COLONIZATION OF ARTIFICIAL SUBSTRATES BY EPHEMEROPTERA: FIRST STAGES

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ABSTRACT

In order to evaluate the colonization in a temporary river, a sampling program was designed in 6 collecting places all along the river Degebe (Guadiana basin) during 1988 in Winter, Spring, Summer and Autumn.

Mesh bags filled with 2500 cm³ of brickbad were used as artificial substrates.

Cloen schoenemundi, *Cloen simile*, *Caenis luctuosa*, and *Choroterpes picteti* were the most abundant species.

The propensity of Ephemeroptera species to colonize the artificial substrates by drift as well as by movements over the substrate is discussed.

INTRODUCTION

The "stream macroinvertebrates communities are structured assemblages of individual populations in a state of dynamic equilibrium" (Minshall & Hildrew, 1985). At the same time, a loss of organisms into the water column is accompanied by a permanent recolonization of the bottom, thus, contributing for a continuous redistribution of the stream benthos (Townsend & Hildrew, 1976).

The denuded areas of the stream bed can be colonized by drift as well as by movements over the substrate (Bird & Hynes, 1981; Townsend & Hildrew, 1976). Although Benzie (1984) results point out to a random nature of the colonization, drift seems to be the most important one (Bishop & Hynes, 1969; Elliot, 1971; Townsend & Hildrew, 1976; Bird & Hynes, 1981).

The propensity of the different taxa for moving in drift or over the substrate is different (Bournaud *et al.*, 1978; Townsend & Hildrew, 1976; Hart & Resh, 1980; Bird & Hynes, 1981). The propose of this study is to evaluate the relative importance of these two behaviours on the colonization process, for Ephemeroptera species.

THE STUDY AREA

The River Degebe is a tributary of River Guadiana. It flows from Northwest to Southeast for c. 79km. The difference in altitude between spring and mouth is c. 250m (325m vs. 75m) which mean an average slope of 3%.

The river flow shows a wide variation all over the year, with Winter flood and Summer flow interruptions clearly connected with the well marked seasonally of rainy and dry periods.

MATERIAL AND METHODS

The colonization experiments took place in 6 collecting places all along the river, and covering 6 different ecological situations (fig.1).

- A, a peneplain area without riparian vegetation and presence of macrophytes;

Fig.1. Study area with the 6 collecting places.

- B, a canopy area;
- C, a shifting feature between lotic and lentic ecosystem;
- D, a lentic ecosystem;
- E, an area with riparian vegetation, macrophytes and wood debris, just downstream the dam;
- F, an area with rocky slopes almost without riparian vegetation and macrophytes.

The study was carried out during 1988 in Winter, Spring, Summer and Autumn.

Mesh bags filled with 2500cm³ of brickbad (6x8cm) were used as artificial substrates. In order to evaluate the way of colonization, two artificial substrates were used: one on the bottom (B) and the other on a support (S) which enables the contact with the bottom.

During one month 15 samples were performed, in each season and collecting place. The two artificial substrates were removed, brushed to plastic containers, sieved with a special designed device and the macroinvertebrates preserved with a 40% formalin solution. The two artificial substrates were replaced again on the river bed.

The bottom substrate (B) is colonized by drift as well as by movements over the substrate, while the suspended one (S) is colonized by drift only. The the bottom substrate (B) represents the total colonization, so the average ratio of the number of macroinvertebrates present on the suspended substrate to those from the bottom substrate (S/B) is the mean drift proportion involved in the colonization (Townsend & Hildrew, 1976).

RESULTS

In the table 1, the results concerning the number of individuals in the suspended (S) and bottom (B) substrates for Ephemeroptera taxa all along the year are presented.

		WINTER	SPRING	SUMMER	AUTUMN
<i>Baetis fuscatus</i>	S	15	78	-----	2
	B	12	79	-----	6
<i>Cloen schoenemundi</i>	S	7	99	33	3
	B	5	70	40	2
<i>Cloen simile</i>	S	4	73	98	2
	B	4	45	132	14
<i>Procloen sp.</i>	S	4	17	7	9
	B	3	28	12	4
<i>Caenis luctuosa</i>	S	45	310	1045	469
	B	31	434	1309	522
<i>Choroterpes picteti</i>	S	5	53	73	-----
	B	4	60	81	-----
<i>Thraulius bellus</i>	S	-----	7	9	1
	B	-----	1	9	2
<i>Habrophlebia cf. lauta</i>	S	-----	1	-----	-----
	B	-----	3	-----	-----

Table 1: number of individuals in the suspended (S) and bottom (B) substrates all along the year.

As whole, Spring and Summer present the greatest values of number of individuals, confirming previous results (Pinto, 1988). For all the seasons, *Caenis luctuosa* is the most abundant taxa.

Thraulius bellus and *Habrophlebia cf. lauta* were excluded from this study, due to its reduced numbers.

DISCUSSION

Confirming the results of Bird & Hynes (1980) and Townsend & Hildrew (1976), the Ephemeroptera taxa, excluding *Cloen simile* in Autumn, present (S/B) ratio values higher than 0,5, which denote a propensity to colonize the substrates by drift (see table 2).

	WINTER	SPRING	SUMMER	AUTUMN	mean S/B	S.E.
<i>Baetis fuscatus</i>	1,25	1,14	-----	0,33	0,91	0,36
<i>Cloen schoenemundi</i>	1,40	1,40	0,82	1,50	1,28	0,18
<i>Cloen simile</i>	1,00	1,62	0,74	0,14	0,87	0,35
<i>Procloen</i> sp.	1,30	0,61	0,58	2,25	1,19	0,45
<i>Caenis luctuosa</i>	1,45	0,71	0,79	0,90	0,96	0,19
<i>Choroterpes picteti</i>	1,25	0,88	0,91	-----	1,01	0,15
mean S/B	1,28	1,06	0,77	1,02		
S.E.	0,07	0,17	0,06	0,39		

Table 2: (S/B) ratio values for the different seasons and its mean values for each taxa and each season. (S.E. = Standard error).

Bird & Hynes (1980) point out (S/B) ratio values between 0,89 and 0,94 for Ephemeroptera taxa. The wide of variation in this study bigger (0,58-2,25), probably as a result of the heterogeneity of the ecological situations.

The low value for *C. simile* in Autumn may result from an aggregated distribution of the community at collecting place A. With some more samples, this value will be certainly higher.

The higher mean value of (S/B) ratio in Winter, and the lowest one in Summer, according to previous works (Dimond, 1967; Waters 1969; Elliot, 1971; Bird & Hynes, 1981; Ciborowski, 1987), suggests a positive correlation between the current and the drift.

The drift seems to be the most important way of colonization, even during the Summer with absent current. An accentuated influence of the swimming behaviour on the colonization process during Summer (58% to 91%), is emphasized by those results. A respiratory stress due to the low values of dissolved oxygen in Summer will be, probably, an explanation to this situation (Minshall & Winger, 1968; Wiley & Kohler, 1980).

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