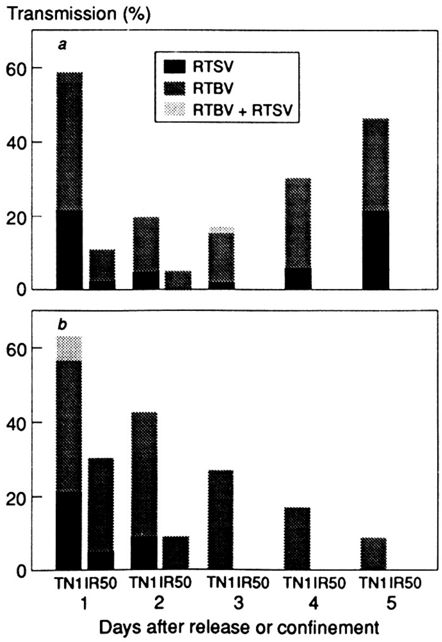

Infectivity of tungro-viruliferous GLH 1-5 d after confinement (a) in a screenhouse in batch with TN1 or IR50 seedlings, or (b) in test tubes individually for serial daily transmission. IRRI.

lings. All inoculated seedlings were indexed by ELISA.

In the screenhouse trial, TN1 had infections of 50% RTBV + RTSV, 23% RTBV, and 8% RTSV (see figure). IR50 had 15% RTBV + RTSV, 27% RTBV, and 5% RTSV.

Percentage of infective GLH in the TN1 cage was as high as 59% the first day after release of viruliferous GLH, declined to 17% by the third day, then increased to 48% by the fifth day (see figure). In IR50, GLH infectivity was 11% the first day, 5% the second day, and zero the third day. In leafhopper-resistant IR50, viruliferous GLH populations that were introduced became noninfective after 2 d.

In the serial daily inoculation, GLH retained RTBV for 5 d and RTSV for 2 d when tested on TNl seedlings but retained RTBV for only 2 d and RTSV for 1 d on IR50 seedlings.

These results indicate that, on susceptible TN1, tungro-viruliferous GLH that lost infectivity in 5 d with serial transfer in test tubes may retain infectivity longer in the field, as they reacquire the viruses from newly infected plants. On IR50, however, viruliferous GLH retained the viruses for only 2 d in the field. □

Effect of crop age and leaf location on food consumption and development of rice leaffolder (LF) *Marasmia patnalis*

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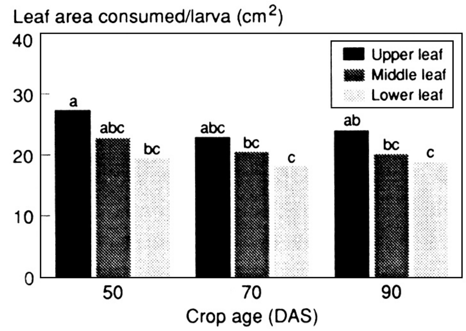
Earlier studies have shown that rice yield is seriously affected by LF defoliation when plants are at the panicle initiation stage. In this study, we examined the effect of crop age and leaf location on LF food consumption.

The experiment was laid out in a split-plot design, with crop age (50, 70, and 90 d after seeding [DAS]) in the main plots and leaf location (upper, middle, and lower) in the subplots. The uppermost leaf was the youngest and the lowest leaf was the oldest. Leaves of each crop age were collected from different locations, cut to 130 mm lengths, and placed individually in 15- x 150-mm tubes plugged with cotton. Ten newly hatched LF were introduced at one larva/tube. Damaged leaves were removed after 24 h and replaced with fresh ones. This was done until LF pupated. Leaf damage was traced on paper using graphing paper.

To determine the effect of leaf location on larval and pupal development, 10 newly hatched larvae were reared individually on leaves from 60-d-old IR64. Leaves were introduced into tubes as described earlier and changed daily. Development time and weight of larvae and pupae reared on leaves at each location were recorded.

In general, LF larvae fed with the uppermost leaf removed more leaf tissue regardless of crop age (see figure). However, the leaf tissue removed was not significantly different from that removed from the middle leaf. Significantly less leaf tissue was removed from 50- and 90-d-old lower leaves.

The weight of larvae and pupae reared on upper leaves was higher than the weight of those reared on middle or lower leaves (see table). Development of larvae reared on upper and middle leaves required significantly more time.



Leaf area consumed by LF reared on leaves from different locations. IRRI, 1989.

Weight of larva and pupa and larval development when reared on leaves at different locations. IRRI, 1989.

Location	Weight[a] (mg) Larva	Weight[a] (mg) Pupa	Larval development (d)
Upper	25.3 a	20.9 a	15.1 a
Middle	24.6 a	18.9 ab	15.0 a
Lower	22.2 a	18.2 b	14.2 b

[a] In a column, means having a common letter are not significantly different at the 5% level by DMRT.

Time from pupation to adult emergence was the same, irrespective of leaf location. □

Using radar to observe brown planthopper (BPH) migration in China

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Although BPH *Nilaparvata lugens* cannot overwinter in temperate regions, it invades the summer rice-growing areas of China each year, starting in the south and moving progressively north. Chinese scientists have found evidence that late generations of BPH make a series of autumn migrations back toward the south.

We used radar to directly observe long-distance movements of BPH at Jiangpu, Jiangsu, during the second half of Sep 1988. In the absence of rain, the specially designed, high-frequency radar could detect individual planthoppers at ranges up to a kilometer and concentrations of insects at much greater ranges. The identity of insects detected by radar was confirmed by sampling between 150 and 450 m above ground, using a net suspended from a balloon.

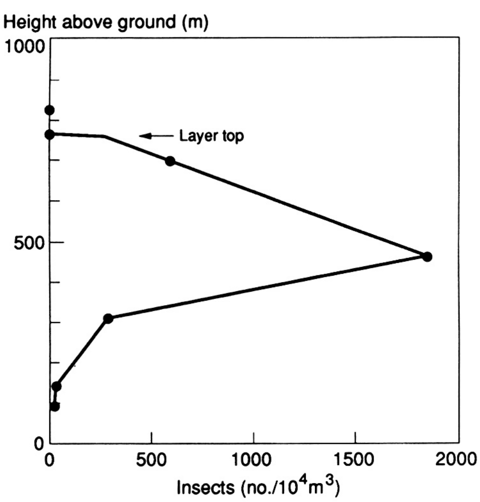
BPH dominated the night-flying aerial fauna during the period of observations, with vast populations on the move every night. Most migrant BPH took off between late afternoon and dusk, climbed to between 300 and 1000 m, and continued flight for several hours, dispersing downwind, mainly to the southwest. This direction is ecologically advantageous at this season because it carries the BPH toward areas where overwintering is possible.

Later in the evening, migrating BPH often concentrated in a dense layer (Fig. 1) with a distinct upper boundary or ceiling, corresponding to an air temperature of about 16 °C. The layer usually lasted until about midnight, but sometimes persisted until dawn, indicating that some individuals remained in continuous flight for about 12 h. Backtracks calculated for insects forming the layers suggest source areas up to 250 km away, in northeast Jiangsu (Fig. 2).

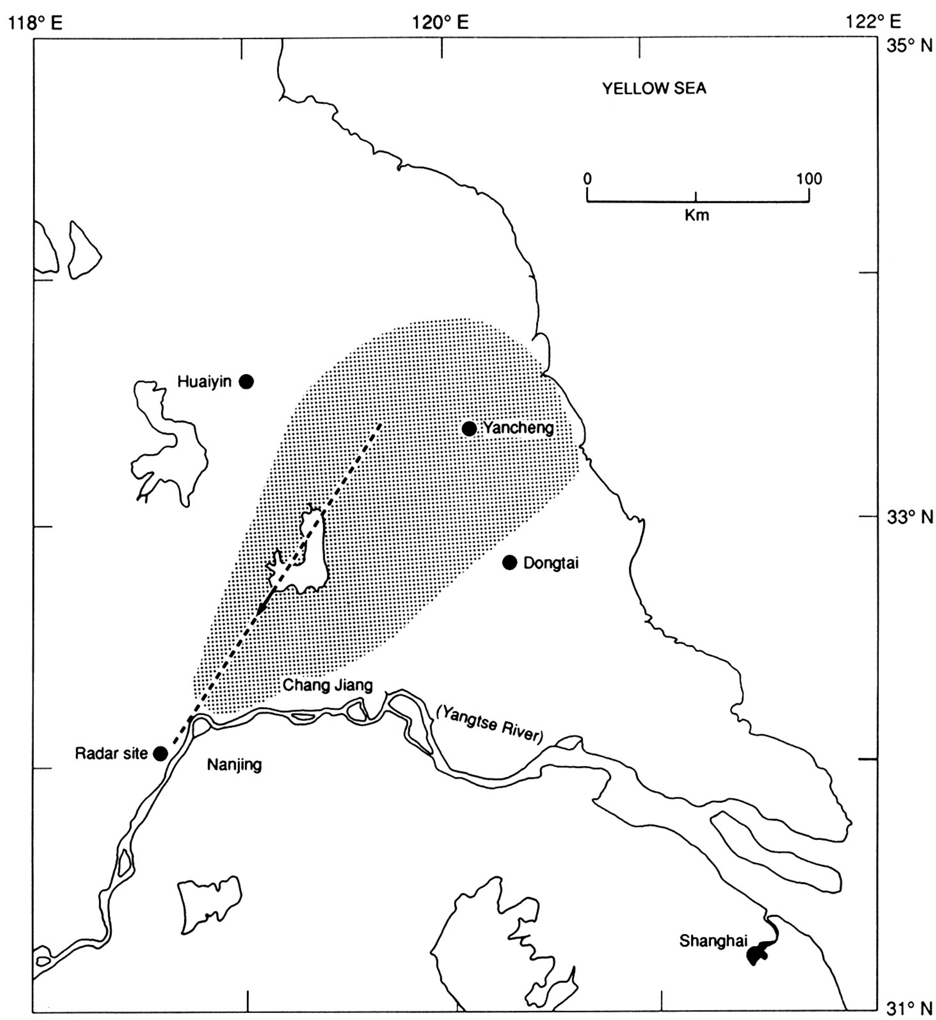
A second period of mass take-off at dawn sometimes led to the formation of layers, but these did not last longer than 1-1.5 h. On some mornings, very little dawn flight occurred, perhaps because low temperatures inhibited take-off.

These results are in striking contrast to those obtained during the dry season in the Philippines. There, BPH comprised a much lower proportion of the aerial fauna, migratory flights were largely confined to periods of about 30 min at dusk and dawn, and layers of overflying, long-distance migrants were not observed.

The shorter flight durations in the Philippines may occur because cultivated or ratoon rice is present in tropical areas year-round. Relatively local movements may be enough to ensure maintenance of BPH populations. In addition, highly migratory genotypes would be at a disadvantage: long-flying emigrants leaving the Philippines likely would not be replaced by low numbers of immigrants from distant, overseas sources. □



1. Vertical distribution of insect density at 2140 h on 26 Sep 1988, when an intense migration was detected by radar. The number of insects flying above a defined area of ground (the area density) was estimated as almost 50/m^2. BPH comprised 90% of the insects caught in an aerial net.



2. Most likely source area of BPH migrating over the radar site at Jiangpu (near Nanjing) on several nights of late Sep 1988. The shaded area encompasses take-off points (estimated from back trajectories) for groups of insects observed overflying Jiangpu. The dashed line indicates the estimated flight path at 600 m altitude for BPH arriving at midnight on 26 Sep 1988 (assuming take-off at 1800 h).