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The situation of insecticide resistance of Brown planthopper in Mekong Delta, Vietnam.

Brown planthopper (BPH) is the main target rice insect to production in Mekong Delta. The BPH has been the most serious insect pest of rice in S. Vietnam since 1970 based on hopper burns occurring in 1978, 1991, and 1992. The BPH population and infected area are usually much higher and larger than those before 1990 but the severity of damage is not much larger in several years from 1993 to 2005.

The areas infested with BPH and average population densities of BPH declined compared to those five years ago. The recent population decline mainly resulted from unfavorable weather conditions, especially due to typhoons and floods in September and October in 1999-2003. Diversification of genetic background for resistance to BPH in rice varieties is also attributed to suppressing the BPH population build-up. However, its virulence has increased gradually becoming the most harmful compared to others in Vietnam.

Then, in the year 2006, a small outbreak of BPH occurred in the area of 210,000 ha. The main causes of this epidemic are the following:

-The stress due to abnormal weather in Mekong Delta which had fog and late raining.

-The gene source of resistance to BPH has been very simple in the past ten years. There is no change besides the resistant genes from varieties as CR94-13, Ptb 33, Ptb 18, Rathu heenati and Babawee except the only one rice variety of AS 996 crossed by the resistant gene of *Oryza rufipogon.*

-The development of BPH on susceptible aromatic rice varieties such as Jasmine 85, MTL 250, Nang thom cho Dao, ST 1, VD 20, etc. and migrating to other moderately resistant varieties as OM 1490, OM 2514, OM 2717, VNĐ 95-20, OM 2517, OMCS 2000, OM 3536.

-The habit of farmers still remained with high seed rates, more nitrogen application and misuse of insecticides in timing of spraying and methods of spraying.

- The development of BPH virulence.

Besides, some information of farmers reveals that several insecticides have been resisted by BPH in Mekong delta, such as imidacloprid and fenobucarb. In April 2006, a pesticide company reported that two imidacloprid insecticides at recommended dose rate (28 and 20 gram ai/ha respectively) gave very good control of BPH in WS 05-06 rice crops, except in Tien Giang and Long An province. After that, in Jan. 2007, they informed that there is evidence of BPH resistance to imidacloprid in Long An province (Figure 1, Tables 1, and Table 2).

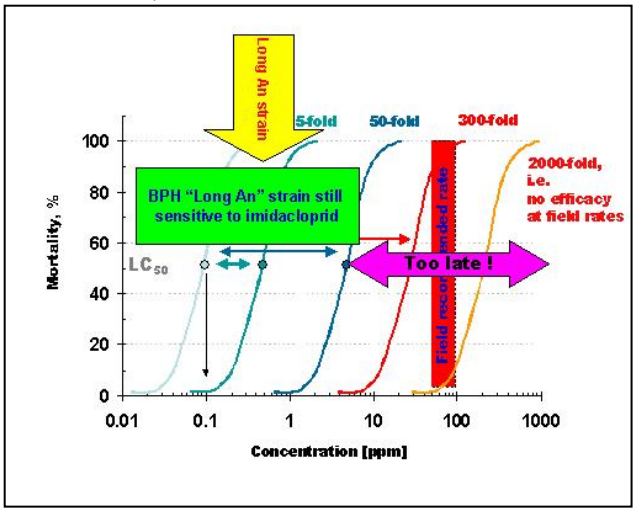


Table 1. Efficacy of Imidacloprid 700 WG demonstration (%)

Province	District	1 DAA	3 DAA	5 DAA	7 DAA	15 DAA
An Giang	An Phu	77	98	90	95	95
An Giang	Cho Moi	74	93	99	99	100
An Giang	Phu Tan	73	92	97	93	95
Dong Thap	Cao Lanh	71	91	91	91	92
Dong Thap	Chau Thanh	75	90	95	98	98
Hau Giang	Long My	70	85	92	91	95
Long An	Moc Hoa				59	
Long An	Tan Hung				70	
Long An	Tan Thanh				72	
Long An	Vinh Hung				60	
Tien Giang	Go Cong Dong	24	61	83		
Tra Vinh	ChauThanh	75	91	95	84	86
Tra Vinh	Tieu Can	72	93	93	87	85

Table 2. Efficacy of Admire 050 EC demonstration (%)

Province	District	1 DAA	3 DAA	5 DAA	7 DAA	15 DAA
An Giang	Chau Phu	50	86	98	98	100
An Giang	Chau Thanh	70	85	89	89	85
An Giang	Thoai Son	78	87	92	93	93
Tien Giang	Go Cong Dong	72	94	94		
Long An	VinhHung – Thuthua – MocHoa		54	73		

In the wet season of 2006, a susceptibility test was carried out at Entomology laboratory (CLRRI) to check the efficacy of some popular use to control BPH in Mekong Delta.

Four application rates, including the recommended rate were, sprayed (table 3) on filter-paper disks with 10 fifth-instar nymphs. Our results show that mortality of Laivung BPH to imidacloprid 700WG, imidacloprid 10WP, buprofezin10WP, fipronil 5SC and etofenprox 10EC were very low (16-62%) when treated at recommended rate and higher rates (table 4).

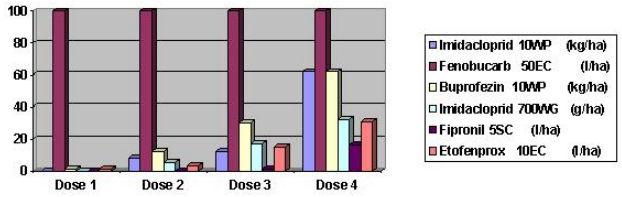
Table 3. Application rate of insecticides

Treatment	Dose 1	Dose 2	Dose 3	Dose 4
Imidacloprid 10WP (kg/ha)	0.2	0.4*	0.6	1.0
Fenobucarb 50EC (l/ha)	1.0	1.2	1.5*	2.0
Buprofezin 10WP (kg/ha)	0.7	1.0*	1.5	2.0
Imidacloprid 700WG (g/ha)	30	40*	50	60
Fipronil 5SC (l/ha)	0.1	0.2	0.3	0.5*
Etofenprox 10EC (l/ha)	0.5	0.7	1.0*	1.5
Untreated control check	water	water	water	water

* recommended rate

Table 4. Mortality of Laivung BPH to insecticides (%) 24 hours after application

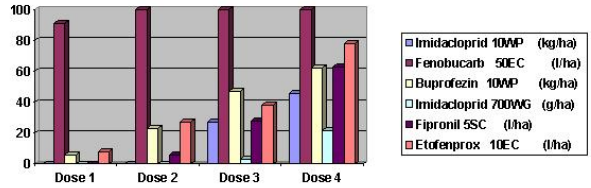
Treatment	Dose 1	Dose 2	Dose 3	Dose 4
Imidacloprid 10WP (kg/ha)	0	8	12	62
Fenobucarb 50EC (l/ha)	100	100	100	100
Buprofezin 10WP (kg/ha)	1	12	30	62
Imidacloprid 700WG (g/ha)	0	5	17	32
Fipronil 5SC (l/ha)	0	0	1	16
Etofenprox 10EC (l/ha)	1	3	15	31
Untreated control check	0	0	0	0
LSD 0.05	1	13	19	32
CV %	58	33	27	40



BPH population of Codo died from 22% to 78% to imidacloprid 700WG, imidacloprid 10WP, buprofezin 10WP, fipronil 5SC and etofenprox 10EC when treated at a higher recommendation rate (table 5).

Table 5. Mortality of Codo BPH to insecticides (%) 24 hours after application

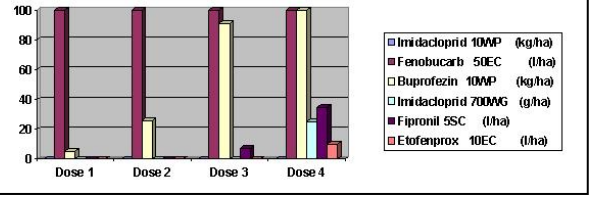
Treatment	Dose 1	Dose 2	Dose 3	Dose 4
Imidacloprid 10WP (kg/ha)	0	0	27	46
Fenobucarb 50EC (l/ha)	91	100	100	100
Buprofezin 10WP (kg/ha)	6	23	47	62
Imidacloprid 700WG (g/ha)	0	0	3	22
Fipronil 5SC (l/ha)	0	6	28	63
Etofenprox 10EC (l/ha)	8	27	38	78
Untreated control check	0	0	0	0
LSD 0.05	9	17	18	26
CV %	59	18	32	34



The susceptibility of Thanhbinh BPH was lowest to imidacloprid 700WG, imidacloprid 10WP, fipronil 5SC and etofenprox 10EC (0-35%) although

Table 6. Mortality of Thanhbinh BPH to insecticides (%) 24 hours after application

Treatment	Dose 1	Dose 2	Dose 3	Dose 4
Imidacloprid 10WP (kg/ha)	0	0	0	0
Fenobucarb 50EC (l/ha)	100	100	100	100
Buprofezin 10WP (kg/ha)	5	26	91	100
Imidacloprid 700WG (g/ha)	0	0	0	25
Fipronil 5SC (l/ha)	0	0	7	35
Etofenprox 10EC (l/ha)	0	0	0	10
Untreated control check	0	0	0	0
LSD 0.05	6	21	12	26
CV %	42	43	89	25

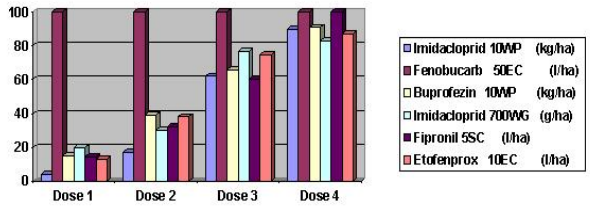


treated at dose 4 (table 6).

Most insecticides caused mortality of more than 50% when Triton BPH is treated at dose 3 and 83-100% when it is treated at dose 4. But imidacloprid 10WP, imidacloprid 700WG, buprofezin 10WP, fipronil 5SC, and etofenprox 10EC were only effective to control BPH when treated at the higher dose than the recommended rate (table 7).

Table 7.Mortality of Triton BPH to insecticides (%) 24 hours after application

Treatment	Dose 1	Dose 2	Dose 3	Dose 4
Imidacloprid 10WP (kg/ha)	4	17	62	90
Fenobucarb 50EC (l/ha)	100	100	100	100
Buprofezin 10WP (kg/ha)	15	39	66	91
Imidacloprid 700WG (g/ha)	20	30	77	83
Fipronil 5SC (l/ha)	14	32	60	100
Etofenprox 10EC (l/ha)	13	38	75	87
Untreated control check	0	0	0	0
LSD 0.05	23	36	33	23
CV %	23	64	37	3



The BPH population was still susceptible to Fenobucarb 50EC, buprofezin 10WP, fipronil 5SC and etofenprox 10EC except imidacloprid 10WP and 700WG (table 8).

Fenobucarb 50EC was most effective to control BPH in Mekong Delta due to the high mortality of all BPH populations.

In conclusion, we can say that BPH populations in Laivung (Dongthap) and in Codo (Cantho) resisted imidacloprid 700WG, imidacloprid 10WP, buprofezin 10WP, fipronil 5SC and etofenprox 10EC, and were only susceptible to Fenobucarb.

While the BPH population in Thanhbinh (Dongthap) was resistant to imidacloprid 700WG, imidacloprid 10WP, fipronil 5SC and etofenprox 10EC, and it is still susceptible to Fenobucarb and buprofezin.

The BPH population in Triton (Angiang) was also resistant to imidacloprid 700WG, imidacloprid 10WP, buprofezin and etofenprox 10EC at the recommended rate but less serious than other population. It is still susceptible to Fenobucarb, fipronil.

The BPH population in Thotnot (Cantho) was only resistant to Imidacloprid, and it is still susceptible to other insecticides.

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Table 8 Mortality of Thotnot BPH to insecticides (%) 24 hours after application

Treatment	Dose 1	Dose 2	Dose 3	Dose 4
Imidacloprid 10WP (kg/ha)	4	8	38	58
Fenobucarb 50EC (l/ha)	97	100	100	100
Buprofezin 10WP (kg/ha)	28	86	94	100
Imidacloprid 700WG (g/ha)	0	3	9	47
Fipronil 5SC (l/ha)	53	92	100	100
Etofenprox 10EC (l/ha)	57	78	90	100
Untreated control check	0	0	0	0
LSD 0.05	28	22	18	20
CV %	78	76	71	47