LETHAL EFFECTS OF ULTRAVIOLET RADIATION UNDER DIFFERENT
CONCENTRATIONS OF DISSOLVED ORGANIC CARBON ON
NEOBOSMINA CHILENSIS (DADAY, 1902) (CLADOCERA, BOSMINIDAE)

BY

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ABSTRACT

The increase in the penetration of ultraviolet radiation that has been reported lately for freshwater
ecosystems in southern South America, would allegedly generate alterations in ecological processes.
In the present study, the mortality of Neobosmina chilensis (Daday 1902), a small cladoceran
distributed in South American lakes and ponds, was studied in this respect. Specimens were reared
in five different concentrations of dissolved organic carbon, and subjected to 24 hrs of exposure to
artificial ultraviolet radiation.

An inverse correlation between the dissolved organic carbon concentration and individual
mortality was found. This result supports the description of a screen effect of dissolved organic
carbon against ultraviolet radiation. The data obtained describe a linear relation, in which LC50
corresponded to 4.43 mg/l of dissolved organic carbon. The ecological implications of this result are
discussed.

RESUMEN

El incremento de la penetración de la radiación ultravioleta ha sido reportado para ecosistemas
lacustres en el sur de Sudamérica, y genera alteraciones en procesos ecológicos. En el presente
trabajo, se estudió la mortalidad de Neobosmina chilensis (Daday, 1902), un cladócero de pequeño
tamaño corporal distribuido en lagos y lagunas de América del Sur. Los especímenes fueron
mantenidos por 24 horas bajo cinco concentraciones de carbono orgánico disuelto, y con exposición
da radiación ultravioleta artificial.

Se observó una relación inversa notoria entre la concentración de carbono orgánico disuelto y la
mortalidad individual. Este resultado respalda la propuesta que el carbono orgánico disuelto genera
un efecto protector contra la radiación ultravioleta. Los resultados describieron LC50 correspondió a
4.43 mg/l de carbono orgánico disuelto. Se discutieron las implicancias ecológicas de los resultados
obtenidos.
INTRODUCTION

In recent years, an increase in the penetration of ultraviolet radiation has been reported, caused by a decrease in atmospheric ozone. In South America, this situation was mainly studied for Patagonia (Cabrera et al., 1995; Villafañe et al., 2001) and for some mountain zones (Villafañe et al., 1999; Helbling et al., 2002). These changes in the penetration of ultraviolet radiation induced alterations in freshwater ecosystems, resulting in physiological changes in plankton organisms, which are partly reflected in protective and/or reparative responses (Hebert & Emery, 1990; Villafañe et al., 2001). A natural protective resource against ultraviolet radiation is dissolved organic carbon, which is able to absorb different wavelengths within the ultraviolet spectrum (Morris et al., 1995), and which thus can act as a protective "screen" for the plankton (Williamson et al., 2001; Rautio & Korkhola, 2002a, b; De los Ríos, 2003). This interaction between ultraviolet radiation and dissolved organic carbon can also have another positive effect, because it generates molecules that are used by bacteria, and these bacteria are again grazed upon by the zooplankton (Reche et al., 1998). On the other hand, it can also cause a negative effect, because this interaction would cause the production of peroxides and reactive oxygen substances unfavourable for zooplankton organisms (Reche et al., 1998).

The presence of shallow ponds with high concentrations of dissolved organic carbon had been reported for mountains lakes in northern Chile (De los Ríos, 2003), and southern Patagonia (Morris et al., 1995; De los Ríos, 2003), whereas, in contrast, in southern Patagonia there are also great lakes with a notoriously low level of dissolved organic carbon (Soto & Campos, 1995; Morris et al., 1995; De los Ríos, 2003).

Crustacean zooplankters exhibit different responses to the exposure to ultraviolet radiation. Thus, in the deep and pristine lakes where there is a high penetration of ultraviolet light, the zooplankton makes vertical migrations to depth zones without ultraviolet radiation (Storz & Paul, 1998; Rhode et al., 2001; Villafañe et al., 2001). One typical species from deep lakes and shallow ponds is Neobosmina chilensis (Daday, 1902), distributed mainly in Patagonia (Campos, 1984; Ruiz & Bahamonde, 1989; Soto & Zúñiga, 1991; De los Ríos, 2003). In the present study, the effectiveness of dissolved organic carbon, acting as a protective screen against ultraviolet radiation was determined experimentally, by monitoring, in different concentrations, the survival of N. chilensis.

MATERIAL AND METHODS

The experiment was done in the Photobiology Laboratory of the Comahue National University in Bariloche, southern Argentina. A water sample with a high