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Phytochemical and Antibacterial Screening: A Review on Datura stramonium

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A B S T R A C T

Plant have benefited as an alternative medicine in treatment and prevention of disease. Medicinal plants like Datura stramoniumare assessed for phytochemical components and anti-microbial activity. Plant have important medicinal components like tropane, alkaloids, amino acids, tannins, phytic acids, carbohydrate. The components \ phytochemicals are used to cure different human diseases like skin disorder, ear pain, cough, fever, burns and asthma. In the present study the phytochemicals and antimicrobial activity of Datura stramonium was reviewed and results found that the phytochemicals studies are performed using various specific extracts like petroleum ether, ethanol and chloroform, crude extract to indicate the presence of flavonoids, terpenoids, glycosides, etc. mostly antimicrobial activity was studied by disc diffusion method. In antimicrobial activity extracts found active against pathogen like *Escherichia coli, Staphylococcus aureus, Bacillus subtilis* and *Salmonella typhi.*

Keywords:Datura stramonium, Phytoconstituents, Phytochemicals.

1.Introduction

Datura commonly known as throne apple [1-4]. It is a leafy herbaceous plant. It has a powerful hallucinogen that causes delirium [5-10]. It has originated in Central America but it is distributed in different parts of world [11, 12]. Datura stramonium is an erect branch and annual shrub. Branching is somewhat freely giving bushy look [1-4, 13, 14]. It have simple leaves with white or purple flowers with attained height of 3 feet [1-4]. D. Stramonium spread naturally in hot and temperate region. And it can cause toxicity to animal that consumed it [11-12].

Since D. Stramonium has powerful hallucinogen that causes delirium because of it is often used in "love potion and witches" brews 5-10]. Due to its analgesic and anaesthetic property it is used as alternative medicine. It can be used for treatment of epilepsy and asthma [11, 15, 18, 19]. The plant course mental and physical effects. It also cause profound and prolonged disorientation with potential fatal consequences [11, 16, 17]. It contain active constituent like Hyoslyamine, Scopolamine and atropine [1]. Atropine is being used in the treatment of Parkinson's disease, peptic ulcer, diarrhoea and bronchial asthma [20, 21].

Scopolamine have been used in treatment of Parkinson's disease and painful visceral sapiens through injection [20, 22]. D.stramonium leaf extract of various solvent is found to have Antimicrobial and Antifungal Activity.

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Regional and other names [23]

Sanskrit:	Umatta-virkshaha
English:	Throne apple
Hindi:	Sadah-Daturu, Safed Datura
Tamil:	Umatai
Arab:	Jouz-masal
Gujrat:	Dhatoria
Bengali:	Dhattura
Malayalam:	Maraummam
Marathi:	Kanaka

Scientific classification of Datura stramonium [23]

Kingdome:	Plantae
Division:	Magnoliophyta
Class:	Magnoliopsida
Order:	Solanales
Family:	Solanaceae
Genus:	Datura
Species:	Datura stramonium

2.Plant appearance

Datura is annual plant. Stems of Datura is branch, herbaceous and globous. When cultivated its height can reach up to 1 m. The branching stem are spreading leafy, stout, erect, smooth and patealize screen in colour, branching is in forked manner. Big, hairy, simple dentate, oval and globous leaves are present. Leaves have pale black opposite veins. Stalk length is about 4-6 inch ovate and pale green coloured. The surface of leaves is dark and greyish green and smooth, the under surface is paler and when dried minutely wrinkled. The plant bear purple and white coloured, funnel shape flowers, its flowers has superior ovary and 5 stamens. Average length of flower is about 3 inches. The calyx is long, tubular and somewhat a swollen below and very sharply five angled surmounted by five sharp teeth. Corolla in funnel shaped. Stem stalk is pale blue or greenish white. Seeds are black, kidney shape and flat. Fruits are as large as walnuts and fall of thorns. Datura has strong narcotic property but it has a peculiar action on human which makes it very valuable as medicine. The whole plant is poisonous and the seeds are the most active; neither dying nor boiling destroys the poisonous properties. The symptoms of acute Jimsonweed poisoning included dryness of the mouth and extreme thirst, dryness of the skin, pupil dilate ion, impaired vision, urinary retention, rapid heartbeat, confusion, restlessness, hallucinations, and loss of consciousness [23, 24].

Distributions

Datura had originated from Caspian Sea and from there it spread to Europe in first century. Presently it grows in waste lands of Asia, South Africa, Europe and America. Datura is cultivated in France, South America, Germany, and Hungary, throughout the world [25].

Cultivation

Datura is easily cultivated, flourish well in open, sunny situation. It thrives in most moderately good soil, but grows best in good sandy loom or calcareous rich soil and with leaf mould added. Seeds are sown in summer season (in the month of May), they are drilled 3 feet apart, barely covered. As the plant achieve a good size/height it detaches from seed (grows freely from seed). Young plants are planted with 12 to 15 inches distance between each plant. Weed free soil in early stages are best for growth. In dry and hot condition compost of rotted cow-manure is given. If crop is grown for leaves, the capsules should be picked off as soon as possible, as in wind its spine tears the leaves. After 3 months (in the month of August) the plant reaches the height of 1 meter and bears flower and fruits. The leaves with steam and flowering top are collected and dried at 46˚C to 50˚C by the end of August. The leaves are harvested in late summer and when plant is fully bloom and they are carefully dried. In later summer the crop is cut with the help of sickle in the morning on a fine day and after the sun has dried off the dew. The leaves are cut, steam and dried carefully and quickly [23, 25, 26, 27].

3. Phytoconstituents

The major tropane alkaloids hyoscyamine and scopolamine and several minor tropane alkaloids have been identified in Datura species. Typical examples of minor alkaloids in D. stramonium are tigloidin, aposcopolamine, apoatropin, hyoscyamine N-oxide and scopolamine N-oxide 17-20. 6-ditigloylaxytropane and 7-hydroxylyoscyamine are reported for the first time in this species [23, 24].

Distribution of hyoscyamine and scopolamine in D. stramonium was studied. The production of hyoscyamine and scopolamine in D. stramonium has been

investigated in the different plant parts, at different stages of their life cycle. The maximum contents were found in the stems and leaves of young plants, hyoscyamine being always the predominate component. These compounds were included in many pharmacopeia's because of their anticholinergic activities D. stramonium contain variety of alkaloids including atropine, hyoscyamine and scopolamine [23, 28].

Sixty-four tropane alkaloids have been detected from D. stramonium. Two new tropane alkaloids, 3-phenylcetoxy-6, 7-epoxyntropane and 7-hydroxyapoatropine were tentatively identified. The alkaloids scopoline, 3-(hydroxyacetoxy) tropane, 3-hydroxy-6-(2-methylbutyryloxy) tropane, 3-tigloyloxy-6-hydroxytropane, 3, 7-dihydroxy-6-tigloyloxytropane, 3-tigloyloxy-6-propionyloxytropane, 3 phenylacetoxy-6, 7-epoxytropane, 3-phenylacetoxy-6-hydroxytropane, aponor scopolamine, 3â, 6â-ditigloyloxytropane and 7-hydroxyhyoscyamine are reported for the first time for this species. Other alkaloids found in D. stramonium include[23, 29]: Hygrine, 3, 6-Ditigloyloxy-7-hydroxytropane, 6-Hydroxyhyoscyamine, Pseudotropine, 3-Tigloyloxytropane, Hydroxy-6-tigloyloxytropane, Phenylacetoxytropane, 3-Tigloyloxy-6-(2-methylbutyryloxy) tropane, Hyoscyamine, 3-Tigloyloxy-6-isovaleroyloxy-7-hydroxytropane, Scopolamine, Tropinone, Scopine, 6-Hydroxyacetoxytropane, 3,6-Diacetoxytropane, 3-Tigloxyloxy-6-acetoxytropane, 3-Tigloyloxy-2-methylbutyryloxytropane, 3á, 6â-Ditiglotoxytropane, 3-Acetoxy-6-isobutyryloxytropan, 3-(2-Phenylpropionyloxy) tropane, Littorine, 6-Hydroxyapoatropine, 3â, 6â-Ditigloyloxy-7-hydroxytropane, 3-Tropoyloxy-6-acetoxytropane, 3,6-Dihydroxytropane, 3â-Tigloyloxytropane, 3-Tigloyloxy-6-propionyloxy-7-hydroxytropane, 3á-Apotropoyloxytropane, Aposcopolamine, 3â, 6â-Ditigloyloxytropane, 3-(3'-Acetoxytropoyloxy) tropane, 3á-Tigloyloxy-6-hydroxytropane, Tropine, 3-Acetoxytropane, 3-Hydroxy-6-acetoxytropane, 3-Hydroxy-6-methylbutyryloxytropane, 3-Tigloloxy-6-isobutyryloxytropane, Aponorscopolamine, 7-Hydroxyhyoscyamine, Meteloidine, 3â, 6â-Ditigloyloxytropane.

The phytochemical analysis of the plant revealed that D. stromonium contained saponins, tannins and alkaloids and glycosides. The secondary metabolites identified in the plant materials in the study of Banso A and Adeyemo S showed antimicrobial activity [21, 23, 29, 32-48].

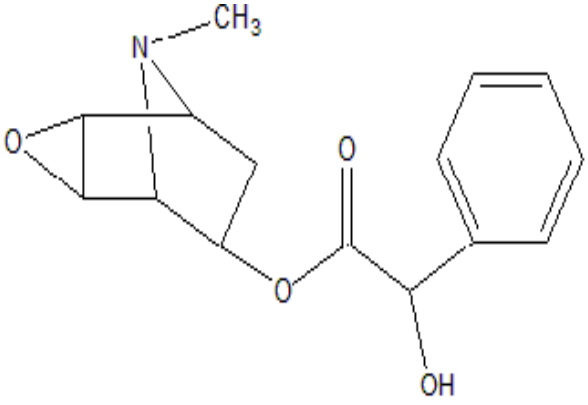

Fig a :- Scopamine[49]

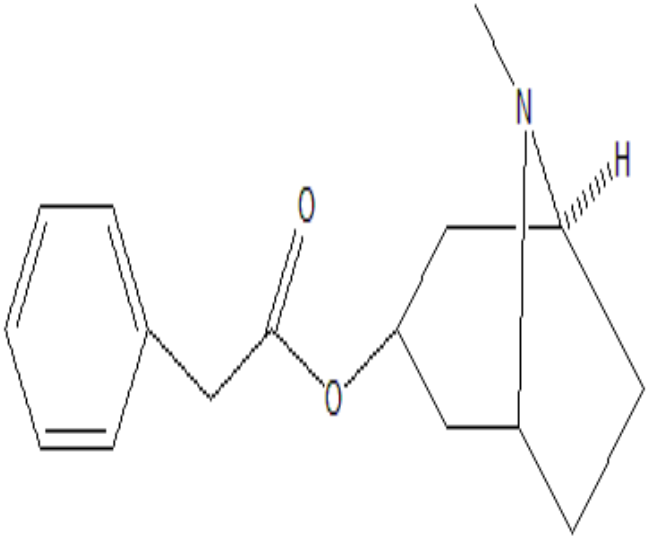

Fig b :- 3-phenylacetoxcy-6-hydroxctropane[50]

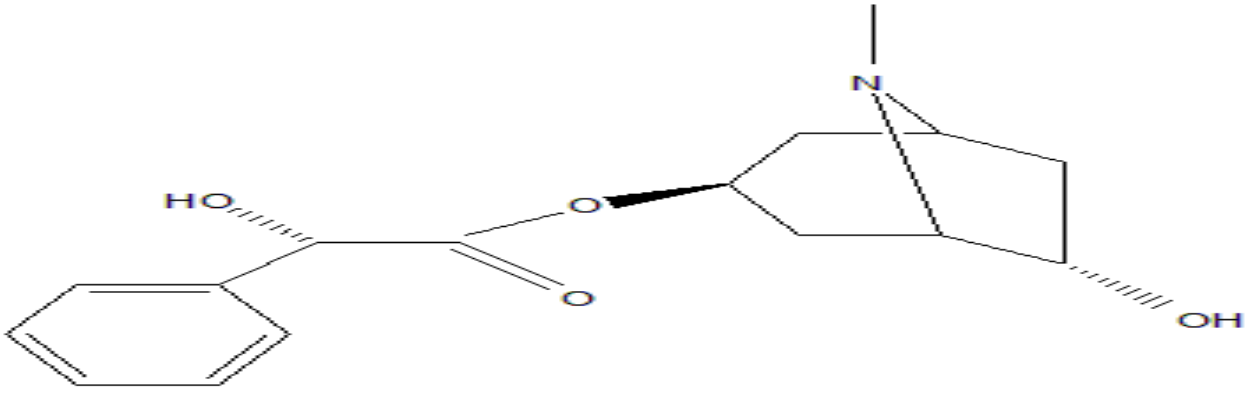

Fig c :- 6-hydroxyhyoscyamine [51]

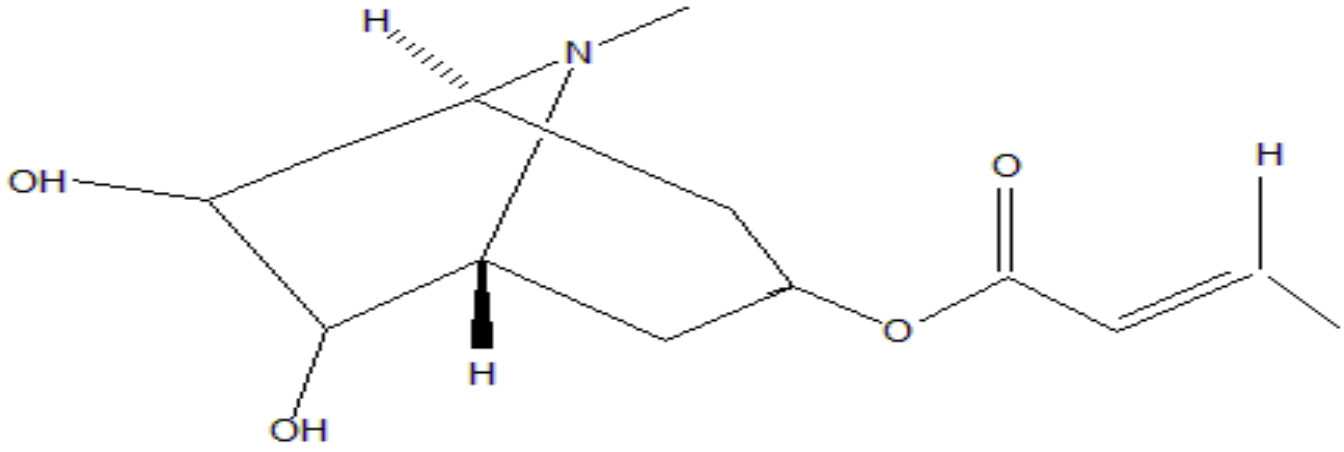

Fig d :- 3,7dihydroxy-6-tigloxytropane[52]

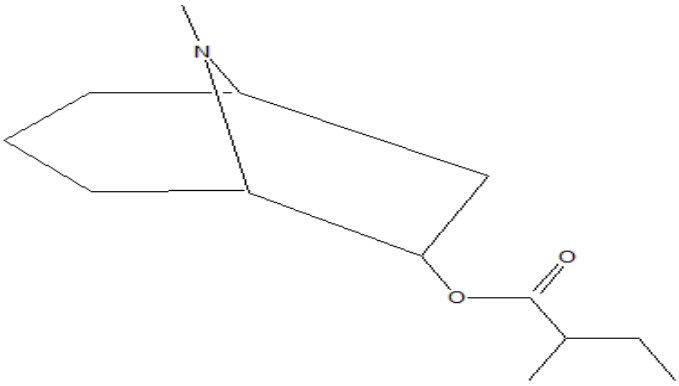

Fig e:- 3hydroxy-6-(2-methylbutyrloxy)tropane[53]

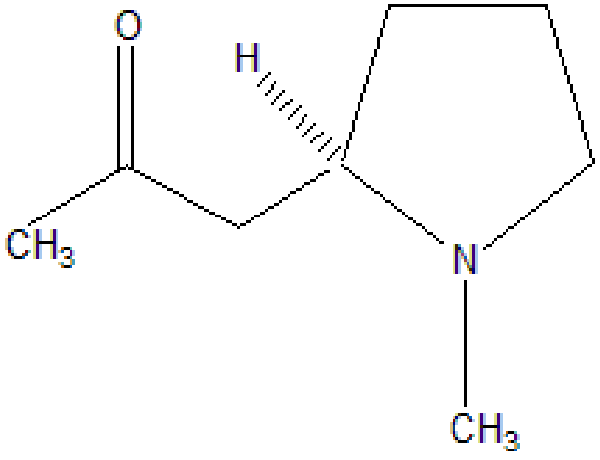

Fig f :- Hygrine[54]

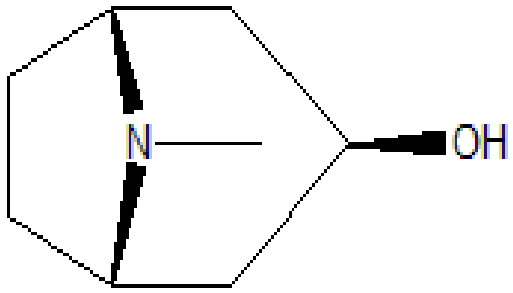

Fig g :- Pseudotropine[55]

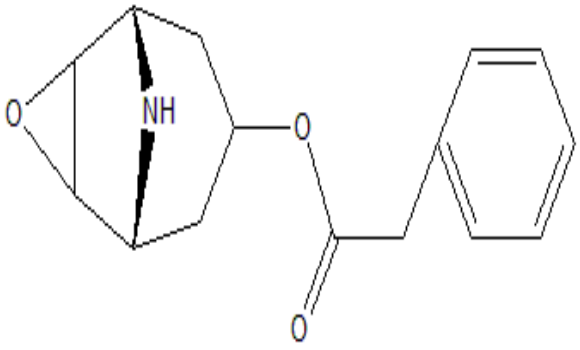

Fig h :- 3-phenylacetoxcy-6,7- epoxcytropane[56]

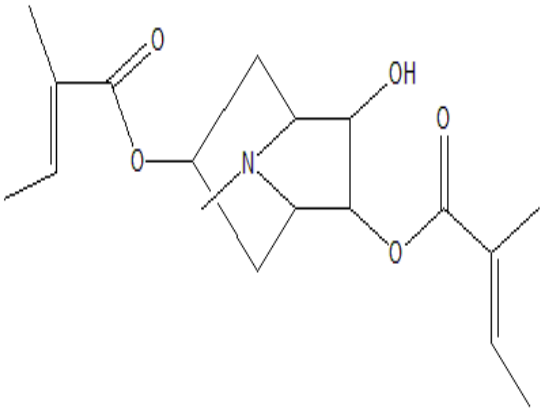

Fig i :- 3,6- ditigloyloxy-7- hydroxytropane[57]

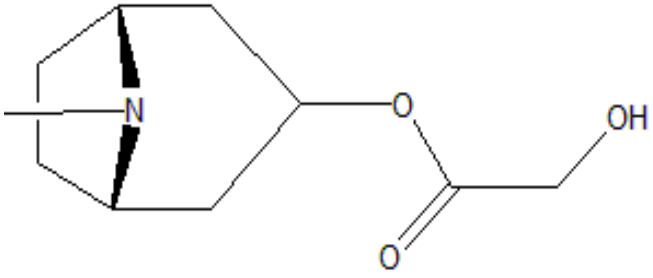

Fig j :- 3-(hydroxyacetoxy)tropane[58]

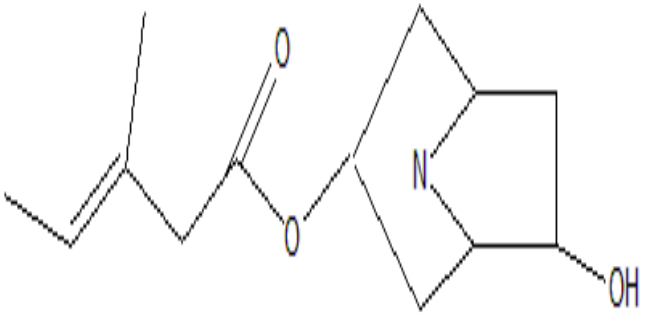

Fig k :- 3-Hydroxy-6-tigloyloxytropane[59]

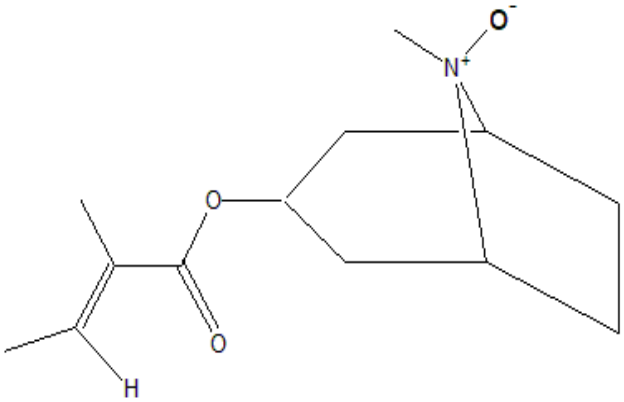

Fig l :- 3- Tigloxcytropane[60]

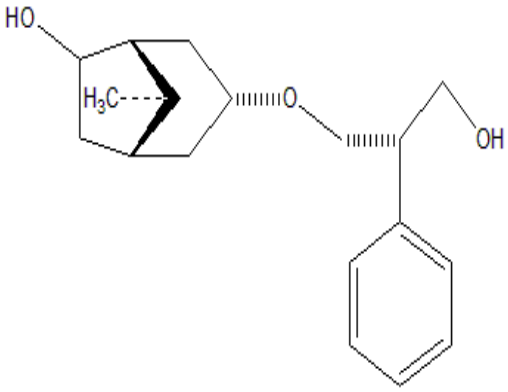

Fig m :- 7-hydroxyhysocyamine[61]

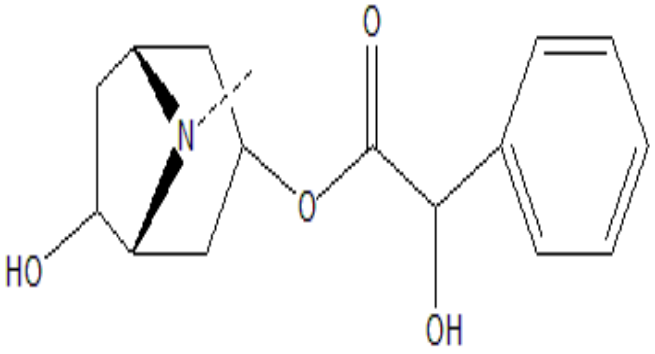

Fig n :- 7-hydroxyhysocyamine [62]

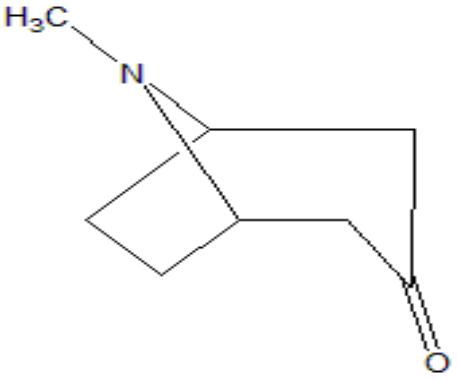

Fig o :- Tropinone [63]

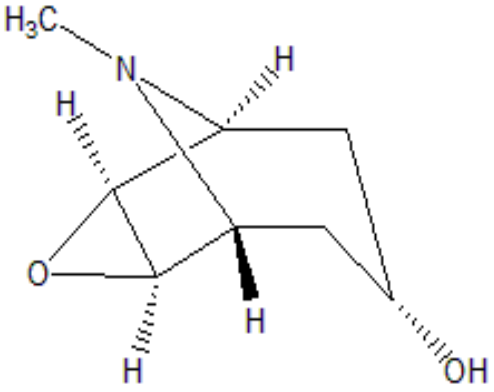

Fig p :- Scopine [64]

Ethanol using soxhlet apparatus. Extracts of different solvents were collected in separate container. The extract obtained were evaporated to dryness using a rotary evaporator and stored in refrigerators [19, 64].

4.Phytochemical screening of Extract

Different extracts of D. Stramonium was tested by the researcher by using general chemical test [19, 22, 65-72]

Determination of saponins

Each of the plant extracts (0.5g) was separately stirred in a test tube, foaming which persisted on warming was taken as an evidence for the presence of saponins [19, 64].

Determination of tannins

Extract of each sample (0.5g)was separately stirred with 10ml of distilledwater and then filtered. To the filtrate was addedtwo drops of 5% Iron (III) Chloride (FeCl3)reagent. Blue – black or blue – green colouration or precipitate was taken as an indication of thepresence of tannins [19, 65].

Determination of alkaloids

Each plant sample (0.5g) was separately stirred with 1% hydrochloric acid (HCl) on a steam bath. The solution obtained was filtered and 1ml of the filtrate was treated with two drop of Mayer's reagent. The two solutions were mixed and made up to 100ml with distilled water. Turbidity of the extract filtrate on addition of Mayer's reagent was regarded as evidence for the presence of alkaloids in the extracts [19, 65].

Determination of glycosides

Coarsely powered plant material (1g) was introduced into two different beakers. To one of the beakers was added sulphuric acid (5ml) while water (5ml) was added to the other beaker. The two beakers were heated for 3 minutes and the contents filtered into labelled test tubes. The filtrate was made alkaline with sodium hydroxide (0.5ml) and allowed to stand for three minutes. The presence of reddish brown precipitate in the filtrate was taken as positive for glycosides [19, 65].

Determination of flavonoids

Extract of each piece of test plant leaf extract was added a small piece of magnesium ribbon, this was followed by drop wise addition of concentrated hydrochloric acid. Colours ranging from orange to red indicated flavones, red to crimson indicated flavones, crimson to magenta indicated flavanones [19, 65].

Culture Media

Researcher prepared nutrient agar medium (NAM) using 8% nutrient broth in double distilled water and agar-agar. It was subjected to autoclaving at 15 lbs psi for 25–30 min s. Agar test plates was prepared by pouring 15 ml of NAM into Petri dishes under aseptic condition and allowed to stand for room temperature for stabilization. Bacterial cell cultures was maintained in peptone saline solution by regular sub culturing and were incubated at 37˚C for 24 h [73,74].

Test for Antibacterial activity

Filter paper disc of 6 mm diameter list in a beaker with sterilized in an oven at 180°C for 1 hour. Then 20 and 40 ug/ml of the solution crude extract to the disc in the three replications. The paper disc impregnated with the sample work and transferred with sterile forces to media seeded with spore suspension of bacteria stain has described above. The crude extract was evaluated by measuring the zone of inhibition against the test bacteria after an incubation period of 24 hours and compared with standard [19, 22, 75, 76].

5.Result and Discussion

Phytochemical screening

The phytochemical screening test were conducted using three different solvents such as chloroform, petroleum ether and ethanol crude extract of D.stramoniumleaves were summarized in Table-1. The results obtained from this study pointed that the presences of flavonoids, alkaloids, tannins, saponins and glycosides in the plant extract. According to the previous study, a qualitative phytochemical screening test of water and ethanol extract of D.stramoniumextract showed the presence of different class of chemical constituents such as saponins, flavonoids, alkaloids, phenols, steroids, and glycosides.

Table 1

Phytochemical screenings of crude extracts of D. stramoniumleaves [22]

S.NO.	Chemical Constituents	Solvents		
		Petroleum ether	Chloroform	Ethanol
1	Saponins	+	+	+
2	Tannins	+	+	+
3	Alkaloids	+	+	+
4	Glycosides	+	+	+
5	Flavonoids	+	+	+

+ = the presence and - = the absence of chemical constituents

Antibacterial

The antibacterial activity of crude extracts of D.stramonium was tested by disc diffusion method. The extract of plant leaves has been found to be potent against S. Typhi, E. Coli, B.Subtillis and S. aureus.The antibacterial activity of D.stramonium leaves extract of different solvents are summarised in Table 2. Petroleum ether extract shown the maximum inhibition zone against S.aureus(19.30±017mm) in 40ug/ml concentration and minimum against S.Typhi(12.30±0.16mm) in 20ug/ml, Chloroform extract shown the maximum inhibition zone against B.Subtillis(18.43±0.57mm) in 40ug/ml concentration and minimum against S.Typhi(11.51±0.54mm) in 20ug/ml and Ethanol extract shown the maximum inhibition zone against S.aureus(15.50±0.55mm) in 40ug/ml concentration and minimum against E. Coli(8.74±0.22mm) in 20ug/ml.

Table 2
Antibacterial activities of D. stramoniumleaves crude extracts [22]

Solvents	Bacteria							
	S. Typhi		E. Coli		B. Subtillis		S. aureus	
	20ug/ml	40ug/ml	20ug/ml	40ug/ml	20ug/ml	40ug/ml	20ug/ml	40ug/ml
Petroleum Ether	12.30 ±0.16	14.25 ±0.42	13.08 ±0.14	16.23 ±0.62	14.06 ±0.37	18.20 ±0.26	15.57 ±0.45	19.30 ±017
Chloroform	11.51 ±0.54	13.14 ±0.40	12.33 ±0.22	14.32 ±0.35	16.94 ±0.26	18.43 ±0.57	14.43 ±0.35	16.27 ±0.17
Ethanol	9.06 ±0.32	11.20 ±0.12	8.74 ±0.22	12.57 ±0.61	11.54 ±0.64	13.15 ±0.35	12.10 ±0.72	15.50 ±0.55

± Standard deviation

6.Conclusion

From the above study it can be concluded that the leaf extract of D.stramonium have phytochemicals that could contribute in antibacterial activities. Possible antibacterial substance in extract of different solvent includes tannins, alkaloids, saponins, flavonoids and glycosides. The antibacterial characteristics of the plant can be further tested to use in treatment of bacterial infection. The crude extract of D.stramonium can be used against some selective microorganisms. Crude extract of D.stramonium can be better alternative to the conventional antibacterial additives in food industry. Also traditionally the anti bacterial potency of crude extract of D.stramonium leaves have been justified.

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