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Bioefficacy of some plant extracts on growth parameters and control of diseases in *Lycopersicum esculentum*

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ABSTRACT

The present study was undertaken to determine the effect of some medicinal plants on growth parameters and diseases, like alternaria canker, blight, leafspot, fruitspot, blossom end rot and sunscald of Lycopersicum esculentum. To understand the mechanism, the phytochemical analysis of plants and its effect on bacterial and fungal cultures were investigated. The effects of selected plant extracts on tomato were observed. Ten medicinal plants were applied for the control of diseases, and its antibacterial and antifungal effect was tested against Clavibacter michigenesis, Alternaria solani, and Septoria lycopersici, Pythium debaryanumand and Phytopthora capsici that cause alternaria canker,early blight, leaf spot, fruit spot, blossom end rot and sunscald disease in Lycopersicum esculentum..Extract of Ageratum.conyzoides was efficient in inhibiting the growth of Clavibacter michigenesis while mycelial growth of Alternaria solani,Septoria lycopersici,Pythium debaryanum & Phytopthora capsici was inhibited by Tagetes patula, Piper nigrum, Aegle marmelos & Ageratum conyzoides.Among the plant extract tested in field, Ageratum.conyzoides was found most effective in reducing the Alternaria canker disease by 78.20% and Azadirachta.indica reduced the Early blight & leaf spot disease by 53.84% & 40.78%respectivilly,Aegle marmelos reduced the fruit spot disease by 61.29%.Pongamia piñata & Brassica campestris reduced the Blossom end rot disease by 86.95% and 82.17% and Ageratum.conyzoides& Pongmia piñata reduced the sunscald disease by90.08% & 76.85% respectively in Lycopersicum esculentum. The result suggests the applications are also growth promotive and cost effective and non-hazardous in agro-ecosystem.

Keywords: Antibacterial, Antifungal, Biopesticides, Growth parameters, *Lycopersicum esculentum,* Plant diseases.

INTRODUCTION

The natural plant products, known as botanical pesticides or herbal medicines, have long been used in the control of microorganisms causing plant and human diseases. However, with the employment of synthetic pesticides in agriculture, the use of botanical pesticides has significantly diminished. Although highly effective, synthetic pesticides often have undesirable side effects such as toxicity to mammals and causing environmental pollution. Of the herbal medicine and botanical pesticides, much attention has been given to the use of phenolic-rich plant extracts. Tannins are important water soluble plant phenolics. Tannin-rich plant extracts have traditionally been used as medicines to treat infectious human diseases **[1,2]** and they exhibit antimicrobial activity against phytopathogenic fungi and bacteria **[3,4]**. The toxicity of tannins on microorganisms operates either by their direct action on the microbial membrane or by metal ion depletion. In general, tannin-chelated metal ions are not bioavailable. The low decomposition of tannin-rich plant materials (walnut, chestnut and oak) has been in part attributed to the low levels of biologically available metal ions **[5,6].**

Tomato (*Lycopersicon esculentum*) of *Solanaceae* family is an most important vegetables worldwide. As it is a relatively short duration crop and gives a high yield, it is economically attractive and the area under cultivation is increasing daily. Tomato is an annual plant, which can reach a height ofover two metres. The first harvest is possible 45-55 days after flowering, or 90-120 days after sowing. The shape of the fruit differs per cultivar. The colour ranges from yellow to red. The temperature lower within the crop and the fruits grow in the shade of the leaves. Because they are covered, the sun does not damage the fruits and they ripen more slowly. Slower ripening and a high leaf/fruit ratio improve the taste of the fruits and in particular the sweetness. Vigorous tap root system that grows to a depth of 50 cm or more. The main root produces dense lateral and adventitious roots. Growth habit ranges between erect and prostrate. The stem is solid, coarse, hairy and glandular. Spirally arranged, leaflets are ovate to oblong, covered with glandular hairs. Small pinnates appear between larger leaflets. Inflorescence is clustered. Flowers are bisexual, regular and grow opposite or between leaves. Calyx tube is short and hairy, sepals are persistent. Usually 6 petals up to 1 cm in length, yellow and reflexed when mature. 6 stamens, anthers are bright yellow in colour surrounding the style with an elongated sterile tip. Ovary is superior and with 2-9 compartments. Mostly self-but partly also cross-pollinated. Bees and bumblebees are the most important pollinators. Fruits are fleshy berry, globular to oblate in shape. The immature fruit is green and hairy. Ripe fruits range from yellow, orange to red. It is usually round, smooth or furrowed. Seed are numerous, kidney or pear shaped.

Some bacterial/fungal diseases commonly found in tomatoes are Alternaria canker, Early blight, Leafspot, Fruitspot, Blossom end rot and Sunscald. Alternaria canker is an economically important tomato disease that occurs worldwide**.** Early blight is a fungal disease of tomato .The leaves of infected plants become yellow, wilt and dry up. Round, brown spots (with concentric rings) appear on the leaves, reaching a diameter of 1.5 cm. Sometimes small lumps can be found on the stem or on leaves, causing leaves to turn yellow and wilt. Flowers and small fruit fall off. Small spots appear on the leaves and on the fruits of infected plants .These spots are generally brown and circular, leaves turn yellow and drop off. Blossom end rot disease is caused by calcium deficiency. This is usually a result of too much salt in the soil, which is caused by the use of saline water, or irrigating with too little water during the dry season. The amount of salt in the soil can be lowered by flushing it out with one or more abundant applications of salt-free irrigation water (normally during the rainy season), making sure that there is good drainage. Sunscald is a common disease of tomato .Brown or grey indentations appear on the fruit. The part of the fruit that is most exposed to the sun. In order to prevent the plant from these diseases and from pathogens, chemical control methods are needed. Because of high cost of chemical pesticides and their hazardous consequences, the use of different biodegradable materials, like fresh plant extracts has gained importance during last three decades **[4,7,8,9]**. In this context, the present study was undertaken in order to find out the effort of ten botanical plant extracts on *Lycopersicum esculentum* for controlling Alternaria canker. Early blight, Leaf spot, Fruit spot, Blossom end rot and Sunscald.

MATERIALS AND METHODS

The medicinal plants selected for the current study were: *Pongamia piñata; Aegle Marmelos; Azadirachta Indica; Brassica Campestris; Piper Nigrum; Euphorbia tirucalli; Vitex Negundu; Ageratum Conyzoides; Tagetes Patula; and Zigiphus jujube.* tomato requires a relatively cool, dry climate for optimum yield and quality, but it can also adapt to a wide range of environmental conditions. The optimum temperature range for proper growth and development is 21°C-24°C while fruit set is enhanced below 21^0C. Tomato grows best in sandy loam to clay loam soils with a pH of 6.0-6.5. Prepare seedbeds 50 cm in width at any convenient length in an area fully exposed to sunlight. Pulverize soil thoroughly and add well decomposed compost or animal manure at the rate of about 1-2 kg/m2. Ten such beds were raised to grow seedlings for planting in one hectare area. Distance of about 70 cm was kept between two beds to carry out other mandatory operations like watering, weeding, etc. Raised beds were necessary so as to avoid the problem of water logging in heavy soils. In sandy soils, however, sowing can be done in flat beds. Fresh plant parts of 10 medicinal plants were collected from local regions of Odisha. The plant materials were washed thoroughly; air dried, and were then homogenized to fine powder and stored in airtight bottles.

Hundred grams from each of the dried, powdered plant sample were weighed and were placed in a 1000 ml flask. The flask was closed with cotton balls and was covered with aluminum foil. It was then filtered with the help of cheese cloth. 10ml solution of the liquid extract, which was placed in the flask, was sprayed on the leaves of tomatoes on a weekly basis. The following growth parameters were recorded on a weekly basis.

Morphological measurements of the tomatoes were taken at 7, 14, 21, 28, 35, 42, 49, 56, 63, and 70 days post transplantation for determining changes in growth parameters. Morphological measurements of tomato were taken at every 7 days interval after transplantation to determine the disease control rates. From the day of transplantation till harvest time the experimental fields were maintained and the following parameters of tomatoes were recorded at every 7day interval: shoot height; number of leaves; number of branches; number of flowers; and number of fruits per plants. Fruits were collected, weighted, and were stored at 34°C for routine observation.

Phytochemical screening of plant materials

Presence of saponins, tannins, carbohydrates, alkaloids, flavonoids, glycosides, steroids, proteins, and alkaloids were detected by simple qualitative **[10]** and quantitative methods **[11].**

Antimicrobial assay of test microorganism

Bacterial cultures of that were used for antimicrobial assay of test organisms were obtained from the culture collection centre, Department of Microbiology, Orissa University of Agriculture and Technology, Odisha, India,. The bacteria were maintained on nutrient broth (NB) at 37^0C till required for analysis. The *in vitro* antimicrobial activity of the sample solution was done by disc diffusion method **[12].**

Antifungal Assay of test fungi

The infected portion of the plants were extracted and cultured on Sabouraud's dextrose agar and the plates were incubated at room temperature for two days. Greyish brown mycelia were seen which turned later to black color. Smears were prepared and stained with lacto phenol cotton blue stain and were observed under high power microscope. The agar dilution assay was carried out according to **[13]** with a slight modification. Thirty nine grams of potato dextrose agar (PDA) powder was boiled until the agar completely dissolved in 1 L of distilled water. The solution was then sterilized using autoclave at 121°C for 15 min. 19 ml of the sterilized PDA and 1 ml of plant extract were mixed and plated on the sterilized petridishes (8.5 mm in diameter). 10 mm diameter of mycelia discs were inoculated at the centre of the medium. The antifungal assay was divided into 10 different treatments as crude extract of leaves in different concentration (5,10, and 15%). Colony growth was determined on the basis of linear dimensions. The percent reduction (Rr) or stimulation (Rs) of colony diameter by each extract was determined using the following formula **[14]:**

$$Rr = \frac{(R1 - R2)X100}{R1}$$

$$Rs = \frac{(R2 - R1)X100}{R2}$$

Where, Rr = percent reduction in colony diameter; Rs = percent stimulation in colony diameter; R1 = colony diameter on the untreated medium (control); and R2 = colony diameter on the treated medium.

Statistical analysis

The experimental data were statistically analyzed .The significance of differences between the treatments was evaluated by one way analysis of variance at the significance level of 95 % .The Statistical software SPSS version 17.0 was used in the analysis. All the data were analyzed with students 't' test .The value of growth parameter and disease data were statistically analyzed .In the test of significant *($P \leq 0.05$),**($p \leq 0.01$),***($p \leq 0.001$) indicate the treatments were significant at probability level respectively.

RESULTS AND DISCUSSION

Effect of Medicinal plants on growth parameter in *Lycopersicum esculentum*

The data presented in Table-1 and figure-1,2,3,4,5 in shoot height, number of branches, number of leaves, number of flowers, number of fruits in tomato was noticed .Shoot height was significant at ($P<0.001$) in all treatments except *A. marmelos* Which was significant at $P<0.01$ Level.(Table-1,Fig-1).

The number of branches were significant at (P<0.001) in *B.campestris, V.negundu, T.patula & Z.jujube* treatments, significant at(P<0.01) in *P.pinatta, A.indica, P.nigrum, E.tirucalli, A.conyzoides* treatments, while no significant growth was observed in A .marmelos treatment .(Table-1,Fig-2).

The number of leaves were significant at (P<0.001) in *A.marmelos B.campestris, E.tirucalli,V.negundu & Tagetes patula* treatments, significant at(P<0.01) in *P.nigrum,& A.conyzoides* treatments,significant at (P<0.05) in *P.pinata* .,while no significant growth was observed in *A .indica & Z.jujube* treatments .(Table-1,Fig-3).

The number of flowers were significant at (P<0.001) in *A.marmelos, P.nigrum, A.conyzoides, T.patula, Z.jujube* treatmenst, significant at (P<0.01) in *P.pinatta, A.indica* treatments, significant at (P<0.05) in B.campestris, V.negundu treatment, while no significant growth was observed in E.tirucalli treatment (Table-1,Fig- 4).

The number of fruits were significant at (P<0.001) in *P.pinatta, E.tirucalli, V.negundu, A.conyzoides,* treatments, significant at(P<0.01) in *B.campestris, P.nigrum, Z.jujube* treatments, significant at (P<0.05) in A.indica treatment, while no significant growth was observed in *A.marmelos, T.patula* treatment (Table-1,Fig-5)

Effect of medicinal plants on diseases in *Lycopersicum esculentum*

In general disease incidence (Table-2)was reduced by the application of plant extract. Plant extracts of *A.conyzoides* reduced Alternaria canker 78.2%,*Z.jujube* reduced 58,97%,*A.marmelos* reduced 51.6% while other plants reduced disease from range of 14.12-46.79% Extract of *A.indica* reduced Early blight 53.84% while other plants reduced disease from range of 15.38-46.79%. Plant extract of *A.indica* reduced Leafspot 40.78% while other plants reduced disease from range of 1.84-26.31%.Extract of *A.marmelos* reduced Fruitspot 61.29%,*B.campestris* reduced58.06% ,while other plants reduced disease from 27.41-46.45%. Plant extract of *P.pinata* reduced Blossom end rot 86.95%,*B.campestris* reduced 82.17% while other plants reduced disease from 37.39%-66.08%. Plant extract of*A.conyzoides* reduced Sunscald 90.08%, *P.pinata* reduced 76.85%,*V.negundu* reduced 70.24% while other plants reduced disease from 0.82%-59.50%.

Antibacterial activity

The antimicrobial effect of crude medicinal plant extracts of 10 plants species were determined by in vitro studies using water as a solvent. Solvent extracts of *P.pinatta, A.marmelos, A.indica, B.campestris, P.nigrum, E.tirucalli, V.negundu, A.conyzoides, T.patula, and Z. jujube* at concentrations of 5,10, and 15 exhibited the zone of inhibition(Table-3). In case of *Clavibacter michigenesis*,the higher inhibition was noticed in *A.conyzoides* extract at 15% (10.5±0.17).The lower inhibition was noticed in *B.campestris* and *T.patula* extract at 10%(1.26±0.27) and 15%(1.30±0.15).

Antifungal activity

All the medicinal plant extracts *P.pinatta ,A.marmelos ,A.indica ,B.campestris ,P.nigrum ,E .tirucalli ,V.negundu .A.conyzoides ,T.patula and Z.jujube* at 5.10,15% inhibited mycelia growth132 growth to different degrees(Table-4).Different species of fungi isolated and identified to be associated with disease of tomato are *Alternaria solani, Septoria lycopersici, Pythium debaryanum, Phytopthora capsici*..In case of *Alternaria solani aqueous extract of T.patula* showed high inhibition of mycelial growth and *A.indica* showed low inhibition of mycelial growth in all concentration .Rest of the plants were less effective in reducing the mycelial growth of Alternaria solani in comparison of *T.patula* .Maximum inhibition recorded at 15% concentration in all treatments. Highest zone of inhibition observed was 71.87±0.78%.

In case of *Septoria lycopersici, P.nigrum* showed high inhibition of mycelial growth and *A.indica* showed low inhibition of mycelial growth in all concentration. Rest of the plants were less effective in reducing the mycelial132 growth of *Septoria lycopersici* in comparison of *P.nigrum* . Maximum inhibition recorded at 15% concentration in all treatments. Highest zone of inhibition observed was 31.06±0.04%. In case of *Pythium debaryanum, A.marmelos* showed high inhibition of mycelial growth and *T.patula* showed low inhibition of mycelial growth in all concentration .Rest of the plants were less effective in reducing the mycelia growth of *Pythium debaryanum* in comparison of *A.marmelos.* Maximum inhibition recorded at 15% concentration in all treatments. Highest zone of inhibition observed was 59.07±1.44%.

In case of *Phytopthora capsici, A.conyzoides* showed high inhibition of mycelial growth and *Z.jujube* showed low inhibition of mycelial growth in all concentration. Rest of the plants were less effective in reducing the mycelial

growth of *Phytopthora capsici* in comparison of *A.conyzoides*. Maxium inhibition recorded at 15% concentration in all treatments. Highest zone of inhibition observed was 85.00±0.00%.

TABLE 1. Effect of medicinal plant treatment on significance level of various morphological parameter in *Lycopersicum esculentum*

PLANT	Shootheight	Branches	Leaf no	Flowers	Fruits
P.pinatta	***	**	*	**	***
A.marmelos	**	NS	***	***	NS
A.indica	***	**	NS	**	*
B.campestris	***	***	***	*	**
P.nigrum	***	**	**	***	**
E.tirucalli	***	**	***	NS	***
V.negundu	***	***	***	*	***
A.conyzoides	***	**	**	***	***
T.patula	***	***	***	***	NS
Z.jujube	***	***	NS	***	**

Values are significantly different at P <0.05, P <0.01**, P <0.001*** NS-Not significant*

TABLE 2. Percentage reduction of diseases in tomato by 10 medicinal plant extracts

Treated plant	*AC*	*EB*	*LS*	*FS*	*BER*	*SS*
P.pinatta	14.10%	33.33%	23.15%	46.45%	86.95%	76.85%
A.marmelos	51.60%	16.66%	18.94%	61.29%	66.08%	37.19%
A.indica	42.94%	53.84%	40.78%	41.93%	40.86%	25.61%
B.campestris	17.94%	46.79%	15.52%	58.06%	82.17%	59.50%
P.nigrum	41.66%	36.62%	1.84%	52.58%	56.95%	59.50%
E.tirucalli	12.82%	27.56%	26.31%	35.48%	60.85%	16.52%
V.negundu	46.79%	27.56%	13.68%	45.16%	37.39%	70.24%
A.conyzoides	78.20%	35.25%	13.68%	50.00%	40.86%	90.08%
T.patula	15.70%	15.38%	18.42%	27.41%	50.43%	26.44%
Z.jujube	58.97%	37.82%	19.47%	57.04%	43.93%	0.82%

(AC-Alternaria canker,EB-Earlyblight,LS-Leaf spot,FS-Fruit spot,BER-Blossom end rot,SS-Sunscald)

The present study,the tested plant extract showed antibacterial and antifungal activity against Alternaria canker,Earlyblight,Leafspot,Fruitspot,Blossom end rot & sunscald in tomato.The efficacy of different plant extracts belonging to different species other than the tested botanical extracts against the A.solani either under laboratory or greenhouse conditions have been reporte **[2,15,16,17,18].**

The inhibitory effect of the plant extract might be attributed to the presence of secondary metabolites of medicinal plants. Greater inhibitions of fungal growth were observed by *T.patula* for *Alternaria solani*, *P.nigrum* for *Septoria lycopersici, and A.marmelos* for *Pythium debaryanum* and *A.conyzoides* for *Phytophthora capsici*. However, lower concentration of the extract supported the average mycelia growth inhibition. *Alternaria, Septoria, Pythium* and *Phytophthora* are the common soil inhibiting plant pathogenic fungus which causes diseases such as Blight and Blossom end rot, Leafspot, Fruitspot and Sunscald in Tomato. Several other species of this genus are responsible for huge loses to their respective host crop. Natural chemicals and their use for integrated plant protection is one of the focuses of research workers all over the world .These results of the present investigation are clear indication for the potential of plant extracts to control fungal pathogens and these compounds can be used.

It is evident of the result that all the plant extracts inhibited bacterial growth. Antibacterial test by using a simple MIC test was done. Among the plant extract of *A.conyzoides* showed higher antibacterial activity where as *B.campestris and T.patula* showed lower antibacterial activity .Successful attempts have been made for the management of *Clavibacter michigenesis , Alternaria solani, Septoria lycopersici, Pythium debaryanum* and *Phytopthora capsici.*

The plants were examined for disease symptoms and quantitative assessments. In general disease incident was reduced by the application of plant extractof *A.conyzoides was* effective for Alternaia canker. Similarly *A .indica was both* for Early blight and leaf spot and *A.marmelos,P.pinatta and A.conyzoide for* Fruitspot,Blossom end rot and Sunscald.Literatures are avalible on effect of plant extracts on various diseases of tomato **[19,20].**Similar reports on plant products containing fungi-toxic constituents that have the potential to control plant diseases **[21,22]** are

available in recent literature. *Vitex nigudo* showed maximum fugal activity against *Colletotrichum falcatum* which causes red rot diseases **[23]**. Similarly some medicinal plants are like Pandanus, Sedrus, Capparis, Mirabilis, Eicchornia, Nymphaea etc inhibited *Setophaeria rostrata* causing seedling blight disease in sugar cane **[24]** and *Pythium debaryanum* was inhibited by some medicinal plants namely Lawsonia, Phyllanthus, Vinca, Tephrosia and Mimosa **[25]**.

TABLE 3. Antibacterial efficacy of leaf extracts of experimental plants

Plant species	concentration(%)	ZONE OF INHIBITION IN (mm)
		Clavibacter michigenesis
P.pinatta	5	1.30±0.51
	10	1.60±0.43
	15	1.70±0.27
A.marmelos	5	2.25±0.13
	10	2.50±0.29
	15	3.00±0.09
A.indica	5	1.30±0.51
	10	1.60±0.43
	15	1.90±0.05
B.campestris	5	1.20±0.09
	10	1.26±0.27
	15	1.30±0.15
P.nigrum	5	1.20±0.09
	10	1.30±0.15
	15	1.41±0.09
E.tirucalli	5	1.30±0.01
	10	1.30±0.09
	15	1.30±0.51
V.negudu	5	1.42±0.14
	10	1.50±0.23
	15	1.70±0.27
A.conyzoides	5	7.00±0.09
	10	9.00±0.07
	15	10.5±0.17
T.patula	5	1.20±0.09
	10	1.26±0.27
	15	1.30±0.15
Z.jujube	5	3.00±0.03
	10	4.25±0.15
	15	4.50±0.17

Coincidentally plant extracts increased all growth parameters including yield along with reduction of plant diseases. Extracts of A.conyzoides *andT.patula* increased the number of tomato. Overall this study reveals the potential of *A.conyzoides,A.indica,A.marmelos,P.pinatta* extracts to control the alternaria canker, earlyblight, leafspot, fruitspot , blossom end rot and sunscald disease of tomato.

The phytochemical test results indicated high scores for saponins,moderate scores for tanins and glycosides while alkoids,terpenes and flavonoids had low scores.According to **[15,26]** these constituents found in plants are known to have anti protozoal and anti bacterial activities .Flavonoids especially are of a potential benefit to human health (Table-5 & 6). Recently production of natural insecticides from neem leaves **[27]**. Similar applied research on medicinal plants needs to be under taken for substituting the hazardous chemical pesticides.

TABLE 4. Antifungal efficacy of leaf extracts of experimental plants

Plant species	concentration(%)	Alternaria solani	Septoria lycopersici	Pythium debaryanum	Phytophthoora capsici
P.pinatta	5	27.65 ± 1.73	12.22±0.04	30.27±1.24	62.17±1.18
	10	28.08 ± 1.30	18.84±0.02	33.41±1.08	63.77±0.55
	15	42.64 ± 0.78	20.40±0.07	34.51±2.16	63.56±0.77
A.marmelos	5	31.86±1.21	11.05±0.05	54.78±1.48	40.82±1.54
	10	35.60±1.20	16.56±0.04	55.26±1.58	42.61±1.01
	15	39.96±1.54	18.91±0.07	59.07±1.44	47.41±1.82
A.indica	5	5.84 ± 1.26	8.86±0.03	23.56±0.69	34.23±0.62
	10	8.85 ± 1.99	10.91±0.03	29.43±0.52	36.19±1.13
	15	9.68 ± 1.53	12.62±0.06	31.57±1.38	37.89±0.62
B.campestris	5	14.47 ± 0.84	10.20±0.03	42.42±2.81	42.64±1.30
	10	24.16 ± 1.24	12.30±0.02	46.25±1.59	46.40±0.72
	15	28.48 ± 1.23	18.21±0.10	48.32±1.57	48.97±1.36
P.nigrum	5	22.10 ± 0.93	20.07±0.11	34.23±0.62	42.64±1.30
	10	23.98 ± 1.26	25.05±0.11	36.14±1.13	46.40±0.72
	15	29.90 ± 2.20	31.06±0.04	37.89±0.62	48.97±1.36
E.tirucalli	5	31.08 ± 0.77	15.11±0.02	22.10±0.93	20.23±2.27
	10	33.77 ± 0.78	16.35±0.06	23.98±1.26	25.62±1.51
	15	36.71 ± 0.76	12.57±0.12	29.90±2.20	29.43±0.52
V.negudu	5	27.24 ± 1.19	10.06±0.05	25.62±1.51	55.68±0.36
	10	30.37 ±1.22	12.08±0.03	29.43±0.52	60.06±1.00
	15	34.33 ±1.46	19.06±0.04	31.57±1.38	62.55±1.15
A.conyzoides	5	27.24 ± 1.19	16.06±0.02	31.08±0.77	84.34±0.24
	10	30.37 ±1.22	21.00±0.04	33.77±0.78	84.66±0.34
	15	34.33 ±1.46	26.16±0.02	36.71±0.76	85.00±0.00
T.patula	5	65.50±1.10	12.17±0.03	16.00±0.85	38.69±1.87
	10	66.59±0.89	20.40±0.02	17.56±1.04	40.82±1.54
	15	71.87±0.78	26.28±0.10	28.75±1.01	42.61±1.01
Z.jujube	5	16.00 ± 0.85	20.93±0.03	40.20±1.42	2.83±1.15
	10	17.56 ± 1.04	18.59±0.11	40.37±2.03	3.77±1.32
	15	28.75 ± 1.01	12.00±0.10	46.92±1.11	4.70±1.47

TABLE 5. Phytochemical(Qualitative) Analysis of Medicinal Plant Species

S/n	Plant Species	Alkaloid	Saponns	Tannins	Glycosids	Anthar quinins	Terpens	Steroid	Flavonoid	Reducing sugar	Pentose	Carbohydrates	Proteins	Aminoacids
1.	*Pongmia piñata*	–	+	–	–	–	–	+	+	–	–	–	–	–
2.	*Aegle marmelos*	–	+	–	+	–	+	+	+	+	–	+	+	+
3.	*Azadirachta indica*	+	+	+	+	–	+	+	+	+	+	+	–	–
4.	*Brassica campestris*	–	–	+	–	–	–	–	+	–	–	–	+	–
5.	*Piper nigrum*	+	–	+	+	+	+	+	+	+	–	–	–	-
6.	*Euphorbia tirucalli*	+	+	+	+	–	–	+	–	–	–	–	–	–
7.	*Vitex nigundu*	+	+	+	+	+	+	–	–	–	–	–	–	–
8.	*Ageratum conyzoides*	+	–	–	–	+	–	+	+	–	–	–	–	–
9.	*Tagetes patula*	+	–	–	–	+	–	+	+	–	–	–	–	–
10.	*Zighiphus jujube*	+	+	+	–	–	–	+	+	+	–	–	–	–

(+)-PRESENT , (-)- ABSENT

TABLE 6. Phytochemical (Quantitative) Analysis of Medicinal Plant Species

S/n	Plant Species	Alkaloids (%)	Tannin (%)	Saponin (%)	Flavonoids (%)
1.	*Pongmia piñata*	ND	15.75±0.04	0.87±0.01	3.06±0.03
2.	*Aegle marmelos*	1.036±0.02	14.16±0.12	3.83±0.02	0.94±0.00
3.	*Azadirachta indica*	1.13±0.01	6.13±0.08	0.21±0.01	2.09±0.10
4.	*Brassica campestris*	0.90±0.04	12.33±0.18	ND	4.53±70.10
5.	*Piper nigrum*	1.11±0.04	10.2±0.11	ND	4.8±0.05
6.	*Euphorbia tirucalli*	0.75±0.01	11.2±0.11	0.15±0.00	ND
7.	*Vitex nigundu*	0.86±0.00	9.39±0.08	3.03±0.08	5.10±0.63
8.	*Ageratum conyzoides*	10.2±0.11	ND	ND	4.8±0.05
9.	*Tagetes patula*	1.53±0.01	ND	ND	0.2±0.005
10.	*Zighiphus jujube*	0.49±0.01	0.65±0.02	8.08±0.05	0.59±0.00

ND_Not detected

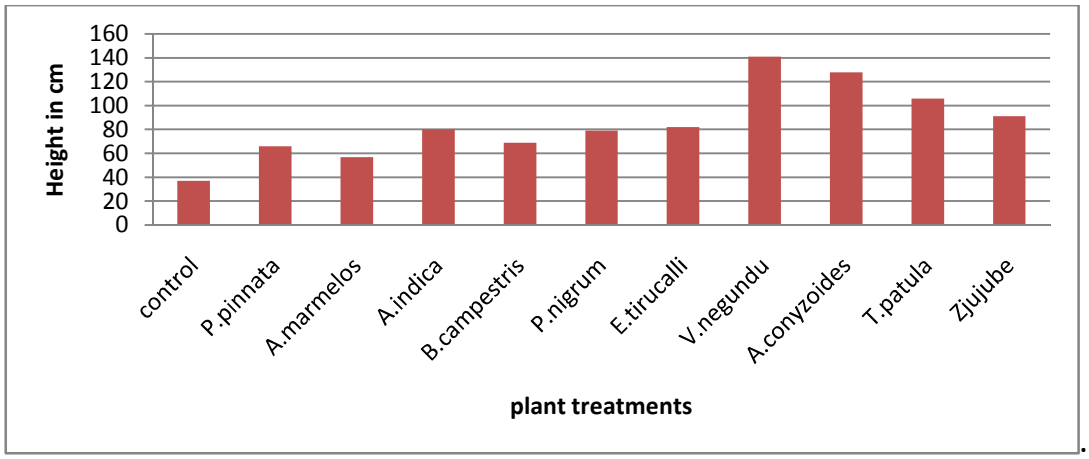

FIGURE 1: (Effect on plant extract on plant height of *Lycopersicum esculentum*)

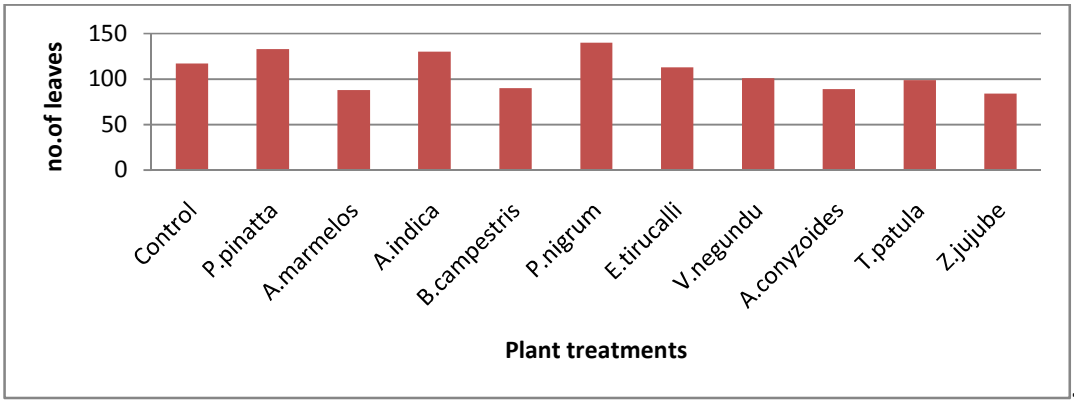

FIGURE 2: (Effect on plant extract on number of leaves of *Lycopersicum esculentum*)

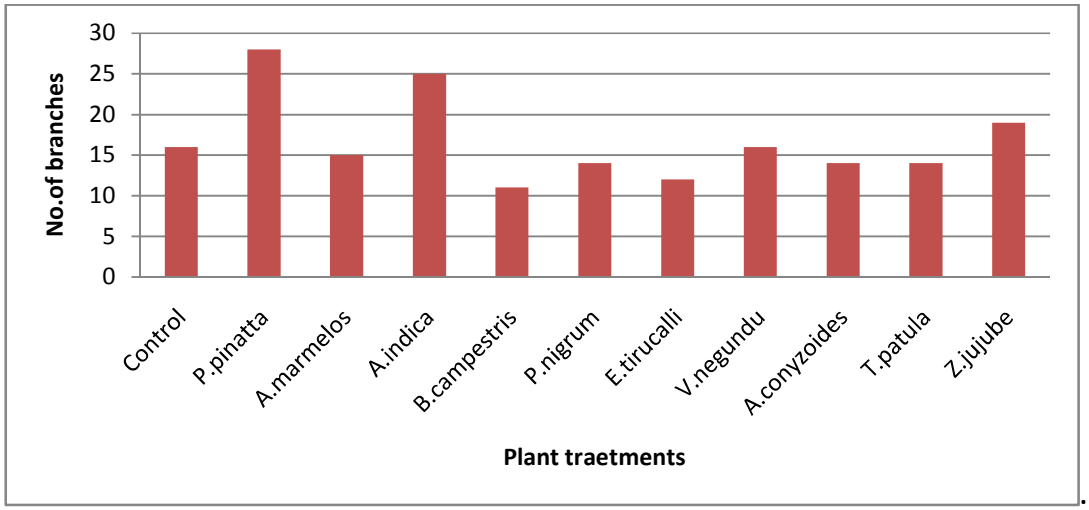

FIGURE 3: (Effect on plant extract on number of branches of *Lycopersicum esculentum*)

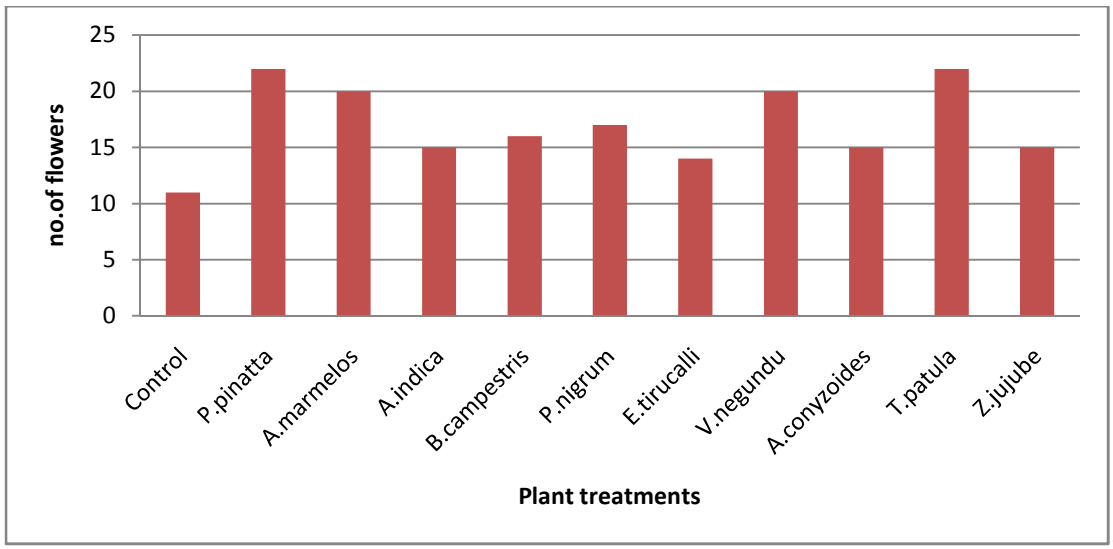

FIGURE 4: (Effect on plant extract on number of flowers of *Lycopersicum esculentum*)

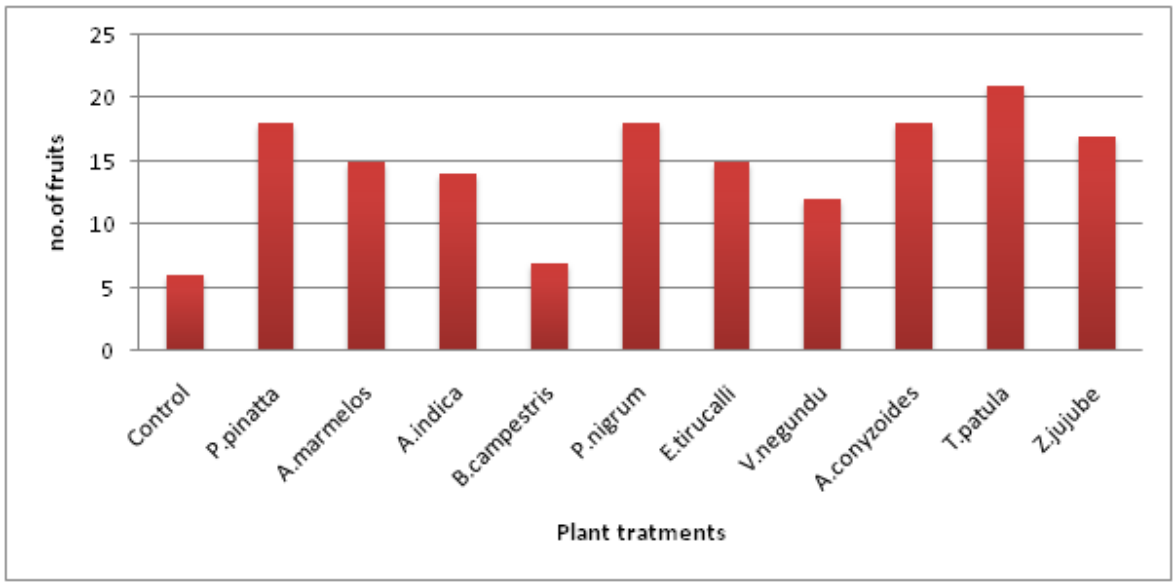

FIGURE 5: (Effect on plant extract on number of fruits of *Lycopersicum esculentum*)

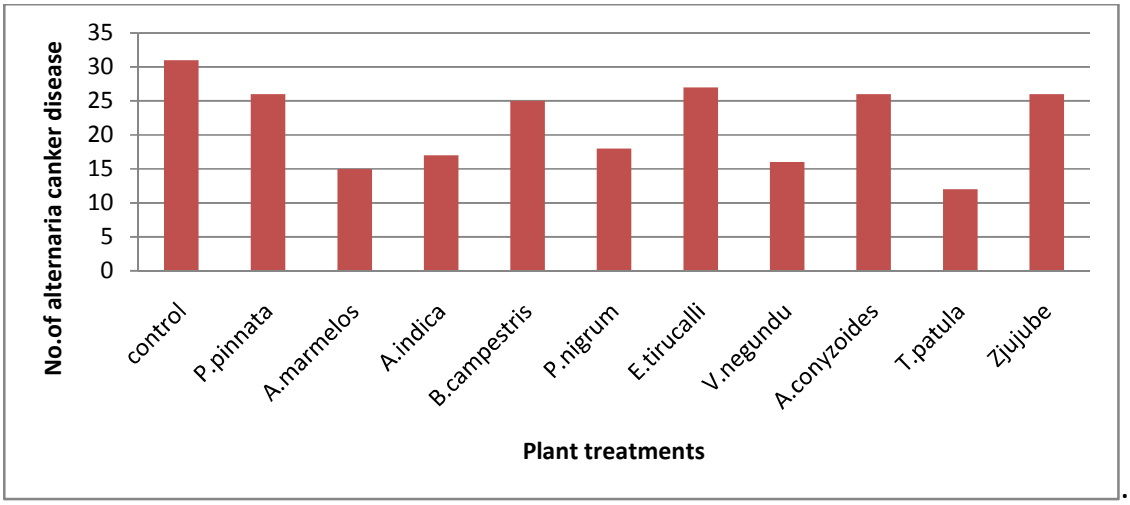

FIGURE 6: (Effect on plant extract on number of alternaria canker of *Lycopersicum esculentum*)

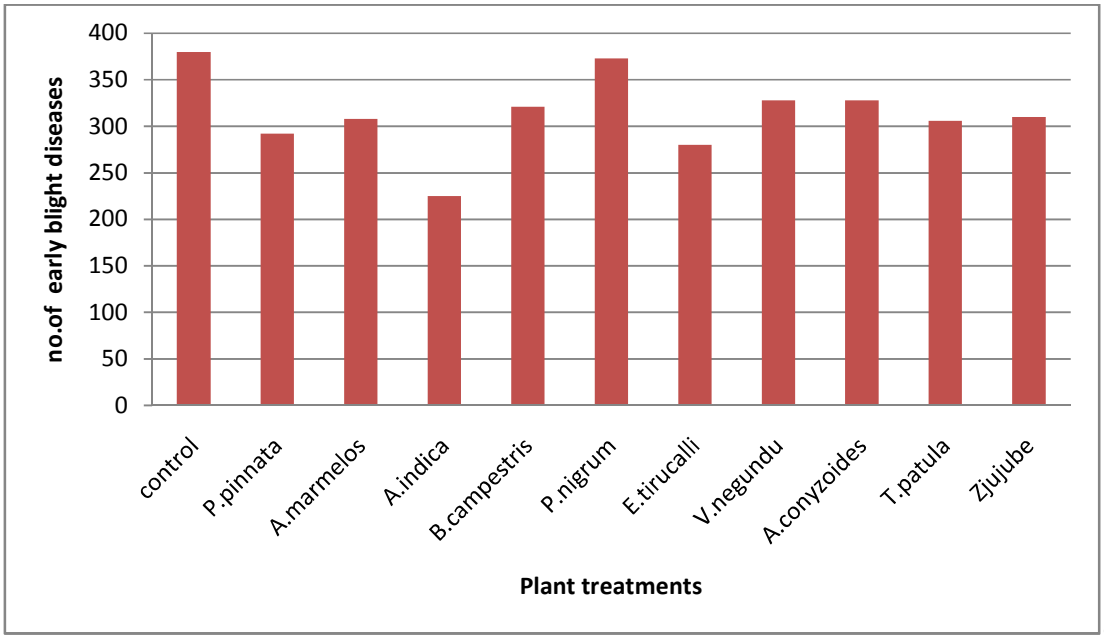

FIGURE 7: (Effect on plant extract on number of earlyblight of *Lycopersicum esculentum*)

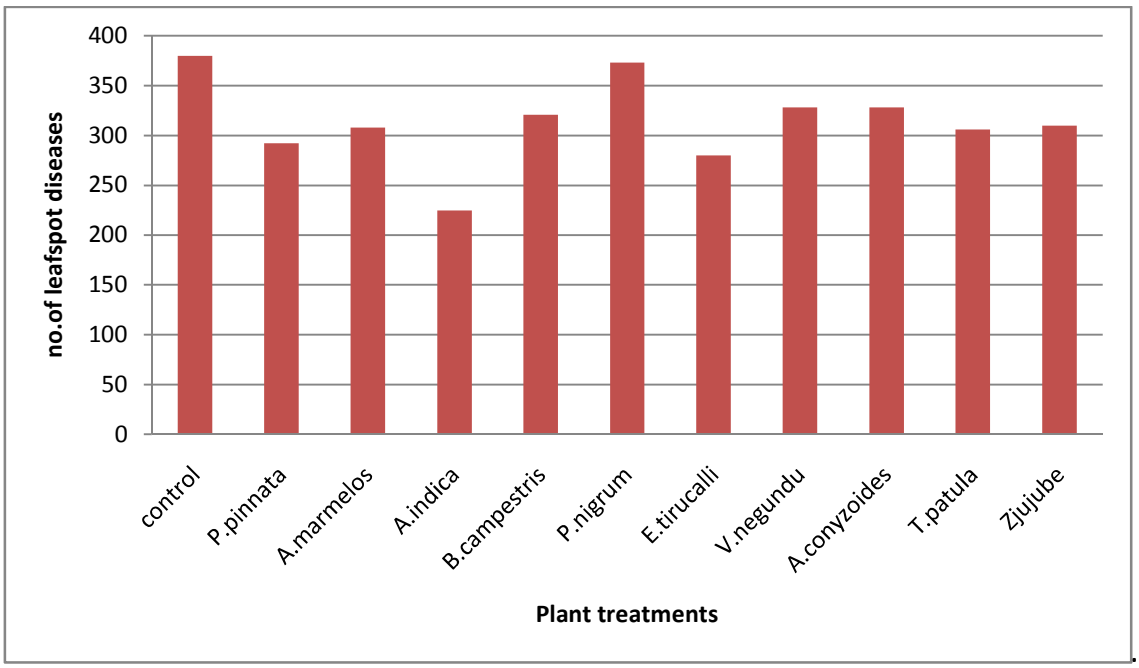

FIGURE 8: (Effect on plant extract on number of leafspot of *Lycopersicum esculentum*)

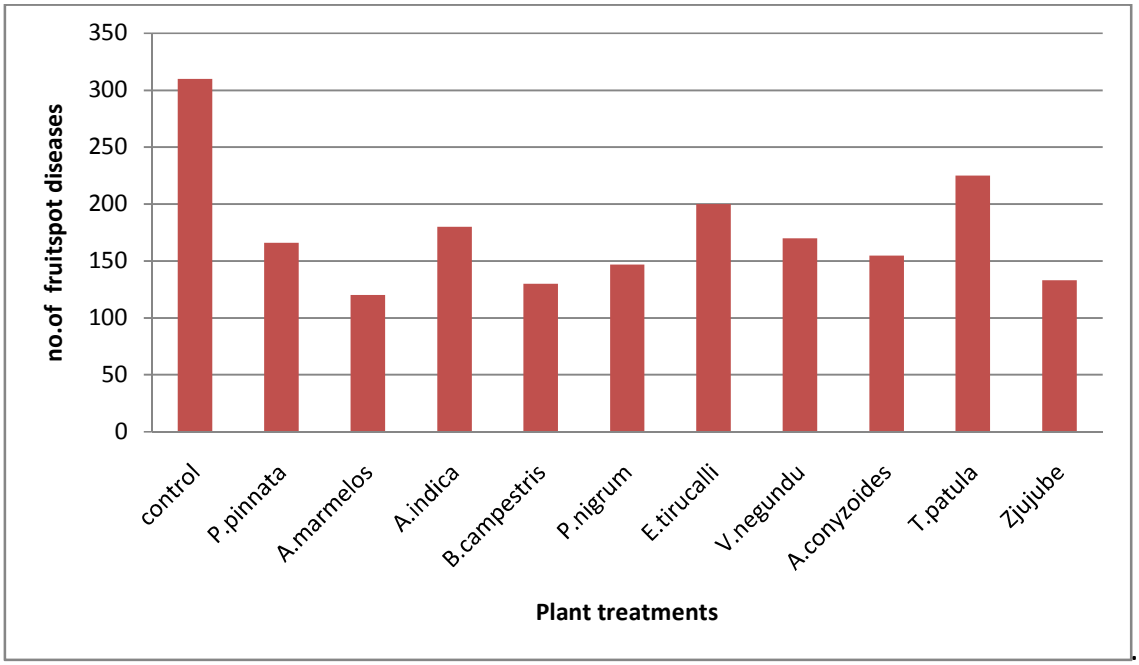

FIGURE 9: (Effect on plant extract on number of fruitspot of *Lycopersicum esculentum*)

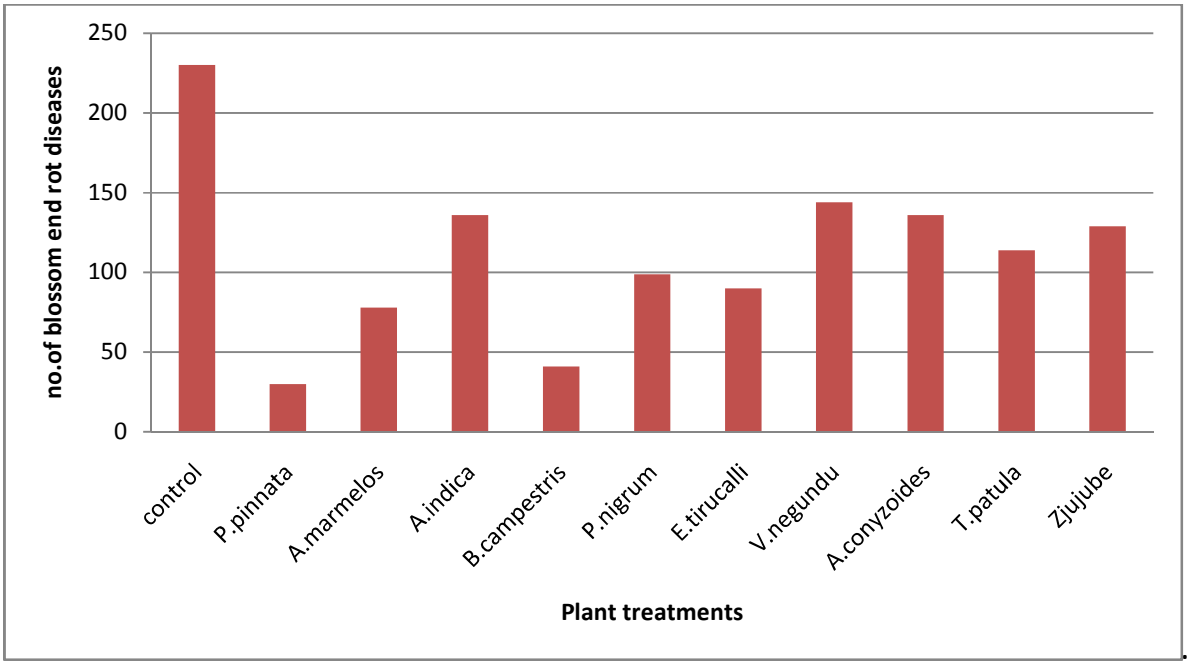

FIGURE 10: (Effect on plant extract on number of blossom end rot disease of *Lycopersicum esculentum*)

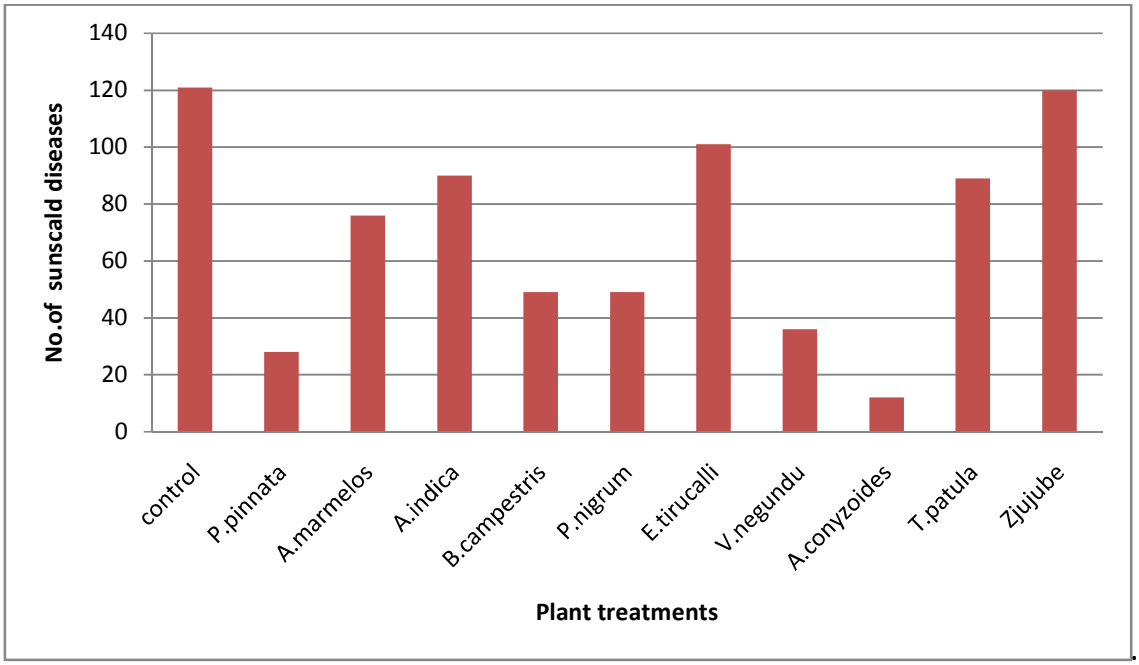

FIGURE 11 (Effect on plant extract on number of sunscald disease of *Lycopersicum esculentum*)

CONCLUSION

The result of present study can be further exploited for formulating integrated disease management schedule of *Lycopersicum esculentum* alternaria canker, early blight, leaf spot, fruit spot, blossom end rot and sunscald. More investigations are needed to investigate this regarding for isolation and characterization of antifungal moieties and recommendations in field applications.

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