Parasitism was lowest in nursery beds in all seasons (see table). Because immigrants were most common in young fields, these results suggest that parasitized GLH may be less migratory than parasite-free GLH. Parasitism in ratoon fields markedly differed between the two seasons. This may be associated with the high percentage of mature females.

Fields 5-8 wk after transplanting are commonly major sources of GLH migrants in asynchronous areas. Using pooled data, parasitism at this rice stage was positively correlated with GLH density (see figure). This suggests pipunculid parasites may be a regulatory factor in GLH abundance. □

Evaluating high temperature tolerance in the brown planthopper (BPH)

I. Domingo and K. L. Heong, IRRI

An increasing body of knowledge suggests that rising concentrations of CO_2 and other gases will raise the earth's temperature substantially. Some scientists have estimated possible increases of 3 ± 1.5°C to even 8-10°C within the next 40 yr. The ways in which rice pest species might respond to this change depend on factors including direct effects on survival; physiological tolerance and interspecific interactions, such as competition, predation, and parasitization; and changes in habitat suitability. A species' ability to adapt to global warming and colonize new areas depends on its ecological versatility and tolerance for temperature extremes.

We used a direct assay method to evaluate high temperature tolerance of BPH populations. Ten 1-d-old individuals from respective populations and stages were caged in a cylindrical (54 × 5.5 cm diam) mylar cage with a 60-d-old rice plant trimmed to a single tiller. We placed 35 replications of this setup in a growth chamber at 40°C with 12:12 h illumination and 70% relative humidity. (Earlier work had shown that mortality increased sharply at 40°C.) At 5-h intervals, we removed five randomly selected cages from the chamber and recorded insect mortality. A similar setup at room temperature was used is the control.

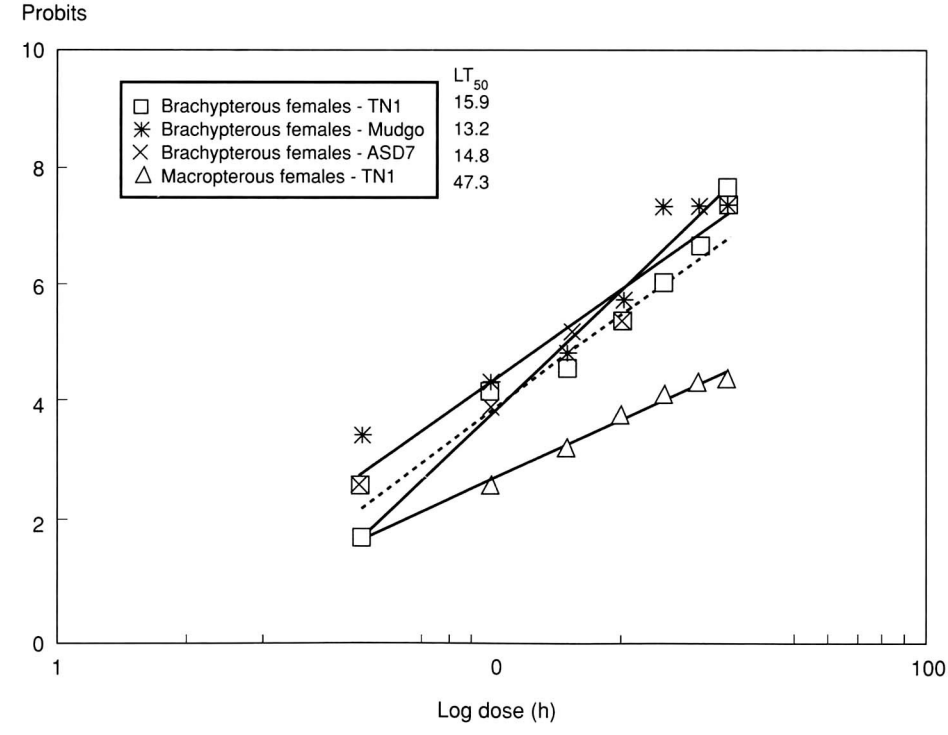
The close was the time that the insects were exposed to high temperature to produce mortality. Thus. the dose (hours of exposure to 40°C) is the variable and the number of dead insects, the quantal response. We subjected the data to probit analysis using Abbott's formula to adjust for mortality in the control cages. The median effective doses (LT_{50} expressed in days) were estimated.

Macropterous females were most tolerant of high temperatures (see figure). The relative potency compared with that of the brachypterous females was estimated to be 2.53 ± 0.32 (at 95% confidence limit). Tolerance of the nymphal stages was also higher than that of the britchypterous females. BPH populations maintained on rice cultivars TN1, Mudgo, and ASD7 did not significantly differ in tolerance (see table).

High temperature tolerance in the macropterous BPH females is a clear advantage for range shifts. This intrinsic colonization ability, along with the specie high fecundity, implies that BPH is extremely adaptable to global warming conditions. □

Median effective doses (LT_{50}) of 1-d-old brachypterous BPH females reared on 3 rice cultivars.

Stage	Cultivar	LT_{50}	Fiducial limits	Slope
1st instar	TN1	23.4	18.3 - 35.4	5.0
	Mudgo	24.6	18.3 - 36.6	4.7
	ASD7	27.1	24.8 - 30.2	4.2
3d instar	TN1	22.8	16.6 - 37.1	2.6
	Mudgo	24.1	18.1 - 38.3	2.4
	ASD7	24.6	16.6 - 50.8	2.0
5th instar	TN1	27.3	25.2 - 30.2	4.6
	Mudgo	32.2	29.4 - 38.7	4.8
	ASD7	34.2	30.8 - 40.6	4.2
Brachypterous females	TN1	16.9	14.8 - 17.1	5.6
	Mudgo	13.2	9.2 - 16.5	5.2
	ASD7	14.8	12.1 - 17.2	7.0



Probit lines of 1-d-old female BPH from different rice cultivars exposed to 40°C.