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Anhelmintic Activity of Ethanolic Extract of Citrus Limon Seeds

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ABSTRACT
The Citrus Limon seeds belonging to family Rutaceae are a common plant, native to Asia. Citrusfoodandderiveproducthavebeneficialimpactson humanhealth.Morethanavitamin-Crichfruits,Limonispowerfulmedicinalplantwithnumerousbenefitsthathavebeenenjoyed for over 3000 years. The citrus Limon seeds are evaluated to determine theAnti-Helmenthic activity. The powdered seeds were extracted by maceration process using ethanol solvent. Phytochemical screening was carried out to check the presence of different Phytochemical constituentslikeflavonoids,tannins,saponins,terpenoidsandphenoliccompounds.Theresults reveal a dose dependent increase in activity of the extracts at 50 mg/ml concentration. The extractat 50 mg/ml concentration. The extract at 50 mg/ml exhibited better activity than standard compound Albendazole

Keywords: Anti-Helmenthicactivity,Albendazole,CitrusLimon,Maceration, Phytochemical constituents.

I. INTRODUCTION

The word "helminth'' comes from the greek word "helminths'' which means body. Gastrointestinal parasites are serious microorganisms in people, homegrown domesticated animals, andwildcreatures.Almost diseases becauseofhelminthsarebyand large limitedto tropical locales and cause colossal risk to well-being and add to the pervasiveness of undernourishment, eosinophilia and pneumonia .

Theyhurt the host bydenying it food , causing blood misfortune, injuryto organs , digestive or lymphatic hindrance, and emitting poisons. They are to blame for a lot of illness, like elephantiasis- causing lymphatic filariasis, river blindness- causing onchocerciasis, schistosomiasis, weight loss, and poor fertility.

They are bad for your health and have pathological symptoms like diarrheal, droopiness, emaciationand anaemia.

One of the most prevalent infections worldwide, soil-transmitted helminth (STH) infections affect the poorest and most disadvantaged communities. Because they can be controlled or eradicated, these STHs are referred to as neglected tropical diseases (NTDs).

However, theycause a great dealofdisabilityand suffering. It is an infestationcaused byone or more round intestinal parasites, such as whipworms, hookworms, orAscaris.

In endemic areas, these infections can affect the majority of the population,, resulting in significant social and economic effects. Within an infected population, the prevalence ofparasitic helminths typically follows a negative binomialdistribution, with few individuals carrying high parasite burdens. Those individuals are most likely to fall ill and spread the disease to others in their community if they do not receive treatment.

Despitebeingtheleast common,tapewormsaretoblamefortheworstoutcomes, such as neurocysticercosis, which results in permanent brain damage and early death.

OtherinfectionslikePlasmodiumfalsipuram ,HumanImmunodeficiencyVirus(HIV),and Mycobacteriumtuberculosisbecome moresevere asaresultofhelminthiasis

1. CLASSIFICATIONOFHELMENTHS:

The definitive classification is based on the external and internal morphology ofegg, larval, and adult stages.

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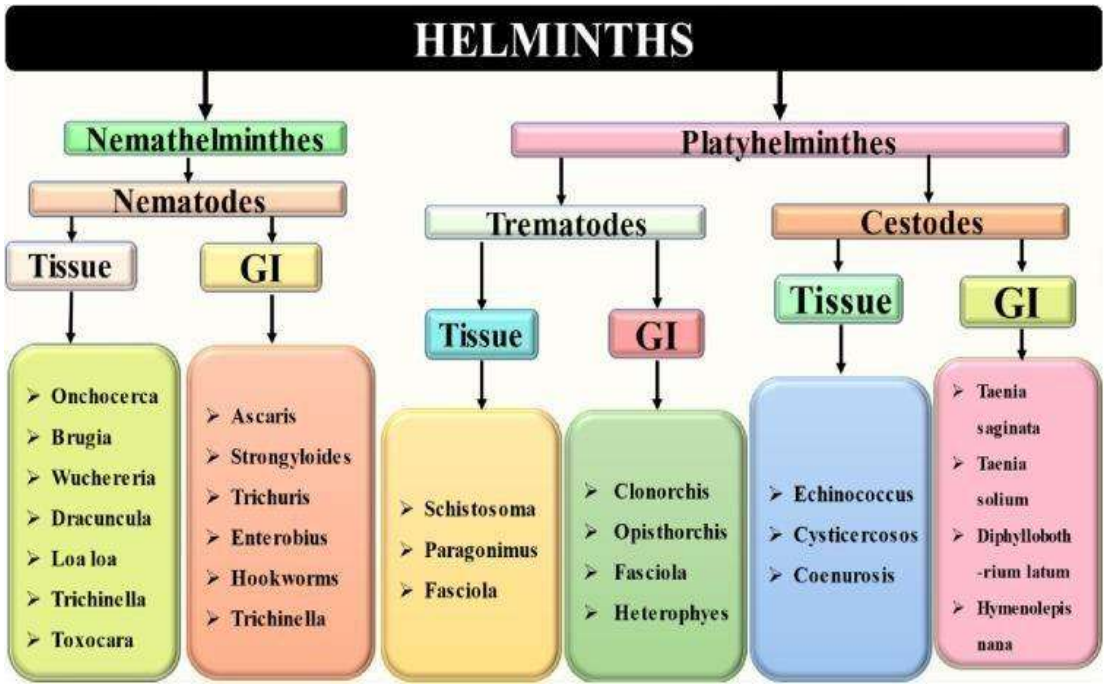

Fig: 1(classificationofanti helminths)

- Hookworms are known to cause chronic intestinal blood loss and can result in anaemia and chronicfatigue.Intestinalwormscancausediarrhea,abdominalpain,andageneralizedfeeling of discomfort , and weakness. In some people , intestinal worms do notcause anysymptoms or they may be irregular . people are infected with Ascaris and whipworm when eggs are ingested. Hookworm eggs are not infective.
- About 40millionpeople are infected with food-borne trematodes. Food-bornetrematodes are emerging in several countries due to the globalization of the food supply, increased international travel, population growth , pollution, ecological transformations, or poverty. Infections with food-bornetrematodes cause inflammatory lesions and tissue damage, which can result in serious secondary complications such as cholangiocarcinoma in the case of infections with clonorchis sinensisand Opisthorchis viverrine.

- Roundwormsare bisexual, cylindricalworms.They inhibit intestinaland extraintestinalsites. In contrast to platyhelminths , nematodes are cylindrical rather than flattened ; hence the common name roundworm. The body wall is composed of an outer cuticle that has a noncellular, chemicallycomplexstructure,athinhypodermis, and a musculature.The cuticle in some species has longitudinal ridges called alae. The bursa is a flaplike extension of the cuticle on the posterior end.

1. EPIDEMIOLOGY:

The World Health Organization (WHO) reveals that over 2 billion people, especially in developingcountries,andparticularlyinchildren,aresufferingfromparasiticworminfections. Of which ascariasis is common, some other worms that cause parasitic infections are Hook worm, Trichuris trichura, and Hymenolepsis nana etc. Helmenthiasis is one of the most widespreadinfectiousdiseaseaffectingmostlychildrenandpregnantwomen.InHelminthiasis this organism multiply outside ofthe defenitive host and havethe unique ability to evade host immunedefences, for reasonsthatarenotfullyunderstood.Helminthiasistendstobechronic, possibly lasting an entire lifetime of the host.
Infectedhosthumansaredividedintotwocategoriesorphyla.

1. Platyhelminthes(flateworms): In which A.Cetodes(tapeworms),B.Trematode(flukes)isincluded

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2. Nematodes(roundworms): In which A.Roundworm,B.Hookworm, C.Pinworm,D.Whipwormareincluded

It isestimated that bythe year 2025, about 57%ofthepopulation indeveloping countrieswill be influenced. Latest estimates indicate that 880 million children need treatment for these parasites. The population at risk in the WHO African Region is estimated at 350 million. A large part of the world's population is infected with one or more of these soil-transmitted helminths.Climate and soilstructure are crucialdeterminantsofhookwormprevalence, asthe parasitethrivesintropicalandsubtropicalzones,where moistureandtemperatureareidealfor larvaldevelopmentoutsidethehost.Thedifferentdistribution ofthevarioushookwormspecies is not absolute, with mixed infections often occurring in individuals. An estimated 438.9 millionpeople (95% credible interval: 406.3–480.2 million) were infected with hookwormin 2010 , with the largest concentration of hookwormcases in SoutheastAsia, followed by sub- Saharan Africa . Hookworm infection tends to be more prevalent in rural areas, where the favourable tropical or subtropical ecologies converge with poverty and weak sanitary infrastructures.

2. ETIOLOGY:

- Intestinalparasiteinfectionsoftencausemorbidity andmortality,especiallyinchildren
- Poor hygiene of mother or caregiver is also one of the most important risk factors for soil-transmitted helminths infection in preschool children.
- The major risk factors of helminthiasis are rural areas, low socioeconomic status, poor sanitation, lack of health care, lack of education, inadequate dwelling conditions.
- Adult Ascaris is a long cylindrical worm, and its larvae can migrate into the pulmonary circulation.
- A. duodenaleand N. americanusaretransmitted bypenetrationoftheskin fromwhere it goes into the lungs and crosses pulmonary capillaries to penetrate into alveolus and then to the intestine through the passing of larynx.
- Contactwithcontaminatedfeces.

3. TRANSMISSION&LIFECYCLE:

They are communicated by eggs present in human drug which thusly defile soil in regions wheredisinfectionispoor.Theroundworm(Ascarislumbriocoides),thewhipworm(Trichuris trichura), and the hookworm(Necator americanus andAncylostoma duodenale) are the main species that infect people.

Hookworms:

Hookworm eggs hatch in soil and rhabditiform (early) larvae moult twice before becoming infective. Larvae accumulate in soil or on grass awaiting exposure to human skin(often the hands, feetorbuttocks) which they can penetrate. The larvae then make their way to the peripheralvasculature,wheretheyarepassivelyswept withinthebloodstream,firsttotheright side ofthe heart and then to the pulmonary vasculature.Mature male and female hookworms produce as many as 10,000 eggs per day.

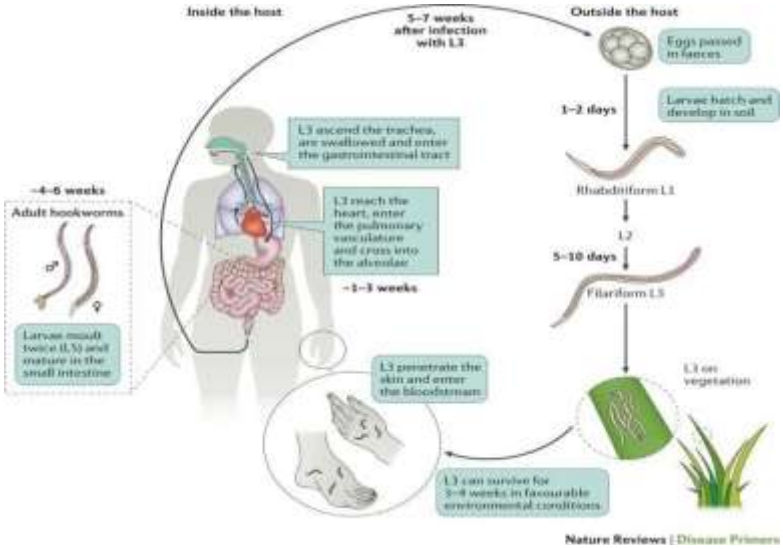

Fig:2 (LifecycleofHookworm)

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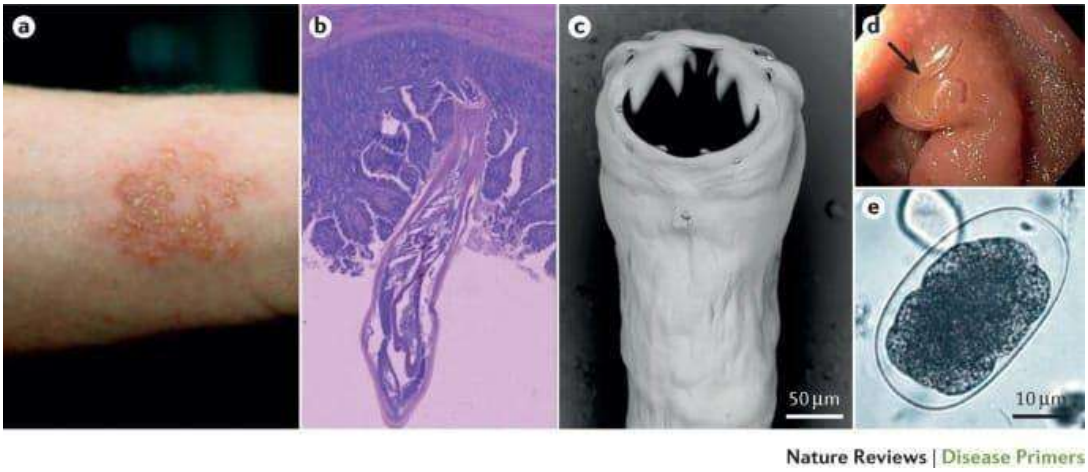

Fig:3 (Developmentalstagesoftheintra-hostphaseofthehookwormlifecycle)

Whipworms:

Ingesting eggs or hatchlings causes whipworm. Consuming fruits and vegetables that have not beenthoroughlywashed, peeled, orcooked canresult in infestation.After plsying withor even eating dirt that has been contaminated, children are most likely to contract whipworm. Worms can continue to layeggs for up to a year after being swallowed.

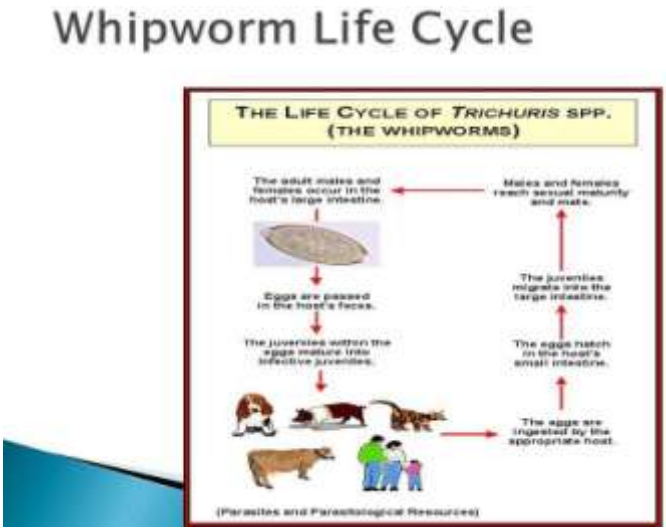

Fig:4 (LifecycleofWhipworm)

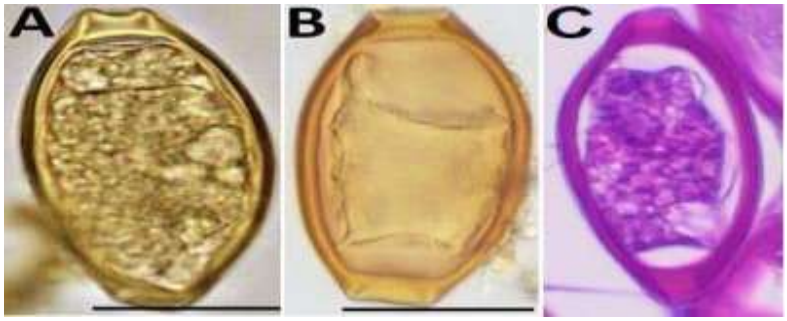

Fig:5(EggsofWhipworms)

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4. PATHOPHYSIOLOGY

Directdamage:

Direct damage isdonebywormactivityitself, suchas internalorganblockageordirect pressure effects by growing parasites.

- Adult Ascaris blocks the intestine that leads to small bowel obstruction, volvulus, or intussusception, especially in children, or can invade orifices leading to appendicitis, cholecystitis,pancreatitis,andgastricascariasis. MigratingAscariscanalsoblockthebileduct and mayalso alterthe intestinalmicrobiota. Mucosalbleeding fromthe uppergastrointestinal tract or generalized inflammation leads to anemia.
- Trichuris lies in intestinal mucosa and can cause petechial lesions, blotchy mucosal hemorrhage, oozing, and colonic inflammation. It can also cause severe anemia in pregnant women.
- Schistosomiasis infection is acquired by contact with contaminated freshwater, especially duringswimmingorwashing.Depositionofschistosomeeggswithintheliverandbladdermay form granulomas around these eggs that can block blood flow in the liver that leads to pathologicalchangeslikeperiportalfibrosisandhavebeenlinkedwithneoplasia.Interestingly, this periportal fibrosis has retained hepatocellular function that is different fromother causes of cirrhosis. These liver flukes can also cause bile duct hyperplasia.
- Wuchereriabancrofticauseslymphaticobstructionleadsto elephantiasisHydatidcyst caused by the larval tapeworm infections (Echinococcus granulosus) leads to pressure atrophy.
- Taenia solium, the porktapeworm, frequentlydevelops inthe intestine leads to taeniasis, and in the central nervous system leads to cysticercosis.
- AncylostomaandNecator burrow their teeth into mucosa and submucosa, create negative pressure by contracting their muscular esophagi that lead to rupture of the capillaries and arterioles and actively sucks blood. Blood vessels are ruptured by both mechanical compressionsandhydrolyticenzymessecretedby thesehookworms.Thesewormsalsosecrete anticoagulantsthatleadtoprolongedbleedingand, ultimately,significantbloodloss.Theycan cause significant anemia, especially in children and pregnant women, along with schistosomiasis,thesecanincreaseneonatalprematurityandmaternalmorbidityandmortality, also causes protein loss by inflammation.
- DiphyllobothriumlatumcausesvitaminB12deficiencythroughinterferingwiththeabsorption through the intestine. Migration through body tissue, many helminths cause direct tissue damage and also by hypersensitivity reactions, whereas most affected organs are skin, lungs, liver, and intestines.

Indirectdamage:

Indirectdamageisdonebythehostimmuneresponseagainsthelminth.

- All helminths are antigenic to the body because they are foreign bodies and stimulate the immune response. Lymphatic blockage by W. bancrofti and granuloma formation by schistosomesintheliverandbladderareassociated withhypersensitivityreactionagainstthese helminths.
- StrongyloidesandTrichinella mayinduce prolonged inflammationofthe intestine that causes villous atrophy; in severe cases, it may cause protein-losing enteropathy.
- SstercoraliscancauseLoeffler syndromebytype1hypersensitivityreaction.
- Trichuris, which is also known as whipworm, can cause inflammation ofthe colon that leads to blood loss and rectal prolapse.

SIGNS&SYMPTOMS

- Abdominalpain
- Nausea
- Lossofappetite
- Weightloss
- Cough
- Visiblewormsinstools(insomecases)

Hookworms

- Skinrashonthefeetwherethelarvaeenteredthebody
- Fever
- Coughing orwheezing
- Abdominalpain
- Lossofappetite
- Diarrhea
- Weightloss
- Anaemia

Roundworms

Early-phasesymptoms;

- Hightemperature feverof38˚C(100.4F)orabove

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- Adrycough
- Shortness ofbreath
- Wheezing

Late-phasesymptoms;

- Passingaworminyourfeces
- Mildabdominalpain
- Nausea
- Vomiting
- Diarrhea

Whipworms

- Bloodydiarrhea
- Abdominalpain
- Painfulorfrequentdefection
- Nausea
- Headaches
- Suddenand unexpected weightloss
- Fecalincontinence,ortheinabilitytocontroldefecation

COMPLICATIONS

Alotofcomplications canoccur inhelminthinfection, whichmayinclude:

- Anemia
- Malnutrition
- Growth retardation
- Developmentalretardation
- Intestinalobstruction
- Gastrointestinalhemorrhage
- Corpulmonale
- Portalhypertension
- Urinarybladder carcinoma
- Neurologicalcomplicationssuchasseizure,myelopathy
- Primaryand secondary infertility
- Ectopicpregnancyandtubalpregnancy
- Hypogonadism
- Systemiccysticercosis
- Cholangitis
- Cholecystitis
- Pancreatitis
- CystorHydatidcystrupture
- ChroniclymphaticdamageBlindness

DIAGNOSIS

Themost commondiagnostictestsforhelminthiasis include:

- Stooltest
- Bloodtest
- Tape test
- Colonoscopy/Endoscopy
- X-ray,MRIscan,CTscan

TREATMENT:

Proper hygiene maintenance is one of the most important measures to prevent helminthinfection.ForthetreatmentofA.lumbricoides,severaldrugsmaybeused,including albendazole,mebendazole,pyrantelpamoate,levamisole,andivermectin.Ifpatientsdevelop intestinal obstruction, it requires propertreatment withintravenous support,anthelmintics, andantibiotictreatment.Laparotomymightbenecessaryincaseofsmallbowelobstruction, intussusception, and volvulus.Hepatobiliary ascariasis can be treated with drug therapy. If conservative therapy fails, then endoscopic and surgical therapy may be required.

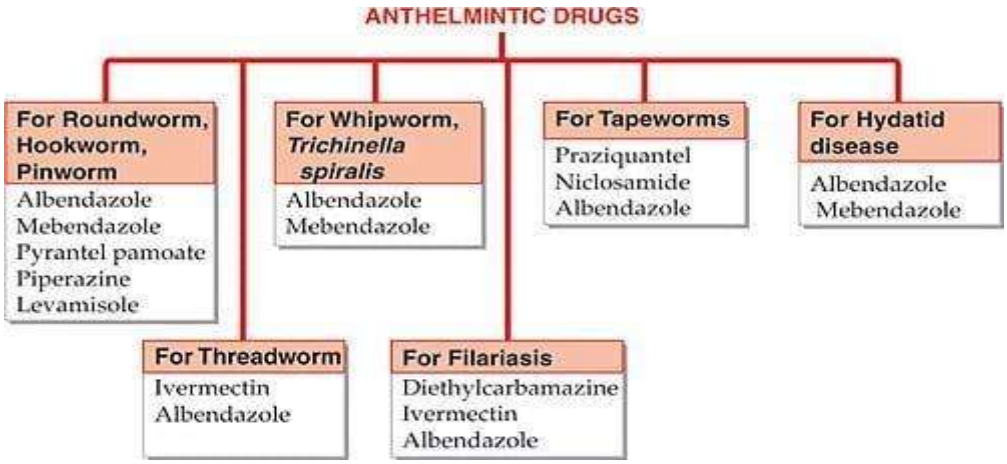

Fig:6(classificationofanthelminticdrugs)

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STANDARDDRUGPROFILE
ALBENDAZOLE

Albendazole isananthelmintic(an-thel-MIN-tik) oranti- wormmedication. It prevents newly hatched insect larvae (worms)fromgrowingormultiplyinginyourbody.
Albendazole is used to treat certain infections caused by worms such as pork tapewormand dog tapeworm. Albendazole mayalso be used for purposes not listed in this medication guide.

Fig: 7(Albendazole)

Mechanismof action:

Albendazole causes degenerative alterations in the tegument and intestinal cells of the worm by diminishing its energy production, ultimately leading to immobilization and death of the parasite. It works by binding to the colchicine-sensitive site of tubulin, thus inhibiting its polymerization or assembly into microtubules. As cytoplasmic microtubules are critical in promoting glucose uptake in larvaland adult stagesofthe susceptible parasites, the glycogen stores of the parasites are depleted. Degenerative changes in the endoplasmic reticulum, the mitochondriaofthegerminallayer,andthesubsequentr eleaseoflysosomesresultindecreased production of adenosine triphosphate (ATP), which is the energy required for the survival of the helminth.

PHARMACOKINETICS:

Absorption: Poorlyabsorbedfromthegatrointestinalt ractduetoitslowaqueoussolubility. Oral bio availability appears to be enhanced when co-administered with a fatty meal.
Distribution:70%boundtoplasmaprotienandiswidel ydistributedthroughoutthebody.

Metabolism: Liver **Elimination**:Urine **Half-life:** 8-12 hrs

Sideeffects:

- Stomachpain
- Nausea
- Vomoting
- Headache
- Dizziness
- Reversiblehairloss
- Peelingskin
- Swellingofthemouth,face,lips,tongue
- Rashes

Uses:

- Forthetreatmentofparasiticworm.
- Thisis usedfor the treatmentof cystichydatiddiseaseof theliverandlungcausedby dog tapeworm.

PLANTPROFILE

The Lemon is a species of small evergreen tree in the flowering plantFamily of Rutaceae,native to Asia , primarily North East India (Assam) Northern Myanmar and China.

Synonym: CitrusLimon
Habitat: Lemontressaresub-tropicalplantsnative toAsia. This evergreenproduces fragrant flowers,has dark green leaves and bears nutritious , edible fruit . **Fig: 8(lemon plant)**
Lemontreesrequires less heattoripenthanothervarietiesofcitrus.
Outstandingvarieties for theHomegardeninclude"ImprovedMeyer"withveryj uicyfruitandVariegatedpinkEureka with fruit featuring green and yellow striped skin and pink flesh.
The best conditions for a lemon tree start with temperatures between 77 and 86 degrees fahrenheit. However growth grinds to halt at temperatures above 104 degrees fahrenheit. Lemon trees do best when theyreceive at least 6 hoursofsun .theyprefer the warmplaces in youryard,typicallyonthesouthernorwesternsideofyo urproperty,anddon'tgrowwellwhen exposed to coolbreezes.lemontreesprefer welldrained,sandy loamsoilwithsoilPHbetween
6.0 and 7.5.theydon'tthrivein heavyclay soil.

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DESCRIPTION:

Lemon,Citruslimon, isasmallevergreentreeinthefamilyRutaceaegrownfor itsediblefruit which, amongotherthings, areusedinavarietyoffoodsanddrinks.Thetreehasaspr eading, upright growth habit, few large branches and stiff thorns. The tree possesses large, oblong or oval, light green leaves and produces purple-white flowers in clusters. The lemon fruit is an ellipsoid berry surrounded by a green rind, which ripens to yellow, protecting soft yellow segmentedpulp.Lemontreescanreach3–6m(10–20ft)inheightandcanliveformanyyears, reaching fullfruit bearing capacityin approximately40 years. Lemon mayalso be referred to as bush lemon or Persian apple and likely originated from the eastern Himalaya of India.

Stem: the lemonplant stemformsanever green spreading bushor smalltree ,3-6 meters(10- 20 feet) high if not pruned .

Leaves:lemonleavesaresmalltomediuminsizeandare ovate,0blong,tapertoapointonthe non stem end. The vibrant green leaves grow alternately along the branches ,and they have fine-toothed edges with a slight rippling .

Flower:Themildlyfragrantflowersmaybesolitaryort heremaybe2ormoreclusteredinthe leaf axils. Buds are reddish; the opened flowers have 4 or 5 petals 3/4 in long, white on the upper surface (inside), purplish beneath (outside), and 20-40 more or less united stamenswith yellow anthers

Fruit:Lemon (Citrus limon (L.) Burm.) a yellow or pale yellow prolate fruit with five to 10 seeds,botanically aberry,isknown throughouttheworld,andisusedinnumerous foodways and cuisines.

Calyx: Calyx cupular with 4 or 5 lobes. Petals linear-oblong, 1.5–2 cm long, white, pink abaxially. Stamens 20–40, basally coherent in bundles. Ovary subcylindric or barrel-shaped, 8–10 (11)-locular

TAXONOMICALCLASSIFICATION

Table:1(Taxonomicalclassification)

KINGDOM	Plantae
DIVISION	Magnoliophyta
CLASS	Mangoliopsida
SUBCLASS	Rosidae
ORDER	Sapindales
FAMILY	Rutaceae
SUBCLASS	Aurantioideae
TRIBE	Citreae
GENUS	Citrus

VERNACULARNAMES

Table:2(vernacularnames)

ENGLISH	Lemon,citrus limon
HINDI	Nimbu
TELUGU	Nimmakaya
KANNADA	Nimbe
MALAYALAM	Naranga
MARATHI	Limbu
SANSKRIT	Jambeer
TAMIL	Eleumiccai

ECONOMICAL:

Lemonsare produced in large number of countries world wide some very large produces of lemons particularly china and india produced negligible amounts of lemon oil production of lemon oil is dominated by Argentina , spain ,italy,the USA and south africa .Argentina and spain dominate world production with approximately 70% og global out put.

NUTRITION:

Lemoncontain verylittlefat and protein.Theyconsist mainlyofcrabs(10%) and water(88- 89%).Amedium lemon provides only about 20 calories. The nutrients in ½ cup (100gms) of raw peeled Lemon are

- Calories:29
- Water:89%
- Protein:1.1gm
- Sugar:2.5gm
- Fiber:2.8gm
- Fat:0.3gm

Carbs: Thecarbohydratesinlemonsareprimarilycom posedoffibersandsimplesugars, such as glucose, fructose, and sucrose .

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ZFiber: The main fiber in lemons is pectin.Soluble fibers like pectin can lower blood sugar levels byslowingdownthedigestionofsugar and starch.Dietary fibresareanimportant part of a healthydiet and linked to numerous healthy diet and linked numerous helath benfit.

VITAMINSANDMINERALS:
VitaminCAnessentialvitaminandantioxidant, vitamincisimportantforimmune function and skin health .
PotassiumAdiet highinpotassiumcanlowerbloodpressurelevelsandhavepositive effects on heart health .
VitaminB6. Agroupofrelatedvitamins,B6isinvolved inconvertingfoodintoenergy.
Chemicalconsitituens
Themostimportantgroupofbio activecompoundsincitruslemonfruitisflavonoidssuchas :flavonones,eriodictyol,hesperidin,hesperitin,naringin;flavones-apigenin,diosmin
Flavonols-quercetin;andtheirderivatives.Inthewholeplantother flavonoidsdetected ;flavonols-limocitrinandspinacetin,andflavones-orientinandvitexin.Someflavonoids,such as neohesperidin ,naringin hesperidin are characterstics citrus lemon plant . Lemon seeds contain 34.92% oil, constituted by major fatty acids including 21.03% palmitic acid, 3.67% stearic acid, 20.80% oleic acid, 44.31% linoleic acid, and 8.96% linolenic acid with 125.01 mg/kg total tocopherols, 4.36 mg/kg carotenoids and 1196.71 mg gallic acid equivalents (GAE)/kg total phenolics.

Industrialapplications
Lemon is a highly valued citrus fruit for its multiple applications in the food, cosmetic and pharmaceutical industries. In addition, the by-products derived from it and considered food waste, such as leather, can be revalued through upcycling thanks to its different properties of interest in the agri-food industry that we will see in detail.

- LemonVerna,whichisgrownmainlyinSpain.Mediumto large insize, it hasathick, roughandirregularlysizedrind,withatenderpulpandjuicewithjusttherightacidity.
- FineLemon,sphericalinshape,smooth andthinrind.Itspulpisjuicy,with ahigh content of juice and few seeds. It is known by the name of Primoflorl.
- Interdonato Lemon, with a large, elongated fruit, with a smooth, thin rind, it has little juice and few seeds in its pulp.
- LemonEureka,withathinandsmoothrind,itsjuice isveryacidicandithasalmostno seeds. It occurs in the California area although the seeds come from italy .

Someoftheproperties oflemonasafunctionalingredientare:

- HighamountsofvitaminCandcitricacid
- Carbohydratesnaturally
- Sourceofmineralssuchascalciumandiron
- Averylowcaloricintake, 29kcal/100grams
- Lemonisa fruit withhighamountsofvitaminC,citricacidandantioxidant activity, widely consumed globally.
- Lemonpeelcanberecovered, revaluedthroughupcyclingandusedasapowderfor various applications in the agri-food industry.
- At **Agrosingularity** we work with lemon peel obtaining a powder of the highest quality, treatedto beapartofourPreNat productsfor itsdistributionandapplication in the agri-food industry.

PHARMACOLOGICALACTIONS:
Anti-bacterialactivity:
Therewereseveral studiesthat determine theanti-microbial property in the citrus plant. Amongthemtherewerefewstudiesthat belongs to anti-bacterialactivityonleavesofCitrus limon plant. In one of the studies showed that increasing theessential oilconcentration, increasesthe zoneof inhibition,so thatthe highestantibacterialactivitywas notedat 10mg/mlofessentialoil.Theresultswereanalyzedbydiscdiffusionmethodand it showed essential oilexhibited maximum zone inhibition against Gram positive bacteria (Bacillus cereus, Staphylococcus aureus, Streptococcus faecium) whereastheminimumzoneinhibitionwasshownbygramnegativebacteria(Salmonellatyphi, Shigella dysentery) atthe same concentration. Because ofthis reason mostlyessentialoilrich compounds can be use as preservatives.
Evaluation of antibacterial activities of threemain citrus plant leaves (Citrus limon, citrus grandis and Citrus reticulata) against pathogenic bacteria has done on 2016, that results determinedCitruslimonleafessentialoilwashavingastrengththatactagainstbetweenGram Positive Bacteria .

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Antifungalactivity:

Anti-fungal activity of the essential oil that extract from Citrus limon leaves was tested by poisoned food technique and the volatileactivity assayagainst fiveplantpathogenic fungi (Alternaria alternata, Rhizictonia solani, Curvularia lunata, Fusarium oxysporum and Helminthosporiumoryzae).Resultsmanifestedbetter activityinvolatileactivityassay.The minimuminhibitoryconcentrationforaAlternariaalternata,Rhizoctoniasolaniandcurvularia lunata was 0.2ml/100ml whereas >0.2ml/100ml for Fusarium oxysporum and Helminthosporiumoryzaeinpoisonedfoodtechnique. Fungal sporulationswascompletelyvanishedat 2ml/100mloftheessentialoilexceptCurvularia lunata and Helminthosporium oryzae.

Sedative,Anxiolyticandantidepressanteffect:

There was a most popular Brazilian traditional herbal compound that greatly worked as sedative, anxiolytic and antidepressant. It was consisting with Citrus limon essential oils. Somestudies evidencedsedativeand anxiolytic effects ofessentialoilthat might involve an action onbenzodiazepine-type receptors,and also an antidepressant effect where noradrenergic and serotoninergic mechanisms will probablyplaya role.Leaves were placed in such a way that the edge of the petiole was in contact with the bottom of a glass bottle, soakedwith0.2mM jasmonicacidand salicylicacidaqueoussolutionsandincubatedat 25^0Cfor 24 hours. The content of amino acids suchas, tyrosine,tryptophan,phenylalanine, valine, leucine, isoleucine, lysine, methionine, threonine, histidine and y-aminobutyric acid, was increased after this stress treatment.

Antioxidantactivity:

Fewstudieswerecarriedto determinetheantioxidant activityofessentialoilsofCitruslimon, in one of the studies was arrangedtostudythepotencyofantioxidantwithusingrats, that revealed Essential oil of Citrus limon treatment significantly reduced the lipid peroxidation leveland nitrite content butincreased the glutathione reducedconcentration (GSH) levels and the superoxide dismutase, catalase, and GPx activities in mice hippocampus.Theantioxidant performance ofcitrus essentialoilcould be attributedto their phenolic contents found in leaves .

Antinociceptiveeffect:

Both antioxidant and antinociceptive activities of Citrus limon leaves were examined using mice or in vitro tests. At the studywhen orallyleaves essentialoil significantlyreduced the number ofwrithesandat highest doses,it reducedthenumber ofpaw licks.soresultswere supportedto exhibit that the essential oilof Citrus limon actas anantioxidant and Antinociceptive effect.

Anti-cancereffect:

Inonestudyreportedthepotentialofcitruslimonoidsasananticancer agentinmice, it was found that five limonoids aglycones (limonin, nomilin, obacunone, isoobacunoic acid, ichangin)inducedsignificantamounts of Glutathione-S-transferaseintheliverandintestinal mucosa.
Glutathione-S-transferase is a major detoxifying enzyme system which catalyzes the conjugationofglutathione with manypotentiallycarcinogenic compoundswhich arehighly electrophilicinnature.Astudyof theinhibitoryeffectsoftwolimonoidaglycones(limonin and nomilin) onthe formation of benzo-a-pyrene induced neoplasia in thefore stomach of mice showed that incidence of tumors could be reduced by more than 50% at 10mg/dose.

PLANOF WORK:

AIM:

Thepresentstudyaimstoevaluatetheanti-helminthicactivityoftheethanolicextractofcitrus Limon seeds against Pherentima posthuma.

OBJECTIVES:

- Tocollectseedsoflemonplant
- Topreparemethanolicextractofseedsofcitriuslemon(familyRutaceae)
- Qualitativephytochemicalanalysisofmethanolic extractofseedsof lemon
- Anti-helminthicactivityofseeds of lemon

II. LITERATUREREVIEW

- **Marta Klimek and Halina Ekiert 2020 et al** -This review presents important botanical, chemical and pharmacological characteristics ofCitrus limon (lemon)—a species with valuable pharmaceutical, cosmetic and culinary(healthy food) properties. Ashort description of the genusCitrus is followed by information on the chemical composition, metabolomic

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studiesandbiologicalactivitiesofthemainrawmaterialsobtainedfromC.limon(fruitextract, juice, essential oil). Recently scientifically proven therapeutic activities ofC. limoninclude anti-inflammatory, antimicrobial, anticancer and antiparasitic activities. The review pays particular attention, with references to published scientific research, to the use of C. limon in the food industry and cosmetology. Lastly, the review emphasizes the significance of biotechnological studies on C. limon.

- **Ramazan Sevik 2022 et al -**In this study, the composition of essential oils (EOs) obtained fromCitrus limonL. andCitrus sinensisL. peels and their biological activities on foodborne pathogenic bacteria and food-borne saprophytic yeasts and molds were investigated. In the lemon peel EO, 17 components were identified, mainly limonene (68.65 %) and γ-terpinene (10.81%). Similarly, 8 components were determined intheorange peelEO, mainlylimonene (95.51 %) and β-myrcene (1.98 %). The lemon and orange peel EOsshowed a higher antibacterial effect on gram-positive bacteria used in the study compared to gram-negative bacteria.

- **Anis Ben Hsouna and Nihed Ben Halima 2017 et al-**In this study, we assessed chemical composition, antioxidant and antimicrobialactivities ofC. limonessentialoil(ClEO) with its preservative effect against Listeria monocytogenes inoculated in minced beef meat. Gas chromatography/mass spectrometry (GC-MS) was used to identify the major components of the obtainedClEO. The antioxidant activities of this ClEO were determined according to the β-carotene bleaching assay, as well as by 2.2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity. For antimicrobial activity, agar well diffusion method was used and the minimuminhibitoryconcentrations (MICs) as wellasthe minimumfungicidalconcentrations (MFCs) were determined. The in situ effect of the ClEO was evaluated through physicochemicalparameters(pHandthiobarbituricacidreactivesubstances(TBARS),aswell as against L. monocytogenes in minced beef meat model.

- **Mansour Amin and Nasrin Aghel 2016 et al-**The purpose of this study was to evaluate the antimicrobial activity of essential oil and extract of Lemon (Citrus limon), Mandarin (Citrus reticulata), and Pummelo (Citrus grandis) against Staphylococcus aureus, Escherichia coli, Bacillussubtilis,andSalmonellatyphi.Microorganismsresistanttomostantibioticsarerapidly spreading,andthereisanurgentandcontinuousneedfornovelantimicrobialcompounds.The genus Citrus belongs to the family Rutaceae and has many biologically active secondary metabolites. In this study, minimum inhibitory concentrations (MICs) of different Citrus leaf extracts were determined against all four food-borne pathogens. The C. grandis leaf essential oilhadpotent antimicrobialactivityagainst allfour pathogens, andtheC. limonleafessential oil was effective on Gram positive bacteria. Salmonella typhi was resistant against these two leaves' essential oils.

- **Chunlian li and Weicheng Zhang 2022 et al-**Species of the genusCitrusare cultivated in many regions of China and are widely used for medicinal purposes. In the present study, essential oils (EOs) were extracted from four different Citrusspecies using steamdistillation. The chemical components of these four essential oils were separated using gas chromatography-mass spectrometry, and 52 compounds were confirmed. D-limonene was found to be the most abundant compound. All four essential oils demonstrated varied but remarkable radical scavenging capacity (IC50; 0.77–13.9%).Citrus paradisi essential oil exhibited excellent antioxidant activity. Compared to ibuprofen, topical application of thefour Citrusspp. essential oils significantly inhibited ear edema formation in mice. Furthermore, essential oils from the four Citrusspecies reduced the expression levels of interleukin-6(IL-6), cyclooxygenase-2(COX-2)and nucleartranscriptionfactorkappaBp65 (NF-κB) to different degrees.These results suggest that the four Citrusessential oils have potential for use as active ingredients in functional foods or cosmeceutical products.

- **MohamedmakniandHamadifetouiet2018etal-**Naturalplantextractscontainavarietyof phenolic compoundswhichare assigned variousbiologicalactivities. Our work aimsto make a quantitative and qualitative characterization of the Zest (ZL) and the Flesh

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(FL) of lemon (Citruslimon), tovalorize thepharmacologicalusesoflemon, byevaluating invitro activities (DPPH, free radical scavenging and reducing power). The antibacterial, antifungal, and antiproliferative activities were sought in the ability of Citrus limon extracts to protect DNA and protein. We found that the ZL contains high amounts of phenolics responsible for the important antioxidant properties oftheextract. These preliminary results showed that Citrus limon has antibacterial and antioxidant activity in vitro. It would be interesting to conduct further studies to evaluate the in vivo potential in an animal model.

- **Sarah zahr and Rana EL Hajj 2023 et al-** Citrus is among the main tree crops cultivated worldwide, with orange and lemon being well-known species. In this review, a thorough investigation of the literature was conducted to compare the phytochemistry of sweet orange and lemon fruits and reveal their nutritional and health implications. This review gives a thorough and critical evaluation of the composition and traditional medical uses of Citrus sinensis and Citrus limonwiththeir pertinent bioactivity. Oranges and lemons are considered potential sources of antioxidant agents scavenging free radicals and preventing their degenerative effects because ofpolyphenols, flavonoids, limonoids, carotenoids, and vitamin C. Additionally, different partsoforanges and lemons have shown efficiency against various pathogenic bacteria, fungi, and cancer.

- **Shefalee k.Bhavsar and Mamta B. Shah 2007 et al -**The current study was designed to investigatetheeffectofCitruslimon.(L.)Burm.(Rutaceae)fruits,commonlyknownaslemon, inexperimentalliver damage. The ethanolextract ofCitrus limon. fruits was evaluated for its effects on experimental liver damage induced by carbon tetrachloride, and the ethyl acetate solublefractionoftheextractwasevaluatedonHepG2cellline.Theethanolextractnormalized the levels of aspartate aminotransferase (ASAT), alanine aminotransferase (ALAT), alkaline phosphatase (ALP), and total and direct bilirubin, which were altered due to carbon tetrachloride intoxication inrats. The results fromthe current investigationalso indicate good correlation between the in vivo. and in vitro. studies.

- **Chistiane Mendes Feitosa and Lidianne Mayra Lopes Campelo 2011 et al** This study investigatedtheeffectsofC.limonessentialoil(EO)onlipidperoxidationlevel,nitritecontent, glutathione reduced (GSH) concentration, and antioxidant enzymes [superoxide dismutase (SOD), catalase, and glutathione peroxidase (GPx)] activities in mice hippocampus. EO of limontreatmentsignificantlyreducedthelipidperoxidationlevelandnitritecontentbut increased the GSH levels and the SOD, catalase, and GPx activities in mice hippocampus.

- **M.H.Moosavy and P.Hassanzadeh 2017 et al-** Citrus fruits have some antioxidant and antimicrobial properties. The aim of this study was to determine the chemical compounds, antioxidant, and antimicrobial activities ofEssentialOil(EO) of lemon (Citrus limon) peel in vitroandina foodmodel.Thetotalphenolcontentwas81.82±8.02mggallicacidequivalent/g oftheEO. Also,thetotalamount offlavonoids intheEOoflemonpeelwas11.72±1.82 mg/g rutin equivalent. Lemon peel EO showed 55.09% inhibition of DPPH, showing significantdifference with controlgroup ($p<0.05$). The MIC and MBC value ofEO against S. aureuswas1.25and5%,respectivelyhavingsignificantdifference($p<0.05$)withcontrolgroup. A dose-dependent manner was seen in food model revealed significantly lower ($p<0.05$) bacterial number in EO containing barley soup groups than the control one.
- **Junab Ali and Trideep saikia 2017 et al** evaluate the antimicrobial activity of methanolic extract from the peel of the fruit of Citrus Limon (Family-Rutaceae) in conjugation with phytochemicalanalysis. The methanolic extract from the peel of the fruit of Citrus Limon (Family-Rutaceae) was separated from fruits, shade dried, powdered and extracted using methanol,analysedforphytochemicalconstituentsusingstandard methods.Theantimicrobial activity of the plant extract was examined against 2 bacterial strains among one is Gram-positive (Staphylococcus aureus) and other is Gram-negative (Escherichia coli) and 1 fungal strains (Candida albicans) using agar well

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diffusion method. Results: Various phytochemical analysesrevealedthepresenceofalkaloids,saponin,flavonoids,carbohydrates,glycosidesand citricacidsandtannins.Theantimicrobialactivity ofthemethanolicextractoftheplantshowed significant result against all the of the test organisms.

- **Amit Pandey and Sudeep KumarTiwari 2011 et** The present studywas carried out to find out the antimicrobial activity of ethanolic, methanolic, ethyl acetate & hot water extract of lemon fruit parts like peels & seeds. Antimicrobial analysis was done by using agar well diffusion method against bacterial and fungal pathogens. Methanolic extrac toflemon peelsexhibitedthe maximumzoneofinhibitionagainst Pseudomonasaeruginosawhereashot waterextractoflemonpeelsexhibitedleastzoneofinhibition.Ethanolicextractoflemonseeds showed maximum zone of inhibition against Pseudomonas aeruginosa whereas hot water extract showed least zone of inhibition. MIC value was determined by using micro broth dilution method. The least concentration was obtained 2.4 mg/ml for ethanolic and hot water extractsoflemonpeelsagainst S.aureus.TheMBCvaluealso determinedandphytochemical analysis showed the presence of tannins, glycosides, reducing sugars and flavonoids.

III. MATERIALS&METHODS

COLLECTIONOFPLANTMATERIAL

FreshLemonfruitswerecollectedfromthe localmarket.Thefruitswerewashedwithsterile distilledwater.Afterthat seedswereseperatedfromthe fruits,driedunderthesheadeat room temperature for one week, and pulverized to a fine powderusing grinders.

Fig: 8 Collection of citruslim on fruits

Fig: 9 Seeds separated and dried

Fig: 10 Pulverizedseed

Fig: 11 Pulverization of seeds

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COLLECTIONOFEARTHWORMS

TheIndianearthwormPheritimaposthumawere collected from a Vermicompost unit at pedda tekur village near kurnool,Andhra Pradesh.

Fig:12(Earthworms)

EXTRACTIONBYMACERATION

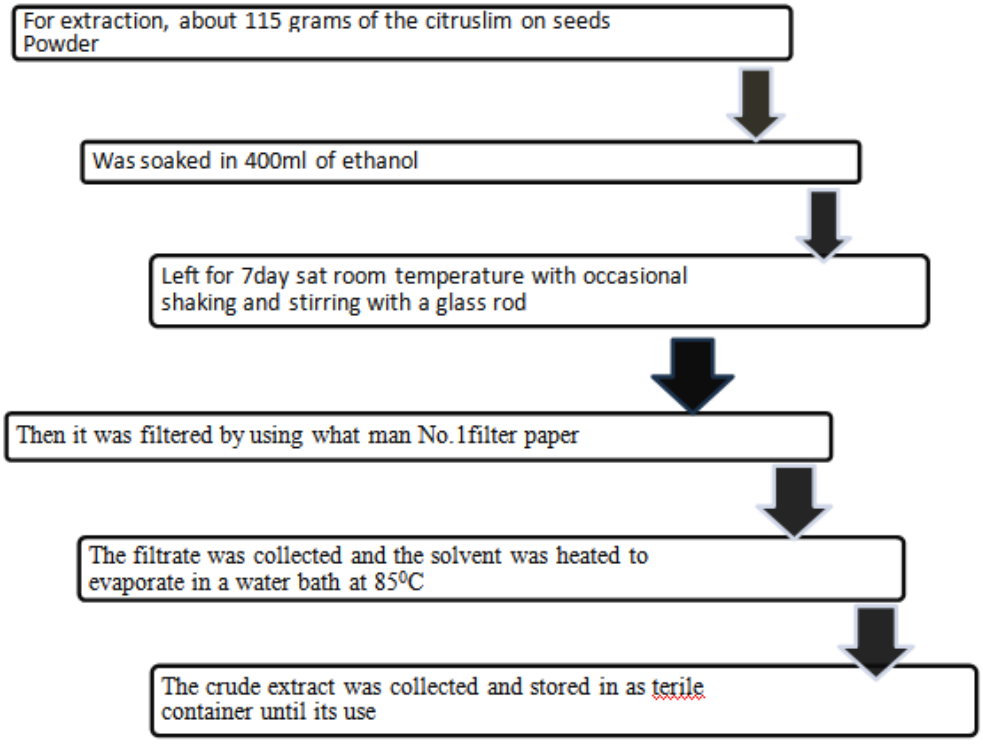

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Fig:13(Maceration)

Fig:14(Filtration)

Fig:15(Filtrate)

PRELIMINARYPHYTOCHEMICALSCREENING

Theplant extractwasassessed fortheexistenceofthephytochemicalanalysis byusing the following standard methods

TestforFlavonoids:

Shinodatest: Piecesofmagnesiumribbonandconcentrated HClweremixedwithlemonseed extract after a few minutes reddish color showed the presence of flavonoids.

Alkaline reagent test: 2ml of 2% w/v NaOH solution was mixed with lemon seed extract, concentratedyellowcolorwasproduced,whuchbecamecolorlesswhenitwasdilutedintothe mixtuer. This result showed the presence of flavonoids.

TestforPhenol:

To1mlofextract,3mlof10%w/vleadacetatesolutionwasadded.Abulkyprecipitate indicates the presence of phenolic compounds.

TestforSaponins:

5ml of water was mixed with lemon seed extract in a test tube and it was mixed vigorously. The frothing was mixed with a few drops of olive oil and mixed vigorously and the foam appearance showed the presence of sapomins.

TestforTannins:

10mlofbrominwaterwasaddedtothe0.5gofextract.Discolorationofbrominewatershowed presence of tannins.

TestforCarbohydrates:

Molisch'stest:2mlofextracttakeninatesttube.Nowtodropsofmolisch'sreagentareadded tothe extract and mix it. Now, addslowlyconcentratedsulphuric acid insloping the test tube byitsslide without mixing vigorously.Apurple ring appearsatthe interface betweenthe acid and test layers which confirms the presence of carbohydrates.

ANTHELMINTHINTIC ACTIVITY

Preparation of plant extract: The extract was dissolved in saline to prepare sample solution of concentrations of 25mg/ml, 50mg/ml to be used for screening the anthelmintic activity.

Standarddrug: Albendazole(25mg/ml,50mg/ml)insalinewastakenasastandardsolution.

Activity: The anthelmintic activity was evaluated on adult Indian earthworms. For preliminaryevaluationofanthelminticactivitytest samplesoftheextract werepreparedat the concentrations of 25mg/ml and 50mg/ml. 20

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worms 5-7cm were divided into 4 groups(1 control, 2standardsand2tests) eachcontaining4wormsandplaced inpetridishescontaining

the above test solutions of extracts. Albendazole was used as the reference standard and a normal saline is used as a control.All the tests, control and standard solutions were prepared freshly before starting the experiment. Observation is made for the time taken for paralysis whenmovementwaslostornomovement.Thetimefort hedeathofwormswasrecordedafter ascertaining those worms neither moved in lukeworm water.

IV. RESULTSANDDISCUSSION

PHYTOCHEMICALSCREENING

Table:3(Qualitativechemicalexaminationofextractofcitruslimonseeds)

Nameofphytoconstituent	Ethanolicextract
Flavonoids	+
Phenoliccompounds	+
Saponins	+
Tannins	+
Carbohydrates	+

Preliminaryphytochemicalscreeningoftheethanolice xtractofcitruslimon seedsrevealsthe presence of flavonoids, tannins, saponins, carbohydrates,phenolic compounds.

ANTHELMINTICACTIVITY

For monitoring anthelmintic activity different concentrations of ethanolic extract(25mg/ml,50mg/ml)weretaken.Whilenormal salineandalbendazole (25mg/ml, 50mg/ml) act as control and standard drug respectively. Time of paralysisanddeathwasobserved.

Fig:16(control)

Fig: 17 (standard drug)

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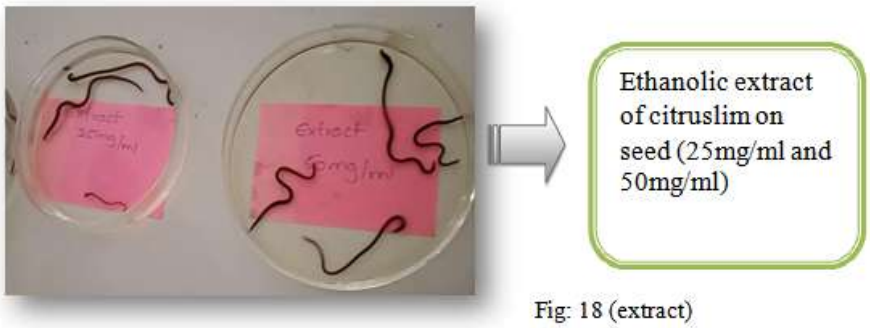

Fig: 18 (extract)

Differentconcentrationsofethanolicextract,controlandstandarddrug.

Table:4Anthelminticactivityoftest(extractofcitrusLimonseeds)

S.NO	CONCENTRATIONS	TIME OF PARALYSIS (MIN)	TIMEOFDEATH (MIN)
1.	25mg/ml	131	156
2.	50mg/ml	28	41

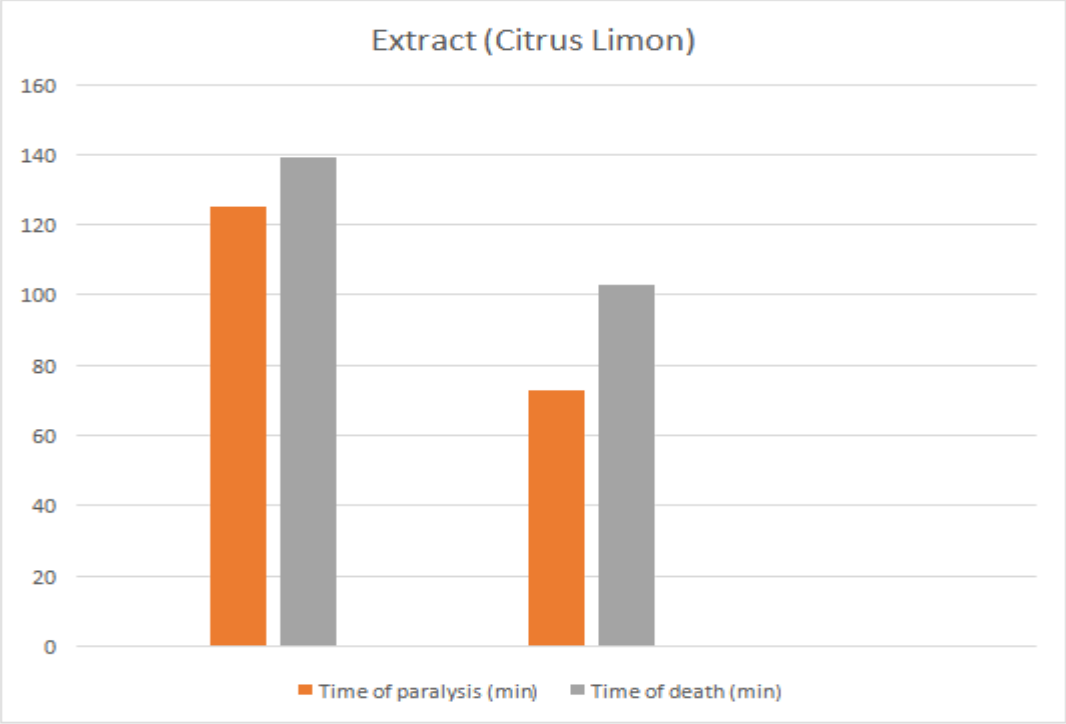

Fig:19(Anthelminticactivityofextractcitruslimonseeds)

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Table5:AnhelminticactivityofstandardDrug (Albendazole)

S.NO	CONCENTRATIONS	TIMEOF PARALYSIS (MIN)	TIMEOFDEATH (MIN)
1.	25mg/ml	125	139
2.	50mg/ml	73	103

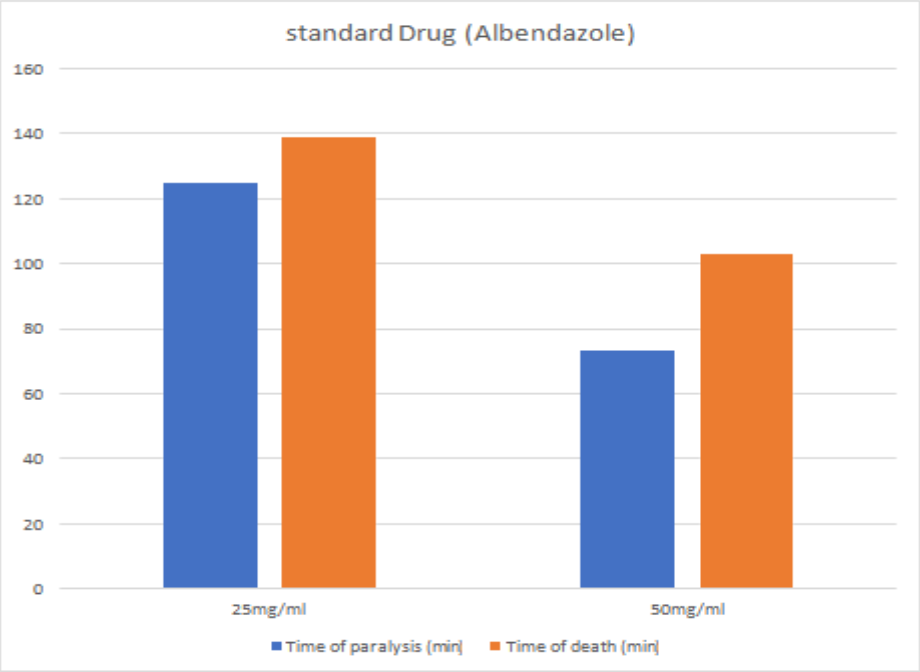

Fig: 20(AnthelminticactivityofstandardDugAlbendazole)

V. DISCUSSION

Citrus Limon fruits were collected froma nearby market to prove the anthelmintic activity of the ethanolic extract of seeds. The seeds were dried, pulverized in to a fine powder, and extracted by maceration with ethanol. The extract was screened for phytochemicals. The screening showed positive for flavonoids, saponins, tannins, carbohydrates and phenolic compounds. The extract was employed to determine anthelmintic activity against Pheretima posthuma. The resultsreveala dose dependent increase inactivityofthe extractsat 25mg/ml and 50 mg/ml concentration. The extracts at 50 mg/ml exhibited better activity than standard compound Albendazole.

VI. CONCLUSION:

Thepresent studyconcludedthattheextracthasshownanthelmintic activityagainst Indian earth worms (Pherentima posthuma) due to thepresence of flavonoidsphenolic compounds and tannins.At allconcentrations of25 mg/mland 50 mg/ml, the extract exhibits anhelmintic action as determined by the duration of the worms paralysis and eventual death. However 50 mg/ml demonstrated the most substantial activity and was comparable to the standard drug 25 mg/ml and 50 mg/ml albendazole.

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