



सत्यमेव जयते

Bio-Resources Development Centre

(A Government of Meghalaya Institution under Science & Technology, Planning Department)



Green Pesticides for Sustainable Agriculture



GREEN PESTICIDES

(Plants with Anti-Microbial & Pesticidal / Insecticidal Properties)

The long-term applications of synthetic/chemical inputs for the prevention and treatment of pathogenic organisms have resulted in harmful residues accumulating in different environmental components

SL. NO.	PLANT	PARTS USED	TARGET ORGANISM
1.	Aegle marmelos (Bael)	Leaves	Insects & Fungi
2.	Allium cepa (Onion)	Bulbs	Insects, Bacteria (E. coli, Pseudomonas pyocyanus, Salmonella typhi, Bacillus subtilis)
3.	Allium sativum (Garlic)	Bulbs	Bacteria, fungi and insects
4.	Aloe vera (Aloe)	Leaves	Insects, bacteria, fungi and virus

which have adverse effects on non-target organisms, ecosystems and human health. Therefore, bio-insecticides or “Green pesticides” have emerged as sustainable alternative to synthetic inputs in agriculture and public health sectors. Some of the common plants exhibiting anti-microbial & Pesticidal/Insecticidal Properties are appended below:

MECHANISM / ACTIVE CONSTITUENT(S)	POPULAR USES
<ul style="list-style-type: none"> • Insecticidal • Essential Oil- enhances feeding deterrence in insects • The essential oil at different doses significantly reduced oviposition and adult emergence of <i>C. chinensis</i> 	<ul style="list-style-type: none"> • The constituents are used in heart diseases, inflammatory and wound healing • Leaves of have been reported as hypoglycemic effect • The essential oil from the leaves is known to exhibited antifungal properties
<ul style="list-style-type: none"> • Insect repellent and pesticidal • Diethyl sulphide (insecticidal property) • Cold aqueous extract (antimicrobial) 	<ul style="list-style-type: none"> • Antidiabetic, antihypertensive, antibiotic and antithrombotic • flavour compound
<ul style="list-style-type: none"> • Insect repellent and pesticidal • Aqueous extract (antimicrobial) • Allicin 	<ul style="list-style-type: none"> • Intercropping systems because of its ability to repel insects
<ul style="list-style-type: none"> • Insect repellent and insecticides • Aqueous extract of the gel 	<ul style="list-style-type: none"> • Minor wounds and inflammatory skin disorders, minor skin irritations, including burns, bruises, and abrasions, natural remedy for burns • Cosmetics industry as a hydrating ingredient in liquids, creams, sun lotions, shaving creams, lip balms, healing ointments, and face packs

5.	Artemisia (Wormwood) A. Nilagirica A. annua	Whole plant	Insects
6.	Azadirachta indica (Neem)	All parts of the plant (specially seed kernels and leaves)	Insects (over 25 species Lepidoptera, Homoptera, Hemiptera, Diptera and Coleoptera) Dandruffs (shampoos) eczema, nematodes, sucking and chewing insects (caterpillars, aphids, thrips, maize weevils)
7.	Cannabis sativa (Maijuana/Ganja)	Leaves & flowers	insects, mites, bacteria, fungi, nematodes, and weeds
8.	Capsicum (Chillies) C.annuum	Fruits	Insects, virus
9.	Carica papaya	Seeds	Insects

<ul style="list-style-type: none"> • Insect repellent and insecticides • Artemisinin • Phenolics 	<ul style="list-style-type: none"> • traditionally used to treat fever, antioxidant, anti-cancer, asthma.
<ul style="list-style-type: none"> • Insecticidal, Nematocide & Repellent/ limonoids (triterpenoids) including Azadirachtin (highest in the kernel than in the leaves and other tissues nimbin, nimbidin, salanin, salannol, quercetin, gedunin and many others 	<ul style="list-style-type: none"> • Anthelmintic, antifungal, antidiabetic, antibacterial, antiviral, contraceptive, and sedative. • Leaves used for skin diseases like eczema, psoriasis, etc. • Neem oil is also used for healthy hair, to improve liver function, detoxify the blood, and balance blood sugar levels.
<ul style="list-style-type: none"> • Aqueous extract • Cannabinoids 	<ul style="list-style-type: none"> • A multiple-use plant, furnishing fiber, oil, medicine, and narcotics
<ul style="list-style-type: none"> • Insect repellent • Capsaicin- 	<ul style="list-style-type: none"> • Due to presence of Capsaicin compounds, chilli pepper is used in preparation of ointment; also used in formulation to be used in arthritic pain and sore muscles, detoxicant, pain killer, antibiotic, anti-cancer, etc.
<ul style="list-style-type: none"> • Insecticidal (Larvicidal & Pupicidal) • Acetonic extract 	<ul style="list-style-type: none"> • Green fruits are used to treat high blood pressure, dyspepsia, constipation, amenorrhoea, general debility, expel worms and stimulate reproductive organs.

10.	Cassia spp.	Seeds, leaves	Bacteria and Fungi
11.	Catharanthus roseus	Leaves	<ul style="list-style-type: none"> • Insects (larvae of gram pod borer <i>Helicoverpa armigera</i>, <i>Spodoptera litura</i> and <i>Spodoptera littoralis</i>, • Bacteria and virus
12.	Chenopodium quinoa (Quinoa)	Seeds	Pathogenic fungi, bacteria, and viral plant diseases
13.	Citrus species (C. aurantifolia, C. Sinensis)	Peel - C. aurantifolia, C. Sinensis Leaves-C. hystrix	Insects (Fleas, aphids, mites, paper wasp, house cricket, dips for pets)
14.	Chrysanthemum (C.morifolium R. and C.indicum L.)	Flower	Insects (Crawling and flying insects such as cockroaches, ants, mosquitoes, termites)

<ul style="list-style-type: none"> • Anthraquinone • The dealcoholized leaves extract - antifungal activity (Candida albicans, Aspergillus niger, Sachharomyces cerevisiae and Trichophyton mentagrophytes) • Torachryson, toralactone, aloe-emodin, rhein and emodin isolated from the seeds -antibacterial effects 	<p>Blindness, xerophthalmia, vision improving, antiasthenic, asperient, diuretic and an effective agent in lowering cholesterol and reducing blood pressure and conjunctivitis.</p>
<ul style="list-style-type: none"> • Aqueous extract (5-hydroxy flavones) • Antifeedant activity 	<p>Decreases blood pressure, anti-diabetic, Leukemia, dysentery/diarrhoea, lung cancer, anti-oxidant, fatigue, asthma, etc.</p>
<p>Triterpenoid saponins-disrupting cell membranes</p>	<p>Seeds used as cereals (nutritional food) based on its amino acid composition; high content of Calcium, phosphorus, and iron; and low sodium content.</p>
<ul style="list-style-type: none"> • Contact poison Essential oil- (d-Limonene, Linalool, Citral), α-pinene and myrcene 	<p>Cardiovascular diseases, Antioxidants against free radicals</p>
<p>Insecticidal, Pyrethrum / Pyrethrin, Broad spectrum insecticidal activity (repels and kills insects depending on concentration)</p>	<p>Antioxidants against advanced glycation end products</p>

15.	Cymbopogons (Lemongrass) C. flexuosus C. martini C. citrates C. winterianus (Citronella)	Leaves	<ul style="list-style-type: none"> • Fungi (Aspergillus, Cladosporium, Colletotrichum, Curvularia, Fusarium Gloeosporium, Penicillium , Botrytis cinerea, Helminthosporium, Phoma and Rhizopus) • Insects
16.	Eucalyptus citriodora (Eucalyptus)	Leaves	Bacteria, fungi, insects, nematodes, weeds and mites
17.	Eupatorium species E. riparium E.adenophorum	Leaves	Fungi
18.	Gaultheria spp. (Wintergreen)	Leaves	
19.	Hypericum perforatum/ tomentosum	Aerial parts	Insects

<p>Fungicidal and Insect Repellent Essential oil (monoterpene fractions) citral (a mixture of geranial and neral), geraniol, citronellol, citronellal, linalool, elemol, 1,8-cineole, limonene, geraniol, β-caryophyllene, methyl heptenone, geranyl acetate and geranyl formate</p>	<p>Anticancer, Anthelmintic, culinary flavouring, hair wash and toilet water, antiproliferative, anti-inflammatory and antioxidant activities</p>
<p>Oil extract</p>	<p>Oil, gum, pulp, timber, medicine and aesthetic value</p>
<p>Methylripariochromene A</p>	<p>Dysentery, Diarrhoea, Wounds and injury</p>
<p>Methyl salicylate</p>	<ul style="list-style-type: none"> • Leaves are used for rheumatism and as an anti- helminthic. • Treating back pain, rheumatism, fever, headaches, and sore throats. The plant and its oil have been used in traditional medicine as an anodyne, analgesic, carminative, astringent, and topical rubefacient.
<p>Insecticidal (Fumigant & Anti-feedant) Essential oil: Decane (59.58%), dodecane (12.93%), ethylcyclohexane (6.84%), 5-methylnonane (4.71%), 3-methylnonane (4.32%) and tetradecane (3.82%)</p>	<p>Treatment of mild to moderate depression</p>

20.	Lantana camara (Lantana)	Leaves	Bacteria, fungi, insects, nematodes
21.	Litsea citrate/ cubeba	Fruits	Aedes, Anopheles, Culex (mosquito)
22.	Mentha piperita (Peppermint)	Leaves	Bacteria
23.	Milletia pachycarpa Benth		Insects (aphids, pentatomids and leaf- beetles as well as against caterpillars, body lice and plant lice)
24.	Nicotiana tabacum (Tobacco)	Leaves	Insects (Aphids, thrips, mites, bugs, leafhoppers) Fungi (fungus Gnat)
25.	Pelargonium graveolens (Geranium)	Leaves	Insects and bacteria (Escherichia coli)
26.	Piper augustifolium		Insects (Callosobruchus maculatus, the garden insect, Zonocerus variegatus)

Insecticidal (Fumigant) Essential oil/Aqueous extract:	Grown as hedge plant and is the raw material for paper pulp Wound healing, ulcers, asthma, anti-septic, chicken pox, etc.
Insecticidal Essential oils- Adehyde. Mainly citral, limonene, miycrene, methyl hepetone, linalool, linlyl acetate.	Used for acne, dermatitis, excessive perspiration, greasy skin, insect repellent, flatulence, indigestion, epidemics, high blood pressure, nervous tension. Used to cool, calm, improve digestion, reduce stress, uplift moods, revive, improve mental clarity, and relieve pain.
Antibacterial Essential oil- (pulegone and menthone)	Peppermint oil- irritable bowel syndrome, carminative, cholagogue, antibacterial, secretolytic, has a cooling action, muscle pain, nerve pain and relief from itching
Insecticidal/ Rotenone (Water suspension of the seeds, dried powdered roots)	Blood tonic and to induce the growth of red blood cells and cancer therapy, intestinal infection.
Insecticidal & fungicidal Nicotine	Dysmenorrhea, destroy worms in sores, myasis, headache and wounds, baldness, dermatitis and infectious ulceration.
<ul style="list-style-type: none"> • Insect repellent • Geraniol 	In aromatherapy, oil is used to treat acne, sore throats, anxiety, depression and insomnia, beneficial effect on menstruation and menopause.
Insecticidal/ Camphene, Piper amides- guineensine, and piperine	Wound healing and urinary antiseptic

27.	Piper longum (Long pepper)	Mainly the fruits	L, and the mosquito larvae causing 96-100% mortality rate in 48 hours mostly as solution sprays)
28.	Rhododendron molle G.Don	Leaves	Insects (lepidopterous larvae, pentatomids and leaf-beetles
29.	Trpterygium Forrestii Loes	Leaves	Insects (aphids, pentatomids and leaf- beetles as well as against caterpillars, body lice and plant lice)
30.	Zanthoxylum (Prickly Ash) Z. acanthopodium Z. khasianum Z. armatum Z. limonella	Fruit and leaves	Aedes aegypti (larvae)
31.	Zingiber officinales (Ginger)	Rhizome	Bacteria, Fungi, Pesticidal and Nematodes

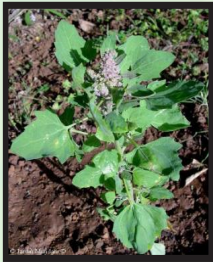
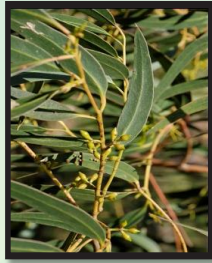
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GREEN PESTICIDES	
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	Stomachache, indigestion, fever, cough, toothache, epilepsy and leprosy.
Insecticidal Rotenone	The root is used in the treatment of arthritis, rheumatism and traumatic injuries
Insecticidal Rotenone/Forrestine	Rheumatoid arthritis, inflammation, cancer, chronic nephritis, hepatitis, systemic lupus erythematosus, ankylosing spondylitis, and a variety of skin conditions
Insecticidal lignan -sesamin, Alkaloids	Fruits are aromatic and used as spice, promotes digestion.
<ul style="list-style-type: none"> • Bactericidal, Fungicidal, Pesticidal and anthelmintic • Zerumbone and its epoxide 	Promote gastric secretions, increase intestinal peristalsis, lower cholesterol levels, raise blood glucose, stimulate peripheral circulation, prophylaxis for nausea and vomiting dyspepsia, lack of appetite, anorexia, colic, bronchitis, and rheumatic complaints

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