ECOLOGY AND BIODIVERSITY IN AN IRRIGATED RICE FIELD ECOSYSTEM

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CHANNA NALIN BANDARA BAMBARADENIYA

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ABSTRACT

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R. R. M. C. N. B. Bambaradeniya

Ph. D. , Board of study in Zoological Sciences

The study on the ecology and biodiversity of a rice field was carried out in two irrigated rice fields located at Bathalagoda in the Kurunegala District. The overall objective was to study the ecology and biodiversity associated with the irrigated rice field ecosystem, in order to understand their role in the conservation and sustenance of the rice agroecosystem. The two rice fields, designated "Research field" and "Farmer field", respectively, differed in agricultural practices. The rice field floodwater, soil and vegetation were sampled to document and quantify certain water quality parameters, aquatic and terrestrial fauna and flora. Field sampling was carried out at fortnightly intervals during five consecutive rice cultivation cycles. Detailed investigations on the floodwater chemistry, the species composition, abundance, diversity and seasonal variation of fauna and flora in the two rice fields were carried out. Temporal and spatial variations of rice field biodiversity were determined using terrestrial arthropods as a surrogate group. The impact of different agricultural practices on the rice field biota were also examined. The overall biodiversity documented during the study consisted of 494 species of invertebrates of which 82% were arthropods, 103 species of vertebrates of which most were visitors dominated by birds. Flora consisted of 89 species of macrophytes representing rice field weeds, 31 genera of microphytes and three genera of macrofungi. The aquatic/benthic invertebrates recorded included 179

species, belonging to five major communities, namely neuston, zooplankton, nekton, periphyton and benthos. Terrestrial arthropod fauna comprised 280 species of insects and 60 species of arachnids. The contribution of arthropod biodiversity towards natural biological control in the rice agroecosystem was evident from the rice pest to natural enemy species ratio of 1 : 3.5. The weed flora included 42 species of monocotyledons, 45 species of dicotyledons and 2 species of pteridophytes. The aquatic weeds together with the aquatic microflora constituted the photosynthetic aquatic biomass which contributed to a high primary production in rice fields. The fauna and flora in the rice field showed a uniform pattern of seasonal colonisation and succession during each rice cultivation cycle. The terrestrial arthropod diversity gradually increased with the progress of the crop cycle, in the rice as well as in the non-rice bund habitat, while fluctuations occurred in relation to pesticide applications and weed management practices. The arthropod diversity was not significantly different between two consecutive annual rice growing seasons, at each rice field. However, a significantly higher terrestrial arthropod diversity was observed at the Farmer field, where the pest and weed management practices were relatively less intense, in comparison to the Research field. Agronomic practices associated with rice cultivation effected different rice field biota in different ways. Biocides adversely affected rotifers, cladocerans, aquatic insects, benthic oligochaetes and terrestrial arthropod natural enemies. Nitrate fertiliser applications showed a stimulatory effect on rotifers, cladocerans, oligochaetes and adult aquatic insects, while the molluscs were adversely affected. Intense slashing of weeds in bunds was detrimental to the predatory spiders. Preparation of fields by tractor caused heavy mortality to aestivating amphibians. Physico-chemical parameters of water such as temperature, pH and DO showed marked fluctuations, both diurnally

as well as seasonally, while nitrate, phosphate and conductivity levels fluctuated in relation to fertiliser inputs. The floodwater pH, DO, BOD and temperature decreased significantly with the progress of the crop cycle. The floodwater DO showed a significant increase with rainfall. The adult aquatic insects showed a significant increase with increasing nitrate levels, while the aquatic molluscs showed a negative relationship with floodwater pH. The rotiferans increased significantly with increased floodwater DO. The species richness of weeds in the rice as well as the non-rice bund habitats showed a significant increase with the progress of the season. Minimal use of pesticides, maintenance of refuges of natural enemies (especially the bunds covered with weeds), landscape planning and management aimed at harbouring a rich biodiversity, and the development of an efficient system of extension to educate rice farmers on integrated pest management (IPM) strategies with emphasis on natural biological control of insect pests, can be recommended as means of conserving and sustaining the rice field agroecosystem through its rich biodiversity