

How to Cite:

Bhutkar, K. G., Balasubramaniam, A., & Chaudhari, S. R. (2022). A phytopharmacological review on *Euphorbia thymifolia* Linn. *International Journal of Health Sciences*, 6(S3), 12320–12335. <https://doi.org/10.53730/ijhs.v6nS3.9060>

A phytopharmacological review on *Euphorbia thymifolia* Linn

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Abstract---The main aim of this paper is different pharmacological activity of plant *Euphorbia thymifolia* L. belongs to family Euphorbiaceae. The herb used as traditional folk medicine and commonly known as laghududhikaor choti-dudhi. The plant is annual, small branch, pubescent and contains white milky latex. The plant used in various therapeutic activity by using different solvent like ethanol, methanol, water etc. shows antimicrobial, antifungal, antiasthmatic, anticancer, antidiarrheal, laxative, antioxidant, antiviral, antidiabetic etc. the other pharmacological activity mention in given review article.

Keywords---anti-inflammatory, antinociceptive, phytochemical.

Introduction

The ratio of population to drug are insufficiently, non-economic treatment and several side effects of modern system of medicine due to recurrent use of medicament increase the development of resistant, due to those effect the community turns to traditional system of medicine for wide variety of human ailments (1). The variety of medicinal activity observed in traditional system of medicine in Ayurveda used in various plants extract. Ayurveda is born in India, and its hub of medicine for ayurvedic treatment. In medicinal system, plant acts as most important role for human healthcare system until in future development. In recent technique, modern system of medicine uses the plant extract to improve the potency of drug with reducing the side effect in medication and prohibition in human disability. "Ayurveda is a traditional convenient treatment, which ranges

from ancient to modern objectives depending upon the type of disease to be cured” (2, 3). The same system of Ayurveda is used in India which is the largest producer of medicinal Herbs used in Ayurveda. (4). The medicinal plant has many bioactivities and therapeutic effects were studied so far. The plant found various medicinal properties, in traditional system of medicine used of plant parts and their extracts for cure the disease and disorder. On information available in various literature studies like phytochemical, pharmacological standards of extraction, isolation, phytochemical screening of active molecule pharmacological studies such as mode of action *in-vitro* and *in-vio* study, formulation development, toxicity testing studies exploring so far. In nineteenth century phytochemical came to focus in treatment in various therapy. In 1940 to 2002, about 70 % of drugs are approved those drugs are partially based on natural product (5).

The Euphorbiaceae is large family of flowering plants, having spurge family. In Euphorbiaceae family consist of 300 genera and 7500 species, it should be identified by monocious herb, shrub, trees, succulent and cactus like and present latex inside the plant and stem (6). The highly reputed plant which are useful in many diseases are categorized under the genus euphorbia. This genus has diverse chemical entities with many structural variation sources. Such plants like *Amla* (*Embelicaofficinalis*), *Arendmul* (*Racinuscommunis*) *Bhoiamli* (*Phyllanthusfractus*), *Caster* (*Ricinuscommunis* Linn) etc. which can be used for the treatment of many chronic illnesses such as diabetes as ma'am liver diseases hyper inflammation etc. Therefore, for the same reason they are medicinal very valuable (7). *Euphorbia thymifolia* l is a small-branched green spine prostrate and Jewel hub also known as Laghududhika or Chhotidudhithat grows on grassland on in most Asian countries. (8). The part of *Euphorbia thymifolia* leaves, seeds used in Ayurveda to cure many remedies such as in worm case and in certain bowel affection of children also used as stimulant and laxative it is also used as many disorder due to present of many active constituent(9). *Euphorbia thymifolia* Linn is commonly called as different name shown below (10, 11).

- **Ayurveda** -Chhotidudhi, Laghududghikaa
- **Bengal** - Dudiya, shweetkeruee, swetkerua, inbodo- Nasraikorophisa
- **Ceylon** -Cgittirapalavi
- **Englis**- Chicken weed, dwarf spurge, red caustic creeper
- **Gujarat** - Nahanidudheli
- **Kannada**- bilechitrapphala, naagaarjuni
- **Hindi**- Chhotidudhi
- **Marathi** -Ghakdidudhi, Chothadudhi
- **Sidha** - Ammanptharisi
- **Sanskrit** - Laghududhika, Raktavindachada
- **Spanish**-Golondrina
- **Unani** - Dudhikhurda
- **Tamil**- sittirappaladi
- **Telugu**- bidurunanabiyam, peddavari

In Euphorbiaceae a wide variety of chemical composition of active group studied which are poisonous but pharmacological active useful to cure disease(12).

Botanical profile of *Euphorbia thymifolia* Linn.

- **Kingdom:** Plantae.
- **Division:** Magnoliophyta.
- **Classis:** Rosopsida.
- **Order:** Euphorbiales.
- **Family:** Euphorbiaceae.
- **Genus:** *Euphorbia* L.
- **Species:** *Euphorbia thymifolia* L.

Euphorbia thymifolia annual soft prostrate herb pubescent stems, hairy slender cylindrical shape having reddish pink colour it become dry produce grayish green colour of all parts of plant. Stem is 10-20 cm length and 1-3 mm diameter consist white latex. Leaves are opposite very small simple in structure with oblong shape 3-6 mm length and 2- 5 mm width, rounded at apex, margin is rough towards apex crenulated, glabrous above very short petioles is 3-6 mm length and 2-4 mm in width appear greenish pink colour, Involucres axillary, solitary or 2-3 in an axil, campanulate, 08 mm .long; stalk very short, capsule is 1.5mm long pubescent, styles are short, seeds observe 125 mm long quadrangular, blunt at point with 5-6 transverse furrows, fruits are ovoid-globose, acutely 3-lobed(13, 14, 15, 16).

Medicinal Uses

The herb *Euphorbia thymifolia* L. used as various dedicated organ disease like “eye disorder, abdominal disorder like dysentery and inflammatory reaction like pain in breast”. “It is an effective drug for bronchial asthma. Juice of the plant is used for ringworm, diarrhea and dysentery; mixed with fresh goat milk is given to cure blood dysentery (17, 19). The leaves and seeds are antihelmintic, astringent, laxative and stimulant and given to children in bowel complaints. Root is used in amenorrhea. *Euphorbia thymifolia* L. The herb *Euphorbia thymifolia* L. is widely used in instillation against dysentery, diarrhea, enteritis and reproductive related diseases (15). New Matured plants of *Euphorbia thymifolia* L. squashed and applied on affected area it reduced pain and improve in healing of sprains. It was proven used in the treatment of *constipation, helminthiasis, ringworm, leprosy* and *skin* diseases etc. as antiviral and antimicrobial activity (18).

Phytochemical studies

The various metabolic activity against *Euphorbia thymifolia* L. extract active due to present of various phytoconstituent present in it line phenol, flavonoids, Terpenoids, and saponins, and minor trace in alkaloid observe in various extract may result to increase action potential against metabolic as well as bacterial action (37).

Sr. No.	Name of Extract	Type of Active phytoconstituent observed	Author
1	Aqueous extract	Alkanes, triterpenes, phytosterols, tannins, polyphenols, and flavonoids like quercetrin, cymol,	Ashwani kumar (2017)

		carvacrol, 2-sesquiterpenes, salicylic acid, etc., phytoconstituents. Furthermore, it contains steroids, terpenoids, triterpenes, glycosides, essential oils, minerals, large number of phenolics and polyphenols	Prashant Y. Mali (2013)
2	Chloroform soluble fraction	cinnamic acid derivatives, thymofoloinates A and B also p-hydroxy cinnamic acid, 5-hydroxy-6,7,8,4'-tetramethoxy flavone and 5-hydroxy-3',4',6,7,8-pentamethoxy flavone have also been isolated for the first time from this species.	Abdul Malik (2012)
3	Ethanol extract	Alkaloid, flavonoid, phytosterol, beta sitosterol, brassica sterol and terpenes	Sivaprasad Gudipudi (2015)
4	70% Aqueous acetone extract	Terpenoids, alkaloids, and flavonoid glycosides were isolated from this plant, other species are isolated 3-Hydroxy-4a,14a-dimethyl-5a-ergosta-8,24(28)-dien-7,11-dione <i>Colorless gum:-</i> 3-Hydroxy-4a,14a-dimethyl-5a-ergosta-8,24(28)-dien-7-one. <i>Colorless oil:-</i> 3,7-Dihydroxy-4a,14a-dimethyl-8,9-epoxy-5a-ergosta-24(28)-ene. White powder.; Cycloart-23-Z-ene-3,25-diol. White needles and Madhusic Acid Colorless oil	Yong Zhao (2018)
5	Methanol extract	Flavan-3-ol isomers (compound I and II) catechin (2,3-trans-3,4-transflavan-3-ol) and compound as epicatechin (2,3-cis-3,4-transflavan-3-ol) epitaraxerol, n-hexacosanol, euphorbol, 12-deoxy-4P-hydroxyphorbol-13-phenylacetate-20-acetate,24-methylene cycloartenol, 12-deoxy-4P-hydroxyphorbol-13-dodecanoate-20-acetate, 12-deoxyphorbol-13,20-diacetate,quercetin-3P-galactoside,12-deoxy-4Phydroxyphorbol-13-dodecanoate-20-acetate, n-hexacosanol, esters, n-alkanes and sterols.	Randhir Singh (2016)
6	petroleum Ether extract	E.thymifolia have 12-deoxyphorbol-13,20-diacetate, 12-deoxy β -OH phorbol-13-dodecanoate 20-acetate, and 1-Hexacosanol compounds, Myricyl alcohol, Taraxerol and Tirucallol	D.R. Gupta (1996)

Part of plant	Name of Phytoconstituent	Category
Aerial parts	Hexa-hydroxy-di-phenic acid; de-hydro-hexa-hydroxy-di-phenic acid, gallic acid Gallotannins; Iso-mallotinic acid and other hydrolysable tannins; ellagitannins; isomallotinic acid, valoneic acid.	Hydrolysable tannin(67)
	Beta-carotene, chlorophyll-a and b, vitamin-C, and tannins	Antioxidants (67)
	Micro-minerals like Fe, Cu, Mn and Co. & Macro-minerals like Na, K, Ca, Li.	Minerals (67)
	Crude protein, fat and fiber, tress in carbohydrate like starch, amylase, amylopectin, cellulose,	Nutrients (67)

	Cymol, (-) isopinocampheol, limonene, 2,6,6-trimethyl-1-cyclohexane-1-carboxaldehyde, safranal, (E,E)2,4-decadienal, A-caryophyllene caryophyllene oxide, phytol, 2-n-Pentylfuran, 1-pentanol, nonanal, 2,4-heptadienal, benzaldehyde, 2,3-heptadione, 1-pentanol, tetradecanoic acid, pentadecanoic acid, n-hexadecanoic acid.	Essential oil (67)
	Thymofolinos A and B in addition, p-hydroxy cinnamic acid, 5-hydroxy-6,7,8,4'-tetramethoxy flavone and 5-hydroxy-3',4',6,7,8-pentamethoxy flavone	Cinnamic acid Derivatives (66)
	Epitaraxerol, n-hexacosanol, euphorbol, two derivatives of deoxyphorbol-OAC, 24-methylene cycloartenol and quercetin galactoside, 1-desgalloyl eugenin, 5-desgalloylstachyruin, 12-deoxy-4- β -hydroxyphorbol-13-dodecanoate-20-acetate, 12-deoxy-4- β -hydroxyphorbol-13-phenylacetate-29-acetate, 12-deoxyphorbol-13,20-diacetate, β -amyrin, β -sitosterol, bixanin, campesterol, carvacrol, casuarinin, cholesterol, corilagin, cosmosiin (apigenin-7-glucoside), eugenin, geraniin, kaempferol, pedunculagin, 2-sesquiterpenes, quercetin, quercetin-3-rhamnoside, stigmaterol, salicylic acid, esters, n-alkanes, sterols and phorbol derivatives.	Miscellaneous Constituents (16,53,56,60,66,67)
Roots	Taraxerol, tirucallol and other sterols.	Sterols (50)

Pharmacological studies

Antibacterial study

The study investigated the antibacterial activity *Euphorbia thymifolia* Linn and *Cassia alata* Linn Species ethanolic extracts against *Staphylococcus aureus* and *Escherichia coli*, concentrations for antimicrobial assay using the Kirby Bauer method. *Euphorbia thymifolia* Linn exhibits antibacterial activity against *Staphylococcus aureus* and *Escherichia coli* with 16mm and 14mm in mean diameter of the zone of inhibition. The presence of phenolics in plants and some other bioactive components shows antibacterial properties(20). Fresh latex of *Euphorbia thymifolia* showed the diameter of the zone of inhibition of 20.37 mm against *Bacillus pumilus*, 22.82 mm against *Staphylococcus aureus*, 20.94 mm against *Streptococcus pneumoniae*, 23.74 mm against *Escherichia coli*, 18.82 mm against *Citrobacter freundii* and 18.32 mm against *Klebsiella pneumoniae*, while the diluted latex (1: 10) of the plants showed no antimicrobial response. *Euphorbia thymifolia* showed Microbes like *E. coli*, *K. pneumoniae*, *S. typhi*, *Proteus mirabilis*, *Shigella dysenteriae* found to show diminished development when rewarded with the concentrate of *Euphorbia thymifolia* L.(21).The *Euphorbia thymifolia* extract of petroleum ether, benzene, chloroform, ethanol 95% and purified water shows antibacterial activity against *Staphylococcus aureus*, *Streptococcus pyogenes*, *Enterococcus faecalis*, *Propionibacterium acnes*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* at 1000 μ g/disc using disc diffusion method to optimize the most effective extract(22).By in-vitro studies ethyl Acetate extract of 0.4 mg per ml and chloroform extract of 0.7 mg per ml which are the extract from each *Euphorbia thymifolia* exhibit antibacterial properties against *Escherichia coli* and *Shigella flexneri* inhibited the growth of these micro-organism (23).*Euphorbia Thymifolia* L in rural area used as folk medicine treatment of various vaginal diseases occurs due to infectious bacterial

disease. The presence of bio active chemical substance sterols, tannins, triterpenoids, phenol and flavonoid effective against bacteria such as “*streptococcus pneumonia*, *Salmonella enteridis*, *Psueudomonas aeruginosa* and *Bacillus cereus* some fungi like *Candida albicans* protozoa like *Trichomonas vaginalis*” (60)

Antifungal Study

Fungi are saprophytes and they are harmful as well as useful to humans. The hurtful impacts are for the most part like obliterating crops; causing sicknesses and so forth. These exercises of parasites like fungi ought to be brought down to have advantage for people. In this manner the plant separates like various extract are checked for their movement as hostile to antifungal. Ethanolic extract of *E. thymifolia* is found to have anti-fungal property to study the fungal strain of *Candida albicans* give positive result (24). The latex extract is effective against “*Aspergillus niger*, *Trichoderma viride*, *Alternaria alternata*, *Fusarium moniliforme* and *Curvularia lunata*” were found to show reduced activity (25). The *Euphorbia thymifolia* extract of chloroform, benzene, ethanol 95%, petroleum ether and purified water shows antifungal activity against *Candida albicans*, *C. tropicalis*, *C. krusei*, *Crypto-occus-marinus*, *Microsporu-mgypseum*, *Trichophyton rubrum*, *Epidermophyton floccosum* and *Aspergillus niger* at 1000 µg/disc using disc diffusion method to optimize the most effective extract (22).

Anti-Diarrheal and Laxative study

The laxative effect of the ethanolic extract significant dose dependent activity tested level of doses (200 and 400 mg/kg, p.o.). to produce similar effect was of the standard tested at 400mg/kg, p.o. dose level. Laxative activity, in a dose up to 8h of drug administration(26). The herb *Euphorbia thymifolia* L. recommended for treatment of diarrhea and dysentery, also reported the various pharmacological activity (27). In India, Dehradun district in Uttarakhand state, the Bhoja community people use in patients suffering with diarrhea and dysentery of plant *Euphorbia thymifolia* L. as anti-diarrheal and anti-dysentery(28).

Diuretic study

The Diuretic property of *Euphorbia thymifolia* L. was studying in a dose-dependent method on Ethanol extract. (200 and 400mg/kg) or extract fractions (200mg/kg each), in normal saline, 5 hrs urine volume was measure. After observation significantly increased the urinary output and concentration electrolyte in urinary at a higher dose of (400mg/kg,p.o.). The ethanolic extract potentiated the diuretic activity (26).

The Anti-Inflammatory study

The Anti-inflammatory activity by carrageenan-induced rat paw edema method using ethanolic extract of dose 100mg/kg body weight, observe reduction of edema compared as standard drug indomethacin 10mg/kg, as conclude extract have potency of anti-inflammatory property. (29, 30).

Anti-oxidant study

Different antioxidant chemical such as chlorophyll-a and chlorophyll-b, β -carotene, vitamin C, tannins and phenolic substances are found to be present in the plant in ethanolic extract and this extract shows nitric oxide scavenging activity of *Euphorbia thymifolia*. was studied. (29, 31). The studies on the antioxidant properties of the *Euphorbia thymifolia* L. was performed using ethanolic extracts from the whole plant. It was assessed in both in-vivo and in-vitro trial models by evaluating the malondialdehyde substance of rodent like 'Rat brain, which is one of the results of the lipid peroxidation'. The aftereffect of the investigation demonstrated critical hindrance of lipid peroxidation level practically identical to that of nutrient as Vitamin- E as standard (32,36). In *Euphorbia thymifolia* tannin, make a effective for potent and stable antioxidant. (21). The *Euphorbia thymifolia* linn. Shows potent antioxidant activity in Phosphomolybdenum method as compare H₂O₂-Scavenging Method and reducing power method by using methanolic extract(33). The antioxidant and antiviral activities for the extract of different fractions of *Euphorbia thymifolia* L. ethanol, methanol, chloroform, n-butanol and water were investigated anti-lipid formation, anti-superoxide formation and free radical scavenging assays for all fractions, were studied Electron spin resonance showed that water extract and pure compounds of *E. thymifolia* expresses hydroxyl radical scavenging and superoxide radical properties (34, 35).

Antidiabetic hypoglycemic study

Aerial parts *Euphorbia thymifolia* aqueous and methanol extract dose (250 and 500 mg/kg, p.o., respectively) for 28 days was investigate the hypoglycemic and hypolipidemic effect in streptozotocin-nicotinamide (STZ-NA) induced diabetic rats. The normal liver function shows the level of restoration of the liver enzymes. The different parts of *Euphorbia thymifolia* as folk claim on this basis studied on diabetic animal, the *Euphorbia thymifolia* extract studied on histopathological studied, pancreas appears as normal. (37). The study evaluates molecular interactions between various bioactive compounds in ethanolic extract of *Euphorbia thymifolia* and targeted proteins related to Type 2 DM. This procedure includes the molecule decrease 3D structures of those bioactive mixes of chemical group into four focused on

- Proteins: 11- β hydroxysteroid dehydrogenase type 1
- Protein-tyrosine phosphatase 1B
- Amido-transferase
- Mono-ADP-ribosyl transferase sirtuin
- Glutamine: fructose-6-phosphate.

Ligand Scout was applied to assess the bonds framed between twenty ligands and the coupling destinations of each focused on protein. The outcomes recognized seven bioactive chemical molecules with high restricting fondness (<8.0 kcal/mol) to every one of the 4 focused on proteins including " β -amyrine, taraxerol, 1-O-galloyl- β -d-glucose, corilagin, cosmosiin, quercetin-3-galactoside and quercitrin" (38). Antihyperglycemic activity was study by oral glucose tolerance test. Mice were given different dosages of extract concentrate, trailed by glucose (2 g/kg

body weight)' 1 h after frequency of the dose extract. The evaluation of the serum glucose level was done after two hours of the glucose administration. The extract induced a enormous dose dependent reduction into serum glucose level within test mice, then 'administered at dose concerning 25,100,200 and 400mg/kg body weight as much compared according to monitoring control animal'. The highest reduction concerning serum glucose (60.5%) used to be executed at a dose concerning 400 mg/kg. permanency. "In evaluation together with a par anti-hyperglycemic medicine of 'glibenclamide', now administered at a dose about 10 mg/kg body weight, diminished serum glucose ranges by means of 48.6 %. Glucose-loaded mice were used for the study of 'Antihyperglycemic properties of *Euphorbia thymifolia* by oral glucose tolerance tests". 'Antihyperglycemic and Antinociceptive activities' of *Euphorbia thymifolia* methanolic extract followed by glucose of dose 2 g/kg body weight given after one hours interval observed the blood serum glucose level of mice (39,59). *Euphorbia thymifolia* used as folk medicine in Bangladesh as an Antidiabetic and castigation permanency (40).

Antiuro lithiatic study

The alcoholic and hydro-alcoholic extracts of *E. thymifolia* L. plant dose of (5 mg/ml-5 ml) cystone (5 mg/ml-5 ml) on size and dissolution of calcium oxalate crystals which result of inhibited the precipitation of calcium and oxalate. The results of our study clearly showed the utility of *E. thymifolia* L. plant for the treatment of renal calculi shows anti-urolithiatic activity (41).

Anthelmintic study

The presence of tannin in ethanol extract shows anti-helminthic activity by paralyzing the worms The ethanol extract showed more significant effect on paralyzing the worms as compare the aqueous extract. Different concentrations were tested against albendazole was included as reference (31). Three different concentrations, each of crude alcoholic and aqueous extract (10, 50,100 mg/ml in distilled water) Piperazine citrate (10mg/ml) was included as reference compound. The leaf extract of *Euphorbia thymifolia* l. not only paralysis, but also caused death of worms at 100 mg/ml concentration of in shorter time as compared to reference drug Piperazine citrate (42). The significant Anthelmintic activity of *Euphorbia thymifolia* aqueous and methanolic extracts using different concentration against *Pheretima posthyma* and *Ascaridia galli* (43).

Anti-asthmatic study

It is observed that for the treatment of bronchial asthma, *E. thymifolia* is observed to be very useful. For estimation and treatment used separate water soluble fraction from alcohol extract used for identification of efficacy. The admission of dose medication helps in the unwinding of smooth muscles relaxes in bronchial asthma. This causes the asthma patient to assuage from the manifestations of asthma as it relaxes up the muscles (44). Antiasthmatic activity of methanol (ETM) and aqueous (ETW) extracts of ET was administered to the rats in dose of 250 and 500 mg/kg orally for 14 days. Anaphylaxis was induced by administration of horse serum and triple antigen vaccine intraperitoneal (i.p.) in albino Wistar rats. The rats were administered the extract of *Euphorbia thymifolia*

Linn in doses of 250 and 500 mg/kg orally for 14 days. In treatment of asthma different parameter was calculated containing IgE were estimated, total WBC count and differential count (45).

Hepatoprotective study

The *Euphorbia thymifolia* 70 % ethanolic extract was determined the hepatoprotective activity by hepato-toxin use as Carbon tetrachloride (CCl₄) which damages the hepatocytes. When ethanolic extract given orally shown the hepatoprotectives activity. 100mg/kg p.o. Silymarin used as reference standard and it showed effect in hepatotoxicity models. The dose dependent significant reduction in biochemical levels in case of CCl₄ induced hepatotoxicity models (30, 46).

Anti Stress study

The study also shows that female reproductive dysfunction which is induced by stress could be treated by the aqueous extract of *Euphorbia thymifolia* L. roots, which has anti-stress properties. Forced swimming stress activity for 15 min per 28 days and resistant stress for 180 min per 28 days in two doses, 100 mg/kg and 200 mg/kg for 28 days observe changes in organs weight and estrous cycle. The results were analyzed by using one-way ANOVA and significant protective effect which is evident by decrease in the duration of proestrous and increase in duration of estrous, metestrous, and diestrousphases. The anti-stress activity may be due to the presence of various phytochemical constituents like alkaloids, flavonoids and other constituents present in the *Euphorbia thymifolia* root (47, 58). The *Euphorbia thymifolia* L. ethanolic root *extract* improves the stress level by maintain the disturb level of luteinizing hormone, follicle-stimulating hormone, estradiol, progesterone and prolactin which observe the improvement in the reproductive system in female rats (48).

Anti-Arthritic study

The *Euphorbia thymifolia* Linn reported the anti-rheumatoid arthritis by using Petroleum ether (40-60°C), Chloroform, Alcohol, Aqueous extract. The in vivo method estimate the anti-arthritic activity using Freund's adjuvant arthritis in albino rats The hemoglobin content, "total WBC count, Differential WBC check, ESR, RBC, SGOT, SGPT, ALP, TP, Lipid peroxidation in liver and impact of gastric mucosa" were additionally evaluated (49,50). The aqueous extracts of *Euphorbia thymifolia* where induced in albino rats to study anti-arthritic activity measured by Freund's adjuvant. When the aqueous extract from *Euphorbia thymifolia* l. was studied, it was recorded that the different constituent of blood measure and estimate indicated the anti-arthritic property. (51). The methanol and aqueous extract of *Euphorbia thymifolia* effectively used on treatment in Anti-anaphylactic and antiasthmatic activity by induced horse serum and triple antigen vaccine by intra peritoneal in albino rats in dose of 250 and 500mg/kg orally for 14 days, at the end Asthma measure with other blood parameter, as per report the *Euphorbia thymifolia* shows both anaphylaxis and anti-asthmatic activity was studied(45).

Antiviral study

The methanol, chloroform, ethyl acetate, n- butanol and water of *Euphorbia thymifolia* using fractions of 3-O-galloyl-4,6-(S)-HHDP-D-glucose and ethyl acetate used to study of anti-herpes simplex virus type-2 (HSV-2). Acyclovir used as positive control and checked the IC₅₀ values in XTT and plaque reduction assays for 3-O-galloyl-4,6-(S)-HHDP-D-glucose were 4.75 B 0.46 and 3.51 B 0.44 mg/ml, whereas for ethyl alcohol fractions they were 7.72 B 0.15 and 7.42 B 1.63 mg/ml, respectively. Shows the fractions are effectively work against herpes simplex virus type-2 (HSV-2). The ethyl acetate *Euphorbia thymifolia* L. 'extract observe virucidal ability affected by incubation period but not on incubation temperature'. The effects of incubation time and temperature were negligible for action of 3OG46HG against HSV-2 (34, 53).

Larvicidal study

Larvicidal activity of some medicinal plant studies in comparison by using hexane, ethyl acetate, petroleum ether, acetone and methanol extracts of some plants *Abutilon indicum*, *Aegle marmelos*, *Euphorbia thymifolia*, *Jatropha gossypifolia* and *Solanum torvum* and study the toxicity test on early fourth-instar larvae of *Culex quinquefasciatus*. All extract observed little larvicidal activity, the report to observe after 24 hrs. (54).

Antitumor study

The ethanol extract of *Euphorbia thymifolia* L. is an effective anti-oxidant and anti-tumor activity against Ehrlich as cites carcinoma tumor in mice administrate oral dose of 200mg/kg prolongs the life span of Ehrlich ascites carcinoma-tumor bearing mice and causes significant increase in number of peritoneal cell count and significant decrease in volume of solid tumor mass compared to Ehrlich as cites carcinoma bearing control animals (55).

Anti-Spasmodic study

The ethanol concentrate of *Euphorbia thymifolia* L. is found to have against uncontrollable muscle movement used as "antispasmodic action, which mitigates the spasm" and its occurrence. It was observed during the studies that the extract taken from *Euphorbia thymifolia* L. could inhibit the growth of unicellular protozoan parasite named *Plasmodium falciparum* (19, 56).

Neurological study

The Neurological Activity study on behavioral dysfunction of "neurochemical abnormality and oxidative stress in mice brain on rotenone induced PD model". In the group of animal dose of '*Euphorbia Thymifolia* 1, 75 mg/kg (P < 0.01-0.001)' treated group of animal observe "the significant reversal of body weight loss, locomotor score, rota rod muscle grip and rearing behavior induced by rotenone". *Euphorbia thymifolia* total sterol has significantly (P < 0.001) reversed the increased lipid peroxidation and declined glutathione and nitric oxide scavenging

ability, so it protects the degeneration of dopaminergic neurons and improved the neurobehavioral, oxidative and neurochemical parameters. (61)

Toxicity studies

The presence of phytosterol as safe on acute toxicity study observe in the plant *Euphorbia thymifolia*, in nootropic activity and acute toxicity of *Euphorbia thymifolia* using dose 283.00 mg/kg (i.p) and the dose range of 25, 50 and 75 mg/kg were all the animals observed for long term toxicity up to 14 days and found on mice LD50 (57).

Conclusion

In this systematic review, “the phytochemistry, hostile anti-microbial activity, anti-spasmodic activity, role in improving reproductive dysfunction, anti-hyperglycemic activity, hepatoprotective activity, anti-bronchial asthmatic activity, anti-arthritic activity, anti-diarrheal and anti-dysenteric activity, anti-inflammatory activity, diuretic activity, anti-oxidant activity, anti-stress activity, anti-helminthic activity was examined and discussed”. Only few bioactive compounds and its derivative of plant *Euphorbia thymifolia* are used to cure illnesses, but further study on the medicinal properties of this plant will help in producing drugs that are more useful.

Conflict of interest

Author declares that there is no any conflict of interest.

References

1. LA Betancur-Galvis¹, GE Morales, JE Forero, J Roldan. Cytotoxic and antiviral activities of colombian medicinal plant extracts of the euphorbia genus, (June 2002); *Memorias do Instituto Oswaldo Cruz*, 97(4): 541-546.
2. Kathi J Kemper and Mitchell R Lester, *Alternative asthma therapies: An evidence-based review*, (1999); *Contemporary Pediatrics*, 16(3): 162-195.
3. Anonymous. 2004. *The Ayurvedik Pharmacopoeia of India*. Govt. of India, Ministry of health and family welfare, Department of ISM &H, New Delhi. 4(1)136-137
4. Ahmedulla M, Nayer MP. *Red data book of Indian plants*. Calcutta: Botanical Survey of India; 1999. p. 4.
5. M K Logani, R E Davies. Lipid oxidation: Biologic effects and antioxidants: A review. *Lipids*. (1980), 15:6, 485–495. [PubMed] [Google Scholar]. DOI: [10.1007/BF02534079](https://doi.org/10.1007/BF02534079)
6. Sunil Kumar, Rashmi Malhotra and Dinesh Kumar. *Euphorbia hirta*: Its chemistry, traditional and medicinal uses, and pharmacological activities, (2010); *Pharmacognosy Reviews* 4 (7): 58–61. doi: [10.4103/0973-7847.65327](https://doi.org/10.4103/0973-7847.65327)
7. Julis T. Mwine^{1*} and Patrick Van Damme². Why do Euphorbiaceae tick as medicinal plants? A review of Euphorbiaceae family and its medicinal features, (2011); *Journal of Medicinal Plants Research*, 5(5): 652-62.
8. Killedar, Suresh Ganpati, Rohan Gurudas Desai, Uday Tukaram Kashid, Nikhil Veerkumar Bhore, and Sarang Sunil Mahamuni. "ANTIMICROBIAL ACTIVITY

- AND PHYTOCHEMICAL SCREENING OF FRESH LATEX OF EUPHORBIA THYMIFOLIA LINN" , (2011); *International Journal of Research in Ayurveda & Pharmacy* 2, no. 5
9. Bhavna Gupta, Rashmi S.Srivastava and RadhaGoyal. Therapeutic Uses of Euphorbia thymifolia: A Review, (2007); *Pharmacognosy Reviews* Vol-1, Issue-2.
 10. PRACHETA, VEENA SHARMA*, RITU PALIWAL, SADHANA SHARMA, IN VITRO FREE RADICAL SCAVENGING AND ANTIOXIDANT POTENTIAL OF ETHANOLIC EXTRACT OF EUPHORBIA. NERIIFOLIA LINN. (2011); *International Journal of Pharmacy and Pharmaceutical Sciences (Int J Pharm PharmSci)* ,Vol 3, Issue1, 238-242.
 11. Plant Details for a Euphorbia thymifolia L. <http://envis.frlht.org/plantdetails/207e083505043a04d736a4ec834c2505/c9473b818a351433b6a4a24949192416>
 12. Julius T. Mwene¹ * and Patrick Van Damme², Why do Euphorbiaceae tick as medicinal plants? A review of Euphorbiaceae family and its medicinal features, (4 March, 2011); *Journal of Medicinal Plants Research* Vol. 5(5), pp. 652-662,
 13. <https://www.gbif.org/species/3066919>
 14. K.R. Kirtikar and B.D. Basu, *Indian medicinal plants*, 2nd edition, (1975), 3:pp-2199-2200
 15. Anonymous. *The Wealth of India (Raw Materials)*. New Delhi: CSIR,(2003); 3; 224-7.
 16. Nadkarni KM and Nadkarni AK, *Indian Materia Medica*, (2007); PopularPrakashan 1: 529., 552.
 17. Md. Shahidul Islam^{*1}, Hasnat Ara¹, Kazi Ishtiaq Ahmad², Md. Mayin Uddin², A REVIEW ON MEDICINAL USES OF DIFFERENT PLANTS OF EUPHORBIAEAEFAMILY, (2019); *Universal Journal of Pharmaceutical Research*, 4(1): pp. 45-49.
 18. Bhavna Gupta, Rashmi S.Srivastava and RadhaGoyal, Therapeutic Uses of Euphorbia thymifolia: A Review, (2007); *Pharmacognosy Reviews* Vol-1, Issue-2, pp. 299-304.
 19. Pardeep Kumar Vaid¹, Ashwani Kumar ² *, Meenakshi Singh¹, Vani Tyagi¹, Akansha Kushwaha¹, Studies on Macroscopic, Microscopic, and TLC Based Phytochemical Analysis of Euphorbia thymifolia Linn. (2018); *Int. J. Life Sci. Scienti. Res*, Vol-04 (03) pg. 1744-1751.
 20. NERO M. PADERES, DIVINIA BORGONA ELOISAN, Phytochemical and Antibacterial Screening of Euphorbia thymifolia Linn and Cassia alata Linn Species in the Province of Abra, Philippines: An Alternative Source of Antibiotics, (October 2016); *JPAIR Multidisciplinary Research* Vol. 26 .
 21. Musaddique Hussain^{1,2}, Umer Farooq², Muhammad Rashid², Hazeer Bakhsh, Abdul ¹Majeed¹, Imran Ahmad Khan¹, Samia Latif Rana¹, Muhammad Shafeeq-ur-Rahman³, Abdul Aziz *Antimicrobial activity of fresh latex, juice and extract of Euphorbia hirta and Euphorbia thymifolia-an in vitro comparative study, (2014); *International Journal of Pharma Science*. 4(3): 546-553
 22. Dr. Bibhuti Bhusana Panigrahi^{*1}, Pradipta Ranjan Behera¹, Kumar Vikram¹, Rajendra Kumar Rath¹, Sachidananda Behera² Antimicrobial Activity of Euphorbia Thymifolia Linn. Against Superficial Dermatological Pathogens,

- (2013); International Journal for Pharmaceutical Research Scholars (IJPRS) Vol-2, I-4.
23. N.H. Khan, M. Rahman and M.S.A. Nur-e-kamal, "Anti bacterial activity of *Euphorbiathymifolia* Linn", (APRIL 1988); Indian J. Med Res., 87:395-397
 24. Mon M, Nwe NT, Hla MM. Antimicrobial activity of selected Myanmar medicinal plants. Third GMSARN International Conference on Sustainable Development: Issues and Prospects for the Greater Mekong Sub-region, Kunming, China, 12-14 Nov, (2008) ; p. 35.
 25. B T Pawar, Anti-fungal activity of some latex against seed-borne pathogenic fungi. 2015, J BiolChem Research.;32(1):183-187.
 26. Sandeep R. Kane*, Vishvesh A. Apte, Sachin S. Todkar, Shrinivas K. Mohite. Diuretic and laxative activity of ethanolic extract and fractions of *Euphorbia Thymifolia* Linn. (2009); International Journal of Chem. Tech. Research. Vol.1, No.2, pp 149-152. (Int J ChemTech Res. 2009;1(2):149-52.)
 27. Siva Jyothi CH*, NareshBabu P, Karmimulla S.K, Gobinath M., Preventive effect of *Euphorbia Thymifolia* Linn against ethylene glycol-induced urolithiasis in male wister albino rats., (2017); International Journal of Research in Pharmaceutical Sciences, Int. j. Res. Pharm. Sci., 8(4), 590-595.
 28. Durai Muthumani¹, Agaath Hedina², Juveriyah Kausar², Vijaya Anand² and Pushpa³Phytopharmacological activities of *Euphorbia thymifolia*Linn, (Jan-Dec, 2016);Systematic Reviews in Pharmacy, Vol 7, Issue 1.
 29. NAGARAJU GARIPELLI¹, CHINNALALAI AH RUNJA², NAGARAJU POTNURI³ and RAVI KUMAR PIGILI⁴, ANTI-INFLAMMATORY AND ANTI-OXIDANT ACTIVITIES OF ETHANOLIC EXTRACT OF *EUPHORBIA THYMIFOLIA* LINN, WHOLE PLANT.(2012); International Journal of Pharmacy and Pharmaceutical Sciences (Int J Pharm PharmSci);4Suppl (3):516-519.
 30. Syed A, Thippeswamy BS, Kulkarni VH and Hegde K. Hepatoprotective effect of *Euphorbia thymifolia* whole plant extract on CCl₄ induced hepatic damage in rats. International Journal of Research in Ayurveda & Pharmacy. (2011); 2(2): 681-686.
 31. Durai MG, Vijay AA, Manikandan R. Anti-oxidant, anti-helminthic and anti-microbial activity of *Euphorbia thymifolia* Linn whole plant. (2013);Int J CurrMicrobiol App Sci. 2(1):66-79.
 32. Prabha T, Singh SK. Antioxidant Activity of EthanolicExtract of *Euphorbia thymifolia*Linn.(2005); Indian Journal of Pharmaceutical Sciences;67:736-738.
 33. Gurava Reddy K¹*, Anuradha V²and Samba Siva Rao V³, Phytochemical and Antioxidant Activities of Methanolic Extract of the Plant *Euphorbia thymifolia* Linn, Natural Products Chemistry & Research (Nat Prod Chem Res) 5: 294, DOI: 10.4172/2329-6836.1000294
 34. Chun-Ching Lin^a, Hua-Yew Cheng^b, Chien-Min Yang^a, Ta-Chen Lin^c. Antioxidant and antiviral Activities of *Euphorbia thymifolia* L. (Nov-Dec 2002); *Journal of Biomedical Science*(J. Biomed.Sci.);9(6):656-664.doi: 10.1159/000067281.[Pub Med]
 35. D.R. Gupta And S.K. Garg, "Chemical examination of *Euphorbia thymifolia* Linn", (1996); Indian J. applied chem.,29(1):39-40.
 36. NAGARAJU GARIPELLI¹, CHINNALALAI AH RUNJA², NAGARAJU POTNURI³ and RAVI KUMAR PIGILI⁴ANTI-INFLAMMATORY AND ANTI-OXIDANT ACTIVITIES OF ETHANOLIC EXTRACT OF *EUPHORBIA THYMIFOLIA* LINN WHOLE PLANT. (2012);Int J Pharm PharmSci, Vol-4, Suppl-3, 516-519.

37. Ghanshyam R. Parmar^{1*}, Kilambi Pundarikakshudu², R. Balaraman¹Antidiabetic and antihyperlipidemic activity of *Euphorbia thymifolia*L. extracts on streptozotocin-nicotinamide induced type 2 diabetic rats, August, (2017); Journal of Applied Pharmaceutical Science Vol. 7 (08), pp. 078-084,. DOI: 10.7324/JAPS.2017.70811
38. T Hoang Nguyen Vo¹, Ngan Tran¹, Dat Nguyen¹, Ly Le^{1 2*}, An in Silico Study on Antidiabetic Activity of Bioactive Compounds in *Euphorbia Thymifolia* Linn(2016 Aug) ;Springerplus, , 18;5(1):1359.doi: [10.1186/s40064-016-2631-5](https://doi.org/10.1186/s40064-016-2631-5)
39. Mohammed Rahmatullah¹, SumaiyahKaniJHasan, Zulfiqar Ali, ShahnazRahman, RownakJahanAntihyperglycemic and Antinociceptive Activities of Methanolic Extract of Euphorbia thymifolia L. Whole Plant, (2012 Feb); Zhong Xi Yi Jie He Xue Bao;10(2):228-32 DOI: [10.3736/jcim20120213](https://doi.org/10.3736/jcim20120213)
40. Hossan M. S., Hanif A, Khan M, Bari S, Jahan R, Rahmatulla M.; Ethnobotanical survey of the Tripura tribe of Bangladesh., (2009); American-Eurasian Journal of Sustainable Agriculture., 3(2): 253-261
41. Asheesh Kumar Gupta^{1*},Rishabh Dobriyal¹, T. Doughton Victorian² In vitro evaluation of antiulcer activity of *Euphorbia thymifolia* L. plant extracts, (September October 2018); International Research in Medical and Health Sciences Vol. 1 Issue 1. pp:1-7
42. SANDEEP R KANE*, SHRINIVAS K MOHITE, JAYKUMAR S SHETE, ANTIHELMINTIC ACTIVITY OF AQUEOUS AND METHANOLIC EXTRACTS OF *EUPHORBIA THYMIFOLIA* LINN , (July-Sept2009);International Journal of Pharm Tech Research, (Int.J. PharmTech Res.) (3). Pg 666-668.
43. Sandeep R Kane, Rahul S Adnaik, Vishvesh AApte, ChandrakantS Magdum, Laxative and Anti-HelminticActivity of Aqueous Extract of Euphorbia thymifoliaLinn. (2009);Research Journal of PharmacognosyPhytochemistryVol.1, Issue. (3):182-184
44. G D Sharma¹, S N Tripathi. Experimental evaluation of dugdhika (*Euphorbia prostrata*W. Ait) for the treatment of 'tamakasvasa' (Bronchial Asthma), (1984); Anc. Sci. Life. 1984;3(3):143-5. (Pub Med)
45. Ghanshyam Parmar^a, *KilambiPundarikakshudu^b, R. Balaraman^a , Anti-anaphylactic and antiasthmatic activity of Euphorbia thymifolia L. on experimental animals, 2019, Journal of Traditional and Complementary Medicine Vol-9 Issue-1 60-65.<https://doi.org/10.1016/j.jtcme.2018.03.002>
46. C. P. Khare. Indian Herbal Remedies: Rational Western Therapy, Ayurvedic and Other Traditional Usage. (2004); Berlin: Springer Verlag; 210-211.
47. SIVAPRASAD GUDIPUDI^{1*} , DAYANAND SUBRAO PURANIK¹ , RAMOJI ALLA² , UPENDRANADH AJJARAPU³ , THIRUPATHI REDDY KISTAMMAGARI³, ANTI-STRESS ACTIVITY OF EUPHORBIA THYMIFOLIA L. AQUEOUS ROOT EXTRACT IN FEMALE RATS , (Apr 2015); International Journal of Pharma Sciences and Research (IJPSR), Vol. 6 No.4 640,
48. Sivaprasad G, Dyanand SP, Upendranadh A, Thirupathi ReKRA. Protective effect of Euphorbia thymifoliaLinn. root on reproductive dysfunction in female rats. (2015); Asian Journal of Pharmacology and Toxicology. Vol-03 (08); pp8-11.
49. V. Jaya Sankar Reddy*. G. Deval Rao² G. Rajya Lakshmi ³.A REVIEW ON ANTI-ARTHRITIC ACTIVITY OF SOME MEDICINAL PLANTS. (2014); Journal of Global Trends in Pharmaceutical Sciences (JGTPS), 5(4): pp 2061-2073.

50. G.C. Mamatha^{*1}, T.Prabhakar², V. Madhuri¹, K. Neelima¹, E. Venkatanagaraju¹ and S.B.Chandrasekar¹, ANTI-ARTHRITIC ACTIVITY OF EUPHORBIA THYMIFOLIA LINN(2014); world journal of pharmacy and pharmaceutical sciences vol-3, issue-2, 1323-1331.
51. Sumeet Gairola^a , JyotsanaSharma^{b,*} , R.D. Gaur^c , T.O. Siddiqi^b , R.M. Painuli^c, Plants used for treatment of dysentery and diarrhea by the Bhoja community of district Dehradun, Uttarakhand, India., (2013); Journal of Ethnopharmacology, 150(3), 989-1006. DOI:[10.1016/j.jep.2013.10.007](https://doi.org/10.1016/j.jep.2013.10.007).
52. M. Aqil, Euphorbianin, a new glycoside from Euphorbia hirta Linn. Global v Journal of Pure and applied science 1999, 5(3), 371.
53. Chien-Min Yang¹, Hua-Yew Cheng, Ta-Chen Lin, Lien-Chai Chiang, Chun-Ching Lin, *Euphorbia thymifolia* suppresses herpes simplex virus-2 infection by directly inactivating virus infectivity, (22 April 2005);Clinical Experimental Pharmacology and Physiology;32:346-9, doi.org/10.1111/j.1440-1681.2005.04194.x (Pub Med) (Wiley Online Library)
54. Abdul Rahuman A, Gopalakrishnan G, Venkatesan P, Geetha K. Isolation and identification of mosquito larvicidal compound from *Abutilon indicum*(Linn.) Sweet. (2008);Parasitology Research, 102 (5):981-988., doi.org/10.1007/s00436-007-0864-5(Pub Med).
55. G.C. Mamatha^{1*}, T. Prabhakar² , Pandya Naitik³ , V. Madhuri³ , K. Neelima³& V.N. Raju Erumalla¹, ANTI-TUMOR ACTIVITY AND ANTI-OXIDANT STATUS OF EUPHORBIA THYMIFOLIA LINN AGAINST EHRLICH ASCITES CARCINOMA IN SWISS ALBINO MICE, (2014);World Journal of Pharmaceutical Research Vol-3, Issue-5, pg 853-864.
56. A. Jabbar, GAMS Khan, Antimicrobial alkaloids from *Euphorbia thymifolia*. (1965);Pak. J. Sci. Indian res,8:293
57. Papiya Bigoniya^{*}and Alok Kumar Shukla, NOOTROPIC EFFICACY OF EUPHORBIA THYMIFOLIA LINN PHYTOSTEROL ON MICE, (2015); Inter. J. of Phytotherapy , Vol-5 ,Issue-1 ,pp-22-32.
58. Sivaprasad Gudipudi^{*} ¹, DayanandSubrao Puranik¹, Ramoji Alla²Upendranadh Ajarapu³ and Thirupathi Reddy Kistammagari³, Role of Euphorbia thymifolia L. ethanolic root extract in treating female reproductive dysfunction in rats, (2015); International Journal of Pharmacological Research (ijpr), Vol-05,(04) pg. 75-79, DOI:10.7439/ijpr
59. Alarcon-Aguilara FJ, Roman-Ramos R, Perez-Gutierrez S, Aguilar-Contreras A, Contreras-Weber CC, Flores-Saenz JL. Study of the anti-hyperglycemic effect of plants used as anti-diabetics. (1998); J Ethnopharmacol.;61(2):101-10
60. ZafilazaArmand¹, AndriantsimahavandyAbel², RandrianarivoRanjana Hanitra², Ramamonjisoa Daniel Joseph², Andrianainarivelo Mahandrimanana³, Ethnobotanical, Antimicrobial and Phytochemical Screening of *Euphorbia Thymoflia* L. (Kinonononomadiny) to Cure the Menstrual Hemorrhage of a Woman SakalavaBemazava in the Northern Region of Madagascar, (2018);International Journal of Plant Research , Vol. 8 (1): 1-7 [doi:10.5923/j.plant.20180801.01](https://doi.org/10.5923/j.plant.20180801.01).
61. Papiya Bigoniya^{*}, EFFICACY OF EUPHORBIA THYMIFOLIA LINN PHYTOSTEROL ON ROTENONE INDUCED PARKINSON'S DISEASE: BEHAVIOURALAND NEUROCHEMICAL STUDY, (December-2017); INDIAN JOURNAL OF APPLIED RESEARCH, Volume-7, Issue-12 , pp-135-140

62. Ashwani kumar, Priyanka, Manisha, Beenu Rathi & Vani Tyagi A CLASSICAL REVIEW ON ANTI-ULSAR MEDICINAL PLANT LAGHUDUDHIKA (*EUPHORBIA THYMIFOLIA*) 2017 *J. Bio.Innov* 6 (4), pp: 562-578.
63. Prashant Y. Mali, Shital S. Panchal A review on phyto-pharmacological potentials of *Euphorbia thymifolia* L. *Ancient Science of Life* / Jan-Mar 2013 / Vol 32 / Issue 3 pg 165 -177.
64. Yi-Kao Hu, Yuan-Yuan Li, Meng-Jia Li, Feng Li, Wen Xu, and Yong Zhao* CHEMICAL CONSTITUENTS OF *Euphorbia thymifolia*, *Chemistry of Natural Compounds*, Vol. 54, No. 6, November, 2018
65. Sushma Kainsa 1, Randhir Singh1*Flavan-3-ol Isomers Isolated from *Euphorbia Thymifolia* Linn, Jan-Mar, 2016 *Pharmacognosy Communications*, Vol 6, Issue 1, 28-33
66. Riaz Hussain, Bakhat Ali, Muhammad Imran and Abdul Malik* Thymofolinoates A and B, New Cinnamic Acid Derivatives from *Euphorbia thymifolia* , 2012 *Natural Product Communications* Vol. 7 (10) 2012, 1351 – 1352.
67. SEUNG-HO LEE, TAKASHI TANAKA, GEN-ICHIRO NONAKA and ITSUO NISHIOKA , HYDROLYSABLE TANNINS FROM EUPHORBIA THYMIFOLIA , *Phytochemistry*, Vol. 29, No. 11, pp. 3621-3625, 1990
68. Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2022). Post-pandemic health and its sustainability: Educational situation. *International Journal of Health Sciences*, 6(1), i-v. <https://doi.org/10.53730/ijhs.v6n1.5949>
69. Suryasa, I.W., Sudipa, I.N., Puspani, I.A.M., Netra, I.M. (2019). Translation procedure of happy emotion of english into indonesian in kṛṣṇa text. *Journal of Language Teaching and Research*, 10(4), 738–746
70. Yuriah, S., Kartini, F., & Isnaeni, Y. (2022). Experiences of women with preeclampsia. *International Journal of Health & Medical Sciences*, 5(3), 201-210. <https://doi.org/10.21744/ijhms.v5n3.1901>