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Phytomicrofauna of pampasic lotic environments (Argentina)*

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Abstract

During 1985–1986, twelve rivers and streams belonging to the Delta Sub-basin (Río de la Plata estuary Basin, Argentina) were sampled for microfauna associated with fifteen species of aquatic macrophytes. A total of 171 species were determined. Ciliates and rotifers were most abundant. Dissimilarities in the colonization of the macrophytes were demonstrated. Water level and current influenced the periphyton community and contributed to the differences observed.

Introduction

In Argentina, the study of the microfauna associated with aquatic macrophytes has received little attention (Seckt, 1924; Dioni, 1962; Claps, 1984).

For the present work, several lotic environments from the northeastern part of Buenos Aires province were sampled. Rivers and streams from this area had not previously been studied from a biological point of view.

Aquatic macrophytes are common along the margins of rivers and streams where water current is low and temperature and light conditions are more or less stable. They are important in providing shelter and spawning sites for a diversity of animals (Moon, 1936; Westlake, 1975), offering a much larger number of habitats than the open water (Pennak, 1966; Eminson & Moss, 1980).

The purpose of this study was to characterize and classify the Delta Sub-basin lotic environments by means of the microfauna of the periphyton, and to investigate the preference of this microfauna for different macrophyte species.

Study area

The study area is located in the NE of Buenos Aires province. According to Frenguelli (1950) the region belongs to 'pampa baja'. The group of lotic water bodies is defined as the Delta Sub-basin belonging to the Río de la Plata estuary (CFI, 1962).

Fourteen stations were selected: Luján (stations 1 and 2), Arroyo del Medio and Baradero rivers; Pescado, Cañada Honda, Del Tala (stations 1 and 2), Las Hermanas, Ramallo, Burgos, Luna, Giles and De La Cruz streams (Fig. 1).

Areco and Arrecifes rivers were excluded from this investigation because of lack of macrophytes.

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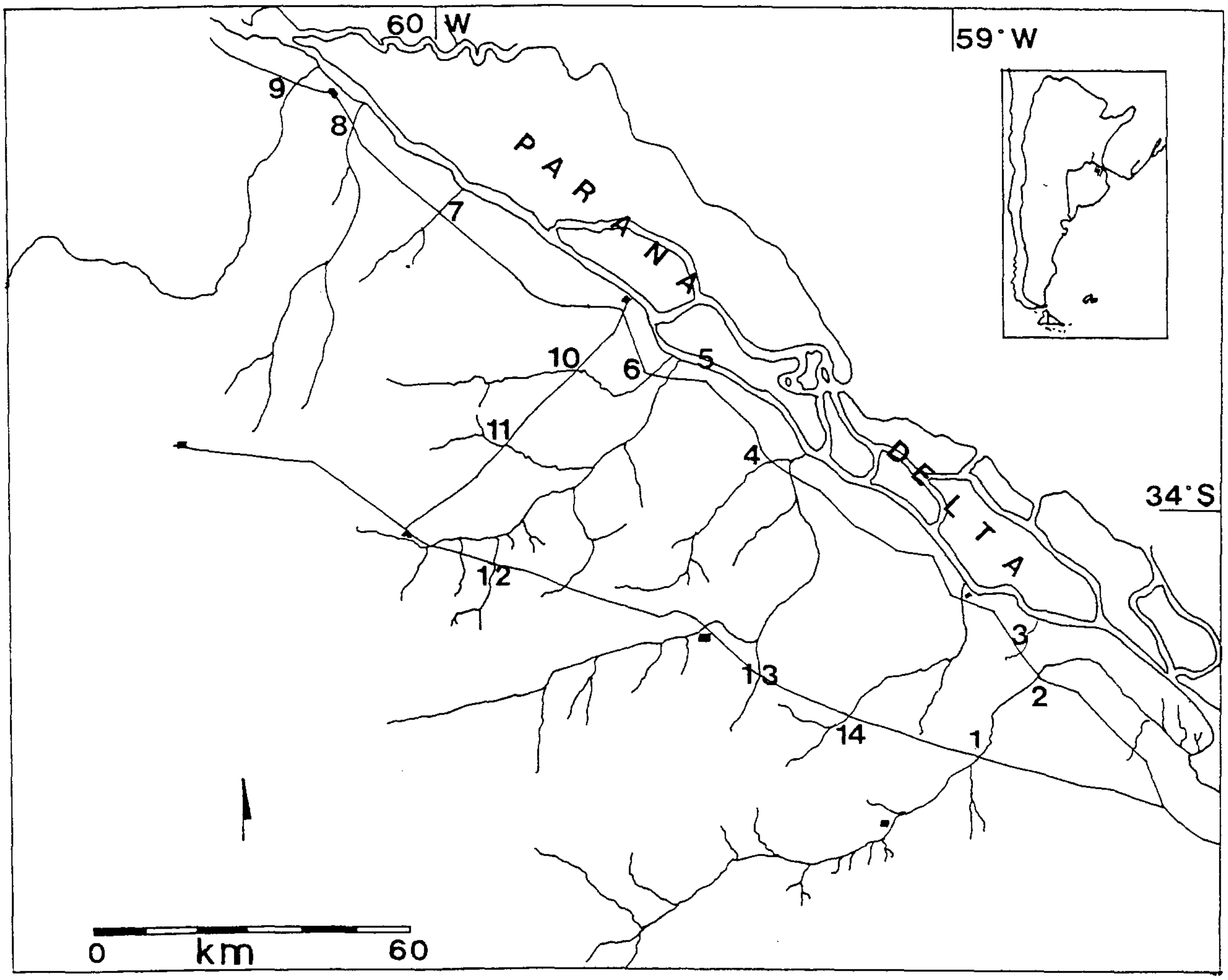

Fig. 1. Map of the studied area: 1. Luján river (Luján 1), 2. Luján river (Luján 2), 3. Pescado stream (Pescado), 4. Cañada Honda stream (Cahon), 5. Baradero river (Baradero), 6. Del Tala stream (Tala 1), 7. Las Hermanas stream (Lasherm), 8. Ramallo stream (Ramallo), 9. Arroyo del Medio river (DelMedio), 10. Del Tala stream (Tala 2), 11. Burgos stream (Burgos), 12. Luna stream (Luna), 13. Giles stream (Giles), 14. De la Cruz stream (Cruz).

The area has a humid temperate climate (Köppen, 1948), and is dominated by agricultural and cattle rearing activities. Human settlements occur on the margins of all principal rivers.

Material and methods

Samples were taken during the four seasons: spring, September 23–25; summer, December 16–18, 1985; fall, April 9–11, 1986 and winter, July 1–3, 1986.

For each sampling station the following variables were recorded: water temperature, transparency (Secchi disc), pH and conductivity (Table 1). Duplicate samples of aquatic plants were fixed with 5% formaline. The methodology of Sladeckova & Pieczynska (1971) was employed for collecting and removing organisms. Countings were performed in a 0.3 ml Sedgwick-Rafter chamber under a microscope.

Basic data were computed in Q-mode matrix, using Pearson and Jaccard coefficients. A cluster analysis was computed from the latter, using the

Table 1. Mean values for physico-chemical characteristics of rivers and streams analyzed. See Figure 1 for the names of the sampling stations.

	Sampling stations													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
pH	7.76	7.57	7.75	7.84	7.71	7.90	7.88	8.14	7.85	7.76	7.98	8.11	8.05	8.03
Conductivity (μS cm^{-1} at 20 C)	1693	1667	823	1457	467	1090	627	840	440	733	643	773	763	637
Temperature (C)	19	20	22	21	21	20	21	19.5	21	21.4	21	18	18	19
Transparency (cm)	42	28	24	15	13	15	26	25	15	24	45	28	32	25

unweighted pair group method with arithmetic averages (UPGMA) (Legendre & Legendre, 1983).

Results

Microfauna from fifteen macrophytes total 171 species (59 Ciliophora, 25 Protozoa Testacea, 1 Coelenterata, 56 Rotifera, 3 Nematoda, 5 Gastrotricha, 4 Tardigrada and 18 Crustacea).

Aloricate and loricate peritrichs were the most abundant organisms. Frequently, these sessile animals represented 50% of total density. In some streams, however, testacea and bdelloid rotifers were temporarily (December and April) dominant.

The density of the investigated microfauna showed seasonal fluctuations, with spring and fall maxima. The number of periphytic species was almost constant ($\overline{x}$ = 117), with a summer minimum (107 species) and spring maximum (131 species).

In the dendrograms of abundance data the groups obtained from spring and fall are similar (Fig. 2). The hydrological conditions in these seasons were quite uniform. In April, specimens of two macrophytes (*Ceratophyllum demersum* L. and *Pistia stratiotes* L.) from different lotic environments were closely associated (Fig. 2). There exists, in both samplings, a lower similarity between the host plants from Luján river stations and the other groups.

In summer, a minimum water level occurs, due to evaporation and drought. The community tended to be scattered because of high temperatures and desiccation. Among aquatic plants, the low December waters produced a decrease in species number and plant area occupied. Thus, *Althernanthera philoxeroides* (Martius) Grisebach was the only species collected in 7 sampling stations. In Baradero river, macrophytes even disappeared. Only Pescado stream constituted an exception: its aquatic plants (*Ludwigia* sp and *Myriophyllum aquaticum* (Velloso) Verdcourt) had high numbers of periphytic individuals and species (Table 2). This fact can be attributed to the contribution of groundwater which maintains a stable water level (EASNE, 1970).

The summer cluster diagram shows a simplification of macrophyte groups, related to the homogeneity of the periphyton community in the majority of host plants and environments (Fig. 3).

High water, occurring in winter, was caused by abundant rainfall. Some of the rivers (Baradero, Del Tala) overflowed on the inundation plane. A decrease in periphyton density in most host plants and environments (*Potamogeton striatus* (Ruiz & Pavón from Las Hermanas stream, *C. demersum* from Cañada Honda and *Polygonum punctatum* Elliot from station 2 of Luján river) resulted from these floods (Table 2). However, species richness

Table 2. Average population density (N° ind. g^{-1}dry weight of host plant) of microfauna associated to 15 macrophytes in September 1985 (S), December 1985 (D), April 1986 (A) and July 1996. See Figure 1 for the names of the sampling stations.

Species		Sampling stations														
	Code	M	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Althernanthera	Alt	S	52181	733			883							6324	1898	924
philoxeroides		D	9049	30105				247	12669				11450	10003	1126	4640
(Martius)		A		66752								2503	1475	2681	1256	1514
Grisebach		J		32277			651					3439		915	780	1760
Ceratophyllum	Cer	S				16922							97147	13782		
demersum L.		D				13670				40559						
		A				6666				33750			21247	2417	1609	4716
		J				2355	4265						11935			3397
Cyperus	Cyp	S					495									
giganteus Vahl																
Echinochloa																
polystachya	Ech	J					246									
(H.B.K.) Hitch																
Egeria sp	Ege	D								31120						
Hydrocotyle	Hyd	S				6086		21370					8888	17762	8151	
ranunculoides L.		A				9440										
		J				2489								3117	16491	
Lilaeopsis																
carolinensis	Lil	A													2988	
Coult et Ros																
Ludwigia sp	Lud	S			1221	8616				55776		6294	20592			
		D			25923	1040				7775						
		A			797	3329							1477			4070
		J			2249	863							3295			2169
Myriophyllum	Myr	S			1273					21189						
aquaticum		D			45375											
(Velloz) Verdcourt																
Pistia	Pis	A			6669	15629										
stratiotes L.		J			9469						52089					
Polygonum	Pol	S					606									
punctatum		D				416										
Elliot		A		42916								5049				
		J	3608	8837	5543							3984			3203	2389
Potamogeton ber																
teroanus Phil.	Potb	A														5411
P. striatus		S	25005	7569						2689		2360				45394
Ruiz et		D							9533	6332						
Pavon		A	72687						2846	7615			1120			
		J							588							
Sagittaria sp		D							564							
		A							12273							
Schoenoplectus		S		3042		914										
californicus	Sch	D							943							
(Meyer) Sojak		A				925										
		J							105							

did not decline significantly. Limnetic species were now registered (Modenutti & Claps, 1988).

Cluster analysis of winter abundance data shows assemblages among different lotic bodies, except one, formed by the majority of the host plants from De la Cruz stream (Fig. 3). The hydrological conditions of this water body are quite different from the other environments. The water level is low and the current is slow.

Cluster analysis, using Jaccard's similarity coefficient, reveals that assemblages with low similarity, are found among most host plants of each environment (Fig. 4).

Discussion

No discussion of suctorians and Monogononta rotifers is here given, as both groups have been the subject of particular studies (Claps & Modenutti, 1988; Modenutti & Claps, 1988).

In accordance with Wilbert's (1969), Nush's (1969) and Roos & Trueba's (1977) results, peritrichs were the most abundant organisms in our samples, while rotifers exceed crustaceans in species richness and density.

Most of the analyzed water bodies are small streams. Low species richness of Crustacea can be related to the size of these environments, and confirms Fryer's opinion (1985) that crustacean diversity is higher in large water bodies. In summer, a peak of density might be expected but the macrophytes are adversely affected by summer drought. The absence or paucity of suitable littoral vegetation determines unfavourable conditions for the microcrustaceans (Smirnov, 1963; Timms, 1967; Daggett & Davis, 1974). A scarcity of crustaceans can also be related to the release of substances by macrophytes which inhibit colonization of the vegetation (Smock & Stoneburner, 1980; Dorgelo & Heykoop, 1985).

Macrophytes differ with respect to periphyton abundance. Some are selected more than others, but density is similar for the same aquatic plant in various water bodies (Table 2). Such preference for certain macrophytes can be related to their shape and structure. Selection favours for macrophytes with finely divided leaves (Westlake, 1975; Cyr & Downing, 1988).

Colonization of emersed plants is different from that of free floating and submerged plants. The former have less contact with water and offer fewer shelters (Krecker, 1939). A lower number of individuals was observed on emersed plants, especially on *Schoenoplectus californicus* (Meyer) Soják (Table 2). A similar situation was mentioned by Roos (1983) and Rossaro (1985).

The absence of clustering based on lotic environments, or host plants, can be caused by the interaction of various factors.

Hydrological conditions contributed to the difference among assemblages. In September and April, host plants from Luján river were sorted into the same cluster (corresponding closely to inputs of pollutants). In at other times (summer drought and winter floods) different clusters contained the macrophytes of this water lotic body.

Finally, differences in microfauna densities caused by their selectivity towards certain macrophytes could have a dominating influence on assemblage conformation (Pearson coefficient).

Although the majority of species can exist under a wide variety of conditions, some become abundant only when conditions are optimal (suctorians in Luján river, some rotifers in Baradero river, certain testacea in Luna and Giles streams, etc). The species composition of the microfauna on different macrophytes is more similar within a particular lotic body than that on one host plant in different environments as confirmed by cluster analysis, using Jaccard's coefficient. Similar results were obtained by Pieczynska & Spodniewska (1963).

The spatial pattern of the community on certain plant parts, and the exact location of the macrophytes within the environment, not measured in this study, may also play an important role in the formation of associations.

All these considerations show the difficulty in establishing a clear separation among environments as well as among host plants. No group can be clearly defined.

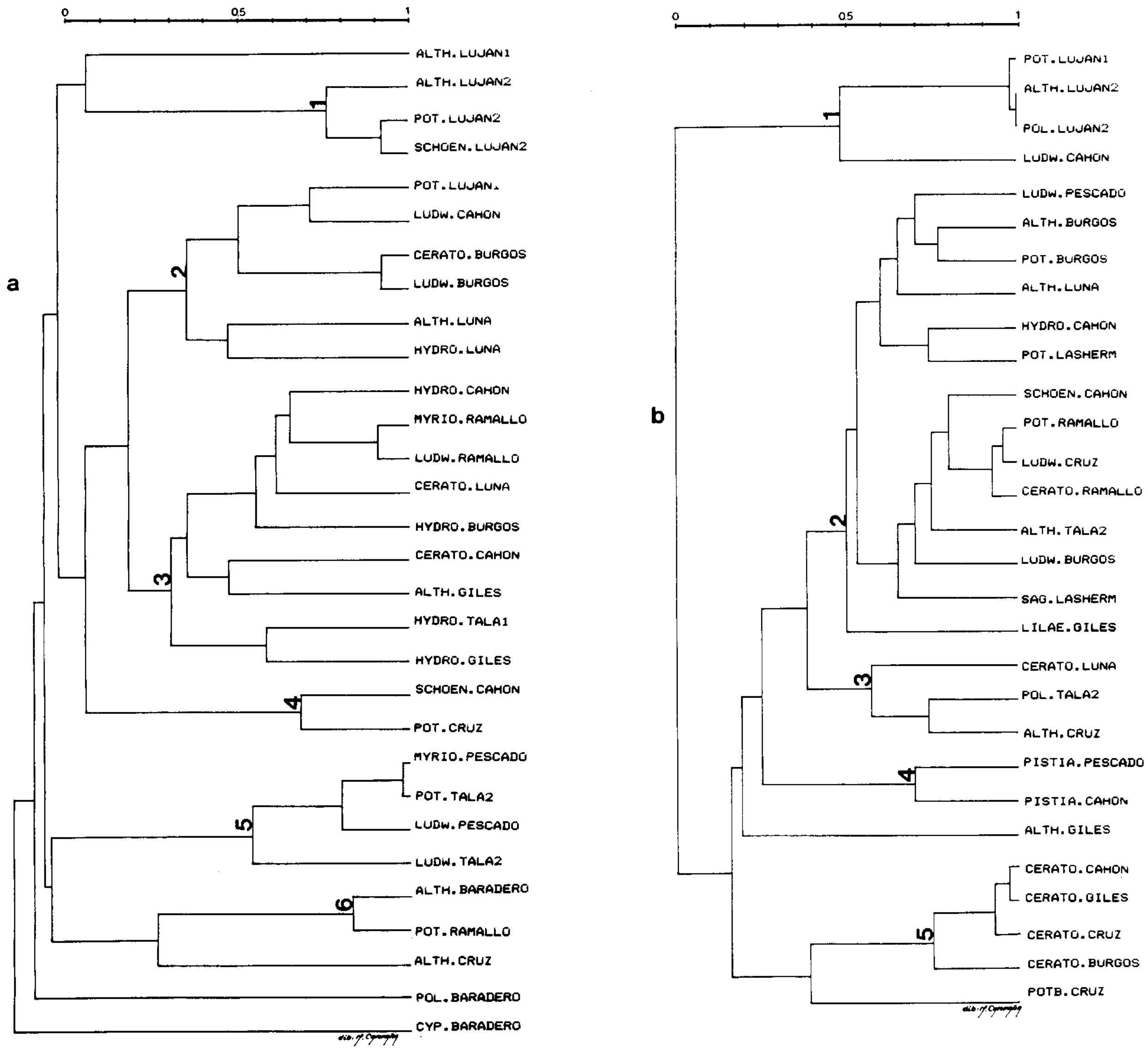

Fig. 2. Cluster analysis (using Pearson coefficient) of microfauna assemblages: a) from 8 aquatic macrophytes in 12 sampling stations in September 1985 (cophenetic correlation coefficient, c.c.c. = 0.81); b) from 11 aquatic macrophytes in 11 sampling stations in April 1986 (c.c.c. = 0.87). See Figure 1 for the codes of the sampling stations and Table 2 for the codes of the aquatic macrophytes.

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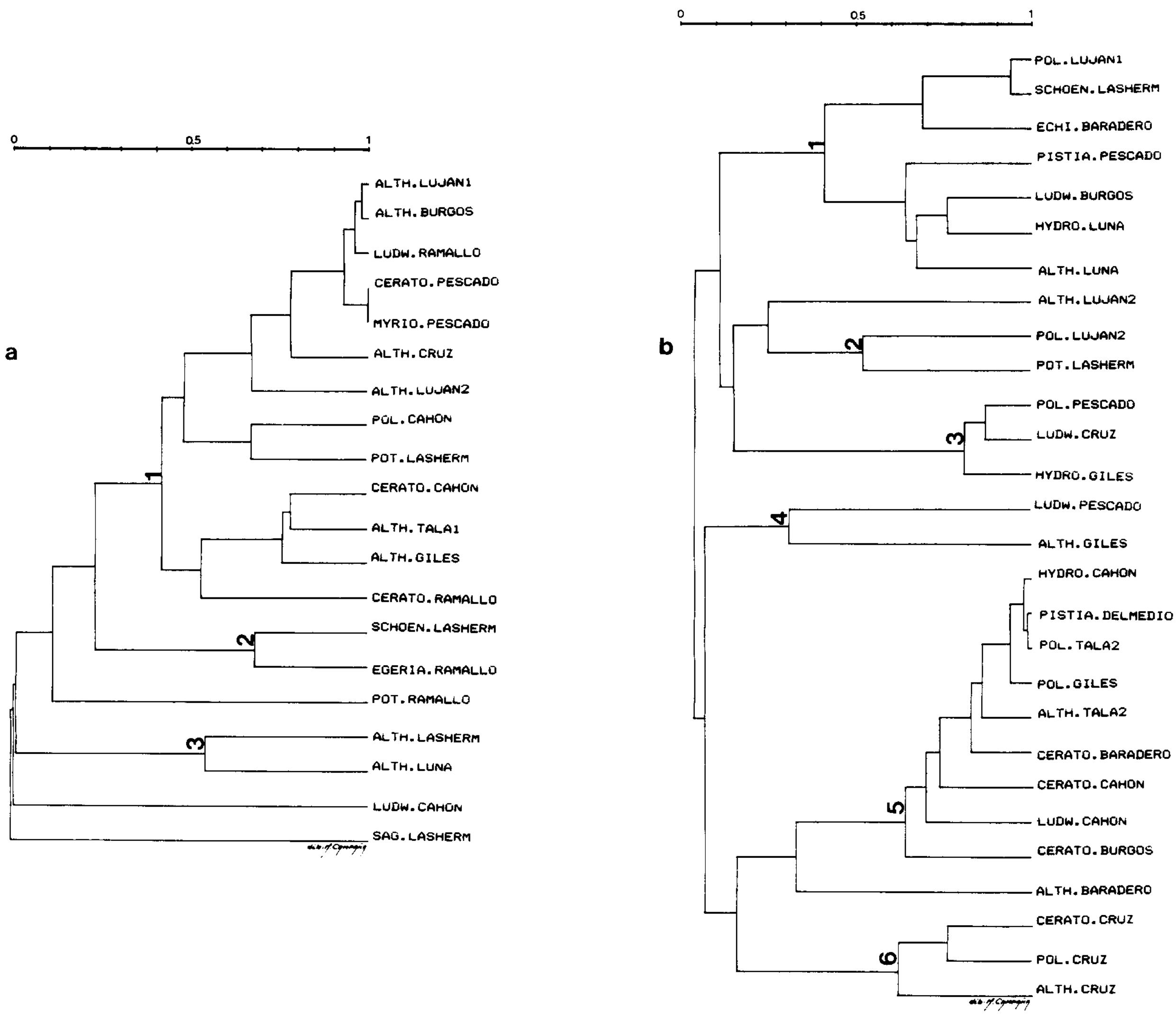

Fig. 3. Cluster analysis (using Pearson coefficient) of microfauna assamblages: a) from 9 aquatic macrophytes in 11 sampling stations in December 1985 (c.c.c. = 0.84); b) from 10 aquatic macrophytes in 12 sampling stations in July 1986 (c.c.c. = 0.82).

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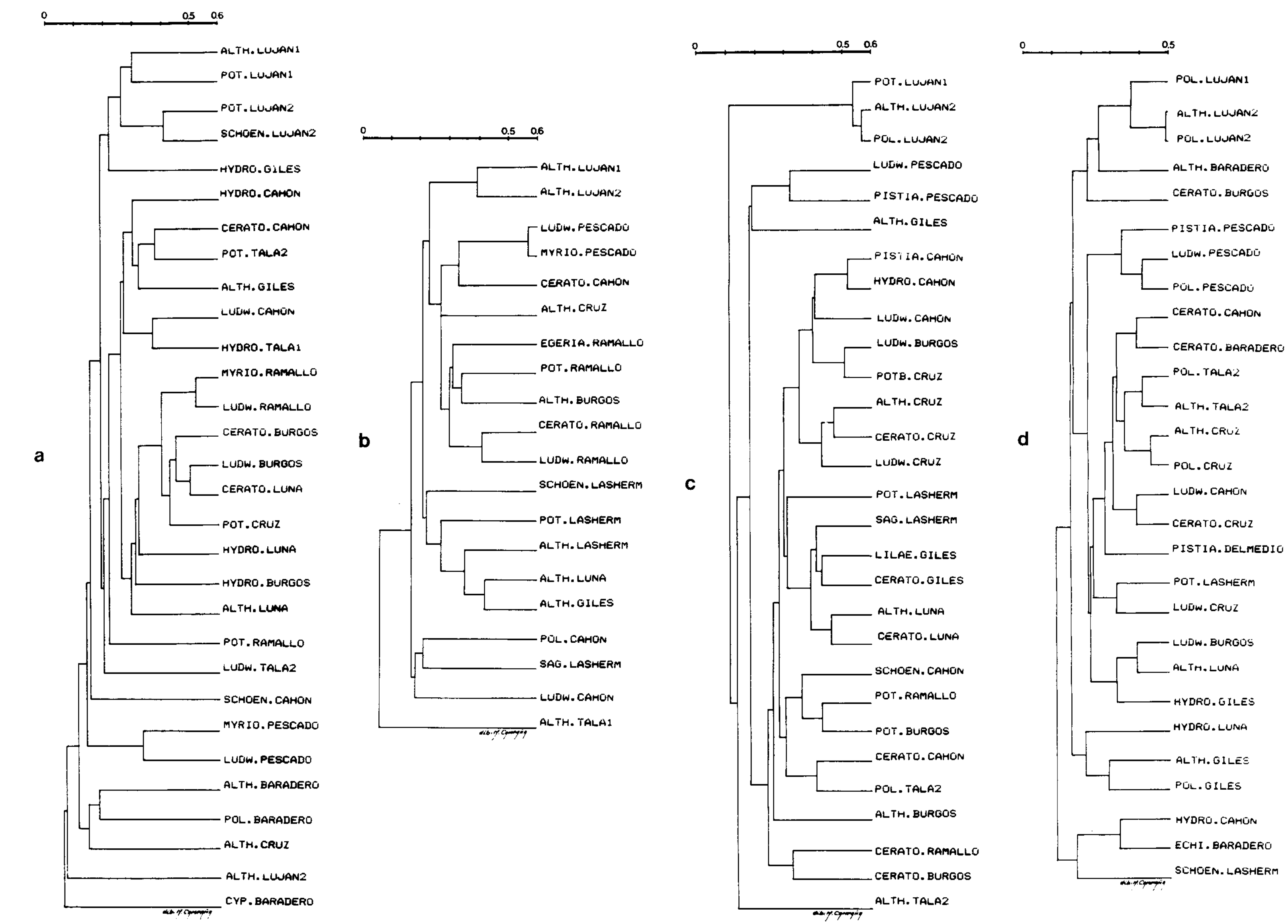

Fig. 4. Cluster analysis (using Jaccard coefficient) of microfauna assemblages: a) from 8 aquatic macrophytes in 12 sampling stations in September 1985 (c.c.c. = 0.86); b) from 11 aquatic macrophytes in 11 sampling stations in April 1986 (c.c.c. = 0.87); c) from 9 aquatic macrophytes in 11 sampling stations in December 1985 (c.c.c. = 0.79); d) from 10 aquatic macrophytes in 12 sampling stations in July 1986 (c.c.c. = 0.78).

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