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Adaptation et résilience des agricultures en Afrique de l'Ouest :  
innovations agroécologiques et intégration des territoires

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*3<sup>rd</sup> Conference on Sustainable Intensification*

*Adaptation and resilience of agriculture in West Africa: agroecological  
innovations and integration of territories*



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## Non-crop habitats concurrently drive crop colonization by the millet head miner and regulation by natural enemies

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Non-crop habitats, depending on their composition, can enhance the abundance and diversity of natural enemies of crop pests, but also at the same time provide resources to pests, thereby reducing the effect of natural regulation on pest incidence and resulting yield losses. The objective of the present study was to test the effect of semi-natural habitats in the landscape on crop colonization by pests and natural regulation, and the relationship between natural regulation and pest incidence. The pearl millet head miner (MHM) was chosen as a case study because it is a key pest of millet cultivated in traditional pesticide-free tree-crop agroforestry systems in which its control mostly relies on the action of natural enemies.

A set of 24 millet fields were selected in a 20 \* 20 km area in Senegal, from the analysis of high resolution satellite images (Pléiades), and hypotheses on relative abundance of semi-natural habitats (here trees and rangelands) in the agricultural landscape. They were monitored for pest infestation of panicles and natural regulation expressed by egg or larval parasitism rate, but also biocontrol services index using computed for each field by experimentally excluding natural enemies from naturally infested millet panicles. We used partial least squares structural equation modelling to evaluate the relationships between the abundance and diversity of semi-natural habitats at the landscape scale, crop colonization and natural pest regulation.

Early panicle infestation by the MHM was generally high and increased with the abundance of trees and to a lesser extent the rangeland area at a 1000 m-radius around millet fields, but decreased with landscape diversity. However, natural regulation provided by natural enemies was amplified by the abundance of semi-natural habitats, particularly trees, but at a more local scale (250 m-radius around millet fields). This was particularly true for natural regulation of early (vs. late) stages of the MHM. This multi-scale effect of semi-natural habitats on crop colonization and natural regulation could explain why no clear relationship between crop colonization and pest incidence was observed. Future studies on the identification of complex species-specific interactions between semi-natural vegetation and natural enemies should provide a better understanding of the ecological processes underlying the natural regulation of MHM populations.

**Keywords:** conservation biological control, natural regulation, millet-based agroecosystem, landscape composition, structural equation modelling (SEM), partial least squares (PLS).