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Degradative processes in macroalgal wrack on sheltered beaches: ecological effects

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INTRODUCTION

Beach consumers are supported primarily by allochthonous inputs, mostly represented by macrophyte wrack including macroalgal and vascular plant material. Wrack deposits at the supralittoral zone undergo dehydration, aging and finally are usually covered by wind-blown sand. Phenolic compounds are secondary metabolites present in macroalgaes and seagrasses whose functions may include deterring being fed by herbivores. One of the main characteristic changes in chemical composition during the macroalgal decay is the loss of phenolic compounds. The goal of this study was to evaluate the loss of phenolic compounds during the decay of wrack and assess the possible effect on the associated herbivore macrofauna.

MATERIAL AND METHODS

The study was carried out on two sheltered beaches on the Northwest coast of Spain (Galicia): Mañóns (ungroomed) and Ladeira (groomed). Field sampling was carried out during spring low tides. Wrack samples were collected along two shore-parallel transects on two tidal levels: one located at the drift-line (Level 1) and the second located at the dune base (Level 2). The characteristics algaes of these zones were sampled on both levels by triplicate. Immediately after collection the samples were thoroughly washed with distilled water and their epiphytes were removed. The clean wrack material was chopped into fragments, weighted and kept at -30ºC for later analysis. Total soluble phenols were extracted with 80% methanol by homogenization with inert sand using cold mortar and pestle. Calculation was based on the calibration curve prepared with phloroglucinol using a modified (Van Alstyne 1995) Folin-Ciocalteu method (Folin & Ciocalteu 1927). Total phenolic compounds were expressed as percentage of phenolic compounds per dry weight.

Macrofauna samples were collected with a 0.05 m^{-2} core to a depth of 15 cm on the two defined levels. Samples were sieved through a 1mm mesh and stored in 4% formalin. The species composition and the number of individuals were determined for each sample. Total abundance for each beach was calculated.

RESULTS

The results showed that the most abundant stranded macrophyte wrack species were *Ulva* sp., *Sargassum muticum*, *Cystoseira baccata*, *Laminaria* sp., *Fucus* sp. and the seagrass *Zostera marina*. Phenolic analyses indicated that stranded wrack had lower values of phenolic compounds than fresh algae (Fig. 1). This decay of phenolic content is higher in algaes located on the upper level (Level 2) indicating an older degradative stage than that observed at the lower drift line level. This pattern of phenolic loss with the ageing is consistent in all the species analysed. Mean phenolic levels were higher in members of the Fucales (*Fucus* sp., *Cystoseira baccata* and *Sargassum muticum*) than in member of the Laminariales (*Laminaria* sp.).

Likewise, the macrofauna presented differences in the total abundance between the two levels and the highest values were recorded in Level 1.Although in terms of the number of individuals both levels were dominated by amphipods Talitridae, the community composition at the two beaches differed. Ladeira was dominated by *Talorchestia deshayesi* and Mañons by *Talitrus saltator* (Table I).

CONCLUSION

There is a clear spatial zonation in the phenolic content of the stranded macrophyte wrack. This indicates different states of freshness of the algae according with tidal level of the deposits. The highest values of the phenolic content and the maximum total abundance of macrofauna were found on the same level. These results show that there are other variables that have more influence on the macrofauna distribution than the content of phenolic compounds, as for instance the tidal situation.

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Different macrophyte wrack may differ in physical structure (levels of branching, toughness), nutritional values and decomposition rates which could potentially influence wrack-associated macrofauna. Different physical structure of seaweeds may also modify microclimatic conditions, *i.e.* temperature and humidity of wrack deposits (Rodil *et al*. 2007).

Different beach grooming intensity could be the reason of different abundance and community composition between beaches. Human activities, such as beach grooming, strongly influence the structure of macrofauna. (Dugan *et al*. 2003).

Table I: Species and total individual abundance of macrofauna as sampling on the groomed (Ladeira) and ungroomed (Mañóns) beaches.

	Mañóns		Ladeira	
	Level 1	Level 2	Level 1	Level 2
Tylos europaeus				1
Talitridae (juveniles)	564	2		
Talitrus saltator	227	52		
Talorchestia brito	15		5	
Talorchestia deshayesii	70	15	101	34
Coleoptera		4		2
Phaleria cadaverina	2	2	1	
Staphylinidae	1			
Tenebrionidae		4		
Diptera	3	3		2
Tabanidae	3			
Diplopoda		1	1	

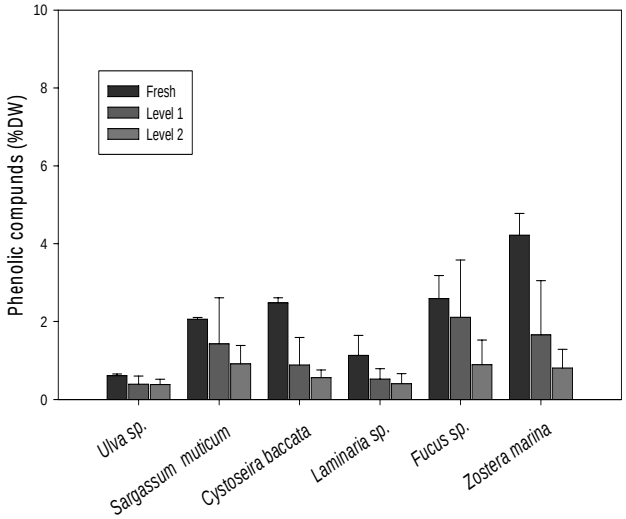

Figure 1: Phenolic contents in tissues of five macroalgaes and one seagrass characteristics of two beaches. Error bars represent standard errors.

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