

# Determination of Economic Threshold level (ETL) of brown planthopper, *Nilaparvata lugens* Stal. population in different stages of rice crop at Raipur

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## ABSTRACT

Determination of Economic Threshold Level (ETL) was carried out at glass house of Entomology Dept., Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during 2012 and 2013. The five to ten BPH nymphs/hill attacked at seedling, fifteen to twenty at tillering and twenty to twenty five at booting stage can cause yellowing in lower leaves then wilting and death in the varieties TN-1, Swarna, Karma mahsuri and Mahamaya. However, the variety Ptb-33 is not affected because of its high level of resistance to BPH but Karma mahsuri was moderately susceptible as compared to TN-1 but variety Mahamaya and Swarna noticed high level of susceptibility. Descending order of BPH infestations observed with the different varieties can be ranked as TN-1 < Swarna < Mahamaya < Karma masuri < ptb-33 within seven day after nymph release.

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## INTRODUCTION

Among the pests infesting rice, the BPH has gained major importance in several Asian countries. Introduction of high yielding varieties, BPH-susceptible rice varieties, use of high levels of nitrogenous fertilizers, continuous cropping, staggered planting, and use of some insecticides favour to BPH multiplication. The continuous and consistent use of insecticides has resulted in BPH resistance to insecticides in Japan (Nagata and Moriya, 1979), Philippines (Heinrichs, 1979). Dyck and Orildo

(1977) demonstrated in the greenhouse, there was usually no significant reduction in grain weight when maximum BPH densities were about 25 BPH/hill in either the second or third generation. In the field, 50-60 BPH/hill at harvest produced no apparent loss in grain yield. Thus, recommended an economic injury level of 1 BPH/ tiller or about 25 BPH / hill as a rough guide for practical BPH control throughout a crop period. Yen and Chen (1976) showed that 25 BPH/ hill were a practical control threshold and a susceptible cultivar of the young plants Pelita I-1 were killed within 2 weeks, when 10

macropterous adults/ hillattacked within a week after transplanting. The application of insecticides when there are more than 10 adult BPH/hill the economic threshold level at tillering stage and more than 50/hill after heading stage as reported by Suenaga (1959). Kisimoto (1975) indicated that, when there are more than 20-30 immigrant adults/100 hills, hopper burn will be expected in later generations. It has been observed in Japan that if rice plants at the tillering stage are attacked by about 10 planthoppers/hill for a week, the lower leaves turn yellow and die, and yield eventually decreases by 10 to 40 per cent. If the plants at the heading stage are infested by 10 to 50 planthoppers for 10 to 14 days, they eventually show hopper burn damage and the yield is reduced by 20 to 50 per cent. Mochida and Dyck (1976) evaluated the control threshold of 20 to 25 planthoppers/hill that has been recommended for tropical countries may be too high. Sugino (1975) had observed in Japan that if rice plants at the tillering stage are attacked by about 10 planthoppers/hill for a week the lower leaves turn yellow and die, and yield eventually decreases by 10 to 40 per cent. If the plants at the heading stage are infested by 10 to 50 planthoppers for 10 to 14 days, they eventually show hopper burn damage and the yield is reduced by 20 to 50 per cent (IRRI, 1974). A different experiment has shown that 2-week infestations by 5 to 25 or more nymphs per tiller at 26- 39 and 40-53 days after seeding caused 8 and 70 per cent or more yield losses, respectively.

**MATERIAL AND METHODS**

The experiment was carried out at the Entomology glass house of Indira Gandhi Krishi Vishwavidyalaya. The different varieties like TN-1, Ptb-33, Sawarna,

Karma mahsuri and Mahamaya were selected to find out ETL at the different critical stages of plant growth i.e. seedling tillering and panicle stage with three replications for each stage. Each potted plant was covered with a transparent, hollow plastic tube, the top portion was covered with muslin cloth and then labeled with the respective A, B, C, D and E wherein 5, 10, 15, 20 and 25 BPH nymphs of third instar, respectively were released. After 24 hours observations were recorded according to their visible damage based on scoring pattern i.e. 0=no damage, 1-partial yellowing of first leaf, 3-partial yellowing of first and second leaf, 5-pronounced yellowing and some wilting, 7-more than half of the plant wilted, 9-all the plants dead.

**RESULTS AND DISCUSSION**

The mean of two years data on the different genotypes at different critical plant stages to find out ETL within seven day after release it may be stated that, the BPH population trends in the infested pots during the experiment must be known to ensure correct evaluation of the effects of the BPH infestation on rice plants are presented in Table 1 and Fig. 1a, 1b. The five released BPH nymphs/hill ranged from 0.0 to 3.65. The TN-1 genotype score (3.65) had maximum. It was followed by (3.30) Swarna at seedling stage with the minimum (0.00) in Ptb-33 at all plant critical stages. The ten released BPH nymphs/hill ranged from 0.0 to 4.90. The maximum score (4.90) was in TN-1 and Swarna at seedling stage followed by (3.70) TN-1 and Mahamaya at seedling stage and tillering stage, respectively whereas, minimum (0.00) in Ptb-33 at tillering and booting stage. The fifteen released BPH nymphs/hill ranged from 0.10 to 6.05. The maximum score (6.05) was in TN-1 at

**Table 1 : Mean data of Economic Threshold Level (ETL) of brown planthopper, *Nilaparvata lugens* Stal. population at different stages of crop growth during 2012 and 2013**

Genotypes	Mean data of BPH population (Nymph/hill) at different stages of crop growth														
	Seedling stage					Tillering stage					Booting stage				
	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25
Mahamaya	2.35	3.70	4.95	7.40	8.15	1.35	2.35	3.70	6.10	7.40	0.60	1.35	2.05	4.10	5.10
Swarna	3.30	4.90	4.95	7.40	8.20	1.45	2.40	3.75	6.15	7.40	0.75	1.40	2.20	4.10	5.30
Karma masuri	2.05	2.25	3.05	6.05	7.35	1.00	1.75	3.05	5.25	6.45	0.35	1.10	1.80	3.10	4.40
TN-1	3.65	4.90	6.05	7.55	8.60	2.30	3.70	4.95	6.05	8.15	1.00	1.25	2.50	4.40	6.10
Ptb-33	0.00	0.10	1.00	2.15	3.10	0.00	0.00	0.35	1.00	1.45	0.00	0.00	0.10	0.30	0.55

\* Average of three replications,

\* Scores: 0= no damage, 1= partial yellowing of first leaf, 3= partial yellowing of first leaf and second leaf, 5= pronounced yellowing and some wilting, 7= more than half of the plant are wilted, 9= all plants dead,

\* 5, 10, 15, 20 and 25= No. of BPH population.

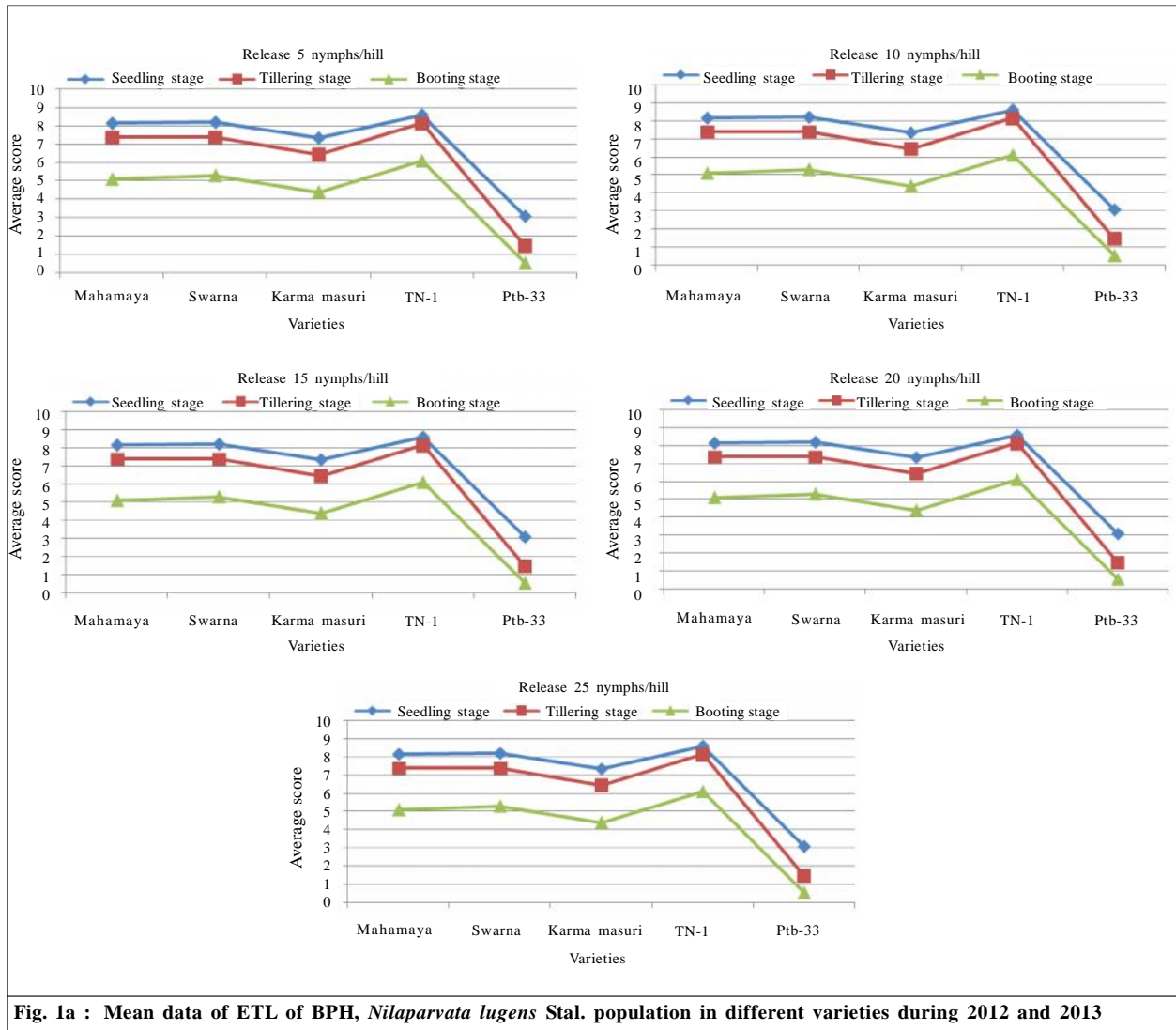


Fig. 1a : Mean data of ETL of BPH, *Nilaparvata lugens* Stal. population in different varieties during 2012 and 2013

seedling stage followed by (4.95) Mahamaya, Swarna at seedling stage and TN-1 at tillering stage, respectively and minimum (0.10) in Ptb-33 at booting stages. The twenty released BPH nymphs/hill ranged from 0.30 to 7.55. The maximum score (7.55) was in TN-1 genotypes. It was followed by (7.40) Mahamaya and Swarna at seedling stage, with the minimum (0.30) in Ptb-33 at booting stage. For twenty five released BPH nymphs/hill ranged from 0.55 to 8.60. The maximum score (8.60) was in TN-1 followed by (8.20) Swarna at seedling stage, respectively with the minimum (0.55) in Ptb-33 at booting stage.

Thus, it is clearly indicated that the five to ten BPH nymphs/hill are attacked at seedling, fifteen to twenty at tillering and twenty to twenty five at booting stage that

caused lower leaves turn yellow some wilted and die. However, Ptb-33 is not affected showing high level of resistance but Karma masuri is moderately susceptible as compared to TN-1, but variety Mahamaya and Swarna showing high level of susceptibility.

Not exact but similar types of findings were reported by Sugino (1975) in Japan that when rice plants at the tillering stage are attacked by about 10 planthoppers/hill for a week, the lower leaves turn yellow and die, and yield eventually decreases by 10 to 40 per cent. When the plants at the heading stage are infested by 10 to 50 planthoppers for 10 to 14 days, they eventually show hopper burn damage and the yield is reduced by 20 to 50 per cent. Similar findings were observed Mochida and Dyck (1976) who evaluated the “control threshold” of

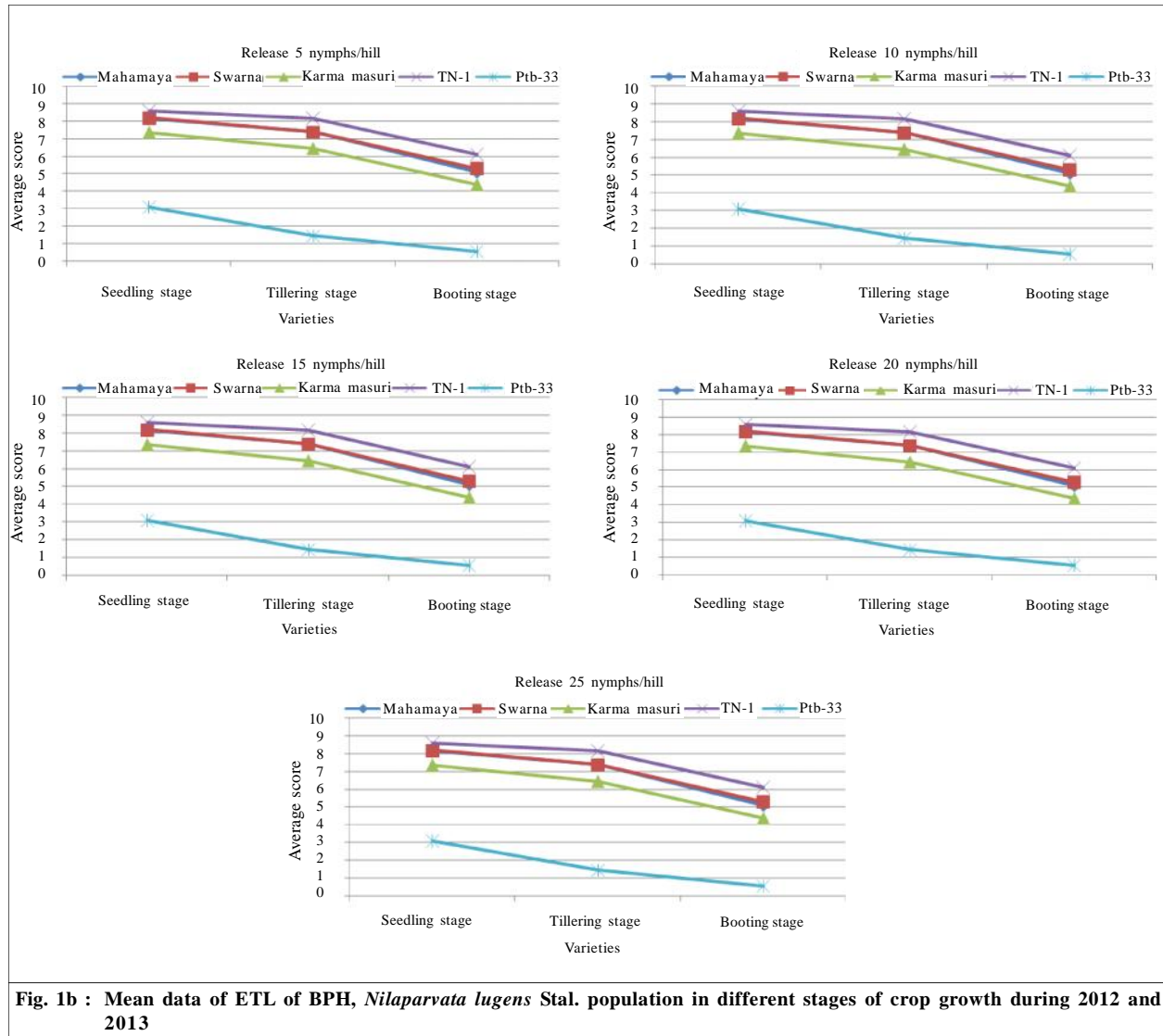


Fig. 1b : Mean data of ETL of BPH, *Nilaparvata lugens* Stal. population in different stages of crop growth during 2012 and 2013

20 to 25 planthoppers/hill that has been recommended for tropical countries to be too high. A different experiment has shown that 2-week infestations by 5 to 25 or more nymphs per tiller at 26- 39 and 40-53 days after seeding caused 8 and 70 per cent or more yield losses, respectively as reported by IRRI, 1974. Yen and Chen (1976) reported that the tolerance to the BPH in rice variety Tainan 5 at different growing stages varies greatly. Grain yields were reduced by 40 to 60 per cent when plants were infested at the tillering stage by 20 to 40 insects/hill for 2 weeks; grain yields were reduced by about 75 to 90 per cent when plants were infested at the booting stage by the same number of insects.

### Conclusion :

The five to ten BPH nymphs/hill attacked at seedling, fifteen to twenty at tillering and twenty to twenty five at booting stage can cause yellowing in lower leaves then wilting and death in the varieties TN-1, Swarna, Karma mahsuri and Mahamaya. However, the variety Ptb-33 is not affected because of its high level of resistance to BPH but Karma mahsuri was moderately susceptible as compared to TN-1 but variety Mahamaya and Swarna noticed high level of susceptibility.

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