A SEMINAR REPORT ON

PHYTOCHEMICAL ANALYSIS AND ANTIBACTERIAL PROPERTIES OF PAPAYA LEAF

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SCIENCE LABORATORY TECHNOLOGY

SUPERVISED BY:

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CERTIFICATION

This is to certify that the project on phytochemical analysis and antibacterial properties of papaya leaf, the project is submitted by the whole member of group 6, Science Laboratory Technology in fulfillments of the requirements for our Higher National Diploma (HND). This project was an authentic work done by us under the supervisor and guidance of Mr Yahya G.M. This project has not been submitted to any other institution for the award higher diploma.

MR YAHAYA G. M **DATE**
(Project supervisor)

DR. USMAN **DATE**
(Head Of The Department)

External Examiner **DATE**

DEDICATION

This is dedicated to Almighty GOD for sparing our lives throughout the course of our study.

ACKNOWLEDGEMENT

We wish to extend our heartfelt gratitude god almighty for his mercy for making our project a success.

We did like to acknowledge our parents contributions for their unwavering support and financial given to us to complete this project

This extend to our supervisor (Mr Yahaya G.M) for his support, guidance and his belief in us which boost our abilities to work harder to complete our project successfully

This also extend to my Mr. and Mrs. YUSUF and family and friends who provided encouragement and emotional sustainance needed to complete this challenging task of mine.

Their unwavering support has been our motivation

Gratitude to them all

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ABSTRACT

The papaya (carica papaya l.) Is a tropical fruit that is widely cultivated and consumed, both for its agreeable flavor as well as its many pharmacological properties. This project will discuss the fruit's origin and principal growing regions in the world and will briefly explore its nutritional and pharmacological attributes. In addition, we will identify and comment on some of the most common physiological disorders that occur postharvest. Such disorders compromise the quality of the fruit, bringing financial losses to the productive sector, along with serious economic and social consequences to papaya-growing countries. Among these disorders, physiological bruising, also known as “skin freckles”, characterized by the appearance of blemishes on the fruit while still in its growth stage, is one of the main problems associated with the crop. Possible causes of and current information on bruising are dealt with in this article. Other physiological disorders of the papaya such as pulp flesh translucency, pulp softening, and hard lumps in papaya flesh are also discussed.

CHAPTER ONE

1.0 INTRODUCTION TO PAPAYA

Papaya is a moldy sweet, melon-like tropical fruit belonging to the family of *caricacea*, is a nature of tropical America (central, America and the Caribbean, including Mexico, *Coasta rica*, and the Bahamas).

After the spaniards took the fruit to luzon island in philippines in the mid sixteen century (16th), malacca shortly afterwards and india. It has been wildly grown throughout tropical and subtropical regions such as australia, hawaii, florida, texas, california and puerto. Rico in the usa, peru, venezuela, various part of central, south Africa and Bangladesh, Pakistan and India. The Australians call it "pawpaw" while the Venezuelans call it "*lechosa*". Fruit size may vary from less than 0.5 kg to 3 kg. A climacteric fruits it is mainly consumed fresh when ripened after harvest. Ripening is judged by the approximate percentage of yellowness on it's skin, and more accurately by measuring its total soluble solids (tss) contents with refractometer. Export. Drake papaya grown in Hawaii should have a minimum of (11.5%tss).

Firmness, as gaged by touch or by a texture measuring device is another way of judging ripening. The fairness is related to the biochemical changes in three fractions of pectin in papayas, and is not a very accurate index of ripeness.

Green papayas can also be consumed as a salad or in soups, both of which are quite popular in south east asia. Huawaii, part of the usa, is the world's largest exporter of papayas with about 16,000 tones in 1999, valved at us$14.15million. Most of the out shipment are to the us mainland, with about 25% going to japan.

Brazil is the second largest exporter, with most papayas going to european countries such as germany, france and uk. Kenya; the ivory coast, and malaysia also ship papayas to european markets. There is no direct archeological evidence for the centre of origin of papaya, but the presence of natural populations in mexico and central america and the cultivation in mexico and bellies predating the spinach suggest a meso american origin (colunga, garcia marina and zizumbo, villareal 2004).

Papaya as a plant is used to make medicine.

Papaya is used for preventing and treating gastrointestinal tract disorders, intestinal parasite infections and as a theoretic and sedative. It is also used for nerve pains (neuralgia and elephantoid growth papaya contains a chemical papain, which is commonly used a meat tenderizer.

Papaya contains a chemical called papain.

Papain breaks proteins, carbohydrates and fats, that is why it works as a meat tenderizer, however, papain is changed by digestive juices, so there is some question about whether it could be effective as a medicine when taken by mouth. Papaya also contains a chemical called carpain. Carpain seems to be able to kill certain parasites and it might affect the central nervous system.

Cancer: it is said that consuming papaya is linked to a reduced risk of developing gallbladder and colorectal cancer.

Diabetes: early research suggest that consuming fermented papaya daily for 2 months can reduce blood sugar levels in people with diabetes.

Human papilloma virus infection: research suggest that consuming papaya is linked to a reduced risk of hpv infection.

- Papaya is likely safe for the most people when taking by mouth in a month commonly found in foods.
- Papaya is possibly safe when taking by mouth as medicine.
- Papaya is possibly unsafe when taking by mouth enlarge amount or when apply to the skin as papaya latex. Taking large amount of papaya by mouth could damage the esophagus which is the full tube in the throat. Applying papaya latest to the skin can cause severe irritation and allergic reactions in some people.

Pregnancy and breastfeeding: papaya is possibly unsafe when taking by mouth during pregnancy. Do not take papaya by mouth in medicinal amount if you are pregnant. There is some evidence that unprocessed papain, one of the chemicals

found in papaya might poison the fetus or cause birth defects. Not enough is known about the safety of papaya during breastfeeding. It is best to avoid taking it in amount higher than normal food amount. (de candolle cited by lassoudiére, 1968)

Disadvantages of papaya

- **Diabetes**: papaya that has been fermented can lower blood sugar people with diabetes who are taking medications to lower their blood sugar. Should pay attention to their blood sugar as adjustment to medications might be needed.
- **low blood sugar**: papaya that has been fermented can lower blood sugar. Taking this form of papaya might make blood sugar too low in people who already have low blood sugar.

  Papain allergy: papain allergy contains papain, if you are allergic to papain, avoid eating papaya or taking products that contain papaya.
- **Latex allergy**: if you are allergic to latex, there is a good chance you are also allergic to papaya, if you have a latex allergy avoid eating papaya or taking products that contains papaya. Papaya that has been fermented can lower blood sugar in theory this form of papaya might affect blood sugary during and after surgery.

  Surgery: if you are taking papaya you should stop 2 weeks before surgery. Papaya that has been fermented can lower blood sugar. This form of papaya might affect blood sugar during and after surgery.

Advantages of papaya

Papaya has a number of advantage that make it a popular and variable crop.

First it is a fast growing plant that can produce fruits within a year of planting. This makes it an attractive option for farmers who wants to get a quick return on their investment.

Additionally papaya is relatively easy to grow and is tolerance of a wide range of soil and climate conditions.

The fruits are also highly nutritious containing vitamins, minerals and antioxidants that are beneficial for human health. Papaya is an important source of income for farmers in many parts of the world. All of this advantages and disadvantages makes papaya a valuable crop.(de candolle cited by lassoudiere,1968)

History of the man who detect pawpaw and the botany of pawpaw

Carl linnaeus a swedish botanistan zoologist who lived in the century. He was the first person to classify the papaya plant using binomial nomenclature system giving it the scientific name "carica papaya".

Linnaeus was a prolific scientist who is credited with classifying and limit thousands of plants and animal species without his work we wouldn't have the modern system of classification we use today.

Carl linnaeus was not only a botanist but also a physician and a professor. He was the first to propose a hierarchical system for classifying plant and animals using binomial nomenclature (using two names genus and species). He traveled extensively collecting and classifying specimen around the world. Is work lady foundation for modern taxonomy the science of identifying and naming living things, in addition to his work on papaya he also named the potato, the tomato and many other familiar plants.

Carl linnaeus add a major influence on charles darwin who later developed the theory of evolution? Darwin's grandfather, erasmus darwin went on his famous voyage abroad the hms beagle, it took with him a copy of linnaeus "book system of nature" which is used to identify and axil of 3types;female flowers 3.5 cm long, large functional pistil, no stamens, ovoid shaped ovary; male flowers on long hanging panicles with 10 stamens in 2rows, gynoecium absent except for a pistillode ; hermaphrodite flowers larger than male,5 capellites ovary, occurrence depends on the season or age of the plants.

Fruit large cylindrical with fleshy orange pulp, hollow berry, thin yellowish skin when ripe, varied. Fruits formed from female flowers are oblong, spherical pear shaped, from

hermaphrodite flowers, long obovoid or pyriform. Seed numerous, small, black, round, covered with gelatinous aril. Small latex vessels extend throughout the tree and are particularly abundant in fruit that has reached full sized but has not yet begun to ripen.the generic name is given from the latin word "carica "meaning"edible fig"on account of the similarity of the leaves.

Biology of papaya

Carica papaya comes into fruiting within 5 months and live for 4 to 5 years usually male and female flowers are different trees but some flowers are bisexual pollinating agent including various insects such as larger bees (xylocarpa, trigona). Honey bees, long tongued sphime moths (sphingidae), humming _bird moths(macroglossia) and wind. With open uncontrolled pollination, a cultivar may lose its identity in a few generation.

Papaya can have a number of positive influences on the environment. First it is a useful source of shade for other crops such as coffee and cacao. Additionally the roots of the papaya plant help to improve soil health by increasing organic matter and adding nutrients to the soil. Beneficial insect such as bees which can help to pollinate the other crops and increase yields while the stem of papaya is used for young leaves flowers which can prepare boiling with water changes. Finally because it's a perennial plant it helps to reduce cost for farmers. In how papaya can be a variable part of a sustainable farming system.

Scientific classification

Kingdom: plantae
Clade: tracheophytes
Clade: angiosperms
Clade: eudicots
Clade: rosids
Order: brassicales
Family: caricaceae
Genus: carica

Species: c. Papaya

Binomial name: carica papaya

Papaya's are plants of tropical regions and for growth and fruit reproduction they need a warm climate they cannot live with low temperature. Carica papaya is an evergreen tree like herb, 2 to 10 m tall, usually unbranched, all those sometimes branched due to injury, containing white latex in all parts, stem cylindrical, 10 to 30 cm in diameter, hello with prominent leaves scars and spongy fibrous tissue. It has an extensive routing system.

List spirally arranged clustered near apex trunk, petiole up to 1 m long, hollow, finish or purplish green, lamina orbicular, 25 to 75 cm in diameter, palmate, deeply 7 loved, glabrous, prominently vained, lobes deeply and broadly toothed.

Flowers tiny, yellow ,funnel shaped, solitary or clustered in the leaf because they do not reliably transmit the parental character to all their progeny. Some of the better known cultivas are listed below with their average weight in kg parentheses

Countries million of tonnes

India	6.0
Domican republic	1.3
Brazil	1.2
Mexico	1.1
Indonesia	1.0
World	13.9

(morton, 1987).

1.2 MORPHOLOGY OF PAWPAW TREES

Papaya is normally a small unbranched soft wooded tree almost like a herb. The whole plant contains latex vessels.

Root: root system is extensive and dense but also rather shallow though the tap root is present.it is beneficial to human health. Prevents kidney stones the papaya tree roots

extract known for its anti-urolithiatic activity. Relieves toothache papaya tree root is an excellent home remedy to prevent toothache due to its anti-inflammatory capability .the papaya plant has a taproot system. It means that it has a large primary root where the secondary and tertiary feeder roots come from. It does not go too far into the soil and prefers well drained and warm soil in order to flourish. Due to its shallow roots and hollow stems it could easily topple over and damaged by inclement weather.

Advantage of root

Papaya root has been used widely in folk medicine for many ailments: the juice for warts, corns, cancers, tumors, and thickened skin; the roots or their extracts for cancers of the uterus, syphilis, the tropical infection, hemorrhoids, and to remove mineral concretions in the urine.

Stem: the stem is hollow with soft fleshy tissue covered with smooth grey bark marked externally by numerous large orbicular leaf scars. Leaves: a crown of large leaves are found in a spiral manner. A papaya plant has a single, erect, tree-like herbaceous stem, with a crown of large, palmately and deeply lobed leaves. The main stem is cylindrical and hollow, with prominent leaf scars and spongy-fibrous tissue. Leaves are arranged spirally, with petioles extending horizontally up to 1m long.

Advantage of stem

It is used as fertilizer and even materials for food! Papaya stem is quite good for the health of the soil.

Leaves: are very large up to 75 cm across and deeply divided into about 7 palmate lobes, each lobe again being innately lobed. Leaves dark green often drooping from the ends of hollow petioles even up to 1m long. Leaves are eventually shed leaving a large scar on the stem.

Advantage of leaves

Papaya leaves are commonly taken in extract, tea or juice form and have been found to treat symptoms associated with dengue fever. Other common uses include: reducing inflammation, improving blood sugar control, supporting skin and hair health, and

preventing cancer.

Sex in papaya: papaya are usually dioecious though hermophrodite plants do occur as in the case of varieties like solo.

Flower types

- Type i: typical female flower apparently polypetalous, obscurely gamopetalous at the base. No external trace of stamens. Pistil is pentacarpellary syncarpous showing 4 shallow lobes
- Type ii: this is the pentandria flower so called due to the presence of 5 stamens alternating with the petals. Petals are adnate with pistil. Pistil is pentacarpellary syncarpous as in but deeply forward, stamens lying in the grooves or furrows between the lobes.
- type iii: intermediate
- Type iv: typical male flower
  The corolla tube carries in its throat ten stamens, arranged in two whorls.

Male flowers: found on long pendulous panicles. Individual flowers are small, 2-3 cm long, sessile. Calyx: minute calyx, gamosepalous.

Corolla: a long corolla tube divided about 1/3 of the way from its mouth into 5 pointed lobes, gamopetalous. The pale yellow corolla is often fragrant.

Androcieum: at the mouth of the corolla tube, ten epipetalous stamens are arranged in two rows of five each. One row with longer filaments alternating with petal lobes, the other with shorter filaments lying opposite to the lobes. Filaments light yellow, anthers, oblong and pistillode is also present.

Female flowers: solitary, much larger than males, around 4-5 cm long and are more or less sessile on the main axis. They also occur as few flowered, comes in the axils of the leaves.

Rachis short and thick. Calyx tube is short with five lobes, yellowish green. Corolla has 5 waxy yellow petals united at the base but free for most of their length and with

twisted pointed tips. Yellow linear lanceolate, somewhat oblique with a slightly narrowed base and an obtuse or rounded apex. Gynoecium-ovary large, superior, sessile, globular and green with 5 much branched sessile stigmas.

Ovary has five united carpels with a single locule which contains many ovules on parietal placentation.

Hermaphrodite flowers: two kinds of hermophrodite flowers, one with long corolla type with 10 stamens and another with a short corolla and only 5 functional stamens.

Blossom biology: anthesis is between 6.30 - 8.30 am. Anther dehiscence immediately follows the anthesis.

Fruit: it is a large fleshy hollow berry elongated or globular. In ripe fruit the smooth skin (epicarp) is yellow or bright orange, the thick orange, yellow or red flesh encloses a centre cavity containing many seeds which are embeded in a mass of musilage.

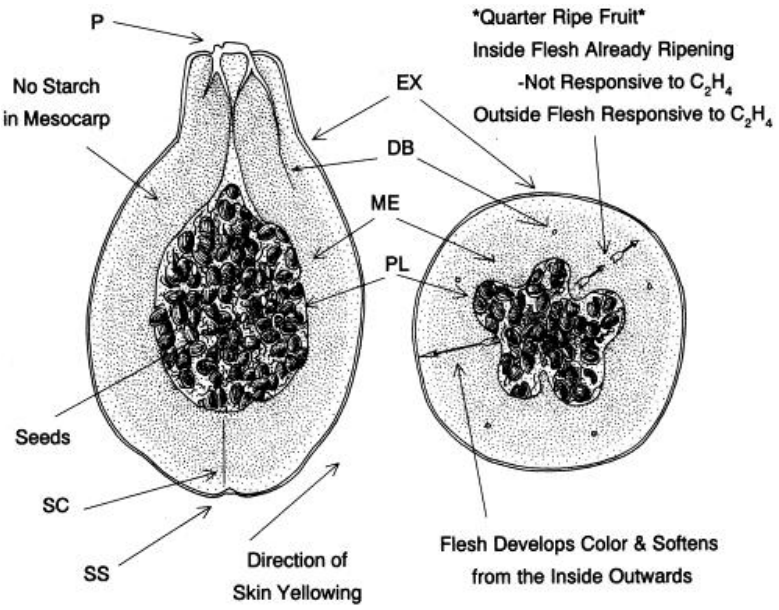
Seed: seeds are small, rounded, dark green or brown or black. The seeds are covered with a gelatinous material and attached to the flesh by a gelatinous stalk.

Species and cultivars

Papaya belongs to the family caricacea,a small ,somewhat anomalous family with four general and 31 species of which three are in tropical and subtropical america and one in did the general and the number of included species are carica 22, facratia 6,farilla 1, and cycliomorpha 2,the edible fruits are found only in carica,of which c papaya, the common papaya is extensively grown other species include; c. Chilensis, c. Goudotiana, c .monica,c. Pubescus, c candamarcensius, known as mountain papaya grows to a height of about 2.5 m tolerate low temperature and tries well at an elevation between 1,500 and 2,000 m. C .monoica grows in amazon basin. A large number of papaya cultivars are grown in different parts of the tropical and subtropical regions however none of these are true cultivars classifying the many new species is encountered on his journey. It's arranging to think that the work of one scientist add such a lasting impact on another scientist who changed her understanding about the

natural world (chan and paull, 2008).

Diagram of the morphology of papaya



Ex=external

Pl= placenta

Me=mesocarp

1.2 THE PHYSIOLOGY PAPAYA

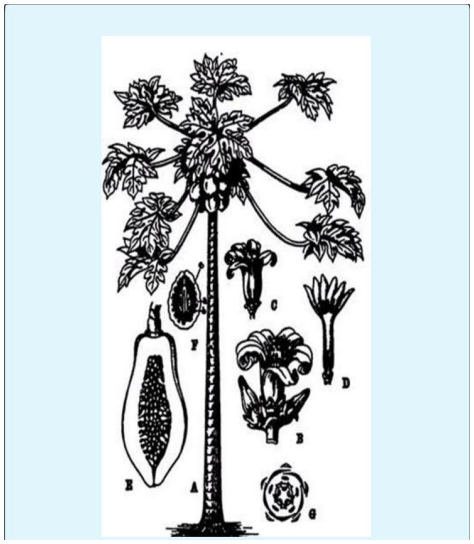
Papaya plant has a single, erect, tree-like herbaceous stem, with a crown of large, palmately and deeply lobed leaves. The main stem is cylindrical and hollow, with prominent leaf scars and spongy-fibrous tissue. Leaves are arranged spirally, with petioles extending horizontally up to 1m long.

Papaya leaves are commonly taken in extract, tea or juice form and have been found to treat symptoms associated with dengue fever. Other common uses include: reducing inflammation, improving blood sugar control, supporting skin and hair health, and preventing cancer. The papaya plant has a taproot system. It means that it has a large primary root where the secondary and tertiary feeder roots come from. It does not go too far into the soil and prefers well drained and warm soil in order to flourish.

The leaves of pawpaw leaf consist of papain, cystatin, chymopapain, tocopherol, phenolic acids, cyanogenic glucosides, glucosinolates, and vitamin c as main phytochemicals. Fruit with its seeds and leaves are excellent sources of vitamins, minerals, fibres, and antioxidants. It contains an abundant amount of vitamin a, vitamin b, vitamin c, vitamin e, vitamin k, and a potent antioxidant. Papaya leaves are rich in minerals such as phosphorus, iron, potassium, calcium, and magnesium. Papaya seeds contain fatty acids and papaya oil. A whole papaya tree is healthy from its fruit to the leaves.

The entire tree has medicinal properties that make papaya a great option to include in your diet. (dubey et al., 2015;

Diagram of the physiology of papaya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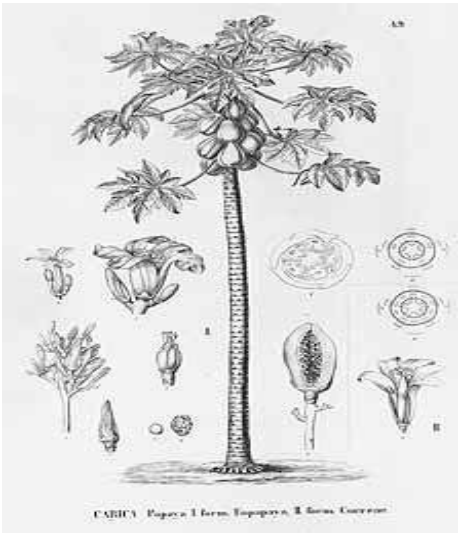


1.4 LIFE CYCLE OF PAWPAW TREES

Papayas are usually grown from seed. Their development is rapid, with fruit being produced before the end of the first year. Under favourable conditions, a plant may live five years or more.

The papaya ring spot virus nearly wiped out papaya crops around the world, first hitting hawaiian plantations in the 1940s and soon spreading.

A genetically modified (gmo) variety named the rainbow papaya was developed in the early 2000s with resistance to the virus. It was one of the first gmo fruits in commercial production, and the majority of exported papayas are now gmo crops turns yellow and drops to the ground after the papaya fruit fly infestation.

The two-spotted spider mite is a 0.5-mm-long brown or orange-red or a green, greenish-yellow translucent oval pest. They all have needle-like piercing-sucking mouthparts and feed by piercing the plant tissue with their mouthparts, usually on the underside of the plant. The spider mites spin fine threads of webbing on the host plant, and when they remove the sap, the mesophyll tissue collapses, and a small chlorotic spot forms at the feeding sites. The leaves of the papaya fruit turn yellow, gray, or bronze. If the spider mites are not controlled, they can cause the death of the fruit.

The papaya whitefly lays yellow, oval eggs that appear dusted on the undersides of the leaves. They eat papaya leaves, therefore damaging the fruit. There, the eggs developed into flies in three stages called instars. The first instar has well-developed legs and is the only mobile immature life stage. The crawlers insert their mouthparts in the lower surfaces of the leaf when they find it suitable and usually do not move again in this stage. The next instars are flattened, oval, and scale-like. In the final stage, the pupal whiteflies are more convex, with large, conspicuously red eyes.

Papayas are one of the most common hosts for fruit flies like, a. Suspensa, which lay their eggs in overripe or spoiled papayas. The larvae of these flies then consume the fruit to gain nutrients until they can proceed into the pupal stage. This parasitism has led to extensive economic costs for nations in central america. Fruit best in areas where

temperatures remain warm to hot (70°f–90°f; 21–32°c). Root growth is best if soil temperatures remain above 60°f (15.5°c) and slows or declines below that temperature. Papaya plants are not tolerant of freezing temperatures and are damaged or killed below 31°f (-0.6°c). High temperatures above 90°f (32°c) may cause flowers to drop, and low temperatures below 59°f (15°c) may inhibit flowering or result in misshapen fruit. Well distributed rainfall is required for best plant growth and fruit production. Any non-favorable weather conditions may lead to a reduction of plant growth and fruit production. Papaya plants are susceptible to wind damage and will not establish or grow well in continuously windy areas. Papaya plants with a large amount of developing fruit are very susceptible to toppling due to high winds. Therefore, plants should be planted in wind-protected areas of the landscape.

Propagation

Papaya is mainly propagated by seed, but tissue culture and rooted cuttings are practiced to a limited extent. The sex of the plant is determined by its parents.

To propagate by seed, remove the seeds from a ripe fruit and place in a colander. Press the seeds against the side of the colander to break the sarcotesta (sac) surrounding the seed (this sac inhibits seed germination). Rinse seeds thoroughly and place on a paper towel to dry (not in the sunlight). Once seeds are dry they may be placed in a plastic bag and stored in the refrigerator for several years for later use.

In general, propagating and planting 2 to 3 plants is best to insure fruit production from at least 1 plant. This is because depending upon the source of seeds, they may produce female, bisexual, or male plants. Plant 2 to 4 seeds in each 1-gallon (3.8-liter) container in a clean, sterile artificial media. Water thoroughly, and place the containers in a warm sunny location. Germination may take 2 to 3 weeks. Once seedlings have emerged, select the most vigorous one and snip the others off at the soil line with clippers. Fertilize the seedlings with a dilute complete fertilizer solution every 10 to 14 days. Once plants have reached 6 to 12 inches (15–30 cm) tall, plant in a sunny location.

Production (crop yields)

Well-cared-for plants may begin to produce flowers 4 months after planting and fruit 7 to 11 months after planting. The amount of fruit produced by a papaya plant varies with the general climate, weather conditions during the year, and plant care. Yields vary from 60 to 80 lbs per tree over a 12-month period.

Spacing and pruning

Papaya plants should be planted in full sun and at least 7 to 10 ft (2.1–3.1 m) away from other plants, buildings, and power lines. In general, planting 2 to 3 papaya plants 7 to 12 ft (2.1–3.7 m) away from each other will insure that at least one will be fruitful, and it will also facilitate fertilizing and watering.

Papaya plants are not pruned because their main growing point is terminal, and branched trees may not produce as well. However, as papaya plants mature and/or if they are exposed to environmental conditions that inhibit growth or if the main growing point is damage or killed, side shoots may grow. Selecting 1 or 2 of the most vigorous shoots and removing the others will facilitate growth and fruiting of the remaining shoots. Tying these side shoots to a stake will reduce the chance they may break off due to a heavy fruit load or high winds.

Removal of dead leaves is a good practice and results in less scarring of the fruit from the base of the leaf petiole. It also reduces disease and insect problems.

Soils

Papaya plants grow and fruit well in many well drained soil types. Plants will do well with care in sands, loams, and rocky soils with a ph of 4.5 to 8.0.

Advantage of soil

Papaya can grow on a variety of soils, yet the best soil is deep, rich, alluvial soils on the banks and deltas of rivers in india.

Planting papaya plants

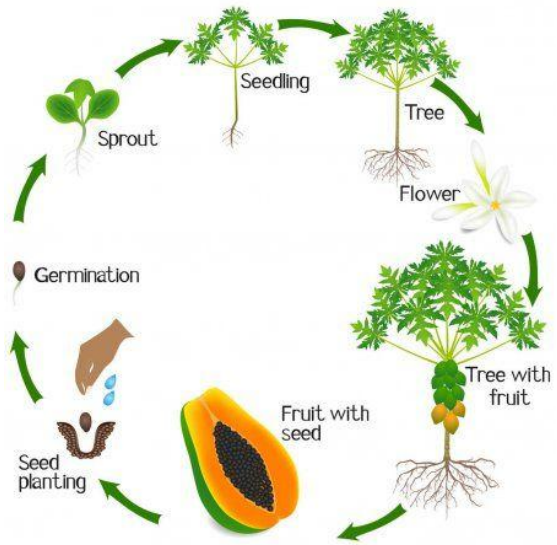
Properly planting a papaya tree is one of the most important steps in successfully establishing and growing a strong, productive tree. Some nurseries offer papaya plants

and the first step is to choose a healthy nursery tree.

Commonly, nursery papaya trees are grown in 1- to 3-gallon containers and trees stand 6 inches to 2 ft tall. Large trees in smaller containers should be avoided as the root system may be "root bound."

This means all the available space in the container has been filled with roots to the point that the tap root is growing along the edge of the container in a circular fashion. Root bound root systems may not grow properly once planted in the ground. Inspect the tree for insect pests and diseases and inspect the trunk of the tree for wounds and constrictions. Select a healthy tree and water it regularly in preparation for planting in the ground. (perez et al.1980)

Diagram of the life cycle of papaya



CHAPTER TWO

2.1 ECONOMIC IMPORTANCE OF PAPAYA

Pawpaw is a potential crop species, but has not yet been developed. It has potential over a broad climatic range and the fruits have nutritional value. Additionally, the wholesale and nursery market for plants is great; the pawpaw peduncle borer is the only known pest, and it is relatively rare.

The larvae of this moth bore into the flowers and prevent successful fruit set, interesting facts

Pawpaw seeds, barks, and leaves can be used to make home remedies for alternative treatments that can help reduce fever, vomiting, inflammation and vomiting.

Every third thursday september it is national pawpaw day where people celebrate the fruit by going to farms or markets to buy and taste.

Pawpaw is the state fruit of ohio11, and there is an annual pawpaw festival held in albany, ohio by the ohio pawpaw growers association that is held on national pawpaw day. An american folk song describes picking the fruit. Of the estimated safe and adequate daily dietary intake, average value for adults. E- percentage of the estimated amino acid requirement for a 60 kg (130 lb) adult.

Number in bold face represents highest value for each component. Practically, every part of carica papaya is of economic value. Its uses ranges from domestic to industrial uses in short, the benefits of pawpaw are enormous both the natural fruit and natural pawpaw supplements. The unripe papaya fruit has a high latex content that may make it unsuitable for raw consumption although raw shredded green papaya is often used in asia for salads preparation, the unripe green pawpaw if peeled, seeded and chocked is used in a variety of savoury asian dishes including pickles and chutneys and for canning in sugar syrup .

The green fruit leaves and flowers can also be used as a cooked vegetable .the tiv ethnic group from benue state nigeria processes the unripe fruit into thin dry sheds

and uses them as vegetables in fruit preparation especially during the dry season when regular vegetables become scarce, soups have been known add variety to food such as improve eye appeal taste, flavour and aroma thereby creating diet diversity,(daagema et al.; ejnfs, 2012).

Papaya have a peppery taste and can be dried in a dehydrator then grounded in a mortar and pestle and used as pepper. The seeds are also medically important in the treatment of sickle cell condition and poisoning related disorder. Chewing the seeds of the ripe pawpaw fruit also helps to clear nasal congestion.

The seeds are used in some countries as a vermifuge, counter-irritant and abortifacient. Carica papaya is the most important species within the caricaceae, being cultivated widely for domestic consumption for its fresh fruit which could be eaten raw, in dessert and fruit salads and are used industrially for making other edible products such as soft drinks, juice, jam candies, wines, ice cream flavouring and crystallized fruit canned in syrup drinks.

The unripe fruits are cooked as a substitute for mango and for apple sauce. (kolawole et al);used ripe pawpaw fruits in the preparation of ogi (a nigerian traditional infant complementary food) where it was co-fermented with sorghum to produce sorghum-ogi.

Pawpaw leaves and fruit produces several proteins and alkaloids with a lot of important pharmaceutical and other industrial applications. Due to its antioxidant and fiber contents pawpaw is used in the treatments of digestion and other ailments such as chronic indigestion, overweight, obesity, arteriosclerosis, fibroid, tuberculosis, malaria, high blood pressure(hbp) and weakening of the heart. Pawpaw stems, leaves and unripe fruits contains milky latex that is harvested by scarifying the green skin to induce latex flow and the latex collated is allowed to dry before taken for industrial processing.

Papain a major component of the milky latex have various industrial uses in the food, beverage and pharmaceutical industries these includes its use in the production

of chewing gums, chill-proofing beer, meat tenderizers as such traditionally meat becomes tenderized by wrapping it in pawpaw leaves for some hours before cooking. Papain also aids in general digestion with emphasis on proteins since it is a proteolytic enzyme.

medically papain has been used to produce drugs useful in the treatment of less serious digestive disorders like bloating and other conditions such as arthritis, intestinal worms, chronic indigestion and treatment of gangrenous wounds.

2.1**phytochemicals of papaya**

Phytochemicals in papain when extracted and used invitro may increase immune system strength and may also promote the release of natural chemicals that attack tumor cell there by making it useful in cancer prevention revention and treatment. In the tanning industry papain is used for bating hides, for degumming silk and wool softening in the textile industry while in the cosmetics industry it is used for the production of skin and hair care products such as creams, soaps and shampoos.

Countries with the highest papain imports globally are united states, japan, united kingdom, belgium and france with united states as the chief importer. While major exporters are (d. R. Congo, tanzania, uganda and sri-lanka).

The fresh unripe green pawpaw fruits and pawpaw leaves tea have antiseptic properties where it cleans the intestines from bacteria allowing for proper absorption of vitamin and minerals, especially vitamin b12,while the brown dried pawpaw leaves are best served as a blood tonic and purifier. Over all the leaf tea or extract has a reputation as a tumor destroying agent .

Some constituents of carica papaya exhibit an alkaline ph thus when combined with borax or potassium carbonate and they have showed good results in treatment of warts, corns, sinuses, eczema, coetaneous tuberculosis and other hardness of the skin. Green fruits of papaya are used to stimulate reproductive organs there by boosting male fertility. It contains an enzyme called arginine which is known in the medically community to boost blood flow around the man-hood where it boosts nitric

acid in the body to relax the muscles surrounding the blood vessels that supply the man-hood with blood. These blood vessels then dilate and increase blood flow, a more concentrated form of arginine is used to treat erectile dysfunction. Both papain and chymopapain can help lower inflammation and improve healing from burns.

Carpain: which is also found in pawpaw is an alkaloid which slows heart rate in humans and thus reduces blood pressure its action is similar to digitalis the drug prescribed for heart patients, it is also reported to be able to kill worms and amoebas. Papaya has an abundance of cancer fighting lycopene which is a key intermediate in the biosynthesis of many important carotenoids, such as beta-carotene and xanthophylls and thus another useful compound not readily found in the plant kingdom but found in pawpaw is fibrin.

fibrin reduces the risk of blood clots and improves the quality of blood cells, optimizing the ability of blood to flow through the circulatory system and also important in stroke prevention.

Pawpaw fruit leaves and peels are also useful in making as livestock and fish feeds production. A large portion of the annual harvest of pawpaw fruits in the tropics is consumed locally, as it is difficult to transport them over long distances. Pawpaw fruit storage requires special conditions which are based on temperature control thus extending the shelf life of fresh fruits but sometimes the temperature control may in turn expose them to microbial spoilage and deterioration of fruits in the tropics is consumed locally, as it is difficult to transport them over long distances.

Pawpaw fruit storage requires special conditions which are based on temperature control thus extending the shelf life of fresh fruits but sometimes the temperature control may in turn exposed them to microbial spoilage deterioration from water loss, bleaching, surface burning, shriveling, excessive softening and desiccation thus leading to loss of quality (softening, flaccidity, limpness, loss of crispness and juiciness) and nutritional quality. Inadequate storage of fresh pawpaw fruits results in fading of colour by oxidation and enzymatic activity which affects the commercial value of

fresh fruits when stored at room temperature. Studies have also shown that chilling temperatures are not appropriate for many tropical crops such as pawpaw due to their susceptibility to chilling damage resulting in pitting, discoloration, poor sensory appeal and even loss of some nutrients. However fresh pawpaw fruits are exported by air and in cold storage by sea from hawaii to the united states, but only a little of the fresh fruits reach other temperature countries.

Pawpaw fruits are now being canned and with this the market will probably increase. Currently india has become the leading producer of pawpaw fruits in the world, with production of about 5.5 millions tons per annum .

The production in nigeria is quite high but still does not meet even domestic demands in the big cities a most of the harvest is lost to microbial decay, these microorganisms under the influence of favorable environmental factors.

Plant part medicinal uses

Ripe fruits: sinuses, chronic forms of skin indurations in caribe, philippines; chronic skin ulcers in jamaica stomachic, digestive, diuretic, expectorant, sedative and tonic, bleeding piles and dyspepsia in india.

Green fruits: malaria, hypertension, diabetes mellitus, hypercholesterolemia, jaundice intestinal helminthiasis in nigeria.

Latex: dermatitis and psoriasis in africa, asia, europe. Papaya latex used is from the flower of male papaya with main compositions consisting of proteolytic enzymes, papain and chemopapain, glutamine cyclotransferase, chymopapain a, b and c, peptidase a and b and lysozymes. As the auxiliary precursor, aluminum oxide particle is used. For 4 h.

Leaves: heart tonic, febrifuge, vermifuge, colic, dengue fever, beriberi, abortion, asthma india, stomach troubles, cancer in australia.

Flowers: jaundice, cough, hoarseness, bronchitis, laryngitis, and tracheitis in asia. These flowers were used to control a number of diseases by our ancestors. After consuming the flowers, a significant change in insulin levels was observed in diabetic patients. These flowers can stabilize high blood pressure; prevent heart disease and many other diseases

Seeds: anti-fertility. Antimicrobial, fungicidal, carminative, counter irritant. Improved digestion. Papaya seeds contain an enzyme called papain that aids in digestion, better liver health, rich in antioxidants & anti-inflammatory properties, boosted immune system, weight loss aid, anti-parasitic properties, anti-cancer potential, improved heart health.

Roots and bark: digestive, tonic, abortifacient in australia, sore teeth in india, syphilis in africa (almora et al.2004).

Allergies, side effects of papaya

Papaya extract is frequently used as an important ingredient in the production of hair and skin care products; however it should be used in small amounts to avoid irritation and allergic reaction in some people. The latex concentration of unripe pawpaw fruits is speculated to cause uterine contractions which can induce abortion or may lead to a miscarriage hence it is advised to avoid eating plenty of unripe pawpaw fruits salad if pregnant.

Reported that papaya seed extracts in large doses had a contraceptive effect on rats and monkeys, but in small doses have no effect on the unborn animals while also reported that green pawpaw and pawpaw seeds extract have shown contraceptive effects in adult male langur monkeys and human adults.

excessive consumption of ripe papaya can cause carotenemia a harmless condition associated with the yellowing of soles of the feet and palms.

However, a very large dose would need to be consumed for this condition to occur as ripe pawpaw fruits contains about 6% of the level of beta carotene found in carrots the most common cause of carotenemia. Papaya latex is an irritant to human skin and if ingested it can causes severe gastritis. Some people are allergic to the fruit as well as the enzyme papain because of its negative properties however all parts of the plant contain latex and so care must be taken when harvesting pawpaw fruits as fresh latex is a skin irritant and can cause blisters and also conjunctivitis. Pawpaw flower pollen and papain can also induce respiratory discomfort in sensitive individuals.

Symptoms of pawpaw allergy includes dizziness, trouble breathing, itching, rashes and swelling and in some people stomach upset or nausea may also occur therefore it is not advised to consume pawpaw if you have recently had surgery or are on a blood thinner (daagema et al.; ejnfs, 12(3): 52-66, 2020).

2.2 **CLASSIFICATION OF PAWPAW LEAF**

(carica papaya l.) Belongs to the family caricaceae and is the most economically important species of the genus carica. Papaya is native to tropical america, and seeds of papaya were taken from the caribbean, to malacca or philippines, then to india. Subsequently, papaya was introduced as a plantation crop to australia, hawaii, (sri lanka).and other tropical and subtropical countries in the world.(hemambara&yogesh,2014).

2.3 CHARACTERISTICS OF PAWPAW

Papaya is a melon-like fruit which varies greatly in shape and size, the skin of unripe fruit is smooth, green and thin and changes to deep orange or yellow when ripe. The flesh varies from 2.5 to 5.0cm in thickness and yellow to orange in colour.

Papaya fruits are very susceptible to invasion by certain pathogenic fungi and bacteria due to high moisture and nutrients. The development of fungal infection during the postharvest phase can depend upon the physiological age of the fruit, mechanical injuries, and storage conditions. Anthracnose is a major cause for the postharvest loss of papaya particularly when attempting to extend the storage life.

The causal organism colletotrichum gloeosporioides is of common occurrence in home garden environments. Symptoms of the disease are known to be particularly destructive once ripening has been initiated. Incidence of the disease limits the storage life of the commodity in both local and export markets during the ripening process, storage, and transportation.(i.g.n. Hewajulige, s.a. Dhekney).

2.4 HABITAT OF PAWPAW

Native to tropical america, papaya originates from southern mexico and central america. Papaya is also considered native to southern florida, introduced by predecessors of the calusa no later than ad 300.spaniards introduced papaya to the old world in the 16th century. Papaya cultivation is now nearly pantropical, spanning hawaii, central africa, india, and australia. Wild populations of papaya are generally confined to naturally disturbed tropical forests.

Papaya is found in abundance on everglades hammocks following major hurricanes, but is otherwise infrequent. In the rain forests of southern mexico, papaya thrives and reproduces quickly in canopy gaps while dying off in the mature closed-canopy forests.

Papaya releases a latex fluid when not ripe, possibly causing irritation and an allergic reaction in some people. Because the enzyme papain acts as an allergen in sensitive individuals,meat that has bee tenderized with it may induce an allergic reaction.(sagar et al., 2012).

CHAPTER THREE

METHODOLOGY

3.1 EXPERIMENTAL SITE

The experimental was carried out at a Microbiology laboratory, Department of Science Laboratory Technology Kwara State Polytechnic, Ilorin.

3.2 COLLECTION OF PLANT MATERIALS

Leaves were collected from the Papaya leaf plant at Kwara State Polytechnic, Ilorin no Nigeria. It was ensured that the plant was healthy and uninfected. The leaves were washed under running tap water to climate dust and other foreign particles and to clean the leaves throughly. It was dried under shade at room temperature and grinded into powder. The powdered samples were sealed in a polythene bags until the time of extraction.

3.3 PREPARATION OF LEAF EXTRACTS

Two solvents were used in the preparation of leaf extracts (methanol and distilled water).

Two amber bottles were used with coach containing 20grams of the grinded plants material, 200ml of each solvents was added. It was shaken and left to soak for 5days, during the period of 5days it was shaken twice daily.

Thereafter, it was filtered using Whatman No. I filter paper. The solvents was placed in a water bath and leave to evaporate to make the final volume one-fifth of the original volume. It was stored in airtight bottles for further studies (Sahira and Cathrine, 2015)

3.4 TEST MICRO-ORGANISMS

Three pathogenic bacteria, *viz*., *staphylococcus aureus, salmonella typhi,* and *klebsiella pneumonia* were used during the present study and were obtained from Micro biology laboratory of the department of Microbiology at Kwara State Polytechnic, Ilorin, the cultures were sub-cultured and maintained on nutrients agar slants and stored at 4^{o}C.

3.5 INOCULUM PREPARATION

For standardizing the inoculums, the test organisms were sub-culture on nutrients agar plates and incubated overnight, colony material from this overnight culture of the test organisms was taken with the aid of sterilized wire loop and transferred into a tube containing 5.oml of normal saline until the turbidity was matched with 0.5 McFarland standards (McFarland, 1907)

3.6 PHYTOCHEMICALS ANALYSIS

Phytochemical test were done to find the presence of the active chemical constituents such as Alkaloids, Glycoside, Terpenoids, Flavonoids, Phenol, Saponins and Tannins by the following proceedure.

3.6.1 Test for alkaloids (Meyer's test)

The extracts of water leaf was evaporated to dryness and the residue was heated on a boiling water bath with 2%$_{o}$ Hydrochloric acid. After cooling, the mixture was filtered and treated with a few drops of Meyer's reagent12. The samples were then observed for the presence of turbidity or yellow precipitation (Trease and Evan, 2009).

3.6.2 Test for glycoside

Tp the solution of the extract in Glacial acetic acid, few drops of Ferric chloride and concentrated sulphure acid are added, and reddish brown collouration was observed at the junction of two layers and the bluish green colour in the upper layer (Chessbrough, 2000,).

3.6.3 Test for terpenoids

4 mg of extract was treated with 0.5 ml of acetic anhydride and 0.5 ml of chlorofone.

Then concentrated solution of sulphuric acid was added slowly and red violet colour was observed for terpenoids (chessbrough, 2000)

3.6.4 Test for flavonoid

4mg of extract solution was treated with 1.5 ml of $50^0/_0$ methanol solution. The solution was warmed and metal magnesium was adedd and red colour was observed for flavonoids orange colour for flavonoids (chessbrough, 2000,)

3.6.5 Test for reducing sugars

To 0.5 ml of extract solution, 1 ml of water and 5-8 drops of Fehling's solution was added at hot and observed for brick red percipitate (Trease and Evan, 2009)

3.6.6 Test for phenolic compounds (ferric chloride Test)

300 mg of extracts was diluted in 5 ml of distilled water and filtered to the filtrate $5^0/_0$ Ferric chloride was added and observed for dark green colour formation (Trease and Evan, 2009)

3.6.7 Test for tannins

To 0.5 ml of extracts solution, 1 ml of water and 1-2 drops of ferric chloride solution was added Blue colour was observed for garlic tannins (Trease and Evan, 2009).

3.6.8 Test for saponins

2g of the powered sample was boiled in 20 ml of distilled water in a water bath 10ml of the filterable was mixed with 5 ml of distilled water shaken vigorously

for a stable persistent broth. The following was mixed 3 drops of olive oil and shaken vigorously and then observed for the formation of emulsion (Trease and Evan, 2009).

3.7 PREPARATION OF EXTRACTS IMPREGNATED PAPER DISCS

A paper puncher was used to punched out 100 Discs of 6mm diameter from Whatman no. 1 filter paper, the discs were then sterilized by autoclaving at 121^{o}C for 15 minutes and then allowed to cool. Ten bijou bottles were used, three (3) for the aqueous extracts another three (3) for Methanolic extracts the remaining two is for control both positive and negative.

0.1gram of extracts was dissolved in 1ml of DSMO (Dimethyl suffoxide) which is equivalent to 100,000ug/ml to which 100 discs were added and shaken to equilibrium so that, each discs absorbed 0.001g equivalent to 1000ug/discs.

0.5g of extracts was dissolved in 1ml of DMSO which is equivalents to 50,000ug/ml to which 100 disc were added with the help of shaking at equilibrium each disc absorted 0.0005g equivalents to 500ug/disc.

0.5g of extracts was dissolved in 1ml of DMSO which is equivalents to 50,000ug/ml to which 100 disc were added with the help of shaking at equilibrium each disc absorted 0.0005g equivalents to 500ug/disc.

0.5g of extracts was dissolved in 1ml of DMSO which is equivalents to 12.500ug/ml to which 100 disc were added with the help of shaking at equilibrium,, each disc absorted 0.0012g which is equivalents to 125ug/ml. these were stored and kept for further use.

The positive control used was Ampiclox and it was dissolved with 1ml of DMSO after which 100 discs was added. The negative control was used 1ml of DMSO (Bonev *et al.,* 2008)

3.8 DETERMINATION OF ANTIBACTERIA ACTIVITY

The antibacterial activity of the leaf extracts was determined using agar disc diffusion method; the known procedure by Kirby-Bauer was adopted. Four (4) nutrients agar plate was used for each bacteria inoculums. Two (2) for the aqueous extracts: one of the it was divided into four parts (each for different concentration of the extracts) the others were divided into two (one side for the positive control and the other for negative control). The same was done for the Methanolic extracts. Nutrients agar was inoculated with the given microorganisms by spreading the bacteria inoculums on the media by the use of sterile swap stick. The extracts impregnated paper discs containing different concentration of the neem extracts (100,000ug, 50,000ug, 25,000ug, and 12,5000ug) was picked with sterile forceps, it was placed firmly on the surface

of inoculated plates, two control were used these are: the positives control disc of Ampiclox (500mg) and a negative control disc (with DMSO). Both disc were then allowed for pre-difussion time of 15minutes and they were then inverted and incubated at 37^{o}C for 24hours and the diameter of the zone of inhibition formed was measured after incubation with the aid of meter rule to determine the effectiveness of the extracts on the test organisms (Bonev *et al., 2008*)

CHAPTER FOUR
RESULT AND DISCUSSION

4.1 PHYSICAL APPERANCE OF THE EXTRACTS RECOVERED.

Table 1: physical properties of leaf extracts of water leaf extracts

Extracts	Wight of Sample Used	Volume of solvent used	Weight of extracts recovered	Colour	Odour	Texture
Aqueous	10g	100ml	3.19g	Dark	pungent	Creamy
Methanolic	10g	100ml	2.6g	Greenish Black	Pungent	Hard

The result showed the weight of plants sample used, the volume of the solvent, the volume of extracts recovered, the colour, odour and texture.

4.2 PHYTOCHEMICAL SCREENING

The result for phytochemical screening has shown in Table 2 shows that alkaloids, saponins, flavonoids, tannins, and phenol are present in both methanolic and aqueous extracts glycoside is present in the Methanolic extracts but absent in the Aqueous extract while terpenoids is absent in both extract.

Table 2: Qualitatives phytochemical analysis of Papaya Leaf.

Extracts/phytochemical	Methanol	Aqueous
Alkaloids	+	+
Flavonoids	-	+
Glycosides	_	_
Phenol	+	+
Saponins	_	+
Tannins	+	+
Terpenoids	-	+

4.3 ANTIBACTERIAL ACTIVITY OF METHANOLIC EXTRACTS OF PAPAYA LEAF

Table 3: Sensitivity test of Methanolic extracts against the test organism (zone of inhibition)

Isolates	1000ug/dis	500ug/dis	250ug/dis	125ug/dis	
Ampeol	D.M.S.				
	C	c	c	c	x
O					
5mg/dis					
Staphylococcus 30		17	18	03	00
Yaureus 00		02	01	00	00
Klebsiella 08		10	01	02	00
Pneumonia 05		01	00	01	00
Salmonella 12		14	13	07	00
Typhi 00		02	01	00	00

Based on the experiment carried out on the Methanolic extracts of Papaya leaf against bacteria inoculum was observed that there was high inhibitory activity on *staphylococcus aureus* 27mm at concentration of 1,000ug/disc, 9mm at 500ug.disc, 8mm at 250ug/disc, 7mm at 125ug/disc. The positive control was 25mm and the negative control is 0. The act extracts is higher than the positive control.

For klebsiella pneumonia the highest is 8mm at the concentration of 1000ug/disc, 8mm at 500ug/disc, 0 at 250ug/disc and 0 at 125ug/disc. The negative is 0 and the positive 40mm, the positive is higher than the extracts.

For salmonella typhi the highest is at 1000ug/disc and 500ug/disc with 10mm, followed by 5mm at 250ug/disc. There was no activity at 125ug/disc. The negative is 0 while the positive is 32mm.

4.4 ANTIBACTERIAL ACTIVITY OF AQEOUS EXTRACT OF PAPAYA LEAF

Table 4: sensitivity test of aqueous extract against the test organism (zone of inhibition)

Isolates	1000ug/disc	500ug/disc	250/disc	125ug/disc	
	Ampiclo 5mg/disc	D.M.S.O			V
Staphylococcus Us aureus	1000	08	06	05	25
Klebsiella Pneumonia	1800	10	00	00	45
Salmonella Typhi	1000	06	00	00	25

Interpretation

Based on the experiment carried out on the aqueous extract of Papaya leaf against bacteria inoculums 18mm was observed that there was high inhibitory activity on *klebsiella*

pneumonia 18mm at the concentration of 1000ug/disc, 10mm at 500ug/disc, 0 at 250ug/disc and 0 at 125ug/disc. The negative 0 is the positive 45mm.the positive is higher than the extract.

For *salmonella typhi* the highest inhibition is at 1000ug/disc with 10mm and 6mm at 500uh/disc. There was no activity at 250ug/disc and 125ug/disc, the negative is 0 while the positive is 25mm.

4.5 DISCUSION

The result of phytochemicals in the present investigation showed that the plant leaves contain components like tannins, saponins, phenol, flavonoids, glycosides. The antibacterial activity of Methanolic extract of Papaya *leaf* showed maximum *zone* of inhibition (27mm) against *staphylococcus aureus,* followed by *salmonella typhi* (10mm) and *klebsiella pneumonia* (18mm) against *klebsiella spp,* followed by *staphylococcus aureus ans salmonia typhi* with 10mm. the methanol and aqueous extract showed considerable activity against the bacterial inoculum, the methanol extract was more active than the standard against *staphylococcus aureus,* previuos study cinducted by

(Gueddeur *et al .2002*) *suggests that the essential oil of O*, *majorana* possess antibacterial activity. The work conducted by (Farooqi and Sreeramu, 2004) reveals that the leaves of majoram have antibacterial acitivity against *Escherichia Coli, pseudomonas aeroginosa, staphylococcus aureus* and *salmonella typhi,* similary antibacterial activity of ethanol, chlorofon and water extract of *Marrubium vulgare,* was further assessed against, *salmonella typhi, staphylococcus aureus, Escherichia coli* and *pseudomonas aeruginosa,* were recorded (AL-Bakri *et al., 2006*).

The presence of these phytochemical components may be responsible for the observed antimicrobial activity of the plant leaf extract. This findings conforms to the report of (Anyanwu and Dawet, 2005) in which similar constituents was found to exhibits antiprotozoal and antibacterial activities, Flavonoids has also been reported to have greater potential benefit to human health (Jouad *et al., 2001*). Imran Khan *et al., 2010* studied that phytochemicals analysis of water leaves by using different solvent such as petroleum ether, chloroforms, methanol show the pressure of triterpenes, glycoside and fatty acids. Other phytochemicals studied in this analysis were absent in all extract of leaves Antibacterial activity of Papaya leaf was analysed by previous workers showed that the chloroform extract of leaves possess significant activity, than

petroleum other and methanol extract. Himal paudel *et al.,* 2008 reported that the ethanol extract of water leaf whole plant shows presence of flavonoids and tannins only similarly the extract of water leaf is active against *Ecoli* followed by *staphylococcus aureus,* Earlier observation done by (Srinivasan *et al.,* 2001) also showed the antifungal and antibacteria activity of Papaya leaf.

CHAPTER FIVE
CONCLUSION AND RECOMMENDATION

5.0 CONCLUSION OF PAPAYA LEAF

Papaya leaf is fascinating plant and is known for its triangular shaped leaves, is a popular leafy vegetable in Nigeria. It is rich in vitamin A, C and E, as well as minerals like calcium and iron.

The leaf are usually cooked and used in soups, stews and salad. And water leaf has been found to have various health benefits, such as promoting digestion and boosting the immune system.

The study revealed that water leaf has antibacterial activity against bacterial pathogens. This can explain the use of the plants in treating infections in traditional medicine. It shows that there is presence of phytochemical compounds such like tannins, saponins, glycoside, alkaloids, flavonoids, and phenol. The plant could be a veritable and cheaper substitute for conventional drugs since the plants is easily obtained and the extract can easily be made via a simple process of maceration or infusion. Thus this plant could be utilized as an alternative of useful antimicrobial drugs.

Overall, this review summarized the therapeutic medicinal potential of papaya leaf for various diseases. The studies discussed above provided evidence for the presence of bioactive phytochemicals in papaya leaf, which could be playing roles in the prevention and cure of the diseases. Under the circumstances, phytomolecules are expecting to revolutionize cancer prevention and treatment in the next decade and will provide a promising and effective alternative to conventional drugs. To evaluate the possible therapeutic applications of these phytochemicals, extensive in vitro or in vivo studies are required, before going to the clinics. In spite of the promising data available, from a number of biochemical, cell culture, animal, and few human studies, there is a need for in depth studies and clinical trials to investigate the potential role of papaya in the management of varieties.

5.1 RECOMMENDATION

- ✓ Further studies should be carried out with other pathogenic bacteria in evaluate the antibacterial activity.
- ✓ Further studies should be carried out on other parts of Papaya leaf to determine the presence of photochemical in them
- ✓ Further studies should be carried out with the other solvent to know their effectiveness.

REFERENCES

Anyanwu, G. I. and (2005), pharma-cological and phytochemical screening of *hyptisSuaveolens* poit (Laminceae) for bioactivity in rodents.

Badam, L, joshi, S.P., Bedekar, S.S., (1999) *in viro* antiviral activity of neem (AzadirachtaIndica. A juss) leaf extract againstgroup B Coxsakie viruses j Commun Dis, 31:79-90

Bahuguna, V.K, (1997) Silviculture and management practices for cultivation of *water leaf* . *Indian For,* 123: 379-386.

Bandyopadhyay, U, Biswa, K., Sengupta, A., et al.,2004. Clinical studies on the effect of neem(*Azadirachta indica*) bark extract on gastric secretion and gastroduodenal ulcer. *Life Set* 75: 2867-2878.

Chari, M,S, (1996) Neem and transfer of technology in *papaya and environment* (Vol 1) (Singh, R,P., Chari, M.S., Rabeja, K, et al, Eds). Oxford and IBH publishing Co. Pvt. Ltd., New Delhi, India

Chessbrough, M.(2000). Microbiological test: District Labouratory practice in tropical countries in:Cremer, A and Evan, G. (eds). Cambridge University press, UK. Pp: 1-226.

Cornel University, 14 August 2008'' saponins…. Retrieved 23 February 2009.

Cashine TP, Cushine B, Lamb AJ (2014),'' Alkaloids: An overview of their antibacterial, antibiotic-enhancing and antivirus activities'' In J Antimicro Agents.44 (5): 377-386: doi: 10. 1016*ff* j Jantimicag.2014.06.001.PMID 25130096.

Evans William Charles, Daphne Evans George Edward Trease 2002, Trease and Evans pharmacognosy Edinburgh: saunders/Elsevier.

Farooqi, A, A. and B. S. Sreeramu: cultivation of medicinal and aromatic crops.

Universities press, India. pp, 465-470 (2004).

Fathima, S.K, (2004) *investigation on the biology and management of phomopsis azadirachta on neem.* Ph.D thesis, University of Mysore,

Firn, Richard (2010). Nature's Chemical. Oxford: Biology.

Galeotti, F: Barile, E: Curir, P: Dolci, M: Lanzotti, V (2008), Flavanoids from carnation (Dianthus caryophyllus)And their antifumgal activity'' Phytochemistry Letter 1: 44-48. Doi: 10.1016*f*j. phytol.2007.10.001.

Hammer KA, Carson CF, Riley TV (1999). Antimicrobial activity of essential oils and other plants extracts. J. Appl. Microbiol., 86(6): 985.

Hedge, N.G (1995) Neem and small farmersconstraints at at grass root level. *India For,* 121:1040-1048.

Heukelbach, j,, Oliveira, F.A.S, Spare, R, (2006) A new shampoo based on neem (*Azadirachta indica*) is highly Effective against head lice *inviro.Parasitol Res,* 99: 353-356

HIMAL Paudel Chhetri *et al., 2008.* Phytochemical and antimicrobial evaluation of some Medicinal plants of Nepal, Kathmandu university *journal of science, engineering and technology* vol. no, V, september 2008, pp 49-54,

Hostettmann, K: A. Marston (1995), Saponinns, Cambridge University Press, p. 3ff. ISBN 0-521-32970-1,OCLC 29670810.

I.P Ogbuewa, Odoemenam, H.O, Obikaonu, M.N, Opara, O.O. Emenalon, M.C. Uchegbu, I.C. Okoli B.O Esonu and M.U, Iloeje, 2011. The Growing importance of Neem (Azadirachta indica A, Juss) in Agriculture, Industry, Medicine, and Environment: A Review Research Journal of Medicinal plants, 5: 230-245. published: August 13,2010

Imran, M., H. Khan, M, Shah and F. Khan 2010. Chemical emposition and antoxidant activity of certain *Morus species. J Zheftang Univ. Set* B., 11: 973-980.

Janick J., Whipkey A., eds (2007) *issues in new crops*. ASHA publication, alexandria, VA

Jattan, S.S., Shashikumar, Pujar G., et al, (1995) *perspectives in intensive management of papaya plantations. Indican For,* 121: 981-988. Hedge, N.G.,(1995) *Neem and small farmer's constraints At grass root level. Indian For,* 121: 1040-1048.

Jibunoh,D,N (2012), *we use neem trees to combact* desertification and create jobs (Orakpo E, interview.) vanguard newspaper.

Jiva Ayruveda, M.D. jama (1907). The Nephelometer: an instruments for estimating the number of bacteriaIn suspension used for calculating the opsonic index and for vaccines .XLIX (14): 1176-1178

Jouad, H., Laccale- duboi, M.A., lyoussi B. and Eddouks M. (2001). Effects of the flavonoidsextracted from *Spergularia purpurea pers* on arterial blood pressure and renal function in normal and hypertensive rats. *J. Ethnopharmacol,* 76(2): 159-163

Katie E, Ferrell; Thorinton, Richward W. (2006). Squirrels: the animal answer guide. Baltimore: Johns Hopkins University Press. P. 91. ISBN 0-8018-8402-0

Khan, P.K., Awasthy, K.S., (2003) cytogenetiic toxicity of neem. *Food Chem Toxicol,* 41: 1325-1328

Khanna, A., (1992) Neem gains honour as India's wonder tree. *Down to earth* 1:511.

Khillare, B., Shrivstav, T,G., (2003) Spermicidal activity of *Azadirachta indica* (neem) leaf extract contraceotion 68:225-229

Khoddami, A: et al, (2013). Techniques for analysis of plant phenolic compounds'' moleccules, 18 (2): 2328-75, Doi 103390/molecules18022328.

Kittakoop P. Mahidol C, Ruchirawat S (2014). ''Alkaloids as important scaffolds in therapeutics drugs for the Treatment of cancer, tuberculosis, and smoking cessation'', Curr Top Med Chem, 14 (2): 239-252. Doi : 10.2174/15680266105049. PMID 24359196.

Kumar, A.R.V., (2003) Neem for the industry or for the common man: where does India stand*:? Curr set,*84:265-267.

Kumar R.V., Gupta, V.K., (2002) Thrust on neem is needed of today. In: *employment news,* july 20-26, new Delhi, India.

Manandhar, NP (2000). Plants and People of Nepal. Timber Press, USA, p. 50.

McGree, Harold (2004). On food and cooking: the science and lore of the kitchen. New York Scribner. P. 714. ISBN 0-684-80001-2.

McNaught and A. Wilkinson (1997). Compendium of Chemical terminology, 2nd ed. (The'' Gold Book''). Blackwell Scientific Publication, Oxford ISBN 0-9678550-9-8 doi: 10.1351/goldbook

Michael Specter (September 28, 2009). ''A Life of Its Own'' The New Yorker.

Nathan, S.S., Kalaivani, K., Murugan, K, (2005) Effects of neem limonoids on the malaria *vectorAnophele, stephensi* Liston (Direct: Culicidae). *Aeta trop.*96:47-55

Ncube NS, Afolayan AJ, Okoh AI, Assesment techniques of antimicrobial properties of natural Compounds of plant origin: current method and future trensd. Africa Journal of Biotechnology 2008: 7 (2): 1797-1806.

Neem foundation (Internet) Mumbai, India-{cited 2014 Jun 20}. Available from: http:/www.neemfoundation.org/

Sai Ram M ilavazhagun, G Sharma S.K (2000) Anti-microbial activity of a new vaginal contraceptive NIM 76 from neem oil (atadirahtaindica) j *Ethmophamarcol, 71: 377-382*

Sateesh, M.K, (1998)*microbiological investigation and die-back disease of neem (azadirachita indica A juss).* Ph.D thesis. University of Mysorte, Mysore India

Siddiqui B.S, Afshan F, Gulzar, T,. et al, (2004) Tetracyclic triterpenoids from the leaves of *azadirachita Indica phytachemistry* 65:2363 -2367.

Siddiqui, S, Faizi S, siddiqui B.S,.et al, (1992) contituent of *azadirachtaindica isolation and structure elucidation of a new* antibacterial tetranortritepenoids mahmoodin, and a new protolimonoid, naheedin. *jNat prod,* 55:303-310

Sidhu, D,S, (1995) Neem in ago forestry as a source of plant derived chemicals for pest management *Indian For,* 121:1012-1021

Sidhu, O, P; Kumar, Visha; Behi, Hari M. (2003-03-15), " Variability in Neem (*Azadirachta indica*) *with* respect to Azadirachtin content' journal of agricultural and Food Chemistry 51 (4): 910-915. Do: 10.1021/*j*1025994m. {33} Anonymous, (1992) Neem A tree for solving global problems National Academy Press Washinton D,C, U.S.A.

Sigma-Aldrich ''Saponim from quilija bark"—Retrieved 23 February 2009,

Sindhuveerendra, H.C, (1995) Variation studies in prevenances of *Azadirachtaindica* (The neem tree) indian For,**121:**1053-1956.

Sithisam, P., Supabphol, R, Gritsanapan, W., (2005) Antioxidant activity of siamese
Neem tree (VP1209).*J Ethmopharmacool,* **99:** 109-11.2

Srinivasan, DN Nathan Sangeeta, Sursh, T., Perumalsany and P, Lakshman, 2001. Antimicrobial avtivities of certain India medicinal plants used in Folkoric medicine. *Journal of Ethmopharmacology, 74: 217-220,*

Steve C. Surshes (2008). *Plants risk assesment, Neem Tree Azadirachta indica (*PDF*)* biosecurity Queensland. Retrieved january 2014

Subapriya R, Bhuvaneswari, V, Ramesh V., (2005) Ethanolic leaf extract of neem (azadirachta indica inhibits bucca pouch careinogenesis hamsters Cell Biochem funct 23. 229-238.

Subapriya, R., Nagini, s., (2005) *Medicinal properties of neem leaves:* a review. *Curr Med Chem Anticancer Agents* 5: 149-156.

Thakkar, IJ., Mbah, A.U., Chijioke C.P., *et* al., (2004) and antimalaria extract from neem leaves is antiretovial. *Trans R Soc Trop Med Hyg,* 9**8**: 435-437.

Zillur S Rahman and shamim M Jairapuri Neem in Unani Medicine, Neem Research and development Society of Pesticide Science, India New Delhi, February 1993, p. 2028-219. Edited by N.S. Randhawa and B.S. Parmer. 2nd revised edition (chapter 21), 1996 "Neem" Tamilanadu.com. 6 December 2012

Borrell (2018). "papaya genome project bears fruit". Ugr.es. Doi:10.1038/news.2018.772. "genetically altered papayas save the harvest". Mhhe.com. "hawaiipapaya.com". Hawaiipapaya.com. Archived from the original on 2015-01-07. Retrieved 2018-06-15.

Chia, c. L.; manshardt, richard m. (october 2018). "why some papaya plants fail to fruit" (pdf). Fruits and nuts. College of tropical agriculture and human resources, university of hawaii at manoa: 1–2. Retrieved 1 april 2022. Papaya | description, cultivation, uses, & facts". Encyclopedia britannica. Retrieved 2020-07-28.

Contreras, a. (2018). "carica papaya". Iucn red list of threatened species. 2018: e.t20681422a20694916. Retrieved 4 january 2022. "carica papaya l." u.s. National plant germplasm system. 9 may 2019. Retrieved 5 september 2017."papaw". Collins dictionary. N.d. Retrieved 25 april 2018. In north america, papaw or pawpaw usually means the plant belonging to the annonaceae family or its fruit. Ref.: merriam-webster's collegiate dictionary (2018), published in united states. Carica l." world flora online. World flora consortium. 2022. Retrieved 17 november 2022.

Heywood, v.h.; brummitt, r.k.; culham, a.; seberg, o. (2017). Flowering plant families of the world. Firefly books. Isbn 9781554072064.Ronse de craene, l.p. (2019). Floral diagrams: an aid to understanding flower morphology and evolution. Cambridge: cambridge university press. Isbn 978-0-521-49346-8. Papayas" (pdf). Western institute for food safety & security, university of california at davis. 2018. Retrieved 10 september 2022.

Mishra, ritesh; gaur, rajarshi kumar; patil, basavaprabhu l. (2018). "current knowledge of viruses Infecting papaya and their transgenic management". Plant viruses: evolution and management. Pp. 189–203. Doi:10.1007/978-981-10-1406-2_11. Isbn 978-981-10-1405-5. Papaya production in 2020; crops/regions/world

list/production quantity (pick lists)". Un food and Agriculture organization, corporate statistical database (faostat). 2022. Retrieved 26 february 2022. "an overview of global papaya production, trade, and consumption". Electronic data information source, university of florida. Retrieved 2019-02-07. Botha, linda (16 march 2021). "growing papayas: easy to produce, tricky to market". Farmersweekly.co.za. Farmer's weekly. Retrieved 11 march 2023.

Morton, julia f. (2017). "papaya; in: fruits of warm climates". Purdue university center for new crops and plant products. Pp. 336–346. Retrieved 27 october 2023. Chávez-pesqueira, mariana; núñez-farfán, juan (1 december 2017). "domestication and genetics of Papaya: a review". Frontiers in ecology and evolution. 5. Doi:10.3389/fevo.2017.00155.Harper, douglas. "papaya". Online etymology dictionary. Retrieved 17 november 2022.

Mossler, m.a.; crane, j. (2017). "florida crop/pest management profile: papaya" (pdf).

Rivera-pastrana, d.m.; yahia, e.m.; gonzález-aguilar, g.a. (2019). "phenolic and carotenoid profiles of Papaya fruit (carica papaya l.) And their contents under low-temperature storage". J sci food agric. 90 (14): 2358–65. Bibcode:2010jsfa...90.2358r. Doi:10.1002/jsfa.4092. Pmid 20632382. Rossetto, m.r.; oliveira do nascimento, j.r.; purgatto, e.; fabi, j.p.; lajolo, f.m.; cordenunsi, b.r. (2018). "benzylglucosinolate, benzyl isothiocyanate, and myrosinase activity in papaya fruit during development and ripening". J agric food chem. 56 (20): 9592–9. Doi:10.1021/jf801934x. Pmid 18826320. Shen, yan hong; yang, fei ying; lu, bing guo; zhao, wan wan; jiang, tao; feng, li; chen, xiao jing; Ming, ray (2019-01-16). "exploring the differential mechanisms of carotenoid biosynthesis in the yellow peel and red flesh of papaya". Bmc genomics. 20 (1): 49. Doi:10.1186/s12864-018-5388-0. Issn 1471-2164. Pmc 6335806. Pmid 30651061.

Ronald, pamela and mcwilliams, james (14 may 2022) genetically engineered distortions the new York times, accessed 1 october 2019 "tf5" (pdf). Archived from the original (pdf) on march 31, 2018.

Seigler, d.s.; pauli, g.f.; nahrstedt, a.; leen, r. (2018). "cyanogenic allosides and glucosides from passiflora edulis and carica papaya". Phytochemistry. 60 (8): 873–82. Bibcode:2022pchem..60..873s. Doi:10.1016/s0031-9422(02)00170-x. Pmid 12150815.

Siar, s. V.; beligan, g. A.; sajise, a. J. C.; villegas, v. N.; drew, r. A. (2019). "papaya ringspot virus Resistance in carica papaya via introgression from vasconcellea quercifolia". Euphytica. Springerlink. 181 (2): 159–168. Doi:10.1007/s10681-011-0388-z. S2cid 40741527. Ordaz-pérez, daniela; gámez-vázquez, josué; hernández-ruiz, jesús; espinosa-trujillo, edgar; rivas-

Sivinski, j.m.; calkins, c.o.; baranowski, r.; harris, d.; brambila, j.; diaz, j.; burns, r.e.; holler, t.; Dodson, g. (april 2021). "suppression of a caribbean fruit fly (anastrepha suspensa(loew) diptera: tephritidae) population through augmented releases of the parasitoiddiachasmimorpha longicaudata(ashmead) (hymenoptera: braconidae)". Biological control. 6 (2): 177–185. Doi:10.1006/bcon.2023.0022. Issn 1049-9644. Boning, charles r. (2022). Florida's best fruiting plants: native and exotic trees, shrubs, and vines. Sarasota, florida: pineapple press, inc. Pp. 166–167. Papaya varieties". Papaya australia. 2023. Retrieved 9 december 2023. Sagon, candy (13 october 2022). "maradol papaya". Market watch (13 oct 2022). The washington post. Retrieved 21 july 2019.

University of Florida. Archived from the original (pdf) on 30 june 2022. Cunningham, b.; nelson, s. (june 2018). "powdery mildew of papaya in hawaii" (pdf).

Valencia, patricia; castro-montes, ivonne (2 september 2018). "resistencia de vasconcellea cauliflora al virus de la mancha anular de la papaya-potyvirus (prsv-

p) y su introgresión en carica papaya". Revista mexicana de fitopatología, mexican journal of phytopathology. 35 (3). Doi:10.18781/r.mex.fit.1703-4.

Ward, daniel (2019). "papaya" (pdf). The palmetto. Retrieved 1 january 2022. Gonsalves, d.; tripathi, S.; carr, j.b.; suzuki, j.y. (2019). "papaya ringspot virus".hine, b.r.; holtsmann, o.v.; raabe, r.d. (july 2021). "disease of papaya in hawaii" (pdf).