esculenta is a largely cultivated plant and contain flavonoids and triterpenoids which are the two major therapeutically active groups of compounds found in the plant.

Pharmacologically, the plant is antimicrobial, antihepatotoxic, antidiabetic, anti-lipid peroxidative, antimetastatic, antifungal and anti-inflammator. There are also many pharmaceutical applications for the plant. There is a lot of scope for usage of *C. esculenta* in pharmaceutical industries as well as in research work. Herbal formulations consisting of plant extracts from different parts of plants can be developed for many ailments as discussed in this paper. More research work can be done on structural investigation and applications of the gum obtained from *C. esculenta*. The starch and the gum obtained from the tubers can be commercially made use of in pharmaceutical industries in form of binder, matrix forming agent, thickening agent etc. Thus, there is need to explore this plant so as to make use of its medicinal and pharmaceutical properties to its fullest.

The qualitative phytochemical analysis of methanolic and aqueous extract of *Colocasia esculenta* showed the presence of alkaloids, terpenoids, glycosides, resins, saponins, tannins, flavonoids, phenols and amino acid in methanol extract with the absence of glycosides and amino acids in the aqueous extract of leaves. The antioxidant activity of leaf using DPPH method showed 86.5%, lowest from the standard ascorbic acid 87.5%. The antimicrobial activity against four bacterial isolates *Pseudomonas aeruginosa, klebsiella sps, E. coli, Staphylococcus aureus* and a single fungi *Candida albicans* using disc diffusion method. The methanolic extract against *Staphylococcus aureus* and *E. coli* gave a higher inhibition zone compared to antibiotics. Lower values were recorded than antibiotics against *Pseudomonas aeruginosa* and *klebsiella sps* and less antifungal activity was recorded against *Candida albicans.* The antimicrobial activity of aqueous extract showed less activity against *Staphylococcus aureus* and high activity against *Pseudomonas aeruginosa* (Al-kaf *et al.,*2019). The antibacterial activity of ethanolic extract of *Colocasia esculenta* stem against several assay bacteria using TLC -Bio autoradiography showed that a concentration of 1mg/ml shows inhibitory activity against *Bacillus subtilis, E. coli, Pseudomonas aeruginosa, Salmonella typhi, Shigella dysentriae, Staphylococcus aureus, S. epidermidis, Streptococcus mutans* and *vibrio cholera* (Hibai *et al.,*2015).

MATERIALS AND METHODS

4.1. COLLECTION OF PLANT

The corms of *Amorphophallus paeoniifolius* (Dennst.) Nicolson and *Colocasia esculenta* (L.) Schott were collected from Alappuzha district in Kerala and authenticated by the references from literature. The samples were thoroughly washed several times using tap water followed by distilled water to remove the impurities. For the study the samples were dried after cutting them into small pieces and placing under sunshade to remove the moisture content. The dried samples were then stored in clean dry place till use.

Fig. 3:
Dried Corm of *A. paeoniifolius*

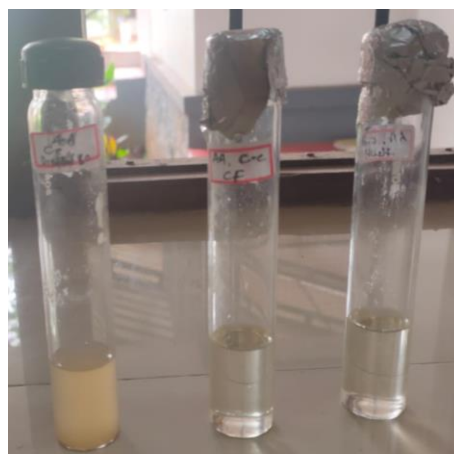
Fig.4:
Dried Corm of *C. esculenta*

4.2. EXTRACTION OF PLANT PARTS

Three solvents were used for this study including distilled water, chloroform and ethanol. 4g of both the dried samples were measured and suspended in 20 ml of the solvents. Here we have prepared the extracts by cold extraction method. This extraction was done at room temperature in screw cap bottles.

Fig. 5:
Ethanol, Chloroform and Distilled water Extracts of *A. paeoniifolius*

Fig. 6:
Ethanol, Chloroform and Distilled water Extracts of *C. esculenta*



4.3. PRELIMINARY PHYTOCHEMICAL ANALYSIS

The extracts using different solvents were screened for the qualitative analysis of different classes of natural compounds, using the methodology of Sofowora (1982) and Kepm (1986). The major pharmaceutically valuable phytochemical compounds investigated in the present study were,

1.Alkaloids

2.Coumarins

3.Quinones

4.Xanthoproteins

5.Glycosides

6.Terpenoids

7.Carotenoids

8.Protein & amino acid

9.Steroids & Phytosterols

10. Carboxylic acid

11.Resins

12.Phenols

13.Flavonoids

14.Phlobatannins

15.Tannins

16.Saponins

4.3.1. Detection of Alkaloids

Extracts were dissolved in dil. HCl and then subjected to the following tests.

a. Dragendroff's test:

Filtrates were treated with 1ml of Dragendroff's reagent. Formation of reddish orange precipitate indicates the presence of alkaloid.

b. Wagner's test:

Few drops of Wagner's reagent are added to few ml of plant extract along the sides of test tube. A reddish – brown precipitate confirms the test as positive.

4.3.2. Detection of Coumarins

1 ml of alcoholic extract was treated with 10% NaOH solution. Production of dark yellow color indicates the presence of coumarins.

4.3.3. Detection of Quinones

a. 1ml of various extracts were separately treated with alcoholic KOH solution. Quinones give coloration ranging from red to blue.

b. Small amount of the extract was treated with con. HCl and observed for the formation of yellow precipitate or coloration.

4.3.4. Detection of Xanthoproteins

1ml of various extracts were treated separately with a few drops of con. HNO_3 and NH_3 solution. Formation of reddish orange precipitation indicates the presence of xanthoprotein.

4.3.5. Detection of Glycosides

a. Bromine water test:

Test solution was dissolved in bromine water and observed for the formation of yellow precipitate to show a positive result for the presence of glycosides.

b. Fehling test:

A small portion of various filtrate were treated with 1ml of Fehling's solution 1 and 2 and then heated gently. Change in color indicate the presence of sugars.

4.3.6. Detection of Terpenoids

About 0.8g of the plant sample was taken in a test tube, 10ml of methanol was poured into it, shaken well and filtered to take 5 ml extract. Then 2 ml of chloroform were mixed in extract. Formation of reddish-brown color indicate the presence of terpenoids.

4.3.7. Detection of Carotenoids

1g of sample was extracted with 10 ml of chloroform in a test tube with vigorous shaking. The resulting mixture was filtered and 85% H_2SO_4 was added. A blue color at the interphase shows the presence of carotenoids.

4.3.8. Detection of Protein and amino acids

5 ml of each of the extracts were dissolved in 5 ml of water and were subjected to the following test.

a. Biuret test:

Gently warm about 1 ml of the extracts with 10% NaoH solution and add a drop of distilled CuSo4 solution to it. Formation of reddish-brown colour indicates the presence of proteins and amino acids.

b. Ninhydrin test:

1 ml of the various extracts was separately treated with a few drops of ninhydrin solution. Change in color indicate the presence of protein and free amino acid.

4.3.9. Detection of Steroids and Phytosterols

5ml each of various extract were dissolved in 5 ml of chloroform separately and was subjected to the following test.

a. Salkowski test:

1 ml of conc. H_2SO_4 was added to the stock solution and allowed to stand for 5 minutes after shaking. Occurrence of golden yellow color in the lower layer indicates the presence of steroids and phytosterols.

4.3.10. Detection of Carboxylic acid

1 ml each of various extracts was separately treated with a few ml of saturated solutions of sodium bicarbonate. Observation of effervescence indicate the presence of carboxylic acid.

4.3.11. Detection of Resins

1ml of various extract was diluted with distilled water. Formation of bulk black precipitate indicates the presence of resins.

4.3.12. Detection of Phenols

a. Ferric chloride test:

Treat a fraction of the extract with 5% aqueous ferric chloride and observed for the formation of deep blue or black color.

b. Lead acetate test:

The extract is dissolved in distilled water and to this 3 ml of 10% lead acetate solution is added. A bulky precipitate indicates the presence of phenolic compounds.

4.3.13. Detection of Flavonoids

a. Alkaline reagent test:

Extract was treated with a few drops of sodium hydroxide solution. Formation of intense yellow color which becomes colorless on addition of dilute acid indicates the presence of flavonoids.

b. Con. H_2SO_4 test:

1ml of con. H_2SO_4 was added to the test solution. Formation of red color indicates presence of flavonoids.

4.3.14. Detection of Phlobatannins

Plant extract was mixed with distilled water in a test tube, then shake well and filter. To each of the extract 1% aqueous HCl was added and then boiled using a hot plate stirrer. Formation of red colored precipitate indicate the presence of phlobatannins.

4.3.15. Detection of Tannins

5 ml of the extracts were dissolved in minimum amount of water. Filter it separately and the filtrate is subjected to the following tests.

a. Ferric chloride test:

To the above filtrate, a few drops of ferric chloride solution was added. Color change indicate the presence of tannins.

b. Potassium iodate test:

To a little solution add a few drops of saturated solution of potassium iodate. Presence of pink color indicate the presence of tannin.

4.3.16. Detection of Saponins

a. Foam test:

A small amount of the extract was shaken vigorously with water. Persistent foam indicates the presence of saponins.

4.4. QUANTITATIVE PHYTOCHEMICAL ANALYSIS

4.4.1. Estimation of Total Phenolic content

The total phenolic content of extracts was determined using the Folin-Ciocalteau's Phenol reagent. Pipetted out 0.5ml of sample into test tubes. Made up volume in each test tube to 3ml with distilled water. Add 0.5ml of Folin- Ciocaltueau reagent. After 3 minutes, added 2ml of 20%

sodium carbonate solution to each test tube. Mixed thoroughly. Place the tubes in boiling water for exactly I minute. Cool and measure the absorbance at 650 nm against a reagent blank.

4.4.2. Estimation of Total Lipid content

Estimation of total lipid content in the sample was carried out using the method of Folch *et al* (1957). Weighed 2g of the sample into a wide mouthed boiling tube and added 20ml of ethanol: diethyl ether (3:1) mixture to this and stirred well. Then it was kept in a thermostatic water bath for 2 hours at 50° C and cooled. The contents were then centrifuged at 3000rpm for 10 minutes and decanted the clear supernatant to a pre-weighted petri dish. The pellet was collected into the boiling tube, added 20ml of ethanol: diethyl ether mixture and again extracted for 2 hours. Centrifuged the contents and supernatant was decanted to the same Petri dish. Added 20ml of chloroform: methanol (1:1) mixture to the residue and extracted for 1 hour at 50^0C. Centrifuged and decanted the supernatant to the same petri dish was recorded. The quantification of total lipid content was carried out by reducing the weight of Petri dish before extraction (W 1) from weight of petri dish after extraction (W 2).

Total lipid = W 2 - W 1

4.4.3. Estimation of Starch

Starch content in aril was estimated by sedimentation method. 5gm sample was ground with 100 ml distilled water using a mortar and pestle. The mixture was separated through a cheese cloth and again added 50 ml distilled water. The filtrate was allowed to stand at Overnight. After that starch was settled out. The filtrate was decanted off. So, the starch was left in the beaker. After that, 100 ml water added to rinse the starch. The process was repeated where the water was decanted off again. Lastly the wet starch was sundried to get a white powder. The percentage yield of isolated starches was determined using equation.

Starch%= ((Initial weight- final weight) / (Initial weight)) x 100.

4.4.4. Estimation of total Carbohydrate content

The carbohydrate content was detected by Anthrone method. Take 1mg of the sample into a boiling tube, hydrolyzed by keeping it in a boiling water bath for three hours with 5.0 ml of 2.5 N HCI and cooled to room temperature. Neutralized it with solid sodium carbonate until the effervescence ceases. Made up the volume to 100 ml and centrifuged, collected the supernatant and take 0.5 ml for analysis. Prepared the standard by taking 0.2 -1.0 ml of the working standards, 1.0 ml of water serves as blank and made up the volume to 1.0 ml in all the tubes with distilled water, then added 4.0 ml of anthrone reagent, heated for eight minutes in a boiling water bath, cooled rapidly and read the green to dark green color at 630nm.

4.4.5. Estimation of Total Flavonoid content

2.5gm of aril sample was mixed with 80% of aqueous methanol and let it kept for 24 hrs. Discarded the supernatant, the residue re-extracted three times with same volume of methanol with Whatman filter paper. Sample filtrate was transferred to a crucible and evaporated to dryness over a water bath. The content in the petri dish is cooled.

4.4.6. Estimation of Total Protein

a. Bradford Method:

5g of the plant sample is weighed. Homogenize it in 5-10ml of phosphate buffer. Filter the extract through a double layered cheese cloth. Centrifuge the extract at 10000rpm for 15 min. Collect the supernatant, take an aliquot of the sample and make up to 1ml with extraction buffer. Add 1.5 ml of Bradford reagent to all the test tubes and incubate at room temperature for 5 minutes and read the absorbance at 595 nm against blank.

Concentration of protein present in given sample =

Concentration Of standard× OD of test /OD of standard × Vol. of test.

4.5. ANTIOXIDANT ASSAY

4.5.1. DPPH Free Radical Scavenging Assay:

The DPPH free radical scavenging assay was determined by the method of Shimda *et.al* (1992). 0.1mM DPPH (2,2-diphenyl -1-picrylhydarzil) was prepared in methanol solution. 0.5g of sample was homogenized using 5ml of methanol and centrifuged the contents. The supernatant was collected, different aliquots (0.5 and 1 ml) were prepared and final volume was made up to 1 ml using methanol. To this mixture added 2ml of 0.1mM DPPH solution (control) and reaction mixtures were measured at 517 nm against methanol as blank. The assay was carried out in triplicates. Lesser values of absorbance of the reaction mixture indicate higher free radical scavenging activity. The capability to scavenge the DPPH radical was calculated using the formula.

DPPH Scavenged (%) =

((Absorbance of control – absorbance of test) ÷ (Absorbance of control)) × 100

4.6. ANTIBACTERIAL ASSAY

4.6.1. Agar well diffusion method

Agar well diffusion method is widely used to evaluate antimicrobial activity. Mueller - Hinton agar (15-20ml) was poured on glass Petri plates of same size and allowed to solidify. Standardized inoculum of the test organism was uniformly spread on the surface of the plates using sterile cotton swab. Wells with a diameter of 8 mm were punched (20 mm apart from one another) aseptically with a sterile cork borer in each plate. The test samples were added into the wells using micropipettes. Gentamycin (40microlitre) and the solvent used for sample dilution were added as positive and negative control respectively. The plates were incubated at 36°C±1°C for 24 h, under aerobic conditions. After incubation the plates were observed and the zone of bacterial growth inhibition around the wells were measured in mm.

RESULTS AND DISCUSSION

PRELIMINARY PHYTOCHEMICAL ANALYSIS

In this study the presence of various phytochemicals presents in ethanol, chloroform and distilled water extracts of dried corm of *Amorphophallus paeoniifolius* (Dennst.) Nicolson and *Colocasia esculenta* (L.) Schott was evaluated. This investigation also helps to compare the similarity and dissimilarity of various phytochemicals in various tuberous root extracts of both the plants. The results of preliminary phytochemical analysis are given in tables below.

TABLE – 1

The preliminary phytochemical analysis in various extracts of *A. paeoniifolius*

PHYTOCHEMICALS	Distilled Water	Ethanol	Chloroform
Alkaloids	-	-	+
Coumarins	-	-	-
Quinones	-	-	-
Xanthoproteins	-	-	-
Glycosides	-	-	-
Terpenoids	-	+	-
Carotenoids	-	-	-
Protein & amino acid	+	-	+
Steroids & phytosterols	-	-	-
Carboxylic acid	-	-	-
Resins	-	-	-
Phenols	-	+	-
Flavonoids	+	+	+
Phlobatannins	+	+	-
Tannins	+	+	-
Saponins	+	-	-

+ indicates presence and - indicates absence

Table 1 represents the results of various phytochemicals in three different corm extracts of *A. paeoniifolius.* Here the ethanol extract shows the presence of phytochemicals like terpenoids,

phenols, flavonoids, phlobatannins and tannins. Chloroform extracts shows the presence of alkaloids, protein & amino acid, flavonoids and tannins. Distilled water extract showed the presence of protein & amino acid, flavonoids, phlobatannins and saponins. Coumarins, quinones, xanthoproteins, glycosides, carotenoids, steroids & phytosterols, carboxylic acid and resins were absent in all the three extracts.

TABLE 2

The preliminary phytochemical analysis in various extracts of *C. esculenta*

PHYTOCHEMICALS	Distilled Water	Ethanol	Chloroform
Alkaloids	-	-	+
Coumarins	-	-	-
Quinones	-	-	-
Xanthoproteins	-	-	-
Glycosides	+	-	-
Terpenoids	-	+	-
Carotenoids	-	-	-
Protein & amino acid	+	-	-
Steroids & phytosterols	-	-	-
Carboxylic acid	-	-	-
Resins	-	-	-
Phenols	-	+	-
Flavonoids	+	+	+
Phlobatannins	-	+	-
Tannins	+	+	-
Saponins	+	-	-

+ indicates presence and – indicates absence

Table 2 represents the results of preliminary phytochemical analysis of three different corm extracts of *C. esculenta*. Here the ethanol extract shows the presence of terpenoids, phenols, flavonoids, phlobatannins and tannins. Chloroform extract shows the presence of alkaloids and flavonoids. Distilled water extract shows the presence of glycosides, protein & amino acid,

flavonoids, tannins and saponins. Here coumarins, quinones, xanthoproteins, carotenoids, steroids and phytosterol, carboxylic acid and resins are absent in all the three extracts.

From the tables (Tables – 1 and 2) it can be identified that flavonoids are present in various extracts of both plant samples. Whereas coumarins, quinones, xanthoproteins, steroids & phytosterols, carboxylic acid and resins were not detected in preliminary analysis in both plant extracts. In both plant extracts studied alkaloids was present in the both chloroform extracts, terpenoids in both ethanol extracts, protein and amino acid in both distilled water extracts, phenol in both ethanol extracts, Phlobatannins in both ethanol extracts, saponins in both distilled water extracts and tannins in both distilled water and ethanol extracts. In our study Flavonoids was the only phytochemical present in all the three extracts.

QUANTITATIVE ANALYSIS

Analysis of Total Lipids

Lipids are important components of plants. They perform some important functions such as providing energy for metabolic activities, form the structural components for membranes and are important intracellular signals. Some of them are also related to biotic stress / pathogen resistance whereas others are good candidates for signals in response to abiotic stress.

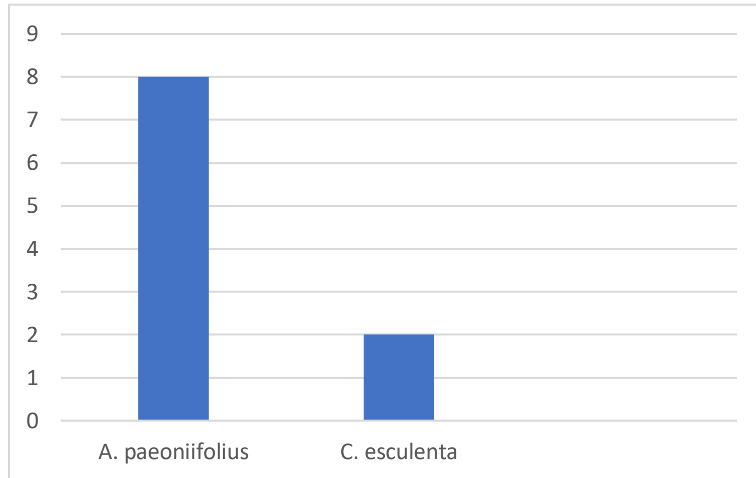
TABLE 3

Total Lipid content

Plant	Quantity of Lipid (%)
Amorphophallus paeoniifolius	8
Colocasia esculenta	2

From the above table – 3 and fig.7 it is clear that the amount of lipids is slightly higher in *A. paeoniifolius* than *C. esculenta.*

Fig. 7: Graph Showing Total Lipid content



Analysis of Total Starch

Starch is an insoluble, non-structural carbohydrate composed of alpha glucose polymers. It is synthesised by plants and algae to store energy in dense, osmotically inert form. Starch has an important role in human life, it serves as main carbohydrate source and as a raw material for industry.

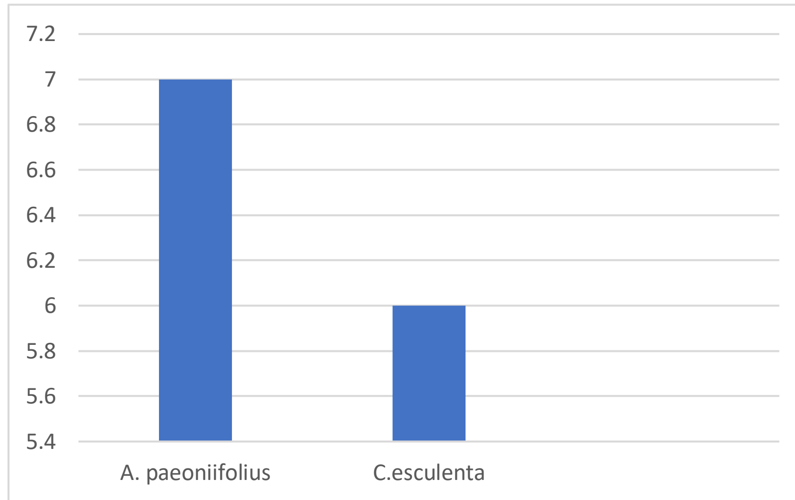
TABLE 4

Total starch content

Plant	Quantity of Starch (%)
A. paeoniifolius	7
C.esculenta	6

Starch is used as a thickener and texturizer in processed foods. It is also used for production of paper and board of biodegradable plastics and packing materials. (Pfister and Zeeman, 2016). From Table – 4 and fig. 8, it is clear that there is only a slight difference in the concentration of starch in both the plant samples.

Fig. 8: Graph Showing Total starch content



Analysis of Total Flavonoid

Flavonoids are secondary metabolites found in plants. They play a vital role in plant structural integrity, UV photo protection, reproduction, internal regulation of plant cell physiology & signalling.

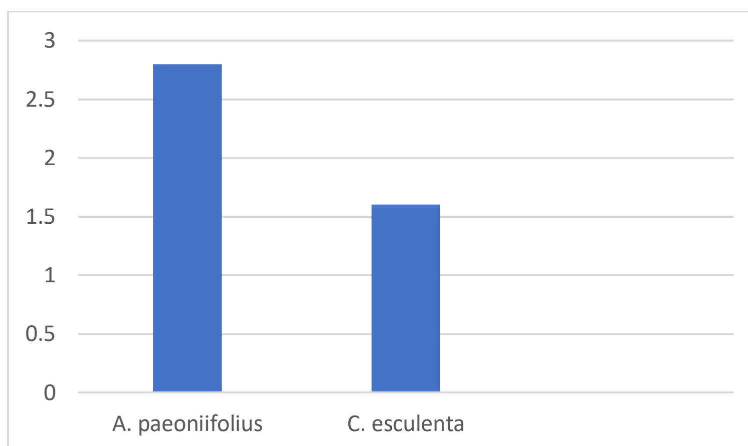
TABLE 5

Total Flavonoid content

Plant	Quantity of flavonoid %
A. paeoniifolius	2.8
C.esculenta	1.6

From table – 5 and fig.9, it is clear that the amount of flavonoid is higher in *A.paeonifoliius* than *C. esculenta.* They also provide protection against pathogens and herbivores and induce root nodulation (Mandal *et al.,* 2010).

Fig. 9: Graph Showing Total Flavonoid content



Analysis Of Total Phenol

Phenolics are compounds possessing one or more aromatic rings with one or more hydroxyl groups. They are the most abundant secondary metabolites in plants (Dai and Mumper, 2010).

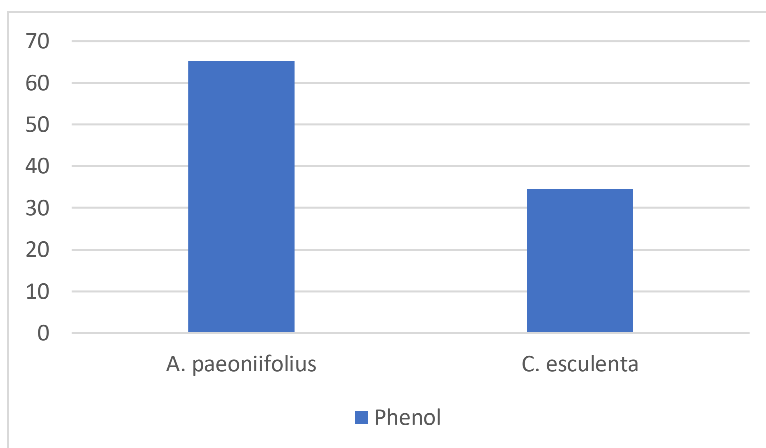
TABLE 6

Total Phenol content

Plant	Quantity of phenol (mg/g)
A. paeoniifolius	65.25
C. esculenta	34.6

Table – 6 and fig.10, shows that phenol content is greater in *A. peoniifolius* than in *C. esculenta.* Phenol derivatives have been found to possess antimicrobial, analgesic, anti-inflammatory, antioxidant, anti-convulsant, anti-cancer, aesthetic, antiseptic and disinfectants, anti-tubercular and anti-Parkinson activity (Kumar and Mishra, 2018).

Fig. 10: Graph Showing Total Phenol content



Analysis Of Total Protein

Proteins are necessary for a number of plant processes. Many of them help in gene expression, cell division, cell repair and reproduction. Proteins also provide several health benefits like increase in lean body mass, increased leg power, gait speed, improved bone density (Hertzler *et al.,*2020)

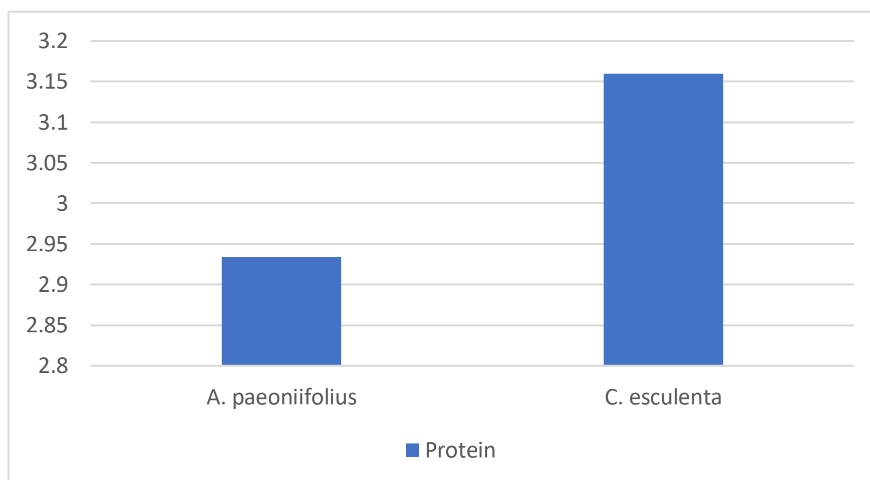
TABLE 7

Total Protein content

Plant	Quantity of Protein (mg/g)
A. paeoniifolius	2.934
C. esculenta	3.16

Nutritional analysis of *C. esculenta* corms showed 824mg/100g (Krishnapriya and Suganthi, 2017). Koni *et al,* (2017) showed that the crude protein content of *A. campanulatus* tubers to be 1.126±0.101%. In our study from the table – 7 and fig.11, it is clear that *C. esculenta* has higher protein content than *A. paeoniifolius.*

Fig.11: Graph Showing Total Protein content



Analysis of Total Carbohydrate

Carbohydrate is a stored form of starch which release carbon atoms during their breakdown.

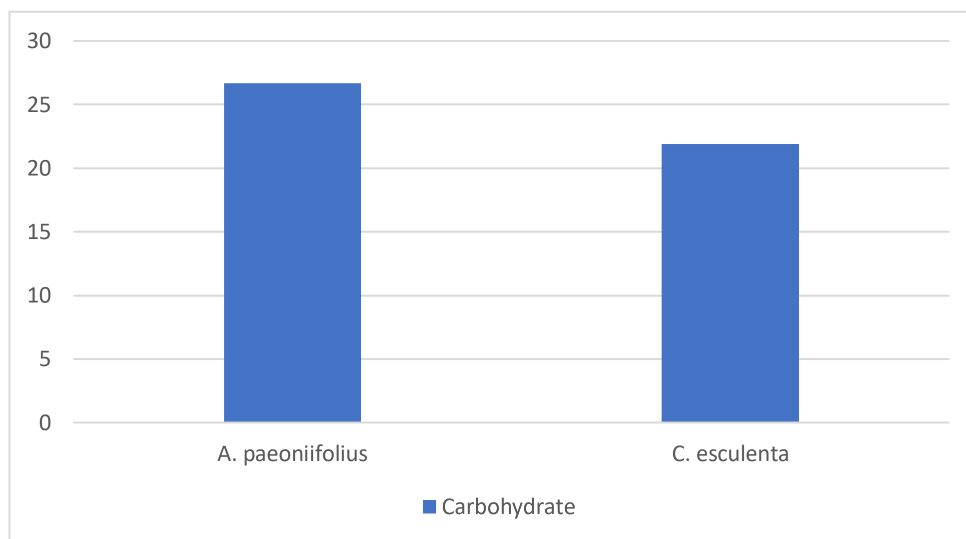
TABLE 8

Total Carbohydrate content

Plant	Quantity of Carbohydrate(mg/g)
A. peoniifolius	26.7
C.esculenta	21.9

High content of carbohydrate is present in both the plant samples. About 3000mg/100gm carbohydrate content was found in *C. esculenta* during nutritional analysis (Krishnapriya and suganthi, 2017). The mean values of carbohydrate content of flour of two varieties of *A. paeoniifolius,* NDA-5 and NDA-9 were 73.42 and 73.79 per cent respectively. (Yadav and Singh, 2016). From table – 8 and fig.12, it is clear that carbohydrate content of crude extract is higher in *A. paeoniifolius* than *C. esculenta.*

Fig.12: Graph Showing Total Carbohydrate content



RESULT OF ANTIOXIDANT ASSAY

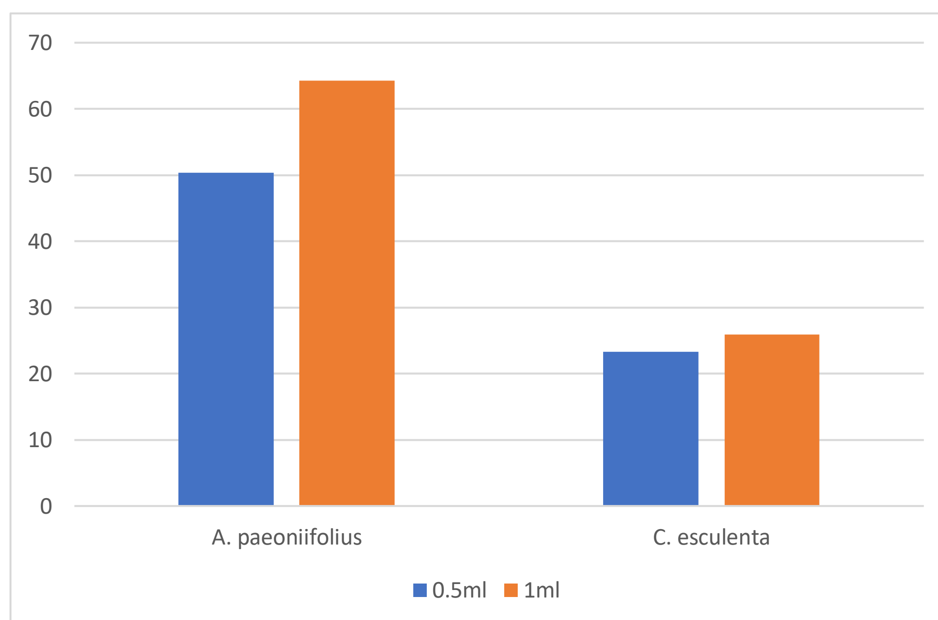
The DPPH assay was used to study antioxidants. DPPH assay is a simple, rapid, economical, and widely used method to evaluate antioxidant activity. Although the DPPH assay involves the transfer of hydrogen atoms, the underlying chemical reaction is considered to be an electron transfer (ET) reaction. This is because the transfer of hydrogen from an antioxidant to DPPH is a very slow process and is considered as a marginal reaction path, whereas ET from a deprotonated antioxidant to DPPH is a faster and rate-determining step. This scavenging activity has been widely used as a quick and reliable parameter to evaluate the general in vitro antioxidant activity of plant extracts. The results of the free radical scavenging activity of the ethanol extracts of both samples are given below.

TABLE 9

DPPH scavenging activity

Concentration of samples	Percentage of inhibition *A. paeoniifolius*	Percentage of inhibition *C. esculenta*
0.5 ml	50.35	23.29
1ml	64.23	25.88

Fig.13: Graph Showing DPPH scavenging activity



Recently, many scientific studies have shown that free radicals play a major role in the development of cancer, heart disease, aging, cataracts, and immune system damage (Asimi *et al*, 2013). These unstable free radicals can be eliminated by antioxidants that inhibit the rate of oxidation and protect cells from damage. Antioxidant drugs are used for the prevention and treatment of oxidative stress related disease such as diabetes, Alzheimer's disease, atherosclerosis, stroke, and cancer (Devasagayam,*et al,*. 2004; Howlader *et al,* 2011) However, its side effects and high prices force many people to take herbal medicines, which have fewer side effects (Kala,2005).

From tables – 9 and fig.13, it is clear that *A. paeoniifolius* has more antioxidant potential than *C. esculenta.*

ANTI-BACTERIAL ASSAY

In this part of the work, we studied the antimicrobial effect of the plant extracts under investigation. The test pathogens used were, *Vibrio cholerae, Serratia marcescens*, *Escherichia coli* and *Staphylococcus aureus*. This results of this part of the study are summarised in tables 11 and 12 and in figure – 14. In this experiment antibiotic Gentamycin was used as a Positive Control. For the positive control maximum zone of inhibition, was observed against all extracts

TABLE 11

Anti-bacterial activity of corm extracts of *Amorphophallus paeoniifolius*

Microorganisms	Extracts Used (100µl)			Positive Control (Gentamycin 160mcg)	Negative Control
	Ethanol	Chloroform	Distilled Water		
Vibrio cholerae	10mm	-	-	29mm	-
Serratia marcescens	-	-	-	29mm	-
Escherichia coli	-	-	-	28mm	-
Staphylococcus aureus	-	17mm	-	32 mm	-

TABLE 12

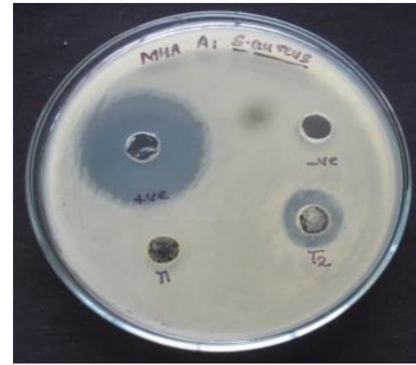
Anti-bacterial activity of corm extracts of *Colocasia esculenta*

Microorganisms	Extracts Used (100µl)			Positive Control (Gentamycin 160mcg)	Negative Control
	Ethanol	Chloroform	Distilled Water		
Vibrio cholerae	-	-	-	29mm	-
Serratia marcescens	13mm	11mm	-	29mm	-
Escherichia coli	-	-	10mm	28mm	-
Staphylococcus aureus	-	-	-	32 mm	-

From the table – 11 it is understood that the ethanol extract of *A.paeoniifolius* shows activity against *Vibrio cholerae* (10mm) and chloroform extract shows activity against *Staphylococcus aureus* (17mm). From table – 12 it is clear that the ethanol and chloroform extracts of *C. esculenta* shows activity against *Serratia marcescens* (13 and11mm respectively) whereas the distilled water extract showed activity against *E. Coli*(10mm).

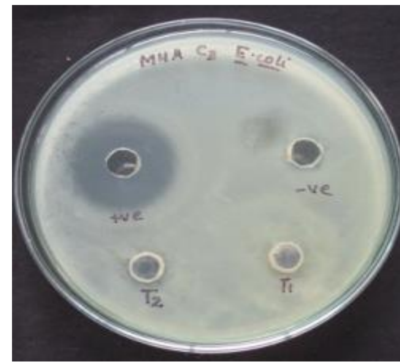
Fig.14: Anti-microbial assay

Anti-bacterial activity of ethanol extract of *A.paeoniifolius* against *Vibrio cholerae*



Anti-bacterial activity of chloroform extract of *A.paeoniifolius* against *Staphylococcus aureus*

Anti-bacterial activity of ethanol and chloroform extract of *C.esculenta* against *Serratia marcescens*



Anti-bacterial activity of distilled water extract of *C.esculenta* against *E.coli*

SUMMARY AND CONCLUSION

Plant and plant products are an important part of the human diet and a major source of biologically active substances such as vitamins, dietary fibre, antioxidants, and cholesterol lowering compounds. This study evaluated the quantitative and qualitative analysis of phytochemicals present in three different extracts (ethanol, chloroform and distilled water) of *Amorphophallus paeoniifolius* (Dennst.) Nicolson and *Colocasia esculenta* (L.) and also to study the in vitro antioxidant and anti-bacterial properties. For this the root tubers of *A. paeoniifolius* and *C. esculenta* were collected, washed, cut into small pieces and dried in sunshade. Ethanol, chloroform and distilled water extracts were prepared using the dried plant samples.

The qualitative phytochemical analysis of the extracts revealed the presence of alkaloids, phenols, flavonoids, proteins and free amino acids, terpenoids, glycosides and saponins in various extracts of both the samples. The quantitative analysis revealed that the concentration of phenols and carbohydrates are comparatively higher in these plants than lipids, starch, flavonoids and proteins.

The antioxidant assay was conducted by DPPH scavenging method in which the percentage of antioxidant activity was found to be 50.35% in 0.5 ml and 64.23% in 1 ml of *A. paeoniifolius* as well as 23.29% in 0.5 ml and 25.88% in 1 ml of *C. esculenta* extracts.

The anti- bacterial studies were conducted against four selected bacteria namely *Vibrio cholerae, Serratia marcescens, Escherichia coli* and *Staphylococcus aureus* using well diffusion method. It was found that out of these four bacteria the ethanol extract of *A. paeoniifolius* produced an inhibition zone against *Vibrio cholerae* and its chloroform extract produced an inhibition zone of against *Staphylococcus aureus*. Gentamycin was used as positive control. Similarly, the ethanol and chloroform extracts of *C. esculenta* produced inhibition zones against *Serratia marcescens* and distilled water extract produced an inhibition against *E. coli*.

The antioxidant and anti-bacterial analysis of the corm extracts of *A. paeoniifolius* and *C. esculenta* revealed that comparatively more antioxidant property is exhibited by *A. paeoniifolius*. The extracts of both *A. paeoniifolius* and *C. esculenta* was found to possess anti-bacterial activity against certain bacterial strains, out of which the chloroform extract of *A. paeoniifolius* shows maximum activity (17mm) against *Staphylococcus aureus* and ethanol extract of C. *esculenta* showed a maximum activity (13mm) against *Serratia marcescens.* From this study it can be

understood that the plants used here contains various phytochemicals which can be used for the treatment of various ailments. Hence it can be expected that these plant extracts can be used for the formulation of new types of antioxidant and anti-bacterial materials for pharmaceutical and biomedical applications, however more studies are required before they can be used as drug for human beings.

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