Plant and Leaf Hoppers in Rice Ecosystems

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ABSTRACT

Rice ecosystems, like most grasslands dominated by graminaceous species, are inhabited by cicadellids and delphacids. The main species are the green leaf hoppers (GLH), *Nephotettix* spp, the brown plant hopper (BPH), *Nilaparvata lugens* and the white backed plant hopper (WBPH), *Sogatella furcifera*, all of which are important rice pests. Rice intensification programs in the so-called green revolution of the 1960s and 70s, through to the present day, has brought about an unprecedented leap in rice production, from 220 million tons in 1961 to 530 million tons in 1993. This revolution was based on the use of new short-strawed rice cultivars, that were highly responsive to fertlisers. As they yielded so well, they were grown under high input regimes. Increased pesticide use also exacerbated the outbreaks of certain rice pests. Delphacids, being r- strategists, had developed exceptionally well under such frequently perturbed environments. In the 1970's, the BPH became a major threat to rice production in Asia. BPH resistant genes were incorporated into new rice cultivars, but they were not durable through the development of biotypes. Thus, although resistant cultivars were introduced and widely adopted by farmers, insecticide use also increased.

It is now well established that BPH is a secondary pest problem caused by ecological disruptions, which may include drought, flood, and pesticide use. Exceptional migratory influxes of this highly mobile pest also contributes to outbreaks. Insecticide

sprays, especially in the early crop stages for leaf folder (*Cnaphalacrocis medinalis)* control, can disorganize food web linkages, favoring BPH. Naturally occurring biological control agents, especially predators of the eggs and nymphs, are destroyed by the broad spectrum chemicals used by farmers to kill the highly visible leaf folders. Research has shown that these sprays are unnecessary and may be the primary reasons for increased BPH problems. Practical measures now concentrate on encouraging farmers to reduce insecticide use to protect natural control agents.

Among the virus and virus-like diseases transmitted by plant and leaf hoppers, the most serious is the rice tungro virus vectored by *Nephotettix virescens.* The deployment of cultivars with resistance to *N virescens* also confers some field resistance to tungro. However, insecticides have been the main control measure used by farmers, although these have not been effective in reducing tungro. Current management strategies place greater emphasis on cultural methods, such as appropriate planting dates, crop sanitation and maintaining natural biological control .agents.

In the next 30 years, rice production will need to increase by 70% to keep up with population growth, estimated to reach 8.4 billion by the year 2025, with over 4 billion rice consumers.. Yields doubled from 2 to 4 tons/ha during the green revolution in the 1960s and 70s. However, with less land, water and labour, there is a need to further increase yields per unit area to meet the dramatic new demands. High production systems tend to favor herbivore development and whether natural biological control be sustained under further intensified systems remains to be seen. The characteristics of these systems and their implications for management strategies are discussed.

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