

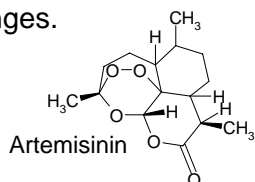


# Production of biomedicine under different climatic conditions – artemisinin as a study case

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## Aim

Risk assessment of biomedicine production in new climates – new production areas cause new environmental challenges.



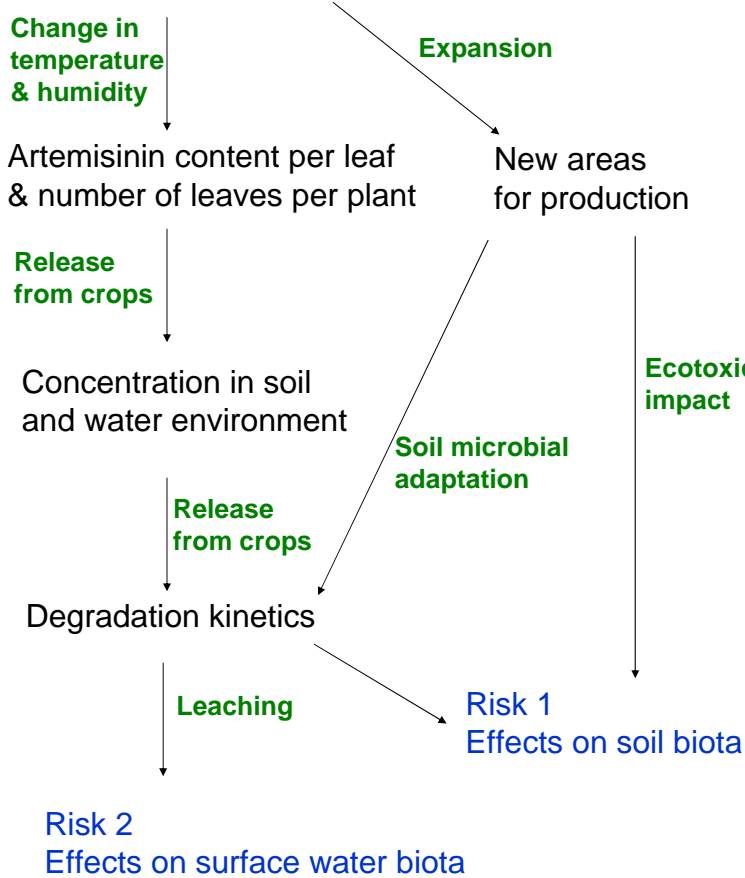
## Background

The production of biomedicine, i.e. bioactive compounds formed in plants and utilised for pharmaceutical products, requires monocultures of plants with high contents of the desired bioactive molecules for getting high yield of the bioactive substances. As well as synthetic pharmaceuticals have shown risk of serious disturbance in the aquatic environment, these naturally produced bioactive compounds can harm the environment. *Artemisia annua* producing the antimalarial bioactive compound artemisinin is a good example of such a biomedicine producing plant. Cultivation of *A. annua* is on land area basis the largest contributor to biomedicine production.

Based on the presented data the risks of adverse environmental effects due to cultivation of *A. annua* are high and comparable to the risks when using commercial pesticides.

## Climate changes affect risk of biomedicine production:

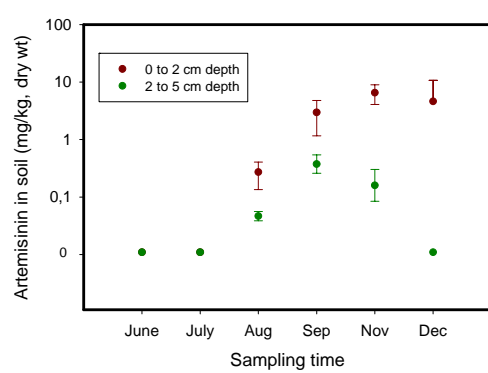
Geographical range of growth & production



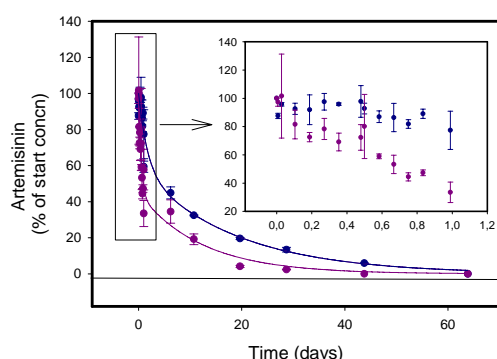
Climate change may cause introduction of these biomedicine producing plants to new environments, due to higher temperature and changed rainfall conditions. This might cause severe effects, as no adaptation to the compounds in question has occurred among organisms in that environment.

## Exposure:

Artemisinin in Danish *A. annua* field



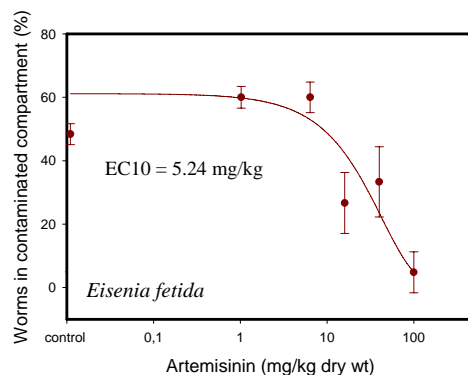
Degradation kinetics, 21±1°C



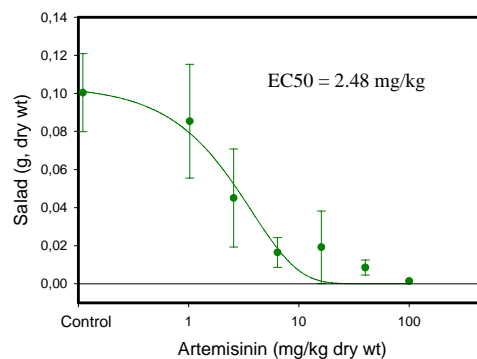
Degradation kinetics of artemisinin in sandy (blue) and loamy (purple) soils at app. 17% gravimetric moisture content. Start concn: 20 mg/kg dry wt.

## Effects:

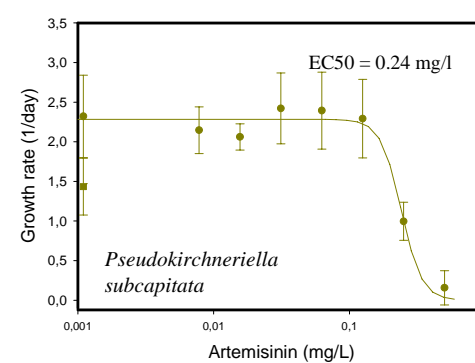
Earthworm avoidance test in sandy soil at 20°C



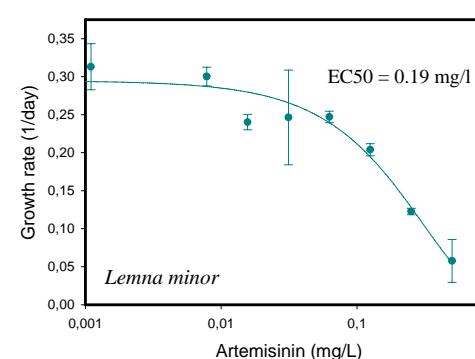
Salad growth test in sandy soil, 21 days at 18°C



Algae growth test in fresh water



Lemna test in fresh water, 25°C



## Literature

Jessing, KK, Cedergreen, N., Jensen, J. and Hansen, HCB. (2009) "Degradation and Ecotoxicity of the Biomedical Drug Artemisinin in Soil" *Environmental Toxicology and Chemistry*, Vol. 28, No. 4  
DOI: 10.1897/07-171