



Phyllanthus Amarus: A Review

Hanumant Shinde*, Onkar Dawane, Akash Dhaygude, Nitin Nimbalkar, Jyoti More

Shardabai Pawar Institute of Pharmaceutical Sciences and Research, Shardanagar, Baramati, Maharashtra, India

Abstract

Phyllanthus amarus Schum. & Thonn. belongs to the family Euphorbiaceae is a small herb well known for its medicinal properties and widely used worldwide. *P. amarus* is an important plant of Indian Ayurvedic system of medicine which is used in the problems of stomach, genitourinary system, liver, kidney and spleen. It is bitter, astringent, stomachic, diuretic, febrifuge and antiseptic. The whole plant is used in gonorrhoea, menorrhagia and other genital affections. It is useful in gastropathy, diarrhoea, dysentery, intermittent fevers, ophthalmopathy, scabies, ulcers and wounds. This review summarizes the information about its botanical, morphological, ethanobotanical, pharmacological and biological activities of the plant. In addition, this review provides information about the structure of the phytochemical compounds that promotes better commercial exploitation.

Keywords: phyllanthus niruri, ethano botany, phytochemistry, hepatoprotective, antiviral, kidney stones, HIV replication inhibition

Introduction

The genus phyllanthus is one of the most important groups of plant traded as raw herbal drug in India. The genus phyllanthus of family Euphorbiaceae, consist of approx 1000 species, spread over tropical and sub-tropical continents like America, Africa, Australia and Asia. The extracts and the compounds isolated from phyllanthus Amarus have Show a wide spectrum of pharmacological activities including Antiviral, Antibacterial, Antiplasmodial, Antimalarial, Antimicrobial, Anticancer, Antidiabetic, Hypolipidemic, Antioxidant, Hepatoprotective, Nephroprotective and Diuretic properties [1].

Phyllanthus Amarus which is widely spread throughout the tropical and sub-tropical countries of the world including India is most commonly used in Indian ayurvedic system of medicine in problems of stomach genitourinary system, liver, kidney, and Phyllanthus Amarus has been described in ayurveda by the Sanskrit name -Bhoomyamalakee, Taamalakee and Bhoodhatree. It was described to have the properties of Rasa, Guna, Veerya and Vipaaka. The use of phyllanthus Amarus is gaining momentum because of its Novel antiviral activity against hepatitis B virus and for several other biological activities such as kidney and gallbladder stone, for cold, flu, tuberculosis and other viral infection: Liver diseases and disorders including hepatitis, jaundice and liver cancer (under et al.1993) it also act against liver cell toxicity and improves the immune system of patients and has been found effective against hepatitis A (Jayaram et al. 1997). *P. Amarus* is often used in the traditional system of medicine for a variety of ailments including dropsy, diabetes, jaundice, Asthma, and bronchial infection (foo and Wong, 1992). It is bitter astringent stomachic, Diuretic, febrifuge and antiseptic [21, 23, 24].

The whole plant is used in gonorrhoea, menorrhagia and other genital affection. It is useful in gastropathy, diarrhea, dysentery, intermittent fevers, ophthalmopathy, scabies, ulcers and wounds. It is also used as a good tonic. The Spanish name 'Chanca Piedra' means "stone breaker or shutter stone". *P. Amarus* is always sold as fresh and dry plant material in the herb market decoctions are used in herbal baths and after labor, cramps, asthma, uterus complaints and to treat stomachache (May 1982: Titjari, 1985: Heyde,1990: Sedoc, 1992: Nanden,1998). It is a restoration herb and used as an appetizer and as tonic. It is also used as colic [2, 4, 6].

Plant extracts are used as blood purifiers, for light malaria fevers and anemia. Ellagitannins (geraniin and corilagin) were shown to be the most potent mediator of the antiviral HIV activity. This review is intent to compile various studies on this plant and critically evaluates the issues related to ethnopharmacology, phytochemistry, pharmacology, clinical studies and toxicology of *P. Amarus* [12, 14].

Historical Perspectives

P. amarus has been indexed in majority of published phytochemical, pharmacological and ethano-botanical review and research article till date with different named. This species *P. amarus* has been confused with *phyllanthus niruri* Linn. In the past, Linnaeus's *P. niruri*, though well defined in the 'Hortus cliffortianus,' became confused owing to his erroneous reduction of other species to the synonyms of the former and subsequent misidentification by another author. The commonest weedy species so mistaken for *P. niruri* by Muller and others was defined as *Phyllanthus swartzii kostelezsky* in 1836, based on *P. niruri* of Swartz "but the earliest name of this species appear to be *P. amarus* Schum. And Thonn. For a full discussion on the botanical description and nomenclature of this species reference has been made to the excellent discussion by webster

(1957). The earliest botanical description could be observed from south India, Sri Lanka and Indonesia which have cited *Phyllanthus urinaria* and *P. niruri* respectively (van Rhede 1690"rumphius 1750). In the ayurvedic system in India, no definitive botanical description exists in. The original literature and the plants indicated by many of the old Sanskrit word have been lost in course of history (Handa et.al.1951"Chopra et al.1958). It was the opinion of Dymock (1886) demock et al. (1893 *p. urinaria*. similar reports have stated that even the rather visually different *p. urinaria* was often used enter changeably with) that the same same common names in a number of Indian languages apply for both *p. niruri* and those species earlier known as *p. niruri* in the traditional system of India (Van Rhede, 1990.Dymock, 1886.kirtikar and Basu 1975.) and suggested that the practitioner did not differentiate it accordingly [6, 7, 8].

Sidha Medicinal Uses [8, 9, 10].

1. For jaundice: The whole plant juice with 10-20ml of dose is recommended three times daily.
2. The fresh roots (10gms) powder is mixed with fresh milk. This is recommended to take in the early mornings for effective cure for jaundice.
3. The leaves were crushed with salt and applied for skin diseases.
4. The plant decoction was very effective for diabetes and chest pain.
5. The decoction of leaves or roots is used for ulcers.
6. The dried powder of the plant mixed with gruel water is applied over ulcers and wounds.
7. The juice of whole plant can be taken as a dose of 45-50 ml in the early morning for leucorrhea, gonorrhoea, menorrhoea and other urinary complains

Botanical Classification

Phyllanthus niruri
 L. Kingdom: Plantae
 Division: Magnoliophyta
 Class: Magnoliopsida
 Order: Euphorbiales
 Family: Euphorbiaceae
 Genus: Phyllanthus
 Species: Niruri

Vernacular names: In India

Assamese: Holpholi; Poram-lokhi
 Bengali: Noar
 Hindi: Chalmeri, Harfarauri, Bhuiakonla.
 Kannada: Kirunelli, Nela Nelli,
 Konkani: Bhui-avalae
 Telugu: Ratsavusirike, Nela Usiri,
 Tamil: Arunelli, Keela Nelli,
 Malayalam: Arinelli, Kizhanelli, Nellipuli
 Marathi: Rayavali, Bhuiavli,
 Oriya: Narakoli
 Sanskrit: Amala, Bhumymlaki, Sukshmadala, Vitunika, Bhoodatri.

Table 1: Ethnomedicinal Uses of *P. amarus* In Different Countries World Wide [12, 13, 14].

Region	Ethnomedicinal use
Amazonia	Anodyne, aperitif, blennorrhagia, carminative, colic, diabetes, digestive, diuretic, dropsy, dysentery, dyspepsia, emmenagogue, fever, flu, gallstones, gonorrhoea, itching, jaundice, kidney ailments, kidney stones, laxative, malaria, proctitis, stomachache, tenesmus, tonic, tumor, vaginitis, vermifuge
Aruba	Blood purifier
Bahamas / Caribbean	Antihepatotoxic, cold, constipation, fever, flu, stomachache, typhoid, flatulence, vermifuge, appetizer
Brazil	Abortifacient, ache (joint), albuminuria, analgesic, antibacterial, anticancerous, antidiabetic, anti-inflammatory, antilithic,
Barbados	Abortifacient
Cuba	Oedema and malaria
Haiti	Carminative, colic, digestive, diuretic, fever, indigestion, malaria, spasmolytic, stomachache, stomachic, tenesmus
India	Anemia, asthma, astringent, bronchitis, conjunctivitis, cough, deobstruent, dropsy, diabetes, diarrhea, diuretic, dysentery, fevers, eye disorders, galactagogue, genitourinary disorders, gonorrhoea, hepatitis, jaundice, leucorrhoea, menorrhagia,
Indonesia	Colic, cough, diuretic, eye diseases (external), kidney diseases, stomachache, toothache.

Island of North Caicos jamaika	Fever, presentation of intestinal worm diabetes, Dysentery, diuretic, oedema, gonorrhoea, jaundice, Stomachache.
Malaya	Caterpillar sting, dermatosis, diarrhea, diuretic, emmenagogue, itching, miscarriage, purgative, renosis, syphilis, vertigo
Nigeria	Malaria, chronic stomach pains, oral or vaginal thrush, alcoholic liver disease, hyperglycaemia, urinary tract infection and venereal disease. Taken with honey as aphrodisiac
Peru	Calculus, diuretic, emmenagogue, gallstones, hepatitis, kidney pain, kidney problems, kidney stones, renal problems, urinary infections, vermifuge
Trinidad	Diuretic, venereal disease
United states	Analgesic, bronchitis, chologogue, deobstruent, diabetes, fever, gallbladder problems, gallstones, gout, hepatitis, hypertension, kidney problems, kidney stones, liver disease, uric acid excess, urinary tract infections.
Elsewhere	Analgesic, antipyretic, appetite stimulant blennorrhagia, bruises, chologogue, cough, diabetes, diarrhoea, diuretic, dropsy, dysentery, dyspepsia, emmenagogue, eye diseases, fever, gallstones, gonorrhoea, itch, jaundice, kidney disease, kidney stones, laxative, malaria, menorrhagia, menstrual problems, poultice, purgative, rectitis, stomachache, tonic, tuberculosis, urinary tract infections, vaginitis, venereal diseases.

Table 2: Ethnomedicinal Uses of *Phyllanthus Amarus* Schum and Thonn [15, 16].

Place	Local name	Plant part used	Disease	Method of use	Reference
Dharapuram taluka tamilnadu, India	Keelan Elli	Whole plant	Migraine, Jaundice	(1) Whole plant is boiled in gingelly oil, filtered and applied on the head (2) The fresh root is used with water. Paste or fresh roots are given orally	Balakrishnan et. Al. (2009)
Paliyar tribals in theni district of namilnadu, india	Keelanelli	Leaves	Jaundice	Leaf paste is given internally	Ignacimuthu et al.(2008)
Uttarakhand western ghat, india	Nelli	Whole plant	Malaria	Not stated	Kuppusamy and murugan (2010)
Estern region of shimoga district, Karnataka, india	Nelanelli	Root juice	Jaundice	Root juice is taken orally with cow's milk early in the morning for 1 week	Rajakumar and shivanna(2009)
Dindigul district, tamilnadu, India	Kizhnelli	Leaves	Menstrual problem	Leaf extract with milk and onion is given during night, 3 times once in 3 days	Samuel and Andrews(2010)
Buldhana district, Maharashtra, india	Bhui-awala	Whole plant	Jaundice	Extract, 1 spoonfull perday for 3 day	Ahirrao and patil(2010)
North Andaman island, india	Nallesari	Whole plant	Jaundice	Hand full of leaves is crushed with a pinch of turmeric and 1 teaspoonfull of extract is taken orally for 3-5 days	Prasad et al.(2008)
India	Bhumi-amalaki	Whole plant	Liver disease, dyspepsia, anorexia, moderate Constipation, chronic colitis, irritable bowel syndrome, urinary tract infection	20% whole plant and 10% KoPlumbago zeylanica (roots). 4 gof powdered mixer is given to the patient twice daily, half an hour before meals with water	Samy et al.(2008)
Northern India	Bhui amla	Whole	Jaundice, aphrodisiac, dysentery	Not stated	Kala et al.(2006)
Sitamata Wildlife Sanctuary of Chittorgarh and Udaipur district Rajasthan, India	Not stated	Leaves	Jaundice, gonorrhoea, syphilis	Leaf paste decoctation of leaves	Jain et al.(2005)
Esan north east local government area of	Abenaghe	Leaves	Stomachache	Ground leaves with pepper and salt. Half of cup is taken	Idu et al.(2008)

Edo state, Nigeria				twice daily	
Delta State Nigeria	Ibuko-oyeke	Leaves	Stomachache	The leaves are infused in alcohol and drunk as a remedy for stomachache	Idu et al.(2008)B

Table 3: Vernacular Name ^[5, 6, 7].

Languages	Vernacular name
Hindi	Bhumi amla, Jangli amla
English	Black catnip, carry me seed, Child pick-a-back, Gale of wind, Gulf leaf flower, Hurricane weed, Shatterstone, Stone breaker
Tamil	Keelanelli (Keezhanelli)
Bengali	Bhui amla
Rajasthani	Gugario
Oriya	Bhuliaola
Telugu	Nela urika
Kannada	Nela-nelli, kirunelli
Malayalam	Kilanelli
Sanskrit	Bhoomyaamlakee, Bhoodhatree, Tamala Kee
French	Poudre de plomb (ivory coast)
America	Yerba de la nina 10, Chanca piedra 13, Hurricane weed
Spanish	Yerba magica

Botanical Characteristics

Phyllanthus amarus is a branching annual glabrous herb which is 30-60 cm high and has slender leaf bearing branchlets, distichous subsessile leaves with elliptic-oblong, obtuse, rounded base. Flowers are axillary and yellowish, whitish or greenish. Male flowers are in groups of 1-3 where as females are solitary. Fruits are depressed –globose lies smooth capsules present underneath the branches and seeds are trigonous, pale brown with longitudinal parallel ribs on the back. Capsules on stalks are 1 -2 mm long, round, smooth, 2 mm wide six seeds. The plant has explosive seed capsules that propel the seeds some distance from the plant. Seeds are triangular, light brown, 1 mm long with 5-6 ribs on the back ^[8, 9].

**Fig 1:** *Phyllanthus amarus***Distribution**

Phyllanthus amarus is a common pantropical weed that grows well in moist, shady and sunny places. It is widely spread throughout tropics and subtropics. The taxonomic revision of genus *Phyllanthus* by Webster included closely-related genera *P. amarus*, under the sub-section *Swartzianii* of the section *Phyllanthus*. The nomenclature, taxonomic distinctness and close relatives of *P. amarus* were addressed in details based on morphology and geographical distribution. It is said to be related to *P. abnormis*, which is endemic to sandy areas in Texas and Florida of southern USA.

It is, therefore, most likely that *Phyllanthus amarus* originated in the Caribbean area as a vicarious species of *P. abnormis* of the southern United States and has spread around the tropical by trading vessels. Among approx. 1000 species of genus *Phyllanthus* 53 species are found in India, of which 23 species are endemic. These are

distributed throughout the Indian subcontinent, with higher densities in the southern region. Among 53 species of *Phallanthus*, 37 are shrubs, 13 are herbs and 3 are trees Jain et al., 2003 assessed the molecular diversity of *P. amarus* across India using RAPD (random amplified polymorphic DNA) markers. The genetic variability was assessed across 33 locations covering the states of Tamil Nadu, Karnataka, Maharashtra, Gujarat, Assam, West Bengal, Tripura, Uttar Pradesh, Panjab and Hariyana. Intra population variation was larger in accessions from southern India compared to other parts of the country. *P. amarus* grows wild in all drier parts of Rajasthan.^{11,12}

Phytochemical Properties

Phytochemistry is regarded as the heart of herbal therapy and the phytochemical research plays an important role in the development of green medicines, which are safer to use. The major class of bioactive compounds like alkaloids, flavonoids, lignans, phenols, tannins, terpenes and volatile oils has been isolated. These bioactive compounds further include their respective phytoconstituents. Alkaloids possess securinine, nor-securinine, epibubialine, isobubialine, dihydrosecurinine^[4, 5, 6].

Table 4: Phytochemicals Present in *P. Amarus*^[7, 8].

Sr.no	Secondary metabolite	Structural definition	Some important phytochemicals
1	Alkaloids	Alkaloids are a group of naturally occurring nitrogenous organic compounds of plant origin.	Securinine, nor-securinine, epibubialine, dihydrosecurinine.
2	Flavonoids	Flavonoids are polyphenolic molecules containing 15 carbon atoms and are soluble in water.	Quercetin, kaempferol, astragalin, quercetin-3-O-glucoside, quercetin.
3	Tannins	Tannin is a polyphenolic biomolecule that binds to precipitate proteins and various other organic compounds like amino acid and alkaloids.	Amarulone, geraniin, amariin, furosin, corilagin, melatonin, phyllanthusin D.
4	Lignans	Plant lignans are also polyphenolic compounds derived from phenylalanine via dimerization of substituted cinnamic alcohols.	Phyllanthin, hypo-phyllanthin, 5-dimethoxyniranthin, nirtetralin, phyltetralin, hinokinin, 4-(3,4-diethoxy-phenyl)-1-(7-methoxybenzo[1,3]-5-yl)-2,3-bismethoxy methyl-butan-1-ol
5	Sterols	Phytosterol, which encompass plant sterols and stanols, are phytosteroid similar to cholesterol which occur in plants and vary only in carbon side chain and /or presence or absence of a double bond.	Amarosterol A, amarosterol B.
6	Triterpenes	Triterpenes are a class of chemical compounds having three terpenes' units with the molecular formula C ₃₀ H ₄₈ or consists of six isoprene units.	Phenazine and phenazine derivatives, 2Z, 6Z, 10Z, 14E, 18E, 22E-farnesyl farnesol.
7	Volatile oils	A volatile oil is a concentrated hydrophobic liquid containing volatile aroma compounds from plants	Linalool, Phytol.

Pharmacological activity

Plants as sources of new drugs are still poorly explored of all plant species. Only a small percentage has been investigated phytochemically and even a smaller percentage has been properly studied in terms of their pharmacological properties^[4, 5].

Antioxidant activity

Methanolic extract of *P. amarus* was found to have potential antioxidant activity as it could inhibit lipid peroxidation and scavenge hydroxy and superoxide radicals in-vitro. The amount required for 50 % inhibition of lipid peroxide formation was 104 micro gram and the concentrations needed to scavenge hydroxyl and superoxide radicals were 117 and 19 mg /ml respectively. Different drying treatment led to a significant reduction, (P<0.05) in antioxidant properties of *P. amarus* methanolic extracts, with microwave drying causing the highest decrease, in TPC and antioxidant activity exhibited by the reduction in both radical scavenging activity and FRAP. On the other hand, boiling water extracts appeared to exhibit significantly stronger antioxidant potentials (P<0.05) even the dried plant materials due to greater solubility of compounds, the breakdown of cellular constituents as well as hydrolysis of tannins.

Characterization of Phyllanthin was done by mass spectrophotometry, UV-visible spectrophotometry, elemental analysis, FTIR, HNMR, CNMR and mass spectral analysis. Free radical scavenging activity of *P. amarus* extract and Phyllanthin was also examined using DPPH assay. The CCl₄ treatment caused a significant decrease in cell

viability. It was observed that Phyllanthin effectively alleviated the changes induced by CCl_4 in a concentration-dependant manner, with much smaller strengths as compared to Phyllanthus amarus extract ²⁶

Anti-diabetic Activity

The methanolic extract of the phyllanthus amarus was found to reduced the blood sugar in alloxan diabetic rats by 6% at a dose level of 200Mg /kg body weight and 18.7% reduction in blood sugar Antidiabetic effect of an aqueous and hydroalcoholic extract of Phyllanthus amarus used in Togo for treating diabetes and many other diseases. Two doses (500 and 1000mg/kg) of the both extracts were administered orally to diabetic rats. Consequently, aqueous and hydroalcoholic extract of Phyllanthus amarus decrease significantly blood glucose level after 15 days of administration. A study by Shetti, oral administration of ethanolic leaf extract (400mg/kg body weight) for 45 days resulted in significant decline in blood glucose and increase in the activity of glucokinase in the liver of diabetic mice ^[24, 25, 26].

Antimicrobial Activity

Antimicrobials of plant origin have an extremely large therapeutical potential. They are effective in the treatment of infectious diseases, while simultaneously alleviating many of the side effects that are often connected with synthetic antimicrobial. The effect of nor-securinine, an alkaloid isolated from phyllanthus amarus was studied against spore germination of some fungi (*Alternaria brassicae*, *Alternaria solani*, *Curvularia penniseti*, *Curvularia sp.*, *Erysiphe pisi*, *Helminthosporium frumentacei*) as well as pea powdery mildew (*E. pisi*) under glasshouse conditions. The sensitivity of fungi to nor-securinine varied considerably. Nor-securinine was effective against most of the fungi. Pre-inoculation treatment showed greater efficacy than post-inoculation in inhibiting powdery mildew development on pea plants in a glasshouse. Maximum inhibition occurred at 2000 micro gram/mL.

Six intestinal organisms were isolated and identified: *K pneumonia*, *p aeruginosa*, *S. aureus*, *E. coli*, *P. mirabilis* and *E. faecalis*. Both agar diffusion and broth dilution methods were used to assay antimicrobial activity against the organisms. *Phyllanthus amarus* showed bacteriostatic action at this concentration because subculture yielded growth except on plate of *K. pneumonia*. Alcoholic extract of *P. amarus* showed the maximum zone of inhibition and minimum inhibitory concentration against all the microorganisms ^[24, 25, 26].

Anti-venom Activity

Phyllanthus amarus and *Andrographis paniculate* plant extracts when combined possess potent snake venom neutralizing capacity and could potentially be used for therapeutic purposes in case of snakebite envenomation. Di-herbal plant extracts effectively neutralized the cobra venom induced lethal activity. About 0.24 mg of di-herbal plant extract is able to completely neutralize the lethal activity of 2LD of *N. naja* venom ^[13, 14].

Antifungal Activity

The effect of nor- securinine, an alkaloid isolated from *phyllanthus amarus* was studied against spore germination of some fungi (*Alternaria brasicca*, *Alternaria solani*, *Curvularia penniseti*, *Curvulari sp.*, *Erysiphe pisi*, *Helminthosporium frumentacei*) as well as pea powdery mildew (*E. pisi*) under glasshouse conditions. the sensitivity of fungi to nor-securinine varied considerably. Nor-securinine was effective against most of the fungi. *Frumenties* was more sensitive even at the lowest concentration. Conidia of *E. pisi* were also inhibited in partially or completely appressorium formation. Pre-inoculation treatment showed greater efficacy than post-inoculation in inhibiting powdery mildew development on pea plant in a glass house. Maximum inhabitation occurred at 2000 ug/ml (sahni et al., 2005). Antifungal bioassay in terms of reduction in weight, colony diameter and sporulation of the target fungal colony was carried out using Broyh dilution method. Root `concluded that Chloroform fraction of the aerial part of the plant *P. amarus* have showed significant inhibitory effect against dermatophytic fungi *M. gypseum* (Agrawal et al., 2004) ^[24, 25, 26].

Anti-cancer Activity

The methanolic extract of *P. amarus* hairy roots revealed potent antiproliferative activity in the MCF-7 cells through induction of apoptosis mediated by increased intracellular reactive oxygen species (ROS) in conjunction with decreased mitochondrial membrane potential. *P. amarus* against Cr (VI) induced oxidative toxicity *in vitro* in MDA-MB-435S human breast carcinoma cells revealed a distinct decline in Cr (VI) induced cytotoxicity was noticed in MDA-MB-435S cells with an increased in extract dosage. Its phenolic constituents simultaneously may inhibit Cr (VI) induced oxidative toxicity to MDA-MB-435S cells ^[23, 24, 25].

Table 5: Pharmacological activities reported in *Phyllanthus amarus* by various authors

Sr No	Pharmacological Activity	Work Done	Place
1	Antioxidant activity	<p>Hypoglycemic effect of menthol extract of Phyllanthus amarus Schum and Thonn on alloxan induced diabetes mellitus in rat and its relation to antioxidant potential.</p> <ul style="list-style-type: none"> ▪ Anti-oxidant properties of Phyllanthus amarus extract as affected by different drying methods. 	Thissur (India) Malaysia Pune, Mumbai, (INDIA), New

		<ul style="list-style-type: none"> Anti-oxidant activity of sub polyphenol constituents of the medicinal plant <i>Phyllanthus amarus</i> linn 	Zealand Nigeria
2	Anti-diabetic activity	<ul style="list-style-type: none"> Hypoglycemic effect of methanol extract of <i>P. amarus</i> Schum and Thonn on alloxan induced diabetes mellitus in rats and its relation to anti-oxidant potential. Anti-diabetic activity of <i>P. amarus</i> Schum and Thonn on alloxan induced diabetes in male wistar rats. Antidiabetic effect of ethanolic leaf extract of <i>P. amarus</i> in alloxan induced diabetic mice. 	Thrissur (India) Togo (France) Dharwad (India)
3	Antimicrobial Activity	<ul style="list-style-type: none"> Antifungal activity of nor-securinine against some phytopathogen fungi. Determination of antimicrobial potentialities of different solvent extracts of the medicinal plants <i>Phallanthus amarus</i> Schum. And Thonn. -Biological and Chemical Evaluation of the extracts of Leaf of <i>Phallanthus amarus</i> Schum. Antibacterial attributes of extracts of <i>Phallanthus amarus</i> and <i>Phallanthus niruri</i> on <i>Escherichia coli</i> the causal organism of urinary tract infection. 	Varanasi (India) Jaipur (India) Nigeria
4	Anti-venom Activity	<ul style="list-style-type: none"> Isolation, purification and characterization of active compound from <i>Andrographis paniculata</i> Linn. and <i>Phallanthus amarus</i> L. and testing the anti-venom activity of the di-herbal extract by <i>in-vivo</i> and <i>in-vitro</i> studies. 	Chennai (India)
5	Anti-cancer Activity	<ul style="list-style-type: none"> Hairy root extract of <i>Phallanthus amarus</i> induces cell death in human breast cancer cells. Aqueous extract of <i>Phallanthus amarus</i> inhibits chromium (VI)-induced toxicity in MDA-MB-435S cells. Anti-metastatic effects of <i>Phallanthus</i> on human lung (A549) and breast (MCF-7) cancer cell lines. 	Mumbai (India) Vellore (India) Malaysia.

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