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Nested assemblage structure of caddisflies (Insecta: Trichoptera) inhabiting in North-Hungarian streams

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ABSTRACT: Nested assemblage structure of caddisflies inhabiting in North-Hungarian streams supported the assumption that their species diversity could be maintained through the protection of species rich sites.

The Northern Mountains in Hungary is a group of isolated mountains of diverse geological origin. Some of the mountains are volcanic while others are limestone. Deciduous forests dominate the vegetation and numerous streams providing habitats for freshwater insects (MÓRA & CSABAI 2002, 2003, CSABAI et al. 2003), such as the caddisflies. In fact, the Trichoptera fauna of the Northern Mountains is rich (UHERKOVICH & NÓGRÁDI 1992, 1994), including some rare species (NÓGRÁDI et al. 1996, 1999). To maintain diversity of caddisflies, different management strategies could be applied. In this study, I attempted to test, whether caddisfly assemblages were nested (BÁLDI 2003a, 2003b). If species rich sites include basically the same species occurring at species poor sites then the caddisfly assemblages show nested distribution. Perfect nested distribution means that species rich sites include exactly the species being present at other sites. If the caddisfly fauna shows nestedness, preserving only species rich sites can efficiently protect it. If the assemblages are not nested, i.e. species occurring at species poor sites are not present at species rich sites then a different nature conservation strategy should be applied.

Material and Methods

Börzsöny Mountains are volcanic composed mostly of *andesit* and *riolit*, the Bükk Mountains is dominantly limestone. The diverse geological origins affect runoff and also the chemical parameters of the streams. The main yearly rainfall in the Northern Mountains varies between 600-900 mm, which produce numerous streams, but only permanent streams were selected as basic data collection sites. Larval stages were selected as studied object considering that adults show species-specific dispersal ability (SWENSON 1974). It is noted that adult caddisflies have been found in light traps some kilometres apart from any watercourse (MALICKY 1987). Thus, a faunal evaluation based solely on adults could provide a biased picture.

Trichoptera larvae were collected by the quadrat method within sites shown in table 1. In the Börzsöny Mountains, larvae were collected from 15 sampling sites representing three streams. At each site 8 quadrats of 0.25 m^2 were installed within different stream habitats. Sampling sites in the same stream were approximately 3 km apart. Larvae were collected individually by disturbing the substratum of the stream from the marked sampling area monthly from May to October. The Bernecei stream was sampled in 1994 (from June onwards), the Kemence stream in 1998 and the Morgó stream in 1999 (both from May to October). The identification of the larvae collected in the Börzsöny Mountains was based on the work of WARINGER & GRAF (1997). For the Bükk Mountains, caddisfly data collected by a similar method by KISS (1991) and KISS et al. (1998) were used. In their streams, eight sites were sampled, using a 0.5 m^2 quadrat.

The Nestedness Temperature Calculator (ATMAR & PATTERSON 1993, 1995) was used to measure the nested distribution of caddisfly assemblages within the different regions. The concept of nestedness is based on the extent of order or disorder in a presence-absence matrix of the species, measured through "system temperature" (*T*). A perfectly nested (ordered) community has *T*=0, and a maximally disordered one *T*=100. As the nestedness depends on the fill of the matrix (sampling sites×species), Monte Carlo randomisations (500 runs were used) of the data matrix were used to measure the probability (*p*) that a result, like the one actually obtained could come about by chance. If the obtained value was lower than that of the randomly generated assemblage, the assemblage was nested declared.

Results and Discussion

Caddisfly larvae are significant components of stream ecosystems (GILLER & MALMQVIST 1998) and are present in high numbers both as species and as individuals (MALMQVIST & HOFFSTEN 2000). The caddisfly fauna of the Northern Mountains is species rich, with marked differences between the regions (UHERKOVICH & NÓGRÁDI 1994). In total, 23 caddisfly species were found in the Börzsöny Mountains based on larval sampling while 21 in the Bükk Mountains. Several conservation strategies could be applied to maintain diversity of caddisflies. Nestedness analysis (*Table 2*) shows that larval assemblages are nested both in the Börzsöny and Bükk Mountains. Based on the results, species diversity of caddisflies in the Northern Mountains could be maintained through the protection of species rich sites. In contrast, another study examining stream dwelling caddisfly assemblages collected by light traps in Hungary suggests that rare caddisflies are not necessarily present in species rich assemblages, thus the maintenance of rare caddisfly species could not be supported through the protection of species rich sites (SCHMERA 2003).

Table 1. Information about sampling sites

Mountains	Stream	Number of sampling sites	Reference
Börzsöny	Bernecei stream	5	SCHMERA (1999)
Börzsöny	Kemence and Morgó streams	10	Unpublished
Bükk	Ablakoskő and Nagy Valleys	8	KISS (1991)
Bükk	Hosszú Valley	8	KISS et al. (1998)

Table 2. The results of nestedness analysis (*S*: total number of species, *fill*: fill of the presence/absence matrix in %, *T*: system temperature, *calc. mean T*: mean of the calculated system temperature based on Monte Carlo randomisations, *SD*: standard deviation of the randomised values, *p*: probability of the obtained temperature)

Mountains	*S*	*fill*	*T*	*Calc. mean T*	*SD*	*p*
Börzsöny	23	24.0	17.62	46.7	6.85	$1.13*10^{-5}$
Bükk	21	44.3	38.35	58.39	5.35	$9.12*10^{-5}$

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