Plant diversity and community composition of rice agroecosystems in Vietnam and the Philippines

Oliver Fried*, Ingolf Kühn, Julian Schrader, Nguyen Van Sinh & Erwin Bergmeier

Abstract

Aims: The knowledge of rice weed communities, their diversity, composition, dynamics and distribution is still inadequate. We present information on the plant diversity of rice fields in major Southeast Asian centres of rice cultivation, the prevailing life forms, the plant communities, the main environmental drivers, and phytogeographic patterns that shape these communities. Study area: Seven different regions of Vietnam and the Philippines, including lowland and mountain areas (0–1390 m a.s.l.). Methods: Altogether 115 vegetation relevés using the Braun-Blanquet method were recorded during wet and dry seasons between 2013 and 2015. Soil samples were collected and farmers of surveyed rice fields were interviewed. Vegetation surveys were designed to detect possible effects of soil properties, climate, altitude, geographic location, landscape heterogeneity, seasonality, management and intensity of cultivation, and structural parameters on the paddy vegetation. Hierarchical cluster analysis UPGMA was applied and NMDS ordinations were performed to visualize differences in plant community composition along the different gradients. Results: We found 113 vascular plant species, with annual hydrophytes and therophytes being the prevailing life forms. Sixty of the recorded species appear to be globally rare. We revealed four clusters of plant communities which are explained mainly by soil acidity, crop height and temperature: Paspalum distichum-Hydrolea zeylanica community, Echinochloa crus-galli community, Rotala indica-Monochoria vaginalis community and Fimbristylis littoralis-Leptochloa chinensis community. The two latter communities were further classified into regional subunits. Conclusions: We conclude that the composition of weed communities provides valuable information on environmental and biogeographical conditions of the local rice landscapes, and that it is probably the most applicable and reliable indicator of management intensity.

Keywords: Oryzetea sativae; Philippines; phytosociology; plant life form; rice field; Southeast Asia; species richness; Vietnam; weed community; weed control.


Abbreviations: Corg = organic carbon; EC = electrical conductivity; NMDS = Nonmetric multidimensional scaling; Ntotal = total nitrogen; PH = Philippines; SD = standard deviation; UPGMA = Unweighted Pair Group Method with Arithmetic Mean; VN = Vietnam.

Introduction

Rice is the staple food for more than half of the world’s population and has fed more people longer than any other crop (GRiSP 2013). For 2015 the FAO forecasted a global rice production of 490.3 million tons (milled basis), of which Asia contributes by far the major part of 443.4 million tons (FAO 2016a). Particularly in Southeast Asia, most countries are highly dependent on their rice yields to meet the increasing demands for food and economical security of a growing population. In Vietnam and the Philippines, rice consumption in 2013 totaled...