Listening to orthoptera in agroforestry: methodological and management insights for conservation

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Highlights

- Agroforestry supports orthopteran biodiversity
- Passive acoustic monitoring (PAM) is an effective monitoring method
- Combining monitoring methods improves species detection
- Management practices influence orthopteran communities

Introduction

In the context of agroecology, practices combining production and biodiversity promotion, silvoarable agroforestry systems (SAS) emerge as very promising. In particular insects, which face considerable threats in intensively managed agricultural landscapes, could benefit from understory vegetation strips (UVS). In this study we focused on orthopterans, a very important taxonomic group, which contributes to more than half of the total arthropod biomass in the grass layer and is an essential part of the diets of other organisms (spiders, birds).

Method

The study design followed the design of the monitoring scheme in the Agro4esterie project, which selected 20 SAS located in western Switzterland. Orthoptheran diversity was sampled using two methods: transect walks and passive acoustic monitoring (PAM) with AudioMoth devices. The sampling was conducted in July and August 2024. Abundance was obtained only from transects. Moreover we also collected information on other important factors as plant species richness, crop, management system (organic/conventional) and size of SAS. The analysis focused in a first step on different detection methods by comparing passive acoustic monitoring (PAM) with classical field monitoring. Subsequently, we aimed to identify management factors influencing orthopteran richness and abundance in SAS, by modelling these parametes with the collected environmental variables.

Results

In total, we found 19 species of orthopterans in the 20 systems, including 5 Red List species. Results of the method comparison revealed that both methods can yield similar species numbers. Daytime PAM detected cryptic or low-abundance species missed by daytime transects but failed to record one non-stridulating and some nocturnal species (Figure 1). This highlights that the combination of the two methods increases data quality and that they should be seen as complementary. Consequently, data from both methods were combined for the second research question investigating factors influencing orthopteran richness.

The analysis of the environmental factors influencing diversity and abundance is not signficiant but points towards the fact, that increasing plant species diversity within the understory vegetation strips (UVS) could have positive effects on orthopteran species richness. Furthermore, higher orthopteran abundance was observed in organically managed agroforestry systems compared to conventionally managed ones. Our results could help to develop management strategies for SAS that account for orthopteran conservation.

Figure

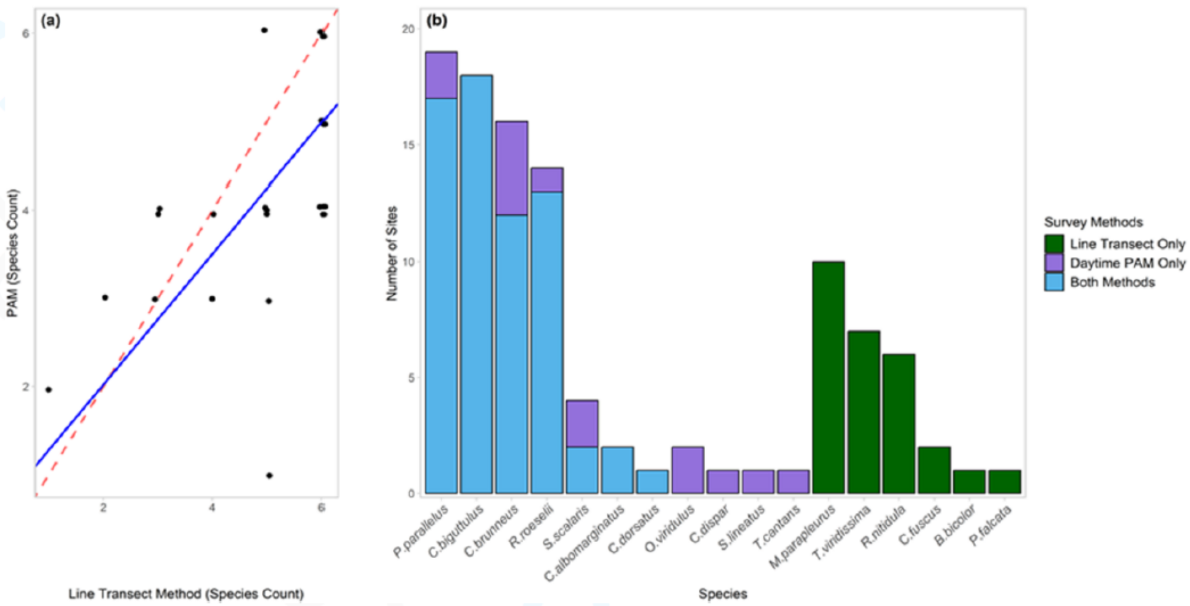

Figure 1: Comparison of daytime PAM and the Line Transect Method. a) Number of orthopteran species detected by the Line Transect Method and by the daytime Passive Acoustic Monitoring (PAM) method. The dashed red line indicates the 1:1 diagonal, and the solid blue line represents the Reduced Major Axis (RMA) regression. b) Number of sites at which each orthopteran species was recorded using the Line Transect Method, daytime Passive Acoustic Monitoring (PAM), or both.

Keywords
Orthoptera, Silvoarable Agroforestry, Passive acoustic monitoring, Biodiversity