



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Antiparasitics

= compounds used for treatment of parasitary infestations

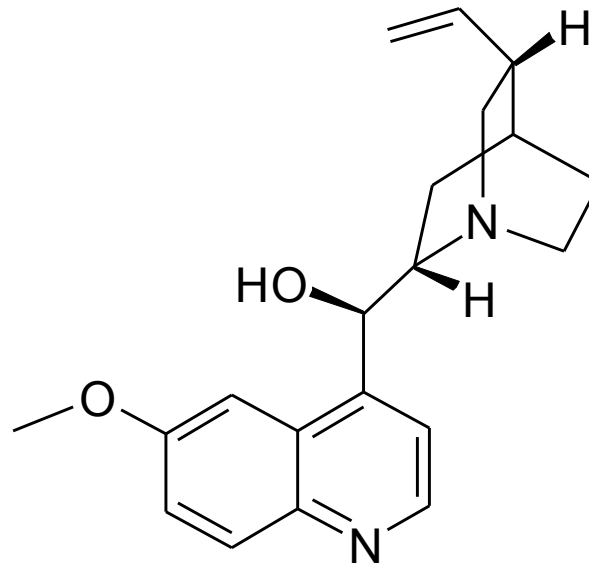
1. Antoprotozal drugs
2. Anthelmintics
3. Insecticides, ixodecides and repellents

1. Antiprotozoal drugs

= compounds killing pathogenic protozoa

1.1. Antimalarial drugs

•infectious agents – protozoa of the genus *Plasmodium*: *P. vivax*, *P. falciparum*, *P. malariae*, *P. ovale*



quinine

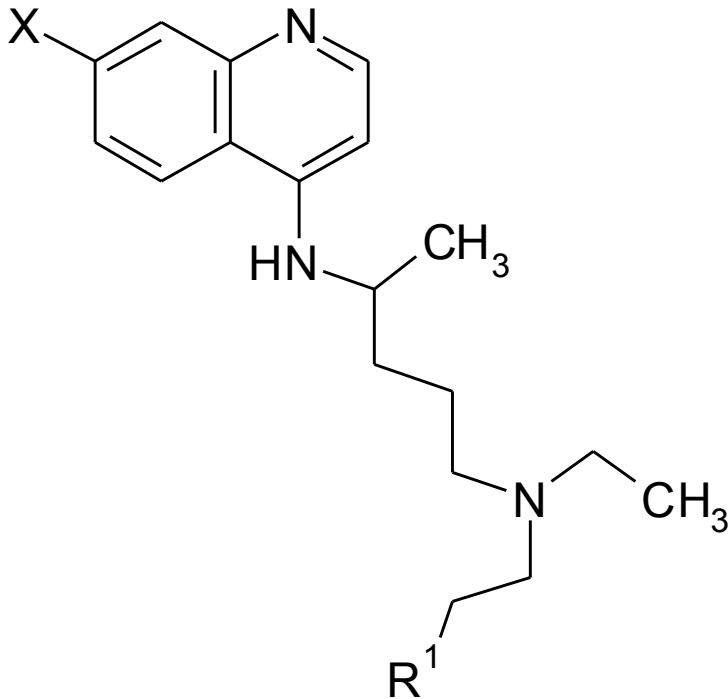
•isolation from cinchona bark *Cortex chinae* (+ its stereoisomers quinidine, cinchonine, cinchonidine)

•except antimalarial effects has also antirheumatic and antipyretic ones

•„lead compound“ for design of newer antimalarials with quinoline skeleton

Antimalarial drugs

Quinoline derivatives



X = Cl R¹ = H **chloroquine**

Delagil® tbl.

X = F R¹ = H **fluoroquine**

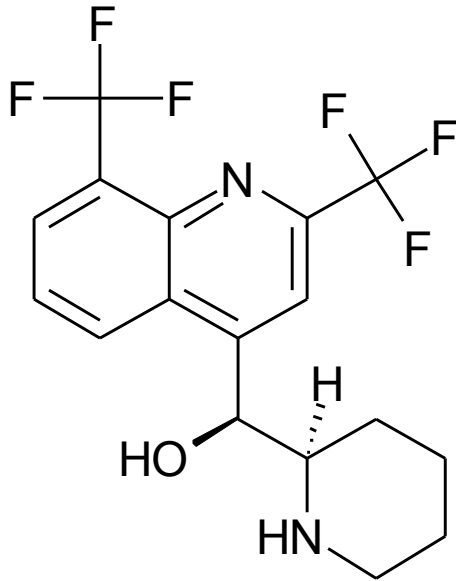
X = Cl R¹ = OH **hydroxychloroquine**

Plaquenil® drg.

•also treatment of rheumatoid arthritis

•mech. of action: inhibition of transformation of heme, which is toxic for the parasite, into hemozoin, which is not (= „malarial pigment“ - non-toxic for *Plasmodium*)

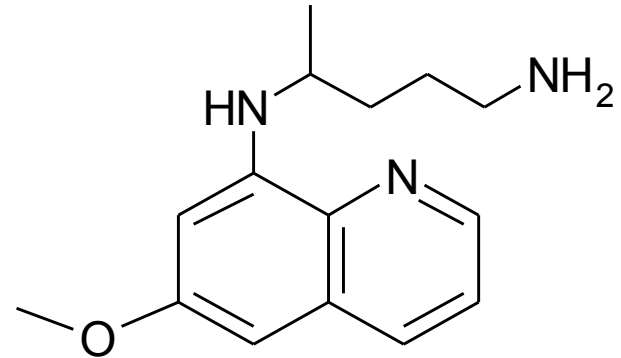
Antimalarial drugs
Quinoline derivatives



mefloquine

Lariam[®] tbl.

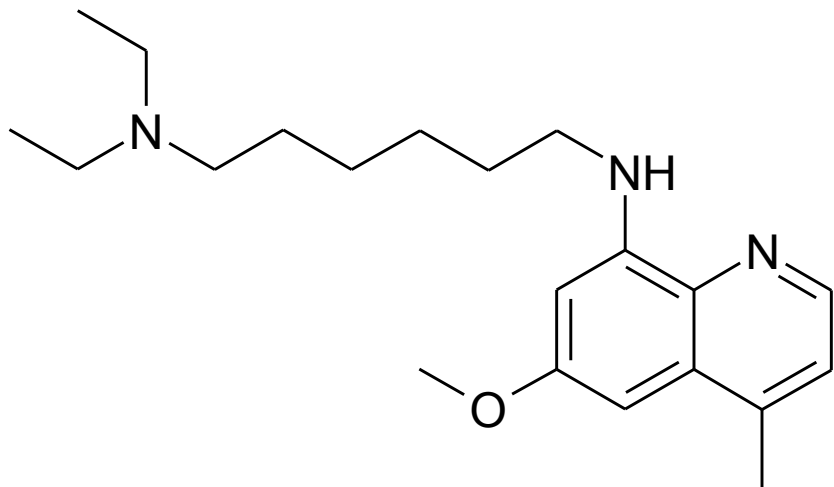
•also prophylactic before a
travel to a tropic region



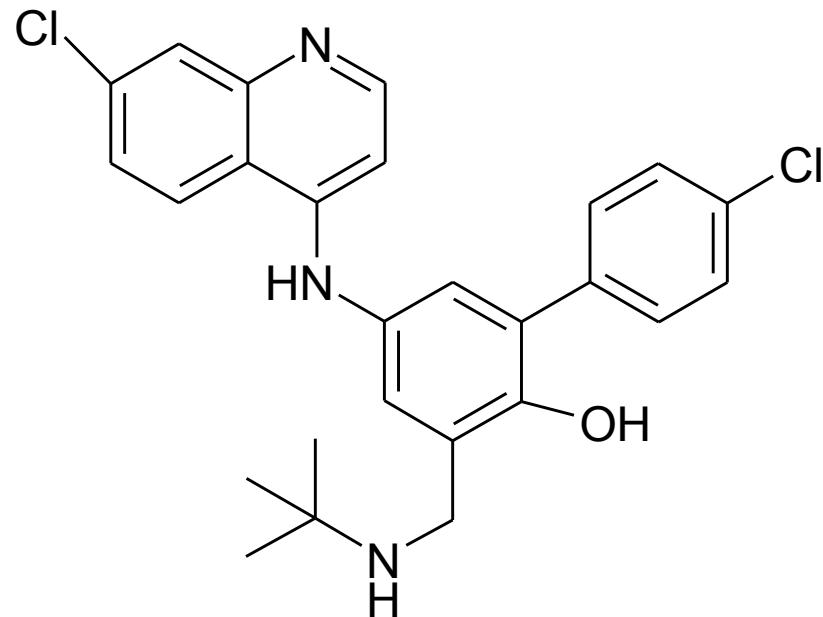
primaquine

Primaquine[®] tbl. obd.

Antimalarial drugs
Quinoline derivatives

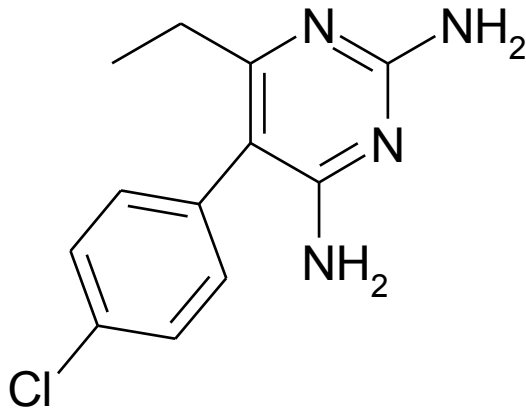


sitamaquine



tebuquine

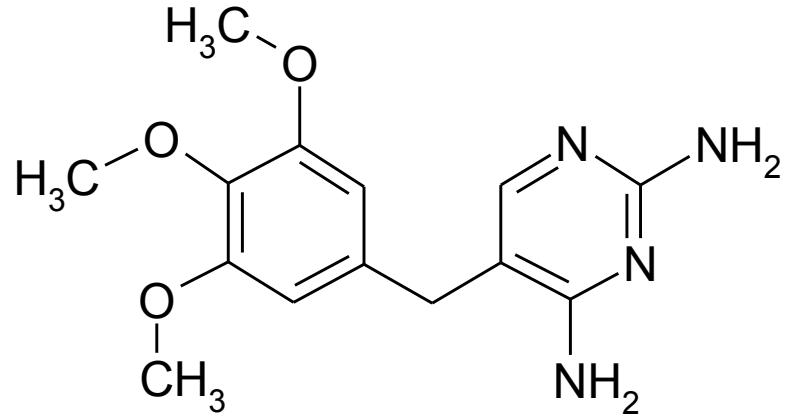
Antimalarial drugs
Pyrimidine derivatives



pyrimethamine

Daraprim[®]

▪also treatment of toxoplasmosis in combination with sulfadiazine

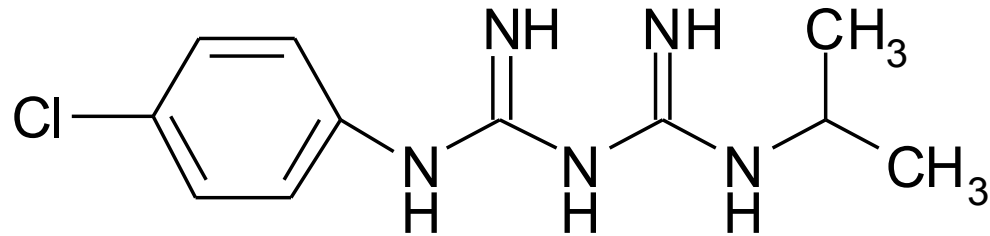


trimethoprim

Triprim[®] tbl.

▪now more frequently used in antibacterial combinations with sulfonamides

Antimalarial drugs
Biguanide derivatives



proguanil

Malarone® por. tbl. flm.

•spectrum: *P. falciparum*

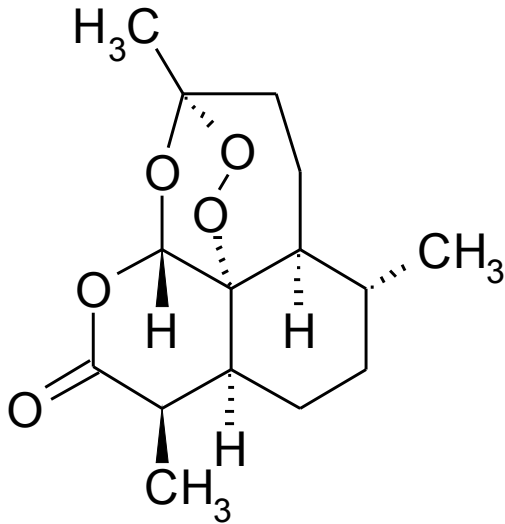
•mech. of action: inhibition of dihydrofolate reductase

•avoids formation of tissue schizonts (hypnozoites)

Antimalarial drugs

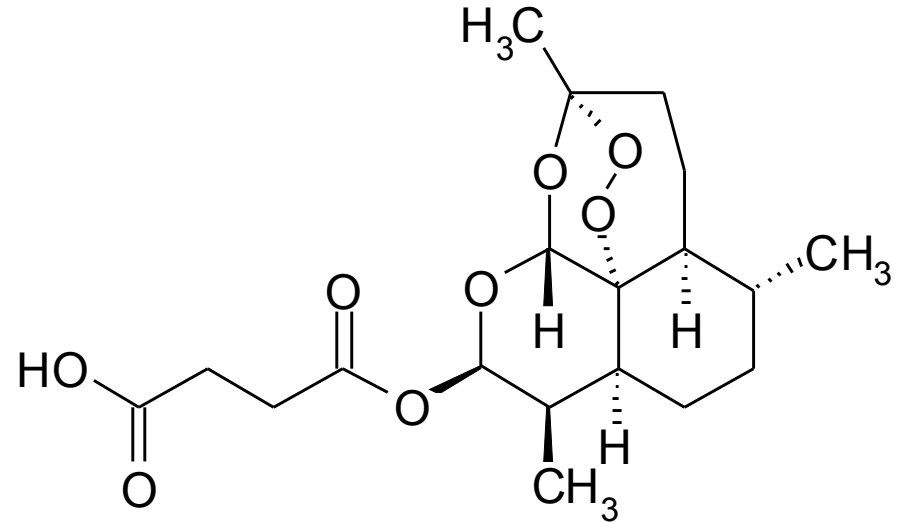
Artemisinin and its analogues

- cyclic endoperoxides
- mech. of action: forming of free radicals, toxic for *Plasmodium*, catalyzed by Fe of heme



artemisinin

- sesquiterpene lactone isolated from wormwood *Artemisia annua*
- poor biological availability

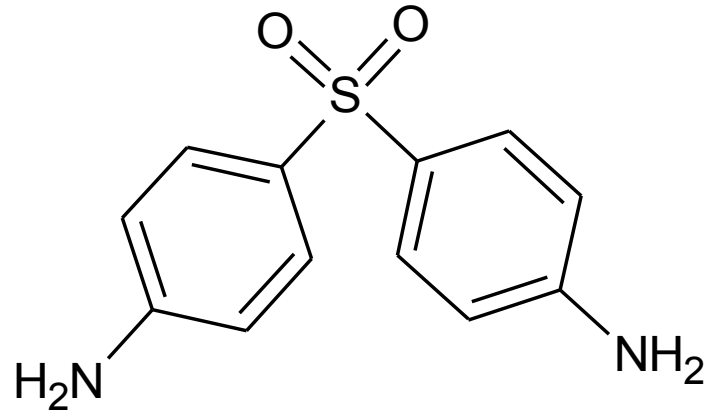


artesunate

- used as sodium salt for i.m. administration

Antimalarial drugs

Sulfones



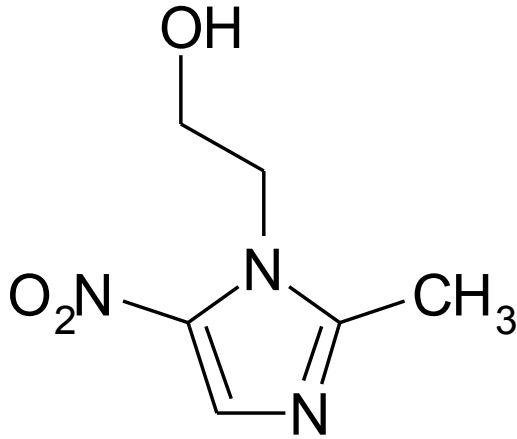
dapson

1,1'-bis(4-aminophenyl)sulfone

- mode of action: inhibition of folic acid synthesis, inhibition of dihydropteroate synthase (like sulfonamides) in particular
- also drug for leprosy

1.2 Antiprotozoal drugs other than antimalarials

5-nitroimidazole derivatives

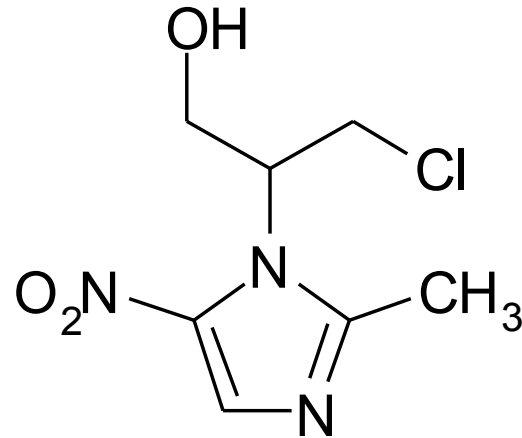


metronidazole

Entizol[®] tbl., tbl. vag.

•spectrum: *Trichomonas vaginalis*, *Entamoeba histolytica*, *Treponema*, anaerobic bacteria

•mechanism of action:
interference with metabolism



ornidazole

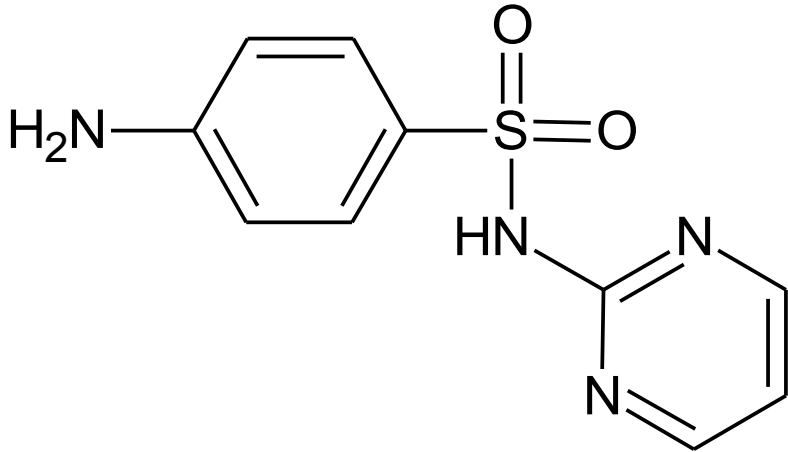
Avrazor[®] inj.

•spectrum: *Trichomonas vaginalis*, *Entamoeba histolytica*, *Giardia intestinalis*, *Bacteroides*, anaerobic bacteria

mechanism of action:
interference with metabolism

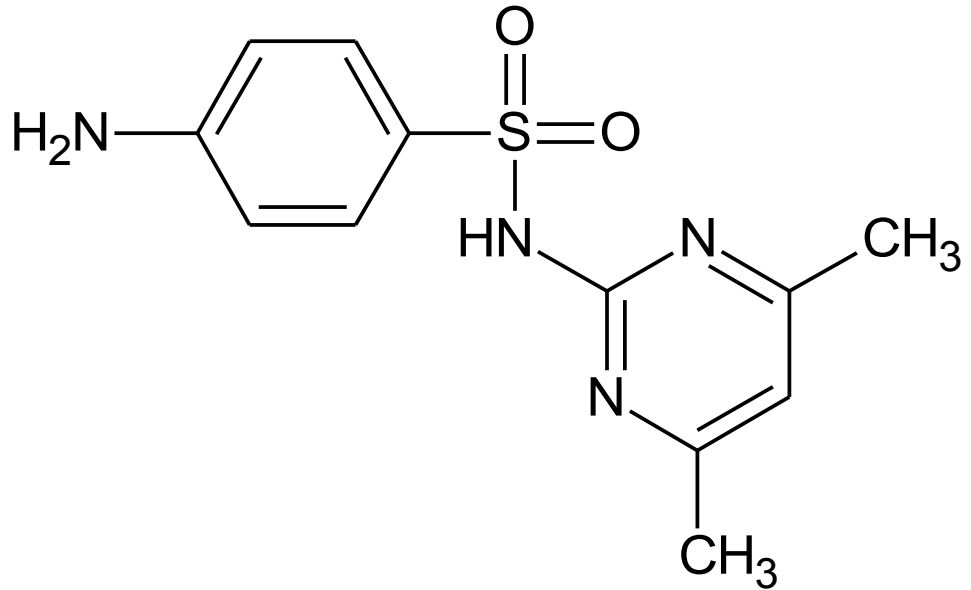
1.2 Antiprotozoal drugs other than antimalarials

Sulfonamides



sulfadiazine

- One of the short-acting sulfonamides used in combination with pyrimethamine to treat toxoplasmosis in patients with acquired immunodeficiency syndrome and in newborns with congenital infections.



sulfadimidine

syn. sulfamethazine [USP]

- sodium salt against coccidiosis (caused namely by *Eimeria* sp.) in poultry and rabbits

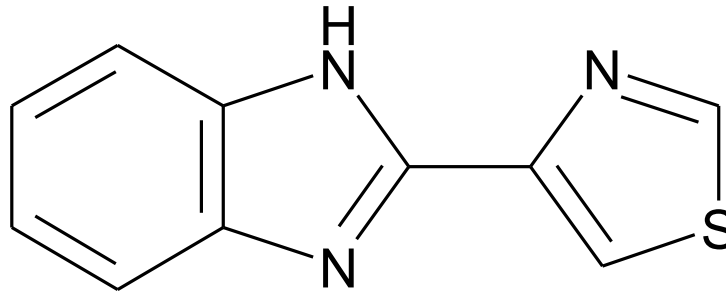
SULFADIMIDIN BIOVETA® plv.
sol. ad us. vet.

- mode of action: inhibition of dihydropteroate synthase

2. Anthelmintics

= compounds against parasitic worms

Benzimidazole derivatives



tiabendazole

syn. thiabendazole [USAN, BAN]

Mintezol[®] tbl.

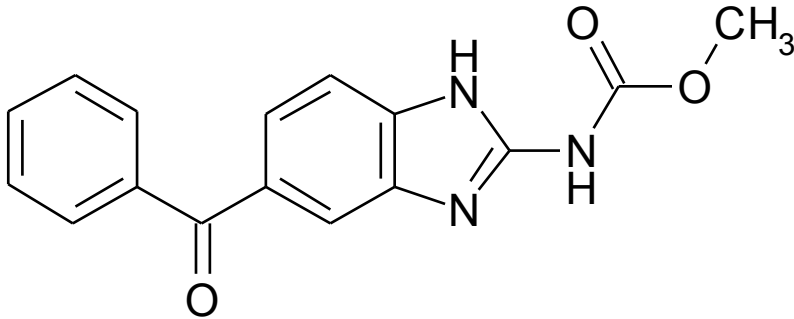
•also fungicidal effect

2. Anthelmintics

Benzimidazole derivatives

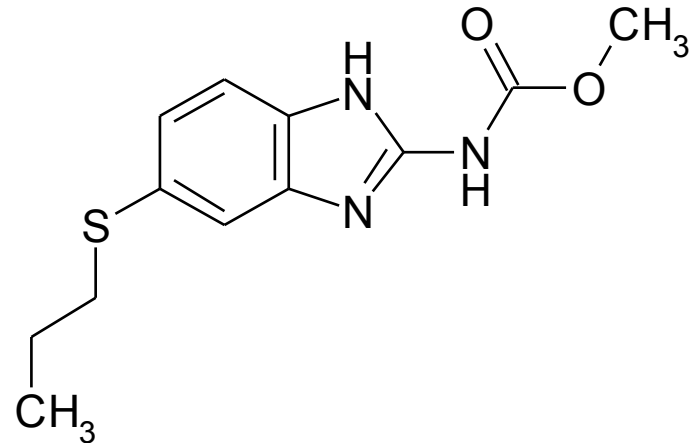
Methyl 1*H*-benzimidazole-2-carbamates

- mech. of action: selective inhibition of mitosis of both worms and protozoa (binding to tubuline)



mebendazole

Vermox[®] tbl., por. sus.



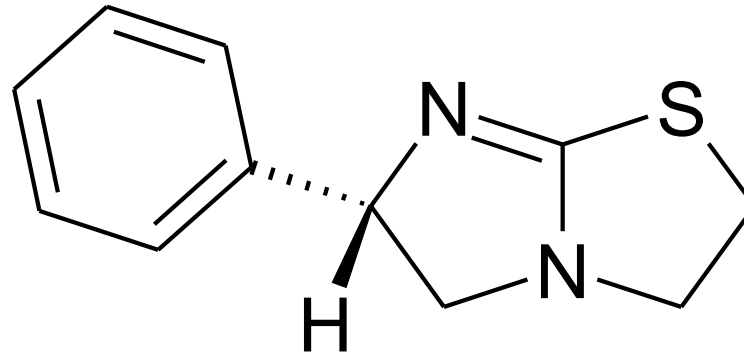
albendazol

Zentel[®] por. sus.

- spectrum: human pinworm *Enterobius vermicularis*, whipworm *Trichuris trichiura*, human large roundworm *Ascaris lumbricoides*, hookworm *Ancylostoma duodenale*, threadworm *Strongyloides stercoralis*, tapeworms *Taenia spp.* etc., also protozoa *Girardia lamblia*, *Trichomonas vaginalis*

Anthelmintics

Imidazothiazole derivatives



levamisole

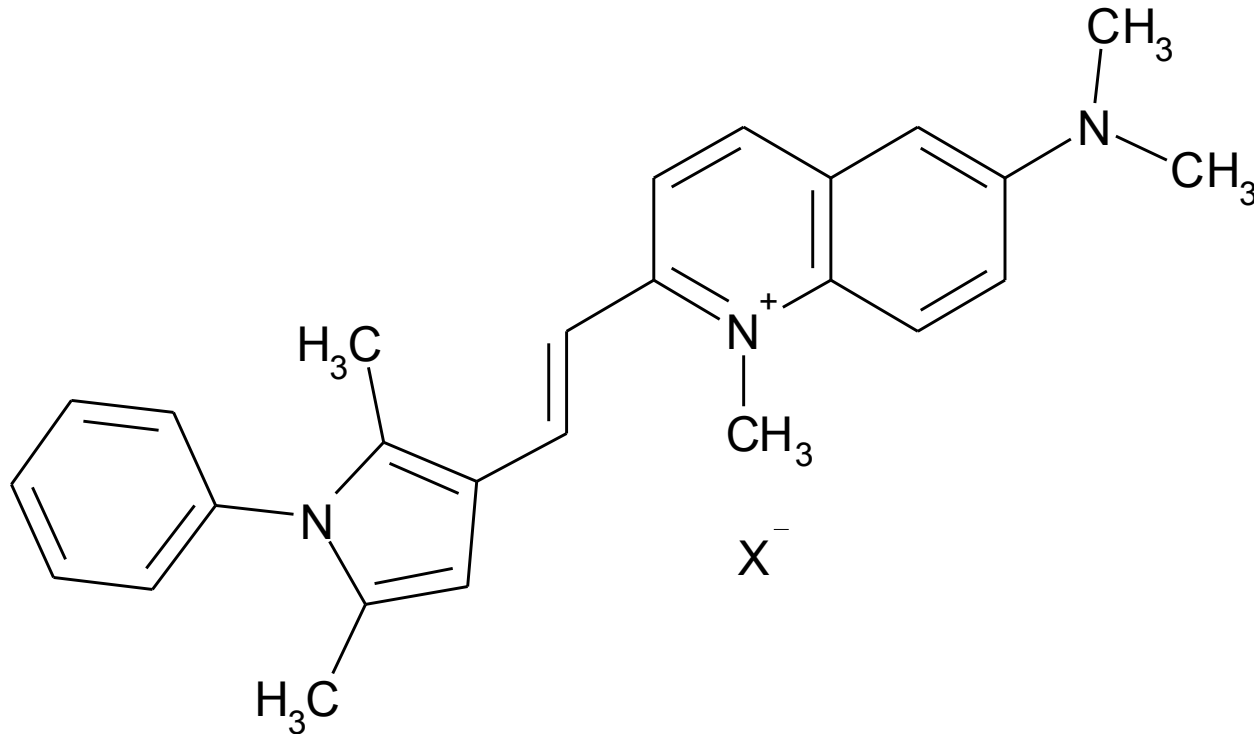
S-(-)-2,3,5,6-tetrahydro-6-phenylimidazo[2,1-b]thiazole

Decaris[®]-tbl.

- ascaridosis, ancylostomosis, strongyloidosis, trichuriasis
- also immunomodulation effect – useful in rheumatoid arthritis, *lupus erythematoses*

Anthelmintics

Quinoline derivatives

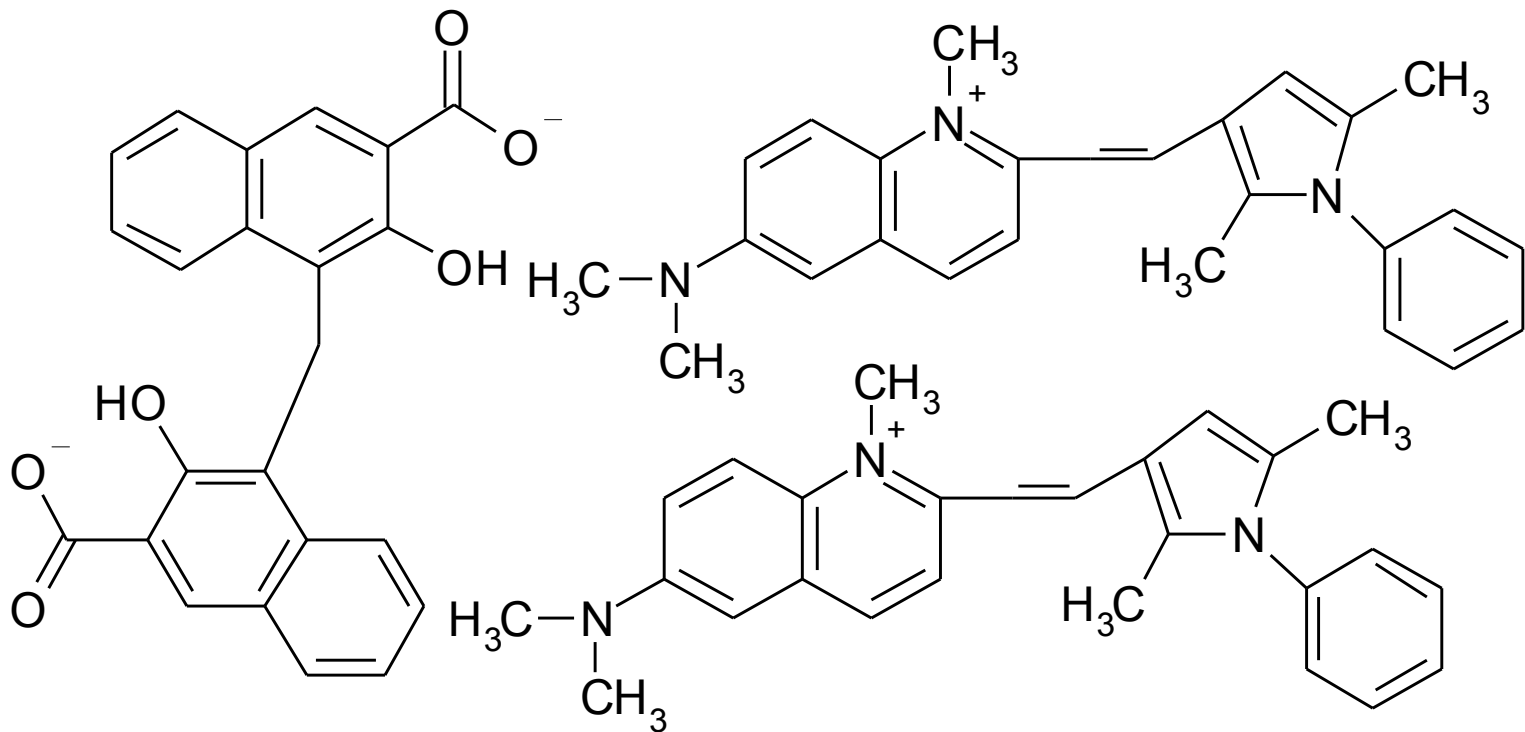


pyrvinium

Pyrvinium[®]-susp. as embonate, i.e. salt with 4,4-methylenebis(3-hydroxynaphthalene-2-carboxylic)acid

- human pinworm *Enterobius vermicularis*

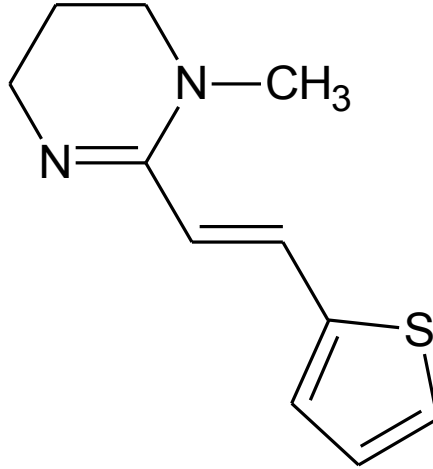
Pyrvinium embonate



•pyrvinium embonate (syn. pamoate)

Anthelmintics

Tetrahydropyrimidine derivatives



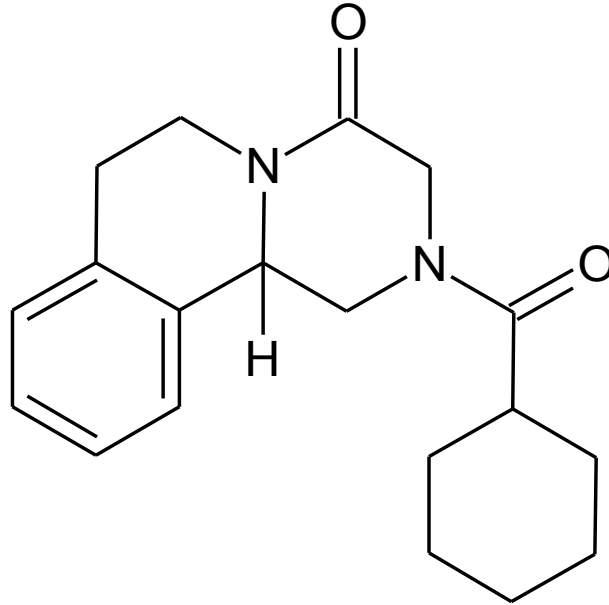
1-methyl-2-[(*E*)-2-(thiophen-2-yl)ethenyl]-1,4,5,6-tetrahydropyrimidine

pyrantel

- mechanism of action: depolarizing neuromuscular-blocking agent, that causes persistent nicotinic activation resulting in spastic paralysis of susceptible nematodes
- drug of second-choice after benzimidazoles for treatment of ascariasis, hookworm, and pinworm infections
- effective after a single dose

Anthelmintics

Pyrazinoisoquinoline derivatives



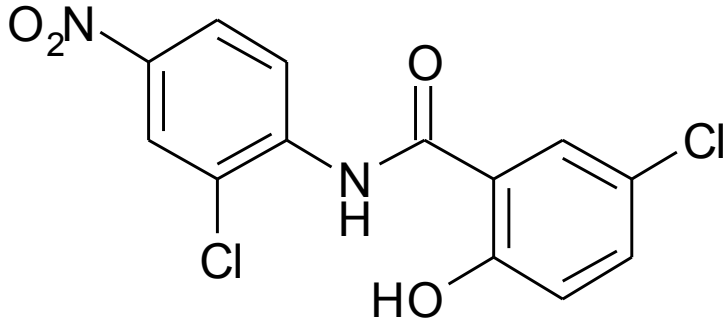
2-(cyclohexylcarbonyl)-1,2,3,6,7,11b-hexahydro-4*H*-pyrazino[2,1-*a*]isoquinolin-4-one

praziquantel

▪ treatment of schistosomiasis (blood-flukes or bilharzia or *Schistosoma* infection)

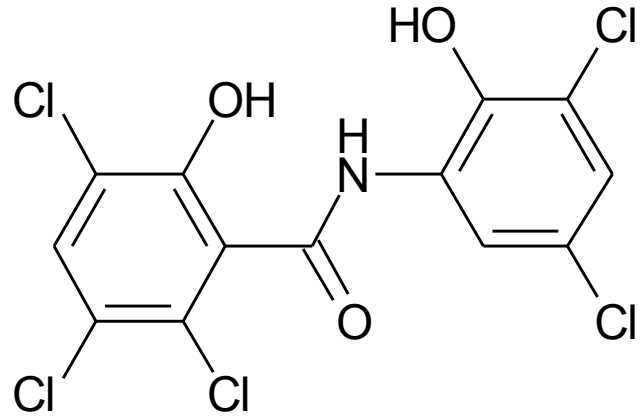
Anthelmintics

Halogenated salicylanilides



niclosamide

▪ tapeworms

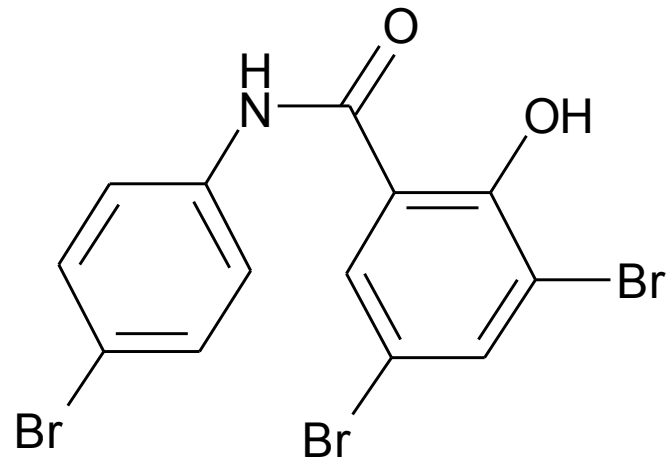


oxyclozanide

▪ veterinary medicine: for fasciola (liver fluke) and tapeworms infestations in grazing animals (cattle)

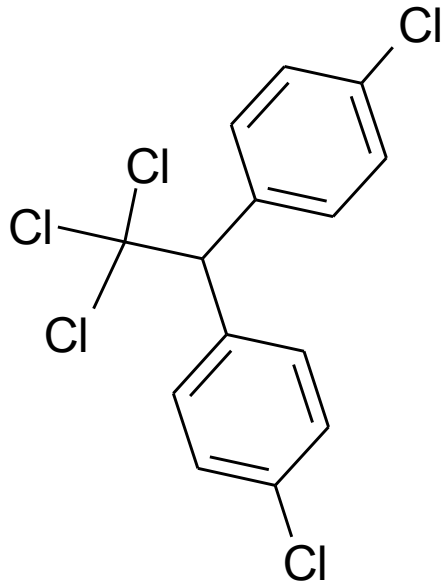
Anthelmintics

Halogenated salicylanilides



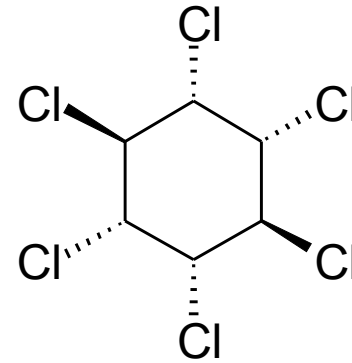
tribromsalan

3. Insecticides Chlorinated compounds



DDT

- fundamental importance for eradication of stings which spread malaria and yellow fever
- accumulated in organism and in the environment ⇒ **not used any more**



γ -hexachlorocyclohexane

lindan

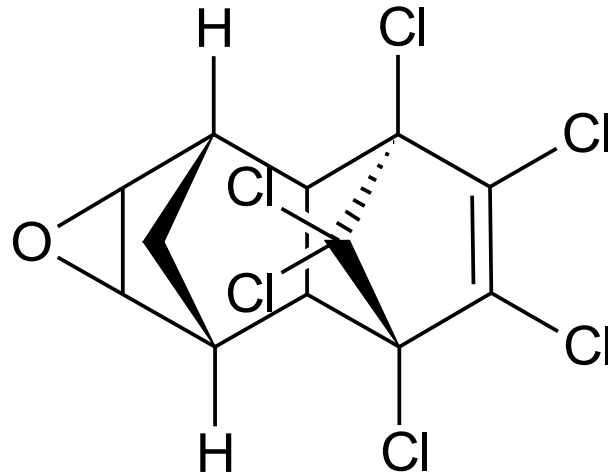
Skabacid® drm. eml.

•spectrum: *Sarcoptes scabiei*,
Phthirus pubis, louse
Pediculus capitis

•topical treatment of scabies

•contact, alimentary and inhalation neural poisons for insects

Insecticides
Chlorinated compounds



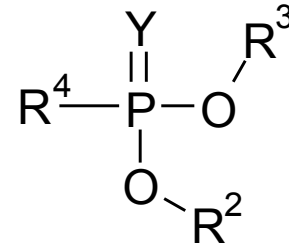
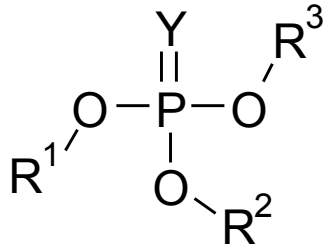
dieldrine

- mechanism of action: inhibition of GABA-receptors
- obsolete: resistance, residues in environment

Insecticides

Organic compounds of phosphorus

Esters of (thio)phosphoric acid & (thio)phosphonic acids



Y = O, S

R¹-R⁴ = alkyl, aryl

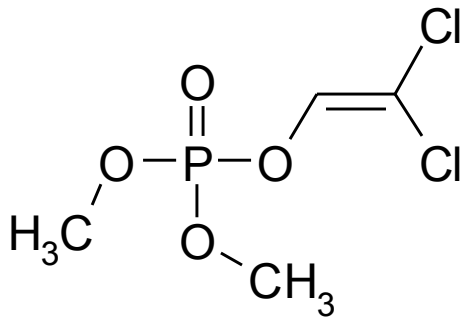
**organophosphates,
organophosphothioates**

**organophosphonates,
organophosphothionates**

·irreversible cholinesterases inhibitors ⇒ strong parasympathomimetics

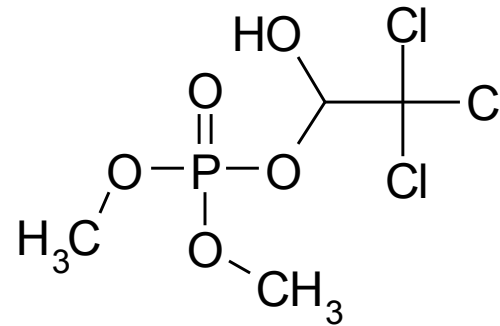
Insecticides

Organic compounds of phosphorus
Esters of phosphoric acid & phosphonic acids



dichlorvos

Nuvan Top[®] spray a.u.v.



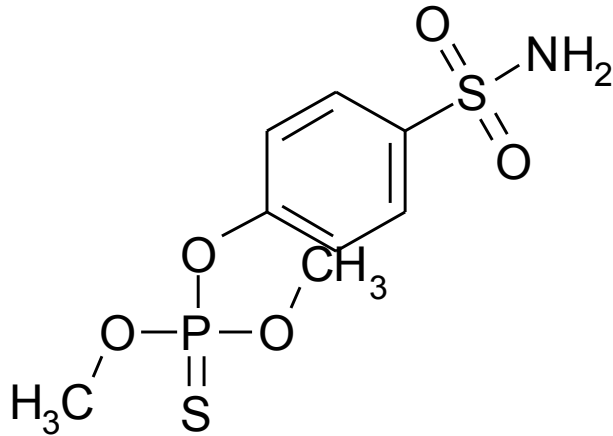
metriphosphate

syn. trichlorfon [USAN]
Arpalit[®] spray a.u.v.

- against fleas in furs (hair) of dogs and cats

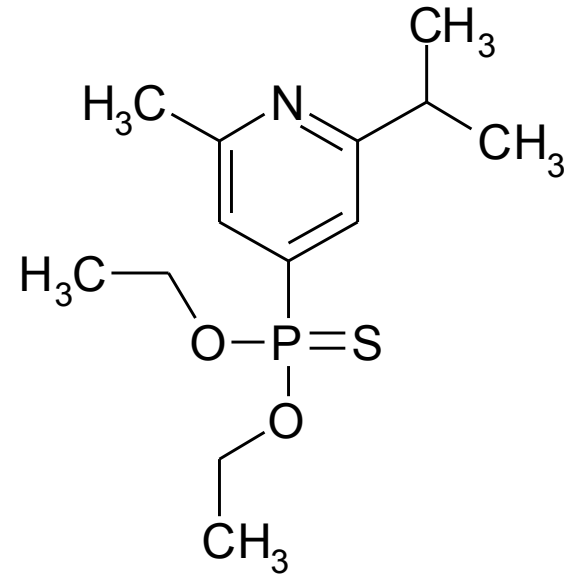
Insecticides

Organic compounds of phosphorus
Esters of thiophosphoric acid & thiophosphonic acids



cythioate

Cyffee® sol. a.u.v.



dimpylate

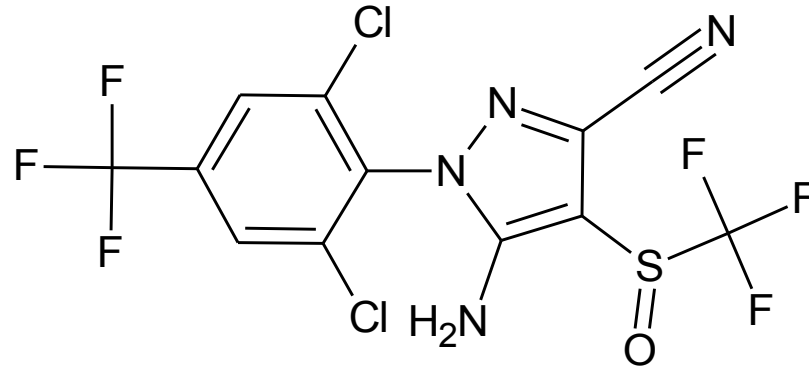
syn. diazinon

Droplix® a.u.v.

•transcutaneously absorbed, kills
parasites on whole body surface

Insecticides

Selective inhibitors of GABA-receptors

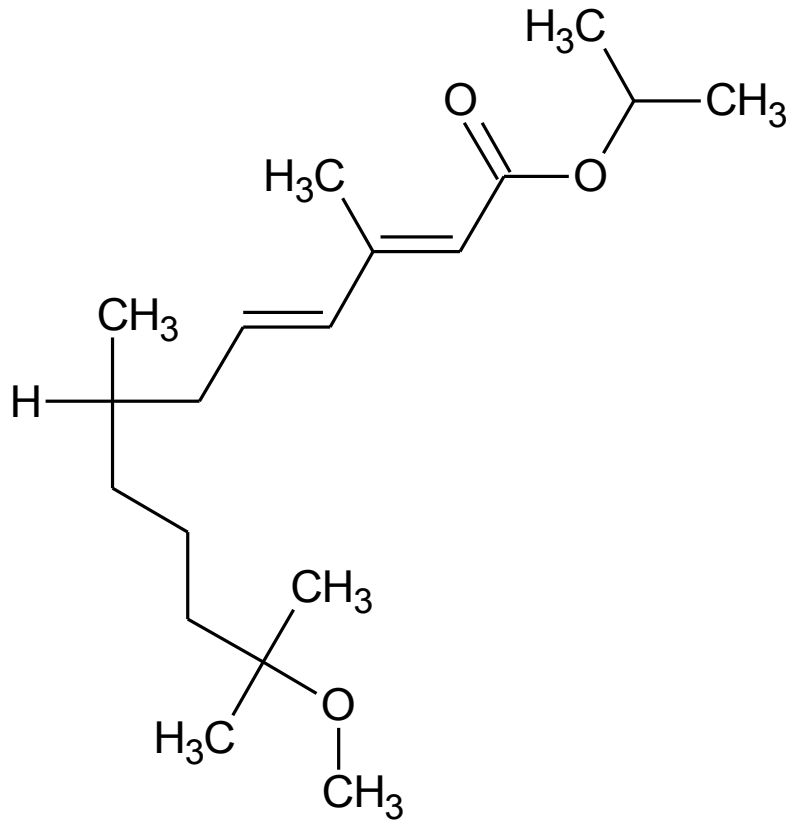


fipronil

- blocks GABA-receptors of insects which basically differs from mammalian ones in both structure and function
- highly selective toxicity for insects

Certifect® „spot-on“ pipettes (+ (S)-methoprene and amitraz) against ticks, fleas and chewing lice in dogs

Insecticides
Insect hormone analogues



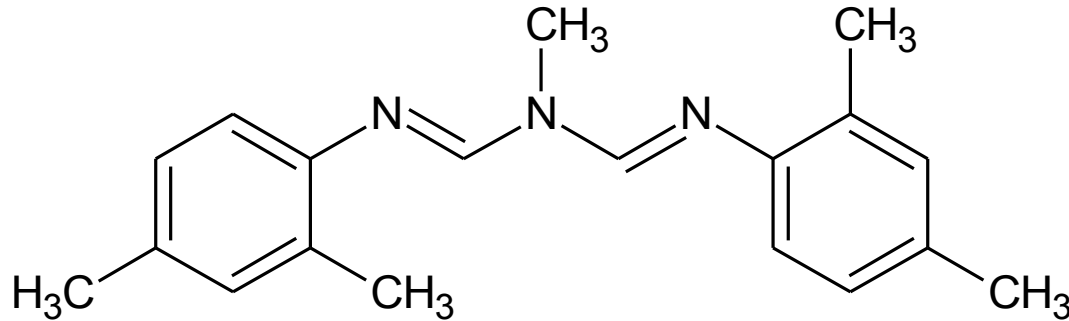
methoprene

- juvenile hormone analogue and insect growth regulator used to control insects by disrupting metamorphosis
- absorbed into flea eggs or larvae, where it stops their development
- effective also in controlling mosquito larvae

Certifect ®

Ixodecides

- kill ticks (arthropods)

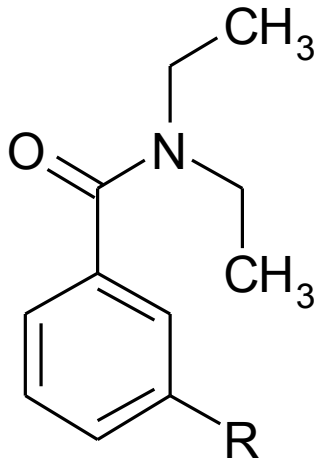


N-(2,4-dimethylphenyl)-*N*-{(*E*)-[(2,4-dimethylphenyl)imino]methyl}-*N*-methylimidoformamide
1,5-bis(2,4-dimethylphenyl)-3-methyl-1,3,5-triazapenta-1,4-diene
amitraz

- mode of action: stimulates the nervous systems of ticks, leading to hyperactivity and death of them.

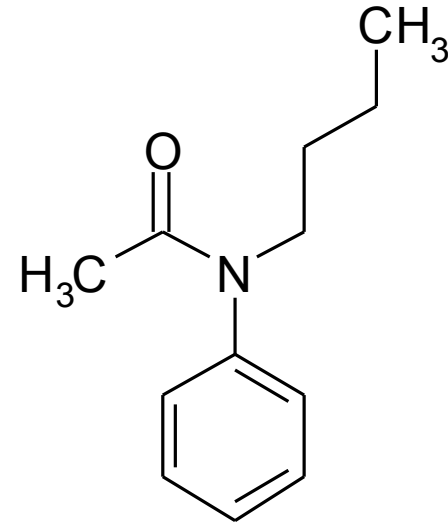
Certifect ®

Repellents



R = H
N,N-diethylbenzamide

R = CH₃
N,N-diethyl-*m*-toluamide
(= 3-methylbenzoic acid diethylamide)



N-butylacetanilide
(= N-butyl-N-phenylacetamide)

- only repel, do not kill insects and ticks
- used in repellent gels, creams and lotions in concentrations 10 – 20 %