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Editorial

Ecophysiology

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ABSTRACT

One of the goals of ecophysiology and agronomy is to understand the physiological basis of plant growth. In this respect, the process of photosynthesis has received ample attention. Large efforts have been made to analyze the physical and biochemical processes that are necessary for carbon fixation. The subsequent fate of the acquired carbon has been investigated far less. Factors controlling the plant's respiration and translo cation of C to several organs are only fragmentarily understood. This applies even more so to the fate of C in a specific organ or cell. In most studies related to plant growth, biomass accumulation is taken as such and not analyzed further. However, the way a plant invests its carbon as well as the other acquired elements into different compounds may have a profound effect on its growth and performance in a certain environment.

INTRODUCTION

Therefore, it is crucial to understand the factors controlling chemical composition. So far, we only have a limited understanding of the causes and consequences of variation in chemical composition. In this chapter, we discuss first the integration level at which the chemical composition of plants will be considered. Second, we characterize the chemical composition of various plant organs at that integration level. What values for the concentrations of the various plant compounds could be taken as typical for an "average" plant, and what variation is to be expected around these average values? Third, we analyze to what extent these compounds covary in specific patterns. That is, in comparing different species or a range of environments, will a rise in compound A always be accompanied by a decrease in compound B? Or do both compounds vary independently? Fourth, we review the possible mechanistic explanations that have been put forward to explain variation in chemical composition. The last two sections of this chapter discuss the consequences of variation in chemical composition. Given the chemical composition of a plant, it is possible to arrive at an estimate of the total amount of photosynthate that has to be spent to construct one gram of biomass: the so called construction costs.

First, we focus on these construction costs, and discuss to what extent they depend on environment and type of species. Second, we briefly discuss the ecological consequences of variation in chemical composition. There are other aspects of sandy-beach ecophysiology about which we as yet know very little. One of these is the apparently gregarious behavior of many mobile psammophiles, in contrast to the typically nonaggregated distribution of tube-dwelling invertebrates on more sheltered shores. Such groupings may certainly come about because of the action of water currents, particularly in those animals that surf, and this may be intensified in the case of carnivorous scavengers which home in on fairly large food masses. Aggregations of mole crabs and clams may be maintained passively by the physical factors acting upon them. However, in some cases peak periods of aggregation may coincide with maximum abundance of reproductive females. Thus, although physical forces may play a major part (at least in some species), other phenomena (such as visual cues or chemical stimuli, including pheromones) may also be important. It may be noted that chemically mediated gregariousness has been reported for several members of the meiofauna. It is also suggested that in both Bullia and Donax, aggregations tend to occur in just those areas where food is plentiful. The implication that the animals actively seek the most suitable areas cannot be ignored, although no direct evidence of this is presently available.

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