Dietary acquisition of photoprotective compounds (mycosporine-like amino acids, carotenoids) and acclimation to ulraviolet radiation in a freshwater copepod

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ABSTRACT: We experimentally tested the hypothesis that accumulations of dietary compounds such as carotenoids or UVabsorbing mycosporine-like amino acids (MAAs) protect against natural levels of ultraviolet radiation (UVR). A calanoid copepod, *Leptodiaptomus minutus*, was collected from a relatively UV-transparent lake in Pennsylvania where levels of copepod MAAs and carotenoids vary during the year (MAAs high/carotenoids low in summer). Animals raised in the laboratory under different diet/UVR treatments accumulated MAAs from an MAA-producing dinoflagellate but not from a cryptomonad that lacks them. The acquisition efficiency increased under exposure to UVR-supplemented photosynthetically active radiation (PAR, 400-700 nm), yielding MAA concentrations up to 0.7% dry weight compared with only 0.3% under unsupplemented PAR. Proportions of individual MAAs differed between the animals and their diet. Shorter wavelength absorbing palythine and shinorine (λ_{max} 320 and 334 nm, respectively) were disproportionately accumulated over usujirene and palythene (λ_{max} ca. 359 nm). Carotenoids accumulated under UVR exposure (to 1% dry weight) when dietary MAAs were not available. Tolerance of ultraviolet- B (UV-B) radiation was assessed as LE_{50}s (UV exposure giving 50% mortality after 5 d) following 12-h acute exposure to artificial UV-B radiation. LE_{50}s increased 2.5-fold for UV-acclimated, MAA-rich animals, but only 1.5-fold for UV-acclimated, carotenoid-rich animals. Compared with carotenoids, MAAs offer this copepod a more effective photoprotection strategy, potentially as important as photorepair of DNA damage, to promote tolerance of natural levels of UV-B radiation.

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