Insecticide resistance and activities of relative enzymes in different populations of the white-backed planthopper

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White backed planthopper (WBPH), *Sogatella furcifera* (Horvath), is one of the most devastating insect pests on rice in Asia. Its control mainly depended on the chemical pesticides. Surveys of insecticide susceptibility revealed that organophosphorus and carbamate resistance has emerged since early 1980s in China and Japan. WBPH has the long-distance migration property, and Heinrichs(1994) considered that the migration might influence the resistance level of planthoppers. So we conducted the comparative studies on insecticide susceptibility and activities of resistance relative enzymes in four WBPH populations collected from Zhejiang, Yunnan, and Hainan provinces of China in 1997.

Toxical application method was used to determined the susceptibility of WBPH to three insecticides, malathion, methamidophos, and isoprocarb. Activities of esterase, carboxylesterase, glutathione S-transferase (GST), and acetylcholinesterase (AchE) in individual adult were measured according to Hama and Hosoda (1983).

Compared with the data reported by Fukuda and Nagata(1969), it was found that there were significant increase in LD_{50}: 16.2 - 137.2 times for malathion, and 10.3 - 15.6 times for isoprocarb (Table 1). The susceptibilities of Yunnan and Hainan populations were lower compared with that of Zhejiang and Guangxi's.

The activities of four enzymes in female of Yunnan and Hainan populations were higher than in other populations (Table 2). It was corresponding with the results of the activity test of enzymes.

The resistant level showed a fluctuation within different stages and locations, and it tended to decrease in recent years. This maybe relate to the increasing use of buprofezin.

Results showed that insecticide susceptibility and the slope of regression line of Zhejiang population were higher than that of other populations, and that was converse for activities of enzymes.□

Table 1. Insecticide susceptibility of WBPH[a].

Location	Year	LD_{50}(μg/♀)		
		Malathion	Methamidophos	Isoprocarb
Chikugo(Japan)	1967	0.0025/7.4	-	0.0012/5.8
Hubei (China)	1987	0.1994/1.3	0.0083/2.4	0.0099/1.3
Zhejiang(China)	1992	0.5204/-	0.0233/-	0.0234/-
Zhejiang (China)	1997	0.1010/2.5	0.0120/4.0	0.0134/3.8
Guangxi(China)	1997	0.0405/1.4	0.0128/5.4	0.0123/2.8
Yunnan (China)	1997	0.2135/2.8	0.0141/2.3	0.0187/3.1
Hainan (China)	1997	0.3431/2.5	0.0117/3.6	0.0177/3.5

[a] Data indicate the slope of regression line.

Table 2. Activities of resistance relative enzymes of WBPH.

Enzyme and substrate	Zhejiang		Guangxi		Yunnan		Hainan	
	Female	Male	Female	Male	Female	Male	Female	Male
Esterase($\mu mol \cdot min^{-1} \cdot \mu g^{-1}$)								
α-naphthyl acetate	0.0120	0.0053	0.0096	0.0079	0.0065	0.0031	0.0054	0.0025
β-naphthyl acetate	0.0066	0.0047	0.0045	0.0059	0.0036	0.0023	0.0031	0.0016
Carboxylesterase ($\mu mol \cdot min^{-1} \cdot \mu g^{-1}$)								
α-naphthyl acetate	0.0016	0.0031	0.0038	0.0064	0.0034	0.0026	0.0031	0.0018
β-naphthyl acetate	0.0034	0.0022	0.0025	0.0051	0.0023	0.0043	0.0020	0.0013
Glutathione S-transferase ($\mu mol \cdot min^{-1} \cdot \mu g^{-1}$)	0.0050	0.0028	0.0028	0.0029	0.0052	0.0044	0.0036	0.0014
Acetylcholinesterase ($10^{-5} \mu mol \cdot min^{-1} \cdot \mu g^{-1}$)	15.62	11.15	9.89	16.16	10.17	16.36	8.56	8.18