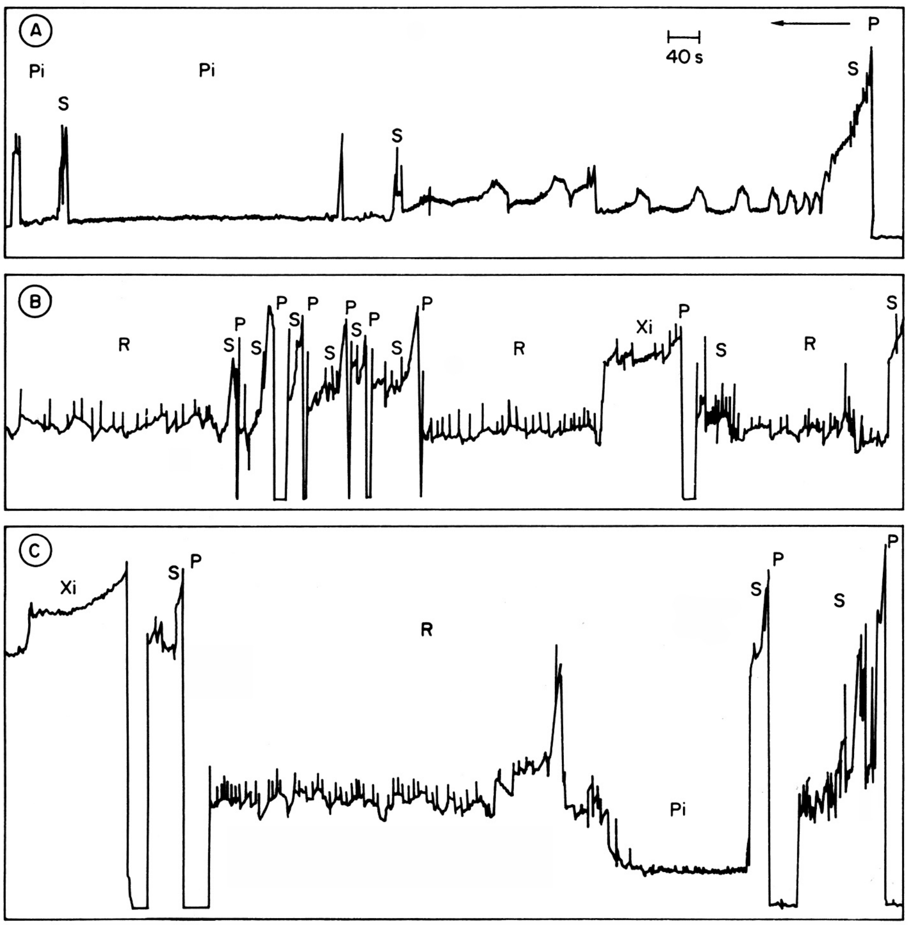
exceeded 250 hoppers/hill. Populations of natural enemies like mirid bug, wolf spider, and coccinellid beetles were higher in unsprayed fields. □

Effect of neem seed bitters (NSB) on green leafhopper (GLH) feeding

R. C. Saxena and M. E. M. Boncodin, Entomology Department, IRRI

A simple process has been developed at IRRI to extract the "bitters" (limonoids) from neem seed kernel. Using an electronic device, we monitored the feeding behavior of newly emerged GLH *Nephotettix virescens* females on 21-d-old TN1 rice seedlings that had been treated systemically by overnight root immersion or by dipping the foliage in a 2,500 ppm NSB aqueous solution for 25 s.

During a 3-h observation, waveform patterns (see figure) showed that duration of phloem feeding was significantly reduced in neem-treated seedlings (see table). The decrease in phloem feeding was accompanied by a corresponding significant increase in frequency of probing, salivation period, and xylem feeding. If GLH feeds less in the phloem, it has less probability of acquiring or transmitting tungro viruses. □



Waveforms electronically recorded during *N. virescens* feeding on TNI rice plants, IRRI, 1987. a = control, b = 2500 ppm NSB-systemic, c = 2500 ppm NSB-foliar. P = probe, S = salivation, Pi = phloem ingestion, R = rest, Xi = xylem ingestion.

Events in 3-h feeding by *N. virescens* females on TN1 rice seedlings treated with 2,500 ppm NSB solution.[a] IRRI, 1987.

Treatment	Probes (no .)	Salivation (min)	Phloem ingestion (min)	Xylem ingestion (min)	Total ingestion (min)
Systemic	25 a	20.7 a	27 b	23 a	50 a
Foliar	24 a	15.2 ab	33 b	27 a	60 a
Control	13 b	9.6 b	77 a	1 b	78 a

[a]Av of 10 replications. In a column, means followed by a common letter are not significantly different at the 5% level by DMRT.

Effect of neem seed treatment on rice seedling vigor and survival of brown planthopper (BPH) and green leafhopper (GLH)

A.A. Kareem, R.C. Saxena, M.E.M. Boncodin, Entomology Department; and V. Krishnasamy and D.V. Seshu, IRTP, IRRI

The principal bitters of neem, particularly azadirachtin, are known to be systemically translocated through the roots. We evaluated seed treatment with crude neem seed kernel extract (NSKE) or neem cake (NC) as a BPH or GLH control measure for young seedlings. We also measured the effect of neem treatment on seed germination and seedling vigor.

In one treatment, healthy seeds of TNl, IR36, and IR42 were soaked in 2.5, 5, or 10% aqueous NSKE solution for 24 h, then incubated for 48 h. In

Table 1. Effect of seed treatment with crude NSKE and NC on BPH and GLH survival.[a] IRRI, 1987.

Neem concentration (%)	Nymphs becoming adults (%)		
	BPH on TN1	GLH on TN1	GLH on IR42
NSKE			
2.5	46.7 b	57.0 b	6.7 a
5.0	63.3 cd	44.3 b	10.0 a
10.0	30.0 a	6.7 a	10.0 a
NC			
1.0	50.0 bc	50.0 b	6.7 a
2.0	30.0 a	30.0 b	13.3 a
0 (check)	70.0 d	70.0 b	36.7 a

[a]Av of 3 replications, 10 first-instar nymphs/ replication. In a column, means followed by the same letter are not significantly different at the 5% level by DMRT.

another treatment, seeds soaked in water for 24 h were dressed with 1 or 2% NC powder and incubated for 48 h. Untreated seeds were used for the check.

At 7 d after sowing, individual TN1 seedlings in 15- × 1.5-cm glass test tubes were infested singly with first-instar BPH nymphs. TN1 or IR42 seedlings were infested with first-instar GLH nymphs. Insect survival was recorded daily until all nymphs became adults or died.

Fewer BPH nymphs reached adulthood on TN1 seedlings treated with NSKE or NC than on check seedlings, but only 10% neem extract treatment was significantly more effective than other treatments (Table 1). Only treatment with 10% NSKE reduced GLH nymph emergence on highly susceptible TN1. GLH nymph emergence on IR42 was not significantly affected by neem derivatives, probably because IR42 is already moderately resistant to GLH.

Seed germination of IR36 and IR42 and seedling root length, shoot length, and chlorophyll content were not affected by neem treatment. In fact, soaking seed in NSKE increased seedling vigor, with significantly higher seedling root and shoot growth indices than control. NC treatment also improved seedling vigor, but not as much as NSKE. Dried IR36 and IR42 seedlings germinated from seeds without neem treatment weighed significantly less than seedlings germinated from neem-treated seeds (Table 2). □

Table 2. Effect of treating rice seed with crude NSKE and NC on germination and seedling vigor.[a] IRRI, 1987.

Neem treatment (%)	Germination (%)	Growth index		Length (mm)		Dry wt (mg)/10 seedlings	Chlorophyll[b] (µg/g)
		Root	Shoot	Root	Shoot		
IR36							
NSKE							
2.5	96 a	77.5 a	66.0 a	250.3 a	105.0 a	91 a	51 a
5.0	95 a	79.8 a	71.3 a	249.3 a	104.0 a	92 a	50 a
10.0	94 a	81.5 a	70.5 a	250.8 a	106.0 a	90 a	52 a
NC							
1.0	94 a	60.8 b	60.5 b	249.3 a	106.0 a	90 a	50 a
2.0	96 a	55.0 c	63.5 b	250.0 a	105.8 a	89 ab	51 a
0 (check)	94 a	34.8 d	44.3 c	249.8 a	105.3 a	85 b	49 a
IR42							
NSKE							
2.5	96 a	43.8 ab	46.8 b	218.0 a	80.0 a	83 ab	106 a
5.0	96 a	39.5 b	47.8 b	220.5 a	80.8 a	85 a	106 a
10.0	95 a	48.8 a	52.5 a	219.5 a	80.0 a	84 ab	105 a
NC							
1.0	95 a	24.8 c	22.5 c	220.0 a	80.0 a	80 bc	104 a
2.0	95 a	24.8 c	26.3 c	220.8 a	81.0 a	82 abc	106 a
0 (check)	94 a	16.0 d	17.3 d	219.0 a	81.0 a	78 c	104 a

[a] Av of 5 replications. In a column, means for each variety followed by a common letter are not sitnificantly different at the 5% level by DMRT. [b] Fresh weight basis.

Effect of plant derivatives on green leafhopper (GLH) and rice tungro (RTV) transmission

V. Narasimhan and V. Mariappan, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai 625104, India

Leaf extracts of nirgunda *Vitex negunda* L., croton *Crotons sparsiflorus* Marong, bilwa *Aegle marmelos* Coor., ocimum or sweet tulsi *Ocimum sanctum* L., and ikshugandha *Tribules terestris* L. in water; seed oils of neem *Azadirachta indica* A. Juss, laural *Calophyllium inophyllum* L., mahua *Madhuca longifolia* Koen. Macbr. var. *latifolia* Roxb. chevai, custard apple *Annona squamosa* Linn. in water emulsified with 1% teepol; crude seed extract of neem and cake extract of neem in water; and insecticides phosphamidon (dimecron) and carbofuran were tested for effects on survival of GLH *Nephotettix virescens* Dist. and RTV transmission.

The plant derivatives and insecticides were sprayed on l0-d-old TKM9 seedlings raised in mud pots, using a

GLH survival and RTV infection rates on TKM9 seedlings sprayed with leaf extracts, seed oils, and insecticides.

Source	Rate[a]	GLH survival (%)			RTV (%)
		1 d	5 d	10 d	
Leaf extracts					
Nirgunda	10	100	65	15	14
Crotons	10	100	90	30	64
Bilwa	10	100	40	5	26
Ocimum	10	100	65	5	33
Ikshugandha	10	100	60	10	36
Seed oil or extracts					
Neem oil	1	15	0	0	25
Custard apple oil	1	60	0	0	33
Laural	1	60	5	0	39
Mahua	1	80	45	5	17
Neem seed extract	2	95	75	0	54
Neem cake extract	5	100	55	5	31
Insecticides					
Carbofuran 3 G	1.3	7	0	0	29
Phosphamidon	0.1	15	0	0	50
Control		100	90	15	75

[a] In percent, except carbofuran in kg/ha.