

# BIOPHYSICAL SCREENING OF BRINJAL GENOTYPES AGAINST FRUIT AND SHOOT BORER, *LEUCINODES ORBONALIS* (GUEN.)

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## ABSTRACT

The effect of nine biophysical parameters of twenty nine genotypes of brinjal was tested against shoot and fruit borer (SFB). The lowest damage on shoots (1%) and fruits (4%) occurred in 12/SPT BL VAR 7 followed by statistically at par Punjab Sadabahar with damage of 1.2 and 5.2%, respectively. While the highest damage on shoots (6.2 %) and fruits (22.8 %) found in 12/SPT BL VAR 10, succeeded by statistically at par 12/SPT BL VAR 9 with 6 and 22.5% damage, respectively. The correlation of fruit damage was positively strong with fruit girth ( $r = 0.638$ ), pedicel length ( $r = 0.444$ ) and fruit numbers ( $r = 0.014$ ), but negatively strong with fruit length ( $r = - 0.343$ ). The non significant positive correlations were found with canopy length ( $r = 0.059$ ), days to 1<sup>st</sup> flowering ( $r = 0.017$ ), mean fruit weight ( $r = 0.106$ ) and yield (0.075). Six genotypes viz. 12/SPT VAR 8, Punjab Sadabahar, 13/BRL VAR 5, 12/SPT BL VAR 7, 12/SPT BR VAR 6 and 12/SPT BL VAR 5; two genotypes viz. 12/SPT BL VAR 10 and 12/SPT BL VAR 9 and rest twenty one genotypes were recognized respectively as highly resistant, tolerant and fairly resistant.

## INTRODUCTION

Brinjal is known as king of vegetables originated from India. India is the second largest producer of brinjal after China (NHB, 2013). In India, it is cultivated in about 7.22 lakh hectare with a production of 134.43 lakh tones. West Bengal contributes 22 % of the total Indian production followed by Odisha (16 %). Brinjal is one of the most important vegetable crops in West Bengal. The unripe fruit of brinjal is primarily used as a cooking vegetable for various dishes (Grubben and Denton, 2004). It suffers severely due to the attack of various insect pests which reduces its yield and quality of fruits. The most important insect as a key pest of brinjal (Latif *et al.*, 2010; Chakraborti and Sarkar, 2011; Saimandir and Gopal, 2012) is the Shoot and fruit borer (SFB) that causes economic damage in almost all the eggplant growing areas (Dutta *et al.*, 2011) with 63 % loss in yield (Dhankar *et al.*, 1997). As a result of its feeding inside fruit, the fruits become unmarketable and yield losses go upto 90 % (Baral *et al.*, 2006). Many farmers hesitate to grow brinjal because of heavy infestation of fruit and shoot borer and also lower return. The Screening of brinjal genotypes against SFB has been attempted by several workers (Javed *et al.*, 2011; Khan and Singh, 2014 and Devi *et al.*, 2015)

Application of pesticides to control SFB on brinjal has resulted pollution, resurgence of secondary pests, insecticides resistance, elimination of beneficial fauna and different human health hazards. Hence, there is an urgent need to look alternate and safer method to manage insect pests of crops. Keeping it in mind, the present study was undertaken to find out safe approach to manage SFB using resistant genotypes of brinjal.

Moreover, identification of biophysical basis of resistance may also serve as a major part of integrated management of SFB in brinjal. Because, it is useful for genetic improvement to get sustainable management of the pest in a convenient, economical and eco-friendly manner. So, the objective of the present investigation was to screen brinjal genotypes with biophysical basis of resistance against SFB, *Leucinodes orbonalis*.

## MATERIALS AND METHODS

The present field study was conducted at Kalyani 'C' block Farm, Bidhna Chandra Krishi Viswavidyalaya, Nadia, West Bengal (23.5°N latitude, 89.0°E longitude and 9.75 m above mean sea level) during autumn winter season of 2013-14. Twenty nine genotypes of brinjal were screened against SFB of brinjal in randomized block design (RBD) with three replications. The cultural practices except plant protection measures were followed as per local recommendation.

The mean percent shoot and fruit infestation was calculated as per methodology of Javed *et al.*, 2011. Based on percent fruits damaged by SFB, all the genotypes have been categorized into six grades viz. Immune (I): 0%, Highly Resistant (HR): 0.1-10%, Fairly Resistant (FR): 10.1-20%, Tolerant (T): 20.1-30%, Susceptible (S): 30.1-40% and Highly susceptible (HS): > 40.1%. This is based on the rating given by Rai and Satpathy, 1998.

### Biophysical parameters of brinjal crop

Nine biophysical characters in 29 genotypes were studied to find out their relation with damage by *Leucinodes orbonalis* in

brinjal (Table 1).

### Statistical analysis

The data regarding different parameters were subjected to analysis of variance using SPSS 13.0 version separating means at 5 % level of critical difference (CD). The data were then processed for multiple correlation and stepwise regression analysis to determine their effect against infestation of *Leucinodes orbonalis*.

## RESULTS AND DISCUSSION

### Biophysical screening of genotypes against Shoot and fruitborer in brinjal

Attempts were made to find out nine biophysical responses of genotypes on damage of shoots and fruits by SFB in brinjal. It resulted with the following findings (Table 2).

#### Plant height

Plant height of the twenty nine tested genotypes was ranged from 74.27 to 115.10 cm. The significantly highest plant height of 115.10 cm was recorded in genotype 12/SPT BR VAR 3 with 3 percent shoot and 11 percent fruit damage. The genotype 12/SPT BR VAR 10 had the lowest plant height of 74.27 cm with 4.1 and 15.5 percent damage on shoot and fruit, respectively. It was statistically at par with genotype 12/SPT BL VAR 3 regarding height (74.43 cm) and fruit damage (14.8 %). There was a weak negative response of plant height on shoot and fruit damage by SFB in brinjal which supports the work of Javed *et al.*, 2011 who reported maximum plant height of 125 cm in cultivar Nirala.

#### Plant canopy length

The canopy length ranged from 45.90 to 100.83 cm amongst the tested genotypes. The genotype Kashi Taru had the significantly maximum length with 4 percent shoot and 12.8 percent fruit damaged by SFB. The lowest length at significant level was recorded in genotype 12/SPT BL VAR 3 with 3.5 percent shoot and 14.8 percent fruit damage. Effect of canopy length on damage was recognized as positive but not so strong. Reference on previous work in this respect is not found by the present authors.

#### Days to 1<sup>st</sup> flowering

The required time for first flower initiation after transplanting of tested genotypes ranged from 25 to 38.33 days. The first flowering depicted in genotype 12/SPT BL VAR 1 in which shoot and fruit damaged by SFB were 3.3 and 12 percent,

respectively. The first flower initiation started latest by 38.33 days in genotype 13/BRL VAR 3 with 2.9 percent shoot and 11.8 percent fruit damage. Generally, damage response of SFB was recognized comparatively greater in early flowering genotypes. No evidence found in support of the present report.

#### Fruit length

The fruit length ranged from 8.61 to 21.64 cm among the tested genotypes. In most of the genotypes, percent infestation of SFB both on shoots and fruits increased with the decrease in fruit length and vice versa. The length significantly highest in genotype Punjab Sadabahar (21.64 cm) with 1.2 percent shoot and 5.2 percent fruit damage. It depicted lowest in 12/SPT BR VAR 9 (8.61 cm) with shoot and fruit damage respectively by 4.2 and 16.3 percent. Such finding is in agreement with Devi *et al.*, 2015 who found maximum fruit length of 21 cm in variety 2010/BRL VAR-1 with 5.20 percent fruit damage and smallest length of 9.50 cm in variety swamamani with 35.58 percent fruit damage.

#### Fruit girth

Mean fruit girth ranged from 4.33 to 9.90 cm among all twenty nine tested genotypes. In maximum genotypes, the infestation level by SFB on shoots and fruits increased with the increase in girth of fruit. The highest fruit girth (9.90 cm) was recorded in genotype 13/BRL VAR 4 with 5.7 and 20 percent shoot and fruit damage, respectively. Whereas it was lowest in genotype Punjab Sadabahar with 1.2 percent shoot and 5.2 percent fruit damage. It was statistically at par with genotype 12/SPT BL VAR 7 bearing 5.36 cm fruit girth, 1 percent shoot and 4 percent fruit damage. The present finding is in agreement with Naqvi *et al.*, 2009 and Devi *et al.*, 2015. The last author reported maximum fruit girth of 8.89 cm in variety KS-224 with 29.33 percent fruit damage and minimum of 3.44 cm in variety Punjab Sadabahar with 7.18 percent fruit damage.

#### Pedicle length

Pedicle length ranged from 4.33 to 9.17 cm amongst all the tested genotypes. The genotype 13/BRL VAR 4 had the significant maximum length of 9.17 cm followed by 7.01 cm in genotype 12/SPT BL VAR 6. It was minimum of 4.33 cm in genotype 12/SPT BL VAR 5 which was statistically at par with 4.50 cm in genotypes Punjab Sadabahar. Pedicle length had remarkable positive effect on infestation level of SFB on shoots and fruits of brinjal. The highest length was associated with 5.7 percent shoots and 20 percent fruits damage. Consequently, the lowest length resulted shoots and fruit damage by 2 and 8.7 percent, respectively.

**Table 1: Biophysical characteristics of brinjal and methodology used for their study**

S. No.	Characteristics	Methodology
1	Plant height (cm)	Five randomly selected plants per plot were measured with the help of scale from the base of the plant
2	Canopy length (cm)	Five randomly selected plant canopy per plot were measured with the help of scale
3	Days to flowering	Five randomly selected flowers from each of 5 plants per plot were tagged
4	Length of fruit (cm)	Ten fruits of marketable maturity per plot were selected randomly to measure length with the help of scale
5	Girth of fruit (cm)	Above mentioned ten fruits were taken to measure girth at the centre with the help of vernier caliper
6	Length of pedicel (cm)	Five randomly selected fruits from each of 5 plants per plot were selected to measure pedicel length with the help of scale from point of attachment to the base of the calyx
7	Mean fruit weight (g)	Five randomly selected marketable fruits from each of 5 plants per plot were selected to measure mean weight of fruit
8	Yield (q/ha)	Total yield was calculated per plot starting from first picking to final picking and converted into q/ha
9	Mean fruit numbers	Mean fruit numbers were recorded by counting total numbers of harvested fruit per plot

**Table 2: Biophysical screening of brinjal genotypes against shoot and fruit borer of brinjal during autumn-winter season of 2013-14**

Genotypes	PH (cm)	PCL (cm)	DF	FL (cm)	FG (cm)	PL (cm)	MFW (g)	Y (q/ha)	MFN/plot	MSI (%)	MFI (%)
13/BRL VAR 1	99.20	73.53	34.67	17.37	8.38	6.50	302.90	424.30	210.00	4.4	14.6
13/BRL VAR 2	97.43	71.17	28.00	13.78	7.65	6.83	143.20	256.67	240.67	4.7	17.3
13/BRL VAR 3	96.57	67.57	38.33	17.03	7.34	6.37	167.50	266.40	235.67	2.9	11.8
13/BRL VAR 4	84.20	66.00	34.67	13.08	9.90	9.17	296.63	324.33	183.67	5.7	20
13/BRL VAR 5	85.33	63.10	27.67	16.67	5.43	5.03	157.23	386.59	354.33	1.5	7.5
13/BRL VAR 6	94.60	71.73	35.33	14.79	5.11	6.87	126.33	288.29	329.33	4.3	16.4
Punjab Sadabahar	94.13	65.23	37.00	21.64	4.33	4.50	150.17	333.45	319.67	1.2	5.2
Kashi taru	100.50	100.83	35.00	15.54	5.30	6.50	172.33	231.04	183.00	4	14.8
12/SPT BL VAR 1	88.17	55.00	25.00	13.63	5.56	6.63	112.47	199.81	246.00	3.3	12
12/SPT BL VAR 2	95.83	60.47	30.67	14.21	5.37	5.67	126.33	268.15	304.00	3.5	13.2
12/SPT BL VAR 3	74.43	45.90	31.33	12.36	5.59	6.67	142.17	279.52	273.33	3.5	14.8
12/SPT BL VAR 4	93.17	74.43	31.00	11.56	6.13	5.17	150.83	283.18	261.67	3	11.5
12/SPT BL VAR 5	88.00	65.33	25.33	9.84	8.21	4.33	173.33	182.52	149.33	2	8.7
12/SPT BL VAR 6	88.17	55.90	27.67	13.35	4.46	7.01	83.00	163.18	271.67	2.2	10.6
12/SPT BL VAR 7	85.93	57.93	29.33	18.55	5.36	5.53	204.67	307.18	216.00	1	4
12/SPT BL VAR 8	82.10	58.47	27.33	16.01	5.31	5.00	160.83	238.15	211.33	2	9
12/SPT BL VAR 9	84.80	54.33	28.33	18.09	7.73	6.93	126.17	385.11	410.00	6	22.5
12/SPT BL VAR 10	86.30	65.07	29.67	9.60	8.54	6.83	187.03	274.85	210.00	6.2	22.8
Pusa Kranti	88.17	72.00	29.33	14.77	6.46	5.50	167.17	216.00	183.33	3	12.4
Punjab Barsati	78.27	58.00	30.00	12.35	5.66	6.07	134.17	180.85	194.67	4.9	19.3
12/SPT BR VAR 1	75.87	56.00	34.00	11.44	7.38	5.00	161.00	265.00	224.00	3.2	11.2
12/SPT BR VAR 2	81.73	57.97	31.33	9.99	7.25	6.60	186.67	253.78	195.00	4.1	16.8
12/SPT BR VAR 3	115.10	65.07	29.00	10.29	5.34	5.00	109.17	206.59	272.00	3	11
12/SPT BR VAR 5	81.60	54.00	28.33	10.53	9.44	5.97	215.17	294.11	186.00	4.3	16.6
12/SPT BR VAR 6	83.40	52.70	30.33	8.66	6.66	5.00	149.17	242.00	233.00	1.7	6.6
12/SPT BR VAR 8	91.50	64.00	30.00	9.58	6.30	6.13	130.83	264.59	282.00	4.7	18.5
12/SPT BR VAR 9	84.23	56.20	28.00	8.61	5.20	5.57	150.83	300.55	288.67	4.2	16.3
12/SPT BR VAR 10	74.27	53.17	28.00	9.24	7.84	4.87	182.67	308.26	237.33	4.1	15.5
Arkanidhi	81.17	60.20	31.00	14.09	5.20	5.70	86.17	202.63	306.67	3.9	14.3
CD (p=0.05)	1.28	1.34	1.61	2.50	1.26	1.30	20.91	44.37	17.21	0.22	3.70

PH: Plant height, PCL: Plant canopy length, DF: Days to 1<sup>st</sup> flowering, FL: Fruit length, FG: Fruit girth, PL: Pedicel length, MFW: Mean fruit weight, Y: Yield, MFN: Mean fruit number/plot, MSI: Mean shoot infestation, MFI: Mean fruit infestation

**Table 3: Correlation of infestation by *Leucinodes orbonalis* in fruits with biophysical parameters of brinjal**

Parameters	Correlations
Plant height	-0.112
Plant canopy length	0.059
Days to flowering	0.017
Fruit length	-0.343*
Fruit girth	0.444**
Pedicel length	0.638**
Mean fruit weight	0.106
Yield	0.075
Mean fruit number	0.014*

\*\* Significant at 1 % level, \* Significant at 5 % level

### Mean fruit weight

The significantly highest mean fruit weight of 302.90 g/fruit was found in genotype 13/BRL VAR 1 which was statistically at par with 296.63 g in genotype 13/BRL VAR 4. They were succeeded by at par genotypes 12/SPT BR VAR 5 (215.17 g) and 12/SPT BL VAR 7 (204.67 g). The same depicted significantly lowest of 83.00 g/fruit in genotype 12/SPT BL VAR 6. Mean fruit weight was statistically at par amongst genotypes 12/SPT BR VAR 3 (109.17 g), 12/SPT BL VAR 1 (112.47 g), 12/SPT BL VAR 9 (126.17 g), 13/BRL VAR 6 (126.33 g), 12/SPT BL VAR 2 (126.33 g). Generally, infestation level of SFB on shoots and fruits of brinjal remained less in light weighted fruits. The genotype 13/BRL VAR 1 with highest

individual mean fruit weight fetched damage by 4.4 percent in shoots and 14.6 percent in fruits while the genotype 12/SPT BL VAR 6 with lowest individual fruit weight fetched 2.2 and 10.6 percent damage on shoots and fruits, respectively.

### Yield

Amongst twenty nine test genotypes, the marketable yield ranged from 163.18 to 424.30 q/ha with maximum in genotype 13/BRL VAR 1 and minimum in genotype 12/SPT BL VAR 6. The genotype 13/BRL VAR 1 was statistically at par with genotypes 13/BRL VAR 5 (386.59 q/ha) and 12/SPT BL VAR 9 (385.11 q/ha). The genotypes Punjab Sadabahar (333.45 q/ha), 13/BRL VAR 4 (324.45 q/ha), 12/SPT BR VAR 10 (308.26 q/ha), 12/SPT BL VAR 7 (307.18 q/ha), 12/SPT BR VAR 9 (300.55 q/ha) and 12/SPT BR VAR 5 (294.11 q/ha) were also statistically similar in respect to their yield. Similarly, the genotypes Punjab Barsati (180.85 q/ha), 12/SPT BL VAR 5 (182.52 q/ha), 12/SPT BL VAR 1 (199.81 q/ha), Arkanidhi (202.63 q/ha) and 12/SPT BR VAR 3 (206.59 q/ha) were statistically at par with lowest yield resulting genotype 12/SPT BL VAR 6 (163.18 q/ha). The non remarkable positive effect of yield on infestation level of shoots and fruits by SFB was found in most of the tested genotypes. It recorded damage on shoots by 4.4 percent and on fruits by 14.6 percent in highest yielding genotype. Whereas, the same was found respectively as 2.2 and 10.6 percent in lowest yielding genotype. Such finding of positive impact of fruit yield on damage by SFB in brinjal is in agreement with Javed *et al.*, 2011.

**Table 4: Categorization of brinjal genotypes based on the mean fruit infestation (%) by *Leucinodes orbonalis***

Fruit damage (%)	Name of Genotypes	No. of Genotypes	Grade
0	Nil	0	Immune
0.1 – 10	12/SPT VAR 8, Punjab Sadabahar, 13/BRL VAR 5, 12/SPT BL VAR 7, 12/SPT BR VAR 6, 12/SPT BL VAR 5	6	Highly Resistant
10.1 – 20	12/SPT BR VAR 1, 12/SPT BR VAR 2, 12/SPT BR VAR 3, Arkanidhi, 12/SPT BR VAR 8, 12/SPT BR VAR 9, 12/SPT BR VAR 10, 12/SPT BR VAR 5, 13/BRL VAR 1, 13/BRL VAR 2, 13/BRL VAR 3, 13/BRL VAR 4, 13/BRL VAR 6, KASHI TARU, 12/SPT BL VAR 1, 12/SPT BL VAR 2, 12/SPT BL VAR 3, 12/SPT BL VAR 4, 12/SPT BL VAR 6, Pusa Kranti, Punjab Barsati	21	Fairly resistant
20.1 – 30	12/SPT BL VAR 10, 12/SPT BL VAR 9	2	Tolerant
30.1– 40	Nil	0	Susceptible
> 40.1	Nil	0	Highly susceptible

### Mean fruit numbers

Mean fruit numbers/plot had positive significant impact on the infestation percent of SFB in shoots and fruits of brinjal. Comparatively greater damage by SFB was found in plot with more number of mean fruits in number and vice versa. The significantly highest and lowest average fruit numbers per plot were recorded in genotypes 12/SPT BL VAR 9 (410 fruits/plot) and 12/SPT BL VAR 5 (149.33 fruits/plot) with shoot damage by 6 and 2 percent and fruit damage by 22.5 and 8.7 percent, respectively.

### Shoot and fruit infestation

Varietal differences were observed (Table 2) regarding percent infestation on shoots and fruits by SFB. Among 29 genotypes, the highest damage on shoots (6.2 %) and fruits (22.8 %) occurred in 12/SPT BL VAR 10 which was significantly at par with 6 and 22.5 % respectively in 12/SPT BL VAR 9. It was lowest on shoots by 1% and fruits by 4% in 12/SPT BL VAR 7 followed by statistically at par genotype Punjab Sadabahar with infestation of 1.2 and 5.2 %, respectively. This finding in respect to above mentioned genotypes are new one as it is reported first by the present authors. The less susceptibility on shoots was reported by Jat *et al.*, 2003 in other genotypes viz. Arka Kusumkar (3.28 %), Neelum Long (5.71 %), Pusa Purple Long (6.28 %), Pusa Kranti (6.51 %) and Pant Rituraj (7.42 %). In present study, the shoot damage was also recorded as 3 % in Pusa Kranti. Similarly, Yadav *et al.* (2003) categorized Pusa Purple Cluster, Pusa Kranti, Pusa Purple Long, Neelum Long, Black Beauty and BR 112 as least susceptible genotypes of brinjal against SFB. Chaudhary and Sharma (2000) found very low attack of SFB (2.88-5.64%) during screening of nine genotypes of brinjal.

### Correlation of SFB with bio-physical parameters of brinjal

Different biophysical characters of plant sometimes play pivotal role on infestation status of its pests. In such context, simple correlation studies on incidence of brinjal's fruit borer with some selected biophysical characters are presented in Table 3. The results revealed its highly significant and positive correlation in respect of fruit girth and fruit pedicel length with values of  $r = 0.638$  and  $0.444$ , respectively. The mean fruit numbers also showed significant positive correlation ( $r = 0.014$ ) with infestation of fruit borer. Considering height of the plant, the relation was shown as negative and non significant with  $r = -0.112$  while it was highly negatively significant in case of fruit length with  $r = -0.343$ . The non significant positive

correlations were existed for infestation of SFB with respect to canopy length, days to flowering, mean fruit weight and yield resulting  $r = 0.059, 0.017, 0.106$  and  $0.075$ , respectively. The present findings also support the work done by Behera *et al.* (1998) who reported positive correlation of fruit diameter with infested fruit yield, number of holes and larvae per fruit at genotypic level. It may indicate that the round/oblong fruits are more susceptible to borer. The positive correlation of infested yield and infested fruits per plant with total yield was mainly due to its direct effect via diameter of fruit. Shukla *et al.* (2001) found positive correlation between fruit numbers and fruit borer infestation that corroborates with present study, too. However, the negative correlation of plant height with borer infestation as per present report is in agreement with Javed *et al.* (2011), but it is in non agreement with Naqvi *et al.* (2009) who reported no effect of plant height on borer infestation in brinjal.

### Categorization of brinjal genotypes

Twenty nine (29) genotypes of brinjal are categorized into different 6 grades (Table 4) on the basis of mean per cent fruit damage. The fruit damage by *Leucinodes orbonalis* ranged between 4 to 22.8 %. No genotype was found to be free from attack of the said insect that could be categorized as immune. Similarly, any genotype might be categorized as susceptible or highly susceptible ranging infestation between 30.1 to 40 and above 40 %, respectively. Six genotypes viz. 12/SPT VAR 8, Punjab Sadabahar, 13/BRL VAR 5, 12/SPT BL VAR 7, 12/SPT BR VAR 6 and 12/SPT BL VAR 5 were highly resistant to SFB ranging 0.1 to 10 % infestation. The genotypes 12/SPT BL VAR 10 and 12/SPT BL VAR 9 were found tolerant with infestation between 20.1 to 30 %. The rest 21 genotypes were screened as fairly resistant with range of infestation between 10.1 to 20 %. The present findings are more or less corroborating with the earlier workers (Ghosh and Senapati, 2001; Khan and Singh, 2014) where they used different set of genotypes. The screening of brinjal genotypes against shoot and fruit borer infestation was also done by Mannan *et al.* (2009), Javed *et al.* (2011) and Devi *et al.* (2015).

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**APPLICATION FORM**  
**NATIONAL ENVIRONMENTALISTS ASSOCIATION (N.E.A.)**

To,  
The Secretary,  
National Environmentalists Association,  
D-13, H.H.Colony,  
Ranchi - 834 002, Jharkhand, India

Sir,  
I wish to become an Annual / Life member and Fellow\* of the association and will abide by the rules and regulations of the association

Name \_\_\_\_\_

Mailing Address \_\_\_\_\_

Official Address \_\_\_\_\_

E-mail \_\_\_\_\_ Ph. No. \_\_\_\_\_ (R) \_\_\_\_\_ (O)

Date of Birth \_\_\_\_\_ Mobile No. \_\_\_\_\_

Qualification \_\_\_\_\_

Field of specialization & research \_\_\_\_\_

Extension work (if done) \_\_\_\_\_

Please find enclosed a D/D of Rs..... No. .... Dated ..... as an  
*Annual / Life membership fee.*

**\*Attach Bio-data and some recent publications along with the application form when applying for the Fellowship of the association.**

Correspondance for membership and/ or Fellowship should be done on the following address :

SECRETARY,  
National Environmentalists Association,  
D-13, H.H.Colony,  
Ranchi - 834002  
Jharkhand, India

E-mails : m\_psinha@yahoo.com      Cell : 9431360645  
            dr.mp.sinha@gmail.com      Ph. : 0651-2244071