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Contents

INCIDENCE OF LEAF WEBBER (*DIAPHANIA PULVERULENTALIS*) ON MULBERRY – A STUDY

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Abstract: Leaf webber is one of the major leaf eating pests of Mulberry,the only food source of Silkworm Bombyx mori.L. Especially during post rainy season in the months of November to January this pest is becoming a major problem in the sericulture areas. This pest lays one or two eggs on each and every leaf of mulberry and the young larvae secrets a silky and gluey substance that binds both the ends of the leaf and make a roll and reside in side the rolled leaf and feed on the leaf.The infestation is resulting in the shortage of leaf for silkworm rearing during this season. Hence the present study which is aimed to findout the intensity of infestation and qualitative loss, helps in taking timely measures to reduce the leaf webber infestation.

Keywords: Leaf webber, Mulberry leaf, Qualitative loss, Infestation levels

INTRODUCTION

India is the second largest producer of silk next to China. Mulberry the only food plant of silkworm is prone to various pests and diseases which cause a significant reduction in the yield there by reducing the silk production. Among the insect pests mulberry leaf webber (Diaphania pulverlentalis) is one of the major pests responsible for low yields, predominantly in winter season in many parts of southern states.

Leaf webber has been recorded in mulberry since 1995 predominantly in southern parts of India mainly the major silk producing states of Karnataka, Andhra Pradesh and Tamilnadu The activity of pest is initiated in the month of June and remain active up to the December. The pest complete several over lapping generation from June to December .The most active period was September to December with mean infestation ranged from 1-2 larvae to 5-6 larvae /leaf. The average leaf yield loss due to leaf Webber is found to be 12.1% (Rajadurai *et al.*, 1999)

The female moth lays 150-200 eggs at the rate of 1 to 2 eggs per apical shoot of mulberry plant and they hatch into larvae after 4 days. The larvae have 5 stages (instars) and then pupate into the soil or in dry leaves. The total lifecycle completes within 17-24 days. The life cycle of leaf webber is comparatively shorter than the other lepidopteran pests of mulberry and it complete 8-10 generations during its occurrence in mulberry (Rajadurai2003)

Damage

The larvae defoliate on the apical shoot after webbing the tender leaves together and inhibit the growth of plants. Larvae mainly infests the apical portion of mulberry shoot and binds the tender leaves by secreting silky substance and the larvae remain inside the rolled leaves. The young larvae start feeding on the tender leaves and finally causing drying of shoots. Hence farmers face shortage of tender leaves to rear chawki (young age silkworms).

The present study has been carried out with the following objectives:

a) To know the infestation level of leaf webber on mulberry in major mulberry growing areas of chittoor district in Andhra Pradesh.

b) To know the impact of leaf webber infestation on mulberry quality of leaf production.

Survey on the incidence of leaf webber:

Objectives of the study: Leaf webber is a major pest during winter season every year in various sericulture villages of Palmaneru mandal which is a major sericulture area in Chittoor district and major losses are being faced by the farmers. Hence the present study has been carried out choosing important major sericulture villages in Palamaneru mandal for two years (2013-14) in winter season(between November –January).

METHODOLOGY

Survey on the incidence of leaf webber: A survey was conducted to know the incidence of leaf webber on mulberry in the major sericulture villages of Palamaneru mandal in Chittoor district of Andhra Pradesh.

For the present study five villages were selected from Palamaneru mandal. The selected villages are Berupalli, Pengaragunta, T.S.Agrahara, Kothigunta, Thavadapalli. In each village five mulberry gardens were selected for the study. From each garden 50 plants totally 250 plants at random were chosen for the study from each village. Each plant was observed for the presence of leaf webber larvae. The Percentage of infestation was calculated as follows.

Table -1

Percentage of infestation

$$= \frac{\text{Total number of infested plants}}{\text{Total number of plants selected}} \times 100$$

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Qualitative analysis of leaf webber infested leaves
Total 100 infested leaves were collected at the rate of 20 per village and they were dried and analysed for protein, carbohydrates, phenols and chlorophylls using standard protocols simultaneously keeping control. Table II

RESULT

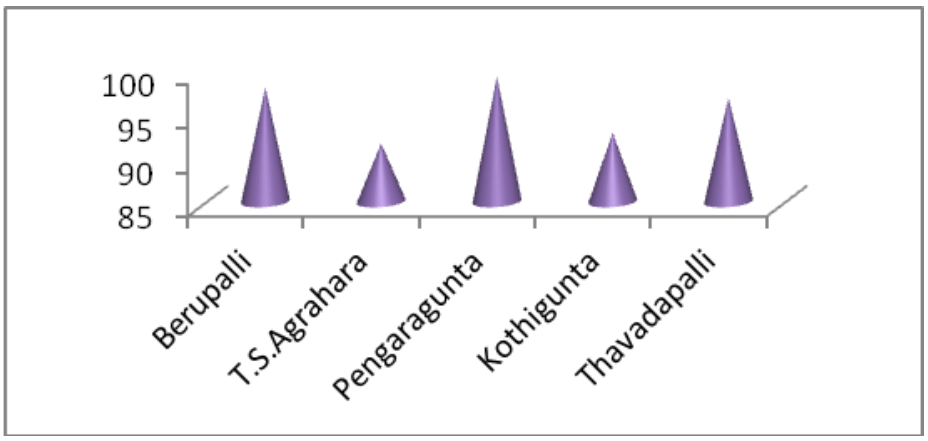
The survey was conducted on the infestation of Leaf webber and it was found that all the mulberry gardens were infested with this pest at more than 90% infestation. Each and every leaf was infested with one or two larvae.
Total number of plants /village =250
The percentage of infestation was calculated as follows.

$$\text{Percentage of infestation} = \frac{242}{250} \times 100$$
$$= 96.8\%$$

Leaf webber infestation in different villages

S. No.	Name of the village	Number of gardens selected	Number of plants infested	Total number of plants selected	% of infestation
1	Berupalli	5	245	250	98.0
2	T.S.Agrahara	5	229	250	91.6
3	Pengaragunta	5	248	250	99.2
4	Kothigunta	5	232	250	92.8
5	Thavadapalli	5	242	250	96.8

Graphical representation of leaf webber infestation in different villages

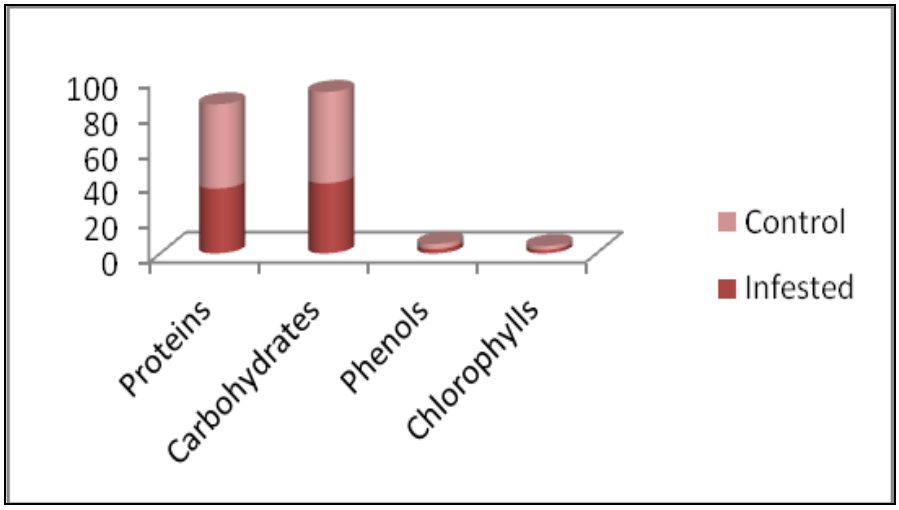


In the present survey it was found that, among 5 villages selected Pengaragunta has shown highest percentage(98.0) of infestation of leaf webber.The farmers are suffering severe leaf yield loss and shortage of foliage for silk worm rearing especially in early instars during post rainy to early winter seasons(October –December). The percentage of infestation in all the five villages are recorded viz, Pengaragunta (98.0) Berupalli (98.6) Thavadapalli (96.8), Kothigunta(92.8), T.S.Agrahara(91.6%).
To know the impact of leaf Webber infestation on mulberry leaf quality, 100 infested leaves were collected randomly and they were dried and analysed for protein, carbohydrates, phenols and chlorophylls.

Qualitative analysis of leaf webber infested mulberry leaf

Mulberry leaves	**Proteins mg/g drywt**	**Carbohydrates Mg/g drywt**	**Phenols** Mg/gm drywt	**Chlorophylls** Mg/g drywt
Leaf webber infested	37mg	40mg	2.5mg	1.95mg
control	48mg	52mg	2.95	2.22
% loss over control	29.08	24.92	13.7	13.6

Graphical representation of leaf webber infestation on mulberry leaf quality








Qualitative analysis of infested and healthy mulberry leaves revealed that, the percentage of loss of various metabolites which contribute to quality have shown significant decrease. The loss of protein percentage over control was 29.08, carbohydrates were 24.92, phenols 13.7 and chlorophyll was 13.6%.

Control measures: Leaf webber can be managed by following appropriate management methods. Collection and burning of dried leaves from the infested garden. Exposing the hidden pupae to their natural enemies like bird predators by deep ploughing and flooding the land is the best method to minimize the adult emergence. Setting up of light traps helps in attracting the adults and killing those enmass. Hand picking the young larvae and destroying them also one of the best method in practice. Release of the pupal parasitoid, Tetrastichus howardii at 20,000 numbers per acre helps in significant reduction in the incidence.

Chemical pesticide spraying of dichlorovos at 1ml/litre of water (200–250 litres of solution/acre) two times at the interval of 10 days is recommended in case of severe infestation.It is advisable to use the mulberry leaves for silkworm rearing 10-12 days after spray of the insecticide.

CONCLUSION

The present study gives a clear picture about the regular and intense infestation of leaf webber on mulberry which is causing a major leaf yield loss leading to shortage of leaf during peak seasons of rearing. This survey helps as a reference to the people concerned with sericulture as a forecast to take necessary measures to avoid webber infestation by following appropriate precautionary as well as management methods.

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AN ECONOMIC ANALYSIS OF INCOME, EMPLOYMENT AND EXPENDITURE IN RAJNANDGAON DISTRICT OF CHHATTISGARH STATE

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Abstracts: Consumption, in economic theory, means the final use of goods and services to satisfy human wants, needs and desires. It is a process of deriving utility from goods and services. Consumption is defined as total value of expenditure incurred on goods and services for the use by the households. Consumption pattern provides the structure for everyday material life, and this structure creates economic distance across classes. People belonging to different classes of income have different pattern of consumption. Rich people spend more in absolute term, and low in percentage term of incomes for food and basic needs while poor people spend higher percentage of income on food and basic needs. In short, the propensity to consume is always higher for poor as compared to the people blowing higher income.

Keywords: Economic analysis, Income, Rajnandgaon, Employment

INTRODUCTION

Food consumption pattern are undergoing substantial change in many countries as economic development proceeds. The trend is moves from traditional cereals towards higher value and higher protein food (Rae, 1999). The declining trend in per capita cereals consumption implies that non-food grain items and non-food items are getting increased share in consumption basket, such increase is smallest in rural area as compare to urban area (Selvarajan and Ravi Shankar, 1996).

There is a lot of variation in cereal consumption among, Monthly Per capita Consumption Expenditure (MPCE) classes in India during 2004. The variation was more pronounced in rural areas than in urban areas. The consumption of rice varied from 6.04 kg to 7.39 kg with seven out of 12 MPCE classes having consumption less than the national average. There was variation in total cereal consumption ranging from 9.12 kg to13.50 kg wheat and total cereals consumed more than the national average of 4.67 kg and 10.03 kg respectively .The decline in consumption of coarse cereal like sorghum from 0.80 kg to 0.47 kg in rural areas and 0.40 kg to 0.27 kg in urban areas respectively.

The data from 61st rounds of NSSO (National Sample Survey Organization) on consumption expenditure in food (different food stuffs) and non-food items. There has been a decline in the proportion of expenditure on food items in last three decades in both urban and rural areas. However, the expenditure on food remained higher in rural areas as compared to urban areas. Between 2004-05, the share of food in total consumer expenditure has fallen from 73 per cent to 55 per cent in rural areas and from 64 per cent to 42 per cent in urban areas. The proportion of expenditure on non-food items has increased from 24 per cent to 37.7.

METHODOLOGY

Chhattisgarh state consists of three zones *i.e.* Northern hills, Chhattisgarh plain and Bastar plateau; there are 27 districts of Chhattisgarh. Rajnandgaon district will be selected purposively for the study. There are 9 blocks in Rajnandgaon district, Rajnandgaon block, Ghumka village, Mohla block, Kewattola village was be selected as urban area and Mohla block, Kewattola village was be selected as Rural area purposively for represents.

The urban and rural household of Ghumka, kewattola village were categorized into two major categories *i.e.* farm households. Farm household are those who have land cultivation. Farm household was two categorized in Above Poverty Level (APL) and Below Poverty Level (BPL) household. There was being 60 respondents. 30 from each urban and rural area were being selected. The urban and rural respondents were be categorized, BPL Respondents were selected on the basis of possession of BPL card issued by government of Chhattisgarh the APL and BPL households. The household were further classified on the basis of income.

Table 1. Number of sample households under different categories

Area	S.N.	Categories of Household	No. of sample household	% of total sample household
Urban Area	1	APL	15	50
	2	BPL	15	50
	Total	All	30	100

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Rural Area	1	APL	15	50
	2	BPL	15	50
	Total	All	30	100

Note: Figures in parentheses indicate percentages to total.

Methods of analysis

The methods of analysis quantity objectives of the study area described in the section. the stated objectives of this study where accomplished by tabulating analyzing the data pertaining to the same, using sample arithmetic mean or average, percentage and regression analysis.

RESULT AND DISCUSSIONS

The results are analyzed of following points like income, employment and expenditure of the sample households, rural and urban. These are:

Table 2. Distribution of cropped area and cropping intensity at sampled households

Cropped Area		**Urban Area**			**Rural Area**		
		APL	**BPL**	**Average**	**APL**	**BPL**	**Average**
Total cultivated area (ha.)		73.60	19.50	46.55	52.00	18.70	35.35
Kharif	Paddy	73.60	19.50	46.55	52.00	18.70	35.35
Rabi	Wheat	10.68	0.00	5.34	8.00	0.00	4.00
	Gram	9.55	0.00	4.78	5.95	0.00	2.98
	Lathyrus	6.62	7.50	7.06	7.86	9.65	8.76
Summer	Paddy	15.00	0.00	7.50	12.00	0.00	6.00
Total cropped area (ha.)		115.45	27.00	71.23	85.81	28.35	57.08
Cropping intensity (%)		156.86	138.46	147.66	165.02	151.60	158.31

Note: Figures in parentheses indicate percentage of the total cropped area.

A comparative figure of cropped area and cropping intensity of the sample households of different area are given in Table 2.Total cultivated area in the urban APL family was observed 73.60 ha. Which is comparatively higher than the BPL households. Total cropped area observed as 115.45 and 27.00 ha. In APL and BPL family of urban area while it is observed 85.81 ha. and 28.35ha.in the same family of rural area. Paddy is important crop in kharif season for both of the urban area families which is cultivated in 73.60 ha. and 19.50 ha.in area respectively in APL and BPL family. Similarly in rural area paddy is observed as important crop where the 52.00 ha.and 18.70 ha. were recorded for the APL and BPL family. Further, rest of the total cropped area are allocated under the different crops such as paddy, wheat, gram and lathyrus in *rabi* and *summer* season by the APL family of both rural and urban area whereas the paddy and lathyrus is cultivated by the urban and rural area of BPL family in *Rabi* season. The average cropping intensity is estimated in 147.66 percent in urban area and 158.31percent in rural area.

Table 3. Consumption of some selected food items by sampled households

S.N.	**Particulars**	**Categories of household**						**Total**	**Average**
		Urban Area			**Rural Area**				
		APL	**BPL**	**Average**	**APL**	**BPL**	**Average**		
1	Cereals	433.50 (47.47)	460.45 (58.45)	449.15 (52.67)	444.45 (51.04)	465.21 (59.97)	454.83 (55.25)	901.81 (53.88)	450.90 (53.89)
2	Pulses	65.67 (7.19)	58.20 (7.39)	61.94 (7.26)	60.61 (6.96)	55.12 (7.11)	57.87 (7.03)	119.82 (7.16)	59.90 (7.16)
3	Vegetables	93.24 (10.21)	79.25 (10.06)	86.25 (10.12)	89.84 (10.32)	75.88 (9.78)	82.86 (10.06)	169.12 (10.10)	84.56 (10.10)
4	Fruits	10.94 (1.20)	9.70 (1.23)	10.32 (1.21)	9.33 (1.07)	8.37 (1.08)	8.83 (1.07)	19.15 (1.14)	9.58 (1.14)
5	Milk & its Products	201.07 (22.02)	88.91 (11.29)	144.99 (17.00)	166.63 (19.14)	84.29 (10.87)	125.46 (15.24)	270.46 (16.16)	135.23 (16.16)
6	Edible oils	49.24 (5.39)	38.79 (4.92)	44.01 (5.16)	46.25 (5.31)	37.61 (4.85)	41.93 (5.09)	85.94 (5.13)	42.97 (5.14)
7	Meat,Fish& eggs	9.54 (1.04)	8.21 (1.04)	8.88 (1.04)	8.77 (1.01)	7.98 (1.03)	8.38 (1.02)	17.25 (1.03)	8.63 (1.03)
8	Sugar	46.19 (5.06)	40.75 (5.17)	43.52 (5.10)	41.23 ()4.73	37.89 (4.88)	39.56 (4.81)	83.04 (4.96)	41.52 (4.96)
9	Spice	3.75 (0.42)	3.52 (0.45)	3.64 (0.43)	3.70 (0.42)	3.42 (0.44)	3.56 (0.43)	7.20 (0.43)	3.60 (0.42)
	Total	**913.14 (100.00)**	**787.79 (100.00)**	**852.69 (100.00)**	**870.81 (100.00)**	**775.74 (100.00)**	**823.28 (100.00)**	**1673.75 (100.00)**	**836.87 (100.00)**

Note: Figures in parentheses indicate percentage of the total. **(Gms. / Adult / Day)**

The consumption of some selected food items by sample household is presented in Table 3. It is clear from this table that, average total food items consumption is estimated as 852.69gms/adult/day in urban area while it is observed 823.28 gms. / adult / day in rural area. The total quantity consumed of cereals is estimated at 433.50(47.47 per cent) gms/adult/day at APL and 460.45(58.45 per cent) at BPL family of urban area respectively. Milk and its products and vegetables items are observed another important food items consumed in high amount in the urban area. The quantity estimated for these two items are 201.07 (22.02 per cent) and 93.24 (10.21 per cent) gms/adult/day at APL and 88.91 (11.29 per cent) and 79.25(10.06 per cent) at BPL families of urban area. Remaining other items is also important and on average households consumed less than 10 per cent of total amount in gms/adult/day in urban area.

The total quantity consumed of cereals is estimated at 444.45 (51.04 per cent) at APL and 465.21(59.97 per cent) gm/adult/day at BPL family of rural area respectively. Milk and its products and vegetables items are observed another important food items consumed in high amount in the rural area. The quantity estimated for these two items are 166.63(19.14 per cent) and 89.84(10.32 per cent) gms/ault/day at APL and 84.29(10.87 per cent) and 75.88(9.78 per cent) at BPL families of rural area. Remaining other items is also important and on an average household consumed less than 10 per cent of total amount in gms/adult/day in urban area. It is concluded from the table that cereals, milk and its products and vegetables are the important items in both the area in which respondent consumed about 80 per cent quantity (gms/adult/days) out of the total quantity of food items.

Table 4. Components of farm employment **(Days/Family/Year)**

	Per household number of employment days					
	Urban Area			**Rural Area**		
	APL	**BPL**	**Average**	**APL**	**BPL**	**Average**
Kharif	118.00 (35.22)	120.00 (34.99)	119.00 (35.12)	118.00 (36.53)	120.00 (34.58)	119.00 (35.56)
Rabi	117.00 (34.93)	98.00 (28.57)	107.50 (31.75)	115.00 (35.60)	95.00 (27.38)	105.00 (31.49)
Summer	100.00 (29.85)	125.00 (36.44)	112.50 (33.15)	90.00 (27.86)	132.00 (38.04)	111.00 (32.95)
Total	**335.00 (100.00)**	**343.00 (100.00)**	**339.00 (100.00)**	**323.00 (100.00)**	**347.00 (100.00)**	**335.00 (100.00)**

Note: Figures in parentheses indicate percentage of the total component farm employment days.

It is evident from Table 4.that on an average, 339.00 days employment provided by farm sector to sample households in urban family. The total employment days calculated 335.00 and 343.00 urban area APL and BPL family respectively.

On an average *Kharif* season provided nearly average(35.12 percent) employment to sample households and remaining (31.75 percent) from by *rabi* and (33.15 percent) from *summer* season in the urban area respectively. Respectively, 335.00 days, employment provided by farm sector to sample households in rural family. The total employment days are calculated 323.00 and 347.00 in rural area of APL and BPL family respectively.

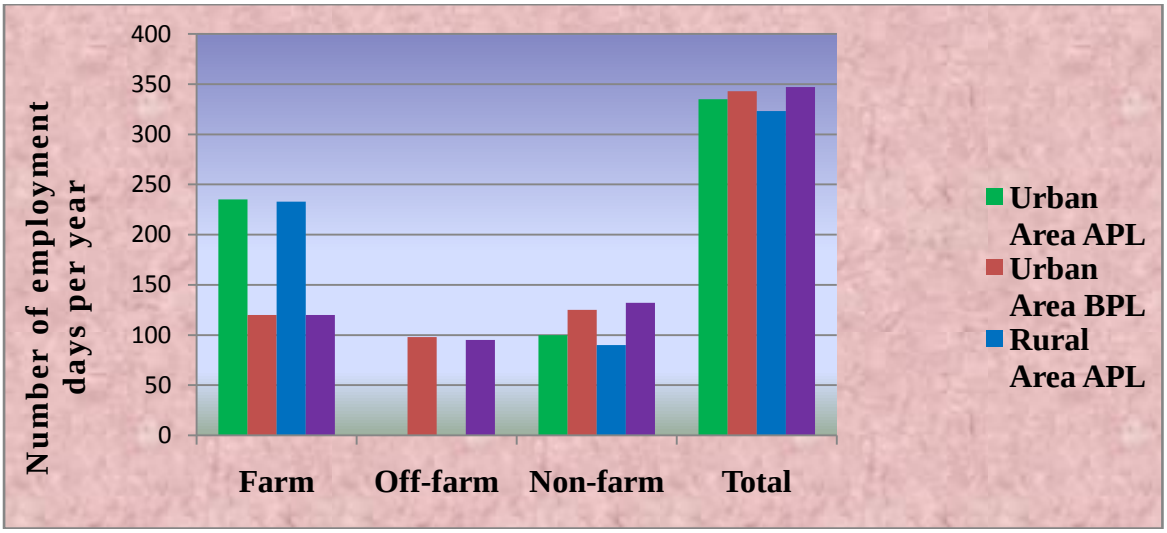

Fig. Employment pattern in different categories of sample households

Table 5. Components off-farm & non -farm employment **(Days/Family/Year)**

Per family off-farm and non-farm employment days		Urban Area			Rural Area		
		APL	**BPL**	**Average**	**APL**	**BPL**	**Average**
Off-farm	wages	0.00	100.00	50.00	0.00	95.00	47.50
	Total	**0.00**	**100.00**	**50.00**	**0.00**	**95.00**	**47.00**
Non-farm	Service	22.00 (22.00)	0.00 (0.00)	11.00 (9.78)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	Business	18.00 (18.00)	41.00 (30.37)	29.50 (26.22)	23.00 (25.56)	46.00 (34.85)	34.50 (30.21)
	Labour	25.00 (25.00)	72.00 (53.33)	48.50 (43.11)	49.00 (54.44)	68.00 (51.52)	58.50 (52.83)
	Carpenter	0.00 (0.00)	15.00 (12.00)	7.50 (6.67)	8.00 (8.89)	12.00 (9.09)	10.00 (8.99)
	Livestock enterprises	7.00 (7.00)	6.00 (4.80)	6.50 (5.78)	7.00 (7.78)	6.00 (4.55)	6.50 (6.17)
	Water selling	3.00 (3.00)	0.00 (0.00)	1.50 (1.33)	6.00 (6.67)	0.00 (0.00)	3.00 (2.70)
	Contractor	25.00 (25.00)	0.00 (0.00)	12.5 (11.11)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	Total	**100.00 (100.00)**	**125.00 (100.00)**	**112.50 (100.00)**	**90.00 (100.00)**	**132.00 (100.00)**	**111.00 (100.00)**

Note: Figures in parentheses indicate percentage of the total off-farm & non -farm employment days.

It has been worked out from Table 5. That off-farm and non-farm activities provided average employment days 50.00 and 112.50 of urban area of APL and BPL family respectively. Non-farm households getting considerable higher employment (48.50 days) from non-farm sector compared to farm households (50 days). BPL households engaged 100.00 days in off-farm activities while APL households is not found engaged in these activities.
Non-farm sector provided highest employment days as labour, accounted for (25.00 percent) and (53.33 percent), followed by service (22.00 percent), business (18.00 percent), (30.37 per cent), contractor (25.00 per cent), livestock enterprises (7.00 per cent), (4.80 per cent), remaining (5.00 percent) provided by other activities like, fuel fodder collection etc. In urban area of APL and BPL family respectively.
Non-farm sector provided highest employment days as labour, accounted (54.44 percent) and (52.83 per cent), followed by business (25.56 per cent), (34.85 per cent), livestock enterprises (6.67 per cent) remaining (5.00 per cent) provided by other activities like, fuel fodder collection etc. in rural area of APL and BPL family respectively.

Table 6. Components of farm income **(Rs./Family/Year)**

Farm income	Urban Area			Rural Area		
	APL	**BPL**	**Average**	**APL**	**BPL**	**Average**
Kharif						
Paddy	163807.25 (80.07)	51656.99 (78.11)	107732.12 (79.09)	122469.69 (73.02)	48925.60 (77.92)	85697.76 (74.35)
Rabi						
Wheat	6633.34 (3.24)	0.00 (0.00)	3316.67 (1.62)	11242.00 (6.70)	0.00 (0.00)	5621.00 (4.89)
Gram	1885.31 (0.92)	0.00 (0.00)	942.66 (0.46)	3558.42 (2.12)	0.00 (0.00)	1779.21 (1.54)
Lathyrus	950.30 (0.48)	14478.49 (21.89)	7714.44 (11.18)	1564.45 (0.93)	13862.71 (22.08)	7713.58 (6.69)
Summer						
Paddy	31241.35 (15.29)	0.00 (0.00)	15620.68 (7.65)	28894.64 (17.23)	0.00 (0.00)	14447.32 (12.53)
Total	**204517.55 (100.00)**	**66135.48 (100.00)**	**135326.52 (100.00)**	**167730.20 (100.00)**	**62788.31 (100.00)**	**115259.00 (100.00)**

Note: Figures in parentheses indicate percentage of the total farm income.

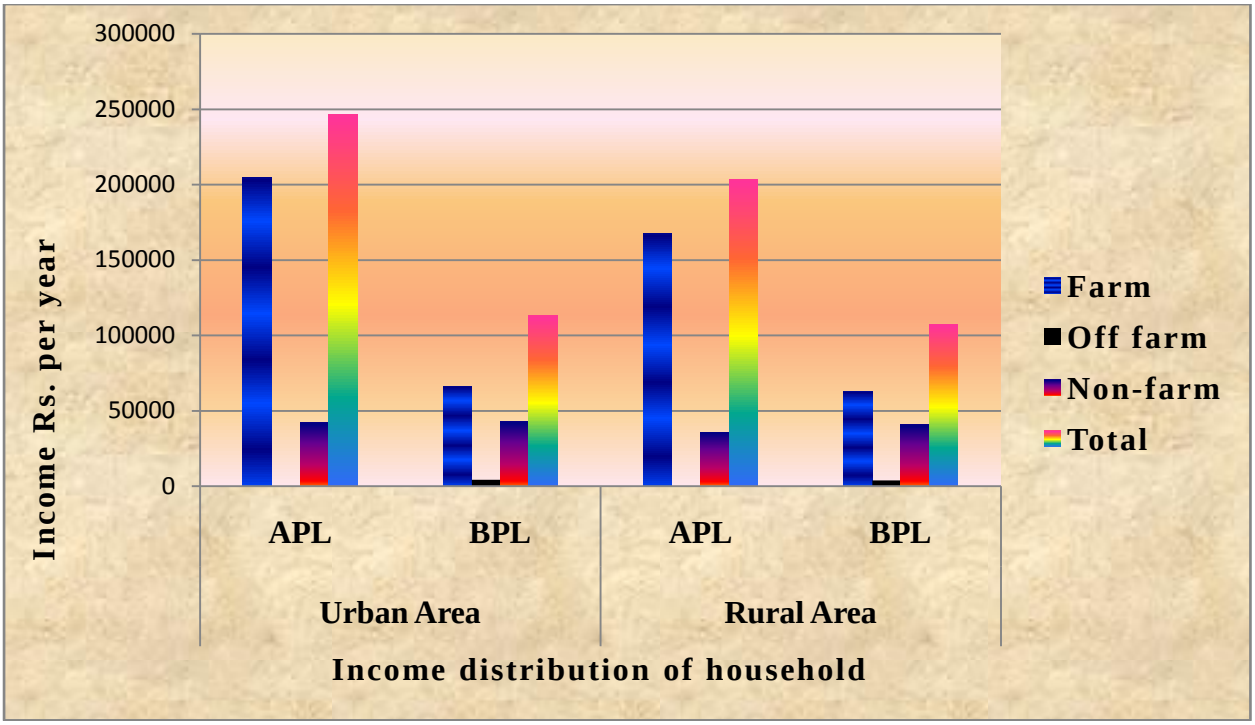

Fig. Income distribution of sample households

Component of farm income are presented in Table 6.Table indicates that on an average per family income estimated as Rs.107732.12 and Rs.27594.45 in the urban area, whereas it is estimated as Rs.85697.76 and Rs.29561.11in the rural area of both *kharif, rabi and summer* season respectively. In the *kharif* season, paddy is important crop and major source of farm income of both the family of both areas, contributed 100 per cent farm income in the *kharif* season.

In the *rabi* and *summer* season, paddy, wheat and gram and other crops contributed Rs.31241.35 (15.29 percent), Rs.6633.34 (3.24 per cent) and Rs. 1885.31 (0.92 per cent) in urban APL family. In case of rural APL family, these figures were estimated as Rs.28894.64 (17.23 per cent), Rs.11242.00 (6.70 per cent) and Rs.3558.42 (2.12 per cent) per family per year. It is evident from table that BPL families of both the area are not product some crops in the rabi season, due to less resource power. In the BPL family, lathyrus crop is observed major component of farm income contributed Rs.14478.49 (21.89 per cent) and 13862.71 (22.08 per cent) in both urban and rural area while contribution of this crop in APL family of both the area is observed less than 3 per cent of total farm income.

Table 7. Components of off-farm and non- farm income **(Rs./Family/Yera)**

Per family off-farm and non-farm income		**Urban Area**			**Rural Area**		
		APL	**BPL**	**Average**	**APL**	**BPL**	**Average**
Off-farm income	wages	00.00	4157.86	2078.93	00.00	3880.60	1940.30
	Total	**0.00**	**4157.86**	**2078.93**	**00.00**	**3880.60**	**1940.30**
Non-farm income	Service	9400.00 (22.47)	00.00 (00.00)	4700.00 (11.13)	00.00 (00.00)	00.00 (00.00)	0.00 (0.00)
	Business	16521.34 (39.49	15223.00 (35.70)	15872.17 (37.58)	15000.59 (41.85)	13300.00 (32.76)	14150.30 (37.03)
	Labour	5544.85 (13.25)	17240.20 (40.43)	11392.53 (26.97)	8020.87 (22.38)	16820.57 (41.44)	12420.7 (32.50)
	Carpenter	00.00 (00.00)	8110.02 (19.02)	4055.01 (9.60)	5700.83 (15.91)	8932.75 (22.01)	7316.79 (19.15)
	Livestock enterprises	4024.61 (9.62)	2067.18 (4.85)	3045.90 (7.21)	3118.53 (8.70)	1540.67 (3.80)	2329.6 (6.10)
	Water selling	1000.00 (2.40)	00.00 (00.00)	500.00 (1.18)	4000.00 (11.16)	00.00 (00.00)	2000.00 (5.23)

	Contractor	5341.62 (12.78)	00.00 (00.00)	2670.81 (6.32)	00.00 (00.00)	00.00 (00.00)	0.00 (0.00)
	Total	**41832.42 (100.00)**	**42640.40 (100.00)**	**42236.41 (100.00)**	**35840.82 (100.00)**	**40593.99 (100.00)**	**38217.40 (100.00)**

Note: Figures in parentheses indicate percentage of the total off-farm and non- farm income distribution.

Component of off-farm and non-farm income are presented in Table 7. Income from off-farm wages was significant higher in non-farm households than farm households of urban area. The farm size groups have inverse relationship with the off-farm and non-farm income Rs.2078.93 and 42236.41respectively in both APL and BPL family. Services contribute largest farm size share to non-farm income on an average (11.13 percent) urban APL, followed by labour average (26.97 percent), business (37.58 percent),carpenter (9.60percent) and remaining (7.00 percent) shared by contractor and water selling etc. Farm households generated higher income from business than non-farm household (39.49 percent) urban APL.The total income estimated Rs.41832.42 and 42640.40 from non-farm income urban APL and BPL family respectively. BPL family generated (40.43 percent) income of total non-farm income as labour wages by migration from one place to another during *rabi* and summer season.

The average value of off farm and non-farm income estimated as Rs.1940.30 and 38217.40 respectively in rural area. Income calculated from labour (32.50 percent), business (37.03 percent), carpenter (19.15 percent) and remaining (5.00 percent) shared by contractor, water selling etc. Farm household's generated higher income from business than non-farm household (41.85 percent) rural APL.The total income estimated Rs.35840.82 and 40593.99 from non-farm income rural APL and BPL family respectively. BPL family generated (32.76 percent) income of total non-farm income as business wages by migration during rabi and summer season.

Table 8. Expenditure on food and non- food items by sample households **(Rs. /Year)**

Categories of household		**Expenditure**		**Total Expenditure**	**Total income**	**Balance income**	**% amount of total income Spent on food and non- food items**
		Food	**Non-food**				
Urban Area	**APL**	29831.73 (57.20)	22322.23 (42.80)	52153.96 (100.00)	246349.97	193871.87	21.17
	BPL	25439.54 (59.06)	17632.98 (40.94)	43072.52 (100.00)	112933.74	69861.22	38.13
Rural Area	**APL**	28368.28 (59.16)	19584.75 (40.84)	47953.03 (100.00)	203571.02	155617.99	23.56
	BPL	25852.98 (65.82)	13425.52 (34.18)	39278.50 (100.00)	107262.90	67984.40	36.62
	Average	**27373.13 (60.31)**	**18241.37 (39.69)**	**45614.50 (100.00)**	**167529.41**	**121758.87**	**29.87**

Note: Figures in parentheses indicate percentage of the total food and non-food expenditure.

Expenditure on food and non-food items by sample households is presented in table 8. Table shows that the total expenditure on food and non-food items by APL family is estimated as Rs. 52153.96 per year, in which amount spent on food items calculated Rs. 29831.73 (57.20 per cent) on food items and Rs. 22322.23 (42.80 per cent) on non-food items by APL family. In the BPL family of urban area total expenditure calculated Rs. 43072.52 per year. The amount spent on food items is calculated Rs. 25439.54 (59.06 per cent) followed by non-food items Rs. 17632.98 (40.94 per cent) in the urban area.

Table shows that the total expenditure on food and non-food items by APL family is estimated as Rs. 47953.03 per year, in which amount spent on non-food items calculated Rs. 28368.28 (59.16 per cent) and Rs. 19584.75 (40.84 per cent) on food items by

APL family. In the BPL family of rural area total expenditure calculated Rs. 39278.50 per year. The amount spent on food items is calculated Rs. 25852.98 (65.82 per cent) followed by non-food items Rs. 13425.52 (34.18 per cent) in the rural area. Table revealed that the sample households spent their 21.17 per cent of total income on food items by APL family followed by 38.13 per cent by BPL family by urban area. In case of rural area this figure has 23.56 per cent and 36.62 per cent by APL and BPL family of rural area. Table also concluded that the BPL family spent more amount of their total income an these items is compared to APL family in both the area.

Table 9. Comparison of actual consumption and recommendation of ICMR of some selected food items.

(Gms. /Adult/Day)

S.N.	Particulars	Actual consumption	Recommendation (ICMR)	Gap exist
1	Cereals	450.90	520.00	69.10
2	Pulses	59.90	50.00	9.90
3	Vegetables	84.56	64.00	20.56
4	Fruits	9.58	13.00	3.42
5	Milk & its Products	135.23	200.00	64.77
6	Edible oils	42.97	45.00	2.03
7	Meat,Fish&eggs	8.63	13.00	4.37
8	Sugar	41.52	35.00	6.52
9	Spice	3.60	-	3.60
10	**Total**	**836.87**	**940.00**	**184.27**

Source: -ICMR Indian experience on household food and nutrition security.htm.

In this study, one additional exercise is carried to know the actual consumption status of some selected food items to compare with recommendation given by Indian council of medical research (ICMR) on food and nutrition security Detailed exercise (Comparison of actual consumption and recommendation of ICMR of some selected food items) is presented in table 9. The table shows the big difference between the actual consumption and recommendation given by ICMR on the food items.

The highest gap exists in the cereals items, (69.10 gm/day). The actual consumption of cereals is calculated 450.90 gm/day while the recommendation does is given 520.00 gm/day. The second big gap observed in the quantity of milk and its product which is calculated 64.77 gm/day followed by vegetables calculated 20.56 gm/day. The gap exit to the recommendation does to the actual consumption is observed from 2 to 10 gm/day on remaining some other important selected food items.It is revealed that, food items which are important and used in daily are not consumed in complete does. In urban and rural area of both (APL & BPL) family.

CONCLUSION

The major source of income is farm and non-farm sector, both the source together contribution nearly 95 per cent to total income.The average per family income estimated as Rs.107732.12 and Rs.27594.45 in the urban area, whereas it is estimated as Rs.85697.76 and Rs.29561.11 in the rural area of both *kharif* and *rabi* season respectively.Major portion of non-farm income generated from business followed by labour both urban and rural area.Total expenditure on different food items estimated as on an average Rs.29831.73 which is about 17.29 per cent more from the total expenditure Rs.25434.54 calculated in BPL family of urban area.Average total employment days 339.00 in urban area and 335.00 days in rural area. The higher employment days in 52.36 per cent and 52.69 per cent of farm days in urban and rural area respectively.Non-farm sector is main source of employment for sample households.it provided more employment days to non-farm households.The total expenditure on food and non-food items by APL family is estimated as Rs. 52153.96 per year, in which amount spent on food items calculated Rs. 29831.73 (57.20 per cent) on food items and Rs. 22322.23 (42.80 per cent) on non-food items by APL family. In the BPL family of urban area total expenditure calculated Rs. 43072.52 per year. The amount spent on food items is calculated Rs. 25439.54 (59.06 per cent) followed by non-food items Rs. 17632.98 (40.94 per cent) in the urban area.The total expenditure on food and non-food items by APL family is estimated as Rs. 47953.03 per year, in which amount spent on non-food items calculated Rs. 28368.28 (59.16 per cent) and Rs. 19584.75 (40.84 per cent) on food items by APL family. In the BPL family of rural area total expenditure calculated Rs. 39278.50 per year.The highest gap exists in the cereals items, (69.10 gm/day). The actual consumption of cereals is calculated 450.90 gm/day while the recommendation does is given 520.00 gm/day. The second big gap observed in the quantity of milk and its product which is calculated 64.77 gm/day.

Suggestions

Rural development programme and agro-based industries may be started which generate adequate employment opportunities and income for rural population.

The existing public distribution system (PDS) scheme should be continued and strengthened.

Government should start milk or milk powder distribution through public distribution system to improve nutritional status of rural population, particularly those belonging to below poverty line.

The existing poverty alleviation schemes should be continued and strengthened.

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A REVIEW ON ESTIMATES OF VARIABILITY FOR YIELD AND SOME YIELD ATTRIBUTES IN MUNGBEAN

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Abstracts: Mungbean (*Vigna radiata* (L.) Wilczek) (2n=2x=22), is a leading pulse of Asia after chickpea and pigeonpea. It is also called as mung, green gram, moong, mungo, mungbean, chicksaw pea and Oregon pea. It belongs to fabaceae family. It is a short duration legume having wider adaptability, low input requirement and has ability to fix the atmospheric nitrogen (50-109 Kg ha^{-1}) in symbiotic association with rhizobium bacteria, which not only enables it to meet its own nitrogen requirement but also benefits the succeeding crops. It is consumed in the form of several food products such as bean sprouts, dhal, soup *etc.* Being rich in nutritional profile, mungbean is an inseperable ingredient in the diets of vast majority of population in Indian sub continent.

Keywords: Mungbean, Green gram, Production, Yield

INTRODUCTION

India is the world's largest producer, consumer and importer of pulses as they are the major protein source in the vegetarian diet. Half of the worldwide mungbean production is generated in India (3 million hectares), followed by China and Myanmar (Nair *et al.*, 2012). In India, it is cultivated in an area of 34.4 lakh hectares with a production of 14 lakh tonnes and with the productivity of 407 $kgha^{-1}$ (Agriwatch, 2010-2011).It is mainly cultivated in the states of Rajasthan, Maharashtra, Karnataka, Andhra Pradesh, Tamilnadu and Gujarat.

Taxonomy: Mungbean belongs to the order Leguminosae and Papilionoideae family and its botanical name is *Vigna radiata (L.)*Wilczek syn and earlier name is *Phaseolus radiatus*L., P. aureus Roxb (Wilczek, 1954, Verdcourt, 1970).

Kingdom	Plant kingdom
Division	Spermatophyte
Sub division	Angiospermae
Class	Dicotyledonae
Oder	Leguminosae
Family	Papilionoideae
Tribe	Phaseoleae
Genus	*Vigna*
Sub genus	Ceratotropis
species	*radiata*

Rachie and Roberts (1974), Jain and Mehra (1980).

Botany

Mungbean is an annual herb, 0.3 to 1.5 m tall. It has deep tap root system with root nodules. Stem is erect or sub erect plant, hallow, sometimes slightly twining at the tips. Leaves are alternate, trifoliolate with long petioles and dark or light green, pulvinate base, stipulate. Leaflets are stipellate, two lateral leaflets are obliquely ovate and terminal leaf let is ovate or obovate. The inflorescence is axillary raceme with 10-20 flowers and peduncle is of 2 to 13 cm long. The flower is yellow, complete and bisexual. Pods are 6 to 10 cm long, slender, short and hairy. At the time of maturity, pods attain black or brown or pale grey colour. Seeds are globose, weight 15 to 85 mg, mostly green but sometimes yellow, tawny brown, black or mottled. The white, flat hilum is not concave; germination is epigeal (Bailey, 1970).

Genetics variability for Quantitative traits

Mungbean genetic improvement of economically important traits requires availability of genetic variability, adequate knowledge of their inheritance pattern, relative contribution of genetic and non-genetic components in their expression. Many traits of economic importance are inherited in a quantitative fashion and their expression may be affected by both genetic and environmental influences. Variability results due to differences either in the genetic constitution of the individuals of a population or in the environment in which they are grown. Selection is also effective when there is genetic variability among the individuals in a population. Hence, assessment of variability for different yield attributes and the nature of their heritability are the prime requisites for an efficient

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plant breeding programme. Literature on genetic studies of mungbean largely comes from India whereas vast array of researchers work on the crop. With mungbean, genetic studies are sparse compared to other pulse crops like soybean, chickpea due to lesser economic importance of the crop and less funding for research. A brief resume of the work done on variability in mungbean is presented here under (Table-1).

Heritability for yield and some yield attributes

Days to 50% flowering: Broad sense heritability for days to 50% flowering varied from 3.01 to 97.00. High heritability was reported by Lakshmaiah *et al.* (1989), Kumar *et al.* (1992), Wani *et al.* (2007), Pandey *et al.* (2007), Makeen *et al.* (2007), Singh *et al.* (2009), Reddy *et al.* (2011), Srivastava and Singh (2012) and Kumar *et al.* (2013).

Days to maturity: The magnitude of heritability was ranged from 22.90 to 97.00. High heritability was reported by Misra and Sahu (1985), Lakshmaiah *et al.* (1989), Reddy (1997), Dodwad *et al.* (1998), Wani *et al.* (2007), Makeen *et al.* (2007), Singh *et al.* (2009), Reddy *et al.* (2011), Srivastava and Singh (2012) and Kumar *et al.* (2013)

Plant height: A wide range of heritability observed for plant height and varied from 9.40 to 99.60. High heritability was reported by Misra and Sahu (1985), Lakshmaiah *et al.* (1989), Reddy (1997), Dodwad *et al.* (1998), Lavanya (2006), Wani *et al.* (2007), Pandey *et al.* (2007), Makeen *et al.* (2007), Singh *et al.* (2009), Reddy *et al.* (2011), Srivastava and Singh (2012), Kumar *et al.* (2013) and Jyothsnanand and Anuradha (2013)

Number of branches per plant: Heritability for number of branches per plant ranged from 28.81 to 91.70. High heritability was reported by Reddy (1997), Singh *et al.* (2009), Reddy *et al.* (2011), Srivastava and Singh (2012), Kumar *et al.* (2013) and Jyothsnanand and Anuradha (2013)

Number of clusters per plant: Brosd sense heritability was varied from 48.12 to 96.40. High heritability was reported by Misra and Sahu (1985), Lakshmaiah *et al.* (1989), Reddy (1997), Khairnar *et al.* (2003), Srivastava and Singh (2012) and Kumar *et al.* (2013)

Number of pods per cluster: The range in number of pods per cluster varied from 42.47 to 78.20. High heritability was reported by Reddy (1997), Wani *et al.* (2007), Pandey *et al.* (2007) and Makeen *et al.* (2007)

Number of pods per plant: A range of 36.88 to 98.80 was observed for number of pods per plant. High heritability was reported by Misra and Sahu (1985), Lakshmaiah *et al.* (1989), Reddy (1997), Dodwad *et al.* (1998), Khairnar *et al.* (2003), Lavanya (2006), Wani *et al.* (2007), Makeen *et al.* (2007), Singh *et al.* (2009), Reddy *et al.* (2011), Srivastava and Singh (2012), Kumar *et al.* (2013) and Jyothsnanand and Anuradha (2013)

100 seed weight: Heritability for seed weight ranged from 18.78 to 98.81. High heritability was reported by Lakshmaiah *et al.* (1989), Kumar *et al.* (1992), Dodwad *et al.* (1998), Khairnar *et al.* (2003), Wani *et al.* (2007), Makeen *et al.* (2007), Singh *et al.* (2009), Reddy *et al.* (2011), Srivastava and Singh (2012) and Kumar *et al.* (2013)

Pod length: The magnitude of heritability was ranged from 23.90 to 81.53. High heritability was reported by Misra and Sahu (1985), Reddy (1997), Dodwad *et al.* (1998), Venkateswarlu (2001), Lavanya (2006), Pandey *et al.* (2007) and Kumar *et al.* (2013)

Number of seeds per pod: Broad sense heritability estimates for number of seeds per pod ranged from 28.29 to 97.10. High heritability was reported by Misra and Sahu (1985), Venkateswarlu (2001), Khairnar *et al.* (2003), Wani *et al.* (2007), Singh *et al.* (2009), Reddy *et al.* (2011) and Srivastava and Singh (2012)

Seed yield per plant: Estimates of broad sense heritability for seed yield per plant ranged from 31.22 to 99.00. High heritability was reported by Misra and Sahu (1985), Lakshmaiah *et al.* (1989), Reddy (1997), Dodwad *et al.* (1998), Venkateswarlu (2001), Khairnar *et al.* (2003), Lavanya (2006), Singh *et al.* (2009), Reddy *et al.* (2011), Srivastava and Singh (2012) and Kumar *et al.* (2013). Several workers reported high heritability coupled with high genetic advance indicating the additive gene action in the inheritance of yield and yield attributes.

Breeding objectives: The primary objective is high yield with stable performance. But, yield was regularly affected with biotic and abiotic stresss. So, breeding for biotic stress like sucking pests, pod borer, bruchids, powdery mildew, cercospora leaf spot, MYMV and other regional pests and diseases are considered as main objectives. Further, tolerance to lodging, pod shattering, drought tolerance are some of the regular objectives in mungbean.

Table 1. Estimates of broad sense heritability and genetic advance for seed yield and some yield attributes in mungbean

Reference	Days to 50% flowering	Days to maturity	Plant height	Number of branches per plant	Number of clusters per plant	Number of pods per cluster	Number of pods per plant	100 seed weight	Pod length	Number of seeds per pod	Seed yield per plant
Misra and Sahu (1985)		80.10 (7.60)	86.60 (28.20)		81.40 (34.00)		85.80 (33.90)		67.80 (9.00)	72.40 (8.20)	74.30 (21.10)
Lakshmaiah *et al.* (1989)	97.00 (14.41)	97.00 (5.25)	97.00 (38.83)		88.00 (39.58)		85.00 (23.20)	78.00 (10.46)		52.00 (6.29)	85.00 (24.84)

Kumar *et al.* (1992)	90.29 (10.98)	14.38 (21.41)	54.21 (18.36)				50.22 (31.19)	95.21 (16.60)			31.22 (13.81)
Reddy (1997)		88.90 (16.17)	77.84 (37.26)	71.93 (66.44)	66.78 (39.39)	62.50 (38.22)	70.07 (41.27)	41.28 (15.20)	75.03 (11.58)	53.81 (10.21)	65.90 (46.41)
Dodwad *et al.* (1998)						42.47 (20.36)	66.28 (45.67)	98.81 (59.23)	59.82 (17.92)	28.29 (6.13)	66.67 (54.97)
Venkateswarlu (2001)	25.60 (3.01)	48.46 (3.64)	33.08 (9.57)		48.12 (21.05)		36.88 (21.48)	18.78 (1.52)	25.63 (4.06)	84.10 (19.27)	
Khairnar *et al.* (2003)	8.70 (0.35)	22.90 (2.48)	9.40 (1.72)		96.40 (59.92)		78.30 (37.29)	90.00 (20.80)		74.20 (12.47)	92.10 (38.57)
Lavanya (2006)		45.51 (11.67)	75.64 (39.36)	28.81 (17.76)	55.93 (43.74)	52.15 (38.60)	65.54 (45.82)	35.94 (12.04)	81.53 (32.57)		74.55 (55.53)
Wani *et al.* (2007)	69.54 (7.08)	66.57 (6.01)	75.62 (23.32)			73.44 (27.09)	61.44 (36.05)	71.76 (17.02)	53.75 (6.14)	69.63 (9.96)	59.57 (59.46)
Pandey *et al.* (2007)		57.10 (10.50)	79.70 (33.14)	39.70 (13.44)		78.20 (33.29)		58.80 (11.43)	67.01 (10.24)	56.70 (8.49)	48.80 (42.68)
Makeen *et al.* (2007)	69.54 (7.08)	66.57 (6.01)	75.62 (23.32)			73.44 (27.09)	61.44 (36.05)	71.76 (17.02)	53.75 (6.14)	59.63 (9.96)	59.57 (59.46)
Singh *et al.* (2009)	84.30 (13.13)	96.80 (17.58)	99.60 (32.36)	91.70 (21.43)			98.80 (99.07)	96.00 (57.59)		97.10 (39.25)	99.00 (79.38)
Reddy *et al.* (2011)	88.00 (26.22)	84.00 (15.40)	93.00 (46.58)				79.00 (46.31)	94.00 (27.29)		86.00 (24.47)	93.00 (86.82)
Srivastava and Singh (2012)	83.90 (8.22)	80.30 (5.22)	67.50 (4.10)	51.70 (17.25)	68.90 (12.22)	54.80 (18.73)	96.60 (19.14)	63.70 (18.55)	34.70 (5.48)	60.40 (17.28)	92.90 (35.92)
Kumar *et al.* (2013)	73.30 (10.57)	83.10 (16.91)	75.20 (18.07)	37.50 (16.09)	61.20 (24.16)		78.40 (56.35)	89.90 (28.64)	88.20 (25.26)	46.40 (7.37)	53.50 (09.18)
Jyothsnanand and Anuradha (2013)	28.80 (4.41)	32.20 (3.82)		30.60 (12.05)			76.10 (59.73)	28.30 (7.74)	23.90 (8.48)	56.20 (23.30)	34.50 (24.43)

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STUDY OF CORRELATION COEFFICIENT AND PATH COEFFICIENT ANALYSIS IN GLADIOLUS (*GLADIOLUS HYBRIDUS* HORT.)

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Abstract: Correlation coefficient and path analysis in fifteen genotypically diverse genotypes of gladiolus (*Gladiolus hybridus* Hort.) were studied at Horticultural Research Centre (HRC) of SVPUAT, Meerut, U.P. during the years 2013-14 for seventeenth important characters. Number of corms per plant showed positive and significant genotypic and phenotypic associations with diameter of corm, number of spikes per corm and flower. Path coefficient analysis provides an effective means of a critical examination of specific force action to produce a given correlation and measure the relative importance of each factor. Path results showed that maximum positive direct effect was observed for length of rachis followed by, leaf length, visibility of spike and spikes per corm and rest of the characters showed negative correlation at genotypic and phenotypic level.

Keywords: Gladiolus, Correlation, Path analysis, Flower characters

INTRODUCTION

Gladiolus (*Gladiolus hybridus* Hort.) is one of the most important bulbous ornamentals for cut flower trade in India. It is also ideal both for garden display, floral arrangements for table and interior decoration as well as making high quality bouquet (Lepcha *et al.*, 2007). Gladiolus is very rich in varietal wealth and every year there is an addition of new varieties (Kumar and Yadav 2005). It is also known that the modern cultivars are derived from inter-specific hydrides among several species. Hence, wide variation is exhibited by gladiolus cultivars for their growth habit, size, shape and color of as well as spikes, and florets. The assessment of natural genetic variation is important not only for ethical and aesthetic reasons but also to ensure that genetic resources may be used even more efficiently and sustainably in agriculture and other industries. Thus, there is urgent need to assess the variation that already exist and how it can be conserved and utilized effectively.

MATERIAL AND METHOD

The present investigation was carried out at Horticulture Research Centre (HRC), Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India during Rabi session 2013-2014. The experimental material for the present investigation was use fifteen varieties/genotypes Punjab Pink, Punjab Glance, Pacific, Orange Ginger, Prabha, Sylvia, Aldebaran, Pricilla, Novalux, Gold Field, Ocilla, Kum-Kum, Arka Keshar, Arka Gold and American Beauty the trail was laid out in randomized complete block design and replicated thrice. Following observations for morphological characters based on five randomly selected plants in each treatments/genotype of all replications were recorded at 30 days interval, respectively. The following characters were taken in the study i.e. pant height, number of leaf per plant, leaf length, leaf width, number of suckers per corm, length of spike, length of rachis, number of spikes per corm, diameter of spike, number of flower per spike, flower diameter, visibility of spike in (day), opening of first flower in (day), longevity of spike in (day), diameter of corm, weight of corm, number of corms per plant and cormlets per plant. The recorded data were statistically analysed i.e. phenotypic and genotypic correlation coefficients calculated by the formula suggested by Al-Jibauri *et al.* (1958) and Miller *et al.* (1958) and path estimated by Dewey and Lu (1959).

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RESULT AND DISCUSSION

In the present investigation correlation coefficient was estimated with seventeen characters at genotypic and phenotypic levels (Table. 1). The data presented in table-1 showed that all most characters exhibited genotypic correlation to each other in positive and negative ways. Cormlets per plant showed positive correlation with plant diameter of corm (0.43**), followed by, weight of corm (0.37**), Number of spike per corm (022**) opening of first flower in days (0.16). Number of corms per plant showed positive significant correlation with length of spike (0.28**), followed by, length of rachis (0.25**). Weight of corm showed positive and highly significant correlation with diameter of corm (0.93**) followed by, spikes per corm (0.41**), flower diameter (0.24**). Flower diameter exhibited

positive and highly significant correlation with diameter of corm (0.26**), Number of flower per spike revealed positive and highly significant correlation with spikes per corms (0.77**), followed by length of rachis (0.76**), length of spike (0.66*). Length of rachis showed positive and highly correlation with length of spike (0.94**), followed by leaf width (0.31**). Leaf width showed positive and highly correlation with number of leaf per plant (0.81**).

Significant phenotypic correlation coefficient was observed among the characters as indicated in table-1. Number of corms per plant showed positive significant phenotypic correlation with length of spike (0.25**), followed by, length of rachis (0.25**). Weight of corm showed positive and highly significant correlation with diameter of corm (0.84**) followed by, spikes per corm (0.38**). Flower diameter exhibited positive and highly significant correlation with diameter of corm (0.26**), followed by, spikes per corm (0.37**), flower diameter (1.00**). Number of flowers per spike revealed positive and highly significant correlation with spikes per corm (0.69**), followed by, length of rachis (0.73**), length of spike (0.60**). Length of rachis showed positive and highly correlation with length of spike (0.86**), followed by, leaf width (0.32**). Leaf width showed positive and highly correlation with number of leaf per plant (0.37**). Similar results were also reported by Rashmi *et al.* 2012, Vanlaruati *et al.* 2013, Chopde *et al.* 2012, Neeraj *et al.* 2001, Anuradha *et al.* 2000, Deshraj *et al.* 1998, and Hedge *et al.* 1997. Maximum positive direct effect was observed for diameter of spike, followed by, number of leaves per plant, visibility of spike in days, number of spikes per corms, plant height, length of spike, weight of corm. However, the maximum negative direct effect was observed for length of rachis, followed by, leaf width, leaf length, and diameter of corn. A critical perusal of result in the table revealed that diameter of spike had showed maximum direct positive effect followed by, weight of corm, spikes per corm, plant height, and number of leaves per plant respectively. At genotypic level also observed direct and indirect effects similar to those observed at phenotypic level with little variation in magnitudes. Hedge *et al.* 1997, Deshraj *et al.* 1997, Anuradha *et al.* 2000, Katwate *et al.* 2002, Chopde *et al.* 2012.

The Path coefficient analysis exhibited the direct and indirect effect of all these characters on 17th characters. The results obtained from the present study at phenotypic level are presented in (Table 2). The revealed data showed that maximum positive direct effect was observed for length of rachis (1.42) followed by, leaf length (0.57), leaf width (0.45), flower diameter (0.31), visibility of spike in days (0.29), spikes per corm (0.14) and diameter of corm. Partitioning of the correlation coefficients in to direct and indirect effects was done at the genotypic level. A data exhibited in table-2 showed that the length of rachis had the maximum direct positive effect (2.20) followed by, visibility of spike in days (0.66), spikes per corm (0.66), leaf width (0.93), leaf length (0.98), weight of corm (0.25).

The data presented in Table- 2 explained that correlation coefficient was estimated with seventeen characters at genotypic and phenotypic levels. The genotypic correlation generally was found higher then phenotypic correlation. It might be due to that mostly phenotypic correlation is influenced by the environmental factors and genotypic correlation is not influenced by environmental factors. Cormlets per plant showed significant positive genotypic and phenotypic correlation with number of suckers per corm, diameter of corm weight of corm and also exhibited significant negative genotypic and phenotypic correlation with flower diameter at 5% level, and number of corm per plant showed positive significant genotypic and phenotypic correlation with length of spike, length of rachis. However, diameter of corm and number of corms per plant found negative significant correlation with visibility of spike (days), opening of first flower (days), diameter of corm and weight of corm. Weight of corm found significant positive correlation with suckers per corm and diameter of corm. The present results are close conformity with Rashmi *et al.* 2012, Vanlaruati *et al.* 2013, Chopde *et al.* 2012, Neeraj *et al.* 2001, Anuradha *et al.* 2000, Deshraj *et al.* 1998, and Hedge *et al.* 1997.

Correlation and path analysis indicated the effective improvement in suckers per corm rachis, length spike diameter, florets per spike, flower diameter, visibility of spike in days, opening of first flower in days, longevity of spike in days, diameter of corm, weight of corms, corms per plant also can be considered as further breeding work.

Table 1. Estimates of correlation coefficient for genotypic (G) and phenotypic (P) levels among different characters in gladiolus.

Genotpyes		NLPP	LL(cm)	LW (cm)	NSPC	LS (cm)	LR (cm)	SPC	DSPC (cm)	NFPS	FD (cm)	VSD	OFFD	LSD	DC (mm)	WC (gm)	NCPP	CPP
	G	0.69**	1.02	0.02	-0.32	0.32**	0.05	-0.19	0.10	0.03	0.04	0.10	-0.02	-0.35	-0.05	-0.04	0.14	-0.43**
PH (cm)	P	0.41**	0.73**	0.02	-0.28	0.29**	0.10	-0.18	-0.03	0.01	0.20**	0.04	-0.00	-0.30	-0.12	-0.04	0.20*	-0.34
	G	1.00	0.87**	0.81**	0.08	0.10	0.10	0.01	0.40**	0.30**	0.26**	0.14	0.46**	-0.58**	-0.24	-0.12	-0.22	-0.60**
NLPP	P	1.00	0.46**	0.37**	0.09	0.01	0.03	0.16*	0.17	0.03	0.15	0.38**	0.08	-0.25	-0.14	-0.14	-0.13	-0.09
	G		1.00	0.22*	-0.19	0.19*	-0.01	-0.26	-0.02	0.03	0.12	0.32**	0.19*	-0.36	-0.20	-0.11	0.08	-0.26
LL(cm)	P		1.00	0.20*	-0.20	0.19*	-0.04	-0.25	0.12	0.05	-0.09	0.27**	0.23**	-0.34	-0.13	-0.09	-0.01	-0.24
	G			1.00	-0.15	0.26**	0.31**	0.25**	0.49**	0.53**	0.13	0.36**	0.42**	-0.28	-0.36*	-0.25	-0.25	-0.27
LW (cm)	P			1.00	-0.16	0.22*	0.32**	0.20**	0.44**	0.55**	0.10	0.21*	0.41**	-0.22	-0.36*	-0.22	-0.23	-0.31
	G				1.00	-0.33	-0.23	0.02	-0.13	-0.32	-0.01	0.21*	0.26**	0.08	0.18*	0.13	-0.17	0.22**
NSPC	P				1.00	-0.31	-0.23	0.03	-0.15	-0.32	0.02	0.23**	0.15	0.07	0.18*	0.13	-0.15	0.22**
	G					1.00	0.94**	0.33**	0.46**	0.66**	0.35**	-0.17	-0.19	-0.17	-0.14	-0.07	0.28**	-0.38*
LS (cm)	P					1.00	0.86**	0.29**	0.43**	0.60**	0.29**	-0.13	-0.12	-0.26	-0.07	-0.06	0.25**	-0.34
	G						1.00	0.47**	0.46**	0.76**	0.44**	-0.16	-0.16	-0.21	-0.14	-0.07	0.25**	-0.42*
LR (cm)	P						1.00	0.44**	0.38**	0.73**	0.39**	-0.19	-0.09	-0.15	-0.18	-0.06	0.25**	-0.40*
	G							1.00	0.13	0.77**	0.90**	-0.05	0.04	-0.22	0.39**	0.41**	-0.37	-0.30
SPC	P							1.00	0.10	0.69**	0.76**	0.01	-0.01	-0.17	0.37**	0.38**	-0.34	-0.22
	G								1.00	0.27**	0.27**	0.12	0.12	-0.40	-0.48**	-0.52	-0.00	-0.43**
DSPC (cm)	P								1.00	0.26**	0.02	0.10	0.18*	-0.36	-0.38*	-0.47**	-0.08	-0.39*
	G									1.00	0.72**	0.23**	0.24**	-0.32	0.03	0.18*	-0.24	-0.38
NFPS	P									1.00	0.55**	0.12	0.22*	-0.26	0.01	0.19*	-0.24	-0.42*
	G										1.00	0.06	0.01	-0.38*	0.26**	0.24**	-0.21	-0.55**
FD (cm)	P										1.00	-0.01	-0.03	-0.32	0.20*	0.18*	-0.03	-0.44**
	G											1.00	0.14	-0.57**	-0.04	0.04	-0.56**	0.00
VSD	P											1.00	0.70**	-0.44**	0.00	0.00	-0.51**	0.14*
	G												1.00	-0.54**	0.00	0.06	-0.63**	0.16*`
OFFD	P												1.00	-0.50	-0.00	0.06	-0.54**	0.06
	G													1.00	0.13	0.21*	0.07	0.15
LSD	P													1.00	0.01	0.20*	0.05	0.14
	G														1.00	0.93**	-0.48**	0.43**
DC (mm)	P														1.00	0.84**	-0.44**	0.37**
	G															1.00	-0.59**	0.37**
WC (gm)	P															1.00	-0.58**	0.31**
	G																1.00	-0.25
NCPP	P																1.00	-0.23
	G																	1.00
CPP	P																	1.00

*, ** significant at 5% and 1% level, respectively

Table 2. Path coefficient analysis showing the direct and indirect effect of seventeen characters gladiolus on the grain yield at genotypic and phenotypic level of gladiolus.

Genotpyes		PH (cm)	NLPP	LL(cm)	LW (cm)	NSPC	LS (cm)	LR (cm)	SPC	DSPC (cm)	NFPS	FD (cm)	VSD	OFFD	LSD	DC (mm)	WC (gm)	CPP	r value with ch 17
PH (cm)	G	**-0.74**	-0.45	1.01	0.02	0.19	-0.07	0.11	-0.13	-0.08	-0.12	0.02	0.07	0.11	0.13	0.12	-0.01	0.15	0.14
	P	**-0.44**	-0.21	0.42	0.01	0.08	-0.04	0.15	-0.02	0.02	-0.01	0.06	0.01	0.10	0.08	0.10	0.01	0.08	0.20
NLPP	G	-0.51	**-0.65**	0.86	0.76	-0.04	-0.12	0.22	0.01	-0.33	-0.97	0.11	0.09	-0.26	0.22	0.10	-0.03	0.22	-0.22
	P	-0.18	**-0.52**	0.26	0.17	-0.02	-0.10	0.04	0.02	-0.12	-0.05	0.05	0.11	-0.03	0.06	0.00	0.05	0.02	-0.13
LL(cm)	G	-0.76	-0.57	**0.98**	0.21	0.11	-0.04	-0.03	-0.17	0.01	-0.11	0.05	0.21	-0.11	0.14	0.08	-0.02	0.09	0.08
	P	-0.32	-0.24	**0.57**	0.09	0.06	-0.03	-0.06	-0.13	-0.09	-0.08	-0.02	0.08	-0.10	0.09	0.00	0.03	0.06	-0.01
LW (cm)	G	-0.01	-0.53	0.22	**0.93**	0.09	-0.06	0.68	0.16	-0.40	-1.70	0.05	0.24	-0.24	0.10	0.15	-0.06	0.10	-0.26
	P	-0.01	-0.19	0.11	**0.45**	0.04	-0.03	0.45	0.13	-0.31	-0.92	0.03	0.06	-0.18	0.06	-0.11	0.08	0.08	-0.23
NSPC	G	0.24	-0.05	-0.19	-0.14	**-0.61**	0.08	-0.50	0.11	0.11	1.03	-0.10	0.14	-0.14	-0.03	-0.08	0.03	-0.08	-0.17
	P	0.12	-0.05	-0.12	-0.07	**-0.28**	0.05	-0.33	0.10	0.11	0.53	0.10	0.06	-0.07	-0.02	0.11	-0.04	-0.05	-0.15
LS (cm)	G	-0.23	-0.06	0.19	0.24	0.20	**-0.24**	2.07	0.22	-0.37	-2.12	0.15	-0.11	0.10	0.06	0.06	-0.01	0.13	0.28
	P	-0.12	-0.00	0.11	0.10	0.09	**-0.15**	1.23	0.04	-0.30	-1.01	0.09	-0.03	0.05	0.07	0.00	0.02	0.08	0.25
LR (cm)	G	-0.04	-0.06	-0.01	0.28	0.14	-0.22	**2.20**	0.31	-0.37	-2.42	0.19	-0.11	0.09	0.08	0.06	-0.01	0.15	0.25
	P	-0.04	-0.01	-0.02	0.14	0.06	-0.13	**1.42**	0.06	-0.27	-1.23	0.12	-0.05	0.04	0.04	0.00	0.02	0.10	0.25
SPC	G	0.14	-0.01	-0.25	0.23	-0.11	-0.08	1.05	**0.66**	-0.11	-2.46	0.40	-0.03	-0.02	0.08	-0.17	0.10	0.11	-0.37**
	P	0.08	-0.08	-0.14	0.09	-0.11	-0.04	0.63	**0.14**	-0.07	-1.15	0.24	0.00	0.10	0.04	0.00	-0.13	0.05	-0.34
DSPC (cm)	G	-0.07	-0.26	-0.02	0.45	0.08	-0.11	1.01	0.09	**-0.81**	-0.87	0.12	0.08	-0.06	0.15	0.21	-0.13	0.15	-0.20
	P	0.01	-0.09	0.07	0.20	0.04	-0.06	0.55	0.01	**-0.71**	-0.44	0.10	0.03	-0.08	0.09	-0.20	0.17	0.09	-0.18
NFPS	G	-0.02	-0.20	0.03	0.49	0.19	-0.16	1.67	0.51	-0.22	**-3.19**	0.31	0.15	-0.13	0.12	-0.11	0.04	0.14	-0.24
	P	-0.00	-0.01	0.03	0.24	0.09	-0.09	1.04	0.10	-0.19	**-1.67**	0.17	0.03	-0.09	0.07	0.10	-0.07	0.10	-0.24
FD (cm)	G	-0.03	-0.17	0.11	0.12	0.10	-0.08	0.98	0.60	-0.22	-2.31	**0.44**	0.04	-0.10	0.14	-0.11	0.06	0.20	-0.21
	P	-0.08	-0.08	-0.05	0.04	-0.20	-0.04	0.56	0.11	-0.01	-0.93	**0.31**	-0.10	0.11	0.08	0.10	-0.06	0.11	-0.23
VSD	G	-0.08	-0.09	0.32	0.33	-0.13	0.04	-0.36	-0.13	-0.09	-0.75	0.12	**0.66**	-0.64	0.22	0.21	0.11	-0.10	-0.56**
	P	-0.02	-0.20	0.16	0.09	-0.06	0.02	-0.27	0.10	-0.07	-0.20	-0.10	**0.29**	-0.31	0.11	0.10	-0.10	-0.03	-0.51
OFFD	G	0.01	-0.30	0.19	0.39	-0.16	0.04	-0.35	0.13	-0.09	-0.76	0.20	0.75	**-0.56**	0.21	0.10	0.01	-0.05	+0.63**
	P	0.00	-0.04	0.13	0.18	-0.04	0.02	-0.14	-0.10	-0.12	-0.37	-0.01	0.20	**-0.44**	0.13	0.20	-0.02	-0.11	+0.54**
LSD	G	0.26	0.38	-0.36	-0.26	-0.05	0.14	-0.46	-0.14	0.32	1.03	-0.16	-0.37	0.30	**-0.38**	-0.05	0.05	-0.15	0.07
	P	0.13	0.13	-0.19	-0.10	-0.02	0.14	-0.22	-0.02	0.26	0.44	-0.10	-0.12	0.22	**-0.27**	0.00	-0.07	-0.03	0.05
DC (mm)	G	0.04	0.16	-0.19	-0.33	-0.11	0.13	-0.30	0.26	0.39	-0.11	0.11	-0.02	0.10	-0.05	**-0.43**	0.24	-0.15	-0.48**
	P	0.05	0.07	-0.07	-0.16	-0.05	0.21	-0.26	0.05	0.27	-0.01	0.06	0.10	0.10	-0.00	**0.00**	-0.30	-0.09	-0.44**
WC (gm	G	0.03	0.08	-0.10	-0.23	-0.08	0.11	-0.16	0.27	0.43	-0.57	0.11	0.12	-0.03	-0.08	-0.40	**0.25**	-0.13	-0.59**
	P	0.01	0.07	-0.05	-0.10	-0.03	0.11	-0.09	0.05	0.33	-0.33	0.05	0.20	-0.02	-0.05	0.00	**-0.36**	-0.07	-0.58**
CPP	G	0.32	0.39	-0.26	-0.25	-0.13	0.09	-0.94	-0.20	0.35	1.23	-0.24	0.10	-0.09	-0.05	-0.18	0.09	**-0.36**	-0.25
	P	0.15	0.05	-0.14	-0.14	-0.06	0.05	-0.57	-0.03	0.27	0.71	-0.13	0.04	-0.02	-0.03	0.00	-0.11	**-0.25**	-0.23

Residual values (G) = 0.085, Residual values (P) =0.017.

Bold values indicate direct effects

*, ** Significant at 5% and 1% level, respectively

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SIGNIFICANCE OF DIFFERENT FUNGICIDES FOR THE CONTROL OF POWDERY MILDEW DISEASE (*SPHAEROTHECA* SP.) OF NIGER (*GUIZOTIA ABYSSINICA* CASS) A TRADITIONAL TRIBAL CROP

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Abstract: A field experiment with the four replications was conducted at the Niger Research Station (NRS) in *Rabi*, 2013-14 season at Navsari Agricultural University (NAU), Vanarasi, Navsari, Gujarat on the Powdery mildew disease of Niger cultivar. In this experiment, eight different fungicides have been evaluated for the control of Powdery mildew disease out of which, all the fungicidal treatments were significantly superior over the control. All the fungicidal treatments were significantly superior over the control to reduce the Powdery mildew disease. The least incidence of Powdery mildew disease (12.42 PDI) observed in T5 treatment containing Wettable Sulphur (0.2%) which, was followed by the T-2 Hexaconazole (0.1%) for (15.50 PDI) respectively. With respect to seed yield, Wettable Sulphur (0.2%) treatment recorded the highest seed yield (699 Kg/ha) followed by T-2 Hexaconazole (0.1%) 598 Kg/ha. This study concludes that foliar efficacy is an important step in controlling the above diseases.

Keywords: Niger, Powdery mildew, Fungicides, Crop

INTRODUCTION

Niger (*Guizotia abyssinica* Cass) is one of the important minor oilseed crops of India. In India, it is mainly cultivated in tribal pockets of Gujarat, M.P., Orissa, Maharashtra, Bihar, Karnataka and Andhara Pradesh. Niger is a crop of dry areas grown mostly by tribal and interior places as life line of tribal segment. It is also know by various names such as Ramtil or Kalatil in India and Noog in Ethiopia. The Niger crop is found infested by number of diseases & pests, which causes harsh damage to the crop. Further, the accidental rain at flowering stage leads the expansion of *Alternaria, Cercospora* leaf spot and Powdery mildew disease incidence and results in the poor seed set and seed yield. The crop is affected by number of fungal diseases. The important diseases of Niger are Alternaria blight (*Alternaria porii* & *A. alternata*), leaf spot (*Cercospora guizoticola*), Seedling blight (*Alternaria tenuis*), seed rot (*Rhizotonia bataticola*), rust (*Puccinia guizotiae*), powdery mildew (*Sphaerotheca* sp.), root rot (*Macrophomina phaseolina*) and cuscuta as *Phanerogamic* parasite (Rajpurohit, 2004 and Rajpurohit & Dubal, 2009). Due to Powdery mildew disease in Niger crop, the yield loses are due to early defoliation as a result of the disease. All the aerial parts develop symptoms. Small cottony spot develops on the leaves which gradually cover the whole lamine (Vyas *etal*., 1981). Powdery mildew first appears as white, powdery spots that may form on both surfaces of leaves, on shoots, and seed capsules. These spots gradually spread over a large area of the leaves and stems. An exception is one of the powdery mildews that affect artichokes, onions, peppers, and tomatoes, it produces yellow patches on leaves but little powdery growth. Leaves infected with powdery mildew may gradually turn completely yellow, die, and fall off, which may expose fruit to sunburn. On some plants, powdery mildew may cause the leaves to twist, buckle, or otherwise distort. Powdery mildew fungal growth does not usually grow on vegetable fruits, although pea pods may get brownish spots. Severely infected plants may have reduced yields, shortened production times, and fruit that has little flavor. The pathogen is known to survive through some unknown collateral hosts. Currently studies pertaining to the use of fungicides in management of disease is highly emphasized (Rajpurohit *etal*. 2005).Considering the economic losses in this present investigation attempts were therefore made to ascertain the spectrum of fungal diseases of Niger crop.

MATERIAL AND METHOD

The experiment was laid out in RBD with the four replications at Niger Research Station (Vanarasi farm), Navsari Agricultural University (NAU), Navsari (Gujarat). In the *Rabi*, 2013-14 season against the Powdery mildew disease. The incidence results in poor seed set and seed yield. In such cases there is need to protect the crop through suitable fungicidal sprays at this stage. Hence, keeping in view all above parameters and facts, the study on fungicidal application on crop growth in Niger was initiated. In this experiment below, eight different fungicides was incorporated along with the control.

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Objective	**:**	**To find out the efficacy of fungicides against the Powdery mildew disease**
Location	**:**	**Niger Research Station (NRS)**
Year of commencement	**:**	***Rabi*, 2013-14**
Experimental details		
Treatment	**:**	**08**
Design	**:**	**R.B.D.**
Replication	**:**	**Four**
Plot size in meter	**:**	**Gross: 4.0 x 3.0 m** **Net: 3.6 x 2.4 m**
H.F.		**1157.40**
Spacing	**:**	**30 x 10 cm**
Fertilizer NPK kg/ha	**:**	**20:20:00**
Date of sowing	**:**	**12.12.2013**
Date of harvesting	**:**	**21.03.2014**
Date of Weeding	**:**	**18.01.2014 & 06.02.2014**
Previous crop	**:**	**-**
Plant Protection measures adopted	**:**	**First spray at the initial appearance of the disease (07.02.2014)** **Second spray at the interval of 15 days (22.02.2014)**
Result	**:**	**Table: 2 & Table: 3**

Treatment details as follows

T_1- Carbendazim 50 WP (0.1%)
T_2- Hexaconazole (0.1%)
T_3- Mancozeb (0.2%)
T_4- Propiconazole (0.1%)
T_5- Wettable Sulphur (0.2%)
T_6- Carbendazim + Mancozeb (0.2%)
T_7- Chlorothalonil 75 WP (0.1 %)
T_8- Control

Application of required dose of fungicides was sprayed at the initial appearance of the disease and second at the interval of 15 days. Observation on foliar disease infection was calculated on Niger plant by observing top, middle and bottom leaves of the plant were chosen and scored as per the scale given below. Percent Disease Incidence (PDI) was recorded as per the disease intensity at field condition prior to spray and at the time of harvest by using Disease Rating scale of (0 to 5) as developed by Mayee and Datar, 1986, Townsend and Heuberger, 1943 (Table: 1).

Table: 1 Disease rating scale

Score	Description	Reaction
0	No infection	Immune
1	1-10 % lead area infected	Resistant
2	11-25 % lead area infected	Moderately Resistant
3	26-50 % lead area infected	Moderately Susceptible
4	51-70 % lead area infected	Susceptible
5	71-100 % lead area infected	Highly Susceptible

The average intensity in each plot was calculated by the formula as employed by Wheeler, 1969.

$$\textbf{PDI} = \frac{\text{Summation of infected plants}}{\text{No. of leaves observed x Max. Disease score}} \times 100$$

RESULT AND DISCUSSION

In this experiment, different fungicides have been evaluated to control the powdery mildew disease, small cottony spot develops on the leaves which gradually cover the whole lamine (Vyas *etal*., 1981). All of the powdery mildew fungi are obligate biotrophs, meaning that they require living host tissue on which to grow. As mentioned previously, most of the fungal growth is on the surface of the leaf or other plant part. The mildew penetrates the plant cuticle at regular intervals and produces specialized feeding structures called haustoria, which set up an intimate association with the epidermal cells. Nutrients produced by the plant for its own growth are instead diverted via the haustoria into the fungus. A few species of powdery mildew penetrate more deeply into the leaf, but still obtain their nutrients *via* haustoria. The asexual spores or conidia of powdery mildews are often produced in huge numbers (many thousands on a single leaf) and are readily dispersed by air currents and water splash etc. Powdery mildew attacks can therefore occur during spells of dry weather, when the progress of many other fungal diseases is checked. Powdery mildews overwinter in a number of ways depending on the mildew species and the host plant. Here, all the fungicidal treatment was significantly superior over control. All the fungicidal treatments were significantly superior over control to reduce the Powdery mildew disease. The least incidence of Powdery mildew disease (12.42 PDI) observed in T5 treatment containing Wettable Sulphur (0.2%) which, was followed by the T-2 Hexaconazole (0.1%) for (15.50 PDI) respectively (Table: 2). With respect to seed yield, Wettable Sulphur (0.2%) treatment recorded the highest seed yield (699 Kg/ha) followed by T-2 Hexaconazole (0.1%) 598 Kg/ha (Table: 3). The diseased can also be effectively controlled by spraying with sulfex at the rate of 0.3 percent as the disease starts appearing. Another spray can be after 10-15 days intervals depending upon the disease intensity (Sharma, 1982 and Sharma, 1989).

Table 1. Efficacy of foliar sprays on incidence of Powdery mildew disease of Niger crop

Sr. No.	Treatment	Replication				Mean
		I	II	III	IV	
T-1	Carbendazim 50 WP (0.1 %)	24.00 (29.33)	23.33 (28.88)	26.66 (31.08)	24.66 (29.77)	24.66 (29.76)
T-2	Hexaconazole (0.1%)	13.33 (21.41)	12.00 (20.26)	16.66 (24.08)	20.00 (20.56)	15.50 (23.07)
T-3	Mancozeb (0.2%)	22.00 (27.97)	24.66 (29.77)	19.33 (26.08)	26.00 (30.65)	23.00 (28.61)
T-4	Propiconazole (0.1%)	18.00 (25.10)	16.66 (24.08)	20.00 (26.56)	22.00 (27.97)	19.17 (25.92)
T-5	**Wettable Sulphur (0.2%)**	**13.33 (21.41)**	**10.00 (18.43)**	**14.00 (21.97)**	**12.33 (20.55)**	**12.42 (20.58)**
T-6	Carbendazim + Mancozeb (0.2%)	24.66 (29.77)	28.00 (31.94)	26.66 (31.08)	28.66 (32.36)	27.00 (31.28)
T-7	Chlorothalonil 75 WP (0.1 %)	28.66 (32.36)	30.66 (33.62)	26.66 (31.08)	31.33 (3403)	29.33 (32.76)

T-8	Control	33.33 (35.26)	32.00 (34.44)	28.00 (31.94)	32.66 (34.85)	31.50 (34.11)
SEm ±						**0.78**
CD at 5 %						**2.30**
CV %						**5.55**

Figure in the parenthesis are retransformed values

Table 2. Effect on seed yield of Niger crop

Sr. No.	**Treatment**	**Replication**				**Mean Yield (Kg/ha)**
		I	**II**	**III**	**IV**	
T-1	Carbendazim 50 WP (0.1 %)	450.00	421.00	490.00	511.00	468
T-2	Hexaconazole (0.1%)	600.00	649.00	588.00	556.00	598
T-3	Mancozeb (0.2%)	510.00	490.00	529.00	468.00	499
T-4	Propiconazole (0.1%)	500.00	552.00	589.00	481.00	531
T-5	**Wettable Sulphur (0.2%)**	**720.00**	**630.00**	**689.00**	**757.00**	**699**
T-6	Carbendazim + Mancozeb (0.2%)	400.00	348.00	421.00	399.00	392
T-7	Chlorothalonil 75 WP (0.1 %)	354.00	389.00	311.00	389.00	361
T-8	Control	300.00	280.00	245.00	221.00	262
SEm ±						**21.06**
CD at 5 %						**61.94**
CV %						**8.84**

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EFFECT OF POLLINATION BY INDIAN HONEY BEE, *APIS CERANA INDICA* FABR. ON YIELD , YIELD ATTRIBUTING CHARACTERS AND OIL CONTENT OF NIGER, *GUIZOTIA ABYSSINICA* CASS

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Abstract: The effect of pollination by Indian honey bee, *Apis cerana indica* were under taken on different quantitative and qualitative parameters of niger during 2011-12. The higher number of capitulum plant^{-1} was recorded in treatment total opened (35.17 capitulum^{-1}) however the lowest number of capitulum was recorded in treatment of total closed (28.32 capitulum plant^{-1}). The maximum capitulum weight was found in treatment control i.e. total opened (0.299 g) which was significantly superior but the mimnimum capitulum weight was observed in treatment, total closed (0.079 g). The maximum seed yield plant^{-1} was recorded in control (total opened 2.473 g plant^{-1}) but the least seeds yield plant^{-1} was recorded in treatment with total closed (0.606 g plant^{-1}). The sterility per cent was noticed significantly superior in treatment with total closed (97.09 per cent) however lower sterility per cent was recorded in treatment with total opened (4.92 per cent). The significantly higher per cent of healthy seeds were found in control plot, total open (95.06 per cent) but the minimum per centage of healthy seeds were found in treatment total closed (2.89 per cent). Maximum seed weight (1000 seeds) was recorded in treatment total open (4.89 g) however the treatment total closed had minimum seed weight (3.28 g). The significantly highest yield was found in treatment total open (353.25 kg/ha^{-1}) but the lowest seed yield was observed in treatment total closed (79.50 kg/ha^{-1}). Significantly higher oil content was recorded in treatment with total open (33.50 per cent) the lowest oil content was found in treatment with total closed (26.73 per cent). Significantly higher niger seed germination was recorded in treatment with control (80.25 per cent) The lowest germination was found in treatment with total closed (64.25 per cent).

Keywords : Indian honey bee, *Apis cerana indica*, Oil content, Pollination, Yield parameters, Niger

INTRODUCTION

In the agricultural economy of India, oilseeds are important next only to food grains in terms of area, production and value. The diverse agro-ecological conditions in the country are favorable for growing all the nine annual oilseeds, which include seven edible oilseeds, viz. groundnut, rapeseed-mustard, soybean, sunflower, sesame, safflower and niger, and two non-edible oilseeds, viz. caster and linseed. Apart from annual oilseeds, a wide range of other minor oil-bearing plants of horticulture and forest origin, including coconut and oil palm are cultivated in the country. In addition, substantial quantity of vegetable oils is also obtained from rice bran and cotton seed and a small quantity of oil from corn and tobacco seed (Hegde, 2012).

Among the edible oilseed crops, the niger (*Guizotia abyssinica* Cass. Compositae) is an important oilseed crop cultivated in Ethiopia and India. It is a branched annual herbaceous plant, grows upto a height of 1.8 metre. The niger plant complete its life cycle in 3-4.5 months. The yellow flower heads of 2-3 cm develop in the leaf axil, in a cluster of two to five. Each head contains about eight ray florets and 40 to 60 hermaphrodite disk florets.

The seeds contain approximately 40 per cent oil, which is pale yellow with nutty taste and a pleasant odour. The oil and seeds are free from any toxin and oil taste is similar to *desi* ghee. The oil is used for culinary purposes, anointing the body, manufacturing paints and soft soaps and for lighting and lubrication. The niger oil is good absorbent of fragrance of flowers due to which it is used as a base oil by perfume industry. Niger oil can be used for birth control and treatment of syphilis. Niger seed cake is a valuable cattle feed particularly for milch cattle. Niger is also used as a green manure for increasing soil organic carbon. The fatty acid composition of 75-80 per cent linoleic acid, 7-8 per cent palmitic and stearic acids, and 5-8 per cent oleic acid, (Getinet and Teklewold, 1995).

Various workers have worked on various issues of pollination made by the honey bee and among the workers Howard *et al.* (1919) found that cross-pollination in niger was common. They pointed out that the stigma lobes rarely curled back sufficiently to touch their own style, indicating that the plants were self-sterile. Panda *et al.*(1988) observed that both open pollination and bee pollination treatments were effective to increase the seed yield of sesamum up to 22 to 33 per cent more than that in pollination without insects.

MATERIAL AND METHOD

The experiment was conducted at Raj Mohini Devi College of Agriculture and Research Station, Ambikapur of Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during 2011-12. The

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crop was niger and the variety was JNC-9, plot size were 2 x 2 m^2. Six treatments four times replicated and the design was randomized block design. When the cages (Mosquito net) were opened once in a week, the Indian honey bee, *Apis cerana indica* only allowed visiting the crop, other insect pollinators/visitors were escaped with the help of hand net. The treatments which were totally closed with mosquito net, no any insect pollinators/visitors were allowed to visit inside the cage. In the control treatments (totally opened) all the pollinators/visitors were allowed to visit the niger crop.

All observations of the crop were made at the final stage of the crop.

Treatments Details

Treatments	Description
T_1	Open the cage between 0700 to1000hrs and1500 to1700hrs, Close between 1000 to 1500hrs.
T_2	Close the cage between 0700 to1000hrs and1500 to1700 hrs, Open between1000 to 1500hrs.
T_3	Close the cage between 0700 to 1200hrs Noon, and Open between 1200Noon to 1700hrs.
T_4	Open the cage between 0700 to 1200hrs Noon and Close between 1200Noon to 1700hrs.
T_5	Total closed (Total Net)
T_6	Control (Total Open)

(A) Quantitative Parameters

(I) Capitulum setting plant^{-1}: Ten plants were randomly selected from each pollinated situation in each replication and number of capitulum setting was counted. Then mean number of capitulum plant^{-1} was worked out.

(II) Seed yield plant^{-1}(g): Total 10 plants were used randomly for study under each pollinated situation in each replication. The capitula of all the plants were removed and seeds were separated from these capitulae, then seeds were weighed by electronic balance. Then mean seed yield plant^{-1} was worked out.

(III) Weight of capitulum^{-1}(g): Ten capitulum were used from each pollinated situation in each replication then by weighing the capitulum, average weight of capitulum were workout.

(IV) Sterility percentage: The chaffy seeds were observed and counted from ten capitulum. Then all seeds (number of healthy seeds + number of chaffy seeds) were determined from each treatment. Finally sterlity percentage was determined by the formula:-

$$\text{Sterility percentage (\%)} = \frac{\text{Number of chaffy (sterile) seeds capitulum}^{-1}}{\text{Total number of seeds capitulum}^{-1}} \times 100$$

(V) Test weight of seeds (g) :- Seeds samples were taken randomly from the produce of crop under six different pollinated conditions in each replication. After this 1000 seeds were counted treatment wise separately. Weight of 1000 seeds of each sample was recorded through electronic balance.

(VI) Seed yield (kg plot^{-1}/ kg ha^{-1}):- The crop harvested and tagged into bundles, all bundles were transported to threshing floor. These were kept on threshing floor for sun drying and after sun drying threshing was done plot wise manually. The mean weight of seeds plot^{-1} was taken and then converted into kg ha^{-1} **.**

(B) Qualitative Parameters

(I) Oil content of seeds (%) :- The samples of seeds from the produce of each treatment (20gms.) were collected and analyzed for per cent oil content by NMR (Nuclear Magnetic Resonance) with the help of scientists at Jawahar Lal Nehru Krishi Vishwavidyalaya campus, AICRP on Niger, Jabalpur (M.P.). Thus effect of pollination on oil content of seed was worked out.

(II) Germination percentage - The seeds were obtained from the produce of all the six treatments and their germination were tested by keeping 100 seeds of each treatment, in Petri dishes covered with moist filter paper. The filter paper was removed after germination was seen and thereafter germination was recorded. Finally germination percentage of seeds was determined by using the formula-

$$\text{Germination (\%)} = \frac{\text{Number of germinated seeds in patri dishes}}{\text{Total number of seeds used for germination}} \times 100$$

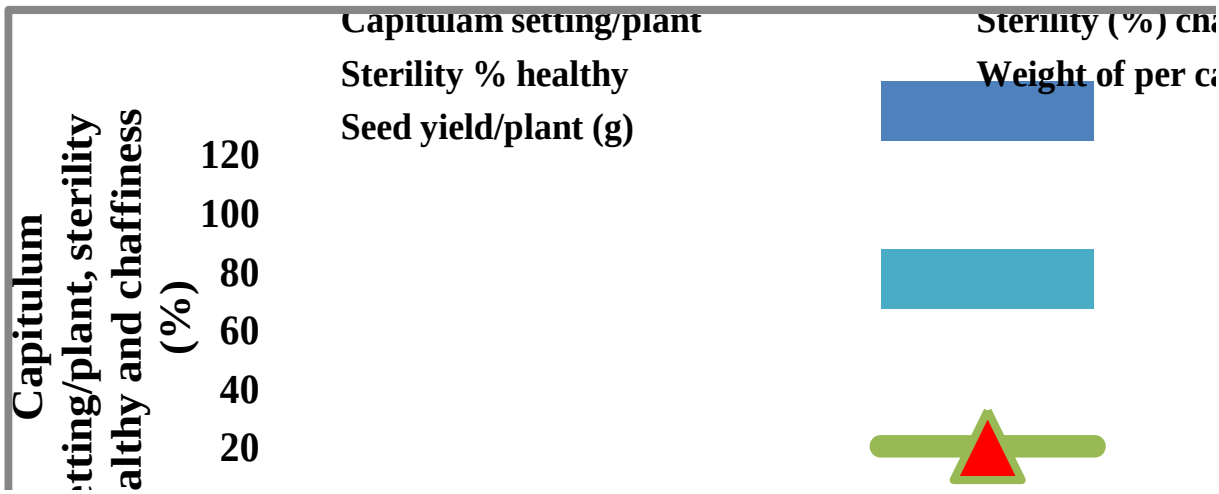

Fig 1. (a) Pollination by *Apis cerana indica* on yield attributing characters of niger during 2011-12

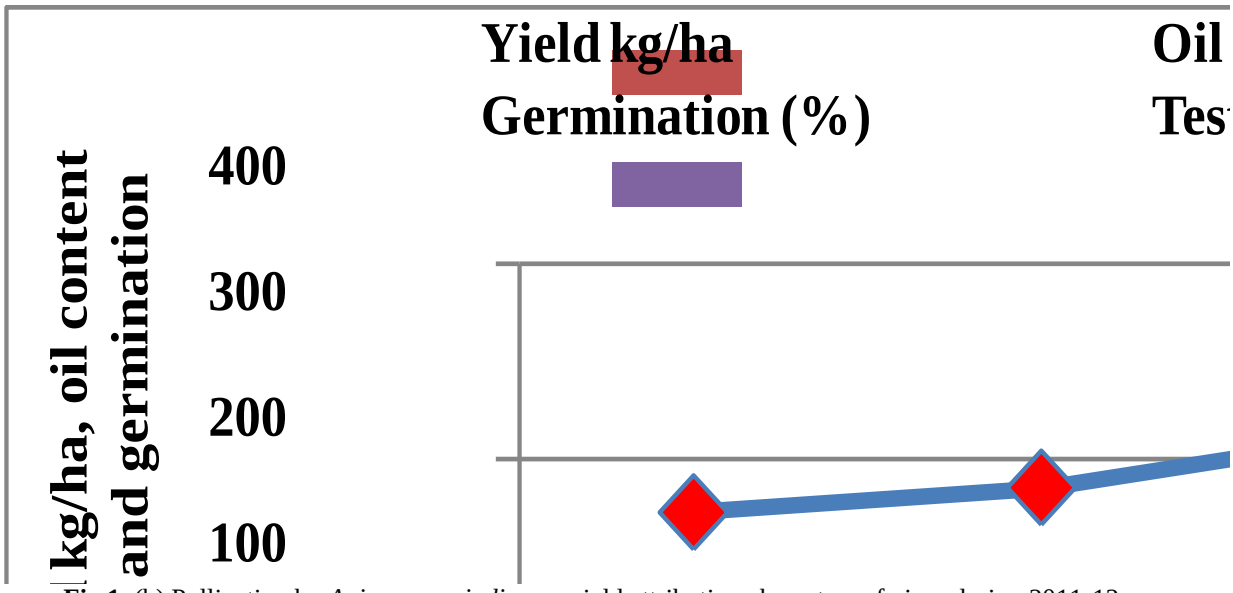

Fig 1. (b) Pollination by *Apis cerana indica* on yield attributing characters of niger during 2011-12

RESULT AND DISCUSSION

To determine the effect of pollination by *Apis cerana indica* in niger crop as compared to other modes of pollination, T1-Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs. T2-Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs. T3-Close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs. T4- Open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs. T5- Total closed (Mosquito net) and T6-Control (Total open) in respect of capitulum setting plant^{-1},number of seeds capitulum $^{-1}$, seed yield plant^{-1}(g), weight of capitulum^{-1}(g), sterility percent^{-1}, test weight of seeds (g), seed yield kg ha^{-1}, oil content of seeds(%), and germination (%) were depicted in (Table 1 and fig 1.a & b). It revealed from the data that there were marked variations among the different modes of pollination.

(A) Quantitative Parameters

(I) Capitulum setting plant^{-1} - Significantly higher number of capitulum plant^{-1} was recorded in treatment total opened (35.17 capitulum^{-1}) followed by treatment Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs (34.97 capitulum plant^{-1}), Close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs (33.42 capitulum plant^{-1}), Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs (32.95 capitulum plant^{-1}) and Open the cage between 0700 to 1200hrs Noon and Close between 1200 Noon to 1700hrs (32.95 capitulum plant^{-1}). The lowest number of capitulum was recorded in treatment of total closed (28.32 capitulum plant^{-1}). The present study is more or less in the conformity of earlier workers to Munawar

(2009) who recorded in canola rapeseed, *Brassica napus* with more number of pods developed in treatments plants caged with honeybees (81.00) and lowest in plants caged without honeybees (52.00). Duran *et al*. (2010) also reported in rapeseed, the number of siliques plant^{-1} which was highest in treatment with free pollination (291.17) followed by partial exclusion (224.83) and lowest in total exclusion (152.94).

(II) Weight of capitulum $^{-1}$ (g) - The maximum capitulum weight was found in treatment control i.e. total opened (0.299 g) which was significantly superior with remaining treatments except Close the cage between 0700 to 1000hrs and 1500 to 1700hrs Open between 1000 to 1500hrs (0.239 g), Open the cage between 0700 to 1200hrs, Noon and Close between 1200 Noon to 1700hrs (0.232 g), Close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs (0.191 g) and Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs (0.178 g). However, the mimnimum capitulum weight was observed in treatment, total closed (0.079 g). Treatments like Open the cage between 0700 to 1000hrs and 1500 to 1700hrs close between 1000 to 1500hrs (0.178 g), Open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs (0.232 g) and control, total opened (0.299 g) were found significantly superior with each other. There was no report on this line however Sarwar *et al*. (2008) reported the individual fruit weight of cucumber significantly increased due to the bee pollination. Thus these results are in the close agreement of the present finding.

(III) Seed yield plant^{-1} (g) - The maximum seed yield plant^{-1} was recorded in control (total opened 2.473 g plant^{-1}) followed by Open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs (1.838 g plant^{-1}), Close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs (1.574 g plant^{-1}), Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs (1.192 g plant^{-1}) and Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs (1.139 g plant^{-1}). However, there was no significant difference found between different treatments i.e. Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs (1.139 g plant^{-1}), Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs (1.192 g plant $^{-1}$), Close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs (1.574 g plant^{-1}). Treatments, Open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs (1.838 g plant^{-1}), Total closed (Mosquito net) (0.606 g plant^{-1}) and Control (Total open) (2.473 g plant-1). The least seeds yield plant^{-1} was recorded in treatment with total closed (0.606 g plant^{-1}). Pastagia and Patel (2008) reported in niger crop, where the highest seed yield was recorded in bee pollination with *Apis cerana* (40.07g) followed by open pollination (37.95g) and the lowest in pollination without insects(11.37g). Munawar *et al*. (2009) who reported in canola, highest yield in caged with honeybees (7.6g) and lowest was in caged without honeybees (1.51g).

(IV) Sterility/ chaffyness (%) - The sterility per cent was noticed significantly superior in treatment with total closed (97.09 per cent), followed by Close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs (26.28 per cent), Open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs (21.57 per cent), Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs (17.98 per cent) and Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs(16.69 per cent). The lower sterility per cent was recorded in treatment with total opened (4.92 per cent). All the treatments were found significant and having significant difference with each other treatments. Dhurve (2008) also recorded the highest unfilled seeds in caged crop *i.e.* without bees (10.70 per cent) followed by the crop caged with bees, the open pollination without any spray and open pollination with water spray showed number of unfilled seeds were 7.87, 6.50, and 6.83 per cent, respectively.

(V) Healthy seeds (%) - The significantly higher per cent of healthy seeds were found in control plot, total open (95.06 per cent) followed by Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs (83.26 per cent), Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs (82.00 per cent), Open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs (78.41 per cent) and Close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs (73.70 per cent). However, the minimum per centage of healthy seeds were found in treatment total closed (2.89 per cent). There was significant difference observed among the treatments. Marabi (2003) who also observed maximum healthy seeds in crop exposed to all type of insect pollinators (48.33) whereas reduced healthy seeds capitulum^{-1} (40.50) was observed in crop pollinated by *A. mellifera*.

(VI) Test weight (1000 seeds) - Maximum seed weight (1000 seeds) was recorded in treatment total open (4.89 g) followed by Open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs (4.83 g), Close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs (4.69 g), Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs (4.29 g) and Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs (4.09 g). The treatment total closed had minimum seed weight (3.28 g). The treatments were

statistically non-significant with each other. Munawar (2009) reported the test weight of seed of canola, *Brassica napus* was with highest seed weight plants caged with honeybees (26.00g) and lowest was in plants caged without honeybees (9.30g). Mupade *et al.*(2009) reported highest test seed weight in one frame *A. florea* colony (7.10g) followed by four frame *A. c*. colony (6.60g), two framed *A. mellifera* colony (6.20g) and lowest in open pollination(5.5g).

(VII) Seed yield (kg ha^{-1}) - The significantly highest yield was found in treatment total open (353.25 kg/ha^{-1}), whereas other treatments were found statistically lower seed yield. The treatments like open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs (271.75 kg/ha^{-1}), Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs (170.25 kg/ha^{-1}), Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs (161.25 kg/ha^{-1}) Close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs (158.50 kg/ha^{-1}) were observed statistically lower seed yield. Treatments open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs (271.75 kg ha^{-1}), Total closed (79.50 kg ha^{-1}) and Control (Total open) (353.25 kg ha^{-1}) found significant difference with each other. However, the lowest seed yield was observed in treatment total closed (79.50 kg/ha^{-1}). Cecan *et. al.*(2007) observed the highest seed yield caged with honey bee(46.2 kg ha^{-1}) followed by caged with bumble bee (37.3 kg ha^{-1}), open pollinated (25.7 kg ha^{-1}) and pollinator excluded (1.37 kg ha^{-1}) on white clover. Gaddanakeri *et al.* (2008) who also recorded the higher seed yield of sunflower (849 kg ha^{-1}) in intercropping system of sunflower + niger and lowest was in sole crop of sunflower (747 kg ha^{-1}) indicating the role of pollinators in both cross pollinated crops.

(B) Qualitative parameters

(I) Oil content (%) - Significantly higher oil content was recorded in treatment with total open (33.50 per cent), whereas other treatments were found significantly low oil content per cent. The treatments which had no significant difference were the Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs (30.08 per cent) and Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs (30.57 per cent). However, the treatments close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs (32.14 per cent) Open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs (30.58 per cent) Total closed (26.73 per cent) and Control (33.52 per cent) were observed significant difference. The lowest oil content was found in treatment with total closed (26.73 per cent). Sattigi *et al.* (2005) who also reported in niger crop, the maximum oil content of seeds was in crop sprayed with 10 per cent sugar (38.81 per cent) and minimum oil content of seeds was in crop sprayed with 10 per cent jaggery (36.82 per cent). Dhurve (2008) who also reported the highest oil content in niger seed when sprayed with 10 per cent sugar syrup (40.10 per cent) followed by open pollination without any spray (40.00 per cent) and sugarcane juice 10 per cent (39.93 per cent) however the lowest oil content was in crop sprayed with Bee-Q 1.25 per cent(38.76 per cent).

(II) Germination per cent - Significantly higher niger seed germination was recorded in treatment with control (80.25 per cent). Other treatments like Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs (74.75 per cent), Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs (71.50 per cent), Close the cage between 0700 to 1200hrs Noon and Open between 1200 Noon to 1700hrs (68.50 per cent) Open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs (73.00 per cent) and Total closed (64.25 per cent) were found significantly low germination. The lowest germination was found in treatment with total closed (64.25 per cent). Dhurve (2008) who recorded highest germination in niger seed in treatment like open pollination with cacambe 10 per cent (81.00 per cent) and the least germination was in crop caged without bees (64.00 per cent). Mupade *et al*. (2009) recorded that the *Apis florea* colony with one frame having highest of germination (90.00 per cent) followed by four frame *A. carana* (89.00 per cent) and two frame *A. mellifera* colony (88.00 per cent).

Table 1. Effect of pollination by Indian honey bee, *Apis cerana indica* on yield, yield attributing characters and oil content of niger during 2011-12 .

Treatments	Capitulum setting plant^{-1}	Weight of capitulum^{-1}(g)	Seed yield plant^{-1}(g)	Sterility (%)		Test weight(1000 seeds) (g)	Seed yield (kg ha^{-1})	Oil content of seeds (%)	Seed germination (%)
				Chaffy seeds	Healthy seeds				
T1-Open the cage between 0700 to 1000hrs and 1500 to 1700hrs, close between 1000 to 1500hrs.	34.97	0.178	1.139	17.98 (4.28)	82.00 (9.08)	4.095	161.25	30.080	74.750
T2-Close the cage between 0700 to 1000hrs and 1500 to 1700hrs, Open between 1000 to 1500hrs.	32.95	0.239	1.192	16.69 (4.13)	83.26 (9.15)	4.285	170.25	30.570	71.500
T3-Close the cage between 0700 to 1200hrs Noon and	33.42	0.191	1.574	26.28 (5.14)	73.70 (8.60)	4.697	158.50	32.140	68.500

Open between 1200 Noon to 1700hrs.									
T4- Open the cage between 0700 to 1200hrs. Noon and Close between 1200 Noon to 1700hrs.	32.95	0.232	1.838	21.57 (4.69)	78.41 (8.88)	4.830	271.75	30.580	73.00
T5- Total closed (Mosquito net)	28.32	0.079	0.606	97.09 (9.87)	2.89 (1.83)	3.288	79.50	26.730	64.25
T6-Control (Total open)	35.17	0.299	2.473	4.92 (2.32)	95.06 (9.71)	4.890	353.25	33.500	80.25
SEM ±	1.37	0.0196	0.2299	0.1855	0.1107	0.6464	12.25	0.4013	0.9643
CD(p=0.05)	4.14	0.06	0.69	0.56	0.33	NS	36.92	1.21	2.91

NS- Non significant, Figures in parentheses are square root transformed value

CONCLUSION

The results obtained from this study, the various yield parameters were significantly increased due to honey bee pollination on different pollination situation. The maximum yield parameters were increased in control pollination (Total open) however the lowest was obtained in treatment Total closed.

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DISTRIBUTION PATTERN OF AVAILABLE NUTRIENTS UNDER MAIZE-POTATO -SUGARCANE CROPPING SEQUENCE IN DAURALA BLOCK OF MEERUT DISTRICT (UTTAR PRADESH)

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Abstract: The present investigation was undertaken to study of chemical properties of Daurala block Soil (district Meerut) under maize-potato - sugarcane cropping system. The depth wise soils samples in maize-potato - sugarcane cropping system at five different locations were analyzed for pH, EC, organic carbon, total nitrogen, macro and micronutrients. The surface and sub surface soil were in neutral to alkaline and none of the soil was found to be saline category. The organic matter content declined with soil depth, varied from 0.20 to 1.01 % at surface and sub surface soil. The available N, P and K 161 to 220, 8.1 to 42.9 and 144 to 379 kg ha^{-1} at surface and sub surface soil and declined with increasing soil depth. Among the different micronutrients with exception of zinc and Fe, the availability of Cu and Mn micronutrients were in sufficient range. The availability of these micronutrients declined with increase in soil depth.

Keywords: Micro nutrients, Soil fertility, Maize, Potato

INTRODUCTION

Maize-potato-sugarcane is an important cropping system of western Uttar Pradesh. This cropping system is a long duration crop with luxuriant vegetative growth which requires more amount of nutrient resulted into higher nutrients uptake from soils. Ultimately, soils have now become deficient in available nutrients. Low productivity of sugar cane and wheat is ascribed possibly due to deficiency of these nutrients. Proposed study area is agriculturally most important and cropping intensity is quite high. Farmers apply inadequate and imbalanced fertilizer due to which the inherent capacity of soil i.e. soil fertility is affected adversely. Many secondary (S, Ca, Mg) as well as micronutrients (Zn, Fe, B,Mo) deficiency are experienced and becoming limiting factor for crop production. In such condition, sustainability of crop production cannot be assured. Since the demand for food grain production is increasing continuously, the productivity of different crops is to be increased. For this purpose the information about the soil fertility status is most important and on the basis of soil fertility, fertilizer application is to be made for higher productivity. In the area so for no information on soil fertility in rice wheat system is available.

MATERIAL AND METHOD

Soil samples were collected from five locations of Daurala block Meerut district under Maize- Potato - Sugarcane Cropping Sequence. Soil samples at three depth of every location were collected with the help of auger and stored in polythene bags. Collected soil samples were air dried in shade, crushed gently with a wooden roller and then pass through 2.0 mm sieve to obtain a uniform representative sample. Samples were properly labelled with the aluminium tag and stored in polythene bags for analysis. The processed soil samples were analyzed by standard methods for pH and electrical conductivity (1:2 soil water suspensions), organic matter (Walkley and Black, 1934), available nitrogen (Subbiah and Asija, 1956), available phosphorus (Olsen et al., 1954), available potassium (Jackson, 1973) and cationic micronutrients (Fe, Mn , Cu and Zn) in soil samples with extracted with a Diethylene triamine pentaacetate (DTPA) solution (0.005 M) DTPA + 0.01 M CaCl2+ 0.1 M triethanolamine, pH 7.3 as outlined by Lindsay and Norvell (1978). The concentration of micronutrients was determined by atomic absorption spectrophotometer (GBC Avanta PM). All the analysis of soil samples was carried out in the laboratory of Department of Soil Science, SVPUA&Tech, Modipurm, Meerut (U.P), India.

General properties

Soil at various depths was usually found normal to alkaline in reaction (Table-1). It was observed that soil pH ranged from 7.0-8.30. The soil pH increased in subsurface inconsistently. Sangwan and Singh (1993) also reported the higher pH values in the lower horizon because of concentration of free carbonates. The soil EC ranged from 0.48 to 1.54 dSm^{-1} (Table-1), thereby indicating non saline nature of soils. The low EC may be due to free drainage condition which favored the removal of bases by percolating and drainage water Leelavathi *et al.* (2009).

The organic carbon varied from 0.20-1.01 % (Table 1). The organic carbon decreased with increasing depth in all the location. It could be attributed to differential additions of FYM and plant residues and

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crop management to surface horizon. The more organic carbon on surface soils may attribute to more addition of plant residue and FYM. Similar result was reported by Rajeswar *et al.* (2009) and Leelavathi *et al.* (2009).

Available macro nutrient

The available nitrogen content in all the soils was low ranging from 161 - 220 kg ha^{-1} throughout the depth. However, available N content was found to be maximum in surface horizons and decreased regularly with soil depth, which might possibly be due to the accumulation of plant residues, debris and rhizosphere. These observations are in accordance with the findings of Prasuna-Rani *et al. (1992).*

The available phosphorus content in the soils varied from 8.1-42.9 P_2O_5 kg ha-I. However, the highest available P was observed in the surface horizons and decreased regularly with depth. Higher P in the surface horizon might be due to the confinement of crop cultivation to this layer and supplementation of the depleted phosphorus through external sources *i.e.* fertilizers. Similar results were reported by Thangaswamy *et al. (2005).* It might be due to the confinement of added of P fertilizers being less mobile the rhizosphere. The lower P content in subsurface soil could be attributed to the fixation of phosphorus by clay minerals (Leelavathi et al., 2009) on surface soils.

Available K in all the soils varied from 144-379kg ha-^{1}. The highest available K content was noticed in the surface and showed decreasing trend with depth. This could be attributed to more intensive weathering, release of labile K from organic residues, application of K fertilizers and upward translocation of K from lower depths along with capillary rise of ground water (Pal and Mukhopadhyay 1992).

Available micro nutrient

The DTPA extractable Zn varied from 0.20-0.81 $mgKg^{-1}$ soil (Table 3). According to critical limit 0.6 $mgKg^{-1}$ as proposed by Lindsay and Norvell (1978) all the surface soil was insufficient in available Zn content with exception Daurala. In general surface horizon had higher concentration of DTPA extractable micronutrient due to higher organic carbon (Nayak *et al.* 2000) this may be ascribed to lower pH values and higher amounts of organic matter in surface.

The DTPA extractable Fe varied from 2.08-8.28 $mgKg^{-1}$ (Table 3). According to critical limit 4.5 $mgKg^{-1}$ as suggested by Lindsay and Norvell (1978) all the soils were sufficient in available Fe with exception of Surani and Machhari soils. A decreasing trend with depth was noticed inn all four locations. The availability of metal ions increases with increase in organic matter content because organic matter may supply chelating agents. Such relationship was also reported by Sharma *et al.* (2003).

The DTPA extractable Cu varied from 0.78-1.98 $mgKg^{-1}$ soil (Table 3). All the observed values were well above the critical limit of 0.20 $mgKg^{-1}$ soil as proposed by Lindsay and Norvell (1978). Increase in the finer fraction of the soil leads to increase in surface area for ion exchange and contribute to greater DTPA extractable forms of metal ions. This is in agreement with the findings of Sharma *et al.* (2003).

The extractable Mn in soil varied from 3.36-9.22 $mgKg^{-1}$ soil (Table 3). According to critical limit of 1.0 $mgKg^{-1}$ soil as proposed by Lindsay and Norvell (1978), all the soils were sufficient in available Mn. These finding are in close conformity by Sharma *et al.* 2003.

Table 1. Chemical properties of Daurala block soils of district Meerut under Maize- Potato -sugarcane cropping

Locations	Depth	EC(dSm^{-1})	pH	OC (%)
Surani	0-15	0.81	8.12	0.84
	15-30	0.68	8.10	0.39
	30-45	0.71	8.00	0.32
	Mean	0.73	8.07	0.52
Machri	0-15	1.54	7.90	1.01
	15-30	1.01	7.90	0.91
	30-45	0.53	8.00	0.37
	Mean	1.03	7.93	0.76
Bafawat	0-15	1.23	8.20	0.71
	15-30	1.01	8.30	0.44
	30-45	0.91	8.10	0.32
	Mean	1.05	8.20	0.49
Alipur	0-15	0.48	7.00	0.42
	15-30	0.51	7.20	0.30

	30-45	0.50	7.40	0.22
	Mean	0.50	7.20	0.31
Dauarala	0-15	1.04	8.20	0.62
	15-30	1.03	8.00	0.30
	30-45	0.98	7.70	0.20
	Mean	1.02	7.97	0.37
	Min	0.48	7.00	0.20
	Max	1.54	8.30	1.01

Table 2. Available N, P and K (kg ha^{-1}) of Daurala block soils of district Meerut under under Maize- Potato -sugarcane cropping

Locations	Depth	Available macronutrients(kg ha^{-1})		
		N	P	K
Surani	0-15	218	33.7	274
	15-30	181	20.4	227
	30-45	176	10.9	190
	Mean	192	21.7	230
Machri	0-15	212	18.7	258
	15-30	193	11.2	199
	30-45	176	8.1	212
	Mean	194	12.6	223
Bafawat	0-15	218	42.7	273
	15-30	187	27.6	194
	30-45	161	14.9	224
	Mean	189	28.4	230
Alipur	0-15	220	33.9	159
	15-30	195	20.9	144
	30-45	173	11.4	153
	Mean	196	22.1	152
Dauarala	0-15	220	42.9	331
	15-30	198	29.4	379
	30-45	172	13.4	317
	Mean	197	28.6	342
	Min	161	8.1	144
	Max	220	42.9	379

Table 3. Available micronutrients (mg kg^{-1}) of Daurala block soils of district Meerut under under Maize- Potato -sugarcane cropping

Locations	Depth	Available micronutrients (mg Kg^{-1})			
		Zn	Fe	Cu	Mn
Surani	0-15	**0.53**	**3.40**	**1.58**	**5.08**
	15-30	0.26	2.57	0.95	4.04
	30-45	0.26	2.37	0.93	3.92
	Mean	0.35	2.78	1.15	4.35
Machri	0-15	**0.63**	**2.08**	**1.32**	**4.49**
	15-30	0.46	2.30	1.46	3.36
	30-45	0.30	2.62	1.04	4.01
	Mean	0.47	2.33	1.27	3.95
Bafawat	0-15	**0.81**	**5.42**	**1.98**	**8.66**
	15-30	0.65	4.41	1.54	6.77

	30-45	0.43	3.36	0.85	4.41
	Mean	0.63	4.39	1.46	6.61
Alipur	0-15	**0.66**	**6.09**	**1.04**	**5.02**
	15-30	0.25	5.69	0.78	5.88
	30-45	0.28	4.52	0.84	6.41
	Mean	0.39	5.43	0.89	5.77
Dauarala	0-15	**0.67**	**8.28**	**1.84**	**5.28**
	15-30	0.26	6.36	1.56	9.22
	30-45	0.20	5.02	0.95	8.31
	Mean	0.38	6.55	1.45	7.61
	Min	0.20	2.08	0.78	3.36
	Max	0.81	8.28	1.98	9.22

CONCLUSION

Chemical characteristics and nutrient status of soils in maize-potato-sugarcane as discussed above indicated that soils were normal to alkaline in reactions, non saline and low to medium in organic carbon. As far as nutrient status is concern, the soils were low in available nitrogen, low to medium in available phosphorus and low to high available potassium. DTPA extractable micronutrient sufficient in surface soil except Fe soils of Surani.

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THE INFLUENCE OF SILICON IN SUPPRESSING RICE DISEASE AND THEIR RESIDUAL EFFECT

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Abstract: Silica (Si) plays a significant role in improving yields in a wide range of crops by increasing resistance to stress and enhancing growth through a number of well-documented mechanisms. Silica is a most abundant mineral element (18%) in soil and plays a significant role in crop production and resistance crop diseases. Silicon can lower the electrolyte leakage from rice leaves and, therefore, promote greater photosynthetic activity in plants grown under water deficit or heat stress. Silicon increases the oxidation power of rice roots, decreases injury caused by climate stress such as typhoons and cool summer damage in rice, alleviates freezing damage in sugarcane, favours' super cooling of palm leaves, and increases tolerance to freezing stress in some plants. Silicon reduces the availability of toxic elements such as manganese, iron and aluminium to roots of plants such as rice and sugarcane and increases rice and barley resistance to salt stress. Silica results did show that there was a relationship between Si content and blast susceptibility and developed resistance of all cucurbitaceous family fungal diseases.

Keywords: Silica, Disease resistance, Rice, Soil minerals

INTRODUCTION

Rice is considered to be a Si accumulator and tends to actively accumulate Si to tissue concentrations of 5% or higher (22). Relatively large amounts of plant available Si appear to be very important for both robust growth and fungal disease resistance of rice (23).Silicon (Si) is the second most abundant mineral element in soil comprising approximately 18% of the earth's crust (5). In warm sub-humid and humid tropical ecoregions, a high degree of weathering, mainly as desalination, has resulted in the development of soil orders rich in iron and aluminium oxides and low in nutrient bases and Si (Fig. 1) (13).

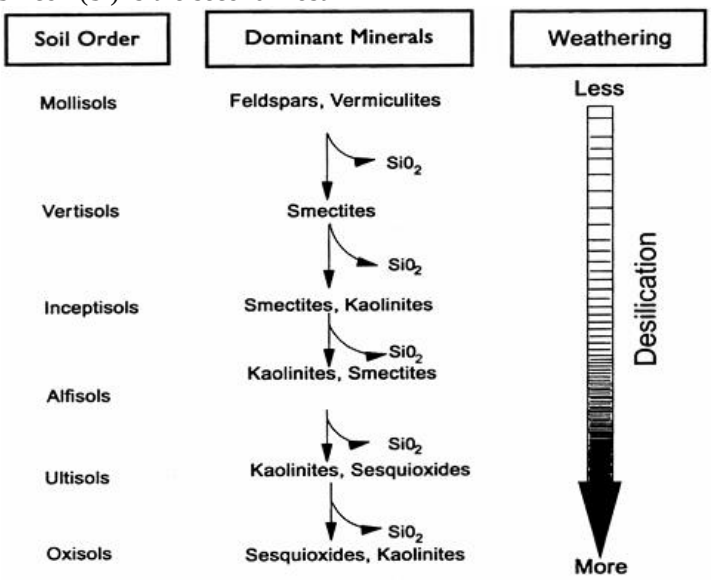

Fig. 1. A simplified acid weathering sequence in soils. Source: Friesen et al. (9)

Some of these soil orders such as Ultisols and Oxisol account for 22% of the area of major soil orders in the tropics. These orders occupy great amounts of land (approximately 1,666 million hectares) in Africa and South and Central America. Histosols and sandy Entisols also contain low levels of Si. As a result of Si leaching, the soluble Si content of tropical soils, such as Ultisols and Oxisols, is generally less than in most temperate soils (8). This might be one of the unidentified causes of lower rice productivity of many tropical/subtropical soils compared to with that of temperate soils. Although most soils can contain considerable levels of Si, repeated cropping can reduce the levels of plant-available Si to the point

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that supplemental Si fertilization is required for maximum production. Abundance of four soil orders in three important continents where rice is grown. Ultisols and Oxisols are characteristically low in plant available silicon.

Many plants are able to absorb Si. Depending upon the species, the content of Si accumulated in the biomass can range from 10 to greater than 100 g/kg (5). Plant species are considered Si accumulators when the concentration of Si (in dry weight basis) is greater than 1 g/kg (7). Relative to monocots, dicots such as tomato, cucumber, and soybean are considered to be poor accumulators of Si with values less that 1 g/kg in their biomass. Dryland grasses such as wheat, oat, rye, barley, sorghum, corn, and sugarcane contain about 10 g/kg in their biomass, while aquatic grasses have Si content up to 50 g/kg (12).

Silicon is accumulated at levels equal to or greater than essential nutrients in plant species belonging to the families Poaceae, Equisetaceae, and Cyperaceous. In rice, for example, Si accumulation is about 108% greater than that of nitrogen. It is estimated that a rice crop producing a total grain yield of 5000 kg/ha will remove Si at 120 to 470 kg/ha from the soil . Therefore, applications of calcium silicate at 5000 kg/ha (Si at 1000 kg/ha) appear to be sufficient for supplying enough Si to the plant so that the tissue content will be 3% or greater (19). Concentrations between 3 and 5% may be the minimum tissue levels needed for disease control (4).

Silicon is considered a plant nutrient "anomaly" because it is presumably not essential for plant growth and development. However, soluble Si has enhanced the growth, development and yield of several plant species including *Equisetum*, rice, sugarcane, wheat, and some dicotyledonous species (5, 12). Plants absorb Si exclusively as monosilicic acid, also called orthosilicic acid (H_2SiO_4), by diffusion and also by the influence of transpiration-induced root absorption known as mass flow (5).

The content of Si in rice shoots cannot be accounted for only by diffusion and transpiration (5). The concentration of Si in the xylem of rice is usually many times higher than that of the soil solution; indicating that the uptake of Si might be metabolically driven (21). Silicon is deposited in the form of silica gel or biogenetic opal as amorphous $SiO_2 \cdot nH_2O$ in cell walls and intercellular spaces of root and leaf cells as well as in bracts (14). Silicon also can be found in the form of monosilicic acid, colloidal silicic acid, or organ silicone compounds in plant tissues (12).

The beneficial effects of Si to plants under biotic and/or abiotic stresses have been reported to occur in a wide variety of crops such as rice, oat, barley, wheat, cucumber, and sugarcane. Leaves, stems, and culms of plants, especially rice grown in the presence of Si, show an erect growth, thereby the distribution of light within the canopy is greatly improved (5, 20). Silicon increases rice resistance to lodging and drought and dry matter accumulation in cucumber and rice (1 and 18). Silicon can positively affect the activity of some enzymes involved in the photosynthesis in rice and turf grass (17) as well as reduce the senescence of rice leaves (13). Silicon can lower the electrolyte leakage from rice leaves and, therefore, promote greater photosynthetic activity in plants grown under water deficit or heat stress (2). Silicon increases the oxidation power of rice roots, decreases injury caused by climate stress such as typhoons and cool summer damage in rice, alleviates freezing damage in sugarcane, favors super cooling of palm leaves, and increases tolerance to freezing stress in some plants (10). Silicon reduces the availability of toxic elements such as manganese, iron and aluminium to roots of plants such as rice and sugarcane and increases rice and barley resistance to salt stress (11).

Silicon and Rice Diseases: A Brief History

Probably, the first researcher who suggested that Si was involved in rice resistance to blast (*Magnaporthe grisea* (T. T. Hebert) Yaegashi & Udagawa) Barr (anamorph *Pyricularia grisea* (Cooke) Sacc.) was a Japanese plant nutrient chemist named Isenosuke Onodera. Onodera (15) published a milestone paper entitled 'Chemical studies on rice blast disease'. This is the first report on Si research published in a scientific journal of agronomy. For this study, he collected rice plants from 7 different regions in western Japan. Onodera compared the chemical composition of the rice plants infected with blast with that of healthy ones grown in the same paddy field. He observed that diseased plants always contained less Si in comparison to healthy ones obtained from the same field, and that the natural Si content found in rice tissue depended on the paddy field in which the plants had been grown. His finding did not necessarily mean that blast infection was reduced by the Si content of the rice plants or that plants with less Si content were more susceptible. His results did show that there was a relationship between Si content and blast susceptibility (16). Although he did not intend to study the role of Si in rice resistance to blast, his discovery certainly stimulated further Si research in Japan.

Grain discoloration, caused by a complex of fungal species such as *Bipolarisoryzae*, *Curvularia* sp., *Phoma* sp., *Microdochium* sp., *Microspore* sp., and *Fusarium* sp., is another important constraint for irrigated and upland rice production worldwide. Prabhu et al. Showed that the severity of grain discoloration in several irrigated and upland rice genotypes decreased linearly as the rates of SiO_2 in the soil increased. The severity of grain discoloration was reduced by 14.5%, on average, at the rate of 200 kg/ha of SiO_2, while grain weight increased 20%.

Stem rot (*Magnaporthesalvinii*Cattaneo), leaf scald and sheath blight also have been efficiently

suppressed by Si applications (5). Regarding bacterial diseases, Chang et al. (3), recently reported a significant reduction in lesion length of bacterial leaf blight (*Xanthomonasoryzae*pv. *oryzae*) of 5 to 11% among four rice cultivars following Si application. The reduction in lesion length was positively correlated with a decrease in the content of soluble sugar in leaves of plants amended with Si. Rice cultivars accumulating high levels of Si in roots also showed increased resistance to the root-knot nematode *Meloidogyne* spp. (20).

Outlook and Future Silicon Research Needs

Silicon fertilization of rice grown in soil orders with Si levels less than optimal offers promising results with respect to reduced rice susceptibility to diseases and improved yields. Interestingly, Si can control rice diseases to the same general degree as is typically obtained by using fungicide applications and also contributes to reducing the amount of fungicides needed. Consequently, sources of Si and their management practices should be developed and practiced in integrated pest management programs for those crops where Si has been demonstrated to have a positive effect.

Some Si sources have residual activity that persists over time, raising the possibility that applications need not be made annually. Also, after the first initial Si amendment, subsequent application rate requirements might be considerably lower due to these residual effects. However, silicate slags are considered to be expensive Si sources so there is a need to find or develop cheaper and more efficient sources of Si. Recycling of rice hulls and/or straw may be one possible alternative.

Rice genotypes may differ in their Si content, and or respond differently to Si application. Genetics definitely plays an important role in Si accumulation and merits further consideration while selecting genotypes for other important agronomic traits. The strategic combination of a fine-grade Si formulation with a 'Si-accumulator' cultivar/genotype also would reduce application rate requirements, thereby minimizing the cost of the Si amendment program.

The fact that Si plays an important role in the mineral nutrition of many plant species is not in doubt nor is its ability to efficiently control several plant diseases. Effective, practical means of application and affordable sources of Si are needed for use in row crop agriculture in particular. As the need for environmentally friendly strategies for management of plant diseases increases, Si could provide a valuable tool for use in crops capable of its accumulation. The use of Si for controlling plant diseases would be well-suited for inclusion in integrated pest management strategies and would permit reductions in fungicide use. As researchers and growers become aware of Si and its potential in agriculture, it is likely that this often overlooked element will be recognized as a viable means of sustainably managing important plant diseases worldwide.

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PHYTOPLASMA DISEASES ASSOCIATED WITH *CLEOME VISCOSA* AND *BORRERIA HISPIDA* WEEDS IN ANDHRA PRADESH, INDIA

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Abstract: Phytoplasma was detected in *Cleome viscose* and *Borreria hispida* weeds by direct and nested polymerase chain reaction using universal primers P1/P7 and R16F2n/R16R2 specific to 16SrRNA gene of phytoplasma. Running of 1% agarose gel electrophoresis for confirmation of phytoplasma associated with these two weeds.

Keywords: Nested PCR, *Cleome viscosa*, *Borreria hispida,* Phytoplasma specific primers, 1% AGE

INTRODUCTION

During 2014 phytoplasma disease symptoms were observed on *Cleome viscosa* and *Borreria hispida* weeds at field of Regional Agricultural Research Station, Tirupati, Andhra Pradesh. These two weeds are more common throughout agriculture and bare lands in A.P. Phytoplasmas are wall less prokaryotes. They are bounded by a "unit" membrane, and have cytoplasm, ribosomes, and both DNA and RNA. In ultrathin sections, they appear as a complex of multibranched, beaded, filamentous or polymorphic bodies ranging from 175-400 nm in diameter for the spherical and oblong cells and up to 1700 nm long for the filamentous forms (Waters and Hunt, 1980). Phytoplasmas are generally present in phloem sieve tubes and in the salivary glands of insect vectors. While phytoplasmas are multiply in the phloem, little is known about its mechanism. Most phytoplasmas are transmitted from plant to plant by leafhoppers and plant hoppers (Purcell, 1982).

MATERIAL AND METHOD

Phytoplasma infected weed samples shows that little leaves, short internodes, stunted growth and virescence, collect infected leaf samples from *Cleome viscosa* and *Borreria hispida* weeds (Fig. 1). To investigate the possibility of a phytoplasma association with these two weeds, total DNA was isolated from 100 mg leaf midribs from infected and symptomless plant samples using the CTAB method (Doyle & Doyle, 1990). Running of nested PCR by using phytoplasma specific primers P1/P7 for first round of PCR (Deng & Hiruki, 1991) and R16F2n/R16R2 for nested PCR (Gunderson *et al*, 1996). Running of 1% agarose gel electrophoresis for confirmation of phytoplasma associated with these two weeds. Expected size of amplicons are 1.8 kb after first round PCR and 1.25 kb after second round PCR, the DNA amplified only from symptom bearing weed samples (Fig. 2), but not from the symptomless plant samples.

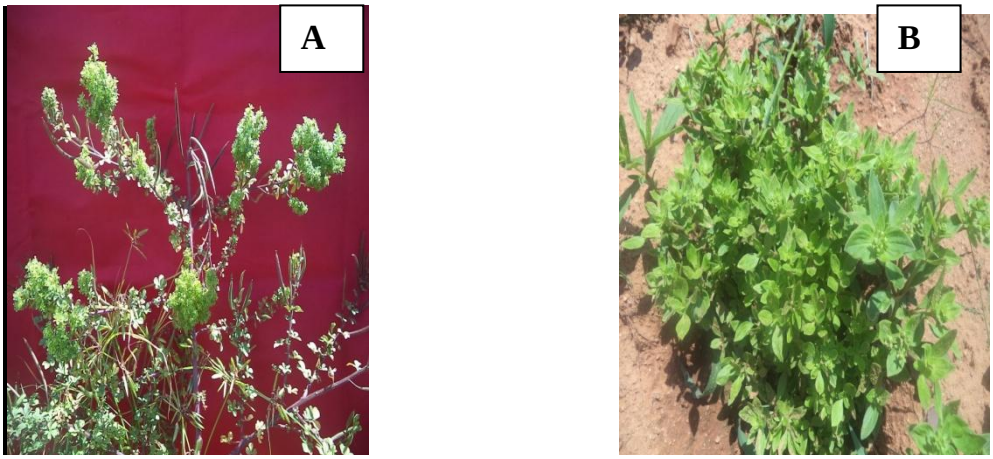

Fig. 1. A. Phytoplasma infected *Cleome viscosa* weedand **B**. *Borreria hispida*. Little leaves, virescence and stunted growth of weeds.

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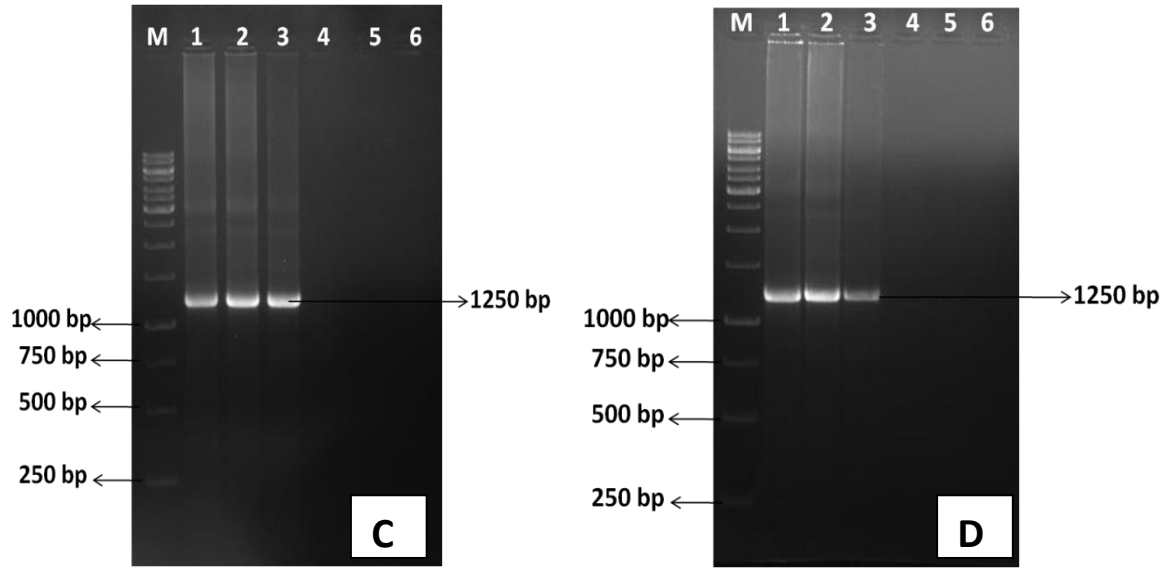

Fig 2. Amplification of phytoplasma 16S rDNA by Nested PCR using the phytoplasma specific primers R16F2n/R16R2 from infected plants. **C.** Lanes: M- gene 1kb ruler (0313) 1, 2 & 3- phytoplasma infected *Cleome viscosa* weed, 4, 5 & 6- healthy *Cleome viscosa.* **D.** Lanes: M- gene 1kb ruler (0313) 1, 2 & 3- phytoplasma infected *Borreria hispida* weed, 4, 5 & 6- healthy *Borreria hispida.*

CONCLUSION

In India so far various weeds are identified having phytoplasma infections. I concluded that the diversity of the potential reservoir of disease has been increased with the discovery of new phytoplasmas hosts. Hence, it would be importance to study the diverse nature of phytoplasmas.

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SEED PROTEIN PROFILING THROUGH ELECTROPHORESIS IN MUNGBEAN [*VIGNA RADIATA* (L.) WILCZEK]

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Abstract: Mungbean (*Vigna radiate (L.*) Wilczek) is an important pulse crop in India with advancement and development of hundreds of varieties and introduction of intellectual property rights it is necessary to identifying them individually for identification and registration purposes. The present investigation was carried out during 2012-2013 in biotechnology lab, Department of genetics & Plant Breeding, C.S. Azad university of agriculture and technology, Kanpur with 13 genotypes of Mungbean K851, SML-683, KM 2272, PDM 51, T- 44, KM-2260, HUM-12, HUM-6, Pusa Vishal, IPM 02-3, IPM 2-14, KM-2241, PDM-139, for protein profiling through SDS-PAGE. In present investigation, 13 variety of Mungbean were studied for varietal identification through electrophoresis. Protein was extracted from dry seed of mungbean varieties and analysed by SDS-PAGE. On the basis of photographs, electrophoregrams, Rm values and dendograms (UPGMA cluster analysis) of banding patterns through SDS-PAGE, results found that the number of protein bands found in 13 genotypes ranged from 10 to 17 with Rm value 0.08 to 0.97 for tris soluble proteins. Protein banding pattern of tris soluble proteins was found more distinct in SDS-PAGE. In UPGMA cluster analysis all the genotypes fall in seven cluster groups. SDS-PAGE for tris soluble proteins found suitable for testing distinctness, uniformity, stability of varieties for registration and identification. On the basis of results, this can be said for characterization and identification of genotypes of mungbean, that electrophoretic profile for tris soluble proteins through SDS-PAGE was resulted distinct banding pattern and act as 'genotypic finger printing'. Therefore, electrophoregram of tris soluble protein in SDS-PAGE was found much better for identification of genotypes in mungbean.

Keywords: Mungbean, SDS-PAGE, Varietal identification, UPGMA

INTRODUCTION

Mungbean (Vigna radiate Wilczek) is short duration legume crop belong to the order leguminosae and papiliponoideae family. It is a self-pollinated diploid legume with the chromosome number 2n= 22 the mungbean crop having high nutritive value 100 g of mungbean contain 23.83 g protien. most of which is consumed in the domestic market with the advancement and development of thousands of improved new varieties and introduction of IPR, it is necessary to identifying them individually for identifications and registration purposes. For the purpose necessity of quick, reliable and reproducible laboratory techniques are required. Protein profiling through SDS-PAGE is an alternate techniques for distinguishing the genotypes. Protein markers are stable, reproducible and genetically controlled and can be conducted in relatively short time.the protein profiling of seed storage proteins in cultivated lentil and their significantly differences in banding patterns by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE).

In electrophoresis, substances in a mixture, which are ionisable, can be reported from others that are net, by subjecting the mixture to an electric field: SDS-PAGE is the most commonly methods used for studying protein differences between species, previously classified on the basis of their morphological characters. SDS is an anionic detergent which binds strongly and denatures proteins. The number of SDS molecule bound to a polypeptide chain is approximately half the no. of amino acid residues in that chain. The protein SDS complex carries net negative charges. Hence, more towards the anode and the separation is based on the size of the protein.

MATERIAL AND METHOD

The study was conducted during 2012-13 at Biotechnology Lab, Department of Genetics and Plant breeding, C.S. Azad University of Agriculture and Technology, Kanpur (UP). For the study, genetically pure seeds of 13 mungbean genotypes K857, SML-683, KM 2272, PDM 51, T- 44, KM-2260, HUM-12, HUM-6, Pusa Vishal, IPM 02-3, IPM 2-14, KM-2241, PDM-139 were procured from the mungbean Breeder of the university on the basis of morphological characters. The soluble proteins were analysed through SDS-PAGE method recommended by Dadlani *et al.*, 1993 for variety identification

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Preparation of Sample

About 1 g seed were grinded in mortar and pestle after removing the seed coat and defatted by defatting solution 4 times of all 13 genotypes were taken in tube separately 1 ml Tris-glysine extraction buffer (pH 8.3) was added to 0.5g of defatted powder and left over night. 10 % solution of SDS (10µl), 2-mercapto ethanol (10µl) with bromophenol blue (10 µl) was added. Mixed well and left over night in a refrigerator. The sample was heated in boiling water bath kept for 10 minutes in water bath for 10 minutes at 100ºC. . The tubes were cooled and centrifuged at 10000 rpm for 10 minutes. The clear supernatant was used for electrophoresis.

Preparation of gel

Seed protein were analysed through slab type SDS-PAGE followed by Laemmli (1970) using 12% polyacrylamide gel. Electrophoresis was conducted in Atto Electrophoresis Unit using fourteen well for loading the sample.fixed the gel cassette into the electrophoresis unit as per design of the equipment. Loaded 50 µl of clear supernatant with one drop of tracking dye (Bromophenol blue) was loaded to each well. The electrophoresis was conducted at a constant current of 1.5 mA per well [42 mA] till the tracking dye crossed the stacking gel than current was fixed @ 2 mA per well at 220 V. The electrophoresis was stopped after the tracking dye reached the bottom of the gel.

Fixing and staining

Removed the cassette from the unit and take out the gel gently. Placed it in a staining tray and incubate overnight in 15% Trichloroacetic acid solution. Wash thoroughly the excess SDS, which might precipitate on the surface. Sufficient 1% commassie brilliant blue solution, prepared in methanol was added to cover the gel uniformly and incubated for 16 hr to stain than rinsed with water. Destaining in water and 5% Acetic acid for two days clears the gel background, resulting in a better resolution. The gel was placed over a trans-illuminator to draw the electrophoregram for calculating Rm values.

RESULT AND DISCUSSION

Results obtained through SDS-PAGE showed that the method provided a powerful tool for reliable variety discrimination and identification based on genetic differences of seed storage protein composition. Genotypes were distinguished on the basis of presence and absence of protein bands at particular Rm value and total numbers of bands present.

In the electrophoregram of tris soluble protein through SDS-PAGE (Fig. 1 & 2) in 13 genotypes, the numbers of protein bands were ranged from 10 to 17 with Rm value 0.08 to 0.97.

The mungbean genotypes based on similarity distance dendrogram of 13 genotype of tris soluble protein banding pattern using UPGMA clusters analysis (Fig. 3) were grouped in 8 clusters. Clusters first contain three genotypes in grouped namely ; K-851, KM-2260 and SML-683, in which K-851 and KM-2260 are more close than SML-683.cluster, second and third KM-2272 and PDM-51, respectively have wider distance to other genotypes.Cluster fourth, IPM 02-3 and PDM-139 are grouped that are contain two genotypes which are close to each other.Cluster fifth contains two genotypes T- 44 and KM- 2241 are grouped that are close to each other.Cluster six contains two genotypes Pusa Vishal, and IPM-02-14 are grouped that are close each other. Cluster seven and eight HUM-6 and HUM- 12 HUM-6, respectively have wider distance to other genotypes.

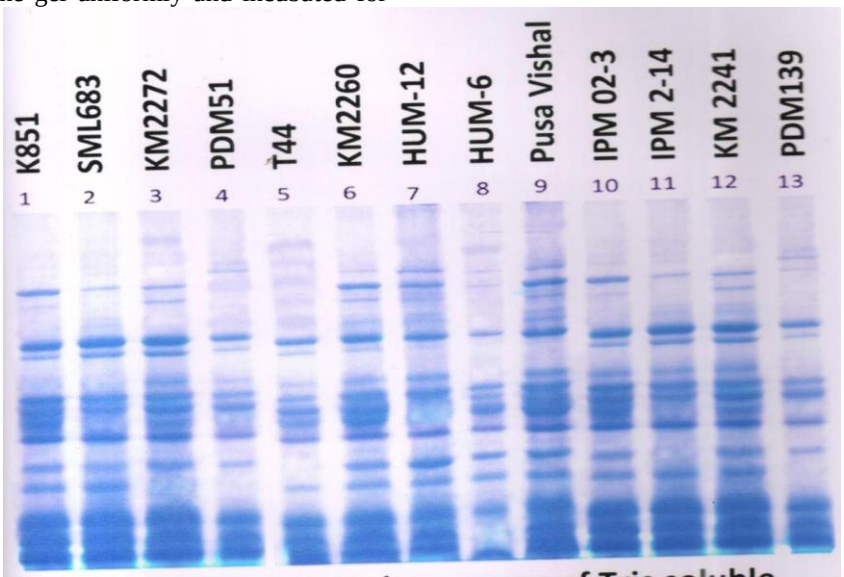

Fig.: SDS-PAGE Electrophoregrams of Tris soluble proteins in Mungbean genotype

Table 1. Relative mobility Rm values and presence/absence of total soluble seed protein in mungbean genotype (SDS-PAGE)

Band No.	Genotype Ram value	K 851 (1)	SML 683 (2)	KM 2272 (3)	PDM 51 (4)	T 44 (5)	KM 2260 (6)	HUM 12 (7)	HUM 6 (8)	Pasa Vishal (9)	IPM 02-3 (10)	IPM 2-14 (11)	KM 2241 (12)	PDM 139 (13
1.	0.08	-	+	-	+	-	-	+	-	-	-	-	+	-
2.	0.11	+	+	+	+	-	-	-	+	-	+	-	+	+
3.	0.16	+	+	+	+	-	+	-	-	-	+	-	-	+
4.	0.18	-	-	-	-	+	-	+	+	-	+	-	+	+
5.	0.21	+	+	+	+	-	+	+	+	+	-	+	-	-
6.	0.24	+	+	+	-	+	+	-	-	+	-	-	+	-
7.	0.27	-	-	-	+	-	-	-	+	-	-	-	-	-
8.	0.29	+	-	-	-	+	+	+	-	-	+	+	+	-
9.	0.31	+	+	-	+	+	+	-	+	+	-	-	+	-
10.	0.36	+	+	+	-	-	+	-	+	-	+	+	+	+
11.	0.40	+	+	+	+	+	+	+	-	-	+	-	+	+
12.	0.44	-	-	-	-	-	-	+	-	-	-	-	-	+
13.	0.47	-	+	+	-	-	+	-	-	+	-	+	+	-
14.	0.51	+	-	+	+	+	+	-	+	+	+	+	-	+
15.	0.55	+	+	+	+	+	+	-	+	-	+	+	+	+
16.	0.58	+	-	+	-	+	+	+	+	+	+	-	+	-
17.	0.63	+	+	+	+	+	+	+	+	-	-	+	+	+
18.	0.70	+	+	+	+	-	+	+	+	+	+	-	+	+
19.	0.74	-	-	+	-	-	-	-	+	-	-	-	-	-
20.	0.76	+	+	-	+	+	+	+	-	-	+	+	+	-
21.	0.85	+	+	+	+	+	+	+	+	+	+	+	+	+
22.	0.90	+	+	+	+	+	+	-	-	+	+	+	+	+
23.	0.97	+	+	+	+	+	+	+	+	+	+	+	+	+
	Total	17	16	16	15	13	17	12	14	10	14	11	17	13

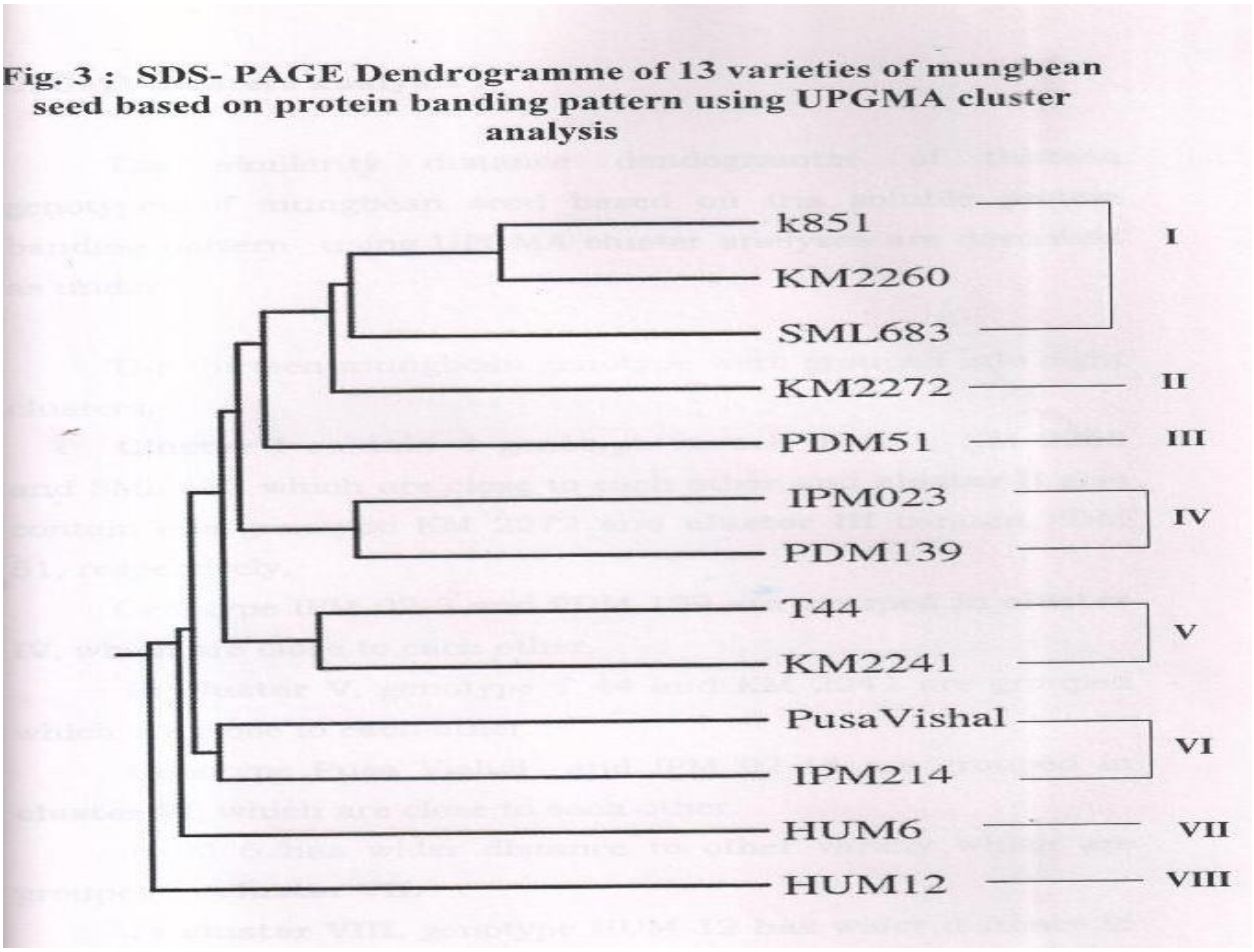

Fig. 3 : SDS- PAGE Dendrogramme of 13 varieties of mungbean seed based on protein banding pattern using UPGMA cluster analysis

On the basis of photographs, electrophoregrams, Rm values and dendograms (UPGMA cluster analysis) of banding patterns through SDS-PAGE, variations were found in Rm value of protein bands, numbers of protein bands, similarity distance cluster analysis. These results are supported to the findings of and

Kawas, A.and S. Nehir, (1992) in mungbean and lentil. Amjad *et al.,* (2012) in mungbean.Gunarti *et al* and Lee *et al* (2013) in mungbean. Protein banding pattern of tris soluble proteins were found more distinct. On the basis of results, this can be said for characterization and identification of genotypes of mungbean, that electrophoretic profile for tris soluble proteins through SDS-PAGE was resulted distinct banding pattern and much better.

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REPORTED

PARTICIPATION OF ELECTED WOMEN PANCHAYAT SAMITI MEMBERS IN PANCHAYATI RAJ INSTITUTION

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Abstract: The present study was an effort to know the extent of Participation of elected women Panchayat Samiti members in Panchayati Raj Institution. A total 23 women representative's randomly selected from Pusa & Kalyanpur Block of Samastipur district in Bihar. In which 40 villages were selected from these two selected block (20 villages from each block). A schedule was used to collect the data by personal interview method. In order to determine the condition governing the extent of Participation of elected women Panchayat Samiti members, the data were subjected to multiple correlation regression and Path analysis. Participation was taken as dependent variable. The findings revealed that maximum 21.73 Percent of EWPSMs were "always" participated with regard to health, welfare and development followed by 17.39 percent of respondents were participated to construction, repair and maintenance and only 8.69 percent of respondents were with regard to poverty alleviation related activities. Maximum 8 respondents performed supervisory duty three times for road construction work. The association of participation by EWPSMs in Panahayati Raj was positively and significantly correlated with marital status, family income, interaction style, developmental constraints and size of land holding at 1 percent level of probability. The t - value of only marital status was positive and significant at 5 percent level of probability. The direct effect of independent variables on participation was substantial in case of Personal Education, Marital Status, Knowledge, Size of Land Holding, Interaction Style, Development Constraints, Caste, Social Linkage, Occupation, Family Size, Family Education House Type, Family Income and Material Possession.

Keywords: Participation, Panchayat Samiti members, Elected women, Panchayati Raj Institution

INTRODUCTION

Panchayati Raj is not a new phenomenon in the country. Its illustration in history goes back to more than a 1000 years. It has its roots in Ancient Indian Institutions when the villages were little republics governed by their Panchayats. During this period, it was not that women could not join politics, but the fact was that they did not take interest in it due to a patriarchal set up. The British through their ruthless method of revenue collection and the introduction of zamindari land tenure system almost destroyed these ancient republics and as well the involvement of women in politics. The British were of the view that "Vote of Women" would be premature in the Indian Society and continued to enforce purdah and prohibition against women's education. (Bhagat 2005).

In India, the most deep rooted forms of inequality built into the structure of traditional society are those based on caste and gender. A number of research findings indicated that the women were the disadvantaged gender in both rural and urban areas of the country (Dubey *et.al.*, 1986; Chan, 1993; Agarwal, 1994). Giving special attention to women, article 14, confers equal rights and opportunities to men and women in the political, economic and social spheres. Article 15(3) empowers the state to make affirmative discrimination in favour of women.

Despite women's mass participation in the national struggle, their representation in the formal political structure has remained marginal. In the Indian parliament women have never crossed eight percent of the membership till recently. In the Lok Sabha women constituted less than three percent of the membership in 1952. This increased to 7.3 percent in 1996 and 7.8 percent in 1998. This year 38 women have won the Lok Sabha seat which calculates to 7.5 percent of the total strength. Similar position was seen in elections held to various state legislative assemblies in different years.

With the passage of 73rd Amendment Act, 1992, India is at a crucial structure in the evaluation of Panchyati Raj institution the Indian brand of rural local self government. It has envisioned people's participation in the process of planning decision making, implementation and delivery system. The Panchayat Acts of state governments has subsequently been amended to in-corporate the stipulations of the central Acts thus the constitutional mandate has heralded uniform pattern throughout Indian states.

The 73rd constitutional amendment mandated a minimum of one third reservation for women in the membership as well as in the position of chairpersons of Panchayat at all three levels, namely the village, district and intermediate levels. All the states without exception have adopted this reservation policy since then. The present study was undertaken with the following objectives:-

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1. To study the working of elected women members with respect to their duties and powers empowered by Panchayati Raj System.
2. To determine the extent of Participation of elected women Panchayat samiti members in Panchayati Raj System.

MATERIAL AND METHOD

The study was undertaken in purposively selected Samastipur district of Bihar state for case in data collection. Out of twenty blocks of Samastipur district two blocks namely Pusa and Kalyanpur were selected to represent the whole district. Forty villages in the total were drawn randomly from the two selected blocks (20 villages from each block). For selection of respondent's multistage sampling procedure was used. Twenty three women representatives were randomly selected from all the gram panchayats of these two blocks. A Schedule was used to collect the data by personal interview method. In order to determine the conditions governing the Participation of elected women, the data were subjected to multiple correlation, regression and path analysis. Participation was taken as dependent variable.

Extent of Participation

It is the degree to which the given Powers are used for performing duties and functions by elected women Panchayat members of Panchayati Raj System.

Extent of participation of elected women Panchayat members was calculated on the basis of their scores related to awareness in performing their duties and function. A score of 2 was given to the respondents who were "aware" and one was given to the respondents who were "not aware" about their duties and functions. Similarly a score of 3, 2 and 1 was assigned to the participation response categories viz. "always" "sometimes" and "never" respectively.

FINDING AND DISCUSSION

Table 1 Clearly indicated that maximum (21.73%) of EWPSMs were "Always" participated with regard to health, welfare and development related activities followed by 17.39 percent of respondents were participated to construction, repair and maintenance and only 8.69 percent of respondents were with regard to "poverty alleviation" related activities.

Table 1. Distribution of elected women Panchayat Samiti members with reference to their extent of participation on the basis of awareness in duties and functions. N=23

Duties and functions		Awareness		Extent of Participation					
				A		S		N	
Activities related to		Yes	No	F	%	F	%	F	%
1.	Agriculture & Allied	19	4	-	-	-	-	23	100.00
2.	Poverty alleviation	18	5	2	8.69	2	8.69	19	82.60
3.	Small Scale Industries	20	3	-	-	2	8.69	21	91.30
4.	Rural housing and Rural Electrification	4	19	-	-	-	-	23	100.00
5.	Construction, repair and maintenance	23	-	4	17.39	1	4.34	18	78.26
6.	Education	23	-	-	-	2	8.69	21	91.30
7.	Cultural, market and Fairs	6	17	-	-	4	19.39	19	82.60
8.	Health, Welfare and Development	23	-	5	21.73	-	-	18	78.26

A= Always S= Sometimes N= Never

All the respondents were never participated in activities related to rural housing & electrification and agriculture. Maximum 11.39 percent of respondents were 'Sometimes' participation in cultural, market and fairs followed by 8.69 percent of EWPSMs were participated in different activates related to poverty alleviation; Small Scale industries and Education respectively.

Performance of elected Women Panchayat Samiti Members

The information pertaining to participation of elected Women Panchayat Samiti Members in various activities is quoted in table 2.

Table 2. Type and number of activities Performed by elected Women Panchayat Samiti members under their duties and function. N=23

Activities Performed		No. of activities performed	No of respondents
1.	Helped in Organizing skill development Camp	1	5
2.	Participated in Camp organized by Village	1	6

3.	Supervised the work of road Construction	3	8
4.	Approved funds for Village roads	1	2
5.	Approved funds for poor students	1	2
	Total =	7	
N= Elected Women Panchayat Samiti Members			

A look at the table shows those 8 respondents performed supervisory duty three times for road construction work followed six respondents participated once in camp organized by village and 5 respondents once in organizing skill development camp at the village level. Two respondents participated once in approved funds for village roads and also approved funds for poor students. Reasons for low participation of respondents in these activities might be that the respondents were short of facilities and social barriers as they were not allowed for going out from their houses.

Table 3. Elected Women Members expectations of participation in Panchayat Samiti. N=23

Expectations		Frequency	Percentage
1.	Social Source	9	39.13
2.	Social Prestige	6	26.08
3.	Livelihood	4	17.39
4.	High level representative	4	17.39

It is perused from table 3 that a maximum number of EWPSMs (39.13%) who expressed Social service to be the sole objective of their participation in Panchayat Samiti. Further 26.08 percent of respondents offered themselves to serve the Panchayat Samiti with a goal to gain in Social prestige and only 13.39 percent of respondents expected a promising future of becoming a representative of a higher level through participation in Panchayat Samiti and also equal number (13.39%) who desired to be part of Panchayat Samiti for the purpose of solving their needs of living.

Therefore, it can be concluded that there was an overall positive impact of increased participation of elected women members in Panchayat Samiti as the representations of the Society.

Relationship of participation by elected women Panchayat Samiti members with socio economic and psychological variables

The result of correlation, multiple regression and Path analysis exercised to know the degree of influence of the independent variables over the dependent variables in respect of the elected women Panchayat Samiti members are presented through table 4.

Table 4. The co-efficient of correlation between participation between socio-economic and psychological variables of elected women of Panchayat Samiti

Sl. No.	Independent Variables	Value of Coefficient of Correlation
1.	Age	-0.698**
2.	Caste	0.524*
3.	Marital status	0.797**
4.	Personal Education	-0.146 ^{Ns}
5.	Family Education	0.433*
6.	Family type	-0.151 ^{Ns}
7.	Family Size	-0.637 ^{Ns}
8.	Occupation	-0.082 ^{Ns}
9.	Size of land holding	0.559**
10.	Family income	0.725**
11.	Material possession	-0.025 ^{Ns}
12.	House type	0.156 ^{Ns}
13.	Social linkage	-0.097 ^{Ns}
14.	Knowledge	0.449*
15.	Development constraints	0.576**
16.	Interaction Style	0.653**

* Significant at 5% level of probability ** Significant at 1% level of probability Ns - Non Significant

It is evident from table 4 that the association of participation by elected Panchayat Samiti members in Panchayati Raj was positively and significantly correlated with Marital Status (r = 0.797, p > 0.01), Family Income (R = 0.725, P > 0.01), Interaction Style (R = 0.653, P > 0.01) Developmental Constraints (r = 576, p > 0.01) and Size of Land Holding (r = 0.59, p > 0.01). The association Participation with Caste (r = 0.527, p > 0.015), Knowledge (r = 0.449, p > 0.05) and Family Education (r = 0.433, p > 0.05) were positive and significant at 5 percent level of probability where as the association between participation and their Age was negative but highly significant at 1 percent level of probability (r = -0.698). House type was positively but non-significantly correlated with the Participation remaining variables i.e. Personal Education (R = -0.146), Family Type (R = -0.151), Family Size (R = 0.037), Occupation (R = -0.082), Material Possession (R = -0.025) and Social Linkage (r = -0.097) were negatively and none significantly correlated with the Participation.

From the above results of correlation co-efficient presented above thus revealed that, there was an improvement in the participation of EWPSMs with that of their age. As from the table it is clear that age was negative but highly significantly correlated with participation. This implied that, the younger EWPSNMs were in possession of greater participation compared to these higher in age.

Table 5. Multiple regressions between participation and Socio-economic and Psychological Variables of elected women members of Panchayat Samiti.

Sl. No.	Characters	Standard regression	Standard error	T-value	SDR regression co-efficient
1.	Age	-0.516	1.010	-0.511	-0.286
2.	Caste	1.233	3.449	0.357	0.096
3.	Marital-status	12.516	4.799	2.608*	0.581
4.	Personal Education	1.052	5.659	0.186	0.080
5.	Family Education	-2.272	4.244	-0.535	-0.146
6.	Family type	2.319	7.737	0.300	0.105
7.	Family Size	-0.917	10.889	-0.084	-0.074
8.	Occupation	1.205	3.571	0.338	0.117
9.	Size of land holding	2.009	2.723	0.738	0.185
10.	Family income	-2.639	6.782	-0.389	-0.218
11.	Material possession	-0.110	7.944	-0.014	-0.007
12.	House type	0.474	5.579	0.025	0.027
13.	Social linkage	2.707	5.595	0.484	0.128
14.	Knowledge	-0.206	0.260	-0.793	-0.293
15.	Development constraints	-0.106	0.52	-0.421	-0.144
16.	Interaction Style	1.701	13.179	0.129	0.140

R^2 = 0.870 F = 2.500 * Significant at 5% level of probability ** Significant at 1% level of probability

A perusal of tables 5 reveals that the t - values recorded in the above tables were found to be significant only in respect of Marital Status (t = 2.608). The t - values were negative in terms of Age, Family Education, Family Size, Family Income, Material Possession, Knowledge and Development Constraints. In terms of Caste, Personal Education, Family Type, Occupation, Size of Land Holding, Social Linkage and Interaction Style were found to be positive and non-significant.

As required the magnitude of the dependence of dependent variables (participation) partial regression co-efficient bi (I = 1,2,3,……..16), were worked out and tabulated in table 57. The co-efficient of determination R^2 = 0.870 indicated that up to 87.0 percent variation in participation was explained by all the sixteen independent variables taken together. The regression co-efficient of Y (participation) upon Marital Status bi_3 = 12.516 was significant. If the Marital Status of elected women is improved by one unit, their participation score will be improved at the rate of 2.608.

Thus, taking into account the standardized regression co-efficient the important characters responsible for improving participation of EWPSMs was Marital Status. The results of path analysis are summarized in table 6.

Table 6. Direct-Indirect effect of independent variables with participation of elected women members of Panchayat Samiti

Sl. No.	Characteristics	Direct effect	Total indirect effect	Maximum indirect effect	Though
1.	Age	-0.1901	0.0117	1.4321	Caste
2.	Caste	0.3211	-0.0821	0.6321	Education
3.	Marital status	1.6213	0.1421	0.2487	Caste
4.	Personal Education	1.7251	-1.4558	-1.0689	Knowledge
5.	Family Education	-0.2429	0.4728	1.5250	Education
6.	Family type	-0.0121	0.1121	0.1232	Knowledge
7.	Family Size	0.2447	0.1237	0.1523	Education
8.	Occupation	0.2789	0.2512	0.0212	Marital status
9.	Size of land holding	0.4431	-0.3791	-0.7762	Education
10.	Family income	0.1239	0.2439	0.3421	Education
11.	Material possession	-0.1215	0.5423	0.6721	Education
12.	House type	-0.1331	0.2122	0.3251	Education
13.	Social linkage	0.3124	0.2432	1.4521	Education
14.	Knowledge	-1.2321	0.0421	1.2321	Education
15.	Development constraints	-0.3421	0.3123	0.4321	Education
16.	Interaction Style	0.3521	0.2521	0.7052	Education

A perusal of the direct effect of the independent variables on participation recorded in table 6 revealed that it was substantial in case of Personal Education (1.7251), Marital Status (1.6213), Knowledge (-1.2321), Size of Land Holding (0.4431), Interaction Style (0.352), Development Constraints (-0.3421), Caste (0.3211), Social Linkage (0.3124), Occupation (0.2789) Family Size (0.2487), Family Education (-0.2429) House Type (-0.1331), Family Income (0.1239) and Material Possession (-0.1215) but the family type did not have substantial direct effect (-0.0121). Interestingly, to have maximum total indirect effect (-1.4552) which was channeled through effects were in fact higher also in case of Material Possession (0.5423), Family Education (0.4728), Size of Land Holding (-0.3791), Development Constraints (0.3123), Interaction Style (0.2521), Occupation (0.2512), Family Income (0.2439), Social Linkage (0.2432) and House Type (0.2122). The maximum indirect effects of the independent variables were through Personal Education. As many as eleven independent variables except Age Marital Status, Personal Education, Family Type and Occupation were having maximum indirect effects though education of the respondents.

CONCLUSION

In Indian Constitution, there are provisions for equal rights for all citizens irrespective of their social and economic status. The association of participation by EWPSMs in Panahayati Raj was positively and significantly correlated with marital status, family income, interaction style, developmental constraints and size of land holding at 1 percent level of probability. The direct effect of independent variables on participation was substantial in case of Personal Education, Marital Status, Knowledge, Size of Land Holding, Interaction Style, Development Constraints, Caste, Social Linkage, Occupation, Family Size, Family Education House Type, Family Income and Material Possession. The path analysis this clearly indicated that the respondents own education played the most important role in their participation in the activities knowledge, caste and marital status also caused substantial direct effects on the participation of the EWPSMs. It can also be concluded that there was an overall positive impact of increased participation of elected women members in Panchayat Samiti as the representations of the Society.

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REPORTED

HONEY BEE FLORA AND FLORAL CALENDER IN NORTH ZONE OF CHHATTISGARH

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Abstract: A study was conducted at Surguja district of Chhattisgarh during 2014-15 to identify the bee flora and to develop the floral calendar for honey bee. Based on the interview with the beekeepers and visual observations, some important plant species were identified as a major source of flora for honey bee. Spring season (March to June) autumn season (July to October) identified as critical dearth period with a few flowering plants. Winter season (November to February) identified as honey flow period having a number of floral plants viz. *Guizotia abyssinica*, *Brassica spp*., *Citrus spp*., *Cajanus cajan*, *Eucaliptus*, Mango, Shisham, Semal, Pea, ornamental plants-Popy, Calendula, Nastertium, Holyhock, *Justicia*, *Berbina*, weed flora *Ageratum conyzoides*, *Bidens pilosa*, and medicinal plants like Adusa, Bhring raj, Justicia, aswagandha, karanj were the major bee flora. This season was identified as the most suitable for initiation and promotion of beekeeping practices.

Keywords: Bee Flora, Beekeeping, Floral calendar

INTRODUCTION

Beekeeping is an important farming activities in Surguja district of Chhattisgarh since ancient times. Some beekeepers are rearing the Indian honey bee *Apis cerana indica* Fabr. to fetch the honey from their beehive. Being a non- land based enterprise the beekeeping is increasing in this region. The success of beekeeping is depends upon the different factors, among them, the avaibility of bee flora and its duration is one of them. Longer the duration of the avaibility of flora nectar or pollen or both more suitable will be the area for beekeeping. In this region inadequate experience and knowledge about the bee flora is facing the problem, those farmers who are interested in beekeeping they trap the *Apis cerana indica* Fabr. from the hole of the trees ,termitarium of termite, cracks of buildings etc. and keeps it into their small size beehive called Newton's bee hive. When the avaibility of bees any month of the year and they do not manage the bee colony especially in the month of (May-June and July-August) the dearth period. During rainy season the wax moth is the major problem for swarming the honey bee. In this hilly region winter season is the most suitable for initiation of the bee keeping because of this period is abundant flora of rabi crops, fruits and ornamental and weeds flora are available. During this period the forest trees are also available abundant flora for honey bees (Shaw *et al*. 2008).

MATERIAL AND METHOD

A study was undertaken in the vicinity of *Apis cerana indica* Fabr. apiary of Raj Mohini Devi, College of Agriculture and Research Station, Ambikapur and beekeeper's apiary by survey during 2011-12. Geographically, Ambikapur (Surguja) is located at an altitude of 20.8' North, at latitude of 83.15'east and at a height of 592.62 MSL. On the basis of beekeeper's interview in the village mainly common and local names of different flowering plants of that area and apiary seasonal plants were characterized by making visual observations on bee activity pertaining to collection of nectar, pollen or both during the flowering period of each individual plant species. The plants either crops or trees or weeds or ornamentals were listed accordingly to the source for which they were visited by bees like nectar,(N), pollen (P) or both (N+P). These observations were recorded for one kilometer of radius of apiary and farmer's field.

Table 1. Different honey bee flora avaibable in Surguja district of Chhattisgarh.

SN.	Common name	Scientific name	Family	Blooming period	Source
1.	Brinjal	*Solanum melongena* L.	Solanaceae	Round year	N+P
2.	Chilly	*Capsicum annum*	Solanaceae	--do---	N
3.	Shimla mirch	*Capsicum annum* L.	Solanaceae	-----do----	N
4.	Tomato	*Lycopersicon esculentum*	Solanaceae	-----do----	P
5.	Onion	*Allium cepa L.*	Liliaceae	Feb-May	N+P
6.	Radish	*Raphanus sativus*	Cruciferae	Oct-April	N+P
7.	Sesamum	*Sesamium orientale* L.	Pedaliaceae	August-Oct	N+P
8.	Sunflower	*Helianthus annus* L.	Astraceae	Round year	P

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9.	Niger	*Guizotia abyssinica*	Compositae	Oct-Mar	N+P
10.	Mustard	*Brassica campestris*	Cruciferae	---do----	N+P
11.	Buckwheat	*Fagopyrum esculentum*	Poligonaceae	Sep-Feb.	N+P
12.	Arhar	*Cajanus cajan*	Leguminoceae	Sep-Apr.	N+P
13.	Moong	*Vigna radiata*	--do---	Aug-Oct	N
14.	Gram	*Cicer arietinum*	---do--	Dec-Feb	P
15.	Lentil	Lens esculenta L.	-----do----	-----do----	P
16.	Lathyrus	*Lathyrus sativus*	Leguminaceae	Dec-Feb	N+P
17.	Pea	*Pisum sativum*	Leguminaceae	Nov-Feb	N+P
18.	Maize	*Zea mays* L.	Graminae	Round year	P
19.	Corinder	*Coriandrum sativum*	Umbelliferae	Nov-Feb.	N+P
20.	Methi	*Trigonella foenumgraecum*	Leguminaceae	----do---	N+P
21.	Bhindi	*Abelmoschus esculentus*	Malvaceae	Sep-Aug	N+P
22.	Carrot	*Dacus carota* L.	Umbelliferae	Oct-Mar	N+P
23.	Turnip	*Brassica rapa* L.	Cruciferae	--do--	N+P
24.	Sakarkand	*Ipomoea batatas*	Convolvulaceae	Sep-Nov	N+P
25.	Rice	*Oryza sativa*	Graminae	Sep-Dec	P
26.	Bottle gourd	*Lagenaria siceraria*	Cucurbitaceae	Round year	N+P
27.	Bitter gourd	*Momordica charantia*	Cucurbitaceae	Round year	N+P
28.	Pumpkin	*Lagenaria vulgaris*	Cucurbitaceae	Aug-Jan	P
29.	cucumber	*Cucumis sativus*	Cucurbitaceae	Round year	N+P
30.	Cabbage	*Brassica oleracea* L.	Criciferiae	Oct-Mar	P
31.	Cauliflower	*B.O. var.botrytis*	----d----	-----do----	P
32.	Knol khol	*B. caulorapa* L.	-----do----	----do---	P
		Fruit and Forest Trees			
33.	Guava	*Psidium guajava* L.	Myrtaceae	AprMayJul-Aug	N+P
34.	papaya	*Carica papaya* L.	Caricaceae	Round year	N
35.	Mango	*Mangifera indica* L.	Anacardiceae	Mar-Apr	N
36.	Citrus	*Citrus limon* L.	Rutaceae	Nov-feb	N+P
37.	Litchi	*Litchi chinensis* Sonn.	Sapindaceae	Mar-Apr	N+P
38.	Banana	*Musa paradisiacal*	Musaceae	Round Year	N+P
39.	Ber	*Zizyphus jajuba* Lam.	Rhamnaceae	Sep-Oct	N
40.	Tamarind	*Tamarindus indica*	Leguminoceae	May-Jul	N+P
41.	Jamun	*Syzygium cumini* L.	Myrtaceae	Apr-May	N+P
42.	Moringa	*Moringa olefera*	Morigiceae	Nov-May	N
43.	Neem	*Azadirachta indica* Juss.	Meliaceae	April	N
44.	Semal	*Bombax ceiba* L.	Bombacaceae	Dec-Mar	N
45.	Shisham	*Dalbergia sisoo*	Papilionaceae	Mar-Apr	N+P
46.	Kachnar	*Bauhinia variegata*	Caesalpiniaceae	Sep-Nov	N+P
47.	Kapok	*Ceiba pentendra*	Bombacaceae	Mar-Apr	N+P
48.	Gulmohar	*Delonix regia*	Bignoniaceae	Apr-June	P
49.	Arjun	*Terminalia arjuna Rox.*	Combretaceae	Apr-May	N+P
50.	Bamboo	*Dendrocalemus strictusness*	Poaceae	Apr-May	N+P
51.	Bottlebrush	*Callistemon lanceolatus*	Myrtaceae	Mar-Apr	N+P
52.	Dhwai	*Woodfordia fructicosa*	Lythraceae	Oct-Apr	N
53.	Coffee	*Coffee arabica*	Rubiaceae	Apr-May	N
54	Sal	*Sorea robusta*		Apr-May	N
		Ornamental plants			
55.	Dahlia	*Dahlia Spp.*	Astraceae	Nov-May	N+P
56.	Marigold	*Tagetes erecta*	Compositae	Oct-May	N+P
57.	Dianthus	*Dianthus caryophyllus*	Caryophllaceae	Jan-Apr	N
58.	Balsum	*Impatiens balsemina* L.	Balsaminaceae	Jan-Apr	N
59.	Aster	*Callistephus chinensis*	Compositae	Dec-Mar	N
60.	Calendula	*Calendula officinalis*	Astraceae	Jan-May	N
61.	Pitunia	*Petunia axillaries*	Solanaceae	Jan-Apr	P
62.	Nastertium	*Nastertium tropaeolummajus*	Tropaeolaceae	Jan-May	N+P
63.	Popy	*Papaverdubium* L.	Paperveraceae	Jan-Apr	P

64.	Hollyhock	*Hollyhock althacrosie*	Malvaceae	Jan-Apr	P
65.	Ginia	*Zinnea elegans*	Balsaminaceae	Dec-Apr	P
66.	Phlox	*Phlox drummondii*	Polimoniaceae	Jan-Apr	N
67.	Berbina	*Verbena hybrida*	Verbanaceae	Jan-Apr	N
68.	Portulaca	*Portulaca olercea*	Oleraceae	Jan-Mar	P
69.	Cosmos	*Cosmos sulphureus* Cas.	Compositae	Dec-Mar	N+P
70.	Cock's comb	*Celosia plumose* L.	Amaranthaceae	Oct-Feb	N
71.	Cornflower	*Centaurea cyanii* L.	Astraceae	Dec-may	P
	Weed flora				
72.	Wild sunhemp	*Crotolaria verracosa*	Leguminaceae	Sep-Feb	N+P
73.	Water freworst	*Bidens pilosa*	Astraceae	Round year	N+P
74.	Basnahi	*Ageratum conyzoides* L.	Astraceae	Round year	P
	Medicinal Plants				
75	Adusa	*Adhatoda vasica*	Acanthaceae	Round Year	N
76	Aswagandha	*Withnia somnifera*	Solanaceae	Oct-March	N+P
77	Bhringraj	*Eclipta alba*	Asteraceae	Round Year	N+P
78	karanj	*Pongamia pinnata*	Fabaceae	March April	N
79	Justicia	*Justicia gendarusa*	Acanthaceae	March-April	N

N-Nectar, P-Pollen

RESULT AND DISCUSSION

Honeybee species and beekeeping practices

On the basis of farmer's experience, three different honey bees species were found in Surguja region. They were Indian honey bees (*Apis cerana indica* F.) ,little honey bee (*Apis florae* F.), and rock bee (*Apis dorsata* F.). The predominant species were *Apis dorsata* F., followed by *Apis cerana indica* F. and *Apis florae* F.(Atwal *et al*.1970).

Apis cerana indica was the predominantly species in this region. Only this species can be domesticated because this species was easily available naturally in termitarium, cracks of walls and holes of trees etc. In this region those peoples who were interested in beekeeping they traped the *Apis cerana indica* and kept it into the beehives and harvested the honey from them. These beekeepers harvesting honey on an average of 10-12 kg. honey per colony per year.

Honey flow and Dearth periods

In Surguja region the peak periods of honeybees foraging activity were recorded during October – February. During this season, abundant bee floral plants were found blooming with mild temperature and little or no rainfall. Some plants and crops species such as *Brassica species, Guizotia abyssinica*, *Cajanus cajan*, *Pisum sativum*, *Zea maize*, *Oryza sativa*, *Sesamum indicum*, *Fagopyrum esculantum*, *Allium cepa*, *coriandrum sativum*, *Raphanus sativum*, *Hellianthus annus* etc were the major crop flora. Honeybees visited these plants extensively for honey production and colony multiplication. Winter season (Nov-Feb.) was the honey flow period most suitable for honey production for this region. Spring season (March-June) partially dearth period because of least bee flora were available. Autumn season (July-Oct.) boths this season were recorded dearth period least number of bee floras were available. Bhatia (2007), Sharma and Raj (1985) has also noted about the bee flora.

Plantation of bee floral plants

Due to variation in altitude and climatic condition, this region was suitable for growing various multipurpose plants such as *Psidium guajava*, *Citrus spp*., *Litchi chinensis*, *Mangifera indica*, *Eucalyptus spp*, *Moringa olifera*, *Azadirachta indica*, *Zizyphus jujuba*, *Acasia arabica*, *Bombax ceiba*, *Madhuka indica*, *Tamarindus indica*, *Pongamia pinnata*, *Dalbargia sisoo*, *Syzygium cumini*, *Bauhinia varigata*, *Ceiba pentendra*, *Jacaranda mimosifolia*, *Terminalia arjuna*, *Bambusa bambos*, *Terminalia ballerica*, etc. should be planted for honey bee flora. It was also noted by Singh and Singh (1980).

Seasonal ornamental plants

Some ornamental plants which were observed as a good source of pollen and nectar or both such as *Jasticia gendrussa*, *Salvia splendens*, *Helichrysum bracteanum*, *Dianthus caryophyllus*, *Impatiens balsemina*, *Callistephus chinensis*, *Calendula officinalis*, *Petunia axillaries*, *Tropa colummajus*, *Papaver dubium*, *Hollyhock althacrosie*, *Zinnea elegens*, *Phlox drummondii* ,*Verbena hybrida*, *Celosia plumose*, *Centaurea cyanii* and same suggestions were given by Chand and Singh (2005).

Weed Flora

Some weeds were identified as a good source of bee flora as a nectar or pollen or both for this region viz- *Bidens pilosa*, *Azeratum conizoides*, *Crotolaria verracosa*. These were weeds naturally available in abundant and in which *Apis cerana indica was* visited predominantly.

Medicinal plants

During the study period, some medicinal plants were also visited by the honeybees plants like *Adhatoda vasica*, *Justicia gendarusa*, *Eclipta alba*, *Vithania somnifera*, and *Pongamiya pinnata* etc. were visited. Looking the visitation by foraging bees, this plans can be planted for initiation and promotion for beekeeping activities in this region .

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SHORT COMMUNICATION

EFFECT OF INORGANIC FERTILIZERS, BIOFERTILIZERS AND ORGANICS ON GROWTH, YIELD AND ECONOMICS OF ONION (*ALLIUM CEPA* L.) CV. N-53

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Abstract: The present investigation entitled Effect of inorganic fertilizers, biofertilizers and organics on growth, yield and economics of onion (*Allium cepa* L.) cv.N-53 was conducted with the aim to understand the better utilization of nutrients for growth, yield and quality improvement of onion. A field experiment was conducted at the Department of Vegetable Science, College of Agriculture, Orissa University of Agriculture & Technology, Bhubaneswar (Odisha), during the *Rabi* season of the year 2012-13 under Randomized Block Design with ten treatments and three replications The results revealed that the growth characters, like plant height, number of leaves per plant, leaf length, leaf width, dry weight of leaf and neck length; yield-attributing characters such as bulb weight, polar diameter and equatorial diameter of bulb were positively influenced under treatment T_9 i.e., Lime @ 0.2 LR + (*Azotobacter* + *Azospirillum* + P.S.B) @ 4 kg per ha each + Vermicompost @ 5t per ha + RDF (120:60:60 kg per ha), while no fertilizer was applied in control. Maximum bulb yield (27.13 t ha^{-1}) was recorded in the same treatment (T_9), which was due to the sum total effect of different growth and yield-attributing characters. Highest B:C ratio was found in treatment T_7 i.e,(Lime + Biofertilizers +RDF).

Keywords: Recommended dose of fertilizer, Vermicompost, Phosphobacteria, Azotobacter, Onion, Bulb yield, Economics

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important vegetable cum condiment crop grown throughout the world including India. . India produces onion about 187.77 lakh tonnes from an area of 11.73 lakh hectares (Anon., 2013) and ranks second in the world' production. Fertilizer application proved to be a great success and production of vegetables crops increasing in our country. Intensive cultivation and excess use of chemical fertilizers resulted in ill health of soil and unstable yield of crops. The modern civilization is posing a threat to environment. So in last few years, a greater concern regarding use of biofertilizers and organic sources as an alternative/supplement to chemical fertilization, has been derived to reduce the high costs that inorganic fertilizer represent in agricultural production. The use of nitrogenous and phosphatic fertilizers can be minimized or by the application of biofertilizers like *Azospirillum*, *Azotobacter* for nitrogen and PSB for phosphorus, as these are free from problems of pollution and other hazards. Long term fertilizers trials have clearly shown the positive role of organic fertilizers in conjunction with chemical fertilizers in maintaining the productivity of soil by maintaining the soil fertility and important physical properties (Bharadwaj *et al.*, 1994). Combined use of vermicompost, biofertilizers and inorganic fertilizers is of special significance under intensive cropping system as these are complementary and supplementary to each other in sustaining crop yields and soil productivity. Balanced fertilization has to be made for different crops based on soil testing for attaining maximum yield and profit Biofertilizers are economically lucrative, ecologically sound and are also self generating sources without any negative influence either to the crop or to the environment. These are also bio-control agents as they control many pathogens and microorganisms. The beneficial microbes are the biological nitrogen fixers (*Azotobacter*, *Azospirillum*, Blue Green Algae, *Azolla* and *Rhizobium*), Phosphate Solubilising Microbes (PSM) and nutrient mobilizers (*Mycorrhizal* fungi) in the soil which are of great significance to different horticultural crops particularly in vegetables.

MATERIAL AND METHOD

The experiment was laid out during the *rabi* season of 2012-13 at at Department of Vegetable Science, College of Agriculture, Orissa University of Agriculture & Technology, Bhubaneswar (Odisha) which is subjected to the extreme of weather conditions. The climate of region is subtropical with maximum temperature ranging from 22^0C to 45^0C in summer, minimum temperature ranging from 7^0C to 15^0C in winter and relative humidity ranging from 60 - 80% in different season of the year. Before start of the experiment, the representative soil samples were taken randomly a depth of 15 cm from experimental field and brought to laboratory for physical and chemical analysis. The results of soil analysis have been presented in the soil of field may texturally be classified as silty clay loam and slightly acidic in reaction. Onion seeds of N-53 were sown on nursery beds at Department of Vegetable Science, College of Agriculture, during the *Rabi* season in line sowing. Raised bed about 3 meter long, one meter width and 15 cm above ground level was prepared for that purpose. The seed beds were covered with compost, mulches and thatches with polythene paper above the bed to protect the young seedling from adverse climatic condition. 60 Days after sowing, bulb lets

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were ready for transplanting. These healthy bulblet uniform shape and size were selected and transplanted in well prepared field. The experiment was laid out in Randomized Block Design with ten treatment combinations and three replications. The treatments comprised of combinations T_1- No application of fertilizers (control); T_2- RDF; T_3 - Lime + Biofertilizers (*Azotobacter* + PSB + *Azospirillum)*; T_4 - Lime + Vermicompost; T_5 -Lime + RDF (100 %), T_6 - Lime + Biofertilizers (*Azotobacter* + PSB + *Azospirillum)*+ Vermicompost, T_7 -Lime + Biofertilizers (*Azotobacter* + PSB + *Azospirillum)*+ *RDF* (100 %), T_8 - Lime + Vermicompost + RDF (100 %), T_9 - Lime + Biofertilizers (*Azotobacter* + PSB + *Azospirillum)*+ Vermicompost + RDF (100 %), T_{10} -Biofertilizers (*Azotobacter* + PSB + *Azospirillum)*+ Vermicompost + RDF (100 %). Seeds were germinated after 5-6 days. The land of the experimental site was irrigated prior to showing for optimum moisture level. The required area was then marked and plots were prepared according to the layout plan. The land of the experimental site was irrigated prior to transplanting for optimum moisture level. The first ploughing was done with disc plough and sub-sequent ploughing was done with cultivator followed by planking. About 50% of NPK and Vermicompost @ 5 tones/ha is applied at the last ploughing. Seedling were treated with combination of biofertilizers Azotobacter @4 Kg/ha and PSB @ 4kg/ha and Azospirillum @ 4kg/ha. Sixty days old bulblets of uniform size (1.5 cm long and 0.25 cm diameter) were selected. After dipping, they were transplanted in field at a spacing of 15 cm × 10 cm. From every plot 5 plants of onion were taken randomly for recording periodical data. The observations were recorded on the plant height (cm), leaf length (cm), leaf width (cm), number of leaves (cm), neck length (cm), polar diameter (cm), equatorial diameter (cm), bulb yield (t/ha), fresh bulb weight (g), dry bulb weight, volume of bulb (ml) and dry weight of leaves (g). The statistical analysis was carried out as per the methods suggested by Steel and Torrie (1981).

RESULT AND DISCUSSION

The data with respect to plant growth and yield-attributing are presented in Table 1 and 2, respectively.

Growth Attributing Characters

Table 1. Effect of organic and inorganic nutrient treatments on plant height and leaf characters of onion cv. N-53

Treatments	Plant height (cm)	Number of leaves	Leaf length (cm)	Leaf width (cm)	Dry weight of leaf (g)	Neck length (cm)
T_1 : L_0 + BF_0 + VC_0 + RDF_0	29.70	6.90	25.09	1.11	2.00	0.57
T_2 : RDF	38.41	10.98	34.60	1.51	3.20	1.04
T_3 : L + BF	32.89	8.04	27.34	1.25	2.50	0.97
T_4 : L + VC	31.47	8.34	27.09	1.39	2.47	1.11
T_5 : L + RDF	43.39	11.34	37.15	1.55	3.10	1.01
T_6 : L + BF + VC	35.48	10.11	33.61	1.35	2.20	0.73
T_7 : L + BF + RDF	46.78	11.01	39.47	1.87	2.77	1.05
T_8 : L + VC + RDF	47.35	12.09	40.15	1.77	3.00	1.13
T_9 : L + BF + VC + RDF	51.44	14.11	43.25	1.97	2.90	2.17
T_{10}: L_0 + BF + VC + RDF	41.32	11.88	38.33	1.44	2.70	0.84
S.E.m ±	0.83	0.42	0.90	0.14	0.03	0.14
C.D. (P=0.05)	2.58	1.25	2.66	0.42	0.08	0.41

The data showed in Table 1 revealed that maximum plant height (51.44 cm) was recorded in T_9, which was significantly superior to all other treatments including control (T_1). The major nutrient phosphorus being essential constituent of cellular protein and nucleic acid might have encouraged the meristematic activities of the plant resulting in increased plant height. This finding corroborates with the findings of Singh *et al.* (1993) and Varu *et al.* (1997) in onion. Maximum number of leaves, leaf length and leaf width was recorded with T_9 (14.11), (43.25 cm) and (1.97 cm), respectively and was significantly different from rest of the treatments. This might be due to the adequate availability and supply of nutrients in proportion, which ultimately triggers the plant growth hormones for proper growth. Maximum dry weight of leaf was recorded in treatment T_2 (3.20 g) and minimum was found in treatment T_1 (2.00 g). Jilani (2004) reported that application of higher amount of nitrogen significantly enhanced the length of onion leaves. Maximum neck length was recorded in T_9 (2.17 cm) which was significantly superior than other

treatments including control followed by T_8 (1.13 cm) and T_4 (1.11 cm).This might be due to increased number of leaves per plant resulting in better photosynthesis and accumulation of photosynthates leading to more vigour. Similar results were also reported by Setty (1988) in Garlic and Thimmiah in Onion (1989).

Yield-attributing characters

Maximum fresh bulb weight was recorded in T_9 (128.53 g) which was significantly higher than the rest of the treatments. The organic treatment of vermicompost had increased the soil organic matter, soil structure and biological activity of the soil and would have reduced the loss of nitrogen by increased cation and anion exchange capacity in soil. Kebede (2003) observed yield increases of about 10 - 15% in onion with nitrogen fertilization in the range of 120 kg N ha^{-1}. Maximum dry weight of the bulb was recorded with T_9 (21.37 g), which was significantly superior to other treatments followed by T_8 (18.70 g) and T_7 (18.49 g). Improved dry weight of bulb was also related to altered root permeability of the plant for nutrients due to effect of biofertilizers. Hansen and Henriksen (2001) reported, dry matter content increased during the period of bulb development while harvesting later than 80 - 90% top fall reduced dry matter content and storage ability of the bulbs. Maximum volume of bulb was recorded in T_9 (131.41 ml), which was significantly higher than rest of the treatments. Maximum polar diameter and equatorial diameter was recorded in T_9 (5.73 cm) and (6.09 cm), respectively which was significantly higher than other treatments. The increase in bulb equatorial and polar diameter with incorporation of organics with inorganics is a reflection of better performance of the plant with respect to different growth parameters by enhancing the nutrient uptake ability. Maximum yield (27.13 t ha^{-1}) was recorded with the application of 100% recommended dose of chemical fertilizers with biofertilizers, vermicompost and lime which was significantly higher than other treatments including control. The minimum marketable yield was recorded in T_1 (11.50 t ha^{-1}) which happens to be control. The increase in crop growth rate such as plant height and number of leaves might have positive and significant correlation with the yield. It increased the net assimilation rate leading to production of more amount of metabolites and phytohormones followed by their mobilization from the source to sink which ultimately resulted in higher yield as also reported by number of workers (Neerja *et al*.,2001; Thilkawati and Ramaswami ,1998; Jayathilake *et al*., 2003) in onion.

Table 2. Effect of organic and inorganic nutrient treatments on yield and yield-attributing characters of onion cv. N-53

Treatments	Fresh weight of Bulb (g)	Dry weight of Bulb (g)	Volume of Bulb (ml)	Polar Bulb diameter (cm)	Equatorial Bulb diameter (cm)
T_1 : L_0 + BF_0 + VC_0 + RDF_0	58.76	9.67	61.18	3.57	4.10
T_2 : RDF	88.33	14.92	93.14	4.13	4.54
T_3 : L + BF	71.07	13.20	86.25	3.99	4.20
T_4 : L + VC	84.41	13.35	83.79	3.80	4.34
T_5 : L + RDF	98.68	15.84	117.42	4.40	5.12
T_6 : L + BF + VC	79.88	12.34	95.30	4.12	4.08
T_7 : L + BF + RDF	111.89	18.49	123.30	4.74	5.43
T_8 : L + VC + RDF	111.84	18.70	123.48	5.10	5.49
T_9 : L + BF + VC + RDF	128.53	21.37	131.41	5.73	6.19
T_{10} : L_0 + BF + VC + RDF	91.44	14.27	110.85	4.38	4.83
S.E.m ±	5.63	0.75	1.92	0.14	0.97
C.D. (P=0.05)	16.72	2.23	5.72	0.40	2.89

Economics

Details on economics and benefit: cost ratio in onion variety N-53 in relation to various combinations of different treatments tested is presented in Table 3. Highest gross return (Rs.1,89,910) was obtained in the treatment T_9 (L+BF+VC+RDF) followed by T_8 (L+VC+RDF) with Rs.1,68,700 per ha. Though treatment T9 resulted in highest gross return, it failed to earn highest net income owing to higher cost of the vermicompost. As for net income, the best performance was that of the treatment T_7 where (L+BF+RDF) was applied to the crop. This treatment also resulted in highest B: C ratio (3.18) by virtue of fetching higher net return, and incurring comparatively low cost investment.

CONCLUSION

From this study, it is evident that application of 100% recommended dose of fertilizers, lime, biofertilizers and vermicompost resulted in higher yield in onion. However, from the point of view of economics,

application of 100% recommended dose of fertilizers with biofertilizers and lime is more profitable. Hence, it is concluded that for better performance and profitability from onion variety N-53, application of 100% RDF along with biofertilizers and lime, is appropriate.

Table 3: Economics of onion as influenced by different organic and inorganic fertilizer treatments

Treatments	Bulb yield (t ha^{-1})	Cost of cultivation (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	B:C Ratio
T_1	11.50	44,137	80,500	36,363	1.82
T_2	16.67	51,193	1,16,690	65,497	2.27
T_3	12.77	45,061	89,390	44,329	1.98
T_4	13.80	59,641	96,600	36,959	1.61
T_5	20.75	51,193	1,45,250	94,057	2.83
T_6	13.60	57,541	95,200	37,659	1.65
T_7	23.52	51,613	1,64,640	1,13,027	3.18
T_8	24.10	66,193	1,68,700	1,02,507	2.54
T_9	27.13	66,613	1,89,910	1,23,297	2.85
T_{10}	17.44	66,613	1,22,080	55,467	1.96

T_1- No application of fertilizers (control); T_2- RDF; T_3 - Lime + Biofertilizers (*Azotobacter* + PSB + *Azospirillum)*; T_4 - Lime + Vermicompost; T_5 -Lime + RDF (100 %), T_6 - Lime + Biofertilizers (*Azotobacter* + PSB + *Azospirillum)*+ Vermicompost, T_7 -Lime + Biofertilizers (*Azotobacter* + PSB + *Azospirillum)*+ *RDF* (100 %), T_8 - Lime + Vermicompost + RDF (100 %), T_9 - Lime + Biofertilizers (*Azotobacter* + PSB + *Azospirillum)*+ Vermicompost + RDF (100 %), T_{10} -Biofertilizers (*Azotobacter* + PSB + *Azospirillum)*+ Vermicompost + RDF (100 %)

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SHORT COMMUNICATION

FRUIT CHARACTERISTICS AND MORPHOLOGY RESPONSIBLE FOR RESISTANCE AGAINST BRINJAL SHOOT AND FRUIT BORER *LEUCINODES ORBONALIS* GUENEE

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Abstract: In the present study fifty four genotypes of brinjal were screened for their resistance against shoot and fruit borer *Leucinodes orbonalis* Guenee and grouped into various categories based on fruit characters. Genotypes with purple coloured fruits were most infested with 41.7 percent damaged fruits. Whereas, genotypes with white coloured fruits were least infested with 34.21 percent fruit damage. Similarly genotypes with solitary fruiting (39.56 percent), compact seed arrangementin mesocarp (40.58 percent) and round fruits with 42.55 percent fruit damage.While genotypes with fruiting in cluster, loose arrangement of seed in mesocarp and oblong fruits were least preferred. Based on observations on fruit morphology, genotypes with comparatively longer fruits (31.08 percent), larger fruit and calyx diameter (50.46 percent) were most susceptible to fruit borer than genotypes with shorter fruits, lesser fruit and calyx diameter with 30.92, 37.15 and 37.97 percent fruit damage respectively. GenotypeIBR-9with round shaped fruits, compact arrangement of seeds in the mesocarp and fruiting singly was most attacked with 61.65 percent damaged fruits as compare to least fruit damage recorded in genotype IBR-109 with oblong shaped fruits, loose arrangement of seeds in mesocarp and fruiting in cluster. Longer fruits and larger diameter of calyx and fruit were more susceptible to fruit borer attack.Correlation coefficient of fruit and calyx diameter on percent fruit damage by number was significantly positive(r =0.8482)

Keywords: Brinjal, *Leucinodes orbonalis* Guenee, Shoot, Fruit borer

INTRODUCTION

Brinjal (Solanummelongena L.), which is commonly known as eggplant is one of the most important solanaceouskharif or summer season vegetable crop in our country. It occupies an important position among the other regular vegetable crops that are available throughout the year (Shukla.andKhatri, 2010). It originated in India, as Subcontinent people are used to grow brinjal since last 4000 years.Brinjal fruit and shoot borer, Leucinodes orbonalis Guenee is the key pest of eggplant (Latif et al., 2010; Chakraborti and Sarkar, 2011; Saimandir and Gopal, 2012) inflicting sizeable damage in almost all the eggplant growing areas (Dutta et al., 2011) and is most destructive, especially in south Asia (Thapa, 2010)which reduces the crop yield up to 60-70% and inflictsthe colossal loss in production (Singh and Nath, 2010). Larvae of this insect bore inside plantshoots and fruits adversely affecting plant growth, yieldand fruit quality, and thus making it unfit for human consumption. It also reduces the content of vitamin C in fruit up to 80 percent. Thepetioles, midribs of large leaves and young tender shoots are bored by the newly hatchedlarvae. The entry place is closed by their excreta and feeding is internal. Due to larval activity, translocation of nutrients in shoot is affectedcausing witheringand drooping of shoots (Asatti*et al*., 2001). The most important and effective way to manage an insect pest is the use of resistant cultivars. Host plant resistance strategy serves as an excellent component when integrated with other approaches as it has several advantages over other measures. It is highly compatible with pesticides and biological control agents.

The paper deals with identification of morphological characters of fruits for insect resistance and to find out the source of resistance against brinjal shoot and fruit borer, *Leucinodes orbonalis*Guenee in order to avoid their attraction, feeding and oviposition

MATERIAL AND METHOD

Field experiments on screening of brinjal genotypes for the resistance against shoot and fruit borer *Leucinodes orbonalis* Guneewere carried outat IGKV Research farm, college of Agriculture, Raipur (C.G.)during rabi-summer season.Fifty four genotypes of brinjal collected from different sources were screened for their resistance against shoot and fruit borer based on fruit characteristics.For screening the genotypes were grouped into different categories based on fruit colour, fruitingpattern, fruit shape and arrangement of seed in the mesocarp.Percent fruit damage based on weight and number was computed for each category separately to quantify the preference of the shoot and fruit borer.

After transplanting at vegetative growth phase number of infested shoots from five randomly selected and tagged plants from a plot were counted as against total number of shoots per plant and per cent shoot infestation was worked out. At the time of

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harvesting, the fruits of each plot were harvested separately and numbers of healthy and infested fruits per plot were counted. At the sametime weight of healthy and infested fruits were taken to work out per cent infestation on weight basis. Irrigation and weeding operations were performed whenever necessary. The genotypes were categorized on following fruit characteristics.

Length of fruit: At the time of harvesting, five mature fruits of average size from each genotype were selected in three replications and Lengths of fruits were measured in cm with the help of standard scale and average per replication was worked out.

Diameter of fruit: The fruit was cut open vertically passing through middle of the fruit. The diameter of the fruit was measured by stretching a thread across the width of the fruit.

Shape and Colour of fruit:-The standard shape and colour of fruit was recorded visually at marketable maturity stage.

Fruiting pattern: -Fruiting pattern was classified based on Fruiting singly (solitary) and fruiting in bunch (clusters)

Arrangement of seed:-Based on arrangement of seed in the mesocarp the varieties under test were grouped under loose and compact arrangement of seed**.**

Diameter of calyx: The calyx was measured by fixing pins at the periphery of the calyx. Diameter was subsequently recorded by using the formula $C=2\pi r$

RESULT AND DISCUSSION

In the present study, for screening the cultivars for resistance against shoot and fruit borer the test varieties were grouped under different categories based on fruit colour, fruiting pattern, fruit shape and arrangement of seed in the mesocarp. Percent fruit damage based on number was computed for each category separately to quantify the preference of the shoot and fruit borer.

Fruit colour: -Genotypes with white fruits were least preferred by *Leucinodes orbonalis* with fruit damage of 34.21 percent by weight and 32.73 percent by number. Genotypes with purple colouerd fruits were most preferred by test insect with 41.7 percent by weight and 38.95 percent by number.

Fruiting Pattern:-Based on fruiting pattern the genotypes with fruiting in cluster were comparatively less attacked with 37.36 percent by weight and 35.64 percent by number as compare to genotypes with solitary type of fruiting with 39.56 percent by weight and 38.59 percent by number.

Fruit shape:-Among different shapes of fruits,genotypes with round shape fruits were most preferred 42.55 percent fruit damage followed by genotypes with oval shape fruits (40.13 percent).Almost similar trend were observed in different shapes of fruits.

Arrangement of seed in mesocarp:-The genotypes with loose arrangement of seed in the mesocarp were comparatively less attacked with 38.26 percent by weight and 35.70 percent by number than the genotypes with compact arrangement of seed having40.58 percent fruit damage by weight and 39.51 percent by number.

Fruit length:-The lowest fruit damage associated with fruit damage to the tune of 30.92 percent on weight basis and 33.14 percent by number basis.The genotypes with longest fruit had 31.08 percent and 32.31 fruit damage by weight and number basis respectively.

Fruit diameter:-The largest fruit diameter observed in genotype IBR-177, associated with fruit damage of 50.64 percent on weight basis and 51.81 percent by number basis.The genotype with smallest fruit diameter had 37.15 percent and38.78 fruit damage by weight and number basis respectively.

Calyx Diameter:- The lowest calyx diameter was associated with fruit damage to the tune of 37.14 percent on weight basis and 38.78 percent by number basis. The genotype with largest calyx diameter had 50.46 percent fruit damage by weight and 51.81 percent on number basis.

Table 1. Mean fruit damage by *Leucinodes orbonalis*on brinjal genotypes as influenced by different fruit characters

S.N.	Fruit Character	Mean fruit damage (%)	
		Weight	Number
1.	**Fruit colour**		
	Light purple	39.65	38.43
	Purple	41.75	38.95
	Dark purple	38.85	36.95
	Greyish purple	39.47	37.94
	Light green	39.29	39.91
	Light to dark green	39.48	37.96
	White	34.21	32.73
2.	**Fruiting pattern**		
	Solitary	39.56	38.59
	Cluster	37.36	35.69
3.	**Arrangement of seed in mesocarp**		

	Loose	38.26	35.70
	Compact	40.58	39.51
4.	**Fruit shape**		
	Long	37.66	36.66
	Oblong	36.59	37.44
	Oval	40.13	38.50
	Oval to oblong	36.66	33.77
	Round	42.55	41.64

Table 2. Incidence of*Leucinodes orbonalis*as influenced byfruit morphology

S.N.	Fruit Character	Mean fruit damage (%)	
		Weight	Number
1.	**Fruit length**		
	16.76	31.08	32.31
	4.4	30.92	33.14
2.	**Fruit diameter**		
	6.76	50.46	51.81
	2.56	37.15	38.78
3.	**Calyx Diameter**		
	6.84	50.46	51.81
	1.96	37.15	38.78

In present studies genotypes with purple coloured fruits were most preferred with 41.7 percent fruit damage and genotypes with white coloured fruits were least preferred with 34.21 percent fruit damage. Prasad*et al*. (2014) reported that the fruit colour varied from green through light purple to black purple. Fruits which were green in colour had less infestation (7.89 to16.32%). Jat and Pareek(2003) also reportedthat the light green coloured fruits were not preferredby the borer. Genotypes such as IC280954, IC099723, IC111013, IC111033and EC038474 had green, oblong and round shapedfruits and high number of seeds, were resistant.

The color of fruits were purple green, light green, violet and green. It was observed that the *S. torvum*with green color fruit were significantly less susceptible and violet color (pink) fruit of BARI Brinjal-1 was highly susceptible followed by light green color fruit of BARI Brinjal-6 fruit.(Amin et al.,2014)

Mishra *et al*. (1988) also reported that tight arrangement of seeds in the mesocarp, among the other characters, may be possible traits of resistance in long fruit genotypes. On the contrary in present studies comparatively more fruit damage was recorded on varieties with compact arrangement of seeds Although, Guptaand Kauntey (2008) reported that genotypes with roundshape and less number of seeds are more susceptibleto borer than those with long fruits.

Khan and Singh (2014) screened 192 genotypes of brinjal and found that 38 genotypes were tolerant to L. Orbonalis. The tolerance nature of above entries of brinjal might be attributed by hardness of the fruit skin and flesh. Fifty two accessions were found susceptible to shoot and fruit borer which might be due to the softness of the shoot, sparse pubescence and spherical and oblong fruit with soft rind and loosely arranged seeds.

In the present studies genotypes with long fruits were infested with high fruit damage of 38.90 to 41.40 percent by weight. Whereas, Shukla *et al*. (2001) reported that the mean length of the fruits of the accessionswere ranged from 6.55 to 22.07 cm and there wasno significant correlation found for shoot and fruit borer infestationwith length of fruits, fruit width, fruit length-widthratio and fruit weight on the infestation, whereas, Naqvi *et al*. (2009)reported that length of fruits hadsignificant negative correlation and diameter of fruitshad significant positive correlation.

Correlation coefficient of fruit and calyx diameter on percent fruit damage by number was significantly positively correlated(r=0.8482) which indicated that as the calyx diameter increased the fruit diameter also increased, which inturn, increased the damage to fruits by fruit borer.The present results are in conformity withthose of Patil and Ajri (1993) reported a strong andpositive correlation between calyx length and fruitinfestation. The long and big or loose calyx in the highlysusceptible genotypes might help the young borer to hideand get easily into the fruit through the soft tissue belowthe calyx.

Wagh *et al*. (2012) also found that calyx is the most important morphological component which has strong association with pest infestation. the highly susceptible genotype RHRB-7 recorded maximum (4.07 cm) length of calyx however, short calyx length was observed in less susceptible genotypes as the length of calyx exhibited highly significant and positive correlation (r = 0.6156) in relation to per cent infestation by L. orbonalis.

Based on above observations it can be concluded that thecalyx is the most important

morphologicalcomponent which has strong association with pestinfestation.Genotypes with longer fruits length, larger fruit diameter and larger calyx diameter were more preferred by shoot and fruit borer as compare to genotypes with shorter fruit length, lesser fruit and calyx diameter.

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SHORT COMMUNICATION

MORPHOLOGICAL CHARACTARIZATION OF GLADIOLUS (*GLADIOLUS HYBRIDUS* HORT.) GERMPLASM

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Abstract: An experiment was conducted with 15 gladiolus cultivars at Horticultural Research Centre, SVPUAT, Meerut, UP, India during the year 2013-14. Results on different characteristics showed that cultivar Prabha gave the maximum plant height while cultivar Sylbia exhibited maximum number of leaves per plant, leaf length and leaf width. Maximum number of suckers per corm was noted with cultivar Aldebaran. Cultivar American Beauty showed maximum length of rachis and spike while cultivar Arka Gold produced maximum number of florets, flower diameter and weight of corm. However, minimum days required for visibility of spike and minimum days for opening of first flower noted in Punjab Glance and it was maximum observed with cultivar Prabha. Orange Ginger gave maximum number of spike and Aldebaran showed maximum diameter of corm and cormlets per plant whereas, highest number of corm was recorded in Pacific.

Kewwords: Gladiolus, Evaluation, Genotypes, Performance, Morphological characterization

INTRODUCTION

Gladiolus is one of the most important boulbous flowering plant of Iridaceae family. This flowering crop has gained popularity in India as well as world due to majestic flower spike with massive florets of brilliant color, attractive shapes, varying sizes of flowers and excellent keeping quality. Therefore, it is necessary to study the performance of existing cultivars for their desirable characters. Moreover, exotic varieties are known for their better quality spike and multiplication rate of corms and cormlets. However, their suitability under local conditions needs to be tested before their recommendation. The varieties with more number of florets, bigger floret size and more number of florets open at a time are well suited for exhibition purpose. The success of improvement depends mainly on the morphological variability. The morphological character of gladiolus varies due to its genotypes. In order to make further improvement for the economic traits efforts are needed on the part of breeders and floriculturist to bring about variations in the gladiolus cultivars for the traits attributing to economic characters.

MATERIAL AND METHOD

The experiment was carried out during 2013-14 at Horticultural Research Centre (HRC) of SVPUAT, Meerut, UP, India. Before planting of corms, well decomposed farm yard manure @ 50 t ha-1 was applied for the experimental plots uniformly as basal application. The application of nitrogen @ 200 kg ha-1 in the form of urea was applied in three equal split doses, one as basal application and the other two split doses 30 and 60 days after planting. Phosphorus @ 200 kg ha-1 in the form of single super phosphate and potassium @ 150 kg ha-1 in the form of Muriate of Potash was applied as basal dose. The beds of 1 m × 1 m size were prepared. Healthy and uniform sized corms (3.0-5.0 cm) were planted at 5-6 cm depth at a spacing of 30 cm × 20 cm in a randomized block design with three replications in Oct., 2013. Standard cultural practices were followed during the cropping season. Harvesting of corms and cormels were performed only when leaves turned into brown (Mukhopadhyay, 1995). The data were recorded on five randomly selected plants from each genotype in each replication on 17 characters i.e. Plant height (PH), number of leaves per plant (NLPP), leaf length (LL), leaf width (LW), number of suckers per plant (NSPC), length of spike (LS), length of rachis (RS), spikes per corm (SPC), diameter of spike (DS), number of florets per spike (NFPS), flower diameter (FD), visibility of spike in days (VSD), opening of first flower in days (OFFD), longevity of spike in days (LSD), diameter of corm (DC), weight of corm (WC), number of corms per plant (NCPP) and cormels per plant (CPP) . The experimental data were analyzed statistically as proposed by (Gomez and Gomez, 1984) using MSTAT–C software to find the significance.

RESULT AND DISCUSSION

The observations recorded at the successive stage of the plant development were analysed statistically and presented in the Table 1. The experimental findings of the present investigation and discussion had been discussed with appropriate reference by different authors as co-authors with the different parameters. It is clear from the Table 1 that all the characters under present investigation were significantly differed from each other in terms of growth, flowering and corm characters, indicating more variation in plant growth, flowering and corm characters. Since plant height is one of the most important character as it contributes towards higher spike length with more number of florets and thereby enhances spike quality. Cultivar

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Prabha showed maximum plant height followed by, variety Sylvia (62.77 cm) and minimum height of the plant (40.45 cm) was observed with the cultivar Arka Kesar. The variation observed in plant height among the genotypes might be due to difference in genetically constituents as well as environmental effects. Wide variation in plant height amongst some genotypes of gladiolus was observed by Hossain et al., (2011), Swaroop, K., (2010). Sylvia had maximum number of leaves per plant (6.72 leaves) and Punjab Glance was found minimum number of leaves per plant .Maximum leaf length was recorded in Sylvia (55.04) followed by, Prabha (54.65 cm) and minimum leaf length (35.76 cm) recorded in Punjab Glance. Similarly maximum leaf width (3.89 cm) was recorded in Sylvia and minimum leaf width (2.19 cm) showed in Aldebaran. Significant variations were observed among the cultivars in terms of number of suckers per corm and it was maximum (2.68) noted in Aldebaran followed by, Gold Field (2.63 suckers) and minimum number of suckers (0.86) was observed in Punjab Pink. This variation in leaf characters might be due to genotype as well as some known and/or unknown environmental factors. It has been reported that plant produces food materials through the process of photosynthesis. With the increasing number of leaves, photosynthesis generally increases, and plant can produce more food that influences the growth and development of the plant. So, genotypes that can produce more leaves have more plant growth leading to higher yield. Similar findings have been reported (Hossain et al., 2011). The wide variation was observed in flowering characters among the cultivars. American Beauty had maximum length of spike followed by Arka Kesar (79.24 cm) and minimum length of spike (48.53 cm) was found in Arka Kesar. The highest spike length is one of the important characters for commercial value of gladiolus. Length of spike is governed by the genotypic constitution of the plant that differs from cultivar to cultivar. Mishra (1997) reported that PG-8 germplasm was found to have the highest spike length among 10 gladiolus germplasm in calcarious soil of North Bihar. Ramachandruru and Thangam (2008) reported the highest rachis length in variety Mascagni. Pandey *et al.* (2009) also reported 'Advance Red' variety which was found to have the highest rachis length among 12 cultivars taken for investigation. Kumar *et al.* (2007) reported that the cultivar 'Jester Gold' to have the highest rachis length among twenty six gladiolus cultivars. Different cultivars showed significant variation in number of spikes per corm and cultivar Arka Gold produced maximum number of spikes per corm followed by, Punjab Glance (1.01 spikes) and minimum number of spikes per corm (0.86) was recorded in Punjab Pink. The maximum diameter of spike (1.11 cm) was recorded in Pricilla followed by Gold Field (1.07 cm) whereas, minimum diameter of spike (.72 cm) observed in Aldebaran.. Cultivar Arka Gold produced maximum number of florets (21.26) and minimum number of florets (10.15) was observed in Pacific. Baweja and Brahma (2003) reported that 'Ben Venuto' variety had the highest number of florets per spike among 15 cultivars of gladiolus. Patil (2003) reported that 'Sancerre' variety had the highest number of florets per spike among 9 cultivars of gladiolus. Nagaraju and Parthasarathy (2001) reported that 'Apollo' variety gave the highest floret number among 10 cultivars. Singh *et al.* (1998) also reported the highest number of florets in the variety 'Oscar' in Nagaland region. All the cultivars showed significant variation in flower diameter and it was maximum (10.45 cm) observed in Arka Gold followed by, (9.29 cm) in Pricilla while it was minimum (7.17 cm) noted in Arka Kesar. Baweja and Brahma (2003) reported that cultivar Oscar was found to have the highest diameter of floret among 15 gladiolus cultivars. Patil (2003) also reported Sancerre, which was found to have largest floret size among 9 gladiolus cultivars. Prabha had late spike initiation (88.33 days) and took more days for first floret opening (99.64 days). Planting of early and late blooming varieties in judicious manner will prolong flowering duration. Variation in days to spike initiation and 1st floret opening seem to be genetically controlled as reported by Pragya *et al*. (2010) in gladiolus. Rama Chandraru and Thangam (2008) also reported that Darshan was found to have the highest number of days for flowering whereas Peter Pears was found to have the lowest number of days to flowering both in shade and open field conditions. The variation in these parameters might be attributed to differences in genetic constitution of genotypes. The present findings are in conformity with the earlier findings of Pandey *et al*. (2012) in gladiolus, Wankhede and Gajbhiye (2012) in gerbera and Kumar *et al.* (2011) in snapdragon. Longevity of spike in days also differed each other among the cultivars and it was maximum (20.00 days) observed in Orange Ginger followed by, (16.13 days) in American Beauty and minimum longevity of spike (11.65 days) recorded in Prabha. The variation in different characters among varieties may be due to genetic traits and the effect of prevailing environmental conditions. The present findings are in conformity with the findings of Swaroop (2010) and Pandey *et al*. (2012) in gladiolus. Different genotypes exhibited significant variation for corm characters (Tables 1). Maximum diameter of corm (7.27 cm) was recorded in Aldebaran followed by, Arka Gold (7.10 cm) and minimum diameter of corm (4.07 cm) was recorded in Kuk-Kum. Weight of corm also varied significantly among different cultivars with minimum weight of corm being in Arka Gold (28.33) and maximum in Arka Gold (86.00 gm). Maximum number of corms per plant was recorded in Pacific (2.00) followed by, (1.67 corms) in Punjab Pink and minimum number of corms (1.00) was recorded in

Arka Gold. The data presented in Table 1 exhibits significant variation for cormel characters among the cultivars evaluated. Maximum number of cormels per plant (17.33) was recorded in Aldebaran followed by, (15.67) in Punjab Pink whereas, minimum number of cormels (11.67) was recorded in Orange Ginger. Variation in number of corms and cormels per plant may be due to the differential genetic make-up of the varieties. The present findings are in conformity to the work of Negi *et al*., (1982) Sharma and Sharma (1984) , Anuradha and Gowda (1994) and Pandey *et al*. (2012), in gladiolus.

Table 1. Mean performance of gladiolus (*Gladiolus hybridus* Hort.) genotypes for eighteen characters of gladiolus

S.No.	Genotypes	PH (cm)	NLPP	LL(cm)	LW (cm)	NSPC	LS (cm)	LR (cm)	SPC	DS (cm)	NFPS	FD (cm)	VSD	OFFD	LSD	DC (mm)	WC (gm)	NCPP	CPP
1	Punjab Pink	54.86	6.31	48.90	3.30	0.86	75.20	46.19	0.86	0.90	14.19	7.75	68.73	78.30	13.43	5.13	45.00	1.67	15.67
2	Punjab Glance	49.19	5.86	35.76	2.73	1.01	73.53	47.19	1.01	1.01	12.52	7.76	63.13	75.78	13.79	6.07	55.00	1.62	13.33
3	Pacific	50.01	5.91	41.93	2.21	2.27	60.25	35.00	0.87	0.76	10.15	8.13	68.53	79.75	13.13	5.37	46.33	2.00	15.33
4	Orange Ginger	50.39	5.91	41.73	2.21	2.27	60.25	35.00	0.89	0.80	11.36	8.13	73.18	79.24	20.00	5.23	50.00	1.64	11.67
5	Prabha	63.14	6.52	54.65	2.35	1.87	58.63	28.94	0.88	0.84	11.36	8.39	88.33	99.64	11.65	6.77	78.33	1.33	14.33
6	Sylvia	62.77	6.72	55.04	3.89	1.47	70.96	40.65	0.90	0.88	13.59	7.73	73.99	87.12	16.97	5.47	74.00	1.38	12.33
7	Aldebaran	45.30	6.11	37.32	2.19	2.68	55.81	36.61	1.06	0.72	11.77	7.73	70.75	84.69	17.98	7.27	76.67	1.00	17.33
8	Pricilla	50.04	6.46	43.33	3.19	2.22	65.65	42.42	1.21	1.11	13.33	9.29	73.93	85.04	14.27	5.23	33.33	1.33	12.67
9	Novalux	52.97	6.67	45.43	3.62	2.42	74.74	54.95	1.01	1.01	14.54	8.89	73.93	86.66	15.46	5.70	58.33	1.63	12.00
10	Gold Field	54.06	6.46	46.54	3.37	2.63	71.11	41.61	1.01	1.07	13.53	8.18	87.47	90.81	12.84	5.37	58.33	1.08	14.00
11	Ocilla	50.78	6.67	44.06	3.79	2.42	70.50	51.71	1.21	0.89	15.76	8.48	76.76	91.71	13.25	4.83	31.67	1.64	12.33
12	Kum-Kum	50.17	6.31	43.89	3.65	1.06	60.86	42.88	0.87	0.98	15.40	7.93	85.90	90.26	12.30	4.07	28.33	1.33	12.33
13	Arka Kesher	40.45	6.11	38.29	3.81	2.48	48.53	24.09	0.87	0.86	11.36	7.17	87.12	84.08	15.95	6.10	65.00	1.10	17.33
14	Arka Gold	49.87	6.11	41.69	3.49	1.47	79.24	56.61	1.67	0.87	21.26	10.45	80.25	93.58	14.31	7.10	86.67	1.00	12.67
15	American Beauty	51.06	5.91	44.35	2.88	2.07	86.71	60.45	0.90	0.96	15.20	7.63	82.67	95.40	16.13	5.37	52.67	1.67	15.00
16	Mean	51.67	6.27	44.19	3.13	1.95	67.46	42.95	1.00	0.91	13.69	8.24	76.98	89.60	15.96	5.67	61.31	1.42	13.89
17	Range	40.45	5.86	35.76	2.19	0.86	48.53	24.09	0.86	0.72	10.15	7.17	63.13	75.78	11.65	4.07	28.33	1.15	11.67
18	SE	63.14	6.72	55.04	3.89	2.68	86.71	60.45	1.67	1.11	21.26	10.45	88.33	99.64	20.00	7.27	86.67	2.00	17.33
19	C.V	5.72	0.30	5.53	0.65	0.62	10.06	10.24	0.22	0.11	2.70	0.81	7.91	9.38	3.52	0.86	8.41	0.32	1.88

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SHORT COMMUNICATION

ADOPTION LEVEL AND CONSTRAINTS IN SUMMER RICE PRODUCTION TECHNOLOGY

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Abstract: The study was carried out to determine the farmers' adoption behavior on summer rice production technology. The farmers were selected from Dhamtari District of Chhattisgarh during 2013-14. Findings of the study revealed that 67.36 per cent respondents had adopted high level followed by 23.61 per cent and 9.03 per cent respondents had adopted the summer rice production technology at medium and low level respectively. The major constraints among the several constraints lack of education, small size of land and home related problem, problem of grazing and others not adopted new technology, lack of motivation and guidance about summer rice cultivation, requirement of more investment for summer rice cultivation, no facility of crop insurance, credit is not available at proper time and lack of minimum support price, lack of extension services, lack of rice based industries and distance of krishi Upaj mandi.

Keywords: Adoption, Constraints, Production Technology

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the important food crops of the world both in terms of area (147.30 million ha.) and production (518.40 million tons) it is consumed by more than half of the world population. About 90 per cent of world rice is grown and consumed in Asia and about 2.8 million people derive 35-39 per cent calories intake from rice. Rice is the staple food for more than 65 per cent of the people of India. At present the rice is grown in 44.6 million ha and the production in the country is around 90 MT.

In India, rice is grown in 39.47 million ha during *kharif* season with average productivity of 2217 kg/ha (2011-12). Summer rice is grown in 4.83 million ha with average productivity of 3174 kg/ha (2010-11) in the country. Net sown area of the Chhattisgarh state is 4.828 m ha and the gross sown area is 5.788 m ha. In Chhattisgarh, rice is grown in 3.788 million ha during kharif season with average yield of 1751 kg/ha (2010-11). In Chhattisgarh, area under rabi crops is 1.707 million ha. During rabi season irrigation is available for 0.361 million ha, in which, share of summer rice is 45 per cent (0.164 million ha) with average yield of 1941kg/ha (Sonit, 2013).

MATHODOLOGY

The study was conducted in Dhamtari district of Chhattisgarh state. Two blocks namely Dhamtari and Kurud were randomly selected; further, twelve villages from each block were selected. From each village ten farmers were randomly selected. Thus in all, 144 farmers were selected. The data on constraints aspects of summer rice cultivation were collected through pre-structured questionnaires. To measure the constraints responsible for low adoption of summer rice production technology, a suitable schedule was developed to enlist the possible constraints. Each of the main constraints areas was further divided into sub-areas.

FINDINGS AND DISCUSSION

Table 1. Distribution of respondents according to their level of knowledge regarding summer rice production technology **(n=144)**

S.N.	Practices	Level of knowledge		
		Low F (%)	Medium F (%)	High F (%)
1.	Time of seed sowing	9 (6.25)	26 (18.06)	109 (75.69)
2.	Seed rate	14 (9.72)	53 (36.81)	77 (53.47)
3.	Improved varieties	2 (1.39)	11 (7.64)	131 (90.97)
4.	Application of manure fertilizers	4 (2.78)	101 (70.14)	39 (27.08)

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5.	Water management	0 (0)	98 (68.05)	46 (31.95)
6.	Weed control	9 (6.25)	59 (40.97)	76 (52.78)
7.	Insect control	3 (2.08)	24 (16.67)	117 (81.25)
8.	Disease control	4 (2.78)	67 (46.53)	73 (50.69)

f = frequency, (%) = percent

The data presented in Table 1 reveals that the respondents had low level of knowledge regarding selected practices of summer rice production technology i.e. Seed rate (9.72%), time of seed sowing and weed control (6.25%), application of manure & fertilizers and disease control (2.78%) and insect control (2.08), None of the respondents had low level of knowledge regarding water management. Whereas the respondents who had medium level of knowledge regarding summer rice production technology i.e. application of manure & fertilizers (70.14%), water management (68.05%), disease control (46.53%), weed control (40.97%), seed rate (36.81%), time of seed sowing (18.06%), insect control (16.67%) and improved varieties (7.64%).

While, in case of high knowledge group selected practices are improved varieties (90.97%), insect control (81.25%), time of seed sowing (75.69%), seed rate (53.47%), weed control (52.78%), disease control (50.69%), water management (31.95%) and application of manure & fertilizers (27.08%).

Table 2. Distribution of respondents according to their overall knowledge regarding summer rice production technology **(n=144)**

Level of knowledge	Frequency	Percentage
Low (up to 33.33%)	28	19.44
Medium (33.34 to 66.66%)	99	68.75
High (above 66.66)	17	11.81

The data regarding overall level of knowledge of respondents summer rice production technology are presented in Table 2 indicated that the majority of the respondents (68.75%) had medium level of knowledge regarding summer rice cultivation, whereas, 19.44 and 11.81 per cent of respondents were having low and high level of knowledge, respectively.

It can be concluded that, most of the respondents (68.75%) had medium level knowledge regarding summer rice cultivation.

Table 3. Distribution of respondents according to their level of adoption regarding summer rice production technology **(n=144)**

S.N.	Practices	Level of adoption		
		Low F (%)	Medium F (%)	High F (%)
1.	Time of seed sowing	7 (4.86)	61 (42.36)	76 (52.78)
2.	Seed rate	9 (6.25)	79 (54.86)	56 (38.89)
3.	Improved varieties	4 (2.78)	37 (25.69)	103 (71.53)
4.	Application of manure fertilizers	8 (5.56)	73 (50.69)	63 (43.75)
5.	Water management	0 (0)	87 (60.42)	57 (39.98)
6.	Weed control	5 (3.47)	66 (45.83)	73 (50.70)
7.	Insect control	3 (2.08)	36 (25.00)	105 (72.92)
8.	Disease control	5 (3.47)	81 (56.25)	58 (40.28)

f = frequency, (%) = percentage

The data presented in Table 3 reveals that the respondents had low level of adoption regarding selected practices of summer rice production technology i.e. Seed rate (6.25%), application of manure & fertilizers (5.56%), time of seed sowing (4.86%), weed control and disease control (3.47), improved varieties (2.78%), insect control (2.08%). And none of the respondents had low level of adoption regarding water management.

Whereas the respondents who had medium level of adoption regarding summer rice production technology i.e. water management (60.42%), disease control (56.25%), seed rate (54.86%), application of manure & fertilizers (50.69%), weed control (45.83%), time of seed sowing (42.36%), improved varieties (25.69%) and insect control (25.00%).

While, in case of high adoption group selected practices are insect control (72.92%), improved varieties (71.53%), time of seed sowing (52.78%), weed control (50.70%), application of manure & fertilizers (43.75%), disease control (40.28%), water management (39.58%) and seed rate (38.89%).

Table 4. Distribution of respondents according to their overall adoption regarding summer rice production technology **(n=144)**

Level of adoption	Frequency	Percentage
Low (up to 33.33%)	34	23.61
Medium (33.34 to 66.66%)	97	67.36
High (above 66.66%)	13	9.03

It is clearly indicated from the Table 4 that 67.36 per cent of respondents had medium level of adoption about summer rice production technology, followed by low level adoption category which comprised of 23.61 per cent of the respondents. While, only 9.03 per cent of the respondents were found in high level of adoption category. Kushwaha (2005) also noted almost similar findings.

Table 5. Distribution of the respondents according to their socio-economic constraints **(n=144)**

Constraints	Frequency*	Percentage
Personnel constrains		
Home related problem	23	15.97
Small size of land	28	19.44
Lack of education	45	31.25
Social constraints		
Others not adopted new technology	22	15.27
Lack of motivation and guidance about summer rice	18	12.5
Problem of grazing	27	18.75
Economical constraints		
Requirement of more investment	83	57.63
Credit is not available at proper time	62	43.05
Lack of minimum support price	44	30.55
No facility of crop insurance	78	54.16
Institutional constraints		
Lack of extension services	54	37.50
Distance of krishi Upaj Mandi	38	26.38
Lack of rice based industries	46	31.94

* Data are based on multiple responses

The data indicated Table 5 that regarding constraints in adoption of cultivation practices of summer rice.

As regards to personnel constraints, 31.25 per cent lack of education, 19.44 per cent small size of land and 15.97 per cent home related problem.

Similarly, social constraints problem of grazing (18.75%), 15.27 per cent others not adopted new technology and 12.50 per cent lack of motivation and guidance about summer rice cultivation.

As regards to economical constraints, 57.63 per cent requirement of more investment for summer rice cultivation, followed by 54.16 per cent no facility of crop insurance, 43.05 per cent credit is not available at proper time and 30.55 per cent lack of minimum support price.

In case of institutional constraints, 37.50 per cent lack of extension services, followed by 31.94 per cent lack of rice based industries and 26.38 per cent distance of krishi Upaj mandi.

CONCLUSION

Majority of the farmers showed medium level of overall adoption of recommended technology. lack of education, small size of land and home related problem, problem of grazing and others not adopted new technology, lack of motivation and guidance about summer rice cultivation, requirement of more investment for summer rice cultivation, no facility of crop insurance, credit is not available at proper time and lack of minimum support price, lack of extension services, lack of rice based industries and distance of krishi Upaj mandi.

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SHORT COMMUNICATION

TECHNOLOGICAL CONSTRAINTS FACED BY FARMERS IN ADOPTION OF COMPOSITE FISH CULTURE TECHNOLOGY

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Abstract: The study was conducted in Raipur district of Chhattisgarh. The major constraints perceived by the fish farmers were high cost of preparation, eradication of weeds, fertilizers feeds, and dragnet. Lack of knowledge, lack of availability of sources, lack of efficient marketing structure, lack of finance, high cost if lease, and aspect of recommended technology are some other major constraints reported by the respondents in adoption of recommended composite traditional practices of fish farming as a result the adoption rate of recommended technology was low (28.37 percent).

Keywords: Constraints in fish culture, Composite fish culture

INTRODUCTION

The importance of fish culture as a source of food production was driven home more realistically and emphasis has laid on the need for extending fish cultural activities in all the part of the country with a view for developing the industry on scientific line, both in private and public sectors. The Government of India established the Central Inland Fisheries Research Station at Calcutta in 1947 to conduct scientific investigation for an appraisal of the inland fisheries resources of the country and for evolving suitable methods directed towards their proper conservation management and development. India's ranks second inland fish production in the world but the per capita consumption of fish in our country is very low (2.6 kg/year). At present, the yearly requirement of fish would be more than six million tones, but our present production is about 3.5 million tones only. Fish constitutes an important item of food to a large section of people in India. The National Commission of Agriculture (1976) estimated that the percentage of fish and meat eating population of about 70 per cent. Fish is an integral and essential item of daily diet and also for many ritual and social occasion. Though fish is on great demand by the fish eating population of the country, it continues to remain scare and costly. The nutritional imbalance in the diet of the fish acting population caused by protein deficiency would in the long run, affect their health and stamina, unless steps are taken to supply adequate quantities of fish at reasonable price. Fish production from inland water is of great significance to India.

Chhattisgarh is blessed with a number of resources including productive water in the form of rivers, tanks and reservoirs etc. Its climatic conditions (mainly temperature being 35° -30°C and rainfall being 1200-1500 mm) are quite congenial for pisciculture. The natural fish fauna consists of Catla, Rohu, Mrigal, Mahasheer, Siland, Padina, Singhad, Bam Patola, Chittal, Kalbasu, Kursa, Kharpata, Bata etc. Exotic varieties like Common carp, Grass carp and Silver carp have become common here where Tilapia is is also found sometimes. Each village of Chhattisgarh is bestowed with 2 to 5 ponds, but majority of them are seasonal in nature. Their fishing rights rest with the Gram Panchayat and panchayat gives them on lease to local fishermen, who in turn partially culture fish and release of fish seed is a common practice. Input addition is very poor and culture means release of seed and harvest only. The average fish production from these village ponds is 0.5 to 1.0 t ha^{-1} $year^{-1}$, these needs to be raised to at least 3.0 tonnes ha^{-1} $year^{-1}$ (Anonymous, 2000-2001)

MATERIAL AND METHOD

The study was conducted in Raipur district of Chhattisgarh. District was selected purposively because it has maximum fish production. Dharsiwa block was selected on the basis of maximum number of farm ponds for fish production as compared to other blocks. 67 villages have farm ponds for fish cultivation. For this study 16 villages were selected as they have more than 5 fish pond. From each of the selected village, 5 respondents were randomly selected. In this way total (16 x 5 = 80) respondents were selected. All the respondents were doing fish culture on lease pond and the leased fish farmers were considered in sample for the collection of data. Data were collected through pre-tested questionnaire and that was analysed through statistical tools.

RESULT AND DISCUSSION

Constraints in adoption of composite fish culture technology

Technological constraints as perceived by fish farmers in the adoption of recommended composite fish culture technology

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The data compiled in Table 1 reveal that high cost of pond preparation and water supply were found as major constraint (81.67 MPS). Timely not available of different input was reported as second major constraint (70 MPS) and unavailable source of irrigation was ranked as third constraint with 15.62 MPS. With regards to constraints related with the eradication of weeds, it was found that majority of respondents (36.67 MPS) faced the high cost of method. While fertilizer application in pond among major constraints, majority of the respondents (25.41 MPS) had lack of knowledge and minimum was due to government pond (20.62 MPS).

Table 1. Technological constraints as perceived by fish farmers in adoption of recommended composite fish culture technology (n=80)

	Technology constraints	MPS*	Ranks
(A)	**Pond preparation and water supply**		
•	Timely not availability of different input	70	II
•	High cost of preparation	81.67	I
•	Not available irrigation source	15.62	III
(B)	**Eradication of weeds**		
•	Lack of knowledge	31.25	I
•	High Cost of method	36.67	II
(C)	**Fertilizer application in pond**		
•	Lack of knowledge	25.41	I
•	Due to Govt. pond	20.62	II
(D)	**Improved breeds and their ratio**		
•	Lack of knowledge	25.84	I
•	Not available	12.08	III
•	High cost of fingerlings	12.5	II
(E)	**Feed management**		
•	Not available	35.41	II
•	High cost of feed	51.67	I
(F)	**Control of disease/ harmful insect**		
•	Lack of knowledge	45	I
•	Lack of technical proficiency	28.33	II
(G)	**Harvesting of fish**		
•	High cost	23.66	II
•	Not available dragnet	40.20	I
(H)	**Transportation**		
•	High cost of transportation	19.28	II
•	Not available at proper time	19.79	I
(I)	**Market**		
•	Fluctuation in price during different seasons	10	III
•	Fluctuation in price during religious function		
•	Not available wholesale market	47.5	I
•	Lack of knowledge		
		6.25	IV
		12.5	II

MPS* Mean per cent score.

About 25.84 MPS respondents reported that lack of knowledge, 12.5 MPS was found the high cost of fingerlings and 12.08 MPS was faced not availability of improved breeds and their ratio. Regarding the feed management, high cost of feed was reported as first major constraint (51.67 MPS), while, unavailability of feed was found as second major constraint with 35.41 MPS. Among major constraints in control of disease and harmful insect, lack of knowledge scored first with 45 MPS, while, lack of technical proficiency was reported as second ranked constraint was 28.33 MPS. With regards to constraints related with the harvesting of fish, it was found that majority of respondents (40.20 MPS) faced the unavailability of dragnet and 23.66 MPS was found the high cost of the harvesting of fish. About 19.79 MPS the respondents reported that due to improper time of the transportation facility and 19.28 MPS was found high cost of transportation. Regarding marketing, first major constraint was (57.5 MPS) fluctuation in price during different seasons and religious functions with and was followed by 12.5 MPS by the respondents due to lack

of knowledge, while, only 6.25 MPS was found due to unavailability of wholesale market.

Effect of different constraints as perceived by fish framer in adoption of recommended composite fish culture

With regards to constraints (Table 2) related with the nature, erratic rainfall was found as major constraint with 86.67 MPS. Drought condition was recorded as second major constraint (53.75 MPS) and soil condition was found as third important constraint with 6.67 MPS. While accessing personal constraints, home related problems with 31.87 MPS recorded as firs constraint. While lack of technical proficiency (29.79 MPS) was ranked second constraint followed by lack of time for the inspection (20.83 MPS), Dislike among the family and social constituted the major social constraint (36.04 MPS). Whereas, not acquired mixed fish cultivation scored second rank with 20.83 MPS and followed by constraints competition for getting the ponds (18.75). With regards to economical constraints, lack of knowledge (48.34 MPS), was the major constraint followed by high rate of interest (41.47 MPS), lack of credit facility (35 MPS), improper time (32.3 MPS) and requirement of more investment (6.67 MPS). While data recorded for institutional constraint reveal that lack of extension facility (91.87 MPS) was the major constraint, whereas, lack of co-operative society ranked second (15 MPS) followed by lack of knowledge about institution help (10.62 MPS).

Table 2. Effect of different constraints as perceived by fish farmers in adoption of recommended composite fish culture technology (n=80)

	Constraints	MPS*	Ranks
(A)	**Natural**		
•	Erratic rainfall	86.67	I
•	Due to drought condition	53.75	II
•	Soil is not good	6.67	III
(B)	**Personal**		
•	Lack of technical proficiency	29.79	II
•	Home related problems	31.87	I
•	Lack of time for the inspection	20	III
(C)	**Social**		
•	Dislike among the family and social	36.04	I
•	Competition for getting the ponds	18.75	III
•	Not acquired mixed fish cultivation	20.83	II
(D)	**Economical**		
•	Requirement of more investment	6.67	V
•	Not available proper time	32.5	IV
•	Lack of credit facility	35	III
•	High rate of interest	41.87	II
•	Lack of knowledge	48.34	I
(E)	**Institutional**		
•	Lack of co-operative society	15	II
•	Lack of extension facility	91.87	I
•	Lack of knowledge about institution help	10.62	III
(F)	**Control of disease/ harmful insect**		
•	Lack of knowledge	45	I
•	Lack of technical proficiency	28.33	II
(G)	**Harvesting of fish**		
•	High cost	23.66	II
•	Not available dragnet	40.20	I
(H)	**Transportation**		
•	High cost of transportation	19.28	II
•	Not available at proper time	19.79	I
(I)	**Market**		
•	Fluctuation in price during different seasons	10	III
•	Fluctuation in price during religious function	47.5	I
•	Not available wholesale market		
•	Lack of knowledge	6.25	IV
		12.5	II

MPS* Mean per cent score.

CONCLUSION

The most important perceived by fish farmers was non-availability of optimum credit for fish cultivation followed by timely non-availability of different inputs, high price of input, lack of information about the technology of composite fish culture, lack of contact with competent fishery extension personnel and scarcity of seed of exotic carps, lack of pure seed of indigenous carps, diverse of fish and lack of facility for soil and water testing.

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SHORT COMMUNICATION

INFESTATION OF LEAF MINER (LEPIDOPTERA: LITHOCOLLECTIDAE) ON KARANJ (*PONGAMIA PINNATA*) AT RAIPUR, CHHATTISGARH

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Abstract: The leaf miner or leaf blotch miner, *Acrocercops anthrauris* [*Lithocollectis virgulata*] is a very serious and common pest on the plantation of karanj, *Pongamia pinnata* that observed at Agroforestry field, Igkv, Raipur. This pest damaged by done in larval stage. They make circular blotches on the upper surface of the leaves. Maximum number of blotches was recorded up to 12-16 blotch per leaf. In during the present investigation, studies on the various provenances of karanj, *P. pinnata* against blotch miner revealed that the Ambikapur provenances was more susceptible to the attack of this pest.

Keywords: Leaf blotch miner, Number, Provenances

INTRODUCTION

Studies on the infestation of leaf miner, *Acrocercops anthrauris* [*Lithocollectis virgulata*] on karanj, *Pongamia pinnata* was conducted Agro-forestry field, IGKV, Raipur. *Pongamia* is a genus having one species only *Pongamia pinnat*a (L.) which belongs to family Leguminosae and subfamily Papilionaceae (Merra et al. 2003). Leaf Blotch miner is a very serious and common pest of karanj, *P. pinnata*. The larvae made circular blotches on the upper surface of the leaves along with remain inside the blotch. The leaf miners constitute mainly two species viz *Acrocercops anthracuris* Meyrick and *Lithocollectis virgulata* Meyrick (Lep. Lithocollectidae), the larvae forming large blotch – mines. Only a single larva has found within a blotch and goes to pupation inside. On an average 2-3 blotches per leaf were observed but maximum number of blotches was recorded up to 12-16 blotch per leaf. Blotch sized about 8-20 mm in length and 4-12 mm in width. The full grown larvae were slender minute orange yellow with black large head and measured about 4-6 mm in length. Severe infestations led to reduction in the photosynthesis part of the leaves thus reducing vigour of the plants.

MATERIAL AND METHOD

In the present investigation during 2013-14 on the screening of various provenances against various insect pests of karanj, *P.pinnata.* For taking observations, the whole experimental field was divided into 6 blocks, each block consisting of 18 trees based on their provenance. The observation was recorded on the various numbers of blotches on each leaf from each block, five trees were randomly selected per provenance and from it five randomly selected twigs per tree were observed. Each twig had about 5-7 leaves. After taking the field data, find out the average number of blotches per leaf.

RESULT AND DISCUSSION

The larvae of the insect feeds on the soft tissues eating away on shallow depression during Aug to Sept. Stunted growth (considerable percentage of leaves is damaged) (Anonymous, 2008). The mean maximum population of blotch miner was observed in the provenance Ambikapur which was recorded 2.23 blotches /leaf and minimum population in the provenance Zaheerabad which was recorded to be 0.79 blotches/ leaf during peak period. Hence, it can be concluded that Ambikapur provenance was more susceptible but Zaheerabad provenance was less susceptible to the attack of leaf blotch miner. (Table:1.1) On the basis of mean number of blotches recorded on the various provenances, it can be arranged in ascending order as :

Arranged data to ascending order based on the number of leaf blotch per leaf:

Zaheerabad (0.79) < Keesaragutta (0.90) < Nainpur (0.96) < Jabalpur (1.66) < Raipur (1.76) < Ambikapur (2.23)

Table 1. To find out the infestation of leaf blotch miner on Karanja, *P. pinnata*

S.N.	Provenances	R-1	R-2	R-3	R-4	R-5	Total	Mean
1.	Raipur	4.083	1.294	0.656	0.848	1.966	8.84	1.76

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2.	Ambikapur	0.714	6.08	1.096	0.843	2.464	11.19	**2.23**
3.	Jabalpur	1.161	2.111	3.826	0.606	0.612	8.31	1.66
4.	Nainpur	0.521	0.857	0.75	1.965	0.75	4.84	0.96
5.	Zaheerabad	1.103	0.724	0.62	0.758	0.782	3.98	**0.79**
6.	Keesaragutta	1.129	0.655	0.787	0.846	1.130	4.54	0.90
	SEm±	0.583						
	CD(5%)	NS						

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