Decomposition of *Posidonia oceanica* leaf litter : litter bag experiments

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There has been a considerable amount of research into the kinetics of decomposition (fragmentation, chemical composition and nutritional value) of the dead leaves of marine phanerogams (litter) (RUBLEE & ROMAN, 1982; WAHBEH, 1988), but relatively few studies have been devoted to *Posidonia oceanica* litter (FRANCOUR, 1990; PERGENT-MARTINI *et al.*, 1990). Despite this, the litter compartment does play a role of primary importance in the functioning of the *Posidonia oceanica* ecosystem (ROMERO *et al.*, in press).

The aim of the present study, which is part of an extensive European Communities Commission programme (STEP Programme), is twofold :

(i) to quantify the amount of the leaf litter, and its variation in space and time (monthly samplings in several stations);

(ii) to analyse the kinetics of decomposition of the leaves.

The findings presented in the present article deal only with the second of these aims.

These *in situ* decomposition investigations were carried out in the Marseilles (France) area. In all, three stations were used : two stations at - 10 m depth (Riou 10 and Cortiou 10) and one station at - 18 m depth (Riou 18). The investigations took place from the 9th July to the 4th December 1991.

Material for incubation was collected from living plants; the oldest senescent leaf of each shoot was chosen in order to simulate a natural leaf abscission. It was weighed (sub-samples of 30 +/- 0.5 g fresh weight) and was enclosed in bags (mesh size : 1 mm) sealed with strips of velcro. The bags were then placed in the meadow under foliar canopy and collected at increasing time intervals (1, 2, 3, 4 weeks; 2, 3, 5 months). Three series of bags were placed at both Riou 10, Cortiou 10, and Riou 18, in July 1991.

At each sampling time, three bags were collected at random and taken to the laboratory. There, the samples were washed, the fauna was eliminated and the foliar debris was separated into three size classes: leaves with a length of > 5 cm (large leaves); leaves with a length of between 5 cm and 8 mm (broken leaves), and leaf debris with a length of between 8 mm and 1 mm (debris). Each fraction was dried in the dryer at 60°C (constant weight), then weighed.

The totality of the samples was powdered (pulveriser). These results are only preliminary, and the carbon, nitrogen, and phophorus content, and the percentage of ash, must be determined by subsequent analyses.

The findings were compared with those resulting from similar investigations carried out (i) at Ischia (Bay of Naples, Italy) from July 1988 to July 1989, and at Marseilles (stations Riou 10 and Riou 18) from June to December 1989. Hydrological conditions in the bay of Lacco Ameno (Ischia, Italy) are generally calm (MAZZELLA *et al.*, 1986), whereas the stations at Cortiou and especially Riou are much more exposed, and subject to very strong currents.

A weight loss with time was apparent in the incubated material. The loss followed a simple negative exponentiel model, (linear after logarithmic transformation of the data). Highly significant correlations were found between the total dry weigth (in g) and the decomposition rate on the one hand, and between the dry weight of large leaves (leaves > 5 cm) and the decomposition rate on the other.

These preliminary findings confirm the patterns of decomposition kinetics observed not only (i) during previous investigations at Riou, but also (ii) during experiments at Ischia :

- at similar depths, the rate of decomposition of leaves is comparable whatever the site (no significant difference between the slopes of the various regression lines);

- decomposition is faster in the surface stations and in those subject to strong hydrodynamic forces (e.g. Riou) (fig.); - in addition to fragmentation resulting from purely mechanical factors (e.g. hydrodynamism forces), evidence is also provided of biological fragmentation (e.g. amphipodes). The period when the experiments are set up (summer or winter) also appears to influence the decomposition kinetics (ROMERO *et al.*, in press). A further series of experiments using litter bag was started in January 1992 at the same stations with a view to providing confirmation for this hypothesis.

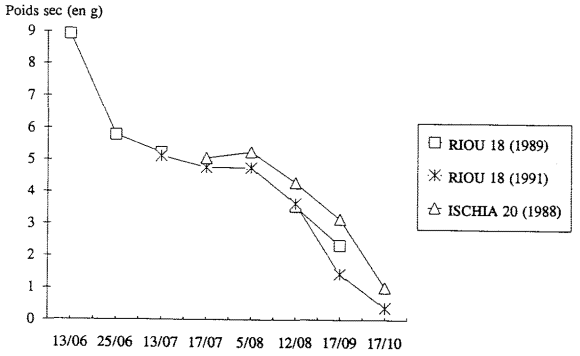

Figure : Dry weigth (in g) of large leaves (leaves > 5 cm), at two stations: Riou (-18m) and Ischia (- 20m).

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Bryozoans of a coastal detritic bottom off Pachino (South-Eastern Sicily)

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Bryozoans represent one of the most common and characteristic elements of detritic bottoms in general and are very significant within the Biocenosis of Coastal Detritic Bottoms (*sensu* PERES & PICARD, 1964). Assemblages such as these have been studied for the area around Marseilles (HARMELIN, 1976) and the Hyeres Islands (HARMELIN, 1978), in the Aegean area (HARMELIN, 1968; 1969) and along the coasts of Catalania (ZABALA, 1986). This paper represents a first approach to the study of this type of association in the Central-Southern Mediterranean.

The Bryozoan assemblage of a particular facies of the Coastal Detritic Biocoenosis, characterized by strong hydrodynamism with a community prevalentely made up by the mollusks *Modiolula phaseolina, Laevicardium oblongum, Pteromeris minuta, Calyptraea chinensis,* and the Echinoderm *Echinocyamus pusillus* and a thanatocoenosis characterized by the extreme abundance of calcareous Algae of the species *Mesophyllum lichenoides* was studied. The sample (PS/81 10 C) comes from the continental shelf of South-Eastern Sicily (Bay of Noto); it was dredged two and half miles off the coast of Pachino (Lat. 36°43,48 N; Long. 15°11,30 E) at a depth of between 61 and 57 metres. In this zone there are several biotopes largely characterized by coarse, organogenic sediments recording an autigenous productivity, often placed side by side with rocky bottoms colonized by the Coralligenous Biocoenosis (VIOLANTI *et al.*, 1990).

The faunistic content of about 30 litres of bottom sediment was analyzed. Granulometrically, it is a gravelly sand with a subordinate muddy fraction and an exclusively organogenic composition. The characterizing element is given by the calcareous Algae (84%), while the rest is essentially made up of Mollusks and Bryozoans. Echinoderms, Crustaceans, Serpuloids and Cnidarians are distinctly subordinate.

A total of 13 species were determined (2 Cyclostomes, 6 Cheilostomes Anascina and 5 Cheilostomes Ascophorina). Within the assemblage, made up overall by 131 colonies, the most abundant species are *Beania hirtissima hirtissima* and *Beania robusta* which together reach 49.26%, followed by *Calpensia nobilis* and *Setosella vulnerata* each with 11.45%, by *Schizobrachiella sanguinea* with 9.92% and *Copidozoum planum* with 4.58%. *Annectocyma major* and *Hincksinoflustra octodon* are present each with 3.05%. All the other species are much more subordinate *(Entalophoroecia deflexa, Hippopodinella kirkempaueri, Cleidocasmidra çanakkalense, Reptadeonella violacea* and *Turbicellepora coronopus)* each present with only two specimens and with 1.53%. It is to be noticed how almost all the species fall into the stock of characteristic (exclusive and preferential) species of the Coastal Detritic Bottom Biocoenosis with *Beania hirtissima hirtissima, Beania robusta, Calpensia nobilis, Reptadeonella violacea* and *Setosella vulnerata*. In particular, the first four species are linked to the small substrata which lie on the bottom such as shells or more often calcareous Algae, as has been already noted by GAUTIER (1962), HARMELIN (1976; 1978) and ZABALA (1986). On the other hand, *Setosella vulnerata* electively colonizes very small elements (1-2 mm) developing spiral-growth colonies but which never totally cover the substratum-grains. The species *Cleidochasmidra çanakkalense* was first noted here after its initial description on specimens from the Dardanelli Strait at depths between 60 and 70 metres (UNSAL & d'HONDT, 1979) and can also be included in the stock of Coastal Detritic Biocoenosis (ROSSO, in prep.). This species prefers to colonize the bulgy parts of the calcareous Algae. The ubiquist *Annectocyma major* and *Entalophoroecia deflexa,* here present with vinculariform morphoses which are more typical of the lower surfaces of small elements lying on the bottom (HARMELIN, 1976; ZABALA, 1986), can also be considered characteristic of the Coastal Detritic Biocoenosis. Also the sciaphylous *Turbicellepora coronopus,* with small globular colonies which would be more typical of Shelf-Edge Detritic Bottom Biocoenosis (HARMELIN, 1978), could be included in such a stock. Finally we must consider as accidental *Schizobrachiella sanguinea* and *Hippopodinella kirchempaueri,* both having a typically infralittoral distribution, and *Hincksinoflustra octodon* which up until now was only known in deep and muddier stations in the westernmost part of the Mediterranean (ZABALA, 1986). From a compositional point of view, this assemblage shows more affinity with the Bryozoan assemblages from analogous Coastal Detritic Bottom Biocoenosis (between 60 and 100 metres) from the area around Marseilles (HARMELIN, 1976; 1978) than with those of the Eastern Mediterranean (HARMELIN, 1968; 1969). The number of species found (13) is, in any case, lower than that quoted from the Mediterranean localities (17-30) studied by HARMELIN.

The analysis of the zoarial morphotypes, with which the species of the assemblage are present, indicates that the bottom is influenced by a strong hydrodynamism. In fact, a very high percentage of encrusting forms can be seen (Membraniporiform, Petraliiforms, Setoselliniforms and Celleporiforms), as well as flexible erect types (Flustriforms) which overall represent about 95% of the zoarial forms present and which allow us to suppose that there are bottom currents of moderate to moderate-high intensity (*sensu* SCHOPF, 1969). The species with a Vinculariform habitus could develop in more sheltered micro-habitats. On the other hand, the inferred rate of sedimentation is low in that almost all the morphotypes, with the exception of Setosellinoforms, Flustriforms and Vincula riforms to a certain degree, do not like muddy conditions. These data agree well with the bottom granulometry (gravelly sand with a subordinate muddy component).

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