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Antiparasitic effects of medicinal plants (part 1)- A review

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Abstract: Many previous researches showed that many plants exerted antiparasitic, antiprotozoal, molluscicidal and insecticidal. These plants included: *Achillea santolina, Ailanthus altissima, Allium cepa, Allium sativum, Ammi majus, Anagyris foetida, Antirrhinum majus, Apium graveolens, Arachis hypogaea, Artemisia campestris, Arundo donax, Asclepias curassavica, Ballota nigra, Bauhinia variegate, Betula alba, Bidens tripartite, Brassica nigra, Bryophyllum calycinum, Caccinia crassifolia, Caesalpinia crista,Calendula officinalis, Calotropis procera, Canna indica, Capparis spinosa, Carum carvi, Cassia occidentalis, Celosia cristata, Chenopodium album, Chorchorus capsularis, Chrysanthemum cinerariaefolium, Cichorium intybus, Citrullus colocynthis, Citrus limetta, Citrus medica, Citrus sinensis, Citrus limonum, Citrus aurantifolia, Citrus reticulate, Citrus vitis, Clerodendron inerme, Clitoria ternatea, Corchorus capsularis, Cordia myxa, Coriandrum sativum, Coronilla scorpioides, Coronilla varia, Crocus sativus, Cupressus sempervirens, Cymbopogon schoenanthus, Cyminum cuminum, Cynodon dactylon, Dalbergia sissoo, Datura metel, Datura stramonium, Dianthus caryophyllum, Digitalis purpurea, Dodonaea viscose, Dolichos lablab, Echium italicum, Equisetum arvense, Eryngium creticum, Eucalyptus camaldulensis, Eucalyptus microtheca, Eupatorium cannabinum, Euphorbia hirta, Ficus carica* and *Ficus religiosa*. This review highlights the antiparasitic effects of these medicinal plants.

Keywords: *medicinal plants, antiparasitic, antiprotozoal, molluscicidal, insecticidal*

I. INRRODUCTION

Plants have been used as drugs by humans since thousands of years ago. As a result of accumulated experience from the past generations, today, all the world's cultures have an extensive knowledge of herbal medicine. Two thirds of the new chemicals identified yearly were extracted from higher plants. 75% of the world's population used plants for therapy and prevention. In the US, where chemical synthesis dominates the pharmaceutical industry, 25% of the pharmaceuticals are based on plant-derived chemicals. Plants are a valuable source of a wide range of secondary metabolites, which are used as pharmaceuticals, agrochemicals, flavours, fragrances, colours, biopesticides and food additives[(1)]. As a result of development of resistances by insects and parasites[(2-11)], many health centers and ecological and environmental centers preferred using of medicinal plants because of their effectiveness and safety. Many previous reviews showed that many plants exerted antiparasitic, antiprotozoal, molluscicidal and insecticidal[(12-16)]. This review was designed to highlight the antiparasitic effects of medicinal plants.

II. PLANTS WITH ANTI-PARASITIC EFFECTS

Table 1: Plants with antiparasitic, antiprotozoal, molluscicidal and insecticidal effects:

Parasite group	parasites	plant	Effective extract or part	Ref
Insects	domestic flies and honeybees	*Achillea santolina*	volatile oil	17-18
	Culex pipiens molestus	*Achillea santolina*	methanolic extract	19
	Tribolium castaneum (Herbst) (Coleoptera: Tenebrionidae), *Oryzaephilus surinamensis* (Linnaeus) (Coleoptera: Silvanidae), *Sitophilus oryzae* (Linnaeus) (Coleoptera: Curculionidae) and *Liposcelis paeta* Pearman (Psocoptera: Liposcelididae) adults	*Ailanthus altissima*	bark oil	20-21
	Culex pipiens	*Ammi majus*	methanolic extract of seeds	22-23
	Callosobruchus chinensis	*Anagyris foetida*	oils and powders	24-25

	Lymantria dispar *Trichoplusia ni*	*Antirrhinum majus*	iridoid glucoside	26-27
	Aedes aegypti	*Apium graveolens*	ethanol extract	28-29
	Aedes aegypti adult and larvae	*Arachis hypogaea*	six stilbenoids showed the highest activity and high lipophilicity activity	30-31
	Culex Linnaeus	*Artemisia campestris*	ethanolic extract	32-33
	General insects repellent effect	*Ballota nigra*	Diterpenes, whole plant	34-36
	Culex quinquefasciatus	*Caesalpinia crista*	petroleum ether, ethanolic and aqueous extracts of dried leaves and fixed oil of seeds	37-38
	Ae. aegypti, *An. stephensi* and *Cx. Quinqefaciatus*	*Calotropis procera*	extracted latex	39-40
	Aedes aegypti	*Calotropis procera*	extracted latex	41
	Musca domestica	*Calotropis procera*	The crude ethanol extract of leaves	42
	Sitophilus zeamais and *Tribolium castaneum*	*Carum carvi*	essential oil	43-44
	Anopheles stephensi	*Cassia occidentalis*	ethanol extract	45-46
	Callosobruchus maculatus	*Cassia occidentalis*	the leaves, seeds and oil	47
	Culex quinquefasciatus	*Cassia occidentalis*	methanolic extract	48
	worker termites (Isoptera: Rhinotermitidoe)	*Cassia occidentalis*	ethanolic leaves extract	49
	Anopheles stephensi	*Chenopodium album*	Pet. ether, carbon tetrachloride and methanol extracts	50-51
	Oryzaephilus surinamensis	*Chenopodium album*	polar and non-polar secondary metabolites from the aerial parts	52
	houseflies, cockroaches and mosquitoes	*Chrysanthemum cinerariaefolium*	Pyrethrum	53-54
	Aedes aegypti and *Culex quinquefasciatus*	*Citrullus colocynthis*	crude hexane, ethyl acetate, petroleum ether, acetone, and methanol extracts of the leaf	55
	Culex quinquefasciatus	*Citrullus colocynthis*	crude acetone, hexane, ethyl acetate, methanol, and pet. ether extracts of the leaf	56-57
	Aphis craccivora	*Citrullus colocynthis*	methylene chloride, n-hexane, chloroform and ethanol extracts of fruits	58
	Aedes aegypti, and malarial vector, *Anopheles stephensi*,	*Citrus* limetta	hexane and petroleum ether extracts of peels	59
	General mosquitoes repellent effect	*Citrus sinensis*, *Citrus limonum*, *Citrus aurantifolia*, *Citrus reticulata* and *Citrus vitis*	repellent activity of extracts	60-61
	Aedes aegypti	*Clerodendrum inerme*	aqueous extract of leaves	62 .
	Anopheles stephensi, Aedes aegypti and *Culex quinquefasciatus*	*Clerodendrum inerme*	hexan, chloroform, ethyl acetate, acetone and methanol leaves extracts	63-64
	Aedes aegypti	*Clerodendrum inerme*	dried powder of leaves	65
	Mosquitoes	*Clerodendrum inerme*	Pet.ether extract	66
	Corcyra cephalonica	*Clerodendrum inerme*	pet. ether, Chlorofrom, ethyl acetate, ethanol and water fractions of the powdered leaves	67
	Pieris brassicae	*Clerodendrum inerme*	aqueous extract of leaf	68
	Aedes aegypti, Culex quinquefasciatus, and *Anopheles stephensi*	*Clitoria ternatea*	methanol extracts of leaves, roots, flowers, and seeds	69-70
	Anopheles stephensi and a dengue vector *Aedes aegypti*	*Corchorus capsularis*	methanol extracts	71-72
	Diacrisia casignetum	*Chorchorus capsularis*	different leaves extracts	73
	Callosobruchus chinensis, *Sitophilus oryzae* L and *Tribolium castaneum* Herbs	*Corchorus capsularis*	emulsified pet. ether extract	74
	Culex pipines	*Cordia myxa*	crude alkaloidss of leaves	75-76

Tribolium confusum and *Callosobruchus maculatus*	*Coriandrum sativum*	essential oil of seeds	77-78
Aedes albopictus	*Coriandrum sativum*	essential oil of the fruits	79
Aedes aegypti	*Coriandrum sativum*	leaf oil	80
Aedes aegypti	*Coriandrum sativum*	seed oil	81
Aedes aegypti	*Coronilla scorpioides*	aqueous extracts	82-83
Costelytra zealandica	*Coronilla varia*	crude extracts of the root	84-85
Insects	*Crocus sativus*	Safranal extract	86-87
Anopheles gambiae	*Cyminum cuminum*	essential oils	88-89
Tribolium confusum and *Ephestia kuehniella*	*Cyminum cuminum*	essential oil	90-91
Callosobruchus maculatus	Cymbopogon schoen anthus	crude essential oil extract	92
Anopheles gambiae	*Cymbopogon schoen anthus*	essential oils	93
Anopheles mosquito	*Cymbopogon schoenanthus*	oil extract	94
Aedes	*Cymbopogon schoenanthus*	citronella oil	95
Plutella xylostella	*Cymbopogon schoenanthus*	aqueous extracts of leaves	96
A. aegypti	*Cynodon dactylon*	volatile oils	97-98
Anopheles culicifacies, *Anopheles stephensi* and *Culex quinquefasciatus*	*Cyperus rotuntdus*	hexane extract of tuber of plant	99-100
Ants, Aphides, houseflies mosquitoes and cockroaches	*Cyperus rotundus*	ethanol extracts of the leaves and stems	101
Aedes albopictus	*Cyperus rotundus*	essential oils of the tubers	102
Anopheles stephensi, Aedes aegypri and *Culex quinquefasciacus*	*Dalbergia sissoo*	pure oil	103
Helicoverpa armigera	*Datura metel*	methanolic extract of seeds	104
Aedes aegypti, *Anopheles stephensi* and *Culex quinquefasciatus*	*Datura stramonium*	ethanolic extracts of leaves	105
Culex pipiens	*Dianthus caryophyllus*	essential oils	106
Aedes aegypti	*Dianthus caryophyll um*	essential oil from the flowers	107
Tribolium. Castaneum	*Digitalis purpurea*	alcoholic extract	108
Epilachna paenulata, Spodoptera littoralis, Myzus persicae, and *Rhopalosiphum padi*	*Dodonaea viscosa*	ethanolic extracts of the leaves	109
Callosobruchus maculates	*Dolichos lablab*	Arcelins, the protein isolated from seed flour	110
Rhyzopertha dominica and Oryzaephilus surinamensis	*Dolichos lablab*	partially purified protein fraction	111
Aedes aegypti	*Echium italicum*	crude plant extracts	112
Plodia interpunctella	*Echium italicum*	aqueous extract	113
rice weevils, pine processionary moths and mushroom flies	Eucalyptus oil	essential oil	114
Anopheles stephensi	*Eucalyptus camaldulensis*	leaf extract and volatile oil exerted	115
Aedes aegypti	Eucalyptus camaldulensis	vapors of essential oils	116
Aedes aegypti, A. albopictus	Eucalyptus camaldulensis	leaf essential oils	117
flour beetle, *Tribolium confusum*, and the Mediterranean flour moth, *Ephestia kuehniella*	Eucalyptus oil	essential oil vapours	118
Culex pipiens	Eucalyptus camaldul ensis	Essential oils extracted from the dried fruits	119
Culex pipiens	*Eucalyptus microtheca*	hot and cold aqueous leaves extracts	120
Culex quinqefasciatus	*Eucalyptus microtheca*	aqueous and organic extracts of the leaves	121

	Callosobruchus chinensis	*Eupatorium cannabinum*	The methanol and chloroform fraction	122
	Culex quinquefasciatus and *Aedes aegypti*	Eupatorium cannabinum	Acetone extract	123
	Aedes aegypti L. and *Culex quinquefasciatus*	*Euphorbia hirta*	petroleum ether extract	124
	Aedes aegypti	Ficus carica	The milky sap	125
arachnida	*Psoroptes cuniculi* and *Sarcoptes scabiei var. cuniculi*	*Ailanthus altissima*	bark extract	126
	Sarcoptes scabiei	*Allium sativum*	aqueous extract	127-128
	Androctonus australis	*Citrullus colocynthis*	fresh fruit extract	129
	Ticks	*Dalbergia sissoo*	leaf extracts	130
	Ixodes ricinus	*Dianthus caryophyllum*	essential oil of the flowers	107, 131
Protozoa	*Plasmodium falciparum*	*Ailanthus altissima*	Extracts and isolated compounds from seedlings, stem constituents and of some related quassinoids	132-133
	Plasmodium falciparum and *P. berghei*	*Ailanthus altissima*	the chloroform extract	134
	Leishmania major promastigotes	*Allium cepa*	aqueous extract	135-138
	Cryptosporidium parvum	*Allium cepa*	oil	139
	Toxoplasma gondii	*Allium cepa*	fresh juice	140-141
	Giardia lamblia, *Leishmania major* and *Leptomonas colosoma*, *E. histolytica*	*Allium sativum*	Sulfur compounds of the plant	141-148
	Leishmania major strain (NLB 145) and *L. donovani* strain (NLB 065)	*Allium sativum*	methanolic extract	149
	Leishmania major	*Allium sativum*	aqueous extract	150
	Acanthamoeba	*Arachis hypogaea*	ethanol extracts	151
	Entamoeba histolytica	*Asclepias curassavica*	hydro alcoholic extract of dried sap	152-153
	Leishmania	*Ballota nigra*	leaves flavonoids, terpenes, and phenols	154
	Leishmania donovani	*Betula alba*	Disuccinyl betulin, diglutaryldihydrobetulin, and disuccinyldihydro betulin	155-156
	Plasmodium falciparum	*Betula alba*	betulinic acid	157
	Plasmodium falciparum	*Bidens tripartita*	ethanol extract of the dried whole plant	158-159
	Leishmania amazonensis	*Bryophyllum calycinum*	flavonoids components	160-162
	Plasmodium falciparum	*Caccinia crassifolia*	root methanolic extract	163
	Plasmodium falciparum	*Caesalpinia crista*	caesalpinins and nor-caesalpinins	164-165
	Plasmodium falciparum	*Calotropis procera*	ethanolic extracts of root and bud	166
	Trypanosoma evansi	*Calotropis procera*	saponins-rich fraction	167
	Theileria annulata	*Calotropis procera*	emulsified herb	168
	Plasmodium falciparum	*Calotropis procera*	ethanolic extract of the leaves	169
	Plasmodium falciparum	*Carum carvi*	essential oils	170
	Plasmodium	*Cassia occidentalis*	extracts and fractions	171-173
	Plasmodium	*Cassia occidentalis*	ethanolic, dichloromethane and aqueous extracts of root bark	174
	Plasmodium falciparum	*Cichorium intybus*	lactucin, lactucopicrin, and the guaianolide sesquiterpenes, isolated from root extracts	175-176
	Leishmania donovani	*Citrullus colocynthis*	fruit extracts	177
	L. infantum and *L. major*	*Cordia myxa*	mucilage extract	178
	Plasmodium falciparum	*Cordia myxa*	crude dichloromethane, methanol, water-methanol, aqueous and alkaloids extracts	179
	L. infantum	*Coriandrum sativum*	many plant fractions	180

	Leishmania major	*Crocus sativus*	IC_{50} and ED_{50} of this saffron extract after 48 h of incubation was 0.7 and 0.5 mg/ml respectively	181
	Leishmania donovani	*Cupressus sempervirens*	ethanol extract of the powdered cones	182
	Plasmodium	*Cyperus rotundus*	Sesquiterpenes from tubers	183
	L. tropica	*Equisetum arvense*	water extract	184
	Leishmania donovani	*Eryngium creticum*	dichloromethane extract	185
	Trypanosoma brucei	*Eucalyptus camaldulensis*	the leaves, stem and root barks extracts	186
	Leishmania major	*Eucalyptus camaldul ensis*		187
	Trichomonas. Vaginalis	Eucalyptus camaldul ensis	total extract, diethyl ether, chloroform, ethyl acetate, and water fractions	188
	Entamoeba histolytica	*Euphorbia hirta*	polyphenolic extract of the whole plant	189
	Plasmodium falciparum	*Euphorbia hirta*	methanolic extracts of aerial parts	190
Trematodes	*Schistosoma hematopium*	*Ailanthus altissima*	chloroform extract of stem bark	191
	Schistosoma mansoni	*Calotropis procera*	latex and flower extracts	192
	Schistosoma	*Eucalyptus* species	essential oil	193
Nematodes	*Meloidogyne javanica*	*Ailanthus altissima*	methanol extracts of various plant parts	194
	Trichinella spiralis	*Allium cepa*	different extracts	195-198
	roundworm (*Ascaris)* and hookworm (*Ancylostoma caninum* and *Necator americanus*), *Trichinella spiralis*	*Allium sativum*	different extracts	199-204
	Caenorhabditis elegans and *Panagrellus redivivus*	*Apium graveolens*	seeds	205-207
	H. contortus	*Arundo donax*	Crude aqueous-methanol extracts of the leaves and their fractions	208-209
	Ascaris sp., Oesophagostomum sp. and Paramphistomum sp.) of cattle	*Arundo donax*	raw	210
	Ascardia galli.	*Brassica nigra*	alcohoilc extract of the seeds	211
	Trichostrongylid	*Caesalpinia crista*	The bark extract	212
	L. sigmodontin and microfilaria	*Caesalpinia crista*	seed kernel extract and fractions	213
	Ascaridia galli *Phertima posthuma*	*Caesalpinia crista*	seeds	214-215
	Haemonchus contortus	*Caesalpinia crista*	ethanolic extracts	216
	gastrointestinal nematodes	*Caesalpinia crista*	crude powder and crude aqueous methanolic extract	217
	Heligmosomoides polygyrus	*Calendula officinalis*	glycosides of oleanolic acid	218
	Heligmosomoides polygyrus	*Calendula officinalis*	saponins	219
	Haemonchus contortus	*Calotropis procera*	crude aqueous and methanolic extracts of flowers	220
	Helminthes	*Cassia occidentalis*	hydro-alcoholic extracts of leaves	221
	Haemonchus contortus	*Chenopodium album*	crude aqueous methanolic extract of whole plant	222
	Haemonchus spp. , Oesophagostomum spp. , Trichostrongylus spp., Cooperia spp., Nematodirus spp., Strongyloides spp. and Ostertagia spp.	*Chrysanthemum cinerariaefolium*	pyrethrum	223
	Natural infection with many nematode	*Cichorium intybus*	condensed tannins and sesquiterpene lactones	224-225
	Dictyocaulus viviparous	*Cichorium intybus*	condensed tannins and crude sesquiterpene lactones	226-228
	Haemonchus contortus	*Cichorium intybus*	sesquiterpene lactone compounds [lactucin and lactucopicrin]	229
	Ascaris lumbricoides	*Citrus medica*	Alcoholic extracts of the rind	230
	Nematodes	*Clerodendron inerme*	Leaf extracts	231

	Bursaphelenchus xylophilus	*Coriandrum sativum*	essential oils	232
	Haemonchus contortus	*Coriandrum sativum*	crude aqueous and hydro-alcoholic extracts of the seeds	233
	Haemonchus contortus	*Coriandrum sativum*	essential oils	234
	Haemonchus contortus	*Cymbopogon schoenanthus*	essential oil	235
	*Haemonchus contortus*and *Trichostrogylus*	Cymbopogon schoenanthus	essential oils	236
	Ascardi galli.	*Dalbergia sissoo*	ethanolic extract of bark	237
	Haemonchus contortus	Eucalyptus	essential oil	238
	Ancylostoma caninum	*Euphorbia hirta*	the aqueous crude extract of the leaves	239
	Heligmosomoides polygyrus	*Ficus carica*	plant cysteine proteinases	240
	Haemonchus contortus	*Ficus religiosa*	bark methanolic extract	203, 241
	Ascaridia galli	*Ficus religiosa*	stem and bark extracts	242
Cestodes	*Echinococcus granulosus*	*Citrus medica*	aqueous extract	243
Mollusca	*Oncomelania hupensis*	*Ailanthus altissima*	The LC_{50} in 24, 48, and 120h reached the middle noxious level	244 .
	Lymnaea acuminate	*Bauhinia variegata*	organic extracts, ethanol extracts of leaf (96 h LC_{50}- 14.4 mg/l).	245-247
	Lymnaea acuminate	*Canna indica*	ethanol , methanol, ether, chloroform and column purified fraction of leaves	248-249
	Lymnaea acuminate	*Canna indica*	root alone and in combination with other plant-derived extracts	250
	Lymnaea acuminate	*Carum carvi*	seed powder	251
	Biomphalaria pfeifferi	*Dalbergia sissoo*	the crude aqueous and ethanolic extracts of fruits, leaves, roots and stem bark	252
	Lymnaea acuminate	*Euphorbia hirta*	aqueous extracts of stem bark and leaf	253
annelid	*Pheretima posthuma*	*Brassica nigra*	alcohoilc extract of the seeds	211
	Earthworms	*Caesalpinia crista*	bark extract	254
	Pheretima posthuma	*Calendula officinalis*	methanolic and ethanolic extract of leaves	255
	Pheritima posthuma	*Calotropis procera*	hydroethanolic, *n*-butanol and chloroform extract of leaves	256
	Pheritima posthuma	*Canna indica*	benzene and methanol extracts of various parts	257
	Pheritima posthuma	*Capparis spinosa*	alcoholic and aqueous extracts	258
	Pheritima posthuma	*Cassia occidentalis*	ethanolic extract	259
	Pheritima posthumad	*Citrus medica*	methanolic extract	260
	Pheretima posthumad	*Citrus medica*	petroleum ether extracts	261
	Pheretima posthuma	*Citrus sinensis*	petroleum ether extract	262
	Pheretima posthuma	*Celosia cristata*	chloroform, methanol and aqueous extract of leaves	263
	Pheretima posthuma	*Chenopodium album*	different extracts of flowers and leaves	264
	Pheritima posthuma	*Clitoria ternatea*	ethanolic extract	265
	Pheretima posthuma	*Clitoria ternatea*	ethanolic extracts of flowers, leaves, stems and roots	266
	Eisenia foetida	*Clitoria ternatea*	aqueous and ethanolic extracts of leaves	267
	Pheretima posthuma	*Cynodon dactylon*	petroleum ether, methanol, and water extracts	268
	Pheretima posthuma	*Dalbergia sissoo*	Pet. ether, CCl_4, benzene and ethanol extracts of leaves	269
	Pheretima posthuma	*Dalbergia sissoo*	ethanolic extract of bark	237
	Pheretima posthuma	*Ficus carica*	aqueous and methanolic extracts	270-271
crustacea	*Artemia salina*	*Dodonaea viscose*	leaf, stem and root aqueous, methanol and chloroform extracts	272

III. CONCLUSION

Parasites treatment especiall in animals was expensive. Several factors, including the emergence of helminths resistant to pharmaceutical anthelmintics, were forcing to seek alternative approaches to parasite control in

animals and human. The current paper reviewed the medicinal plants exerted anthelmintic, antiprotozoal, molluscicidal and insecticidal activity, to be utilize in medical applications as a result of effectiveness and safety**.**

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