NOTE BRÈVE

THE ROLE OF WATERCOURSE FEATURES AND OF LANDSCAPE STRUCTURE IN THE DISTRIBUTION OF TRICLADS INHABITING HEAD WATERS: THE EXAMPLE OF *POLYCELIS FELINA*

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RÉSUMÉ. — *Le rôle des caractères du cours d'eau et de la structure du paysage sur la distribution des triclades dans le haut des cours d'eau : l'exemple de* Polycelis felina. — Le triclade *Polycelis felina* est un taxon intéressant par son rôle de bioindicateur important dans les cours d'eau et les petits environnements lotiques. Des informations ont été recueillies sur sa distribution dans les cours d'eau de la partie sud de la province de Lecco (N Italie) afin d'obtenir une image claire de ses préférences biologiques et écologiques et des particularités des biotopes dans lesquels on le trouve. Au total 194 sites sur 110 cours d'eau ont été prospectés durant la campagne de terrain menée en 2005 et 2006. Des populations de *P. felina* furent trouvées dans 26 % des sites visités. Les rôles respectifs, quant à la présence de *P. felina,* de la morphologie naturelle du cours d'eau, de la qualité de l'eau, et d'autres facteurs (tels la présence d'autres triclades, d'écrevisses et de larves de *Salamandra salamandra*) ont été analysés.

The ecological studies of macro-benthic taxa inhabiting watercourses mainly deal with organisms related to human activities and traditions, such as fishes and freshwater crayfishes, with less papers related to inconspicuous and less known organisms like Triclads. The ecological studies dealing with these latter, and especially with species inhabiting lotic habitats, are few and often out of date. However, Triclads can play an important role in watercourse ecosystems and are often very important as bio-indicators (Tachet, 2002).

In this context our paper presents information about the ecology of the stream-dwelling triclad *Polycelis felina* Dalyell 1814 collected during a survey of the watercourses in the southern part of the Lecco district (Lombardy, Italy). In Italy the genus *Polycelis* occurs with three species such as *P. nigra* (Muller 1774) and *P. tenuis* Ijima 1884 inhabiting lakes, ponds, marshes and rivers and *P. felina* distributed in streams, brooks, creeks with slow flowing and in different typology of springs (Campaioli *et al.,* 1994; Sansoni, 2001; Manenti, 2003).

In spite of many laboratory studies about *P. felina* tolerance to many chemical substances or to experimental conditions (i.e. Kouyoumjian & Uglow, 1974; Brown *et al*., 1988; Kopjar *et al*., 2005), field studies on the ecology of this species are less frequent. Interesting data about the distribution and the ecology of some triclads, including *P. felina,* in the freshwater habitats

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of North Wales and in the springs of central Pyrenees are provided by Wright (1972, 1974) and Roca *et al*. (1992). Lock (1975) studied the role of gradient and substratum in the distribution of *P felina* in the watercourses of North Wales, finding that it had a much reduced ability to colonize the simulated steep-gradient bottoms and suggesting that the absence of *P. felina* from the steep-gradient regions of streams in North Wales is due to a behavioural inability to tolerate the current regimes present in the steep-gradient bottoms.

The purpose of our research was to obtain a clear picture of the distribution of *P. felina* in the watercourses of the studied area and of its ecological and biological preferences in order to increase the knowledge about this taxon.

MATERIAL AND METHODS

STUDY AREA

The study area (Fig. 1) covers the whole of the southern part of the Lecco province which has a continental climate. It is comprised in the catchment basins of the Lambro and Adda rivers. It is characterized by hilly and mountainous reliefs with a good cover of broadleaved woodlands. It has a diversified orographic structure and is crossed by a lot of watercourses which make up a dense hydrographic network characterized by different typologies of water bodies such as creeks, streams, brooks, resurgences and rivers. However, ongoing urban and industrial development is increasingly modifying the landscapes.

SURVEYS

For two consecutive years from 2005 to 2006 field investigations were carried out in all the watercourses of the area. We identified sampling localities on the basis of 1 : 25 000 or 1 : 10 000 topographical maps or by the direct exploration of the territory with no lotic water body being excluded *a priori*. Their elevation was 200-642 m above sea level, and was therefore within the usual range of the species (Tachet, 2002).

P. felina specimens were searched during the day performing samplings by moving the substrate for 5-10 minutes and using a thin-mesh dip net to collect the planarians, by hand lifting stones, observing the substrate elements and catching materials of the bottom of the watercourses. Every site has been observed at least twice during the study period.

HABITAT CHARACTERIZATION

Sites were described by compiling a table of characteristics based on rapid bio-assessment protocols (Barbour *et al*., 2002) that includes parameters for the biological and ecological requirements of triclads (Tachet, 2002) and items referring to water quality and site resilience.

We recorded surrounding habitat characteristics on the basis of the 1 : 10 000 Vector Map of Lombardy, using the ArcView 3.2 GIS. In several studies it has been demonstrated that landscape structure plays an essential role in affecting the occurrence of stream-dwelling organisms such as salamanders (Ficetola *et al.*, 2009; Manenti *et al.*, 2009) and crayfishes (Nardi *et al*., 2005).

The status of aquatic macro-invertebrates communities was evaluated according to the EBI protocol (Ghetti, 1997) in 142 sites; a score ranging from 1 to 14 permits to put the macro-benthic communities into 5 categories indicating water quality, from I (unaltered macro-benthic community) to V (completely altered macro-benthic community).

In addition we evaluated the occurrence of other triclads and two other biotic parameters such as the occurrence of the autochthonous crayfish *Austropotamobius italicus* (Faxon 1814) and of the larvae of the amphibian *Salamandra salamandra* (Linnaeus 1758) in order to establish some possible correlation between the triclad and two of the most representative organisms in the watercourses biomass. Data on crayfish occurrence were extrapolated by Manenti (2006) while those on *S. salamandra* occurrence were taken from part of the data of Manenti *et al.* (2009). We cross-refered to those studies for further information on these species detectability.

RESULTS

We investigated 194 sites on 110 watercourses. *P. felina* has been observed in 51 of them while in the other 143 sites the species has not been found (Fig. 1). *P felina* was detected at an altitude varying from 251 to 815 m a.s.l. with a majority of observations (37.3 %) taking place in the altitudinal range included between 301 and 350 m a.s.l. (Fig. 2). The altitudinal maximum of 815 m a.s.l. is reached in the central hilly part of the studied area.

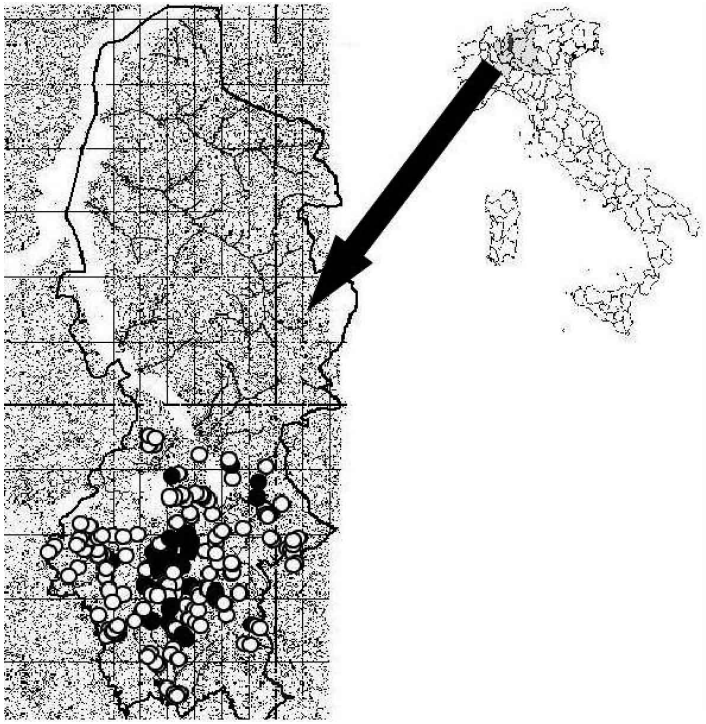

Figure 1. — Distribution of *Polycelis felina* in the southern part of the Lecco district. ○ = negative sites, ● = positive sites.

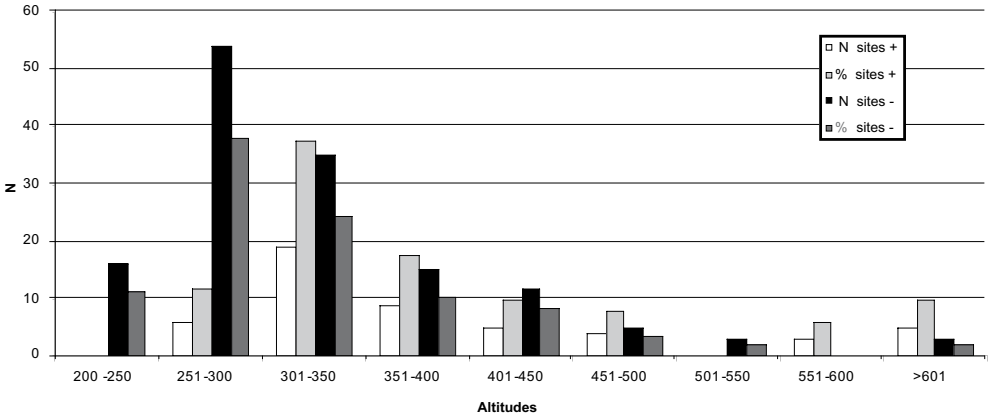

Figure 2. — Presence (+) and absence (-) of *Polycelis felina* according to altitude intervals.

Speaking about environmental parameters in figures 3 & 4 it is possible to appreciate that most of the *P. felina* populations (77 %) were found in sites with a river course highly diversified and a high variety of substratum, corresponding to a great availability of shelters, while in negative sites percentages of the different typologies are more equally distributed.

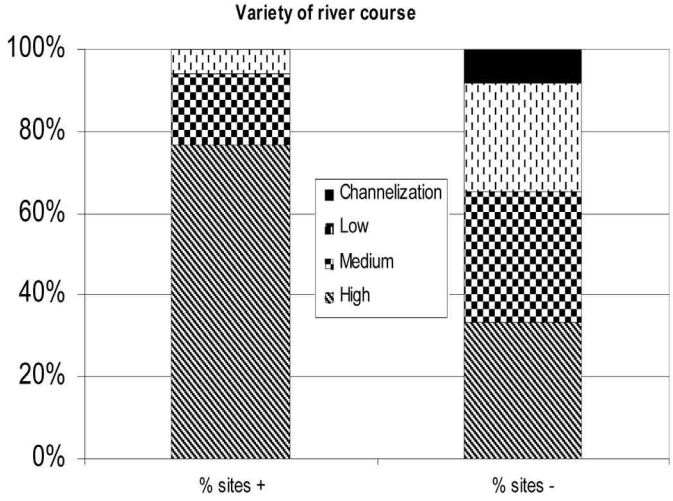

Figure 3. — Presence (+) and absence (-) of *Polycelis felina* according to the variety of the river course.

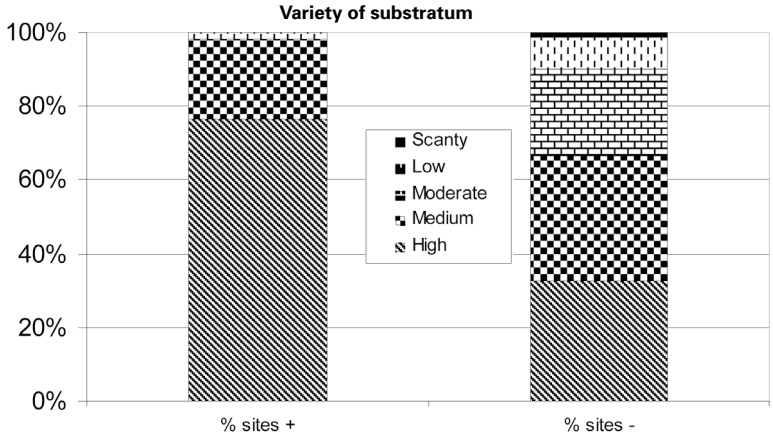

Figure 4. — Presence (+) and absence (-) of *Polycelis felina* according to the variety of the substratum.

It has not been possible to apply the EBI protocol at 79 sites that in some cases were temporary or too close to springs while in others the superficial water flow was fragmented into isolated pools or the flow velocity was near 0. Nevertheless, *P. felina* was more frequent where biological quality of the water was better; in any case it is interesting to note that this species was found in some (2.6 %) polluted sites (EBI class III) with an EBI score of almost 7 (Figs 5 & 6).

Most *P. felina* populations were found in wooded areas (64.7 %) and agricultural ones (31.4 %); however few of them (3.9 %) survive in artificial areas characterized by urban development. In the watercourses we observed, the only other triclad found was the genus *Dugesia*; none of the sites inhabited by *Dugesia* sp. housed also *P. felina.*

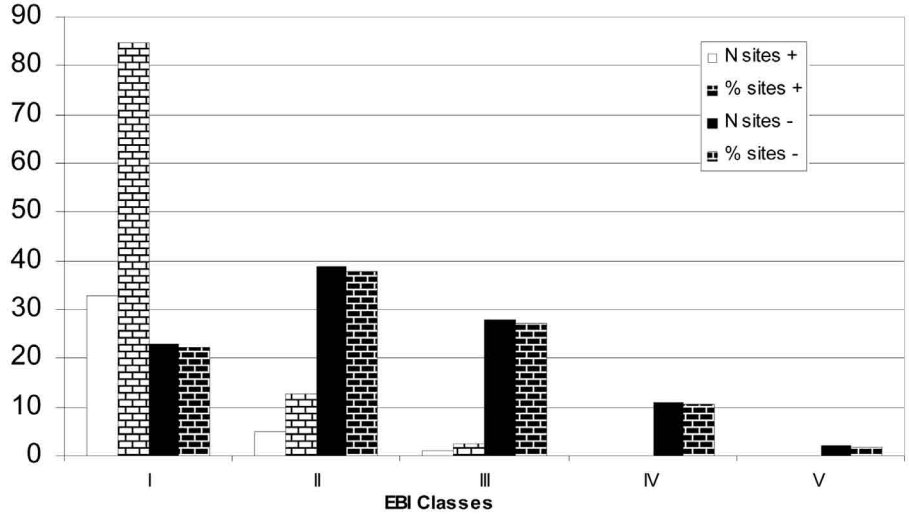

Figure 5. — Presence (+) and absence (-) of *Polycelis. felina* according to the biological quality of the site expressed in EBI classes (Ghetti, 1997).

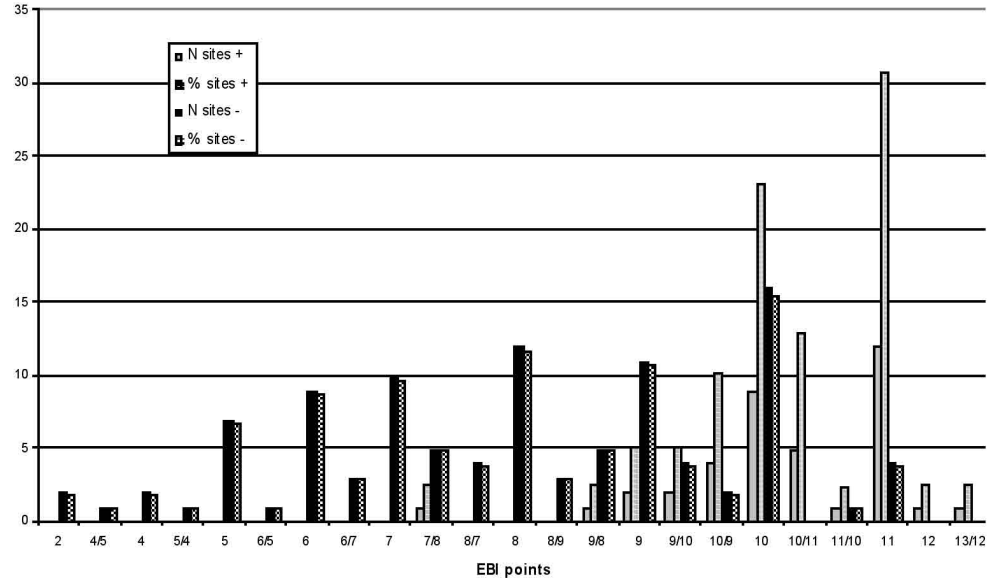

Figure 6. — Presence (+) and absence (-) of *Polycelis felina* according to the biological quality of the site expressed in EBI scores (Ghetti, 1997).

A great percentage of the sites positive to *P. felina* were inhabited by autochthonous crayfishes (86.3 %) and used for deposition by *Salamandra salamandra* (80.3 %) while negative sites were 75.5 % and 68 % without these taxa respectively (fig. 7).

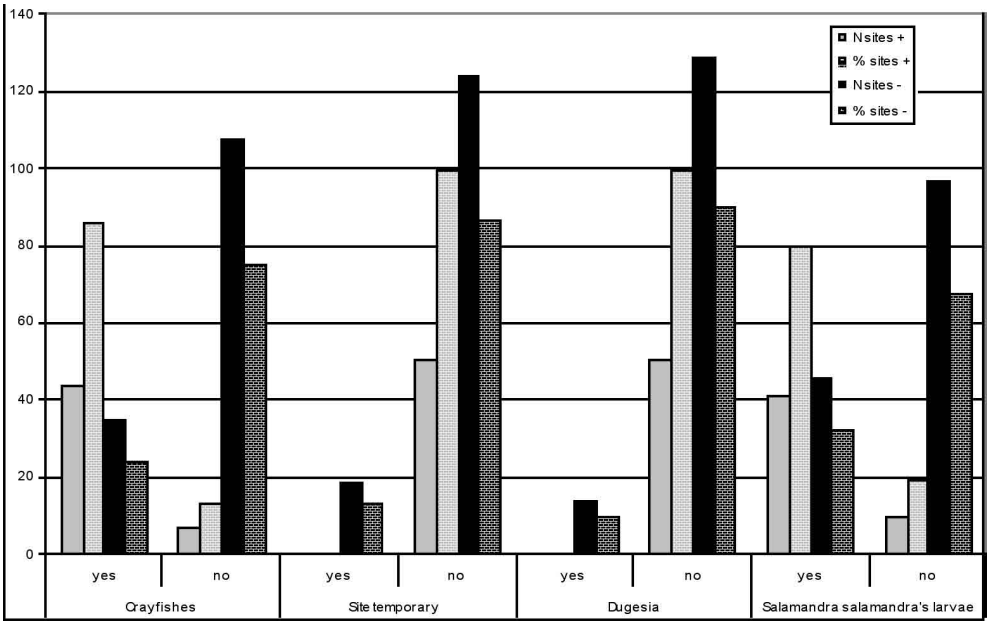

Figure 7. — Presence (+) and absence (-) of *Polycelis felina* according to some biological and ecological factors.

DISCUSSION

This comprehensive survey of *Polycelis felina* throughout the lotic biotopes of the hydrographic system of the southern part of the Lecco province has increased the knowledge of the distribution of this elusive species.

Data about the altitudinal distribution of the species must be attentively considered because in the studied area sites located above 600 m a.s.l are few, and it might be possible that in this range the percentage of positive sites exceeds that of the negative ones. In any case *P. felina* seems to be absent from sites situated below 251 m a.s.l., showing a preference for the hilly district of the province. Talking about water quality, *P. felina* was found to be more versatile than its Biotic Score (Ghetti, 1997) lets usually think, with some findings in condition of pollution and with not optimal macro-benthic community, even if the great percentage of sites inhabited by this triclad remains in a situation of unpolluted water. Interesting are the data about the variety of the river course and of the substratum that show the high diversity reached by the greatest part of the sites where *P. felina* lives. This fact, together with the indication resulting from the analysis of the land cover classes where positive sites are located, suggests the importance of human impact in determining the distribution of this species not only by watercourses pollution, but also by affecting the landscape structure. Comparison with the occurrence of the crayfish *Austropotamobius italicus* and of the larvae of *S. salamandra* shows the affinity between these taxa in habitat preferences. Also for the latter has been evidenced the importance of a high percentage of wood cover around the damp biotopes (Nardi *et al.,* 2005; Fietola *et al*., 2009; Manenti *et al*., 2009).

The number of sites where the genus *Dugesia* occurs is not so relevant, but gives in any case an indication about a possible competition and incompatibility between these triclads.

The results of this study although increasing the knowledge about *P. felina* suggest that further investigation of the habitat requirement are necessary to better define the importance of this taxon in the maintenance of freshwater biodiversity.

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