

# Comparing the performance of three host-related populations of *Nilaparvata lugens* (Stål) on holidic diets with various amino acid compositions

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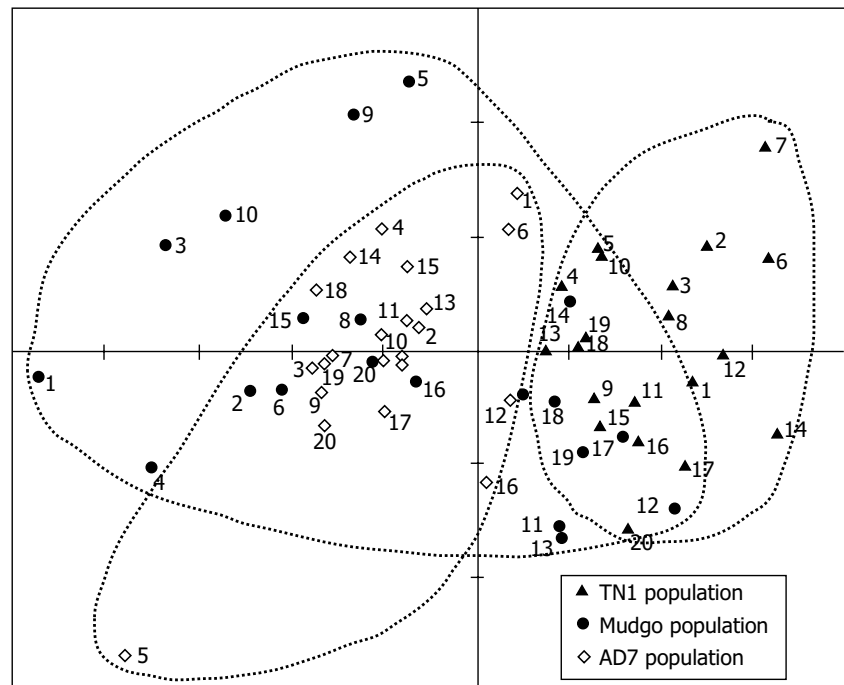
An evident virulence shift of the brown planthopper *Nilaparvata lugens* (Stål) to rice varieties with specific major resistance genes generally occurs upon rearing the insects for several generations on resistant varieties (Rombach and Gallagher 1994, Ketipearachchi et al 1998). Amino acids are the dominant nitrogen nutrients in rice phloem (Fukumorita and Chino 1982). However, little information exists about the effect of amino acids on the survival and development of different host-adapted populations (or biotypes) of *N. lugens*. In this study, we compared the performance of three host-related *N. lugens* populations on holidic (chemically defined) diets with various amino acid compositions.

The three populations used have been successively maintained for more than 30 generations on one of three rice varieties: TN1 (susceptible), Mudgo (*Bph1*), and ASD7 (*bph2*). They were reared on 20 holidic diets, varying in overall amino acid content (2.4%, 3.2%, 4.0%, 4.8%, W/V) and Eaa (essential amino acid)-nEaa (nonessential amino acid) ratio (58:42, 50:50, 42:58, 34:66, 26:74), based on the chemically defined diet D-97 (Fu et al 2001). One hundred 1-d-old nymphs from each population were fed on each diet using four feeding chambers (25 nymphs chamber<sup>-1</sup>) at 27 °C, >85% relative humidity (RH), and a photoperiod of 12–14 h light (Fu et al 2001). The emergence rate, pro-

portion of brachypterous adults, nymphal development period, and weight of newly molted adults were measured.

The three populations differed substantially in the effects of dietary amino acid composition (see table). Overall amino acid content had no significant effect on any of the performance indices of the ASD7 populations, but it affected the emergence rate of TN1 populations. It significantly affected all the indices of the Mudgo population, except for emergence rate. Eaa-nEaa ratio had smaller effects on the TN1 population than on both Mudgo and ASD7 populations. In addition,

interactions between overall amino acids and Eaa-nEaa ratio also had the greatest influence on the Mudgo population. Principal component analysis based on all performance indices indicated that the variation in amino acid composition caused the Mudgo population to spread over the largest area and the TN1 population over the smallest area (see figure). Variation in amino acids in the three populations conformed to the sequence Mudgo > ASD7 > TN1. Populations of resistant rice varieties (Mudgo and ASD7) were more sensitive to variation in dietary amino acids than the TN1 population.



Principal component analysis based on all performance indices of the three *Nilaparvata lugens* populations on 20 holidic diets. The numbers 1–20 represent 20 holidic diets with varying overall amino acid Eaa-nEaa ratio. Dotted lines enclose the area of each population on various diets.

Results indicated that amino acid requirements of *N. lugens*, mainly total concentration, differed across the three populations (see table). The Mudgo population required the highest concentration (4.0–4.8%).

The three populations differed in adaptation to variation in amino acids. It is possible that amino acids are an important biochemical basis for resistance to *N. lugens* in rice and play an impor-

tant role in the formation of new host-related populations or biotypes of the insect.

### References

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**Effects of amino acid composition of the diet on the performance of three host-related populations of *Nilaparvata lugens*.<sup>a</sup>**

Factor	<i>N. lugens</i> population	Emergence rate	Proportion of brachypterous adults	Weight of newly molted adult		Nymphal duration	
				Female	Male	Female	Male
Overall amino acid content (%)	TNI	** (3.2–2.4)	ns	ns	<i>b</i>	ns	ns
	Mudgo	<i>b</i>	*	**	***	***	***
	ASD7	<i>b</i>	ns	ns	ns	ns	ns
Eaa-nEaa	TNI	ns	ns	ns	<i>b</i>	***	***
	Mudgo	<i>b</i>	ns	***	*	***	***
	ASD7	<i>b</i>	*	*	ns	***	***
			(34:66–50:50)	(50:50)		(50:50)	(58:42–50:50)
Interaction	TNI	ns	ns	ns	**	**	ns
	Mudgo	*	ns	***	ns	***	***
	ASD7	*	ns	ns	ns	ns	**

<sup>a</sup>ns = no significant effect ( $P > 0.05$ ); \*, \*\*, and \*\*\* = significant effect at 0.05, 0.01, and 0.001 level, respectively (F test). Numbers in parentheses are the optimum overall amino acid level (%) or Eaa-nEaa determined by Duncan's multiple range test. <sup>b</sup>Main effects are not examined when the interaction term made up a large proportion of the ANOVA total sum of squares.

## Effects of genotypes and insecticide application on tungro disease incidence and grain yield of rice

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Rice tungro disease (RTD) is a devastating viral disease of rice caused by rice tungro bacilliform virus (RTBV) and rice tungro spherical virus (RTSV). It can be managed by controlling its insect vectors—green leafhoppers (*Nephotettix* spp.). However, there

is still a debate on RTD management through insecticide application. Ganapathy et al (2001) and Batay-an and Mancao (2001) have found that RTD could be managed by applying insecticides to control leafhoppers. However, this has not been universally

accepted among research workers. Villareal (2001) reported that leafhopper control by insecticides is not a solution to the tungro problem as application of insecticides to control leafhopper vectors of RTD cannot be justified in areas where inoculum sources are