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MONOGRAPH

Functional importance of freshwater amphipods in the leaf litter recycling process: the role of leaf litter characteristics

Christophe Piscart[1*], Laura Pellan[1], Sara Puijalon[2] & Mathieu Santonja[2]

[1]Université Rennes 1 - UMR CNRS 6553 ECOBIO, Avenue du Général Leclerc, Campus de Beaulieu, 35042 Rennes, France
[2]Université de Lyon, Université Lyon 1, ENTPE - UMR5023 Ecologie des Hydrosystèmes Naturels et Anthropisés, CNRS, Villeurbanne, France
*Corresponding author, email: christophe.piscart@univ-rennes1.fr

ABSTRACT Impact of leaf characteristics on the keystone amphipod species for litter decomposition process.

KEY WORDS Terrestrial inputs; riparian trees; biomechanical structures; chemical composition.

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Leaf litter decomposition is an essential ecosystem function that contributes to carbon and nutrient cycling in freshwater streams and terrestrial inputs provide an essential energy source for many freshwater organisms. Processing of leaf litter is complex and involves several physicochemical (e.g. hydrologic fractioning, water chemistry, leaf litter characteristics) and biological (e.g. the conditioning process by aquatic fungi, the biomass of shredder) factors. Even if the decomposition process involve both physical and biological factors, the role play by shredder macroinvertebrates remains quantitatively essential. Among shredder invertebrate species, amphipods appears as a key assemblage for the leaf litter breakdown processes in streams due to their high abundances and the very high feeding rate (Piscart et al., 2009, 2011).

In order to disentangle the role of both the leaf characteristics and conditioning process by aquatic hyphomycetes, we performed several field and experimental studies using freshwater gammarid species and different types of leaves. In a first experiment in lab condition, we compared the shredding efficiency of 12 species of amphipods and one isopod with alder (*Alnus glutinosa*) leaves in order to highlight the between- species variability. The study highlighted a very great variability in the relative consumption rate of shredders varying from 0.09 to 0.64 gram of leaf per gram of shredder per day.

In a second experiment (Foucreau et al., 2013), we used the very common freshwater amphipod *Gammarus pulex* (Linnaeus, 1758) (Gammaridae) as shredder species and five types of leaves differing in toughness: alder leaves which are very common along streams and rivers and are considered as soft and readily consumed by aquatic invertebrates; and two hornbeams (*Carpinus betulus* and *Ostrya carpinifolia*) and two oaks (*Quercus robur* and *Quercus pubescens*) leaves which are very common throughout European lowlands. We also compared the response of five freshwater amphipods and one isopod to leaf's characteristics and conditioning process. This study demonstrated that leaf toughness and the conditioning process are more important than geographical origin of leaves for determining shredder leaf litter consumption. The conditioning process tends to homogenize the consumption rate

of leaf litters and after several weeks of conditioning, the toughness of leave and their consumption rate did not differ. However, the sensitivity of shredders to the short conditioning period depend on the shredder species.

In a third experiment, we tested the hypothesis that harder leaves are not consumed early but could constitute a reservoir of trophic resources bioavailable later in the year. To do this we followed the leaf breakdown and leaf toughness evolution of three leaf species (alder, chestnuts and oak) with different conditioning duration in 8 streams (Western France). Our results confirm that soft leaves are quickly available for microorganisms and shredders, whereas hard leaves may constitute a reservoir of organic matter that is usable later, in the spring or summer. Our study suggests that a change in the diversity of riparian vegetation, in term of leaf toughness, induced by land use or climate change could shorten leaf litter availability across seasons. For example, in a climate change context, the replacement of soft leaves from trees living in temperate environments by harder leaves from trees adapted to more arid conditions could delay the availability of the feeding resource several months after abscission and should be taken into account in riparian management.

In conclusion, the macroinvertebrate species identity, the litter type and the microbial conditioning level are important determinants in the litter consumption. Our studies highlighted that the leaf consumption are mainly macroinvertebrate species-dependent, whereas the transfer efficiency for other trophic levels is strongly controlled by the litter type.

REFERENCES

Foucreau N., Piscart C., Puijalon S. & Hervant F., 2013. Effect of climate-related change in vegetation on leaf litter consumption and energy storage by *Gammarus pulex* from continental or Mediterranean populations. Plos ONE, 8(10): e77242.

Piscart C., Genoel R., Dolédec S., Chauvet E. & Marmonier P., 2009. Effects of intense agricultural practices on heterotrophic processes in streams. Environmental Pollution, 157: 1011–1018.

Piscart C., Navel S., Maazouzi C., Montuelle B., Cornut J., Mermillod-Blondin F., Creuzé des Châtelliers M. & Simon L., 2011. Leaf litter recycling in benthic and hyporheic layers in agricultural streams with different types of land use. Sciences of the Total Environment, 409: 4373–4380.