Acclimation of different moss species to light and ultraviolet radiation

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UV-B effects on plants

- most of the studies of UV-B effects on terrestrial plants have been done with vascular plants

- effects of UV-B radiation on plants
  - photosynthesis
  - growth
  - soluble UV-B-absorbing compounds (flavonoids)

- effects on plants and ecosystems through, for example, degradation, nutrient cycle or plant competition

Mosses

- an essential part of ground vegetation in northern ecosystems
- the moss carpet forms 55-94 % of the total biomass of the undergrowth vegetation in boreal coniferous forests
- mosses can control the function of ecosystems as a result of their rapid uptake of nutrients, high water-absorption capacity and low thermal conductivity
- the changes in the relative abundances of the dominant forest floor mosses indicate that changes have taken place in the environmental conditions – these changes affect the whole ecosystem

Mosses and UV-B

- mosses are believed to be especially vulnerable to UV-B
- they do not have the same protective means as vascular plants
  - the leaf can be only one cell layer in thickness
  - no roots to provide a buffer against aboveground stress through belowground storage of assimilates
- bryophytes absorb water and nutrients from the air
- different species respond differently

Hypotheses:

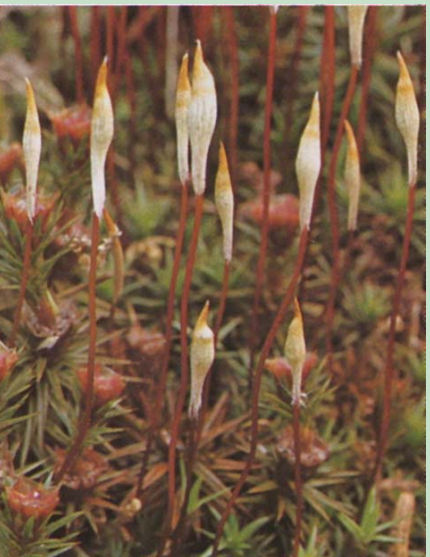
Enhanced UV-B radiation…

- slows down the growth
- increases the concentrations of methanol-extractable soluble UV-B-absorbing compounds
- reduces the concentrations of photosynthesising pigments

The main study species (in experimental research)

- Pleurozium schreberi, red-stemmed feather moss
  - Most common species in Northern forests
  - Simple structure
  - Moderate light environment

- Hylocomium splendens, mountain fern moss
  - Simple structure
  - Shade



- Polytrichum juniperinum, juniper hair cap moss
  - More complex structure
  - High light environment

Modulated open field UV-B exposure site in Northern Finland

(FUVIRC, Finnish Ultraviolet International Research Center)

- dry pine forest with moss- and lichen-cover
- lamp banks
  - UV-B treatment (cellulose diacetate filters, transmission down to 290 nm)
  - UV-A control (polyester filters, transmission down to 315 nm)
  - ambient control (wooden frames)

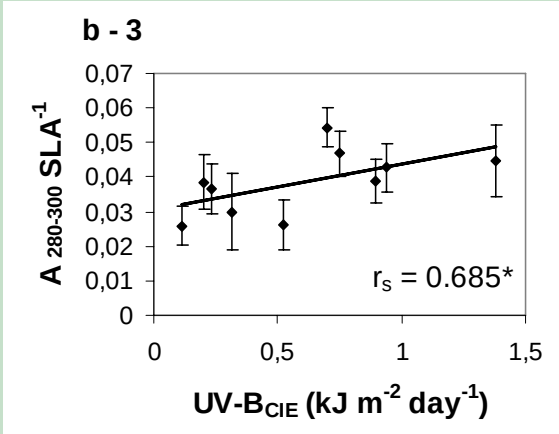
Finnish Meteorological Institute / Arctic Research Centre (FMI-ARC) and Sodankylä Geophysical Observatory (SGO), 67 ^{o}N

- a constant proportional (46%) supplemental UV-B is maintained → about 20% ozone depletion
- erythemally weighted (CIE) sensors
  - 280-370 nm (UV-B sensor)
  - 320-400 nm
- NILU-UV sensor measures UV and PAR
- temperature, precipitation
- 2002 – 2008 and still continues…

Pleurozium schreberi,
red-stemmed feather moss

- UV-B-absorbing compounds increased at 1st year and after 5th year
- biomass reduced after third year

(Lappalainen et al. 2008 CGB, Poster presented in Moss2008 meeting, Finland)

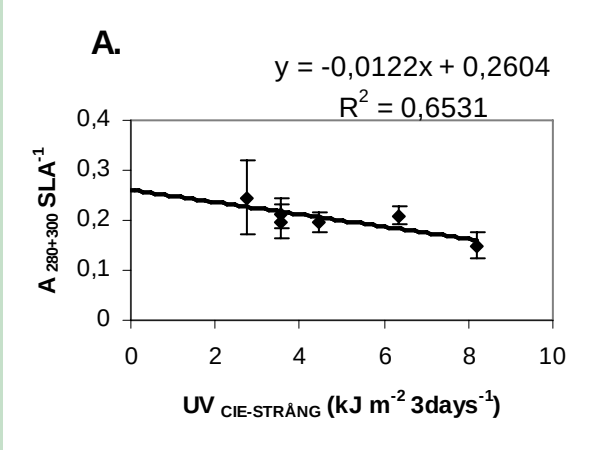


Forest site, under enhanced UV-B

Polytrichum juniperinum,
juniper hair cap moss

- After 6th year reduced biomass, larger variance in the amount of UV-B-absorbing compounds

(Poster presented in IUFRO2008 meeting, Switzerland)



Open site, ambient, STRÅNG-modelled UV radiation (SMHI)


Thank you!