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REVIEW ARTICLE ON EUPHORBIA HIRTA

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1. INTRODUCTION

1.1 *Euphorbia Hirta* Synonyms and Taxonomy

Euphorbia hirta(*E. hirta*) L. belongs to the family Euphorbiaceae. It is a small annual herb common to tropical countries. It is usually erect, slender-stemmed; spreading up to 80 cm tall, though sometimes it can be seen lying down. The plant is an annual broad-leaved herb that has a hairy stem with many branches from the base to the top. The leaves are opposite, elliptical, oblong or oblong-lanceolate, with a faintly toothed margin and darker on the upper surface. The flowers are small, numerous and crowded together in dense cymes (dense clusters in upper axils) about 1 cm in diameter. The stem and leaves produce a white or milky juice when cut. It is frequently seen occupying open waste spaces, banks of watercourses, grasslands, road sides, and pathways***(Rajesh et al., 2010 and Anonymous 2008).***

Synonyms of Euphorbia Hirta(Kumar* et al., 2010*)

Language	Vernacular name
English	Pill-bearing spurge, Asthma plant, Hairy spurge, Garden spurge, Pill pod sandman
Bengali	Boro-Keruie, Barokhervi
Gujarati	Dudeli
Hindi	Daridhudi, Dudhghas, Dudhi
Sanskrit	Chara, Amampatchairasi, Barokheruie
Tamil	Amampatchaiarisi
Telugu	Reddivarinanabalu, Reddinananbrolu, Bidarie
Urdu	LalDodhak

The photo Documentation of *Euphorbia hirta* as shown below:

1.2 Traditional Use

E. hirta is a very popular herb amongst practitioners of traditional medicine and is widely used as a decoction or infusion to treat various ailments including intestinal parasites, diarrhoea, peptic ulcers, heartburn, vomiting, amoebic dysentery, asthma, bronchitis, hay fever, laryngeal spasms, emphysema, coughs, colds, kidney stones, menstrual problems, sterility, and venereal diseases. Moreover, the plant is also used to treat affections of the skin and mucous membranes, including warts, scabies, tinea, thrush, aphthae, fungal afflictions, measles, and guinea-worm and as an antiseptic to treat wounds, sores, and conjunctivitis. The plant has a reputation as an analgesic to treat severe headache, toothache, rheumatism, colic, and pains during pregnancy. It is used as an antidote and pain relief of scorpion stings and snakebites ***(Shih et al., 2012).***

Euphorbia hirta (Euphorbiaceae), commonly known as Dudhi is an annual hairy plant. Traditionally, it is used in treatment of gastrointestinal disorders, bronchial and respiratory diseases, kidney stones, diabetes and in conjunctivitis. It also exhibits antipyretic, analgesic, antibacterial, anxiolytic, anthelmintic, anti-fertility, antispasmodic, antifungal, and anti inflammatory activities ***(Elizabeth 2002)***.

2. Phytochemistry

The aerial parts of plant are well investigated for chemical information ***(Williams et al., 1997)***.

Flavonoids: Euphorbianin, leucocyanidol, camphol, quercitrin and quercitol ***(Gupta., 1966 & Blanc et al., 1972)***.

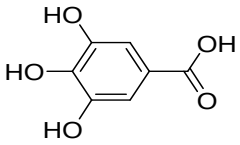
Polyphenols: Gallic acid, myricitrin, 3,4-di-Ogalloylquinic acid,2,4,6-tri-O-galloyl Dglucose, 1,2,3,4,6-penta-O-galloyl-β- D-glucose ***(Aqil., 1999 & Chen., 1991)***.

Tannins: Euphorbins A, B, C, D, E ***(Joseph et al., 2002)***.

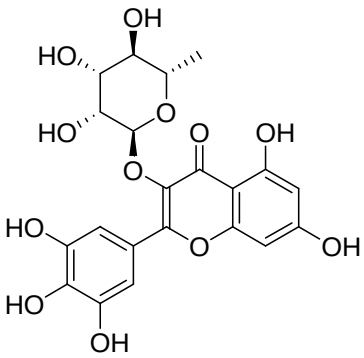
Triterpenes and phytosterols: β-Amyrin, 24- methylenecycloartenol, and β-Sitosterol ***(Yoshida et al., 1989)***.

Alkanes: Heptacosane, n-nonacosane and others ***(Martinez et al., 1999)***.

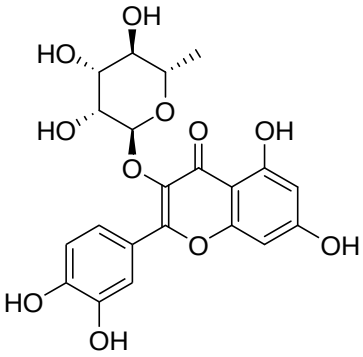
Chemical Structure



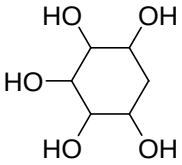
Gallic acid



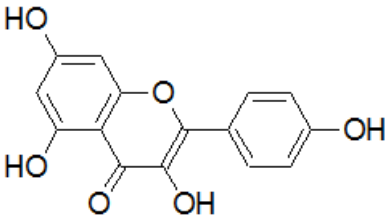
Myricitrin



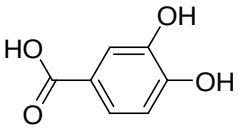
Quercitrin



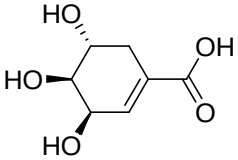
Quercitol



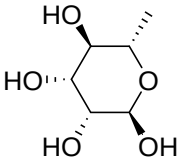
Kaempferol



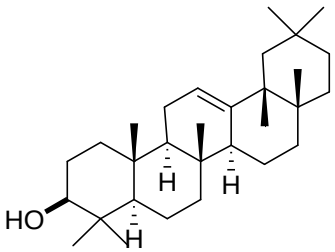
protocatechuic acid



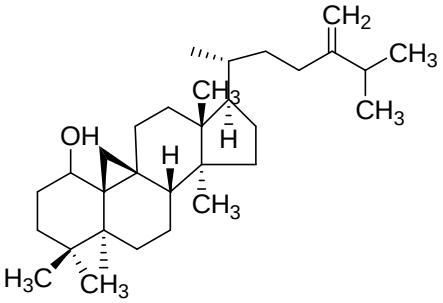
Chtolphenolic acid



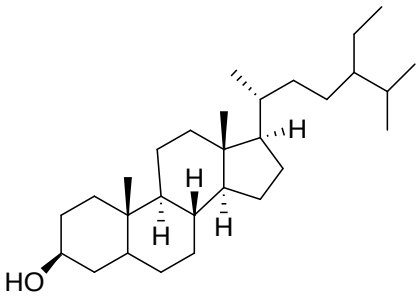
Rhamnose



β-amyrin



24-methylenecycloartenol



β-sitosterol

3. Geographical Distribution

E. hirta is distributed throughout the hotter parts of India and Australia, often found in waste places along the road sides. In India its native in Uttar Pradesh, Bihar, Gujarat, Madhya Pradesh, Himanchal Pradesh and West Bangol ***(Sood et al.,2005)***.

4. Pharmacological Activities Of Extracts, Fractions And Isolated Constituents

Anti-inflammatory activity

The n-hexane extract of the aerial parts of *E. hirta* and its main constituent triterpenes, β-amyrin, 24-methylenecycloartenol, and β-Sitosterol were evaluated for anti-inflammatory effects in mice. Both the extract and the triterpenes exerted significant and dosedependentanti-inflammatory activity in the model of phorbol acetate-induced ear inflammation in mice. The lyophilized aqueous extract showed analgesic, antipyretic and

anti-inflammatory activity in mice and rats. A central depressant activity, expressed by a strong sedative effect associated with anxiolytic effect, was also observed ***(Lanhers et al., 1991)***.

Sedative and Anxiolytic activity

Lyophilized aqueous extract of *Euphorbia hirta* L. (Euphorbiaceae) has been evaluated for behavioural effects in mice. Sedative properties could be confirmed with high doses (100 mg of dried plant/kg, and more), by a decrease of behavioral parameters measured in non-familiar environment tests, whereas anti-conflict effects appeared at lower doses (12.5 and 25 mg of dried plant/kg), by an enhancement of behavioural parameters measured in the staircase test and in the light/dark choice situation test. These findings validate the traditional use of *E. hirta* as a sedative and reveal original anxiolytic properties ***(Lanhers et al., 1990)***.

Anticancer activity

Euphorbia hirta possess anticancer activity. Cytotoxicity studies of the extracts were performed using the cell line and the non-cytotoxic concentration of the extract was tested for antibacterial activity against the cytopathic dose of the pathogen. These extracts were found to be non-cytotoxic and effective Anti-bacterial agents Extracts of *Euphorbia hirta* have been found to show selective cytotoxicity against several cancer cell lines. The plant is useful in effective treatment of cancers, particularly malignant melanomas and squamous cell carcinomas ***(Mathur et al., 1995)***.

Anti-diarrhoeal activity

Euphorbia hirta possess Anti-diarrhoeal activity. Their traditional medicinal use as antidiarrheal agents. Only 8 plant extracts (17.39%) proved as antidiarrheal agents by a triple pronounced antibacterial, antiamoebic and antispasmodic action. *Euphorbia hirta* whole plantare used***(Tona et al., 1999)***.

Antimalarial activity

Euphorbia hirta posses antimalarial activity .*Euphorbia hirta* whole plant produced more than 60% inhibition of the parasite growth in vitro at a testconcentration g/ml. Extracts from E. hirta showedμ of 6 asignificant chemosuppression of parasitaemia in miceinfected with P. berghei berghei at orally given doses of 100-400 mg/kg per day***(Tona et al., 1999)***.

Antifertility activity

Euphorbia hirta at a dose level of 50 mg/kg bodyweight reduced the sperm motility and density of caudaepididymal and testis sperm suspension significantly, leading eventually to 100% infertility ***(Mathur et al., 1995)***.

Aflatoxin inhibition activity

*Euphorbia hirta*aqueous extract significantly inhibited aflatoxinproduction on rice, wheat, maize and groundnut ***(Singh et al., 1986)***.

Anti-platelet aggregation and anti-inflammatory

Aqueous extracts of *Euphorbia hirta* strongly reducedthe release of prostaglandins I2, E2, and D2.Additionally *Euphorbia hirta* extracts exerted aninhibitory effect on platelet aggregation and depressedthe formation of carrageenin induced rat paw oedema. The chemical nature of the active principle of *Euphorbia hirta* could be characterized as (a)compound(s) of medium polarity in the molecular weight range of 1000 to 3000 Da ***(Hiermann et al., 1994)***.

Immunomodulatory activity

Euphorbia hirta aqueous and aqueous-alcoholic extracts, containingflavonoids, polyphenols, sterols and terpenes, demonstrated immunostimulant activity. The aqueousextract affected lectin-induced lymphoblasttransformation *in vitro* ***(Szenasi et al., 1992)***.

Antifungal activity

An ethanolic extract of *Euphorbia hirta* displayed antifungal activity whentested against the plant pathogens Colletotrichumcapsici, Fusarium pallidoroseum, Botryodiplodiatheobromae, Alternaria alternata, Penicillium citrinum, Phomopsis caricae-papayae and Aspergillus niger usingthe paper disc diffusion technique ***(Mohamed et al., 1996)***.

Larvicidal activity

Larvicidal activity of ethyl acetate, butanol, andpetroleum ether extracts of Euphorbiaceae plants, *Euphorbia hirta*, was tested against the early fourthinstar larvae of *Aedes aegypti* L. and *Culexquinquefasciatus* (Say). The larval mortality wasobserved after 24 h of exposure. The LC50 value ofpetroleum ether extract of *E. hirta*, was 272.36ppm against *A. aegypti* and 424.94 against *Cquinquefasciatus* ***(Rahuman et al., 2007)***.

Antioxidant activity

Aqueous extract of *Euphorbia hirta*L. was preparedin hot water and crude extract yield (7%w/w) afterlyophilization was used for antioxidant potentialdetermination. The total antioxidant potential of crudeextract was determined using phosphomolybdenumcomplex and ferric reducing power (FRAP) assays, which showed 185 µmol of ascorbic acid and 398 µmolFe (II) equivalent per gram crude extract, respectively. The crude extract exhibited significant free radicalscavenging activity of 247 µmol Trolox equivalent pergram crude extract ***(Sharma et al., 2007)***.

Serum biochemistry

The effects of the chromatographic fractions of *Euphorbia hirta* Linn were administered to rats ingraded doses of 400mg/kg, 800mg/kg and 1600mg/kgorally for fourteen days. After fourteen days the serumbiochemical parameters total protein, albumin, globulin, alanine aminotransferase (ALT), alkaline phosphatise (ALP), aspartate aminotransferase (AST), totalbilirubin, creatinine, and blood urea nitrogen (BUN)significant increase in rats ***(Subramanian et al., 2011)***.

Anti-anaphylactic activity

The *Euphorbia hirta* ethanolic extract (EH A001) wasfound to possess a prominent anti-anaphylactic activity. A preventive effect of EH-A001 given by oral route atdose from 100 to 1000 mg/kg was observed againstcompound 48/80-induced systemic anaphylaxis. At thesame range of dose, EH-A001 inhibited passivecutaneous anaphylaxis (PCA) in rat and active pawanaphylaxis in mice. A suppressive effect of EH-A001was observed on the release of TNF-α and IL-6 fromanti-DNP-HAS activated rat peritoneal mast cells ***(Youssouf et al., 2007)***.

Anthelmintic activity

The anthelmintic efficacy of the aqueous crude extract of *Euphorbia hirta* Linn was studied in 20Nigerian dogs that were naturally infected with nematodes. Results of this study show that the aqueouscrude extracts of *E. hirta* after its administration intolocal dogs produced a significant increase ($P < 0.05$) in PCV, RBC, Hb conc., TWBC and lymphocyte counts. The faecal egg counts also showed a remarkable and significant reduction in the levels of the identify edhelminthes ***(Duez et al., 1991)***.

Antidiarrhoeal activity

The aqueous leaf extract of *E.hirta* significantly decrease the gastrointestinal motility and decrease the effect of castor oil induced diarrhea. These findingsmay lend support to the traditional use of *E.hirta* indiarrhea. It is also focused that the leaves of this plantpossibly play a vital role in anti- diarrhoeic activity ofthe whole plant as reported earlier ***(Hore et al., 2006)***.

Diuretic Activity

The leaves extract of *E.hirta* increase the urineoutput and enhance the excretion of electrolytes i.e. Na+, K+, HCO3-. The water and ethanol extracts of the plant produced time dependant increases in urineoutput. Electrolyte excretion was also significantly affected by the plant extracts. The water extractincrease the urine excretion of Na+, K+ and HCO3-. In contrast the ethanol extract increased the excretion ofHCO3-, decreased the loss of K+ and had little effect onrenal removal of Na+. Acetazolamide, like the waterextract, increased the urine output and enhance theexcretion of Na+, K+ and HCO3-. The high – ceilingdiuretic, furosemide, increased the renal excretion ofNa+, and Cl-; but had no effect on K+ and HCO3- loss. These results validate the traditional use of *E.hita* as adiuretic agent ***(Johnson et al., 1999)***.

Antimicrobial activity

The ethanolic extract of aerial parts of *E.hirta*was tested for anti microbial activity along with theethanolic extracts of dry fruits of *Caesalpiniapulcherrima* and flowers of *Asystasia gangeticum*. Thethree plants exhibited a broad spectrum of antimicrobial activity particularly against *Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa* and *Staphylococcus aureus* ***(Sudhakar et al., 2006)***.

Molluscicidal activity

The aqueous and serially purified latex extracts of *E.hirta* have potent molluscicidal activity. Sub lethaldoses of aqueous and partially purified latex extracts of plant also significantly alter the levels of total protein, total free amino acid, nucleic acid and the activity of enzyme protease and alkaline phosphatase in nervoustissue of the snail *Lymnaea acuminate* in time and dosedependant manner. This is toxic effect of stem bark and leaf extract of *Euphorbia hirta****(Duez et al., 1991)***.

Antibacterial activity

The methanolic extract of *E.hirta* possesses the anti bacterial activity along with compounds extracted from *Camellia sinensis* were studied against dysentery causing *Shigella* species using the Vero cellline. These extracts were found to be non cytotoxic and effective anti bacterial agent ***(Ajao et al., 1985)***.

Wound healing activity

The ethanolic extract of whole plant of *E.hirta*possesses significant wound healing activity. Thehistopathological study, W.B.C. count and haemostaticactivity were carried out to support its wound healingactivity. The ethanolic extract of *E.hirta* has promotedwound healing activity and probable mechanism maythe promotion of collagen biosynthesis which furthersupports for increase in tensile strength of thegranulloma tissue. This evidence supports the use of *E.hirta* in the management of wounds ***(Jaiprakash et al., 2006)***.

Antihepatoxic activity

The antihepatotoxic effect of *Euphorbia hirta* extracts were evaluated in experimental models of liver injury in rats induced byCCL4 or paracetamol. Hydroalcoholic extract (HE)from whole plant were tested. The Hepatic dysfunction was accessed by determining different biochemicalparameters in serum and tissues. In serum, the activities of enzymes like Aspartate Aminotransferase (AST), Alanine aminotransferase (ALT), alkaline phosphatise (ALP), alkaline phosphate (ALP), Bilirubin were evaluated. Lipid peroxidation and reduced glutathionewere also measured into control and treated rats. *E.hirta*whole plant (HE) showed hepatoprotective activities at doses 125 mg/kg and 250 mg/kg, since serum levels of ALT and AST in rats given the extracts were significantly low ($p<0.05$ and 0.01 respectively) When compare to control CCL4 or paracetamol-injured rats.

Furthered studies were carried on the HE from the whole part of both the plant by using the combination of the extract showed the highest level of antihepatotoxic activity with the hydroalcoholic extract which was effective at doses 75mg/kg and 150 mg/kg, for hepatoprotective activity in CCL4 and paracetamolinjuredrats. In experiments comparing the comprisingthe HE (125- 250 and 75- 150 mg/kg) to reference antihepatotoxic substance (silymarin) the HE exhibiteda 70 and 80% hepatoprotection compared to the 80 and 90% one exhibited by silymarin in CCL4 orparacetamol -injured rats respectively. This study demonstrated that hydro alcoholic extract *Euphorbia hirta*and *Boerhaavia diffusa* was effective in protectingthe liver from toxic hepatitis ***(Brindha et al., 2010)***.

Antiviral activity

The antiretroviral activities of extracts of *Euphorbia hirta* were investigated in vitro on the MT4 human Tlymphocyte cell line. The cytotoxicities of the extractswere tested by means of the MTT cell proliferationassay, and then the direct effects of the aqueous extracton HIV-1, HIV-2 and SIV (mac251) reversetranscriptase (RT) activity were determined. A dosedependentinhibition of RT activity was observed for allthree viruses. The HIV-1 inhibitory potency of *E. hirta* was studied further, and the activities of the aqueousand 50% methanolic extracts were compared. The 50%methanolic extract was found to exert a higherantiretroviral effect than that of the aqueous extract. The 50% MeOH extract was subjected to liquid-liquidpartition with dichloromethane, ethyl acetate and water. Only the remaining aqueous phase exhibited significantantiviral activity; all the lipophilic extracts appeared to be inactive. After removal of the tannins from the aqueous extract, the viral replication inhibitory effect was markedly decreased, and it was therefore concluded that tannins are most probably responsible for the high antiretroviral activity ***(Gyuris et al., 2009)***.

REFERENCES

1. Rajeh MA, Zuraini Z, Sasidharan S, Latha LY, Amutha S. Assessment of *Euphorbia hirta* L. leaf, flower, stem and root extracts for their antibacterial and antifungal activity and brine shrimp lethality, 2010; 15: 6008-6018.
2. Kumar S, Malhotra R, Kumar D. *Euphorbia hirta*: Its chemistry, traditional and medicinal uses, and pharmacological activities. Pharmacognosy, 2010; Rev 4(7): 58–61. doi:10.4103/0973-7847.65327.
3. Shih MF, CherngJY. Potential applications of *Euphorbia hirta* in pharmacology. In: Omboon V, editor. Drug Discovery Research in Pharmacognosy. In Tech., 2012.
4. Elizabeth MW. China: Churchill Livingstone; 2002. Major Herbs of Ayurveda; pp. 64–5.
5. Williams LAD, Gossell-Williams M, Sajabi A, Barton EN and Fleischhacker R; Angiotensin converting enzyme inhibiting and antidipsogenic activities of *Euphorbia hirta* extracts. Phytother. Res., 1997; 11: 401-402D.
6. Gupta R; A chemical examination of *Euphorbia hirta* Linn. Bull Chem Soc Japan, 1966: 39(11): 2532-4.
7. Blanc P, Bertrand P, Plantes G; Flavonoids of. *Euphorbia hirta*. Med. Phytother., 1972; 6: 106-109.
8. Aqil Euphorbianin M; A new glycoside from *Euphorbia hirta* Linn. Global J. Pure and
9. Applied Sci., 1999; 5(3): 371.

10. Chen L; Polyphenols from leaves of *Euphorbia hirta* L, Zhongguo Zhong Yao Za Zhi., 1991; 16(1): 38-9.
11. Joseph GV, Drangari V. Standardisation and quality evaluation of euphorbin nivulia buch.ham. Anc Sci Life., 2002; 21(3): 160-6.
12. Yoshida T, Namba O, Okuda T; Hydrolysable tannin oligomers from euphorbiaceae. Tennen Yuki Kagobutsu Toronkai Koen Yoshishu, 1989; 31: 601.
13. Martinez-Vazquez M, Ramirez Apan TO, Lazcano ME, Bye R; Antiinflammatory active components from n-Hexane extract of *Euphorbia hirta*. The Revista de la Sociedad Química de México, 1999; 43: 103-105.
14. Lanhers MC, Fleurentin J, Dorfman P, MortierF, Pelt JM; Analgesic, antipyretic and anti-inflammatory properties of *Euphorbia hirta*. Planta Med., 1991; 57: 225-233.
15. Lanhers MC, Fleurentin J, Cabalion P, RollandA, Dorfman P, Misslin R and Pelt JM; Behavioral effects of *Euphorbia hirta*L.:Sedative and anxiolytic properties. J.Ethnopharmacol., 1990; 29: 189-198.
16. Mathur A, Dixit VP, Dobal MP; Antifertilityplant product: *Euphorbia hirta* in males. (Proceeding of the international symposium onmale contraception: present and future, New Delhi, 1995.
17. Tona L, Cimanga RK, Mesia K, MusuambaCT, De Bruyne T, Apers S, Hernans N, VanMiert S, Pieters L, Totte J, Vlietinck AJ; Biological sceening of traditional preparations from some medicinal plants used asantidiarrheal in Kinshasa, Congo. Phytomedicine, 1999; 6(1): 59-66.
18. Tona L, Ngimbi NP, Tsakala M, Mesia K, Cimanga K, Apers S, De Bruyne T, Pieters L, Totte J, Vlietinck AJ; Antimalarial activity of 20 crude extracts from nine African medicinalplants used in Kinshasa, Congo. J.Ethnopharmacol., 1999; 68: 193–203.
19. Mathur A, Dixit VP, Dobal MP; Antifertilityplant product: *Euphorbia hirta* in males. (Proceeding of the international symposium onmale contraception: present and future, New Delhi, 1995.
20. Singh P, Sinha KK; Inhibition of alfatoxinproduction on some agricultural commodities. J. Ind. Botanical Soc., 1986; 65(1): 30.
21. Hiermann A, Bucar F*;* Influence of sometraditional medicinal plants of Senegal onprostaglandin biosynthesis. J Ethnopharmacol., 1994; 42(2): 111-116.
22. Szenasi TE (Hung); E.Hirta extracts asImmunostimulants. German Patent DE4102054 (1992).
23. Mohamed S, Saka S, EL-Sharkawy SH, AliAM, Muid S; Antimycotic screening of 58

24. Malaysian plants against plant pathogens. Pesticide Science, 1996; 47(3): 259.
25. Rahuman AA, Gopalakrishnan G, VenkatesanP, Kannappan G; Larvicidal activity of some Euphorbiaceae plant extracts against. Aedesaegypti and Culex quinquefasciatus (Diptera:Culicidae). Parasitology Res., 2007; 839-6.
26. Sharma NK, Dey S, Prasad R; *In vitro* antioxidant potential evaluation of *Euphorbia hirta*L. Pharmacologyonline, 2007; 1: 91-98.
27. Subramanian SP, Bhuvaneshwari S, PrasathGS. Antidiabetic and antioxidant potentials of*Euphorbia hirta* leaves extract studied instreptozotocin-induced experimental diabetesin rats. Gen Physiol Biophys., 2011; 30(3): 278-285.
28. Youssouf MS, Kaiser P, Tahir M, Singh GD, Sharma VK, Satti NK, et al.; Anti anaphylactic effect of *Euphorbia hirta*. Fitoterapia, 2007; 78: 535–539.
29. Duez P, Livaditis A, Guissou PI, Sawadogo M, Hanocq M. Use of an Amoeba proteus modelfor in vitro cytotoxicity testing inphytochemical research. Application to *Euphorbia hirta* extracts. J Ethnopharmacol, 1991; 34(2-3): 235-246.
30. Hore SK, Ahuja V, Mehta G, Kumar P, Pandey S K and Ahmad A H; Effect ofaqueous *Euphorbia hirta*leaf extract ongastrointestinal motility, Fitoterapia, 2006; 77: 35-38.
31. Johnson BP, Abdurahman M Tiam EA, Abdu-Aguye I, Hussaini IM. *Euphorbia hirta* leafextracts increase urine output and electrolytesin rats. J. Of Ethnopharmacol, 1999; 65(1): 63-69.
32. Sudhakar M, Rao Ch V, Rao PM, Raju DB, Venkateswarlu, Y. (2006) Antimicrobialactivity of Caesalpinia pulcherrima, *Euphorbia hirta*and *Asystasia gangeticum*. Fitoterapia, 2006; 77(5): 378–380.
33. Ajao AD, Emele F and Femi OB; Antibacterial Activity of *Euphorbia hirta*. Fitoterapia, 1985; LVI (3): 165.
34. Jaiprakash B, Chandramohan D, Reddy N; Burn wound healing activity of *Euphorbia hirta*. Ancient Science of Life, 2006; XXV(3& 4): 16-18.
35. Brindha D, Saroja S, Jeyanthi GP. Protectivepotential [correction of potencial] of *Euphorbia hirta* against cytotoxicity induced inhepatocytes and a hepg2 cell line. J Basic Clin Physiol Pharmacol, 2010; 21(4): 401-413.
36. Gyuris A, Szlávik L, Minárovits J, Vasas A, Molnár J, Hohmann J. Antiviral activities ofextracts of *Euphorbia hirta* L. Against HIV-1, HIV-2 and sivmac251. In Vivo., 2009; 23(3): 429-432.
37. Sood SK, Bhardwaj R, Lakhanpal TN. India: Scientific Publishers; 2005. Ethnic Indian Plants in cure of diabetes.