Association between hydroid species and their substrates from the intertidal zone of Mar del Plata (Argentine)

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Associations between hydroid species and their substrata from the intertidal zone of Mar del Plata (Argentine).— Colonial organisms, including many species of Hydrozoa, typically have short life cycles and rapid growth. Moreover, they are often found attached to other organisms. The associations between ten hydroid species, *Clytia gracilis* (Sars, 1851), *Obelia longissima* (Pallas, 1766), *Halecium beanii* (Johnston, 1838), *Halecium delicatulum* Coughtrey, 1876, *Sertularella mediterranea* Hartlaub, 1901, *Plumularia setacea* (Linnaeus, 1758), *Tubularia crocea* (Agassiz, 1862), *Sarsia sarsii* (Loven, 1836), *Bimeria vestita* Wright, 1859 and *Rhizogeton nudum* Broch, 1909, and their substrata, from the rocky intertidal zone at Mar del Plata, Argentine, were studied between March 1990 and February 1992. *Sarsia sarsii* and *T. crocea* (Anthothecata) and *P. setacea* (Leptothecata) were the most frequent epibiotic species. Two principal groups of hydroids were found, those that grew on other hydropolyps and those that grew predominantly on Mollusca (bivalves). The most important substrates were Mollusca (48.7%) and Hydrozoa (24.4%); less frequent substrates included Tunicata, rocks, algae, and sponges. In autumn, the predominant substrate changed from Mollusca to hydroids.

Key words: Hydroid, Community, Substrata, Epizoism, Argentine.

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Introduction

Community development is greatly influenced by the characteristics and stability of the substrates (Osman, 1977; Sousa, 1979), as well as by larval behaviour, rates of growth, morphology and interactions between the species.

Colonial organisms, such as most hydroids, usually have short life cycles and rapid growth and many be found attached to other organisms, specially in intertidal rocky substrates where competition for space is great (Jackson, 1977; Llobet et al., 1986). Considerable attention has been paid to the colonization of living substrata by hydroids (Morri, 1980; Boero, 1981; Boero et al., 1985; Llobet et al., 1986, 1991a, 1991b; Piraino & Morri, 1990; Calder, 1991; Piraino et al., 1994).

On the Argentine continental shelf, López Gappa et al. (1982) analysed epibiotic organisms of the giant kelp *Macrocystis pirifera* (L.) finding some epiphytic hydroid species. Genzano et al. (1991) and Zamponi et al. (1998) later investigated hydroid colonies on biological substrata in the south-western Atlantic.

In the harbours of Buenos Aires Province (Argentine), several studies have been performed on epibiosis on artificial substrates (Bastida et al., 1974; Trivi de Mandri et al., 1984), but hydroid communities and their relations with their substrates were not investigated.

Studies in systematics, abundance, seasonal variations and reproductive periods of intertidal hydroids have been carried out in recent years (Zamponi & Genzano, 1990; Genzano, 1990, 1992, 1993, 1994, 1995).

The objectives of this study were to identify the species of hydroids associated with different biological substrata and to analyse the frequency and seasonality of epizoism in the rocky intertidal zone of Mar del Plata, Argentine.

Material and methods

Organisms were collected from the intertidal fringe of Punta Cantera, Mar del Plata, Argentine (38° 08'S, 57° 37'W) (see Genzano, 1994 for a description of the area), between March 1990 and February 1992. Samples were taken monthly, and at random at low-tide. Material was fixed with a 5% neutralized seawater formaldehyde solution. In total 896 colonies were studied and the hydroid species and their substrates were determined.

Data were analysed in two ways: a. Grouping the frequencies for substrata and epibiotic polyps according to season (table 1); b. Calculating the frequency (for the entire study period) of the substrate found as well as their epibiotic polyps. A cluster analysis grouped the epibiotic species. Pearson correlation coefficient index and the simple linking method were used.

Results

A total of ten hydroid species, belonging to eight families, were found in the 896 colonies: Order Leptomedusae, Fam. Campanulariidae, *Clytia gracilis* (Sars, 1851), *Obelia longissima* (Pallas, 1766); Fam. Haleciidae, *Halecium beanii* (Johnston, 1838), *Halecium delicatulum* Coughtrey, 1876; Fam. Sertulariidae, *Sertularella mediterranea* Hartlaub, 1901; Fam. Plumulariidae, *Plumularia setacea* (Linnaeus, 1758). Order Anthomedusae, Fam. Tubulariidae, *Tubularia crocea* (Agassiz, 1862); Fam. Corynidae, *Sarsia sarsii* (Loven, 1836); Fam. Bougauinvilliidae, *Bimeria vestita* Wright, 1859; Fam. Clavidae, *Rhizogeton nudum* Broch, 1909.

Seventeen substrate types were found, including several plant and animal groups: thalloid algae, *Ulva lactuca* (L.), *Dictyota* sp.; coralline algae, *Bossiella orbigniana* Silva, 1957, *Corallina officinalis* Linnaeus, 1761; sponges, *Hymeniacidon sanguinea* Grant, 1827, *Halichondria* sp., *Tedania* sp.; hydroids, *Tubularia crocea* (Agassiz,1862), *Sertularella mediterranea* Hartlaub, 1901, *Plumularia setacea* (Linnaeus, 1758); Bryozoa, *Bicellariella* sp.; polychaetes, Sabellidae tubes; mollusc shells, *Brachydontes rodriguezi* d'Orbigny, 1846, *Mytilus platensis* d'Orbigny, 1846, *Crepidula* sp.; Crustacea, *Balanus* sp.; tunicates, *Molgula* sp.

Epibiotic Hydrozoa

Sarsia sarsii and *T. crocea* (Anthomedusae) were the most frequent epibiotic hydroids. Among the Leptomedusae, *P. setacea* represented almost half of the epibiotic hydroids.

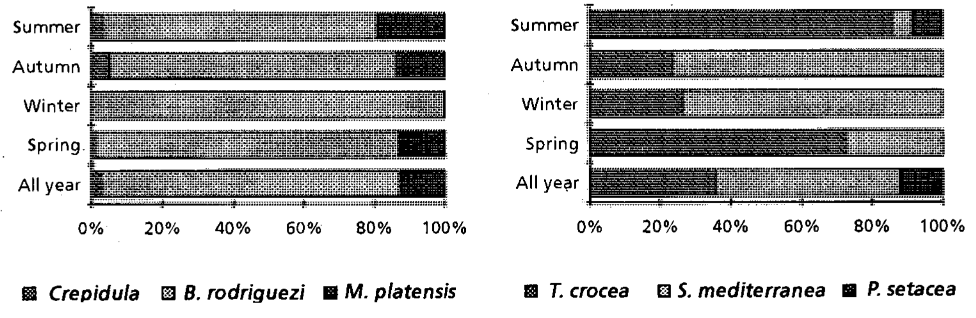

Fig. 1. Frequency of main substrates colonized in different seasons.
Frecuencia de los principales substratos colonizados en las distintas estaciones.

Other Leptomedusae species, represented by similar abundances, included *C. gracilis*, *H. beanii* and *S. mediterranea* (table 2).

Cluster analysis showed the presence of two main groups (fig. 2). Group I comprised hydroid species usually growing on stems of other Hydrozoa. Most of these were small opportunistic species. Group II comprised hydroids most often found on Mollusca (usually Mytilidae). Scanty colonies of *O. longissima* were found on rocks only and *S. mediterranea* grew mainly on Tunicata and less frequently on rocks.

Lastly, with very little affinity with the rest, was *H. delicatulum*. This species, rare among the samples, was found on the alga *Bossiela orbigniana*.

Hydroids exhibited marked seasonal variation throughout the study. Anthomedusae species prevailed in autumn, winter and spring, with maximum representation (95.6%) in winter.

The opportunistic attributes of the species of Leptomedusae resulted in an increase in their frequency during the warmer weather. During this period, *P. setacea* was the most frequent hydroid (table 1).

Substrata

The most frequent substrates for hydroids in the samples were Mollusca and Hydrozoa. Together, they provided substrates for more than 70% of the colonies. Fewer but significant percentages occurred on Tunicata, rocks and Algae. Porifera were less important as a substrate, and other groups were only occasionally colonized by hydroids (table 2, fig. 1).

Analysis of substrates over the seasons of the year showed differences in autumn when hydroids were more important as a substrate than Mollusca (table 1). Among the hydroids as substrates, *S. mediterranea* supported the most colonies in autumn and winter while *T. crocea* did so in spring and summer. Other less frequent groups provided occasional substrates for seasonal hydroids. Thus, there was an increase in the number of substrata with increases of epibiotic organisms in the area.

Discussion

In rocky intertidal areas where competition for space is strong, hydroids may occur on a variety of biological substrates. In the area studied, substrates occupied by hydroids were determined by three primary factors: 1. Their tolerance to physical stress (e.g. air exposure during low tide); 2. Their morphology; 3. Their seasonality and abundance in the area.

In this community, *T. crocea* was the most abundant hydroid. This species is resistant to exposure to air and is able to colonize the bare rocks in the more exposed levels on the intertidal zones.

Sarsia sarsii is also resistant to desiccation

Table 1. Number of polyps found in each substratum in the seasons of the year. Substrata: D. *Dictyota* sp.; Ul. *U. lactuca*; Co. *C. officinalis*; Bo. *B. orbigiana*; Hs. *H. sanguinea*; H. *Halichondria* sp.; T. *Tedania* sp; Tc. *T. crocea*; Sm. *S. mediterranea*; Ps. *P. setacea*; B. *Bicellariella* sp.; S. Sabellidae (tube); C. *Crepidula* sp.; Br. *B. rodriguezi*; Mp. *M. platensis*; B. *Balanus* sp.; M. *Molgula* sp.; R. Rocks. Polyps: Tc. *T. crocea*; Ss. *S. sarsii*; Bv. *B. vestita*; Rn. *R. nudum*; Cg. *C. gracilis*; Ol. *O. longissima*; Hb. *H. beanii*; Hd. *H. delicatulum*; Sm. *S. mediterranea*; Ps. *P. setacea*; T. Total.

Número de pólipos encontrados en cada sustrato en las distintas estaciones del año. (Para las abreviaturas de pólipos y sustratos ver arriba)

	Summer												Autumn											
Substrata	Tc	Ss	Bv	Rn	Cg	Ol	Hb	Hd	Sm	Ps	T	%	Tc	Ss	Bv	Rn	Cg	Ol	Hb	Hd	Sm	Ps	T	%
Algae												5.3												4.6
D					1			1			2	1.0			2		1						3	1.0
Ul		3									3	1.6		5									5	1.5
Co					1						1	0.5		3	1		2		1				7	2.1
Bo					1			3			4	2.2												
Porifera												1.6												1.6
Hs	1	2									3	1.6	1		1						2		4	1.2
H.																			1				1	0.4
T																								
Hydroidea												19.7												40.8
Tc		2	14		9	1				4	30	16.1			10		20		1				31	9.6
Sm		2									2	1.0		2	66		17		16				101	31.2
Ps			1		2						3	1.6												
Bryozoa												1.0												1.8
B		1						1			2	1.0		1	2				3				6	1.8
Annelida (Polychaeta)												1.0												1.8
S								2			2	1.0		1	3				1		1		6	1.8
Mollusca												49.2												36.0
C		3									3	1.6		1					3		2		6	1.8
Br	23	22								27	72	39.3	10	82								3	95	29.5
Mp	2									16	18	9.3		14					1			1	16	4.9
Crustacea																								0.3
B														1									1	0.3
Chordata												7.9												9.6
M	7	5								3	15	7.9	1	9					5		16		31	9.6
Rocks	11					12					23	12.2	2	3							6		11	3.4
Total	44	40	15		14	13	3	4		60	183		14	122	85		40		32		27	4	324	
%	24.0	21.8	8.2		7.6	7.1	1.6	2.2		27.3			4.3	37.6	26.2		12.3		9.9		8.3	12		

(Table 1 cont.)

Substrata	Winter												Spring											
	Tc	Ss	Bv	Rn	Cg	Ol	Hb	Hd	Sm	Ps	T	%	Tc	Ss	Bv	Rn	Cg	Ol	Hb	Hd	Sm	Ps	T	%
Algae												1.7												1.5
D																								
Ul																								
Co		1	1								2	1.7	1	3									4	1.5
Bo																								
Porifera												1.7												5.6
Hs		1									1	0.8	3	9									12	4.5
H		1									1	0.8												
T														3									3	1.1
Hydroidea												19.6												10.9
Tc			6								6	5.6		3	16							2	21	7.9
Sm			16	1							17	14.4			6				2				8	3.0
Ps																								
Bryozoa												4.2												1.1
B	4	1									5	4.2		3									3	1.1
Annelida (Polychaeta)																								
S																								
Mollusca												49.1												63.3
C													1										1	0.7
Br	23	35									58	49.1	45	52								47	144	54.3
Mp													1	4			1		1			15	22	8.3
Crustacea																								0.4
B														1									1	0.4
Chordata												10.2												6.4
M	5	2							5		12	10.2	7	8							2		17	6.4
Rocks	15										15	12.7	26								2		28	10.6
Total	47	41	23	1					5		118		84	86	22		1		3	6	4	64	265	
%	34.0	34.7	19.3	0.8					4.2				31.7	32.4	8.3		0.4		1.1	2.2	1.5	24.1		

because of its formation into bushy clumps which retain water. This species and *T. crocea* are common epizoites on the mytilid mussel *Brachydontes rodriguezi*, the dominant species in this community (OLIVIER et al., 1966; PENCHASZADEH, 1973). Conversely, *P. setacea* does not resist desiccation so well and is often found in summer at low levels on the valves of another mytilid, *Mytilus platensis*, which is more abundant in the infralitoral level.

Some hydroids did not grow on *B. rodriguezi*. These species grew in protected

Tabla 2. Number of hydroids in each main substrata group over the all year. (For abbreviations see table 1.)
Número de hidrozoos en cada uno de los principales grupos de sustratos durante todo el año. (Para abreviaturas ver tabla 1.)

Substrata	Hydroids											
group	Tc	Ss	Bv	Rn	Cg	Ol	Hb	Hd	Sm	Ps	n	%
Algae	2	15	4	-	6	-	1	1	-	2	31	3.47
Porifera	5	16	1	-	-	-	1	-	2	-	25	2.81
Hydroidea	-	9	135	1	48	1	19	-	-	6	219	24.40
Bryozoa	-	6	6	-	-	-	4	-	-	-	16	1.80
Annelida	-	1	3	-	-	-	3	-	1	-	8	0.90
Mollusca	82	201	35	-	-	1	4	1	3	124	451	48.70
Crustacea	-	2	-	-	-	-	-	-	-	-	2	0.23
Chordata	20	16	-	-	-	-	5	-	18	8	67	8.37
Rocks	54	3	-	-	-	12	-	-	8	-	77	8.60
n	163	269	184	1	54	14	37	2	32	140	896	
%	21.54	32.14	16.30	0.11	5.14	1.43	4.20	0.23	4.20	13.40		

areas where they were generally covered by water. At such locations *B. rodriguezi* was absent. Instead, hydroids occurred on Porifera, Tunicata and other substrates. Here, *S. mediterranea* grew frequently on the Tunicata *Molgula* sp. during the coldest months.

Some small stolonial hydroids were found on the stems of other Hydrozoa (table 1, table 2, fig. 2). *H. beanii* was frequently found on *S. mediterranea*, and *C. gracilis* on *T. crocea*. *B. vestita* occurred throughout the year in the study area and its substrate varied from one season to another (Genzano, 1994). In summer, when *S. mediterranea* was absent, *B. vestita* grew on the stems of *T. crocea;* in winter, they grew more frequently on *S. mediterranea*.

Epizoical species grew on basal zones of *T. crocea* and *S. mediterranea* and climbed on their hydrocaulus, but *C. gracilis* grew directly on the distal portions of substrata by larval settlement and development in this zone (Genzano, 1998).

Clytia gracilis and *B. vestita* showed a "guerrilla strategy" (Gili & Hughes, 1995) with an extensive hydrorhizal growth. The asexual reproduction of substrata provides new hydrocaulus which can quickly be colonized by the epizoical hydroids from neighbouring hydrocaulus by mean of stoloniferous growth. This growth pattern reduces interspecific competition for space because there are many other epizoic organisms on the basal portion of *T. crocea* (Zamponi & Genzano, 1992).

The algae in the intertidal community at Mar del Plata are seasonal, and were infrequent as substrates for hydroids (table 2, fig. 1). The most important algal substrate was *Corallina officinalis* (Rhodophyta).

The majority of hydroids studied have a reproductive peak at the end of summer, early autumn, and the greatest frequency of epibiosis was recorded in this period.

In summer it was possible to find immature colonies of *O. longissima* colonizing bare rock in protected and submerged areas. During this period, there was a reproductive peak of this species in the harbour area of Mar del Plata (Zamponi & Genzano, 1990) with abundant medusae of *Obelia* in the plankton. Planulae of *Obelia* can settle on bare

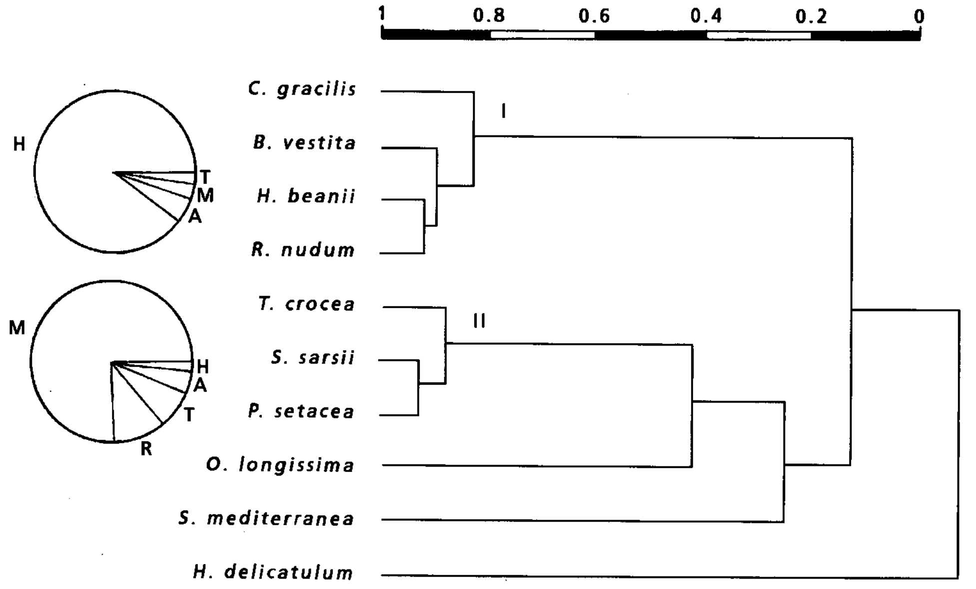

Fig. 2. Cluster grouping of the epizoite hydroids. Main substrates colonized for each group are shown: H. Hydroids; M. Molluscs; T. Tunicates; A. Algae; R. Rocks.
Cluster agrupando los hydroides epizoicos. Se indican los principales sustratos colonizados por cada grupo: H. Hidroides; M. Moluscos; T. Tunicados; A. Algas; R. Rocas.

rocks in the intertidal fringe and metamorphose into small polyps, but these polyps never develop gonophores and are present in intertidal benthos only for short periods.

Few comments can be made about *H. delicatulum* and *R. nudum* because of their sporadic and infrequent occurrence in the samples. *H. delicatulum* is more frequent in the infralittoral area, generally as an epizoite of the sertulariid *Amphisbetia operculata* (see GENZANO, 1990). The few colonies of *R. nudum* from the intertidal area of Mar del Plata are the only reports of this species from the Argentine continental shelf. This species grows on *S. mediterranea*, but was previously reported on the sponges *Hymeniacidon sanguinea* and on the Bryozoa *Bicelariella* sp. (GENZANO, 1993).

Further research is required to clarify the relationship between the species with stoloniferous growth and other hydroid species. The small epizoites perhaps avoid being buried in sediments by climbing on the hydrocaulus of other hydroids. Another point of interest to investigate is the varying abundance of this epizoite in the different height of substrates.

Resumen

Asociaciones entre especies de hidroides y sus substratos de la zona intermareal de Mar del Plata (Argentina)

Los organismos coloniales, que incluyen muchas especies de hidroides, presentan ciclos de vida cortos y un rápido crecimiento; frecuentemente crecen sobre otros organismos. Las asociaciones entre diez especies de hidroides [*Clytia gracilis* (Sars, 1851), *Obelia longissima* (Pallas, 1766), *Halecium beanii* (Johnston, 1838), *Halecium delicatulum* Coughtrey, 1876, *Sertularella mediterranea*

Hartlaub, 1901, *Plumularia setacea* (Linnaeus, 1758), *Tubularia crocea* (Agassiz, 1862), *Sarsia sarsii* (Loven, 1836), *Bimeria vestita* Wright, 1859 and *Rhizogeton nudum* Broch, 1909] y sus substratos fueron estudiadas tomando muestras periódicas desde marzo de 1990 a febrero de 1992 en la zona intermareal de Mar del Plata (Argentina).

Los datos obtenidos se analizaron de dos maneras: a. Agrupando las frecuencias de acuerdo a las estaciones del año; b. Agrupando las frecuencias para todo el período de estudio. *Sarsia sarsii* y *T. crocea* (Anthomedusae) y *P. setacea* (Leptomedusae) fueron las especies epizoicas mas frecuentes (tabla 1).

Un análisis de cluster agrupó los hidroides epizoicos (fig. 2) en dos grupos principales, el de los que crecían sobre otras especies de Hydrozoa y el de los que crecía predominantemente sobre moluscos.

Los substratos más importantes fueron los Mollusca (48,7%) y Hydrozoa (24,4%); los substratos menos frecuentes incluyen los Tunicata, las rocas, las algas y los Porifera. Durante el otoño existe un cambio del substrato predominante, siendo los moluscos menos frecuentes que los hidroides (tabla 1).

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