

# Documented Biological Activities of Graviola (*Annona muricata*)

## IN VIVO RESEARCH

Plant Part / Origin	Activity Tested For	Type Extract	Test Model	Dosage	Results	Notes / Organism Tested	Ref #
Leaf Gabon	Toxic Effect (general)	ETOH(95%) Ext	IP Mouse	100.0 mg/kg	Inactive	No toxicity noted.	K29500
Leaf Gabon	Toxic Effect (general)	ETOH(95%) Ext	IP Mouse	300.0 mg/kg	Active	Reduction in explorative behavior and abdominal constrictions observed.	K29500
Leaf + Stem Jamaica	Toxicity Assessment (quantitative)	H2O Ext	IP Mouse	Various		Minimum toxic dose 1.0 ml/animal.	A03360
Leaf Not stated	Cytotoxic / Antiproliferative Activity	Fraction: Annonacin	IP Mouse	10 mg/kg	Active	Inhibited the growth of Lewis lung carcinoma tumors by 57.9% without toxicity	AA1032
Leaf + Stem Jamaica	Uterine Stimulant Effect	ETOH(95%) Ext H2O Ext	Oral Rat Oral Rat	0.033 ml/liter 0.033 ml/liter	Active Active	Uterus (unspec.cond). Uterus (unspec.cond).	A03360
Leaf + Stem Jamaica	Hypertensive Activity	ETOH(95%) Ext H2O Ext	IV Dog IV Dog	0.1 ml/kg 0.1 ml/kg	Active Active		A03360
Bark Not stated	Cardiac Depressant Activity	H2O Ext	Rabbit	Not stated	Active	Heart	A04104
Leaf Cuba	Hypotensive Activity	H2O Ext	IV Rat	1.0 ml/animal	Active	BP fell by more than 30%.	M29843
Leaf + Stem Jamaica	Vasodilator Activity	ETOH(95%) Ext	IP Rat	0.033 ml/liter	Active	Hind Quarter (isolated)	A03360
Leaf Gabon	Anticonvulsant Activity	ETOH(95%) Ext	IP Mouse	100.0 mg/kg	Active	vs. pentylenetetrazol-induced seizures. Results significant at P < 0.05 Level.	K29500
Leaf Nigeria	Anticonvulsant Activity	ETOH(70%) Ext	IP Mouse	Dose Variable	Inactive	vs. metrazole-induced convulsions and vs. strychnine-induced convulsions.	T06510

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Leaf Brazil	Analgesic Activity	ETOH-H <sub>2</sub> O (1:1) Ext	IG Mouse	1.0 gm/kg	Inactive	vs. writhing test.	M18488
Leaf Brazil	Analgesic Activity	ETOH-H <sub>2</sub> O (1:1) Ext	IG Mouse	1.0 gm/kg	Inactive	vs. tail flick test.	M18488
Leaf + Stem Jamaica	Smooth Muscle Relaxant Activity	ETOH(95%) Ext H <sub>2</sub> O Ext	Rabbit Rabbit	3.3 ml/liter 2.2 ml/liter	Active Active	Duodenum	A03360
Leaf + Stem Jamaica	Spasmogenic Activity	ETOH(95%) Ext H <sub>2</sub> O Ext	Guinea Pig Guinea Pig	0.033 ml/liter 0.033 ml/liter	Active Active	Ileum	A03360
Leaf Cuba	Inotropic Effect Positive	Hot H <sub>2</sub> O Ext	Guinea Pig	0.032 ml/liter	Inactive	Atrium	M29843
Stembark India	Antioxidant Activity	ETOH(95%)Ext	IG Rat	100.0 mg/kg	Active	vs. cold immobilization stress-induced increase in lipid peroxidation.	J10426
Stembark India	5-hydroxyindole-3-acetic Acid Inhibition	ETOH(100%)Ext	IG Rat	100.0 mg/kg	Active	Brain	L19052
Stembark India	Antiulcer Activity	ETOH(100%)Ext	GI Rat	100.0 mg/kg	Weak Activity	Statistical data in report indicating significant results vs. cold stress-induced ulcers.	J19242
Leaf Surinam	Serotonin (5-HT) Receptor Binding Activity	CHCL <sub>3</sub> Ext	Calf Hippocampus	100.0 mcg/ml	Weak Activity	Inhibited the binding of 3h- rauwolscine to serotonin receptors.	J10986
Fruit Surinam	Serotonin (5-HT) Receptor Binding Activity	Juice	Calf	100.0 mcg/ml	Active	Inhibited the binding of 3h-rauwolscine to serotonin receptors.	J10986
		CHCL <sub>3</sub> Ext	Calf	100.0 mcg/ml	Active		
Seed Surinam	Serotonin (5-HT) Receptor Binding Activity	MEOH Ext	Calf Hippocampus	100.0 mcg/ml	Active	Inhibited the binding of 3h-rauwolscine to serotonin receptors.	J10986
Stembark India	Dopamine Increase	ETOH(100%)Ext	IG Rat	100.0 mg/kg	Active	Brain	L19052
Stembark India	Norepinephrine Level Increase	ETOH(100%)Ext	IG Rat	100.0 mg/kg	Active	Brain	L19052

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Stembark India	Monoamine Oxidase Activity Increase	ETOH(100%)Ext	IG Rat	100.0 mg/kg	Active	Brain	L19052
Stembark India	Serotonin (5-ht) Release Inhibition	ETOH(100%)Ext	IG Rat	100.0 mg/kg	Active	Brain	L19052

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Leaf Malaysia	Epstein-barr Virus Early Antigen Induction	Ether Ext	Cell Culture	1.0 mcg/ml	Inactive	Virus - Epstein-barr (Assay designed to test for tumor promoting activity.)	J13478
Leaf Borneo	Cytotoxic Activity	ETOH(95%) Ext	Cell Culture	20.0 mcg/ml	Active	CA-9KB. (Results significant at $p < 0.05$ level)	K27823
Leaf Costa Rica	Cytotoxic Activity	ETOH(95%) Ext	Cell Culture	ED50<20 mcg/ml	Active	CA-9KB	X00001
Leaf USA-FL	Cytotoxic Activity	ETOH(95%) Ext	Cell Culture	ED50<20 mcg/ml	Active	CA-9KB	X00001
Leaf Colombia	Cytotoxic Activity	ETOH(100%) Ext	Cell Culture	IC50=2.0 mcg/ml	Active	Cells-MDBK	L12082
Leaf Indonesia	Cytotoxic Activity	ETOH(95%)Ext	Cell Culture	ED50=1.9 mcg/ml	Active	CA-Mammary-MCF-7	H24563
Leaf Indonesia	Cytotoxic Activity	Not stated	Cell Culture	IC50=0.67 mcg/ml	Active	CA-A498	H19306
Stem Costa Rica	Cytotoxic Activity	ETOH(95%)Ext	Cell Culture	ED50<20.0 mcg/ml	Active	CA-9KB	X00001
Leaf Taiwan	Cytotoxic Activity	ETOH(95%)Ext	Cell Culture	Not stated	Active	Human hepatoma Hep G 2,2,15	AA1009
Seed China	Cytotoxic Activity	Fractions: Acetogenins	Cell Culture	Not stated	Active	Human hepatoma Hep G(2) and 2,2,15	AA1017

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Seed Korea	Cytotoxic Activity	Fractions: Acetogenins	BST	Not stated	Active	Six human tumor cell lines including prostate adenocarcinoma (PC-3) and pancreatic carcinoma (PACA-2) cell lines.	AA1020
Seed + Leaf Taiwan	Cytotoxic Activity	Fractions: Acetogenins	Cell Culture	Not Stated	Active	Human hepatoma cell lines Hep G2, 2, 2, 15.	AA1034
Seed France	Cytotoxic Activity	Fractions: Acetogenins	Not stated	Not stated	Active	Murine leukemia L1210, human breast adenocarcinoma MDA-MB231, human breast carcinoma MCF-7.	AA1031
Leaf USA	Cytotoxic Activity	Fractions: Muricoreacin Murihexocin C	Cell Culture	Not stated	Active	Six human tumor cell lines including prostate adenocarcinoma (PC-3) and pancreatic carcinoma (PACA-2) cell lines.	H22688
Leaf USA	Cytotoxic Activity	Fractions: Annonacin	Cell Culture	Not stated	Strong Activity	Selective toxicity to a panel of human tumor cells, including multidrug-resistant SW480 (P-glycoprotein+, Pgp+) tumor cells.	AA1033
Stembark USA	Cytotoxic Activity	Fractions: Acetogenins	Cell Culture	Not stated	Active	Human tumor cell lines A-549 (lung carcinoma), MCF-7 (breast carcinoma), HT-29 (colon adenocarcinoma).	AA1025
Bark USA	Cytotoxic Activity	Fraction: Gigantetronenin	Cell Culture	Not stated	Active	Human tumor cell lines.	AA1026
Leaf + Twig USA	Cytotoxic Activity	Not Stated	Cell Culture	Not stated	Active	Human tumor cell lines.	AA1023
Bark Venezuela	Cytotoxic Activity	Fraction: Xylomaticin	Cell Culture	Not stated	Active	Human solid tumor cell lines.	AA1024
Pericarp Colombia	Cytotoxic Activity	Hexane Ext Ethyl acetate Ext MEOH Ext	Cell Culture	Not stated	Active	U-937	AA1029
Leaf Colombia	Cytotoxic Activity	MTT	Cell Culture	CC50=49.5 mcg/ml	Active	Human hepatoma 2.	AA1030

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Leaf Cuba	Cytostatic Activity	H2O Ext ETOH Ext Ketonic Ext	Agar plate	Not stated	Active	<i>Neurospora crassa</i>	AA1013
Acetogenins USA	Cytotoxic Activity	Fractions: Acetogenins	Cell Culture	Not stated	Active	Murine P388 leukemia, P03, M17/adr cancer cell lines, human H8, H125 cancer cell lines, adriamycin resistant tumor cells, non-adriamycin resistant tumor cells.	AA1021
Acetogenins France	Cytotoxic Activity	Fractions: Acetogenin analogs	Cell Culture	Not stated	Active	L1210 leukemia cells (Predicts antitumor activity.)	AA1015
Acetogenins USA	Cytostatic Activity	Fractions: Acetogenins	Not stated	Not stated	Active	Adriamycin resistant human mammary adenocarcinoma (MCF-7/Adr) cells.	AA1015
Seed China	Antitumor Activity	CHC13 Ext	Cell Culture	Not stated	Active	Demonstrated antitumor activity.	AA1011
Acetogenins USA	Antiproliferative Activity	Fractions: Acetogenins	Cell Culture	Not stated	Inactive	Non-cancerous GI epithelial cell line (I18).	AA1021
Leaf Indonesia	Anticrustacean Activity	ETOH(95%) Ext	Artemia salina larvae	LC50=0.17 mcg/ml	Active	Assay system is intended to predict for antitumor activity.	H16272
Stem Puerto Rico	Cytotoxic / Anti-HIV Activity	H2O Soluble Fraction	Cell Culture	IC50<2.0 mcg/ml	Active	vs. CEM-SS Cells. Results indicate it has an anti-proliferative effect rather than a cytotoxic effect on HIV-infected cells.	L09586
Stem Puerto Rico	Antiviral Activity	H2O Soluble Fraction	Agar Plate	Not stated	Inactive	Virus - HIV	L09586
Colombia	Antiviral Activity	MTT	Cell Culture	CC50 & EC50 = 0.50 mcg/ml	Active	Virus - HSV-2	AA1030
Stembark India	Antiviral Activity	ETOH(95%) Ext	Cell Culture	1.0 mg/ml	Active	Virus- <i>Herpes simplex 1</i>	J19169

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Leaf Cuba	Antifungal Activity	Acetone Ext ETOH(95%) Ext H2O Ext	Agar Plate	50%	Inactive	<i>Neurospora crassa</i>	T08589
Leaf Guatemala	Antifungal Activity	Hot H2O Ext	Broth Culture	1.0 ml	Inactive	<i>Epidermophyton floccosum</i> <i>Microsporum canis</i> <i>Microsporum gypseum</i> <i>Trichophyton mentagrophytes</i> <i>Trichophyton rubrum</i>	M27151
Stem Cuba	Antifungal Activity	Acetone Ext ETOH(95%) Ext H2O Ext	Agar Plate	50%	Inactive	<i>Neurospora crassa</i>	T08589
Leaf Dominican Republic	Antihepatotoxic Activity	Decoction	Cell Culture	1.0 mg/plate	Weak Activity	Hepatocytes (Measured by leakage of LDH and ASAT. Reduced the leakage of ASAT)	K23019
Leaf Dominican Republic	Antioxidant Effect	Decoction	Cell Culture	1.0 mg/plate	Inactive	Hepatocytes (Monitored by production of malonaldehyde.)	K23019
Leaf Dominican Republic	Radical Scavenging Effect	Decoction	Not stated	250.0 mg/liter	Inactive	Measured by decoloration of diphenylpicryl hydroxyl radical solution.	K23019
Stembark France	Antiparasitic Activity	MEOH Ext	In vitro	Not stated	Active	<i>Leishmania trypanosoma</i>	AA1032
Pericarp Colombia	Antiparasitic Activity	Hexane Ext Ethyl Acetate Ext MEOH Ext	In vitro	Not stated	Active	<i>Leishmania braziliensis</i> <i>L. panamensis</i> <i>L. promastigotes</i>	AA1029
Seed France	Antiparasitic Activity	MEOH Ext	In vitro	Not stated	Active	<i>E. histolytica</i> <i>N. brasiliensis</i> <i>M. dessetae</i> <i>A. salina</i>	M28527
Leaf Puerto Rico	Antimalarial Activity	ETOH(95%) Ext	RBC	IC50=20.0 mcg/ml	Weak Activity	<i>Plasmodium falciparum</i> W-2	K16971
Leaf Puerto Rico	Antimalarial Activity	ETOH(95%) Ext	RBC	IC50 > 63 mcg/ml	Inactive	<i>Plasmodium falciparum</i> D-6	K16971
Leaf Togo	Antimalarial Activity	ETOH(95%) Ext	RBC	IC50=39.9 mcg/ml	Active	<i>Plasmodium falciparum</i>	M23556

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Leaf Borneo	Antimalarial Activity	ETOH(95%) Ext	RBC	20.0 mcg/ml	Active	<i>Plasmodium falciparum</i> D-6 & W-2. (Results significant at P < 0.01 Level)	K27823
Leaf Cuba	Antibacterial Activity	H2O Ext	Agar Plate	Not stated	Active	<i>Escherichia coli</i> <i>Pseudomonas aeruginosa</i> <i>Shigella flexneri</i>	K09159
Leaf Cuba	Antibacterial Activity	Acetone Ext	Agar Plate	Not stated	Active	<i>Escherichia coli</i> <i>Pseudomonas aeruginosa</i> <i>Salmonella B</i> <i>Salmonella newport</i> <i>Salmonella typhosa</i> <i>Serratia marcescens</i> <i>Shigella flexneri</i> <i>Shigella flexneri 3a</i> <i>Staphylococcus albus</i> <i>Staphylococcus aureus</i>	K09159
Stembark Papua-New Guinea	Antibacterial Activity	MEOH Ext	Agar Plate	1 mg/disc	Active	<i>Staphylococcus aureus</i> <i>Escherichia coli</i>	L03211
Stem Cuba	Antibacterial Activity	Acetone Ext	Agar Plate	Not stated	Active	<i>Escherichia coli</i> <i>Salmonella B</i> <i>Salmonella newport</i> <i>Salmonella typhosa</i> <i>Shigella flexneri</i> <i>Shigella flexneri 3A</i>	K09159
Stem Cuba	Antibacterial Activity	H2O Ext	Agar Plate	Not stated	Active	<i>Escherichia coli</i> <i>Pseudomonas aeruginosa</i> <i>Salmonella newport</i> <i>Salmonella typhosa</i> <i>Salmonella B</i> <i>Shigella flexneri</i>	K09159
Stembark Papua-New Guinea	Antibacterial Activity	ETOH(95%) Ext	Agar Plate	2-3 mcg/plate	Active Active Inactive Inactive	<i>Bacillus subtilis</i> <i>Staphylococcus albus</i> <i>Klebsiella pneumoniae</i> <i>Pseudomonas aeruginosa</i>	K15021
Leaf Papua-New Guinea	Antibacterial Activity	ETOAC Ext MEOH Ext	Agar Plate	1.0 mg/disc	Weak Activity	<i>Staphylococcus aureus</i>	L03211

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Leaf Cuba	Antibacterial Activity	Acetone Ext	Agar Plate	Not stated	Inactive	<i>Sarcina lutea</i>	K09159
Stembark Papua-New Guinea	Antibacterial Activity	ETOAC Ext	Agar Plate	1.0 mg/disc	Weak Activity	<i>Escherichia coli</i> <i>Staphylococcus aureus</i>	L03211
Leaf Papua-New Guinea	Antibacterial Activity	ETOAC Ext	Agar Plate	1.0 mg/disc	Inactive	<i>Escherichia coli</i>	L03211
Leaf Cuba	Antibacterial Activity	ETOH(95%) Ext	Agar Plate	Not stated	Inactive	<i>Escherichia coli</i> <i>Pseudomonas aeruginosa</i> <i>Salmonella B</i> <i>Salmonella newport</i> <i>Salmonella typhosa</i> <i>Sarcina lutea</i> <i>Serratia marcescens</i> <i>Shigella flexneri</i> <i>Shigella flexneri 3a</i> <i>Staphylococcus albus</i> <i>Staphylococcus aureus</i>	K09159
Leaf Trinidad	Antibacterial Activity	ETOAC Ext	Agar Plate	1000 mcg/ml	Inactive	<i>Escherichia coli</i> <i>Pseudomonas aeruginosa</i> <i>Salmonella typhimurium</i> <i>Staphylococcus aureus</i> <i>Staphylococcus epidermidis</i> <i>Streptococcus faecalis</i>	L13922
Stem Cuba	Antibacterial Activity	Acetone Ext	Agar Plate	Not stated	Inactive	<i>Pseudomonas aeruginosa</i> <i>Sarcina lutea</i> <i>Serratia marcescens</i> <i>Staphylococcus albus</i> <i>Staphylococcus aureus</i>	K09159
Leaf Cuba	Antibacterial Activity	H2O Ext	Agar Plate	Not stated	Inactive	<i>Salmonella B</i> <i>Salmonella newport</i> <i>Salmonella typhosa</i> <i>Sarcina lutea</i> <i>Serratia marcescens</i> <i>Shigella flexneri 3a</i> <i>Staphylococcus albus</i> <i>Staphylococcus aureus</i>	K09159

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Leaf Trinidad	Antibacterial Activity	Pet Ether Ext	Agar Plate	1000 mcg/ml	Equiv. Equiv. Inactive Inactive Inactive	<i>Staphylococcus aureus</i> <i>Streptococcus faecalis</i> <i>Escherichia coli</i> <i>Salmonella typhimurium</i> <i>Staphylococcus epidermidis</i>	L13922
Stem Cuba	Antibacterial Activity	H2O Ext	Agar Plate	Not stated	Inactive	<i>Sarcina lutea</i> <i>Serratia marcescens</i> <i>Shigella flexneri</i> 3A <i>Staphylococcus albus</i> <i>Staphylococcus aureus</i>	K09159
Stem Cuba	Antibacterial Activity	ETOH(95%) Ext	Agar Plate	Not stated	Inactive	<i>Escherichia coli</i> <i>Pseudomonas aeruginosa</i> <i>Salmonella B</i> <i>Salmonella newport</i> <i>Salmonella typhosa</i> <i>Sarcina lutea</i> <i>Serratia marcescens</i> <i>Shigella flexneri</i> <i>Staphylococcus albus</i> <i>Staphylococcus aureus</i>	K09159
Leaf Puerto Rico	Antimycobacterial Activity	ETOH(95%) Ext	Agar Plate	Not stated	Inactive	<i>Mycobacterium tuberculosis</i>	L12432
Stem Brazil	Molluscicidal Activity	ETOH(100%) Ext	Not stated	100.0 ppm	Inactive	<i>Biomphalaria glabrata</i>	L15585
Dried Stembark Brazil	Molluscicidal Activity	ETOH(100%) Ext	Adult snail Egg masses	LD50 = 0.97 ppm LD50 = 1.0 ppm	Active	<i>Biomphalaria glabrata</i> <i>Biomphalaria glabrata</i>	L15585
Leaf Brazil	Molluscicidal Activity	ETOH(100%) Ext	Adult Snail Egg Masses	LD50 = 1.59 ppm LD50 = 20.26 ppm	Active	<i>Biomphalaria glabrata</i>	L15585
Leaf Brazil	Molluscicidal Activity	Not stated	Adult Snail Egg Masses	LD90 < 20 ppm LD90 < 20 ppm	Active	<i>Biomphalaria glabrata</i>	AA1028
Brazil	Molluscicidal Activity	Not stated	Adult Snail Egg Masses	LD50 = 11.86 ppm LD50 = 49.62 ppm	Active	<i>Biomphalaria glabrata</i>	AA1012
Leaf + Stem India	Larvicidal Activity	H2O Ext	Not stated	0.03 gm/ml	Inactive	<i>Culex quinquefasciatus</i>	M19731

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Leaf Not Stated	Insecticide Activity	ETOH(95%) Ext	Not stated	5.0%	Weak Activity	<i>Macrosiphoniella sanborni</i>	W00220
Spain	Insecticide Activity	Fraction: Squamocin	Agar plate	Not stated	Active	<i>L. decemlineata</i> <i>M. persicae</i>	AA1018
USA	Insecticide Activity	Fraction: Acetogenins	In vitro	Not stated	Active	<i>Blattella germanica</i> (L.)	AA1019
Spain	Antifeedant Activity	Fraction: Annonacin	Agar plate	Not stated	Active	<i>L. decemlineata</i>	AA1018
Root bark Taiwan	Dopaminergic modulation	Alkaloid Ext	Cell culture	18 mcg/ml	Equiv.	Dopaminergic nerve cells and GABAergic nerve cells.	AA1010

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