Table 1. Probit analysis of chlorpyrifos, BPMC, and buprofezin on *C. lividipennis* and *N. lugens*.

Insect	LC_{50} (ppm)	Fiducial limits (95%)	Regression equation
		Chlorpyrifos	
C. lividipennis	228.4	191.5 – 273.8	$Y = 1.03x - 0.59$
N. lugens	96.3	75.2 – 118.1	$Y = .091x - 0.86$
		BPMC	
C. lividipennis	61.6	47.9 – 75.4	$Y = 0.93x - 1.17$
N. lugens	43.6	32.8 – 55.0	$Y = 0.79x - 2.12$
		Buprofezin	
C. lividipennis	>900	–	No regression obtained
N. lugens	0.37	0.02– 1.61	$Y = 0.14x - 5.13$

Table 2. Relative potencies of 3 insecticides on *C. lividipennis* and *N. lugens*.

Insecticide	Relative potency[a]	Fiducial limits (95%)	Parallelism chi-square
Chlorpyrifos	2.75	2.09 - 3.70	3.02 df 1
BPMC	1.25	0.93 - 1.68	1.40 df 1
Buprofezin	>2500	Parallel analysis not carried out	

[a] $\text{Relative potency} = \dfrac{LC_{50} \text{ for } C.\ lividipennis}{LC_{50} \text{ for } N.\ lugens}$

suggesting that the chemical is equally toxic to both species. But the chances of *C. lividipennis* picking up more chemicals in a sprayed field are higher because it is more mobile in the rice habitat. Insecticide toxicity for *C. lividipennis* under field conditions, therefore, may be even higher and exhibit negligible selectivity.

Buprofezin, on the other hand, is >2500 times less toxic to *C. lividipennis* than to BPH. Negligible effects on *C. lividipennis* are expected at doses that affect BPH. Because of this compound's high selectivity, it may be useful in managing BPH. □

Depression of dispersal of the female green leafhopper (GLH) *Nephotettix virescens* by pipunculid parasitism and ovarian maturation

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Pipunculid flies are important parasitoids at the nymph and adult stages of *N. virescens,* the most efficient transmitter of tungro disease. Pipunculid parasitism is higher on nonmigratory GLH populations inhabiting rice than on immigrant populations that appear in seedbeds and fields within 4 wk after transplanting (WT). This suggests that parasitized adults are less migratory than parasitoid-free ones. We compared the parasitism rate on *N. virescens* females attracted by light and females in ricefields to test this hypothesis. We also measured the difference in the percentage of mature females among samples.

We collected GLH females with a sweep net in Jakarta, West Java, Central Java, Bali, and South Sulawesi, Indonesia, from 1986 to 1990 and dissected them under a binocular microscope. Insects collected at a site on different days were treated as one sample because daily catches were often small. Samples were grouped into three categories: GLH attracted by light at more than 500 m from the nearest ricefields (L1), GLH attracted by light around ricefields (L2), and GLH in ricefields 5-12 WT (RF).

The mean parasitism rate was much higher in RF than in L1 and L2, while the difference between L1 and L2 was insignificant (see table). The percentage of mature females was significantly lower in L1 than in the other categories. These results indicate that pipunculid parasitism depresses even a short-range dispersal of *N. virescens* and that long-distance female flyers are mostly pipunculid-free and immature. □

Comparison of pipunculid parasitism and ovarian maturation in *N. virescens* females attracted by light (L1 and L2) and those in ricefields 5-12 WT (RF). Indonesia, 1986-90.

Sample	Insects examined (no.)	Mean ± SD[a]	
		Parasitism (%)	Mature females (%)
L1	411	1.8 ± 2.1 b	4.1 ± 3.6 b
L2	267	0.9 ± 1.3 b	31.4 ± 13.6 a
RF	604	31.0 ± 15.9 a	28.4 ± 14.7 a

[a] In a column, means followed by the same letter are not significantly different at p = 0.05 by DMRT with arcsin-transfomed values.

Shifts in predator-prey ranges in response to global warming

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Scientists have estimated that global temperatures may increase by 3 ± 1.5 °C within the next 40 yr. When temperature patterns change, the overlap of arthropod species range may also change, due to differences in high temperature tolerance among species. If predator and prey species shift at different rates, rice arthropod communities would dissociate into their component species.

We used a direct assay method to evaluate high temperature tolerance in the brown planthopper (BPH) *Nilaparvata lugens* and its predators *Cyrtorhinus lividipennis* and wolf spider *Pardosa pseudoannulata.* Ten 1-d-old *N. lugens* macropterous females and *C. lividipennis* females were caged in cylindrical (54 × 5.5 cm) mylar cages with a 60-d-old TN1 rice plant trimmed to a single tiller.

In the experiment with *C. lividipennis,* rice plants were exposed to gravid BPH females for 24 h to ensure adequate eggs as food. With the wolf spider, 10 mature BPH females of equal size were introduced into the cages.

Twenty replications of each setup were placed in a growth chamber at 40 °C with 12:12 h illumination and 70% relative humidity. We used this test temperature because in a previous study BPH mortality increased sharply at 40 °C.

We removed five randomly selected cages from the chamber at intervals and recorded mortality. A similar treatment at room temperature was used as the control.

The quantal response data obtained were subjected to probit analysis using a computer program developed by D. Finney. The median lethal doses (LT_{50} expressed in hours) were estimated and compared (see table).

The wolf spider was the most tolerant of 40 °C; only 10% mortality occurred after exposure for 200 h. We were thus unable to estimate the LT_{50}, which was likely to be >280 h.

Regressions for BPH and *C. lividipennis* were significant. The slopes were significantly different and the two probit lines were clearly not parallel.

We estimate the wolf spider to be five times more tolerant of high temperatures than BPH. These differences may not affect the BPH-spider relationship and their range overlap would probably remain.

C. lividipennis, however, is extremely susceptible to high temperatures. The response is very homogeneous, as shown by the steep slope of the probit line. BPH is at least 17 times more tolerant of 40 °C than *C. lividipennis.* This implies that global warming might result in a disruption of this predator-prey relationship, and the range dissociation could lead to reduced egg predation.

C. lividipennis, however, is present in regions where temperatures often reach 40 °C and more tolerant populations may in fact exist. Temperature increases will also be gradual. This will allow more tolerant populations to be selected. □

Mean effective doses (LT_{50}) of macropterous BPH females, *C. lividipennis* females, and *P. pseudoannulata* females exposed to 40 °C.

Insect	LT_{50} (h)	Fiducial limits	Slope
Macropterous BPH	47.3	38.6 - 72.1	3.4
C. lividipennis	2.8	2.5 - 3.0	11.0
Wolf spider	>280	Regression not significant	

Hydrellia wirthi Korytkowski damage to rice in Colombia

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Rice leaf miner *Hydrellia* spp. are sporadic and minor rice pests in Latin America. But in Colombia, farmers are reporting an increase in the incidence of the pests and are spraying insecticide to control them twice per season, despite little information on the insect damage-yield relationship.

In Colombia, early weed control coincides with *Hydrellia* spp. infestations. Farmers in many Latin American countries use propanil for weed control. Propanil interacts with insecticides. To avoid phytotoxic effects, farmers must decide whether to control the insects or the weeds.

In fear of losing their crops, farmers often apply insecticides without scouting the field for eggs or larvae. In most cases, however, damage is restricted to isolated areas in the field where plant density is low or where depressions that hold water attract adults.

We initiated a study to correlate damage by *H. wirthi* with reductions in rice yield. We used widely grown cultivar Oryzica 1, which farmers considered to be susceptible to *Hydrellia* spp. damage.

Oryzica 1 was direct seeded at 100 kg seed/ha. A water layer was established 5 d after plants emerged and was maintained for 15 d. Plants were inspected daily for egg oviposition or damage.

To observe oviposition, we marked 1-m^2 plots in the experimental area. All plants inside the plot were counted and inspected for eggs and/or miners. We considered a plant affected if it had one or more *H. wirthi* miner. Affected plants ranged from 0 to 100%. Control plots were selected from areas with no *H. wirthi* oviposition or damage. To eliminate any hidden insects, we sprayed plots with insecticide 15 d after oviposition started. Plots were inspected weekly to detect other pests. Plant height was recorded at maturity. Plant height and yield were correlated with percentage of damaged plants.

The statistical analysis indicated no correlation between yield, plant height, and insect damage (see table). This agrees with results from other countries where *Hydrellia* spp. have little effect on rice yields. Although the damage looks alarming to farmers, plants recover when infested at early stages of plant development. □

Pearson's correlation coeffcient for the relationship between Hydrellia wirthi damage and rice yield and plant height.[a]

Parameter	Correlation coefficient	P>F
Yield	–0.18	0.4381 ns
Plant height	0.10	0.6606 ns

[a] ns = not significant.

Blower-Vac: a new suction apparatus for sampling rice arthropods

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Entomologists commonly use the D-vac suction sampler, available in different models, for quantitative studies of insects in rice and other habitats. This equipment however, is costly (Model 24 [backpack]

Arthropod catches from 4 suction devices.

Arthropods	Mean[a] D-vac (backpack)		D-vac (hand-carried)		FARMCOP		Blower-Vac	
Hemiptera	59.6	(23.7)	25.7	(10.8)	96.4	(32.9)	124.0	(34.9)
Hymenoptera	13.7	(6.3)	7.3	(2.5)	4.0	(1.6)	4.4	(2.4)
Coleoptera	7.5	(3.1)	2.6	(2.5)	8.7	(3.0)	8.3	(3.0)
Diptera	28.8	(6.6)	23.8	(9.6)	57.3	(41.9)	32.4	(23.0)
Orthoptera	4.5	(4.4)	0.7	(0.4)	4.6	(2.2)	3.6	(3.3)
Lepidoptera	0		0		0		0.1	(0.1)
Odonata	0.4	(0.3)	0.2	(0.2)	0.2	(0.2)	0.4	(0.4)
Araneae	11.8	(4.5)	4.9	(2.0)	14.1	(4.4)	12.4	(2.9)
Total	125.9	(40.5)	65.1	(19.8)	185.1	(56.5)	185.6	(45.7)

[a] SE at 95% CL in parentheses.