NATURAL OCCURRENCE OF SECONDARY CAPITULA PHENOTYPE IN *CALENDULA OFFICINALIS* L.

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Abstract: During the spring season (February-April) 2015, the natural occurrence of secondary capitula phenotype was found in *Calendula officinalis* L. in DAV University Campus, Jalandhar, Punjab, India. Out of all *C. officinalis* plants grown, 5.3% were found to bear secondary capitula emerging from primary capitula. One plant was found to bear a tertiary capitulum. A comparative analysis of this dataset of naturally occurring secondary capitula was made with the previous reports of secondary capitula phenotype in *C. officinalis* induced by Gibberlic acid (GA) treatment. The observations were found to be in congruence with a previous report. Further, a possible phytopathogen *i.e.* phytoplasma, was also addressed as a potential cause of the phenomenon.

Keywords: *Calendula officinalis*, Plant, Seed

INTRODUCTION

English marigold commonly known as *Calendula officinalis* belongs to family Asteraceae andis a well known ornamental plant grown as a winter annual in the North India. It is indigenous to central, eastern and south Europe and is commonly cultivated in the Balkans, Eastern Europe, Germany, India and North America (Khan *et al*., 2011). Besides its ornamental importance, it is also known for of its medicinal properties. Its flowers are known to exhibit anti-Inflammatory, anti-tumor-promoting, anti-HIV, anti-microbial, wound healing and cytotoxic properties (Ukiya *et al*., 2006; Preethi and Kuttan, 2009; Khalid and da Silva, 2012). The plant bears the terminal flower heads *i.e.* Capitula at the shoot apex of the main stem as well as on the axillary branches which are light yellow to deep orange in colour. In bisexual disc florets, only male part is functional, however, the ray florets are unisexual females (Ram and Mehta, 1978).

In the *C. officinalis* plants grown in DAV University campus, authors found a floral deformity in the form of secondary capitula. Previous studies have reported the induction of secondary capitula in *C. officinalis* by GA treatment (Bose and Nitsch, 1970; Ram and Mehta, 1978). However, we report the natural occurrence of secondary capitula phenotype in *C. officinalis* without GA treatment in Punjab, India along with its comparison with such previous studies. Further, we have also discussed a probable phytopathogenic cause *i.e.* phytoplasma, which have also been associated with such symptoms (Pavlovic et al., 2014) previously.

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MATERIAL AND METHOD

Seed procurement and nursery rising

The seed of *Calendula officinalis* cv. Bon Bon were procured from Benary, Germeny. A nursery bed was prepared as per regular cultivation practices. The seeds were sown during the month of First week of November, 2014.

Transfer of plants to flower beds

The nursery raised plants were transferred to flower beds during second-third week of December, 2014. The flower bed preparation was done as per regular floricultural practices.

Data collection

The plants grown in DAV University campus were checked for the natural presence of secondary capitula and the total number of plants with and without secondary capitula were counted. The number of secondary capitula and their arrangement on the primary capitula were also studied. The photographs were captured using a digital camera.

Statistical analysis

Chi square test was conducted to check goodness of fit of the frequency of secondary capitula recorded in our study, with the observed frequency of secondary capitula recorded by Ram and Mehta (1978) at $p \leq 0.05$.

RESULT AND DISCUSSION

After the transfer of the nursery raised *C. officinalis* plants to the flower beds, the first flower appeared in the third week of January, 2015. The authors noticed the appearance of secondary capitula in the second week of March, 2015. Out of 2830 plants, 150 plants

were found bearing secondary capitula (Fig. 1b-h). The secondry capitula were emrging mostly from the center of the receptacle and occasionally from along the periphery. Preiviously, Bose and Nitsch (1970) have also reported that all the inflorescences, both terminal and axillary on the GA treated plants developed secondary inflorescences, mainly along the periphery of the thalamus. However, in their report, no secondary head was recorded in the inflorescences of control plants. In contrary to this, Ram and Mehta (1978) reported the formation of secondary capitula in the control plants *i.e.* not treated with GA. Both the reports although reported the induction of secondary inflorescences in response to GA. In our case, we also found the formation of secondary capitula in *C. officinalis* in the plants growing under natural conditions (not treated with GA). We tested the goodness of fit of our data with the previous report (Ram and Mehta, 1978) suggesting 6% of the control plants showing secondary capitula using χ^2 test at $p \leq 0.05$ and found no significant difference with the previous report (Table 1.1).

Further, one plant was found to have the tertiary capitula, however, on the contrary no tertiary capitula was recorded by Ram and Mehta (1978) in control plants. Although, GA treated plants showed the tertiary capitula formation at higher doses. The highest number of secondary capitula emerging from single primary capitula was 12 (Fig. 1e). Further a fusion of varying degrees of was found in the peduncles of secondary capitula (Fig. 1f-h). Recently, similar symptoms in *C. officinalis* were described under a disease, Phyllody caused by Stolbur Phytoplasma in Serbia (Pavlovic et al., 2014). Phytoplasmas are often associated with various symptoms in affected plants that are indicative of hormonal imbalance. Recently, altered gibberellin homeostasis was found in phytoplasmas infected plants (Ding et al., 2013; Mardi et al., 2015). An up-regulation was reported in the genes related to the diterpenoid pathway that leads to the biosynthesis and catabolism of GAs, in Mexican lime trees infected by phytoplasma (Mardi et al., 2015). However, in contrast to this Ding et al., (2013) found that infection by potato purple top phytoplasma causes reduction in endogenous levels of gibberellic acid (GA_3) in tomato plants mediated by the down-regulation of GA biosynthesis genes *GA20ox1* and *GA3ox1* and also by the down-regulations of genes involved in formation of GA precursors *i.e.* geranyl diphosphate synthase (*GPS*) and copalyldiphosphate synthase (*CPS*). Therefore, although the symptoms of many phytoplasmas are associated with hormonal imbalances (particularly GA); no general rule of up-regulation or down-regulation of GA should be applied. Rather, the studies should be made on case by case bases.

Keeping the above studies in mind a phyto-pathological investigation (sequencing phytoplasma 16s rRNA) is required to associate the disease with phytoplasma, if so. Further, the endogenous level of GA in the plants bearing secondary capitula and plants not bearing any secondary capitula is required for establishing the role of GA in this case. Before obtaining further insights, authors hereby report the first natural occurrence of secondary capitula phenotype in *C. officinalis* in Punjab, India and suggested its possible link with the change in endogenous GA level regulated by a probable pathogen *i.e.* phytoplasma.

Table 1. Chi square test on the number of plants in which secondary capitula and without secondary capitula with the expected frequency of secondary capitula recorded by Ram and Mehta (1978), at $p \leq 0.05$.

Description	**Number of plants**		**Total**
	With secondary capitulum	**Without secondary capitulum**	
Observed frequency (O)	150	2680	**2830**
Expected frequency (E) as per Ram and Mehta (1978)	169.8	2660.2	**2830**
Deviation (O−E)	-19.8	-19.8	
Square of deviation $(O-E)^2$	392.04	392.04	
$(O-E)^2/E$	2.308834	0.147372	**2.456206**
	χ^2=2.456206	**$\chi^2_{(critical,\ p\leq0.05)}$=3.841**	**Not. sig. dif.**

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Figure legends

Fig 1 : a. Primary capitulum of *Calendula officinalis* **b.** A bunch of secondary capitula emerging from primary capitulum **c-e.** varing number of secondary capitula emerging from primary capitula **f-h.** varying degrees of fusion of peduncles of secondary capitula indicated by black arrows.

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INFLUENCE OF WEATHER PARAMETERS ON PEARL MILLET (*PENNISETUM GLAUCUM* L.) VARIETIES AT ALLAHABAD

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Abstract: A field experiment was conducted during the kharif season 2014 at the research farm of School of Forestry & Environment, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad, to find out influence of weather parameters on pearl millet (*Pennisetum glaucum* L.) varieties under Allahabad condition in Randomized block design (factorial) with nine treatments replicated thrice. The results revealed that on 23rd July maximum growing degree day (1874.4 ^{0}C), hygrothermal unit-I (159679.6%), hygrothermal unit-II (100522.0%), photo temperature (2968.4 ^{0}C), nycto temperature (2968.4 ^{0}C). Whereas, maximum photo thermal unit (18885.2 ^{0}C), heliothermal unit (12147.9^{0}C) and inter-diurnal temperature (846.8 ^{0}C) was recorded at 06 August sowing date.

Keywords: Pearl millet, Varieties, Agrometeorological indices

INTRODUCTION

In last few decades, there has been an increasing of the importance of millets in India, major cereals which are grown on soils supplied with large quantity of fertilizers, irrigation and pesticide inputs have attained yield plateau. Millets have potentiality of contributing to increased food production, both in developing and developed countries. Millets are one of the cereals asides the major wheat, rice, and maize. Millets are major food sources for millions of people, especially those who live in hot, dry areas of the world. Millets are classified with maize, sorghum, and Coix (Job'stears) in the grass sub-family Panicoideae. In contrast, millet is the major source of energy and protein for millions of people in Africa. It has been reported that millet has many nutritious and medical functions (Yang *et al*. 2001). They are grown mostly in marginal areas under agricultural conditions in which major cereals fail to give substantial yields. Pearl millet [(*Pennisetum glaucum* L.) Br. Emend stuntz.] popularly known as *Bajra*, cattle millet, bulrush millet belongs to the grass family or gramineae. In the world, it's rank sixth followed by rice, wheat, corn, barley and sorghum (Anonymous, 2010). However, in India, it is fourth most important cereal crop after rice, wheat and sorghum. It has the greatest potential among all the millets. In India, annual planting area under pearl millet is 9.4 million hectares producing nearly 10.1million tonns of grains. The Pearl millet growing countries are India, China, Nigeria, Pakistan, Sudan, Egypt, Arabia, and Russia. India is the largest producer of Pearl millet in the world. In India major producing state are Rajasthan (46%), Maharashtra (19%), Gujarat (11%), Uttar Pradesh (8%) and Haryana (6%). Sowing time is the most important non-monetary input influencing crop yield. Sowing at optimum time improves the productivity by providing suitable environment at all the growth stages. Upadhyay *et al*. (2001) have reported higher grain yield of summer pearl millet when sown on 15 march and found reduction in grain yield with delay in sowing. Identifying suitable time of sowing for pearl millet during summer is important to have proper growth and development of plants, save the crop from early monsoon showers and timely vacate the field for succeeding kharif crop. Keeping in view of the importance the study was aimed to investigate influence of weather parameters on pearl millet (*Pennisetum glaucum* L.) varieties under Allahabad condition

MATERIAL AND METHOD

The study was conducted at research farm of School of Forestry & Environment, Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed-to-be-University), Allahabad during in one year 2014-2015 in the *Kharif* season. The area is situated on the south of Allahabad on the right hand of rivers Yamuna at Rewa Road at a distance of about 06 km of Allahabad city. It is positioned at 25^{o}57' N latitude 81^{o}50'E longitude and at the altitude of 98 meters above the sea level. Allahabad has a sub-tropical climate prevailing in the south east part of U.P. With both the extremes in temperature the summer. In summer the temperature rises up to 46-48^{0}C during the month of May and June. The average rainfall is around 1013.4 mm achieve is mostly received during the middle of July to end of August. Both the mechanical and chemical analysis of soil were done before the start of the experiment to ascertain the initial fertility gradient of the soil fence, the soil of the experimental field was analyzed mechanically and found, sand was 60%, clay 26%,

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slit 14% and its fall under textural class of sandy loam.

Chemical Analysis

The chemical analysis was done for pH, Organic carbon, Electrical Conductivity (EC), available nitrogen, phosphorus and potassium. pH was determined by Digital pH meter. The organic carbon was estimated by Walkley and Black method (1934). The Electrical Conductivity (EC) was estimated by electrical conductivity meter. The available nitrogen was estimated by Kjeldahl method, the available phosphorus was determined by Olsen's Spectrophotometer method and available potassium was determined by Flame photometer analysis are presented in the following table 1.

Table 1. Chemical properties of soil before sowing

Analysis	**Quantity**	**Method**
Bulk density(g/cm^3)	1.64	Core method (Black, 1965)
Particle density (g/cm^3)	2.70	Volumetric flask method (Black, 1965)
Pore space (%)	34.3	Volumetric flask method (Black, 1965)
Water holding capacity (%)	11.37	Volumetric flask method (Muthuaval *et al.* (1992)
pH (1:2)	7.6	Digital pH meter (Jackson, 1973)
EC (dSm^{-1})	0.38	Digital EC meter
Organic carbon %	0.36	Rapid titrations method (Wilcox, 1955)
Available nitrogen (kg ha^{-1})	260	Alkaline permanganate Subbiah, and Asija, (1956)**.**
Available Phosphorus (kg ha^{-1})	26	Colorimetric method (Olsen,1954)
Available Potassium (kg ha^{-1})	252	Flame Photometric method (Toth and price, 1949)

The field experiment were laidout in a randomized block design 3X3 factorial with 9 treatment combination, each treatment replicated three times. The factors were located randomly and 3 sowing dated and 3 pearl millet varieties. This design allowed irrigation and other cultural practices to be performed on each sowing time independently. Treatment combinations as follows viz.,

Treatment details

Treatment No.	**Treatment Combination**	**Varieties**	**Dates**
T_1	D_1V_1	Ganga kaveri-22	23^{rd} July
T_2	D_1V_2	DHANYA-1	
T_3	D_1V_3	Pusa-322	
T_4	D_2V_1	Ganga kaveri-22	30 July
T_5	D_2V_2	DHANYA-1	
T_6	D_2V_3	Pusa-322	
T_7	D_3V_1	Ganga kaveri-22	6^{th} August
T_8	D_3V_2	DHANYA-1	
T_9	D_3V_3	Pusa-322	

Seed treatment were performed with Chloropyriphos @ 4 ml kg^{-1} seed to control termite and squirrel all such. Recommended dose of fertilizer was applied through chemical fertilizers at the time of sowing. The nutrients were applied in the form of urea $[CO(NH_2)_2]$ and di-ammonium phosphate $[(NH_4)_2HPO_4]$. Nitrogen was applied in three split doses with 50 percent as basal application, 25 percent at 25 days after sowing and remaining 25 % at sowing after 45 DAS. Subsequently irrigation was applied to the crop as per requirement. Other plant protections measures were taken as and when required. The seeds were sown as per the treatment combination. The observations were recorded on five randomly selected competitive plants in each replication. Agro meteorological indices developed by utilizing various meteorological elements are found in literature to study the crop weather relationships. The indices such as (i) Growing degree days (GDD), (ii) Photo thermal units (PTU), (iii) Heliothermal units (HTU), (iv) Phenothermal index were employed in the present study. The methods of computation of the indices are as under. Growing degree days (GDD) in this investigation (remainder index) were calculated by simple accumulation of daily mean air temperature above a given threshold or base temperature.

It can be mathematically expressed as

$$GDD = \sum_{ds}^{dp}[(Tmax. + Tmin.)/2 - Tb]$$

Photothermal unit (PTU)
The photothermal unit which takes into account the maximum possible duration of day light (day length factor or maximum possible sunshine hours) were worked out for each day by multiplying the growing degree days for a day with the corresponding day length factor (Rajput, 1980). The response of crop was examined in relation to both photo thermal units and growing degree days. The degree days for each date of sowing and varieties for different phenological stages were calculated in terms of PTU from the formula given by Wang (1963).

$$PTU = GDD \times N$$

Where, N- Maximum possible sunshine hours which varies with latitude and month at a location

Heliothermal units (HTU)
The value of heliothermal unit represents the product of GDD and actual duration of bright sunshine hours (BSS) for a particular day as recorded by the sunshine recorder .This may be termed as actual photothermal unit. The heliothermal units for each planting i.e. date of sowing and varieties for different phenological stages were calculated by following expression.

$$HTU = GDD \times n$$

Where, n = Actual duration of bright sunshine hours as recorded by sunshine recorder for a particular location

Phenothermal index
The phenothermal index is expressed as degree day per growth day It can be expressed as under

$$\text{Phenothermal Index} = \frac{\text{Accumulated thermal units during phenophase}}{\text{Duration of the phenophase}}$$

Hygrothermal unit-I&II
The value of hygrothermal unit represents the product of GDD and relative humidity (Morning & afternoon) for a particular day as recorded by the observatory.
HgTU = GDD x RH
The data observed were subjected to statistical analysis as for the methods detailed by Gomez and Gomez (1984).

RESULT AND DISCUSSION

The result obtained during the present course of investigation was carried out to visualize a significant influence of different date sowing

Temperatures
In case of the average per day maximum temperature remained more or less same for 23rd July and 06 August sowing conditions. However, maximum temperatures were higher for D_1 (23rd July) and D_2 sown conditions. Per day Maximum temperature increased constantly during flowering, milking and Dough stage in different sowing conditions (Table. 3). On the other hand, per day minimum temperature was higher in D_3 (06 August) sown conditions and irrespective of duration of maturity period (Table.4). The average per day mean temperature decreased constantly during flowering, milking and Dough Stage development in D_1 and D_3 sowing conditions except second dates of sowing.

Relative humidity-I and Relative humidity-II
The average per day RH during morning hours decreased gradually from sowing to grain development stage in all dates of sowing. Among dates of sowing, the per day morning relative humidity was found to be higher in D_3 (85.98 %) and followed by D_2 (85.24%) sowing conditions. The per day evening relative humidity was observed highest in D_2 sowing conditions (53.87%) however it was observed minimum in D_3 (52.95) (Table.5).

Bright sunshine hours
The average bright sunshine hours for the whole crop season under different sowing conditions remained slightly higher in D_3 (6.33 hours/day) than other dates of sowing. Among dates of sowing, the bright sunshine hours increased consistently from sowing to maturity stage in D_1 and D_2.

Active evaporation (hr/day)
The average active evaporation (hr/day) for the whole crop season under different sowing conditions remained slightly higher in D_1 (3.87 hours/day) than other dates of sowing. Among dates of sowing, the active evaporation hours increased consistently from sowing to maturity stage in D_2 and D_3 (Table 7).

Growing degree days
The data pertaining to accumulated heat units in different date of sowing are presented in table. 8 Different dates of sowing significant influenced GDD. The GDD accumulation was significantly highest in D_1 (1874.4 day °C) than other dates of sowing. The minimum GDD was accumulated in D_3 sowing (1814.9 day °C).The GDD accumulation was highest in D_1 due to longer duration of crop growing period and lowest in D_3 sowing due to forced maturity caused by increase in temperature. The decrease in GDD may be due to decrease in the maturity period of the pearl millet.

Photothermal unit
The photothermal unit (PTU) under various dates of sowing is presented in the table 8 Different dates of sowing were found to be significant for accumulation of PTU.
However, crop dates of sowing were significantly differed for accumulation of photothermal unit (PTU). The highest PTU was obtained by D_3

(18885.2°day hrs) followed by D_2 (18854.8°day hrs). However, non significantly lowest PTU was recorded by D_1 (11575.5°day hrs).

Heliothermal units

The accumulated heliothermal unit (HTU) under various dates of sowing is presented in the table 8. Different dates of sowing significantly influenced heliothermal unit (HTU). The D_3 accumulated maximum heliothermal units (12147.9°day hrs) to reach maturity stage. The lowest HTU was accumulated in D_1 sowing date that is (11629.4°day hrs).This may be due to cloudiness prevailed during the grain development stage of D_1 sown crop.

Hygrothermal Unit-I

The accumulated morning hygrothermal unit-I required by the crop for various phenophases under different dates of sowing are presented in table 8. The hygrothermal unit-I significantly influenced by dates of sowing. The hygrothermal unit-I was highest (159679.6°day%) in the D_1 followed by D_2 (158131.6°day%). The accumulation of HgTU-I was the lowest in D_3 (155445.9°day%) due to short crop growth period.

Hygrothermal Unit-II

The accumulated afternoon hygrothermal unit –II accumulated the crop during various phenophase under different dates of sowing are presented in the table 8.

The hygrothermal unit-II (HgTU-II) significantly influenced by different dates of sowing. The D_1 sown condition accumulated the highest hygrothermal unit (100522.0°day%), while lowest hygrothermal unit-II was accumulated by D_3 sowing condition (94968.7°day%).

Photo temperature (T_{photo})

The photo temperature (T_{photo}) significantly influenced by different dates of sowing (Table 8.). The photo temperature was the highest in the D_1 (2968.4^0C) followed by D_2 sowing condition (2951.9^0C). The lowest photo temperature was taken by D_3 sowing condition (2928.7^0C).

Nycto temperature (T_{nycto})

The nycto temperature (T_{nycto}) significantly influenced by different dates of sowing.The nycto temperature was the highest in D_1 sowing conditions (2580.5^0C) followed by D_2 sowing condition (2541.2^0C). The lowest photo temperature was taken by D_3 sowing condition (2500.9^0C).

Inter diurnal temperature (T_{IDR})

The inter diurnal temperature (T_{IDR}) was significantly influenced by different dates of sowing. The inter diurnal temperature was highest in the D_3 sowing (846.8^0C) followed by D_2 sowing (815.5^0C). The lowest inter diurnal temperature was taken by D_3 (774.9^0C) (Table.8).

CONCLUSION

From the above study it is concluded that Agrometeorological parameters i.e. maximum GDD (1874.4 ^{0}C), HGTU- I (159679.6), HGTU- I I (100522), PHT (2968.4), NCT (2580.4) observed by 23rd July and PTU (18885), HTU (12147.9), DNR (846.8) observed by 06 August, while minimum GDD (1814.9), HGTU- I (155445.9), HGTU- I I (94968.7), PHT (2928.7), NCT (2500.9) observed by 06 August and PTU (11575.5), HTU (11629.4), DNR (774.9) observed by 23rd July dates of sowing respectively.

Table 2. Weekly mean weather data during *kharif* crop season 2014 at Allahabad.

Months Week	Dates	Rainfall (mm)	Temperature (^{0}C)		Relative humidity (%)		Eo (hr/day)	SS (hr/day)
			Max.	Min.	Max.	Min.		
July-04	23-29	1.31	33.5	27.14	81	59	3.82	6.57
Aug-01	30-05	18.71	35.05	27.28	85.71	61.71	3.6	3.12
02	06-12	4.54	33.65	27.62	90.42	61.28	3.62	1.85
03	13-19	1.83	34.45	28.05	84.71	57.85	4.05	4.95
04	20-26	0.18	37.94	28.91	81.28	49.57	4.4	7.58
05	27-02	1.16	37.6	29.09	83.28	52	4.4	8.25
Sep-01	03-09	1.15	35.2	26.69	86	53.57	3.88	6.51
02	10-16	2.42	34.82	25.71	86.57	49.71	3.74	6.08
03	17-23	1.77	35.25	26.74	88	47.42	3.52	6.61
04	24-30	NIL	36.88	26.22	84.85	46.57	4.44	7.34
Oct-01	01-07	NIL	35.22	25.02	87	47.42	4.25	7.4
02	08-14	15.65	34.65	24.51	85.28	60.85	3.74	6.51
03	15-21	0.14	32.42	20.78	85.71	53.14	3.57	7.54
04	22-28	NIL	32.45	20.22	86.57	54.28	3.28	8.34
Nov-01	29-04	NIL	33.22	20.28	86.14	47.71	3.02	8.31

Source: Agro-Meteorological Observatory Unit, School of Forestry and Environment, SHIATS, Allahabad.

Table 3. Average temperatures during *kharif* crop season 2014-2015 (A) Maximum temperature (^{0}C/day)

Sowing date	PHENOPHASE									Average
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
D1	34.33	34.76	34.08	37.61	35.20	35.40	35.34	35.90	33.70	35.14
D2	35.30	33.62	36.10	36.55	34.83	35.47	35.93	35.60	32.40	35.08
D3	33.60	34.70	37.80	35.10	35.30	36.80	35.80	32.60	33.00	34.97

[P1 = 3rd leaf stage, P2 = 5th leaf stage, P3 = panicle initiation, P4 = flag leaf visible, P5 = boost stage, P6 = 50% stigma emergence, P7 = milking stage, P8 = dough stage, P9= physical maturity]

Table 4. Temperature (b) Minimum temperature (^{0}C/day)

Sowing date	PHENOPHASE									Average
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
D1	27.17	27.11	27.98	28.93	26.69	24.2	26.80	25.20	23.20	26.40
D2	27.50	27.47	28.33	28.09	25.71	26.93	25.97	25.60	20.60	26.20
D3	27.50	28.10	29.20	26.30	26.70	26.90	25.50	22.00	20.22	25.80

(c) Mean temperature (^{0}C/day)

Sowing date	PHENOPHASE									Average
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
D1	30.20	30.90	31.03	33.27	30.94	29.8	31.07	30.60	28.50	30.70
D2	31.40	30.50	32.22	32.32	30.27	31.20	30.95	36.60	26.50	31.33
D3	30.51	31.40	33.45	30.73	31.00	31.83	30.67	27.30	26.60	30.39

Table 5. Relative humidity-I and Relative humidity-II (a)Maximum relative humidity (%/day)

Sowing Date	PHENOPHASE									Average
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
D1	80.83	86.11	87.33	82.47	86.00	86.00	86.60	86.30	85.50	85.24
D2	85.33	89.78	83.00	84.27	86.57	86.67	86.57	84.40	87.10	85.97
D3	90.20	85.40	81.90	86.20	88.00	84.00	85.40	86.30	86.40	85.98

(b) Minimum relative humidity (%/day)

Sowing Date	PHENOPHASE									Average
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
D1	60.50	60.89	59.42	51.7	53.57	48.00	48.71	45.90	56.10	53.87
D2	60.83	62.00	53.50	52.4	49.71	46.67	46.93	49.60	58.30	53.33
D3	61.66	58.00	50.00	51.73	47.42	48.66	47.28	59.90	51.90	52.95

(c) Mean relative humidity (%/day)

Sowing date	PHENOPHASE									Average
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
D1	70.66	73.50	73.37	67.08	69.78	67.35	67.65	66.10	70.80	69.58
D2	73.08	75.89	68.25	68.33	68.14	66.67	66.75	67.00	72.70	69.65
D3	75.93	71.70	65.95	68.96	67.71	66.33	66.34	73.10	69.15	69.46

Table 6. Mean Received rainfall (mm/day)

Sowing date	PHENOPHASE									Average
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
D1	0.63	15.4	3.26	0.68	1.22	2.51	1.55	NIL	NIL	2.8
D2	18.6	5.68	1.07	1.23	3.65	2.06	NIL	NIL	NIL	3.58
D3	4.96	1.64	0.1	1.4	3.1	NIL	NIL	NIL	18.26	3.27

Table 7. Mean Active evaporation (hr/day)

Sowing date	PHENOPHASE									Average
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
D1	3.83	3.57	3.89	4.37	3.85	3.8	3.63	3.62	4.3	3.87
D2	3.63	2.46	4.24	4.12	3.7	3.61	4.08	4.32	4.13	3.81
D3	1.8	4.08	4.4	3.8	3.57	4.08	4.32	3.97	3.46	3.72

Table 8. Effect of dates of sowing on various Agrometeorological indices to reach maturity stage in pearl millet crop during crop *kharif* season 2014.

Date	THERMAL AND PHOTOTHERMAL							
	GDD	**PTU**	**HTU**	**HGTU-1**	**HGTU-2**	**PHT**	**NCT**	**DNR**
D1	1874.4	11575.5	11629.4	159679.6	100522.0	2968.4	2580.5	774.9
D2	1846.5	18854.8	11657.3	158131.6	98417.7	2951.9	2541.2	815.5
D3	1814.9	18885.2	12147.9	155445.9	94968.7	2928.7	2500.9	846.8
MEAN	1845.2	16438.5	11811.5	157752.3	97969.4	2949.6	2540.8	812.4
F -test	s	s	s	s	s	s	s	s
S.D.	29.76	4211.50	70.14	2142.17	2803.65	19.940	39.80	36.05

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UTILITY OF *TYLOPHORA INDICA* AS ANTIASTHMATIC PLANT: A REVIEW

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Abstract: There is an increasing demand for plant based medicines to control many of the human diseases. *Tylophora indica* is one of the important medicinal plant of India. It is traditionally used to control asthma and allergic reaction. There is growing research on isolation and identification of bioactive constitunents of plant. The present review highlights the morphology, medicinal uses , biochemistry and other aspects of Tylophora indica (Antamul.)

Keywords: *Tylophora indica* , Antamul, Indian Ipecac, Asthma

INTRODUCTION

Asthma is a chronic disease involving inflammation of bronchial tubes.It makes air difficult to move in and out of lungs.Its symptoms include breathlessness coughing wheezing etc.More than 340 million people are suffering from the disease according to recent comprehensive analysis of WHO.Treatment of asthma to such a large population is a challenge. Allopathic medication has numerous side effects .Use and multiplication of medicinal herbs provide better solution to asthmatic patients. Antamool orTylophora indica is an important medicinal plant with antiasthmatic properties. This review is an effort to summarize its botanical characteristics ethno medicinal uses and pharmacological applications.

Botanical name: *Tylophora indica* (Burm f.) Merrill.

Synonym: *Tylophora asthmatica* (Linn.F.).

Common Name: Antmul.

Other names:

Beng.- Antomul.
Guj.- Antamul.
Hindi- Antamuli.
Kan.- Kirumanji.
Mal.- Valli-pali.
Mar.- Pitakari, Khodki-Rasna.
Ori.- Mendi, Mulini.
Tam.- Naye-pallai.
Tel.- Veripala, Kukka-pala, Vettipala.
Eng-*Indian ipecacuanha*

Tylophora indica belong to the family Asclepiadaceae and has been known in ayurveda for more than hundred years for its use in the treatment of respiratory disease. Clinical trials have been done on *Tylophora indica* extract for evaluating their effectiveness in bronchial asthma.[1-3] The name is drived from the ancient Greek word 'tylos' which means knot and 'phoros' means bearing .Tylophora is also known to possess immunomodulatory, hypoglycaemic, antiallergic and antimicrobial properties. The plant has been traditionally used for the treatment of bronchial asthma, jaundice and inflammation . In Ayurveda ,the plant has been used in treatment of asthma , dermatitis and rheumatism [1, 6]. Although the leaf and root of this plant are widely used for treating jaundice in Northern Karnataka, there is a paucity of scientific evidence regarding its usage in liver disorder [3]. The other reported activities include cytotoxic effect[7] immunomodulatory activity [8], anticancer activity[9] and antiamoebic activity.[10] This review summarizes the information concerning the botany,cultivation ethnopharmacology, phytochemistry of the *Tylophora* .

Habit and Habitat

Tylophora indica is found in plains, hilly slopes and forests. It forms dense patches in the forests in moist, humid conditions in open hill slopes and narrow valley. The plant grows in the area with lesser rainfall. *Tylophora* grows in wide range of well-drained soil and prefers scanty localities [3].

Distribution

It is a twining perennial plant distributed throughout southern and eastern part of India in plains, forests and hilly places. It is indigenous to India and inhabits up to an elevation of 1260m in the sub Himalayan tract. The plant is found growing normally in Uttar Pradesh, Bengal, Assam, Orissa, Himalayas and sub Himalayas in India [2].About 60 species found in tropical, sub-tropical Asia, Africa and Australia and about 35 species are reported from China. Some species found in India are *Tylophora indica/asthmatica, Tylophora rotundifolia, Tylophora fasciculata, Tylophora apiculata, Tylophora anomala, Tylophora sylvatica, Tylophora hetero- phyla, etc.*

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Morphology

Tylophora indica (Burm.F) Merill, commonly known as Indian Ipecse orAntmool belongs to family ***Asclepiadaceae*.** The plant is perennial, small, slender, a twining or climbing herb. Leaves are obvate-oblong to elliptic-oblong, 3-10cm long and 1.5-7cm wide[3].

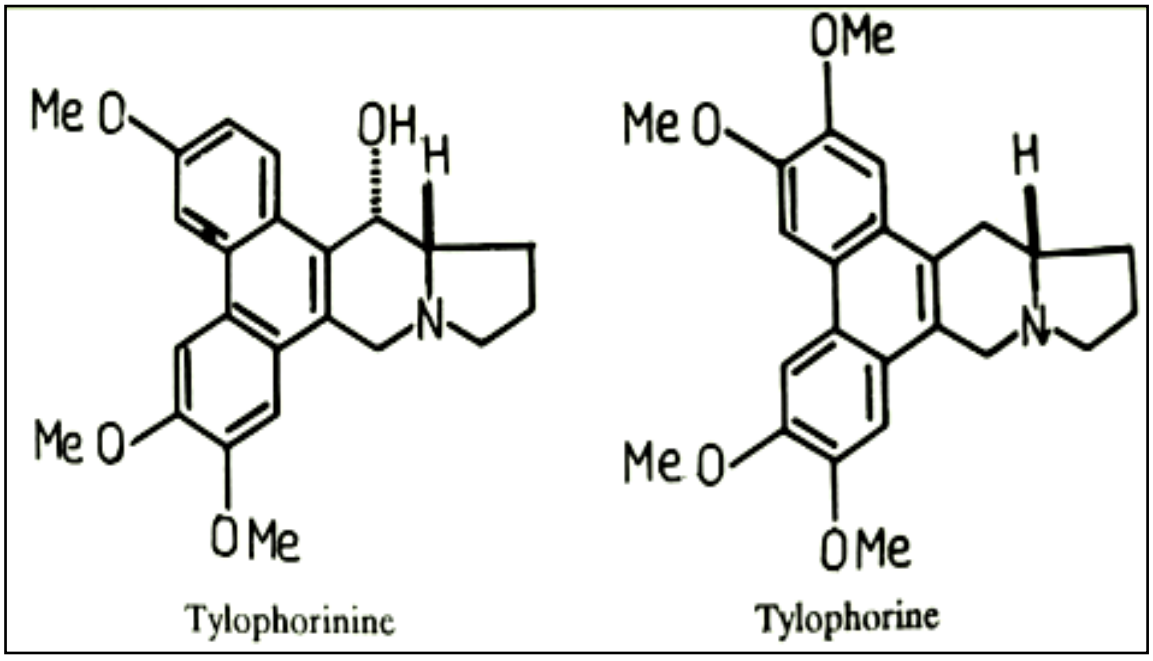
Roots are long, fleshy with longitudinally fissured light brown, corky bark. Flowers minute, 1-1.5cm across, in 2-3 flowered fascicles in axillary umbellate cymes. Calyx divided nearly to the base densely hairy outside; segment lanceolate, acute. Corolla greenish yellow or greenish purple; lobes oblong, acute. Fruit a follicle, up to 7 × 1cm, ovoidlanceolate, tapering at apex , finally striate, glabrous, Seeds 0.6-0.8 ×0.3-0.4cm long [4].

Cultivation practices

Tylophora is conventionally propagated through the seeds. The seeds show good germination percentage, but fruit set is rare. Seeds start germination in 10 days and the germination will complete in 3 weeks. After germination the 3 months old plantlets are ready to transplanting in the field but the transplantation should be done in rainy season and plant distance should also be maintained**.** The annual rainfall required for *Tylophora* plant is 1000 - 1500mm.The plant prefers partial shade condition of the forest and soil rich in humus. It needs the support of host vegetating for climbing to a sunny location. For its cultivation, loamy soil to clay and supplemented with farmyard manure, ambient conditions of temperatures and sunlight are desirable. Bach flower formulation have shown positive result for growth enhancement for this endangered plant (21)

Chemistry

Tylophora plant has been reported to contain 0.46% of alkaloids viz Tylophorine, Tylophorinine, Tylophorinidine, Septicine, Isotylocrebrine, Tylophoricine, sterols, flavanoids, wax, resins and tannins [5]. Actually, the major constituent of *Tylophora* is Tylophorine, responsible for a strong inflammatory action. The active constituents of *Tylophora indica* are phenanthroindolizidine, alkaloids. Recently some rare alkaloids namely tyloindicines A, B, C, D, E, F, G, H, I, and J, desmethyltyloph-orine,desmethyltylophorinine,isotylocrebrine,anhydroustylophorinine,anhydrous-dehydrotylophorinine,γ-fagarine,skimmianine, 14-hydroxyiso tylocrebrine, 4,6- desmethylisodroxy-o-Methyltylophorinindine have been reported. The non-alkaloidal compounds isolated from *Tylophora indica* are kaempferol, quercetin, α- and β- amyrins, tetratriacontanol, octaosanyl octacosanoate, sigmasterol, β-sitosetrol, tyloindane, cetyl-alcohol, wax,Resin , pigments, tannins, glucose, calcium salts, potassium chloride, quercetin and kaempferol. Steam distillation of an alcoholic extract of the air-dried root powder gave *p* methoxy salicyaldehyde and a small amount of oily matter. (4,6 – 8)



Folk or traditional uses

In Ayurveda, the plant has been used in treatment of asthma. The alkaloid of *Tylophora* in powder form, about 400-500miligrams given once daily to asthmatic patients for six days to cure asthma [12]. Traditionally, doses of 250 milligrams 1-3 times daily, standardized to 0.1% of tylophorine per dose have been used. Some clinical trial reports using 350 milligrams of *Tylophora* leaf placed in a capsule and given once daily for seven days. Some experts have

used *Tylophora* leaf taken in the amount of 200-400 milligrams dried herb daily. Another clinical trial reports the use of 40mg of alcoholic extract of *Tylophora indica* daily for six days. The alcoholic extract of crude *Tylophora* leaves in 1gm of glucose had comparable effects to that of chewing crude *Tylophora* leaves. The root or leaf powder is used in diarrhoea, dysentery and intermittent fever [13].

Medicinal Properties

Tylophora has been traditionally used for the treatment of bronchial asthma, jaundice and inflammation. It has antitumor, immunomodulatory, antioxidant, antiasthmatic, muscle relaxant. Although the leaf and root of this plant are widely used for treating jaundice in northern Karnataka, there is a paucity of scientific evidence regarding its usage in liver disorder. The other reported activities include immune-modulatory activity, anti-inflammatory activity, anticancer activity, antihistaminic and antirehumatic.*Tylophora* is traditionally used as folk remedy in certain regions of India for the treatment of bronchial asthma, inflammation [6, 9] bronchitis, allergy and dermatitis [12, 19]**.** *Tylophora* also seems to be a good remedy in traditional medicine as anti-psoriasis [10].The leaves and roots of *Tylophora* are used as a source of bioactive material [11]. It is reported to have laxative, expectorant, diaphoretic, purgative, stimulant, emetic and cathartic properties [2]. It has also been used for the treatment of allergies, cold, dysentery, hay fever and arthritis. It has reputation as alterative and as a blood purifier often used in rheumatism. It is an expectorant and administered in respiratory infection, bronchitis and whopping cough [3]. Dried leaves are emetic diaphoretic and expectorant. It is regarded as one of the best indigenous substitutes for Ipecacuanha. The leaves and roots are also used in hydrophobia. Leaves are employed to destroy worms and the leaf extract act as anti-tumor. The roots are suggested to be a good natural preservative of food.

Pharmacological studies

Anti-Asthmatic activity: The plant is known to exhibit anti asthmatic activity by the direct stimulation of adrenal cortex. Alcoholic extract of the plant inhibited phagocytosis in mice. The anti-allergic effect of *Tylophora indica* was compound with that of disodium cromoglycolate on perfused rat lung in sensitized rats by observing the changes in the volume of the perfusate per minute. Administration of aqueous extract of *Tylophora indica* and disodium chromoglycolate during perfusion of sensitized rat lung significantly increased the rate of flow. The action of *Tylophora indica* may be due to direct bronchodilator property and membrane stabilising and immune-suppressive effects [17].

A brief exposure of human peripheral leukocytes from asthmatic children to tylophorine (an alkaloid occurring in *Tylophora asthematica*) caused the stimulation of adenylcyclase. This effect was not observed in the leukocytes from the nonasthmatic children or adults.

Hepatoprotective activity

The methanolic extracts of *Tylophora indica* leaves was screened for hepatoprotective activity in carbon tetrachloride induced hepatotoxicity in albino rats. *Tylophora indica* leaves exhibited significant reduction in serum hepatic enzyme when compared to rats treated with carbon tetrachloride alone [14]. The hepatoprotective activity of alcoholic and aqueous extracts of leaves of *Tylophora indica* against ethanol-induced hepatotoxicity. Ethanol induced significant changes in physical,biochemical, histologcal, and functional liver parameters. Pretreatment with alcoholic and aqueous extracts significantly prevented the physical, biochemical, histological and functional changes induced by ethanol in the liver [15].

Lysosomal enzyme inhibiting activity

The flavone fraction from *Tylophora indica* leaves showed significant dose dependent lysosomal enzyme inhibiting activity against adjuvant-induced arthritis at 20-50 mg/kg. Flavone fraction showed statistically significant inhibition of arthritis lesions from day 18, from day 20 and from day 21 onwards in the adjuvant-induced arthritis studies which was compared to response of standard drug indomethacin[16].

Diuretic activity

Aqueous and alcoholic extracts of *Tylophora indica* leaves were tested for diuretic activity in rats. The aqueous andalcoholic extracts of *Tylophora indica* leaves possess good diuretic activity. It is investigated that ethanol is most effective in increasing urinary electrolyte concentration of all the ions i.e sodium, potassium and chloride followed bychloroform and aqueous extracts while other extracts did not show significant increase in urinary electrolyte concentration[18].

Commercial demand and formulations

Tylophora species are now in great demand in worldwide because of their proven efficacy against asthma. An ayurvedic nutriceuticals, Sabina Corporation, a U.S. company produced standardized extract of *Tylophora indica* having composition of 0.1% alkaloid used for respiratory disorders. Ayush Herbs Inc. company marketed *Tylophora* Plus capsules is an Ayurvedic herbal formulation designed to support the lungs. The combination of Tylophora indica, Piper longum, Ginger and Emblica *officinalis* have been shown to support the body's immune function. Another drug produced commercially is Geriforte Aqua used for delayed hypersensitivity by Himalaya group of companies.

Biotechnological approach for the propagation

Plant raised through the seeds shows tremendous genetic variation whichis not suitable for commercial cultivation. Vegetative propagation is difficult in *Tylophora* due to low seed viability and germination rate [14]. In addition, the destruction caused by harvesting the roots as a source of drug has threatened the survival of the plant. Thus, large-scale demand necessiates rapid multiplication of *Tylophora*. Biotechnological investigation was aimed to develop rapid micropropagation protocol *invitro* through tissue culture. Micropropagation is one of the important methods for enhancing the rate of multiplication. Through this technique, large number of plant can be raised from a small part of plant tissue within a short span of time. Plant tissue culture has been extensively utilized for the improvement of many medicinal plants. In *Tylophora indica* many tissue culture studies have reported for successful representation protocols. Somatic embryogenesis has been reported from mature leaves of *Tylophora indica* [16, 18]. Another protocol has been developed for high-frequency shoot regeneration and plant establishment of *Tylophora* from petiole-derived callus [9]. New and efficient transformation system for *Tylophora indica* using *Agrobacterium rhizogenes* to infect excised leaf and stem explants and intact shoots were also reported [8]. Root explants cultured on MS medium supplemented with 6-benzyladenine (BA) produced organogenic nodular meristemoids (NMs) within four weeks [17]. Protoplast culture and plant regeneration of *Tylophora* was achieved through callus regeneration [9].

CONCLUSION

According to WHO Asthma is a chronic disease characterized by recurrent attacks of breathlessness and wheezing. It is one of the most common chronic diseases among children, involving about 235 million people. Nowadays, the market is flooded with synthetic drugs to control asthma, but they show many side effects during long-term usage. There is an increasing trend for the usage of herbal drugs to control major diseases including asthma. *Tylophora indica* is an important antiasthmatic medicinal plant used in several Ayurvedic preparations. The present review of *Tylophora* is useful for further studies.

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CARBON SEQUESTRATION CAPACITY OF DIFFERENT NATURAL WEED FLORA UNDER RAINFED ECOSYSTEM

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Abstract: A survey was conducted in the region selecting 6 villages to assess the natural floral composition and its dynamics durring *Kharif* and *Rabi* 2013. Sequestration of carbon due to spatial occurrence of flora affected significantly with attaining biomass by plants. The dry matter includes tillers, leaves and flowering parts are directly proportionate to carbon sequestration capacity leading a higher carbon sequestration as 6.37 g in *Spaeranthes indicus* Linn, 4.75 g in *Heliotropium indicum* Linn, 6.03 g in *Alternanthra sessile* (L.) R.Br., 4.85 g in *Malva coramendelium* (L.) Garcke, 5.18 g in *Polygonum hydropiper* L. and 4.89 g in *Gomphrena celosoides* Mart among observed species, which were more than 4 g per plant in nearly 6 months life cycle under natural rainfed ecosystem. Among the narrow leaved flora, *Rottboellia exalata* L., *Iseilema laxum* Hack, *Echinochloa crusgalli* P. Beauv, *Aritida ascensionis* L., *Coix lacrymma-Jobi* L., *Cyperus defformis* L. And *Themeda japonica* L. stored higher biomass as 3.85, 17.29, 6.65, 4.28, 7.36, 7.41 and 6.65 per plant, respectively over remaining species of terrestrial flora.

Keywords: C-sequestration capacity, Weeds, Plant biomass, Weed ecosystem

INTRODUCTION

Carbon emissions and atmospheric concentrations are expected to continue increasing through the next century unless major changes are made in the way carbon is managed. Managing carbon has emerged as a pressing national energy and environmental need that will drive national policies and treaties through the coming decades. Article 3 of the Kyoto Protocol allows for the offset of emissions by investing in activities that increase carbon sequestration. This would generally involve an investor or buyer being issued with "carbon credits" corresponding to the amount of carbon sequestered by these activities. It is essential component of soil microorganism, which is converting residues into plant available nutrients via soil ecosystem, and responsible for chemical reactions, physical events and biological process. Soil organic carbon (SOC) increases in soil mainly due to incorporation of residues, and a net loss of soil C may increase atmospheric C as a green house gas [7]. Managing land and vegetation to increase carbon storage can buy valuable time to address the ultimate challenge of reducing greenhouse gas emissions. The effectiveness of terrestrial carbon sequestrated has been demonstrated on each of the continents, usually in the context of improving the land management and particularly by reducing the tillage of croplands. Less work has been addressed the improvement of carbon in a natural vegetation. This term reflects the end use of a large fraction of the lands slated for re mediation and also reflects the current use [1]. Collectively these lands are characterized by having the potential for improved carbon sequestration or storage where better management practices or inputs such as fertilizer or improved species can be used. On average, a whole corn plant at physiological maturity contains 436 kg C per 1000 kg dry matter, distributed as follows: 26.6% in the leaves, 24.5% in stem, 32% in grain, 7% in the roots and 9.8% in cob [8]. Indian soils are deficient in nitrogen (nearly 62%) and these can be increased by two ways: through addition of fertilizers and use of plant residues.

Plant growth occurs through the process of photosynthesis, during which carbon is captured and stored in plant cells as the plant grows. Over time, branches, leaves and other materials fall to the ground, gradually losing their stored carbon back to the atmosphere as they decompose, but during growth they can retain carbon content with changing season as *kharif* to *rabi* flora shifting. A portion of the carbon from this decomposing plant litter may sometimes be captured by organisms living in the soil, or through processes involving plants' root systems. Carbon sinks in this category may be living, above ground biomass, living biomass in soils (eg. roots and microorganisms), or organic and inorganic carbon stored in soils and deeper subsurface environments [2].

METHODOLOGY

The matured plants were collected at physiological maturity of weeds from 6 villages *viz.*, Tokapal, Lohandiguda, Golawand, Turenar, Bastanar and Bakawand of the Bastar region during *Kharif* (September/October) and *Rabi* (February/March)

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2013 and the aerial portion of plants were cut carefully and kept into envelope by tagging. The collection sites were sandy to clay loam in texture with varying pH from 6.5 to 7.2, organic carbon 0.35 to 0.45%, available nitrogen 160 to 174 kg ha^{-1}, available phosphorus (P) 18 to 22 and available pottassium (K) 175 to 178 kg ha^{-1} with EC of 0.54 to 0.57 dSm^{-1}.

The plant parts were separated with the help of scissors and stored in separate paper bags and the plants in paper bags were further allowed to air dry for 2-3 days. The collected plants were subjected to drying in oven at 60°C for 24 hours in hot air oven till crispy dry then weighed on electronic balance. The C content of biomass is almost always found to be between 45 and 50 % (by oven dry mass) and the carbon content of vegetation is surprisingly constant across a wide variety of tissue types and species. In many applications, the carbon content of vegetation may be estimated by simply taking a fraction of the biomass by suggested formula of Schlesinger [4].

$C = 0.475*B$

Where, C - Carbon content by mass

B – Dry oven biomass

RESULT AND DISCUSSION

The two categaries of flora apart from the cultivated species i.e. narrow leaved and broad leaved flora which are known as common weeds in agriculture. The biomass accumulation of both the categories show side variability in attaining total above biomass, as broad leaved flora have large amount of dry matter than narrow leaved. Considering the view of these differences, different terrestrial flora had been collected and analyzed the capacity of carbon sequestration of particular flora which come naturally in *kharif* and *rabi* season over the year on waste and uncultivated land without disturbing the soil profile. The carbon sequestration capacity of broad leaved flora (Weeds) ranged 1 to 6 g per plant as per their dry biomass *viz. Spaeranthes indicus* Linn., *Heliotropium indicum* Linn., *Alternanthra sessile* (L.) R.Br., *Malva Coramendelium* (L.) Garcke, *Polygonum hydropiper* L. and *Gomphrena celosoides* Mart were attained maximum dry matter of 13.40., 10.00, 12.70, 10.20, 10.90 and 10.30 g per plant respectively. This dry matter is directly proportionate to carbon sequestration capacity leading a higher carbon sequestration as sequestration as 6.37 g *Spaeranthes indicus* Linn, 4.75 g in *Heliotropium indicum* Linn, 6.03 g in *Alternanthra sessile* (L.) R.Br., 4.85 g in *Malva Coramendelium* (L.) Garcke, 5.18 g in *Polygonum hydropiper* L. and 4.89 g in *Gomphrena celosoides* Mart. which were more than 4 g per plant in nearly 6 months life cycle under natural rainfed ecosystem. Because of higher dry matter, these floras are higher in sequestration and about the process(es) causing carbon to accumulate in these terrestrial ecosytems [5]. The aerial biomass of flora was drastically changed according to the prevelent climate which directly influence the growth habit, but this was not so severe under normal condition of climatic factors. Adverse condition for flora apart from cultivated are generally less uneconomical over economical over cultivated crops, and growth of flora habited out side of farm land or even under farming situation survives freely and complete their life cycle in stipulated time with much efforts; on other hand, cultivated one failunder poor agronomy management. Therefore, it is affected by plant species (C_3 and C_4) and climatic condition [9]. Researchers suggested that the impact of root proliferation on N uptake may be limited [10,11] and more critical for plant to plant competition in growth [12].

The kharif season flora (weeds) mostly higher in biomass than other seasons. The flora of kharif germinate with onset of monsoon (June) and end with cessession of rain in the month of November to December or lasting till mid Jauary in case of late germinated flora. The narrow leaved weeds also contributed significantly in carbon sequestration by attaining remarkable aerial biomass throughout growth. Among the narrow leaved flora, *Rottboellia exalata* L., *Iseilema laxum* Hack, *Echinochloa crusgalli* P. Beauv, *Aritida ascensionis* L., *Coix lacrymma-Jobi* L. and *Cyperus defformis* L. stored higher biomass as 8.10, 16.0, 8.00, 9.00, 15.50 and 15. G per plant, respectively over remaining species of terrestrial flora. Some plant showed higher growth in same environment with higher biomass which also affected by concentration of nitrogen, crop growth and plant species [13]. The lack of available water is an major constraint on the carbon balance due to insufficient moisture in soil which regulate the photosynthesis by boreal evergreen conifers in nearly spring [6].

The second order important flora were *Setaria verticillata* (L.) P. Beauv., *Fimbristylis miliacea* Vahl., *Ischaemum rugosum* Salib., *Fimbritylis monostachya* (L.), *Paspalum dilatum* Linn., *Sporobulous glaucifolius* Hochst ex. Steut and *Digitaria Snaguinalis* L. stored comparative lower as compared to broad leaved floras but higher than remaining species of narrow leaved flora. The lowest biomass was seen under *Setaria glauca* (L.) P. Beauv and *Cyperus kallinga* L. nearly negligible in biomass accumulation. Similar trend was observed in carbon sequestration capacity of narrow leaved flora above ground.

On the basis of dry weight, broad leaved weeds were had carbon sequestrating ranging near 1.0 to 95% confidence interval. This showed higher level sequestration is depend on biomass attained by plant individually. The regression line of carbon sequestrating capacity and biomass attained were equaly important to mitigate atmospheric CO_2 reduction, since as biomass increased as carbon sequestration enhanced linearly, which ranges 0.7 to

6.0 g per plant and similar trend was observed in grasses but level of sequestration was 0.0 to 4.5 g per plant (Figure 1and 2) [14]. Two tailed test was also analyzed for broad and narrow leaved weeds. The higher carbon sequestration was in broad leaved weeds because it had greater amount of attainable biomass while life cycle. Both types of composition should be necessary to mitigate climate at any change in regular climate.

Table 1. Two-sample Kolmogorov-Smirnov test/Two-tailed test

Statistics	Broad leaved weeds range	
D	0.537	0.536
p-value	< 0.0001	< 0.0001
Alpha	0.05	0.05
Maximum (dry and c-sequestration)	12.70, 6.030	36.40, 17.29
Minimum (dry and c-sequestration)	1.500, 0.710	0.430, 0.200
Mean (dry and c-sequestration)	5.461, 2.594	6.188, 2.940
Standard deviation (dry and c-sequestration)	2.808, 1.334	6.401, 3.041
R^2	1.000	1.000

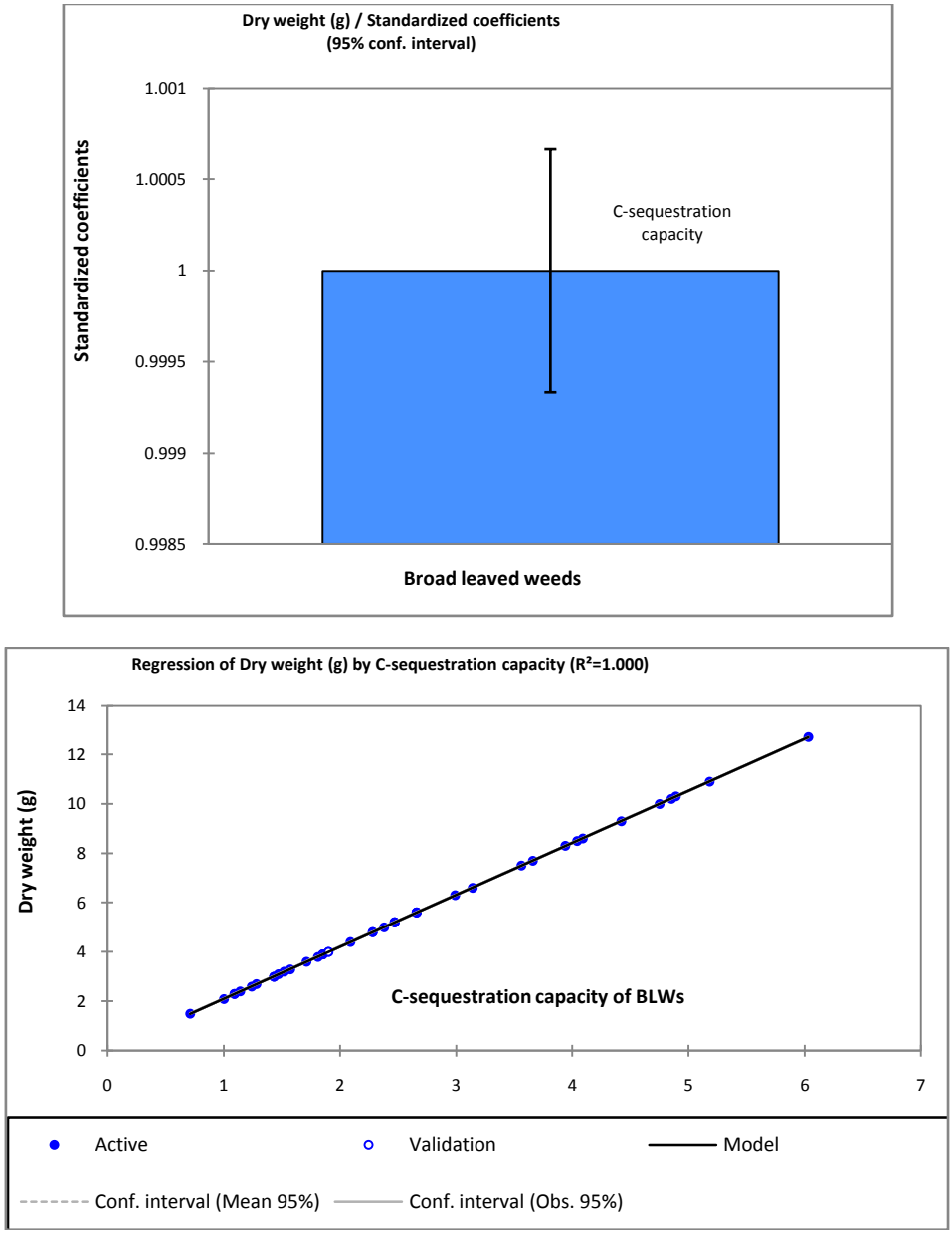

Fig. 1. Regression coefficient of c-sequestration by broad leaved weeds

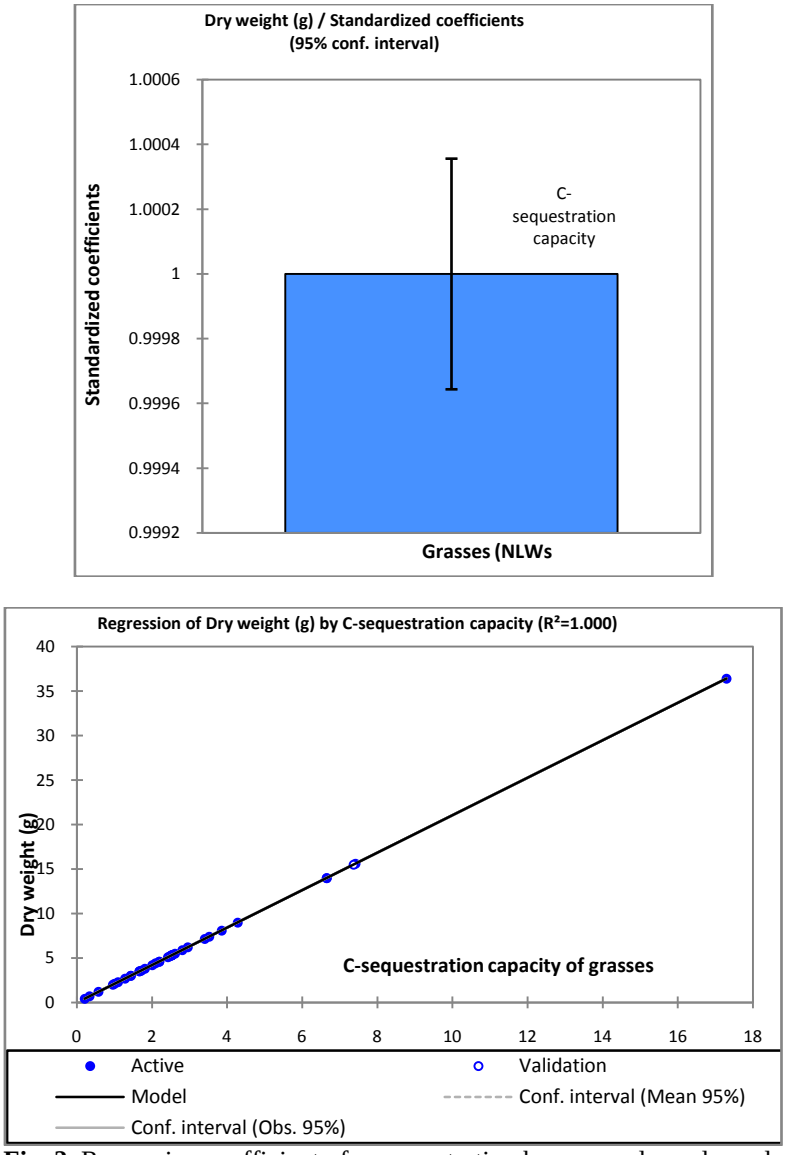

Fig. 2. Regression coefficient of c-sequestration by narrow leaved weeds

Table 2. Carbon sequestration capacity of broad leaved flora (weeds) as influenced by growth habit

S.No.	Weeds	Season	Ecosystem	Growth habit	Height (cm)	Dry weight (g)	C-sequestration capacity
1	*Emilia sonchifolia* (L.) DC	*July-Decmber*	Moist place	Ascending	75.00	3.00	1.43
2	*Crotalaria spectaballis* L.	*July-December*	Off field	Ascending	42.00	3.90	1.85
3	*Sida acuta* Burm F.	*July-January*	Off field	Speading	33.00	3.90	1.85
4	*Vernonia cinerea* (L.) Less	*July-December*	Terrestrial	Ascending	39.00	2.10	1.00
5	*Ageratum conyzoides* L.	*July-January*	Crop land	Ascending	31.00	3.60	1.71
6	*Peristrophe peniculata* (Retz.) Nees	*July-January*	Terrestrial	Ascending	75.00	4.00	1.90
7	*Ipomea pestrigristis* L.	*July-December*	Aquatic	Vine	193.00	5.00	2.38
8	*Scorpia dulcis* Linn.	*July-January*	Crop land	Vine	41.00	2.40	1.14
9	*Heliotropium indicum* Linn.	*July-November*	Bunds	Samll shrub	43.00	10.00	4.75
10	*Ablution indicum* L.	*June-November*	Forest	Ascending	71.00	3.90	1.85
11	*Sonchrus arvensis* DC.	*June-december*	Terrestrial	Ascending	35.00	5.60	2.66
12	*Celosia argenea* Linn.	*June-November*	Upland	Ascending	43.00	1.50	0.71
13	*Lagascea molli* Cav.	June-November	Crop land	Samll shrub	32.00	3.80	1.81
14	*Alternanthera sessile* (L.) R. Br.	*All month*	Semi aquatic	Speading	58.00	12.70	6.03
15	*Malva coramandelium* (L.) Garcke	*June-January*	Off field	spreading	38.00	10.20	4.85

16	*Mimosa pudica* Linn.	*June-December*	Open field	Tuffted	30.00	7.70	3.66
17	*Parthenium hystophorus* L.	*June-October*	Terrestrial	Ascending	20.50	9.30	4.42
18	*Phyllanthes niruri* L.	*July-November*	Moist place	Small shrub	30.00	6.30	2.99
19	*Chromolaena odorata* L.R.M. King & H. Rob	*July-March*	Open place	Ascending	41.00	5.20	2.47
20	*Visia hirsuta* L.	*Rabi*	Crop field	Vine	51.00	3.10	1.47
21	*Physalis minima* Linn.	*June-December*	Bunds	Soft shrub	52.00	5.20	2.47
22	*Sonchrus asper* (L.) Hill	*July-December*	Terrestrial	Ascending	34.00	8.60	4.09
23	*Amaranthes virdis* Linn	*June-November*	Slight moist	Spreading	48.00	4.80	2.28
24	*Blumea lacera* (Burn. F.) DC	*July-January*	Terrestrial	Stout shrub	39.00	8.50	4.04
25	*Catharanthus pusillius* (Murrey) G.Don.	*July-November*	Upland	Small shrub	24.00	2.60	1.24
26	*Spilanthes acmella* Murr.	*July-February*	Crop field	Small shrub	40.00	3.20	1.52
27	*Spilanthes calva* DC	*July-February*	Crop field	Robust shrub	38.00	2.30	1.09
28	*Amaranthes spinosus* Linn.	*July-November*	Dry place	Spreading	27.00	2.30	1.09
29	*Achyranthus aspera* Linn.	*June-December*	Road side	Ascending	44.00	3.30	1.57
30	*Crotalaria pallida* L.	*July-November*	Terrestrial	Ascending	43.00	4.40	2.09
31	*Rumex dentatus* L.	*January- March*	Terrestrial	Stout shrub	18.00	2.70	1.28
32	*Polygonum hydropiper* L.	*July-January*	Aquatic	Ascending	61.00	10.90	5.18
33	*Solanum nigrum* L.	*July-December*	Moist palce	Soft shrub	41.00	3.00	1.43
34	*Ammania baccifera* L.	*June-November*	Semi aquatic	Ascending	26.00	5.60	2.66
35	*Rungia pictinata* (L.)	*July-December*	Bunds	Tufted	45.25	7.50	3.56
36	*Gomphrena celosoides* Mart.	*June-November*	Grass land	Tufted herb	37.00	10.30	4.89
37	*Leucus aspera* (Wild) Spreng	*July-December*	Upland	Small herb	48.00	5.60	2.66
38	*Euhorbia hirta* Linn.	*June-December*	Upland crop	Screeper	32.00	6.60	3.14
39	*Alternanthera flexoroides* L.	*All Months*	Aquatic	Spreading	28.00	5.20	2.47
40	*Ludiwidia octovalvis* (Jacq.) Raven	*July-December*	Aquatic	Ascending	39.00	8.30	3.94
41	*Polygonum persicaria* L.	*June-December*	Moist place	Ascending	79.00	4.00	1.90
42	*Sida cordifolia* Linn	*July-December*	Terrestrial	Ascending	40.00	4.80	2.28

Table 3. Carbon sequestration capacity of narrow/grasses leaved flora (weeds) as influenced by growth habit

S.No.	Weeds	Season	Ecosystem	Growth habit	Height (cm)	Dry weight (g)	Carbon sequestration capacity (%)
1	*Chloris chloridea* L.	*June-November*	Crop land	Ascending	62.00	1.20	0.57
2	*Paspalum dilatum* L.	*June-November*	Moist place	Geniculate	37.00	5.30	2.52
3	*Setaria verticellata* (L.) P. Beauv	*June-November*	Moist place	Ascending	65.00	6.20	2.95
4	*Polypogon species* (L.)	*June-October*	Off field	Ascending	37.00	4.20	2.00
5	*Eragrostis ambellis* (L.)	*June-Noveber*	Off field	Speading	71.00	2.00	0.95
6	*Rottboellia exaltata* L.	*June-December*	Terrestrial	Ascending	58.00	8.10	3.85
7	*Fimbristylis miliacea* Vahl.	*June-November*	Crop land	Ascending	174.00	5.30	2.52
8	*Eragrostis curvula* L.	*June-December*	Terrestrial	Ascending	48.00	3.60	1.71
9	*Ischaemum indicum* (Houtt.) Merr	*June-November*	Aquatic	Ascending	77.00	4.40	2.09
10	*Iseilema laxum* Hack	*June-November*	Crop land	Ascending	105.00	36.40	17.29
11	*Cyperus iria* L.	*June-October*	Bunds	Samll shrub	39.00	2.70	1.28
12	*Setaria glauca* (L.) P. Beauv	*June-November*	Forest	Ascending	58.00	0.43	0.20
13	*Eragrostis pilosa* (L.) P.	*June-November*	Terrestrial	Ascending	142.00	5.20	2.47
14	*Ischaemum rugosum* Salib	*June-November*	Upland	Ascending	53.00	5.30	2.52
15	*Fimbristylis monostachya* (L.)	*June-November*	Crop land	Samll shrub	37.00	5.90	2.80
16	*Echinochloa crusgalli* P. Beauv	*June-October*	Sem aquatic	Speading	73.00	14.00	6.65
17	*Chloris virgata* SW.	*June-November*	Off field	spreading	37.00	3.50	1.66
18	*Penicum glaucum* L.	*June-October*	Open field	Tuffted	63.00	5.50	2.61
19	*Eleusine indica* (L.) Gaertn	*June-November*	Terrestrial	Ascending	47.00	3.00	1.43
20	*Saccharum spontaneum* L.	*June-November*	Moist place	Small shrub	100.00	4.60	2.19
21	*Paspalum dilatum* Linn.	*June-October*	Open place	Ascending	37.00	5.30	2.52

22	*Paspalidium flavidum* (Retz.) A.	*June-November*	Crop field	Vine	62.00	3.00	1.43
23	*Echinochloa colonum* (L.) Link	*June-November*	Rice field	Tufted grass	44.00	2.10	1.00
24	*Setaria pumila* (Poir.) Kunth	*June-October*	Terrestrial	Tufted grass	58.00	2.30	1.09
25	*Cyprus alopecuroides* Rothb	*June-November*	Bunds	Soft shrub	37.00	3.80	1.81
26	*Sporobulous glaucifolius* Hochst ex. Steud	*June-December*	Terrestrial	Ascending	52.00	5.10	2.42
27	*Sporobulous marginatum* Hochst ex. Steud	*June-December*	Slight moist	Spreading	63.00	4.60	2.19
28	*Aristida ascensionis* L.	*June-November*	Terrestrial	Stout shrub	150.00	9.00	4.28
29	*Coix lacryma-jobi* L.	*June-November*	Upland	Small shrub	105.00	15.50	7.36
30	*Digitaria adscendens* L.	*June-December*	Crop field	Small shrub	57.00	0.70	0.33
31	*Digitaria sanguinalis* L.	*June-November*	Crop field	Robust shrub	75.28	7.15	3.40
32	*Cyperus defformis* L.	*June-October*	Dry place	Spreading	33.00	15.60	7.41
33	*Eleocharis atropurpurea* (Retz.) J.C.	*August-November*	Aquatic	Tufted sedge	87.00	7.40	3.52
34	*Themeda japonica* (L.)	*June-November*	Rice field	Tufted grass	73.00	14.00	6.65
35	*Chloris barbata* SW.	*June-November*	Terrestrial	Tufted grass	37.00	3.50	1.66

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FLORISTIC SURVEY AND PHYTOSOCIOLOGICAL ANALYSIS OF ROADSIDE COMMUNITIES OF NH-24 OF MORADABAD DISTRICT

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Abstract: Floristic survey and phytosociological analysis of Delhi road (NH-24) of the district showed 85Angiosperms belonging to 27 families, which included exotics as well as medicinal plants. Among eighty five recorded species, *Partheniumhysterophorus* is emerged as a leading speciesin all study sites with highest IVI followed by *Cynodondactylon,Achyranthesaspera*and*Sidaacuta*whereas *Fagoniacretica*recorded lowest IVI in the selected sites of the study area.

Keywords: Floristic survey, Phytosociology, NH-24 Moradabad

INTRODUCTION

In Moradabad, roads are continuously increasing at a fast rate; and roadsides occupy a very broad area of the District. Ecologically unique roadside communities provide enormous opportunities for investigations and roadsides are great frontiers awaiting science and society (Allem,1997; Rench *et al*., 2005). Physico-chemical disturbance is widely recognized as a primary influence on plant community composition and the spread of invasive exotics (Larson, 2003; Arevalo *et al*., 2005;Beena *et al*., 2010). Pollutants on roadsides include high amount of different heavy metals (Ullmenn *et al*., 1995; Akbar *et al*., 2003; Ahmed *et al*., 2004; Li *et al*., 2004; Rentch *et al*.,2005) and other gaseous hydrocarbons (Latimer *et al*. 1990). Trampling and crushing by people and vehicles are the common physical disturbances. Resilient species of contaminated environments are believed to be reliable indicators of pollution and disturbance. In general, tolerant plants in metal contaminated environments are excluders, accumulators or hyper accumulators. Phytosociological analysis of natural vegetation is recognized as an efficient and appropriate method to select out useful plant species from natural communities (Way,1977; Wester and Juvik, 1983; Lausi and Nmiis, 1985). According to Ray and George (2009) native plants growing on contaminated sites, especially in subtropical and tropical areas are expected to have the potential for phytoremediation. However, practically no literature is found describing roadside vegetation in Moradabad, which is one of the biodiversity-rich and fast urbanizing city of Uttar Pradesh, India. Therefore, roadsides of this city are expected to be rich in unique pollution tolerant and resilient species, which may be ecologically relevant as indicators of pollutions or otherwise economically significant. The present investigation was to identify the species richness and the degree of resilience of different roadside species on the basis of certain phytosociological parameters.

MATERIAL AND METHOD

Moradabad district is located at latitude 28^0 5'N and longitude 78^0 48' E and covers an area of 3806.7 sq.km. The area is characterized by periodic occurrence of hot summers, moderate rains and cold winters. The maximum and minimum atmospheric temperatures are 44.2^0C and 4^0C respectively. The average rainfall varies between 800 to 1000 mm. The relative humidity is up to 90% in monsoon season and in drier part of the year it decreases to less than 20%.Twelve sites were selected for sampling of vegetation along NH-24 (Delhi Road), two inter-city highways (MBD-Amroha road and MBD-Rampur road) and two rural roads. These sites were repeatedly sampled at different months during the year 2014. Species were identified using the taxonomic key of Babu (1977) and Duthie (1994).The vegetation sampling was conducted randomly to determine the density, frequency and cover values. The importance value index (IVI) for each species was obtained by direct summation of relative density, relative frequency and relative cover following Misra (1968). A FORTRAN based computer package TWINSPAN was used to analyse and classify the data. A dendrogram was built from the top down for the association analysis.

RESULT AND DISCUSSION

The vegetation observed at twelve different sites differs considerably, which could be attributed to the change in the soil properties due to availability of industrial effluents. In the present study 304 quadrats were established and a total of 85angiosperm species were recorded in this study. Dominant and co-dominant species were sorted according to maximum importance value in each stand (Table 1). TWINSPAN classified the data into two major

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groups/communities, four sub-groups/communities and eight sub-divisions shown in Fig -1. Total number of plant species were recorded 85, out of which 49 plant species were found in major group 1 while 36 species were found in major group 2. The division of groups into sub-groups is based on the presence or absence of one species or the other. *Partheniumhysterophorus* L. exhibited maximum IVI in all twelve sites and it is interesting to note that it replaced *Achyranthesaspera*L. completely in S-3, S-4, S-5 and S-11. *Partheniumhysterophorus* L. is emerged as a leading species and showed association with 9 species in S-10, with 10 species in S-11 and S-12, with 11 species in S-8, with 12 species in S-1and S-6, with 13 species in S-3 and S-4, with 14 species in S-5 and S-7, and with 15 species in S-2 and S-9. *Desmostachyabipinnata* (L.) Stapf. showed close association with *Alhagipseudalhagi*Desv and *Fagoniacretica* L. in S-2, S-3,S-5, S-7 and S-9. *Triumfettapentanda*A. Rich. and*Chenopodiummurale* L. were found together in seven sites but with different frequencies. Study revealed that 26 species (30.6% of total species) are well known medicinal plants described in many of the books on Ayurvedic Medicine in India and are presently using by local people. 53% of the total species found on roadsides were exotics. Among the total exotics 78% (35 species) were dicots and only 22% (10 species) were monocots. If the percentage of exotic species on roadsides is equated to the degree of disturbing environmental influence on the integrity of roadside communities, the Moradabad roads with 53% exotics, (45 species), irrespective of seasons or regions, could be assessed as highly disturbed; however, none of the exotics observed were of nationally notified species for control and prevention of spread.

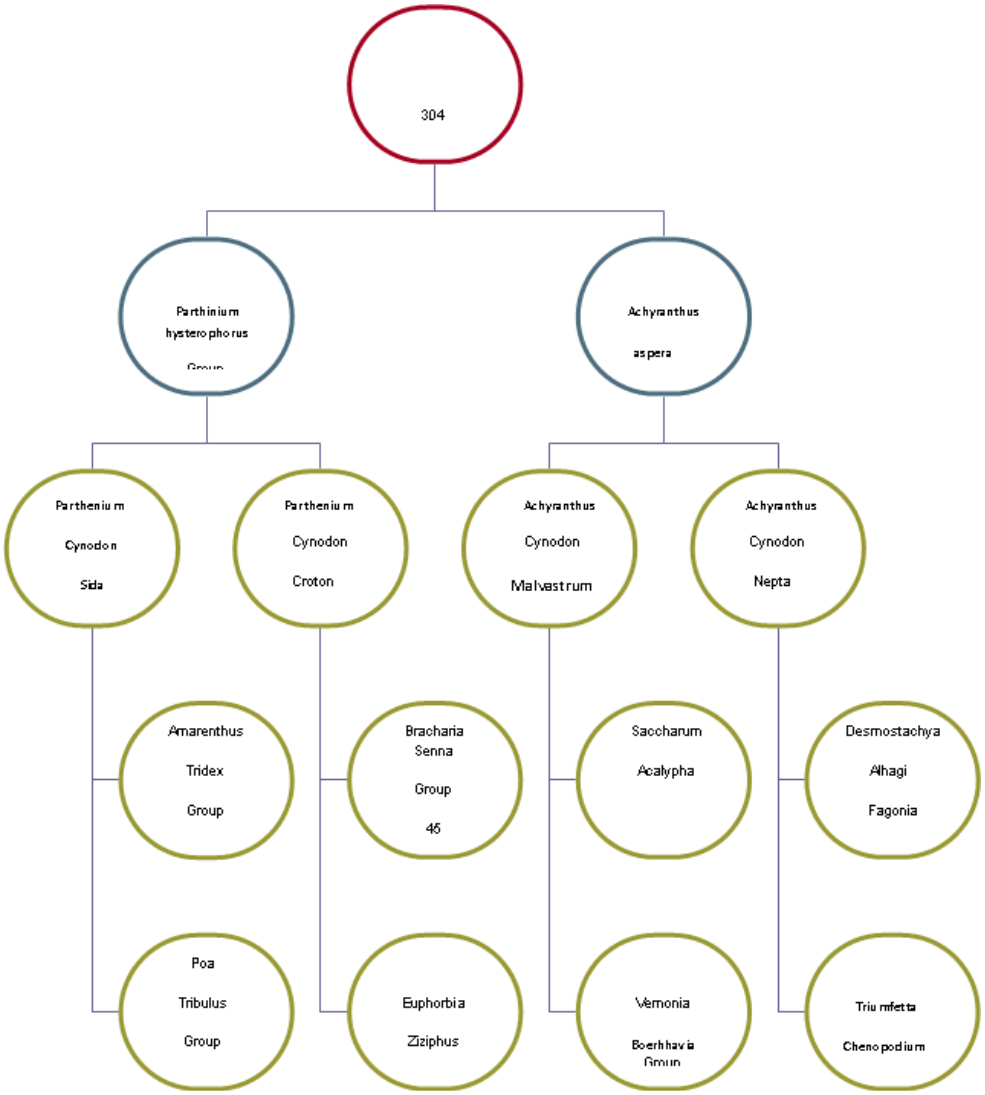

Fig 1. Dendrogram showing the results through TWINSPAN
Total number of quadrats = 304
Total number of species = 85
Number of species in major group 1 =49
Number of species in major group 2 =36

Table 1. Data sheet showing IVI of dominant species at twelve sites of NH-24 of Moradabad.

S. N.	Name of Species	IVI											
		S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	S-12
1.	Partheniumhysterophorus L.	17.10	19.05	22.00	21.50	20.70	15.90	16.00	21.12	14.56	11.54	21.00	11.60
2.	Cynodondactylon (L.) Pers	16.30	12.88	17.82	8.91	5.10	14.70	11.90	13.14	13.67	11.43	12.89	11.00
3.	Achyranthesaspera L.	8.50	9.50	---	---	---	10.26	9.78	19.32	6.83	8.12	---	18.55
4.	SidaacutaBurm f.	---	---	6.99	11.20	19.45	---	13.10	---	21.67	14.23	---	---
5.	Croton bonplandianus Boil.	---	8.12	---	6.75	---	5.87	7.02	9.12	7.20	---	---	12.43
6.	Malvastrumcoromandelianum(L.)Grackle	8.20	---	---	12.45	---	6.44	---	7.00	12.88	3.66	---	4.43
7.	Nepetahindostana (B.Heyne ex Roth) Haines	3.68	6.0	6.10	---	12.00	9.45	10.60	--	--	---	6.67	---
8.	Amaranthusspinosus L.	3.96	6.00	---	---	---	4.97	9.00	5.00	---	9.34	--	13.96
9.	Tridaxprocumbens (L.) L.	5.77		8.78	7.70	---	11.00	---	8.60	---	---	9.66	---
10.	Brachiariaramosa (L.) Stapf	---	11.78	---	---	6.00	---	8.43	---	11.12	---	5.00	---
11.	Senna occidentalis (L.) Link	---	7.92	---	6.66	---	---	5.56	---	---	7.80	---	11.23
12	AcalyphaindicaL.	3.56	---	7.80	---	---	4.26	---	8.12	5.12	---	9.20	---
13.	Saccharummunja L.	---	3.30	8.55	---	12.60	---	---	---	---	8.57	---	4.50
14.	Euphorbia hirta L.	7.67	---	---	4.43	5.70	4.90	---	6.60	---	---	6.56	---
15.	Desmostachyabipinnata (L.)Stapf.	---	7.22	5.00	---	8.57	---	3.00	---	7.10	---	---	---
16.	Poaannua L.	5.03	---	4.40	3.85	---	4.89	---	5.08	---	---	---	---
17.	Tribulusterristris L.	---	---	3.63	---	---	---	5.95	5.44	6.56	---	4.67	---
18.	VernoniacinereaLess.	---	3.00	---	3.34	3.43	3.70	---	---	3.66	---	---	6.00
19.	BoerhaaviadiffusaL.	4.77	---	5.12	---	---	3.03	4.13	---	---	3.44	---	3.34
20.	Ziziphusnummularia (Burm.f.) Wight &Arn	3.56	3.87	---	3.09	3.12	---	---	---	3.00	---	3.80	---
21.	ErigeronbonariensisL.	---	---	---	3.67	3.40	---	---	3.14	---	2.90	3.00	3.11
22.	Triumfettapentanda A. Rich.	2.80	2.45	---	---	---	2.90	3.00	---	2.40	2.80	---	2.80
23.	ChenopodiummuraleL.	2.80	2.50	---	---	---	2.80	1.80	---	3.00	2.00	---	2.00
24.	AlhagipseudalhagiDesv.	---	3.45	3.50	---	3.00	---	2.90	---	3.65	---	---	---
25.	Fagoniacretica L.	---	2.86	3.80	---	2.23	---	2.36	---	4.85	---	---	---

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VARIETAL EVALUATION OF GLADIOLUS (*GLADIOLUS GRANDIFLORA* L.) UNDER THE HILLY CLIMATIC CONDITION OF MAINPAT, CHHATTISGARH

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Abstract: The present investigation was carried out at Potato Research Station, Mainpat, Surguja Chhattisgarh, Indira Gandhi Krishi Vishwavidyalaya. The aim of the study was to evaluate the performance of most suitable cultivar under the climatic conditions of Mainpat, Surguja district. Five cultivars of Gladiolus namely White prosperity, Delhi Local, Juster, Punjab Morning, and Surguja Local were evaluated for their adoptability and performance. Results on vegetative characteristics showed that cultivars White Prosperity and Punjab morning took less number of days for sprouting, White prosperity and Punjab morning produced more plants per corm and White Prosperity obtained maximum plant height with maximum florets. Results on floral characteristics showed that cultivar White prosperity and Delhi Local were earlier for spike emergence, White prosperity and Juster took minimum days to flowering, maximum florets were produced by White prosperity and Juster obtained maximum spike length and White Prosperity remained attractive for longer time. Results on corm and cormels characteristics showed that White prosperity produced more corms, Juster produced maximum cormels and gained maximum corm size, maximum corm weight was recorded in Juster. From the results we conclude that keeping in view the vegetative and reproductive characteristics White prosperity, Juster, Punjab Morning is recommended for general cultivation.

Keywords: Gladiolus, Cultivars, Performance

INTRODUCTION

Gladiolus (*Gladiolus grandiflora* L.) is very much liked for its majestic spikes containing attractive, elegant and delicate florets. This floret open in sequence over a longer duration and hence has a good keeping quality of cut spikes. Gladiolus belonging to the family Iridaceae is an important bulbous crop domestic as well as International market. It is commercial grown in tropical, subtropical and hilly parts of the world. The exquisite and majestic beauty of gladiolus spikes, exhausting range of colour, different shades, varying number of florets, size and better keeping quality has made gladiolus the most popular bulbous flower crop grown worldwide. The spikes of gladiolus are mainly used for garden and interior decoration, and for making bouquets. It is known as queen of the bulbous plants is very popular as a cut flower, both with the consumer and the florist alike because of its many spike forms, colours and colour combinations, an advantage in every floral arrangement (Bushman, 1990). Ram, *et al* . (2005) evaluated the performance of 8 gladiolus cultivars, i.e. American beauty, Nova lux, White prosperity, Sylvia, Delhi local, Jester gold, and Picardy, under sodic soil conditions. White prosperity recorded the highest number of corms (1.79) and cormels per plant (3.25).

Chopde *et al.* (2012) evaluated eight varieties of gladiolus for flower and corm production and inferred that varieties Psittacinus Hybrid and Phule Tejas were superior in respect of quantitative yield of spikes and corms, whereas for quality production of spikes and corms, the varieties Phule Ganesh, Pink Perfection, Monte Alto and Phule Neelrekha were found better than the other varieties of gladiolus. Bulbs as well as flowers are used for the commercial purposes are very expensive and can be used as effective substitute for the conventional crops. The addition of new varieties every year necessities varietal evaluation to find out suitable variety for specific region. The performance of any crop or cultivar largely depends on genotypic and environmental interaction. As results, cultivar which performs well in one region may not perform the same in other region of varying climatic conditions. Hence, the present investigation is therefore, planning to evaluate five cultivars White prosperity, Juster, Punjab morning, Delhi Local and Surguja Local suitable for cut flower and corm and cormels production in hilly region Mainpat district Surguja Chhattisgarh.

MATERIAL AND METHOD

A field experiment was conducted during the year 2014-15 at Potato Research Station, Mainpat, Surguja district, Indira Gandhi Krishi Vishwavidyalaya, Chhattisgarh. The Mainpat Block, district Surguja is situated at latitude $22^0$45 N, longitude $83^0$18 E and height 1075 meter from the mean sea level (MSL) with average rainfall 1125-1230 mm per year. The experiment soil was sandy loam. The Experiment evaluation of different cultivars of gladiolus was carried out at Mainpat Block hilly zone in Surguja district Chhattisgarh, India. Five cultivars: White prosperity, Punjab morning, Juster, Delhi Local and Surguja local of gladiolus were

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selected for the experiment on the basis of their performance in other areas. The experiment was laid out in a Randomized Block Design (RBD) with five treatments and three replications. Gladiolus corms were planted at a spacing of 45 x 30 cm distance. All the cultural practices i.e., irrigation, hoeing, weeding, spraying and fertilizers application was given in time during the entire growth period for obtaining better yield. The following parameters were studied Days to sprouting, Number of plants per corm, Plant height (cm), Number of leaves per plant, Days to spike emergence, Days to flowering, Number of spikes per plant, Spike length (cm), Number of florets per spike, Average field life of spike (days), Number of corms per plant, Number of cormels per plant, Average weight of corms (g), average Size of corm (cm), Average size of cormels (cm), Average weight of cormels (g).

RESULT

The earliest sprouting of (7.25) days were observed in White prosperity followed by Punjab morning (9.0), Juster (10.0) and Delhi local (11.0) days. The Surguja local was too late and took 9.50 days to sprouting. Hundred per cent sprouting was observed in all the cultivars. The number of corms per plant were obtained from white prosperity (3.5) and Punjab morning (3.25), while least of (2.50) in Surguja local, The number of leaves per plant shown in White prosperity (9.30) followed by Juster (9.20),Punjab morning (8.80) and Delhi local (7.50). The maximum plant height was observed in white prosperity (48.25 cm) followed by Juster (45.50 cm), Punjab morning (42.30 cm) and Surguja local (40.80 cm). Different cultivars showed variable responses for vegetative characteristics. Cultivars under study were given same soil and climatic conditions but variations were there. This might be due to the soil and climatic conditions prevailing in the area.

Floral Characteristics

The spike emergence showed that Surguja local took more days (75.25), whereas minimum number of days were in Punjab morning (45.30), Juster (50.25),Delhi local (48.50) and (55.20). Maximum days to flowering were taken by White prosperity (75.25). Minimum days to flowering were taken by White prosperity (55.33) and Delhi local (52.21). Maximum floret were recorded in White prosperity (20.25) followed by Punjab morning (16.25) whereas, minimum (11.30) were observed for Surguja local. The number of spikes per plant shown in Punjab morning (5.20) followed by white prosperity (4.25), Juster (3.50) and Delhi local (2.30). Maximum spike length (90.25cm) was produced by White prosperity followed by Delhi local (85.50cm), Juster (82.50cm) and Punjab morning (80.20cm) whereas, minimum (75.25cm) was obtained by Surguja local. White prosperity remained attractive for longer period and obtained spike life of 8.20 days followed by Juster 7.50 while shorter spike life (5.5) was recorded for Surguja local. Variations among floral characteristics can be observed for different cultivars. Similar variations in spike quality parameters of gladiolus varieties were quoted by the workers viz., Rani *et al.* (2007) and Swaroop and Singh (2007) in gladiolus. The variations among the floral characteristics has been observed by Lal, *et al.* (1984). They observed that among 47 cultivars Ban voyage sport and Apple bloom were earliest to flowering. Patil, *et al* . (1994) evaluated 9 exotic gladiolus cultivars and observed that 'Sancerve' produced the longest spike and maximum number of florets per spike. Rao and Janakiram (2006) worked on the performance of gladiolus cultivars and observed that the spike length and rachis length were maximum in Dhiraj while maximum floret size was in Kumkum. Aswath and Parthasarathy (1996) evaluated 18 gladiolus cultivars, and observed that 'Blue moon', 'Power pufp', 'Friendship' and 'Red majesty' were found promising for spike characters .

Corm and Cormels Characteristics

The maximum corms per plant (3.25) were recorded in Delhi local followed by Juster and White prosperity (3.20) whereas, least number of corms in Surguja local (2.50) and Punjab morning (2.25). The Delhi local obtained the maximum number of cormels per plant (2.50) followed by Punjab morning (2.25), Surguja local (2.10) and 1.5 in white prosperity and Juster. The maximum weight of corm (60.30g) was observed in Punjab morning followed by White prosperity (60.25g) and Delhi local (50.25). The least corm weight (38.25g) was recorded in Surguja local. Maximum cormels weight (2.01 g) was observed in White prosperity while least (0.75g) in Surguja local. Maximum corm size of 6.20 cm was observed in White prosperity, followed by 5.50cm in Punjab morning the least corm size of 4.47cm was observed in 'Juster'. Maximum cormels size of 1.25, 1.25, 1.06, and 1.01cm were recorded in Delhi local, Punjab morning, White prosperity, and Juster respectively while least 1.0 cm in Surguja local. Close observations of the corm and cormels characteristics showed variable responses for the cultivars. Different cultivars responded differently with soil and climatic conditions prevailing in the area depending upon their genetic makeup. Ram, *et al* . (2005) evaluated the performance of 8 gladiolus cultivars and recorded highest number of corms and cormels in White prosperity. Superiority of some of the genotypes over the others in respect of corms plant^{-1}of gladiolus was also reported by Kumar, *et al.* (2009).

CONCLUSION

The evaluation of different cultivars of gladiolus was conducted under the climatic conditions of Mainpat hilly zone of Surguja district. Five cultivars of

Gladiolus namely Punjab morning, White prosperity, Juster, Delhi local and Surguja local were evaluated for their adoptability and performance. Results on vegetative characteristics showed that cultivars White prosperity and Punjab morning took less number of days for sprouting. The variety Juster and Surguja local was produced more plants per corm and variety White prosperity obtained maximum plant height while number of leaves per plant shown White prosperity and Juster. Results on floral characteristics showed that cultivar White prosperity and Delhi local were earlier for spike emergence, White prosperity and Delhi local took minimum days to flowering, maximum florets were produced by White prosperity and Delhi local, White prosperity obtained maximum spike length and Delhi local remained attractive for longer time. Results on corm and cormels characteristics showed that Delhi local produced more corms, White prosperity produced maximum cormels and gained maximum corm size , maximum corm weight was recorded in Juster.

Table 1. Mean performance of Gladiolus in northern hill zone Mainpat

Genotypes/ Characters	Days of sprouting	No. of corms/ plant	No of leaves/plant	Plant height (cm)	Days to spike emergence	Days to Flowering	No of florets/spikes	No of spikes/ plant
White prosperity	7.25	2.70	9.30	48.25	45.30	65.80	20.25	4.25
Delhi Local	8.50	3.20	7.50	40.20	48.50	70.20	11.50	2.30
Juster	7.50	3.30	9.20	45.50	50.25	72.30	13.50	3.50
Punjab morning	8.25	4.10	8.80	42.50	52.30	70.50	16.25	5.20
Surguja local	9.50	2.20	6.50	40.80	55.25	74.25	11.30	2.30

Table 2. Mean performance of Gladiolus in northern hill zone Mainpat

Genotypes/ Characters	Spike length (cm)	Average field life of spike	No of corms/plant	No of cormels/plant	Weight of corms (g)	Corm size (cm)	Cormel size (cm)
White prosperity	90.25	8.20	3.20	1.50	60.25	6.22	1.06
Delhi Local	85.20	7.30	3.25	2.50	50.25	5.20	1.25
Juster	82.50	7.50	3.20	1.50	50.20	5.10	1.01
Punjab morning	80.50	6.25	2.25	2.25	60.30	5.50	1.25
Surguja local	75.25	5.50	2.50	2.10	38.25	5.20	1.0

Photographs

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STANDARDIZATION OF *IN VITRO* PROPAGATION OF *POLIANTHES TUBEROSA* L. (CALCUTTA DOUBLE)

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Abstract: Tuberose is a bulbous, ornamental plant and popular for its sweet fragrance with attractive beauty. They synthesize many commercially valuable compounds. The various types of tuberose varieties are cultivated in the nursery of tropical and subtropical countries. Application of plant tissue culture has been used in large scale clonal multiplication of *Polianthes tuberosa* L. varieties. In the present study *Polianthes tuberosa* L. (Variety Calcutta double) rhizomes were used as explant to culture in solid MS medium containing different concentrations of IAA and BAP. The best response of multiple shoot production was found in MS medium containing 0.5 mg/l IAA and 3 mg/l BAP as compare to control.

Keywords: 6-Benzylaminopurine, Indole-3-acetic acid, Murashige and Skoog, Tuberose

INTRODUCTION

Tuberose (*Polianthes tuberosa* Linn. Family: Agavaceae) is a native plant of Maxico and is spread in different parts of the world during 16th century (Sarkar *et al*., 2010). The bulbous cut flowers are valued for their pleasant fragrance and source of tuberose oil. There are 12 species of the genus *Polianthes* and nine of them bear white flowers (Panigrahi and Saiyad, 2013). The tuberose oil contains benzyl alcohol, butyric acid, eugenol, farnesol, methyl benzoate and geraniol which are used in oil industry (Rakthaworn *et al*., 2009). The plants are mostly cultivated in tropical and subtropical countries of the world (Huang *et al*., 2001). In India the plants are planted in February to March in plains, April to May in the hilly regions and July to August to the Sothern parts of the country (Asif *et al*., 2001). The tuberose flower blooms at night and elongates its spike up to 45 cm long and blooms from bottom towards the top of the spike (Hutchinson *et al*., 2004; Kumar *et al*., 2007). There are several Indian hybrids which are widely grown throughout India, are as follows (Sarkar *et al*., 2010). The conventional method of propagation of tuberose is through bulbs but this means of propagation can't satisfy the growing demand. Thus the present study is to develop a protocol for a large scale clonal multiplication of *Polianthes tuberosa* L. variety 'Calcutta double'. The *in vitro* condition with different concentrations of IAA and BAP in MS medium is used to generate multiple shoots.

Type	Characteristics
Calcutta single	Flowers have one row of corolla segment.
Calcutta double	Flowers with corolla segment in more than two rows.
Prajwal	Every tall stick flowers have single flower.
Shringer	Sturdy spike have single flowers.
Swarn Rekha	Double flower type and middle of the leaf blade have white streak.
Hydrabad double	Flowers have more than three rows of corolla.
Phule Rajni	Flowers with single row of corolla segment.
Rajat Rekha	A white strike in the middle of leaf blade, single flowered.
Subhasini	It is a multi-whorled variety.
Vaibhav	Medium spike with semi double flowers.

MATERIAL AND METHOD

Explants collection and sterilization

Rhizomes of *P. tuberosa* were procured from Panskura floricultural market. The explants were then sterilized in two steps. In step 1, the prepared explants were washed thoroughly with running tap water for 2-3 times to minimize the loss of culture due to microbial contamination. Then, they were transferred to another beaker containing 1% bavistin

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and stirred for 30 min. In step 2, the explants were rinsed thoroughly with sterile distilled water in an aseptic condition under the laminar air flow unit. The explants were then transferred to another beaker containing 2-3 drops of tween-20 solutions for 10 min. For surface sterilization, explants were rinsed in 0.1% mercuric chloride ($HgCl_2$) solution for 5 min. They were rinsed properly with sterile distilled water for 4-5 times to remove all traces of $HgCl_2$. Sterilized explants (bulbs) were excised from both ends, using a fine sterile forceps and scalpel. Explants were inoculated in MS medium supplemented with different level of auxin and cytokine concentrations.

***In vitro* propagation**

The explants were placed on solid MS (Murashige and Skoog, 1962) basal medium containing 3% (w/v) sucrose, 0.8% (w/v) agar, and these media were supplemented with various concentrations of IAA (0.25, 0.50 and 0.75 mg/l) and BAP (1, 2, 3, 4 and 5 mg/l) in combination used for shoot proliferation. After adding growth regulators pH was adjusted to 5.6 using 0.1 (N) HCl or 0.1 (N) KOH prior to autoclaving at 120°C, 15 psi for 15 min. Culture media (20 ml) were dispensed into 50 ml test tubes and capped with cotton plug. All the cultures were maintained at 25 ± 2°C under 16-h light and 8-h dark photoperiod (long day condition) with a light intensity of 1600 Lux by cool-white florescent lights (Panigrahi and Saiyad, 2013). All experiments were replicated four times. The effect of hormones on shoot proliferation was studied and effort was made to determine the appropriate hormone combinations for optimal shoot proliferation.

RESULT AND DISCUSSION

Various concentrations of IAA and BAP were used to develop a model concentration for multiple shoot production. The concentration of IAA 0.5 mg/l and BAP 3 mg/l shows best result. The production of multiple shoot is presented in Figure 1 and the effect of combination of IAA and BAP in different concentrations is presented in Table 1.

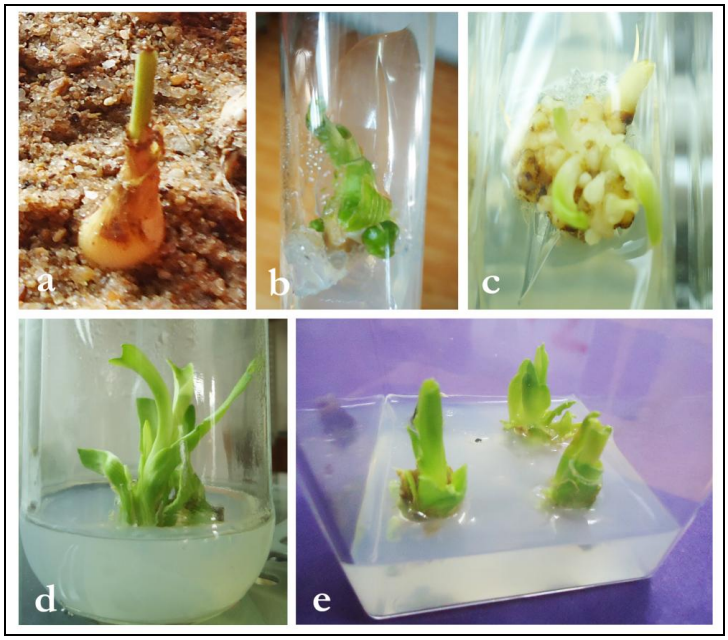

Figure 1. Multiple shoots production in *P. tuberosa* L. (a) Tuberose corm planted in sand. (b) Explant transferred to MS media containing IAA and BAP. (c) Callus and primary shoots formed in culture tube. (d) Shoots propagated in culture jar. (e) Excised shoot propagated in plastic jar.

Table 1. Effect of different concentration of IAA and BAP on multiple shoot induction of *P. tuberosa* ver. Calcutta double.

Concentration (mg/l)		**No. of shoots/ explant**
IAA	**BAP**	**Shoot differentiation**
0.25	1.0	1.1 ± 1.0
	2.0	2.1 ± 1.3
	3.0	3.4 ± 1.3
	4.0	2.7 ± 1.1
	5.0	1.5 ± 0.7
	1.0	1.2 ± 1.5

0.50	2.0	2.1 ± 1.4
	3.0	4.4 ± 1.1
	4.0	2.7 ± 1.2
	5.0	1.6 ± 0.3
0.75	1.0	1.0 ± 1.3
	2.0	1.5 ± 1.2
	3.0	2.4 ± 1.3
	4.0	1.7 ± 0.6
	5.0	1.3 ± 0.8

The application of exogenous hormone in shoot multiplication of tuberose by utilizing chemicals like Thidiazuron (TDZ), BAP and NAA was evaluated by (Hutchinson *et al*., 2004). Their experiments were showed that the highest frequency of shoot was induced after MS media containing 0.5 mg/l IAA and 1.5 mg/l BAP, whereas at low concentration TDZ was more potent than BAP. The concentration of NAA and BAP do not show any significant response in explants of oriental Lily (Kumar *et al*., 2007). Urea and thiocerea derivatives are the most important groups of non-purine cytokinins have important regulatory role in plant growth and development (Yonova and Guleva, 1997). Earlier investigations revealed that specific secondary metabolites production as well as plant growth and development depends upon hormone (Nagar, 1995). Therefore, adding specific plant growth regulators in growth medium causes more production of compound related to perfumes and aroma than control system.

Over all we can conclude that IAA (0.5 mg/l) and BAP (3 mg/l) in MS media causes effective proliferation of *P. tuberosa* ver. Calcutta double callus and shoot. As India is a subtropical country it is not easy to propagate the plant widely in field. This work will make more micropropagules of plants which will increase the availability of plant for plantation as well as secondary metabolite production.

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COST EVALUATION OF PESTICIDE AGAINST MAJOR PEST COMPLEX OF PADDY CROP IN DHAMTARI DISTRICT OF CHHATTISGARH

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Abstract: The study was carried out at the prone area of different villages in Dhamtari districtof Chhattisgarh. During 2009, the average cost of pesticides against major pest complex of paddy was ranged from Rs. 606.94 to 12.00. The maximum cost of the pesticides against SB (Rs. 606.94) was recorded followed by HC (Rs. 278.19) and minimum (Rs.12.00) in GB with the cost of share was 47.77, 21.89 and 0.94 percent, respectively. Whereas, during 2010, the average cost of pesticides was ranged from Rs. 574.64 to 12.00. The maximum cost of the pesticides (Rs. 574.64) was recorded followed by LF (Rs. 338.55) and minimum (Rs.12.00) in GB with the cost of share was 42.19, 24.85 and 0.88 percent, respectively. Pooledpesticide cost of major pest complex was ranged from Rs. 590.79to12.00. The maximum cost (Rs. 590.79) was recorded against SB followed by HC (Rs.277.31) and minimum (Rs. 12.00) in GB with the cost of share was 44.88, 21.07and 0.91percent, respectively.Descending order of the average pesticide cost of major pest complexin paddy crop can be ranked as GM<GB<CW<O<HC<SB.On the basis of information collected from the contact farmer through personal interview, some possible reasons comes out which may be the maximum respondentsinvested cost against SB followed by HC on paddy cultivation which causesmajor problems in that areaandoccurring every season which causing a perceptible damage to rice.

Keywords*:* Paddy cultivation, Pesticides, Cost and return, Plant protection cost, Pest complex of paddy return

INTRODUCTION

Paddy is important cereal crop of the World. The United Nations General assembly, in a resolution declared the year of 2004 as the "International Year of Rice", which has tremendous significance to food security. Farmers due to inadequate knowledge habitually applied fertilizers and hazardous insecticides in high quantum without any concern to the actual level of field requirement. Such injudicious input, in many cases, consequences in insecticide resistance (Khan *et al*, 1989), resurgence (Kushwaha, 1995), secondary pest outbreak (Satpathi*et al.,* 2005), leading to environmental contamination and persistent residual toxicity (Wakil *et al.,* 2001) Chemical input in high amount is detrimental to natural enemy population disturbing the homeostasis of ecosystem (Way *et al.*, 194). In the absence of natural enemy population, the pest population multiplies more comfortably and thus enhances the extent of yield loss (Jena *et al.,* 1983 and Dash *et al.,* 2006). Kalode *et al*. (1995) reported that grain yield loss in rice due to insect pest in India has been estimated from 21 to 51 per cent varying from area to area as per variation in the agro climatic condition. Singh *et al.,* (2004) they examined the pattern of pesticide use in paddy cultivation and assessed the economic and environmental impact of adaptation of IPM practices in paddy in Haryana. The study conducted by David Pimentel (2005) on economic costs of application of pesticides primarily in United States. The major economic and environmental losses due to application of pesticides in USA was $1.1 billion per year to public health, $1.5 billion pesticide resistance in pest, $1.4 billion crop losses caused by pesticides, $2.2 billion to bird losses, and about $2.0 billion to ground water contamination. Shende and Bagde (2013) suggested as the cost incurred and rate of return from pesticide use revealed that the expenditure on pesticides worked out to Rs 2054.30 ha^{-1}. The result also indicated that the rate of return obtained from pesticides use was Rs. 05.31. The decision to spend on PPC must be economic threshold of pest. Sarkar *et. al.* 2013 reported that the magnitude of crop loss due to pests, disease and weed infestation in paddy crop is very high. The actual production with attack is varied from19.36 to 20.88 quintal (q)/ acre. The overall loss with attack has been found to be 3.54q/acre. Similarly, the overall normal production without attack is 23.52q/ acre. However, the percentage loss over normal production is less (15.05 per cent) than that of percentage loss over actual production.

MATERIAL AND METHOD

The study was carried out at the prone area of different villages in Dhamtari districtof Chhattisgarh. Cost evaluation of pesticide against major insect pest complex of paddy crop in each of the village during *kharif*crop season. There were ten each village in the Dhamtari*(viz.,* Medka**,** Kuhkuha**,** Bharda**,** Paraswani**,** Dahdaha**,** Shivnikala**,** Ravanguna**,** BakniandTenwari**)** selected for the study. In each village, ten respondents were selected randomly in potential

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growing area during paddy cultivation in the year 2009 and 2010. Interview schedule was performed with the respondents in "Hindi" through proper discussion and easy response. Tools and techniques were adopted on the personal interview in collecting data with respondents on their observations/ experiences. Respondents were interviewed through personal interview technique with the assurance that information given by them would be kept confidential without complications in the most formal and friendly atmosphere. The cost of pesticidedata was processing and statistical framework used to calculatedstandard method.

RESULT AND DISCUSSION

Cost incurred per ha in paddy major insect pest complex at different villages of Dhamtari district during 2009 and 2010 are presented in table- 1, 2, & 3 and fig.- 1, 2& 3.

Cost of insecticides against SB

During 2009, the cost incurred on SB ranged from Rs. 276.63 to 812.73. The maximum cost incurred on SB (Rs.812.73) was noticed in village V_4 followed by village V_9 (Rs.810.00) with the minimum (Rs.276.63) in village V_{10}. During 2010, the cost was ranged from Rs. 60.00 to 990.00. The maximum (Rs.990.00) was recorded in village V_6 followed by village V_9 (Rs.810.00) with the minimum (Rs.60.00) in village V_{10}.On the basis of two years, the cost was ranged from Rs.168.32 to 870.00. The maximum (Rs.870.00) was recorded in village V_6 followed by village V_9 (Rs.810.00) with the minimum (Rs.168.32) in village V_{10}.

Cost of insecticides against CW

During 2009, the cost incurred on CW ranged from Rs. 0.00 to 180.00. The highest cost incurred (Rs.180.00) was noticed in village V_2 and V_3, respectively followed by village V_8 (Rs.120.00) while during 2010, the cost was ranged from Rs. 0.00 to 180.00. The highest cost (Rs.180.00) was recorded in village V_2. On the basis of two years, the cost was ranged from Rs. 0.00 to 180.00. The maximum (Rs.180.00) was recorded in village V_2 followed by village V_3 (Rs.90.00) with the minimum (Rs.60.00) in village V_8.

Cost of insecticides against HC

During 2009, the cost incurred on HC ranged from Rs. 135.00 to 432.94. The maximum cost incurred (Rs.432.94) was recorded in village V_1 followed by village V_8 (Rs.407.50) with the minimum (Rs.135.00) in village V_4. During 2010, the cost was ranged from Rs. 60.00 to 990.00. The maximum (Rs.990.00) was recorded in village V_6 followed by village V_9 (Rs.810.00) with the minimum (Rs.60.00) in village V_{10}.On the basis of two years, the cost was ranged from Rs. 135.00 to 486.56. The maximum (Rs.486.56) was recorded in village V_1 followed by in village V_9 (Rs.424.38) with the minimum (Rs.135.00) in village V_4.

Cost of insecticides against GM

The cost was not recorded years against GM.

Cost of insecticides against LF

During 2009, the cost incurred on LF ranged from Rs. 0.00 to 500.00. The maximum cost incurred (Rs.500.00) was noticed in village V_1, V_5, V_8, respectively followed by village V_{10} (Rs.420.00) while cost was not recorded in village V_2, V_3, V_4, V_6, V_7 and V_9, respectively. During 2010, the cost involved on LF ranged from Rs. 0.00 to 1000.00. The maximum (Rs1000.00) was recorded in village V_2 followed by village V_8 (Rs.750.00) with the minimum (Rs.460.00) was recorded in village V_1. On the basis of two years, the cost was ranged from Rs. 0.00 to 625.00. The maximum (Rs.625.00) was recorded in village V_8 followed by in village V_2 (500.00) with the minimum (Rs. 250.00) in village V_5.

Cost of insecticides against GB

During 2009 and 2010, the cost incurred on GB ranged from Rs. 0.00 to 120.00. The maximum cost incurred on GB (Rs.120.00) was recorded in village V_3.

Cost of insecticides against O

During 2009, the cost incurred on O ranged from Rs. 0.00 to 204.46. The maximum the cost incurred on O (Rs.204.46) was noticed in village V_{10} followed by village V_6 (Rs.198.40) with the minimum (Rs.99.20) in village V_3. During 2010, the cost was ranged from Rs. 100.00 to 204.46. The maximum (Rs.204.46) was recorded in village V_{10} followed by village V_3 (Rs.253.29) with the minimum (Rs.10000), in village V_2 and V_8, respectively. On the basis of two years, the cost was ranged from Rs. 52.63 to 204.46. The maximum (Rs.204.46) was recorded in village V_{10} followed by village V_3 (Rs.176.25) with the minimum (Rs.52.63) in village V_1.

On basis of overall the average cost of pesticides evaluated against major pest complex of paddy was ranged from Rs. 606.94 to 12.00 during 2009. The highest cost of the pesticides against SB (Rs. 606.94) was recorded followed by HC (Rs. 278.19) and minimum (Rs.12.00) in GB with the cost of share was 47.77, 21.89 and 0.94 percent, respectively. Whereas, during 2010, the average cost of pesticides was ranged from Rs. 574.64 to 12.00. The highest cost of the pesticides (Rs. 574.64) was recorded followed by LF (Rs. 338.55) and minimum (Rs.12.00) in GB with the cost of share was 42.19, 24.85 and 0.88 percent, respectively. Pooled pesticide cost of major pest complex was ranged from Rs. 590.79 to 12.00. The maximum cost (Rs. 590.79) was recorded against SB followed by HC

(Rs.277.31) and minimum (Rs. 12.00) in GB with the cost of share was 44.88, 21.07 and 0.91 percent, respectively. Shende and Bagde (2013)suggested as the cost incurred and rate of return from pesticide use revealed that the expenditure on pesticides worked out to Rs 2054.30 ha^{-1}. Similar type finding were reported by David Pimentel (2005) on economic costs of application of pesticides primarily in United States that major economic losses due to application of pesticides in USA was $1.4 billion crop losses caused by pesticides.Singh *et al.,* (2004)they examined the pattern of pesticide use in paddy cultivation and assessed the economic and environmental impact of adaptation of IPM practices in paddy in Haryana.IPM and INM practices can be popularized to control the pests and diseases during the stage of pre-harvest of crops. SB and HC is very important pest in that area which occurring every season and causing a perceptible damage to rice.

Table 1. Cost evaluation of pesticides against major pest complex of paddy in selected villages of Dhamtari district during 2009

Practices	Surveyed village (ha^{-1})										Av	Share (%)
	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9	V_{10}		
SB	480.00	570.00	630.00	812.73	750.00	750.00	630.00	360.00	810.00	276.63	**606.94**	**47.77**
CW	0.00	180.00	180.00	0.00	0.00	0.00	0.00	120.00	0.00	0.00	**48.00**	**3.78**
HC	432.94	294.77	192.50	135.00	309.23	362.50	228.81	221.75	407.50	196.88	**278.19**	**21.89**
GM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
LF	500.00	0.00	0.00	0.00	500.00	0.00	0.00	500.00	0.00	420.00	**192.00**	**15.11**
GB	0.00	0.00	120.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**12.00**	**0.94**
O	0.00	174.40	99.20	105.26	100.00	198.40	105.26	174.40	173.60	204.46	**133.50**	**10.51**
Total	**1412.94**	**1219.17**	**1221.7**	**1052.99**	**1659.23**	**1310.9**	**964.07**	**1376.15**	**1391.1**	**1097.97**	**1270.63**	

Table 2. Cost evaluation of pesticides against major pest complex of paddy in selected villages of Dhamtari district during 2010

Practices	Surveyed village (ha^{-1})										Av	Share (%)
	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9	V_{10}		
SB	603.00	643.35	90.00	690.00	750.00	990.00	510.00	600.00	810.00	60.00	**574.64**	**42.19**
CW	0.00	180.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**18.00**	**1.32**
HC	540.18	248.75	266.25	135.00	208.75	343.75	159.22	160.00	441.25	261.25	**276.44**	**20.29**
GM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
LF	460.53	1000.00	625.00	0.00	0.00	0.00	0.00	750.00	0.00	550.00	**338.55**	**24.85**
GB	0.00	0.00	120.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**12.00**	**0.88**
O	105.26	100.00	253.29	105.26	174.40	103.91	105.26	100.00	173.60	204.46	**142.55**	**10.46**
Total	**1708.97**	**2172.1**	**1354.54**	**930.26**	**1133.15**	**1437.66**	**774.48**	**1610**	**1424.85**	**1075.71**	**1362.18**	

Table 3. Pooled costof pesticides against major pest complex of paddy in selected villages of Dhamtari district during 2009 &2010

Practices	Surveyed village (ha^{-1})										Av	Share (%)
	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9	V_{10}		
SB	541.50	606.68	360.00	751.37	750.00	870.00	570.00	480.00	810.00	168.32	**590.79**	**44.88**
CW	0.00	180.00	90.00	0.00	0.00	0.00	0.00	60.00	0.00	0.00	**33.00**	**2.51**
HC	486.56	271.76	229.38	135.00	258.99	353.13	194.02	190.88	424.38	229.07	**277.31**	**21.07**
GM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
LF	480.27	500.00	312.50	0.00	250.00	0.00	0.00	625.00	0.00	485.00	**265.28**	**20.15**
GB	0.00	0.00	120.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**12.00**	**0.91**
O	52.63	137.20	176.25	105.26	137.20	151.16	105.26	137.20	173.60	204.46	**138.02**	**10.48**
Total	**1560.96**	**1695.64**	**1288.12**	**991.63**	**1396.19**	**1374.28**	**869.28**	**1493.08**	**1407.98**	**1086.84**	**1316.40**	

*SB= stem borer;CW= cut worms;HC= hopper complex; GM=gall midge; LF = leaf folder; GB = gandhibug and O = other pest

* V_1= Medka, V_2= Kuhkuha, V_3= Bharda, V_4= Paraswani, V_5= Dahdaha, V_6= Shivnikala, V_7= Parsadakala, V_8= Ravanguna, V_9= BakniandV_{10}= Tewari

* Number of ten farmersin each village

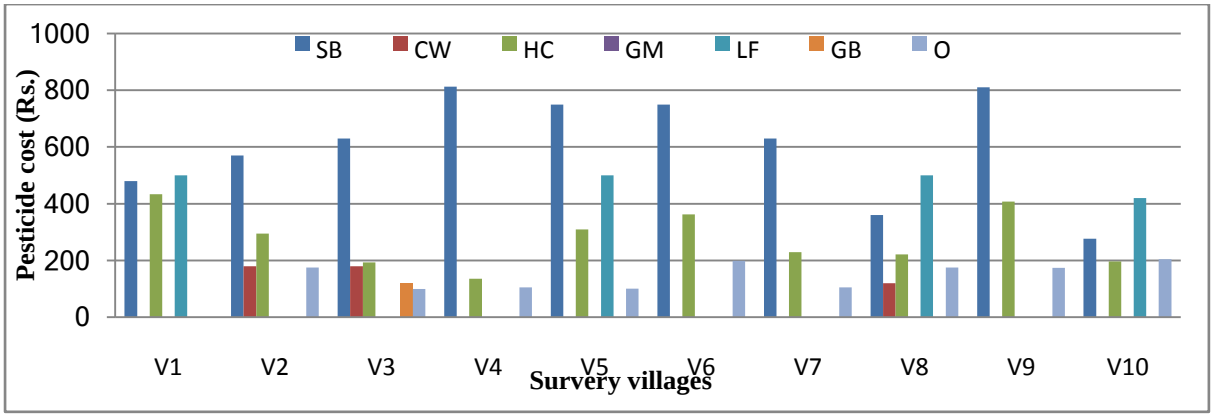

Fig. 1. Cost evaluation of pesticides against major pest complex of paddy in selected villages of Dhamtari district during 2009

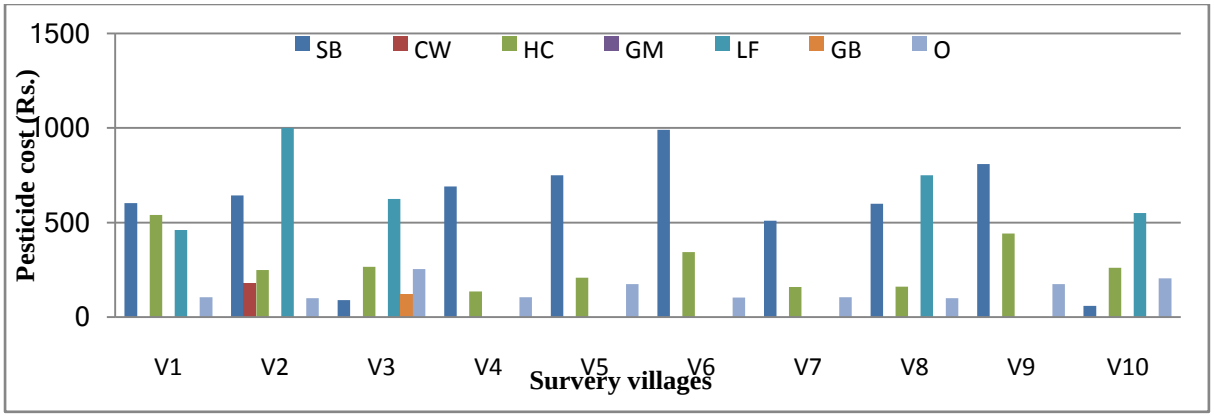

Fig. 2. Cost evaluation of pesticides against major pest complex of paddy in selected villages of Dhamtari district during2010

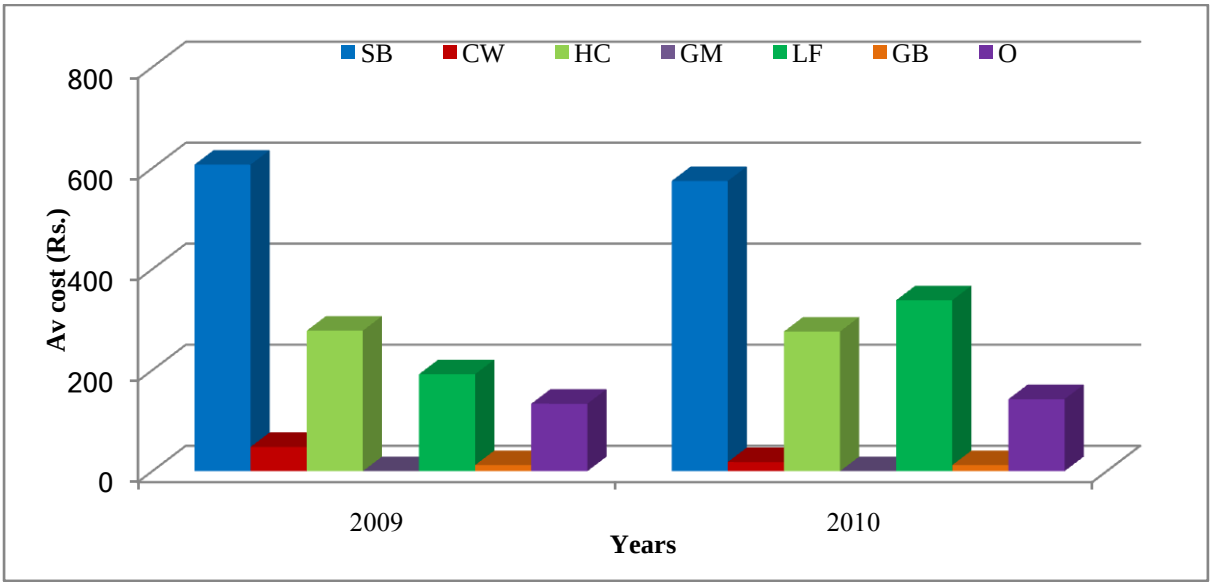

Fig. 3. Average cost evaluation of pesticides against major pest complex of paddy in selected villages of Dhamtari district during2009 &2010

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STUDIES ON GENETIC PARAMETER FOR YIELD AND YIELD ATTRIBUTING TRAITS ACROSS *KHARIF* AND *RABI* SEASONS IN MAIZE (*ZEA MAYS* L.)

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Abstract: The present investigation was carried out with fifty six genotypes to estimate the heritability, expected genetic advance and coefficient of variation for yield and yield attributing traits. Treatments differences for all characters were highly significant in both the seasons which indicates the presence of inherent genetic differences in our experimental material. The values of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all characters in both seasons. Sufficient level of heritability ranging from very high to moderate broad sense heritability were recorded for all characters except anthesis-silking interval across both seasons. Genetic advance at 5% selection intensity was higher for grain yield, plant height, ear height and number of kernels/row in both the seasons. In case of genetic advance as per cent of mean was highest for grain yield across both seasons while next lower values fluctuating with seasons. As grain yield having high both types of expected genetic advance coupled with high heritability in both the seasons, indicates the presence of large proportion of additive gene action for deciding this trait.

Keywords: Maize, Heritability, Genetic advance, Coefficient of variation

INTRODUCTION

Over the last decade, maize (*Zea mays* L.) has been emerged as world's leading crop among the cereals with highest production of 991.45 MT (million tonne) and productivity of 5.46 t ha^{-1} in 2013-14. India contributes about 2.4% of world's maize production from ~ 5.2 % global maize area **(USDA, 2015)**. In India, maize is third important food crop after wheat and rice and its production has been recorded about 24.35 MT from 9.4 Mha (million hectare) area with average productivity of 2.5 t ha^{-1} in 2013-14 (AICRP on Maize, 2015). The overall productivity of maize in Indian scenario is almost half of the world average but *rabi* maize productivity has been recorded about 4.15 t ha^{-1} in 2012-13, which is somewhat closure to the world average (DACNET, 2014). Therefore, exploitation of genetic variability specific to environmental conditions is utmost important for enhancing the grain productivity. The knowledge regardingnature and magnitude of genetic variability of our germplasm is essential for accomplishment of effective breeding programme.The genotypic components of variability directly influences the heritability and genetic advance ultimately magnitude of target trait advancement and selection strategies to be adopted by the breeders (Kumar, *et al.* 2015). Therefore, present investigation was undertaken for the estimation of heritability, expected genetic advance and coefficient of variation for yield and yield attributing traits which would be helpful for enhancing the maize grain productivity under respective environmental conditions.

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MATERIAL AND METHOD

The present investigation was carried out with fifty six genotypes involving ten parental lines, their forty five F_1s hybrids and one check hybrid over *kharif* 2013 and *rabi*2013-14 seasons, at N. E. Borlaug Crop Research Center, Pantnagar, Uttarakhand. All genotypes were evaluated in plot size of 6.00 $m^2$with three replications under each environment (season). The data was recorded on different traits like days to 50% tasselling, days to 50% silking, anthesis-silking interval, plant height, ear height, ear length, ear diameter, number of kernel rows/ear, number of kernels/row, 100-kernel weight and grain yield. The appropriate statistical and biometrical analysis were performed for obtaining the genetic parameters namely heritability, expected genetic advance and coefficient of variation (Burton and Devane, 1953 and Allard, 1960).

RESULT AND DISCUSSION

The analysis of variance for all eleven quantitative characters revealed that treatments differences were highly significant in both the seasons indicating the presence of inherent genetic differences in our experimental material (Table 1).This wide spectrum of variability for all characters provides greater opportunity for the isolation of best genotypes to be fitted in breeding programme. Similar finding on presence of significant variability for various characters in the maize genotypes was also reported by many researcher in their study (Kumar *et al*., 2015 and Has, 2011).

Coefficient of variation:The variability parameters like phenotypic coefficient of variation (PCV) and

genotypic coefficient of variation (GCV) indicated the presence of considerable variations for all the characters under study in both the environments. The values of PCV were higher than GCVvalues for all the characters in both seasons (Table 2).

In *kharif* season, PCV was highest for grain yield (35.59) followed by anthesis- silking interval (34.56), number of kernels/row (16.52) and ear length (14.64), while, lowest level of PCV was observed for days to 50% silking (3.00), days to 50% tasselling (3.65) and number of kernel rows/ear (8.15). The GCV was also observed in same pattern as PCV, highest GCV was found for grain yield (29.75) followed by anthesis- silking interval (15.93), number of kernels/row (13.89) and ear length (13.09), while, lowest level of GCV was observed for days to 50% silking (2.30), days to 50% tasselling (3.05) and number of kernel rows/ear (6.23).In *rabi* season, PCV was also highest for grain yield (40.36) followed by anthesis-silking interval (33.41), ear height (29.88) and number of kernels/row (17.48), while, lowest PCV values were of days to 50% silking (2.34), days to 50% tasselling (2.65) and number of kernel rows/ear (9.85). The highest GCV was found for grain yield (37.91) followed by anthesis- silking interval (24.52), ear height (20.53) and number of kernels/row (14.79), while lowest level of GCV was observed for days to 50% silking (2.12), days to 50% tasselling (2.44) and number of kernel rows/ear (7.77).

The large difference between the values of PCV and GCV of characters like grain yield and anthesis-silking under eachseason, indicated that environmental factors significantly influenced the expression of these traits while other remaining traits were having the lower difference between of PCV and GCV, indicating the less influence of environment in expression of these traits.

Knowledge of nature and magnitude of genetic variability present in the population is of immense value for planning efficient breeding programme to improve the yield potential of genotypes. The extent of variability as measured by PCV and GCV provides information regarding the relative amount of variation in different characters. The characters namely anthesis-silking interval and grain yield had higher PCV and GCV, while, days to 50% tasselling and days to 50% silking had lower PCV and GCV irrespective of environmental condition. Other remaining characters were having the fluctuating PCV and GCV values across the environments. Therefore, characters namely days to 50% tasselling and days to 50% silking, anthesis-silking interval and grain yield might be considered as having the same exploitable genetic variability for crop improvement across both seasons. The present findings are in accordance with earlier findings reported by Abirami*et al.* (2005), Bhoite and Sonone (2007), Bello *et al*. (2012) and Kumar *et al*. (2015).

Heritability: The estimates of broad sense heritability (h^2) were high for days to 50% tasselling, (69.68%), days to 50% silking(58.80%), plant height(60.68%), ear length(79.91%), number of kernel rows/ear(58.33%), number of kernels/row(70.76%), 100- kernel weight(67.95%) and grain yield(69.87%) in *kharif* season. Whereas, moderate level of heritability was recorded for ear diameter(47.40%) and low level of heritability was observed for anthesis- silking interval(21.25%) in this environment. In *rabi* season, very high estimates of broad sense heritability were observed for the characters namely days to 50% tasselling(84.72%), days to 50% silking(81.72%), ear length(79.50%), ear diameter(76.83%), number of kernels/ rows(71.55%)and grain yield(88.24%). While high level of broad sense heritability were observed for remaining traits namely anthesis-silking interval(53.86%), plant height(70.67%), ear height(58.32%) and number of kernel rows/ear(62.26%) in this environment. Overall heritability of all studied characters were higher in *rabi* season than *kharif* season, therefore, more exploitable variation of genotypes are present in rabi season(Table 2).

The estimate of broad sense heritability is the proportion of total genetic variance involving both additive and non-additive types to total phenotypic variance. Most of the traits included in the present investigation were having sufficient level of heritability ranging from very high to moderate broad sense heritability across both seasonswith minor fluctuation.However, the level anthesis-silking interval heritability was significantly changed with seasons as indicated by low heritability in *kharif* season and moderate heritability in *rabi* season due to seasonal effect. This indicated that all characters except anthesis-silking interval are less influenced by the environmental conditions and selection for such characters on the basis of phenotype will be effective. Similar findings of heritability for grain yield and other characters have also been reported by Abirami*et al.* (2005), Bhoite and Sonone (2007), Awasthi*et al.* (2009), Shanthi*et al.* (2011), Badawy (2012) and Kumar *et al*. (2015).

Genetic advance: The estimate of genetic advance at 5% selection intensity was highest for grain yield (23.66) followed by plant height (21.86) ear height (12.39) and number of kernels/row (7.81) in *kharif* season. Whereas, lowest genetic advance at 5% selection intensity was observed for ear diameter (0.39) followed by anthesis- silking interval (0.40) and number of kernel rows/ear (1.30) in this environment. In *rabi* season, genetic advance at 5% selection intensity was also highest for grain yield (40.38) followed by plant height (33.42) ear height (19.63) and number of kernels/row (7.38). Whereas, lowest genetic advance at 5% selection intensity was observed for ear diameter (0.70) followed by

anthesis- silking interval (1.38) and number of kernel rows/ear (1.66) in this environment(Table 2).

For comparison among the characters, genetic advance at 5% selection intensity was transformed into genetic advance as per cent of mean. In *kharif* season, genetic advance as percent of mean was also highest for grain yield(51.23) ear length (24.11) andnumber of kernels/row(24.08). In *rabi*season, highest genetic advance as percent of grain yield (73.36) followed byanthesis- silking interval (37.07) and ear height (32.30), as presented in Table 2.

Expected genetic advance for particular trait indicates the expected genetic progress under one cycle of selection. All the characters had higher genetic advance at 5% selection intensity and genetic advance as percent of mean in *rabi*season than *kharif* season because of higher magnitude of heritability for all the characters in *rabi* season compare to *kharif* season. This indicate that genetic advance at 5% selection intensity as well as genetic advance as percent of mean for all the characters were more responsive in *rabi* season than *kharif* season. High genetic advance along with high heritability arises due to additive type of gene action, while, high heritability estimates with low genetic advance indicates that heritability of these characters is due to non-additive gene effects, *viz.,* dominance, over dominance and epitasis gene action. High expected genetic advance at 5% selection intensity and as per cent of mean coupled with high heritability for most important economic trait i.e. grain yield indicated that genotypic variation present in the genetic material studied might be due to additive genetic variance in both the seasons. These obtained results are in accordance to similar findings with some deviations of Mahmood *et al.* (2004), Singhal*et al.* (2006), Nagabhusan*et al.* (2011), Badawy (2012) and Bekele and Rao (2014).

Table 1. Analysis of variance for important characters in maize across *kharif* and *rabi* seasons

Source of variation	df	Env	Days to 50% tasselling	Days to 50% silking	Anthesis-silking interval	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear diameter (cm)	No. of kernel rows / ear	No. of kernels /row	100-kernel weight (g)	Grain yield (Q/ha)
Replication	2	*Kharif*	3.26	6.47	0.54	122.67	67.78	2.49	0.14	0.63	51.58	5.10	234.54
		Rabi	4.19	2.04	0.21	241.56	604.76	3.41	0.11	0.60	22.42	9.33	819.77
Treatment	55	*Kharif*	8.15**	5.53**	1.20**	676.60**	249.18**	12.34**	0.32**	2.52**	69.27**	19.37**	647.73**
		Rabi	26.86**	21.82**	3.23**	1271.98**	578.15**	11.51**	0.50**	3.77**	60.93**	22.59**	1364.64**
Error	110	*Kharif*	1.03	1.05	0.66	120.17	52.92	0.95	0.09	0.49	8.39	2.63	81.42**
		Rabi	1.52	1.51	0.72	154.62	111.22	0.91	0.05	0.63	7.13	2.30	58.06

*, ** Significant at 5% and 1% probability levels, respective

Table 2. Heritability, genetic advance, genotypic and phenotypic coefficient of variation for important characters in maize across *kharif* and *rabi* seasons

Genetic Parameters	Seasons	Days to 50% tasselling	Days to 50% silking	Anthesis-silking interval	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear diameter (cm)	No. of kernel rows / ear	No. of kernels /row	100 kernels weight (g)	Grain yield (Q/ha)
Heritability	*Kharif*	69.68	58.80	21.25	60.68	55.28	79.91	47.40	58.33	70.76	67.95	69.87
	Rabi	84.72	81.72	53.86	70.67	58.32	79.50	76.83	62.26	71.55	74.62	88.24
Genetic advance	*Kharif*	2.65	1.93	0.40	21.86	12.39	3.59	0.39	1.30	7.81	4.01	23.66
	Rabi	5.51	4.85	1.38	33.42	19.63	3.45	0.70	1.66	7.38	4.63	40.38
Genetic advance as per cent of mean	*Kharif*	5.24	3.63	15.13	11.61	13.33	24.11	10.11	9.80	24.08	16.93	51.23
	Rabi	4.62	3.94	37.07	25.30	32.30	23.76	18.93	12.63	25.77	18.95	73.36
PCV	*Kharif*	3.65	3.00	34.56	9.29	11.70	14.64	10.35	8.15	16.52	12.10	35.59
	Rabi	2.65	2.34	33.41	17.38	26.88	14.51	11.96	9.85	17.48	12.33	40.36
GCV	*Kharif*	3.05	2.30	15.93	7.23	8.70	13.09	7.13	6.23	13.89	9.97	29.75
	Rabi	2.44	2.12	24.52	14.61	20.53	12.94	10.49	7.77	14.79	10.65	37.91

PCV- Phenotypic coefficient of variation, GCV- Genotypic coefficient of variation

CONCLUSION

In present study, our genetic material had high amount of genotypic and phenotypic coefficient of variation for all characters in both the seasons which can be exploited in crop improvement programme.All the charactersexcept anthesis-silking interval were having sufficient level of heritability ranging from very high to moderate broad sense heritability across both seasons with minor fluctuation. Therefore, selection for such characters on the basis of phenotype only will be effective for development of cultivars. Genetic advance as 5% selection intensity and as per cent of mean were higher for grain yield,plant height and ear height were higher in magnitude across both seasons. High

both types of expected genetic advance coupled with high heritability for grain yield in both the seasons indicating the presence of additive genetic variance, which can be effectively exploited in crop improvement programme.

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EFFECT OF OIL COATING AND STORAGE PERIODS ON THE INTERNAL QUALITY OF KALINGA BROWN CHICKEN EGGS

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Abstract: The effect of oil coating and storage periods on the internal quality indicator of Kalinga Brown chicken eggs was examined. The traits were % egg weight loss, albumen height, albumen index, yolk height, yolk index and Haugh unit. In this experiment a total of 108 fresh eggs from Kalinga brown breed were used. The storage periods were 5, 10 and 15 days while the methods were oil coating and without any treatment at room temperature (40°C). This study indicated that as the storage time increased egg weight, albumen height, yolk height, albumen index, yolk index and Haugh unit significantly ($p<0.01$) decreased. Albumen index egg quality indicator was significantly ($p<0.01$) decreased at 5 days (6.54%), 10days (4.97%) and 15 days (3.71%) of storage period. Oil coated eggs maintained better quality in terms of albumen height (4.5mm), yolk height (16.2mm), albumen index (5.6%), yolk index (36.7%)and Haugh unit (74) than untreated egg at room temperature. It evident from the study that most of egg qualities are effected by methods and periods of storage.

Keywords: Kalinga brown, Storage period, Storage methods, Oil Coating, Albumen index, Haugh unit

INTRODUCTION

Unlike external quality, the internal quality of eggs starts to decline as soon as they are laid by hens (Jin *et al*.,2011) because of loss of moisture and carbon dioxide via egg shell pores (Nongtaodum *et al.,* 2013). In rural areas, the backyard system of egg production sustains the economics of small families and generates sustainable income. One of the constraints is to preserve the egg qualities by selecting the most efficient storage system i.e. storage type and duration. Refrigeration is very effective in preserving egg quality, but it has limitation in rural areas. Surface coating is an alternative method to preserve egg quality, although it is much less effective than refrigeration. Nonetheless in some developing countries where refrigeration of eggs is seldom practised, farmers use preservatives like lime and oil in order to keep the eggs for longer periods. Some parameters like egg weight, albumen height and yolk height are important internal indicators to judge the quality of eggs. Haugh unit which is the measure of the albumen quality and measures the freshness of the egg is one of the determinants of egg quality (Keener *et al*., 2006). Many studies have linked extended storage period length with decreased egg quality (Jones and Musgroove 2005; Paditey, 2010) .The present study was undertaken to evaluate certain physic-chemical quality characteristics of chicken eggs as influenced by oil coating treatment and storage periods.

MATERIAL AND METHOD

Collection of samples: Eggs were collected from 64 weeks old Kalinga Brown breed maintained under deep litter system in Government Poultry Farm, Durg. A total of 108 fresh eggs were obtained and distributed in two groups namely A and B with 3 replicates. Control group A comprising 36 eggs were evaluated for their internal characteristics at day 0 without any preservative. Group B comprising 72 eggs were again divided into two subgroups: B1, B2, having an equal number of eggs. Subgroup B1 comprising 36 eggs was kept normal without any preservative (untreated eggs) and B2 was preserved by oil coating method and all eggs were kept at room temperature (40°C). Twelve eggs from each treatment totaling 24 eggs were taken periodically at 5 days interval for a total duration of 15 days storage period.

Egg quality analysis: The indicator of composition and qualities of eggs includes % egg weight loss, albumen height, yolk height, albumen index, yolk index and Haugh unit. The percentage (%) of weight loss of the whole egg was calculated as {[initial whole egg weight (g) at day 0 – whole egg weight (g) after storage]/initial whole egg weight (g) at day 0} × 100 (Bhale *et al*, 2003). The eggs were broken out followed by measurement of the maximum albumen height from at least 3 places with spherometer. Albumen index were calculated for individual egg using the following formula: Albumen Index (%) = Height of thick albumen (mm)/ Mean diameter of thick albumen (mm) x 100 (Heiman and Carver, 1936).The height of yolk was measured in the centre of the egg yolk. The yolk index was calculated after the measurement of height and diameter of yolk with the help of spherometer and vernier calipers, respectively (Funk, 1948). Haugh units were calculated from the recorded egg weights and albumen heights using the formula $HU= 100 \log_{10} (H-1.7 W^{0.37}+7.56)$, where HU= Haugh unit, H =

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height of the albumen (mm), and W = egg weight (g).

Statistical analysis: The data obtained from the study were statistically analyzed by two way classifications of Analysis of Variance to see the effect of storage methods and periods on internal characteristics of eggs by using statistical program SPSS (2007). The individual means was tested by Duncan's Multiple Range Test modified by Kramer (1956) for their significance.

RESULT AND DISCUSSION

Egg weight, % egg weight loss, albumen height, yolk height: So ***e***gg weight was significantly decreased (P<0.01) at different storage periods. Table (1) indicated that the mean value of % egg weight loss at 5 day (0.05%), 10 days (0.79%) and 15 days (1.99%) was observed. These results are almost in agreement with those of Samli *et al.* (2005) and Jin *et al.* (2011) who reported weight reductions of 2.08 and 3.11% respectively with in 5 and 10 days of storage periods. The reason for loss in weight was presumably attributed to loss of humidity from inside the egg due to evaporation effect. Overall effect of storage methods (Table 2) revealed that the percent weight loss was higher in case of untreated eggs (2.5%) than oil coating method. Tabidi (2011) reported the same findings. The losses could be due to loss of carbon dioxide, ammonia, nitrogen, hydrogen sulphide gas and water from the eggs (Dudusola, 2009; Alsobayel and Albadry, 2011). Albumen height was significantly (p<0.01) decreased with increased in storage periods (Table 1). Results indicated that the mean value of albumen height was 5.26mm (5 days), 4.11mm (10 days) and 3.18mm (15 days) at different storage periods. The present findings corroborate with Scott and Silversides (2000), who reported a significant decrease from 9.16 - 4.75 mm in albumen height (p<0.005) in stored eggs at 10 days. Different methods of storage were found to have a significant difference (P<0.01) on the average albumen height (Table 2). Albumen height was found higher in oil coated eggs (4.5 mm) than untreated eggs. Various storage methods and periods were found a significant difference (P<0.01) on yolk height (Table 1 & 2). The results showed that there was higher yolk height (16.2 mm) in oil coated eggs than untreated egg stored at room temperature. The decrease in albumen and yolk height with increasing temperature observed in this study corroborates the findings of Scott and Silversides (2000) and Abanikannda (2007). The difference between the various methods to maintain egg quality could be due to their varying ability to retard carbon dioxide loss and breakdown of carbonic acid to carbon dioxide. This is because these losses cause mucin fibre which gives the albumen and yolks their gel-like texture to loss their structure and so the albumen and yolk becomes watery (Raji *et al*., 2009; Gavril and Usturoi, 2012).

Table 1. Overall effect of storage period on internal quality of Vanaraja eggs

Treatment	Egg weight before storage (g)	Egg weight after storage (g)	Egg weight loss (%)	Albumen Height (mm)	Yolk height (mm)	Albumen index (%)	Yolk index (%)	Haugh unit
5 day	58.5±0.49	58.42±0.59^{a}	0.05±0.05^{c}	5.26±0.23^{a}	16.4±0.44^{a}	6.54±0.32^{a}	36.7±1.15^{a}	79.4±1.51^{a}
10 day	57±0.47	56.5±0.45^{b}	0.79±0.17^{b}	4.11±0.17^{b}	15.5±0.36^{a}	4.97±0.25^{b}	34.5±0.95^{a}	71.9±1.4^{b}
15 day	57.9±0.6	56.72±0.50^{b}	1.99±0.19^{a}	3.18±0.16^{c}	14.4±0.42^{b}	3.71±0.2^{c}	30.8±1.13^{b}	63.7±1.48^{c}
SIG	NS	*	**	**	**	**	**	**

Values (Mean±SE) with different superscripts in a row differ significantly *p<0.05, **p<0.01; NS= Non-significant

Albumen index, yolk index, Haugh unit: The effect of storage periods and methods on albumen index, yolk index and Haugh unit are shown in Table 1 and 2. The results showed that the storage period affected significantly the albumen index. The findings revealed that albumen index was significantly (p<0.01) decreased at 5 days (6.54%), 10days (4.97%) and 15 days (3.71%) of storage period (Table 1). These results are similar to the result of Tabidi (2011). Oil coated eggs showed the higher albumen index (5.6 %) than untreated eggs (2.58%) with significant difference. The significant (P<0.01) decrease in yolk index was observed with increasing storage period. The present study (Table 1) showed that yolk index significantly (p<0.01) decreased from 36.7%-30.8% at 15 days of storage period. Table 2 indicated that oil coated eggs showed the highest value of yolk index (36.7 %) than untreated egg (27.2%). The mean value of HU at 5, 10 and 15 days of storage period was 79.4, 71.9 and 63.7 respectively (Table 1). Haugh unit for the eggs stored in the oil and untreated were 74.0 and 56.9 respectively at room temperature. These results are in agreement with Tona *et al.* (2004) and Jones and Musgrove (2005), who reported storage adversely affected Haugh units (p<0.001).

Table 2. Overall effect of storage methods on internal quality in Kalinga Brown eggs

Treatments	Egg weight before storage (g)	Egg weight after storage (g)	Egg weight loss (%)	Albumen Height (mm)	Yolk height (mm)	Albumen index (%)	Yolk index (%)	Haugh unit
Untreated egg	56.5±0.67	55.0±0.65^{b}	2.5±0.33^{a}	2.4±0.16^{c}	12.7±0.4^{d}	2.58±0.4^{c}	27.2±1.0^{d}	56.9±1.6^{c}
Oil coated egg	59.1±0.68	58.8±0.67^{a}	0.51±0.13^{b}	4.5±0.22^{b}	16.2±0.49^{b}	5.6±0.27^{b}	36.7±1.16^{b}	74±1.56^{b}
SIG	NS	**	**	**	**	**	**	**

Values (Mean±SE) with different superscripts in a row differ significantly *p<0.05, **p<0.01; NS= Non-significant

From the results of the present study, it is concluded that egg weight, albumen and yolk height, albumen index, yolk index, Haugh unit, decrease with increase in storage period. Whereas % egg weight loss was increased with increase in storage period. It can also be concluded that quality of an egg is affected by the method and periods of storage. Oil coating eggs have shown better quality than untreated eggs stored at room temperature. Where refrigeration facilities are not available especially in rural areas, eggs must be stored and protected by oil coating method at room temperature because of their cheapness, effectiveness and simplicity in use. Eggs kept at high temperature without any treatment were deteriorated in quality very fast and were not fit for consumption after one week.

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REPORTED

ASSESSMENT OF GANGA RIVER WATER AT DIFFERENT LOCATIONS AND ITS SUITABILITY FOR DRINKING PURPOSES

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Abstract: An attempt has been made in this study to evaluate the surface water quality of Ganga river at different locations. They were analyzed for a total of 14 physio-chemical parameters. In addition to these elements, 05 heavy metals, namely, Cd, Pb, Zn, Cu and Cr. The results showed that all samples were observed colourless, odourles and neutal to pH. Another physico-chemical parameters showed below the permissible limit as prescribed by WHO and BIS standards. The concentration of heavy metals observed in majority of samples within permissible as per described by WHO and BIS guideline. The water is acceptable due to below the concentration of heavy metals. It is suggested that regular monitoring is required to determine the pollution load with improve the water quality, which is being used for drinking purpose.

Keywords: Ganga, River, Water, Metals

INTRODUCTION

Ganga, the mighty Indian river originates from the snowed peaks of Himalayas, is the lifeline of millions of Indians. From its source to its entry in to the Bay of Bengal, it travels a distance of around 2525 Kms. The river with its well knit tributaries drains the Ganga Basin which encompasses an area of more than a million square kilometers. (1060,000 sq km) spread over four countries- India, Nepal, Bangladesh and China (Chapekar and Mahatre, 1983). Domestic sewage is the major cause of contamination in the Ganga river. According to the CPCB, 2,723 million litre a day (MLD) of sewage is generated by 50 cities located along the Ganga river, which adds up to over 85 percent of the river's pollution load *(Source: CPCB 2013, Pollution Assessment: River Ganga, Central Pollution Control Board, MoEF, July)*. Rapid industrialization, profuse use of fertilizers, heavy sewage effluents in agricultural land, domestic waste, medicinal waste and other anthropogenic activities on the ground also led to the deterioration of surface water quality (Jain *et al.* 2010, Gupta *et al*, 2012 and Sharma and Uniyal, 2013). These activities increase in the level of metal concentration in soil and water is significantly exceeding from those originating from the natural resources. River Ganges is considered to be the most pious river of India and its water used as drinking as well as aesthetic purposes. River Water quality monitoring is necessary especially where the water serves as drinking water sources, are threatened by pollution resulting from various human activities along the river course . The majority of the Ganga pollution is organic waste, sewage, trash, food, and human and animal remains (Chopra, 1990). Drinking water quality has emerged as major issue requiring immediate attention. Hence, regular monitoring of water quality is necessary to determine the pollution level of surface waters. Among the heavy metals, Cadmium and Lead are most dangerous to health (Bryan and Langston, 1992). Cadmium is one of the most toxic metal compounds released into the environment (Kungolos *et al.*, 2001). Cadmium can cause cancer; Lead can cause brain and bone damage (WRI, 1987). An estimated 1.3 billion people living in per capita low income countries do not have access to safe drinking water (UNDP-HDR 2006).

In this paper we have reported an assessment of the water quality of Ganga river at different locations based on phyico-chemical and heavy metals namely cadmium, copper, lead and zinc and their suitability for drinking purposes.

MATERIAL AND METHOD

Three sources of Ganga river water namely Shukratal, Distict- Muzaffarnagar, (site no.1), Garh, District- Hapur, (site no.2), and Annopshahr, District- Bulandshahr (site no.3), were selected as water sampling sites (Table 1 & 2). The collected samples were kept in air tight plastic ice-cold container and were transported with 5 hrs of the collection for further processing. In lab all samples were stored at low temperature. The physical parameters such as colour, odour, pH, turbidity, electrical conductivity (EC) and temperature were measured in the sites using water and soil analysis kit (Electronics India, Model 16 E) and rest of the characteristics of water samples were measured in the laboratory. Dissolved oxygen, BOD, COD, calcium (Ca2+), magnesium (Mg_2^+) Chloride (Cl^-), sulphate (SO_4^-), sodium (Na^+) and potassium (K^+) were estimated using standard procedures [10]. To ensure accuracy analysis was done in triplicates and mean value was taken into consideration. The samples were also analyzed for level of toxic ion like Cadmium, Lead, Zinc, Copper and Chromium by described method of (APHA, 2005).

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RESULT AND DISCUSSION

The detailed discussion of analyzed physico-chemical characteristics of collected water samples from different location is presented under the Table 1 & 2. These results are also compared with WHO (2006) and Bureau of Indian Standard (BIS 10500, 2012) recommended for drinking purpose. All three samples collected from different locations were observed colorless and odorless. The pH values ranged from 7.5-7.8 and it was maximum observed from the water collected from Garh (Hapur). The pH values in all drinking water sources were found within the recommended limit of WHO and BIS as 6.5 to 8.5. Turbidity varied from 32-42NTU and all samples it was more than the permissible limit as prescribed by WHO and BIS standards. EC has a wide applicability with respect to drinking point of view high conductivity denotes proportionately high value of calcium, magnesium, sodium and potassium. In the present study, all samples showed more EC as prescribed the limit. Dissolved oxygen varied from 1.86-2.46 Mg/l and it was maximum analyzed from the water collected from Shukratal. All samples showed, the dissolved oxygen concentration more than permissible limit as per recommended by WHO. Chloride in the water samples ranged between 14.56-17.88 Mg/l and the maximum concentration was noted from the water sample collected from Annopshahr site. Chloride occurs in all natural waters in widely varying concentration. Chloride normally increases as the mineral contents increases (Duvey, 2003). Water containing more than 250 mg/l of Cl- ion has salty taste. In our study, chloride concentration remains well within the prescribed limit as prescribed by WHO. The concentration of sulfate varied from 11.52-12.40 mg/l and all samples were within the specified limit. Sulfate causes gastrointestinal irritation if exceeded 250 mg/l level (Raghunath, 1987). The excess of sulfate (more than 250 mg/l) may also reason bitter taste and may have laxative effect to human beings and livestock at further higher level (WHO, 1984).Very high levels of sulfates have been associated with some brain disorders in livestock. The range of sodium found in between 1.46-2.00 Mg/l and all samples it was below the permissible limit as described by WHO. The values of potassium were confined between 1.68-2.14 Mg/l in water samples collected from different locations. WHO have prescribed the limit for potassium ions in drinking water is 12.0 Mg/l. All samples the concentration of potassium was observed under permissible limit It is useful for total ionic balance as well as important nutrient for human body. The high level of these parameters might be due to that the river has been under constant threat of pollution by sewage and industrial waters, disposal of dead bodies, deforestation, excessive use of fertilizers and pesticides, bathing, pilgrims and water development programmes(Khare et al, 2011). Similar findings were reported by Tyagi and Singh (2012) in Ganga water.

The heavy metal concentration of the surface water samples is given in Table 2. These results are also compared with WHO (2006) and Bureau of Indian Standard (BIS 10500, 2012) recommended for drinking purpose. The cadmium concentration varied in the range from BDL-0.002 Mg/l. WHO have prescribed the limit for cadmium in drinking water is 0.003 Mg/l. All samples the concentration of cadmium was observed within permissible limit as prescribed by WHO and BIS. Lead values ranged 0.006-0.008 and it was maximum observed from the water sample collected from Shukratal site. It is pertinent to note that in this study area, lead in almost all samples showed within the permissible limits. The concentrations of zinc (Zn) and coppers (Cu) ranged between 2.8-7.50 Mg/l and BDL to 0.04 Mg/l respectively in all sampling site. Zn concentration was quit more than the permissible limit as per recommended by WHO and BIS. Chromium (Cr) concentrations in all samples were also more the standard limits, varying from BDL-0.04 Mg/l and all samples showed its limit within the permissible limit. The study also revealed that there was a dramatic increase in the concentration of heavy metals at almost all sampling sites. The heavy metals in Ganga river water might be due to organic waste, sewage, trash, food, excessive use of fertilizers and pesticides, bathing, pilgrims, human and animal remains. Similar report has been reported by Chopra, 1990 and Goswami and Singh, 2014).

Table 1. Physio-chemical analysis of Ganga river water at different locations

S.N.	Parameters analyzed	Units	Shukratal	Garh	Anoopshahr
1.	Colour	-	Colourless	Colourless	Colourless
2.	Odour	-	Odourless	Odourless	Odourless
3.	pH	-	7.5	7.8	7.7
4.	Turbidity	NTU	32	35	42
5.	Conductivity	µScm–1	185	194	192
6.	Dissolved oxigen	Mg/l	2.46	2.20	1.86
7.	BOD	Mg/l	1.86	2.12	2.54
8.	COD	Mg/l	210	380	420
9.	Calcium	Mg/l	10.50	13.96	15.82
10.	Magnesium	Mg/l	1.20	1.45	1.54

11.	**Chloride**	**Mg/l**	**14.56**	**17.24**	**17.88**
12.	**Sulphate**	**Mg/l**	**11.52**	**11.98**	**12.40**
13.	**Sodium**	**Mg/l**	**1.46**	**1.85**	**2.00**
14.	**Potasium**	**Mg/l**	**1.68**	**1.86**	**2.14**

Table 2. Heavy metals analysis of Ganga river water at different locations

S.N.	Parameters analyzed	Units	Shukratal	Garh	Anoopshahr
1.	**Cadmium (Cd)**	**Mg/l**	**0.002**	**BDL**	**0.002**
2.	**Lead (Pb)**	**Mg/l**	**0.008**	**0.006**	**0.007**
3.	**Zinc (Zn)**	**Mg/l**	**2.8**	**4.24**	**7.50**
4.	**Copper (Cu)**	**Mg/l**	**BDL**	**0.04**	**BDL**
5.	**Chromium (Cr)**	**Mg/l**	**0.01**	**BDL**	**0.04**

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REPORTED

SURVEY ON POWDERY MILDEW (*ERYSIPHE POLYGONI* DC) DISEASE IN CORIANDER (*CORIANDRUM SATIVUM* L.) AT GWALIOR DIVISION

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Abstract: A survey on powdery mildew disease in coriander at Gwalior Division of Madhya Pradesh to assess the intensity of powdery mildew on the farmer's fields. It is an important disease of coriander in Guna district. Among the surveyed villages the minimum intensity of powdery mildew 14.73 per cent was recorded in Magroda village of Raghogarh block. However it was maximum 44.14 per cent in Bhadodi village of Raghogarh block. Out of the five Surveyed blocks the minimum disease intensity was recorded in bamori 20.79 per cent followed by Kumbhraj 27.22 per cent, Aron 30.18 per cent and Chachoda 34.79 per cent, while maximum intensity 36.65 per cent was recorded in Raghogarh block.

Keywords: *Coriandrum sativum*, Disease, Powdery mildew

INTRODUCTION

The coriander (*Coriandrum sativum* L.) is an important spice crop of India and its seeds (Fruits) and leaves are extensively used. Since very old time, Coriander is being used as a natural additives in cooking added to food in order to improve its appearance, flavor, texture as well as appetite.

It is an aromatic annual herb of 1-2 ft. height having diploid chromosome (2n=22) belonging to the family umbelliferae. The coriander crop is grown for its aromatic and fragrant leaves and fruits. The pleasant aroma is due to an essential element called at d- Linalol or coriandral . The essential oil content ranges from 0.1 to 1.3 percent in dry seeds. Besides essential oil, the seeds of coriander contain 18-21 percent fatty oils which are used in the cosmetic industries. The dried ground fruits used as condiment and are invariably a major constituent of curry powder employed for flavoring curries, soups, and sauces and in confectionery .

The coriander is a native of the Mediterranean region and is extensively grown in different countries such as India, USSR. Mexico, Poland, Hungary, U.S.A. India is the largest producer in the world. It alone accounts an area of 11, 3382 hectares with an annual production of about 37571 metric tones. The major coriander growing states are Rajasthan, Madhya Pradesh, Andhra Pradesh, Gujrat and Tamil Nadu, In Madhya Pradesh Several coriander cultivars are grown but the common ones are UD-1, CS-2, UD-2, UD-373 UD-436, CS-4, CS-208, G-5365 and R C R-41. Madhya Pradesh alone account an area of 37147 hectares with the average production of 9374 metric tones in 2002-2003. In M.P., coriander is grown in Gwalior, Guna, Indore and Mandsor districts.

The coriander crop suffers from different diseases which is one of the limiting factor in its production. Mukherji and basin (1986) listed twenty fungal pathogens and bacterium causing different diseases. Out of these some common fungal diseases are tem gal (*Protomyces macrosporus*), powdery mildew (*Erysiphe polygoni* DC), wilt (*Fusarium oxysporum f.sp. coriandrii*), stem rot (*Rhizoctonia* spp.) and blight (*Alternaria* spp.). Out of these powdery mildew is a very destructive disease and cause losses by deteriorating the quality of the seed and reducing the yield . It is observed that once the parasite establishes it self in the field it takes quits a heavy toll from year to year.

MATERIAL AND METHOD

The present investigations were undertaken at the research farm, College of Agriculture, Gwalior (M.P.) during 2003-04 on survey of powdery mildew of coriander. Fifteen varieties of coriander were used for screening against powdery mildew disease.

The fungicides were used in present investigation are given below :

Table 1.

SNo.	Trade Name	Common Name	Manufacturer
1.	Sulfex	Wettable sulphur**75%** WP	Indian Allied& Industrial Chemicals, Muzaffarnagar, U.P
2.	Bavistin	Carbendazim 50% WP	BASF India Ltd.
3.	Score	Difenoconazole	Syngenta India Ltd. Mumbai

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4.	Dithane M-45	75% WP	Agromore Ltd., Bangalore
5.	Saff	Carbendazim, 12%+ Mancozeb 63 %	UPL, Mumbai

Survey of the disease in Gwalior division

In Coriander (*Coriandrum sativum* L.) powdery mildew disease generally appears at flowering stage of the crop during the month of February to March. Prior to dealing with this disease it was thought necessary to have an estimate of the prevalence of the disease on farmers fields. Therefore, in the present study a well planned survey was also carried out in the coriander growing areas of the Guna district of Gwalior division. Farmers fields were periodically surveyed for recording the incidence of powdery mildew in Guna district of Gwalior division for one season.

Five blocks were randomly selected in Guna district. Five villages from each book and five fields from each village were randomly selected under the study. The observation for powdery mildew incidence were recorded by throwing quadrate method (one square meter) at four places to count number of disease and healthy plants. In this way percentage of powdery mildew incidence was calculated.

Plants showing symptoms of powdery mildew were given score as follows:

0- No symptoms
1- 1 trace 10% plants infected
2- Above 11 to 25% plants infected

Table 2.

Block	**Village**	**Percent disease intensity**
(1) Aron	Piproda maina	36.58
	Chirola	35.47
	Kushman Kharia	40.73
	Tomedi	20.21
	Chirola majra	17.92
Mean	-	**30.18**
(2) Raghogarh	Shripura	26.59
	Bhadodi	44.14
	Sodakhedi	38.05
	Bagnolakha	40.21
	Bhamar	34.00
Mean	-	**36.65**
(3) Kumbhraj	Lambachak	41.40
	Nathupura	37.18
	Wadnagar	23.77
	Polashpura	17.32
	Khudadipura	16.44
Mean	-	**27.22**
(4) Chachoda	Sunderpura	39.27
	Todichak	44.12
	Fitakhedi	31.34
	Gehunkhedi	30.31
	Netakhedi	28.95
Mean	-	**34.79**
(5) Bamori	Laloni	15.55
	Magroda	14.73
	Bhindra	25.84
	Lodera	19.81
	Viloda	25.69
Mean	-	**20.32**

5-Above 26 to 50% plants infected
7-Above 51 to 75% plants infected
9-More than 75% plants infected

The data on the disease incidence was recorded and the percent disease intensity (PDI) was calculated as follows:

$$PDI = \frac{\text{Sum of Numerical rating}}{\text{Total number of observations}} \times \frac{100}{9}$$

RESULT AND DISCUSSION

Survey of the powdery mildew disease in Gwalior division:

Coriander fields of five block of Guna District were surveyed during March 2003 to assess the intensity of powdery mildew on the farmer's fields and the results are summarized in Table . It is clear from the above table that powdery mildew is an important disease of coriander in Guna district as none as none of the surveyed villages fields were free from the disease. Among the surveyed villages the minimum intensity of powdery mildew 14.73 per cent was recorded in Magroda village of Raghogarh block. While it was maximum 44.14 per cent in Bhadodi village of Raghogarh block. Out of the 5 Surveyed block. The minimum disease intensity was recorded in bamori 20.79 per cent followed by Kumbhraj 27.22 per cent , Aron 30.18 per cent and Chachoda 34.79 per cent, while maximum intensity 36.65 per cent was recorded in Raghogarh block. The findings are closely related to the results of Das and Narain (1990) who reported the powdery mildew disease on mung. El-Meleigi and Al-Rokibah (1996) on wheat disease and Lo, and Wang (2000) had also recorded the fungal disease on wasabi (horseradish).

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SHORT COMMUNICATION

EFFECT OF MODIFIED AND SPLIT APPLICATION OF SSP ON AVAILABILITY OF PHOSPHORUS AT DIFFERENT GROWTH STAGES OF TRANSPLANTED RICE (*ORYZA SATIVA* L.)

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Abstract: A field study was carried out at instructional farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad during *Kharif* season, 2010-11 to evaluate the effect of modified phosphatic fertilizer on apparent recovery and phosphorus content in soil and transplanted rice. The experiment was comprised with nine treatments i.e. (T_1) control, (T_2) 100% RDPF, (T_3) 50% basal +50% top dressing in one split at tillering stage, (T_4) 50% basal+50% top dressing in two split 25% at tillering and 25% at PI stage, (T_5) mahua oil coated SSP, (T_6) neem oil coated SSP (T_7) gypsum coated SSP, (T_8) cow dung coated SSP and (T_9) poultry manure coated SSP. These were replicated as thrice under randomized block design. Rice variety NDR-359 was taken as test crop. The experimental soil having pH (1:2.5) 8.8, EC 0.41 dSm^{-1}, organic carbon (0.27%), available nitrogen (188.54), P_2O_5 (16.64) and K_2O (254.83) kg ha^{-1}. The availability of phosphorus significantly increased with the application of phosphorus at all crop growth stages in soil over the control. The maximum available phosphorus was obtained with the application of phosphorus coated with gypsum at tillering, panicle initiation, milking and harvest stages (32.60, 29.20, 24.30 and 19.70 $kgPha^{-1}$), respectively which was significantly superior over mahua oil, cow dung, poultry manure coated and all split application and at par with neem oil coated SSP.

Keywords: Modified SSP, Rice, Salt affected soil, Phosphorus availability

INTRODUCTION

Indian soils are generally deficient in available phosphorus. About 15-20 percent of applied phosphate is available to current crop, and remaining part is converted into relatively unavailable forms due to fixation of P. SSP is one of the most common as well as cheapest fertilizer used by the farmers in India. The best management strategy with phosphorus is to build up to satisfactory level in soil where maintenance dose is needed not to mine the soil reserve but to reduce the extent of fixation. Coating of phosphatic fertilizers is important technique to enhance the availability of phosphorus. The modified and split application of phosphorus doses may reduce the extent of fixation and enhance the availability of phosphorus. (Singh, S. and Swami, B.N., 2006).

MATERIAL AND METHOD

The field experiment was conducted at Instructional Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) India. It was comprised of nine treatments viz (T_1) control, (T_2) 100% RDPF, (T_3) 50% basal +50% top dressing in one split at tillering stage, (T_4) 50% basal+50% top dressing in two split 25% at tillering stage and 25% at PI stage, (T_5) mahua oil coated SSP, (T_6) neem oil coated SSP (T_7) gypsum coated SSP, (T_8) cow dung coated SSP and (T_9) poultry manure coated SSP. It was replicated three times in randomized block design. Rice verity NDR-359 was taken as test crop. The experimental soil having pH (1:2.5) 8.8, EC 0.41dSm^{-1}, Organic carbon 0.27%, Available N 188.54, P_2O_5 16.64 and K_2O 254.83 kg ha^{-1}.The recommended dose of nitrogen and potassium were applied as per treatment in the plot basis before sowing. The various physico-chemical properties of soil were determined as per standard procedures. The available phosphorus was determined at different growth stages of the crop by 0.5M $NaHCO_3$ at pH 8.5 as procedure of Olsen's *et. al.*, 1954.

RESULT AND DISCUSSION

Grain yield

The grain yield of rice was influenced due to coated and split application of phosphatic fertilizer (SSP) in comparison to control. Application of gypsum coated SSP recorded higher grain yield of rice which was significantly superior over all the treatment except neem oil coated SSP and 50% basal + top dressing in two split 25% tillering stage + 25% panicle stage. This might be due to fact that less fixation of phosphorus and more availability of phosphorus because minimize the contact with soil. The results corroborates with the findings of Yadav *et. al.* (2009) and Bhattacharya *et. al.*(2011).

Availability of phosphorus

The availability of phosphorus in soil at different growth stages decreased with increasing the crop growth stages in all the treatments (Table). Maximum available phosphorus was measured at tillering (32.60 $kgha^{-1}$) and panicle initiation, milking and at harvest with the gypsum coated SSP followed

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by neem oil coated SSP, which was significantly superior over Mahua oil, cow dung and poultry manure coated SSP in all crop growth stages. This might be due to favorable effect of this modified material on SSP which regulates the phosphorus diffusion as well as reduce the surface area of SSP fertilizer The soil particles which may helped in retarding the P fixation consequently increased the availability of phosphorus through out the crop growth period. Subramanyam and Dixit (1988) also reported that release of P from coated superphosphate was high up to 4 week and then gradually declined and different coated form of SSP retained relatively higher quantity of water soluble P even at the end of 8 week period of incubation. Maximum available phosphorus in soil were measured 32.60, 29.20, 24.30 and 19.70 $kgha^{-1}$ at tillering, panicle initiation, milking and harvest stages respectively with gypsum coated SSP were significantly superior over mahua, poultry and cowdung coated SSP in all the stages of crop. Only neem coated SSP was found at par as regards the available P in soil. Application of recommended dose of phosphorus through SSP was found most effective in increase in availability of phosphorus during entire crop growth stages. Among the method of application of SSP three splits (50% basal + 25 % at tillering and 25% at Panicle Initiation stage) was found best for availability of P in soil followed by two splits. These results corroborates with findings of Sarkar and Chaudhary (1988).

It is concluded that modified SSP with coatings of Gypsum and neem oil and application SSP in three splits were found more effective in salt affected soil as regards to availability of phosphorus at different crop growth stages.

Table. Effect of modified and split application of SSP on yield and availability of phosphorus in soil under transplanted rice.

Treatment	Grain Yield ($kgha^{-1}$)	Available phosphorus ($kgha^{-1}$) in soil			
		Tillering	Panicle initiation	Milking	At harvest
T_1:Control	34.20	15.17	15.17	12.16	10.14
T_2 : 100% RDPF Basal @ 60kg P_2O_5 ha^{-1} through SSP	36.30	21.30	18.13	14.13	11.25
T_3: 50% Basal +50% Top dressing in one split at tillering stage	44.00	28.85	25.23	18.78	15.28
T_4: 50% Basal+ 50% Top dressing in two split 25% at tillering stage and 25% at PI stage	44.70	30.08	26.65	21.35	17.85
T_5: Mahua oil coated SSP (1:20)	42.50	27.12	23.85	19.78	16.88
T_6 : Neem oil coated SSP (1:20)	46.40	32.10	28.40	23.10	19.10
T_7 : Gypsum coated SSP (1:10)	49.50	32.60	29.20	24.30	19.70
T_8: Cow dung coated SSP (1:5)	38.80	23.18	20.12	15.52	12.42
T_9: Poultry manure coated SSP (1:10)	40.60	25.35	21.76	17.13	13.63
SEm±	1.69	1.12	0.98	0.78	0.64
C.D. at 5%	4.96	3.29	2.87	2.29	1.88

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PERSONAL INFORMATION

ECOLOGICAL AND ENVIRONMENTAL HAZARDS

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Abstract: Ecology and Environmental biology is the branch of science concerned with plant and animal relationship and their interaction with the environment. Ecology is a multidisciplinary science which includes not only the life science, but also chemistry physics, geology, geography, metrology, climatology, hydrology, anthropology, archeology, sociology and even mathematics and statistics as well. The behaviour of an organism or biotic community in a given enviornment can be explained by making use of data obtained from a number of sources such as morphology, taxonomy, genetics, soil Science, Physiology, Geology etc. Many practical applications of ecology are found in agriculture, horticulture, forestry, limnology, fishery, pest control, public health, toxicology, pollution control etc. A knowledge of ecological principles helps in discovering new sources of food, unpolluting sources of energy (e.g. solar energy) and new methods of pest control. By making use of ecological principles the deserts can be converted into agricultural lands.

Keywords: Ecology, Environment, Temperature, Wind, Light

Environment and Eco Factors

Environment includes all the external factors such as soil, water, air, light, temperature, humidity etc., which gave a direct influence on the activities of the organism. Closely related to the environment is habitat which means the particular place where organism grow and live. Each part of the environment is called the ecological factor or environmental factor. Ecological factors are of two types i.e., biotic or non-living, and biotic or living factors.

Abiotic Factors.

The main abiotic factors are climatic factors (temperature, light, rain fall etc), medium factors (soil, water, air), physical factors (fire, pressure, geomanetism) and chemical factors (acidity, alkalinity and availability of nutrients needed by plants.

Temperature. The heat effects are caused by solar energy falling on the surface of the earth. In space, heat travels in the form of radiation. Some sources other than sun also produce heat which affect atmosphere. The temperature affects wind velocity, evaporation and rainfall, sea currents, soil formation from rocks and other vital activities. All forms of life are affected by the environmental temperature where they live. The temperature is a variable factor and is influenced by time, slope, latitude, direction and industrialization. Life processes are all controlled by the temperature.

The COLD BLOODED or POIKILOTHERMIC ANIMALS in which body temperature with the variation in the environmental temperature, are worst affected by the temperature than the WARM BLOODED or HOMEOTHERMIC ANIMALS, in which body temperature remains almost constant, The cold blooded animals, therefore, undergo hibernation or winter sleep during the cold period of the year and aestivation or summer sleep during the hotter period of the year. Warm blooded animals are not-much affected directly by change in environmental temperature. The body activities of these animals, may however, be influenced by the fluctuation of temperature. In fact, every living organism has a range of tolerance temperature. The life activities of the organisms occur best at the optimum temperature (0^0C to 50^0C). The body activities of the organisms cease at the limiting temperature, i.e., the temperature beyond the minimum and maximum limit. Since temperature is highly variable in time and space, the countries near equator are warmer than those which are on north and south poles.

Temperature affects the morphology, physiology, biochemistry and distribution of the plants. The rate of transpiration is directly proportional to temperature. Optimum temperature is required for germination, growth, flowering and fruiting etc.

Light. Sun is the most important source of energy on our planet. The solar energy that sustains all life on the earth is received in the form of electromagnetic waves. Light affects and regulates the plant activities in a variety of ways and is responsible for the growth and photochemical activities of the plants like photosynthesis, transpiration, movement, germination and reproduction. The quality of light (its wave length), its quantity (intensity) and duration (photo period) influence the activities of plants.

Solar energy is received unequally by the earth surface. It is due to the fact that energy flux depends on seasons, time of the day, dirt and atmospheric humidity. Besides many of the environmental phenomenon like wind movement, currents, rainfall, air, shape of earth, distance between sun and earth, direction of slope of mountains are also influenced

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by the quantity of solar energy reaching the earth. It decreases from equator to poleis.

Humidity. The presence of water vapours in air is known as atmospheric humidity. Absolute humidity is the maximum amount of moisture that the atmosphere can hold at a fixed temperature and pressure. The ratio of real humidity and humidity which could be held in the air at that temperature is called the relative humidity (RH). Relative humidity at a given place is influenced by moisture, temperature. pressure (altitude), air velocity, vegetation and soil water. Humidity plays an important role in regulating the activities of the organisms.

Wind Velocity. The effect of wind is less marked in animals than in plants. The transpiration of plants is directly influenced by wind velocity. The latter helps in the distribution of generally small animals from one place to another. For example, cysts, eggs and even small animals like winged insects are often carried away by wind from one place to another. It is also helpful in the dispersal of pollen grains, seeds and fruits. Wind in the form of storms influences much both the fauna and flora of a particular locality.

Atmospheric Gases. The cover of air that envelopes the earth is called the atmosphere. The atmosphere constituters a mixture of gases, the composition and ratios of which very somewhat with height. The atmosphere contains $O_2\,(21\%), N_2\,(78\%), CO_2\,(0.3\%)$ and water vapours (0.1%).

Traces of other gases such as argon, helium, ammonia, sulphur dioxide, sulphur troxide, ozone and methane are also present in the air, along with dust particles, smoke, micro-organisms, pollen grains etc. Oxygen is used in respiration by all organisms. The photosynthesis of green plants gives out oxygen in the atmosphere in the day light. The oxygen is released through stomata,

$$6CO_2 + 12H_2O \xrightarrow[Chlorophyll]{h\nu} C_6H_{12}O_6 + 60_2 + 6H_20$$

The oxygen is consumed by terrestrial and aquatic animals for energy production and they release CO_2 which is used by the plants in photosynthesis. This cycle of oxygen occurs in nature. A small amount of atmospheric oxygen is converted into ozone by photochemical reactions. This ozone layer covers the gaseous envelope around the earth and prevents from the harmful effects of ultra violet rays.

The bulk of the atmosphere is made up of nitrogen, which dilutes the oxygen and slows down the process of oxidation. Nitrogen is the primary source of nutrients for plants and other biological systems. Nitrogen is an essential constituent of chlorophyll and is also a part of DNA and RNA in living beings.

Rainfall. The hot air masses moving from sea, oceans, lakes and ponds are extremely moist. While moving up to elevations or cooler plances, this condensation of atmospheric moisture is the ultimate source of water for the plants. The type and density of vegetation depends upon the quantity of rainfall which also depends upon the weather and geographic regions like altitude, seasonal air, direction of mountains and distance from the sea.

Medium Factors

There are four types of media in which organisms live. These are soil, water, air and the bodies of other organisms in case of parasites.

Biotic factors

The living or biotic environment generally deals with direct and indirect effects of organisms on individuals. This is probably due to the fact that processes like growth, nutrition and reproduction depend upon interactions of other members within the species or between the members of heterogeneous groups.

Interaction among the individuals of same species is known a intra specific interaction, while that among the individuals of different species is called inter specific interaction. These interactions may be harmful as well as beneficial to the participants. Interspecific interactions include neutralism, competition, mutualism, predation, etc.

In neutralism neither of the population (a population is a group of interactiong individuals, usually of the same species, in a definable space) directly affects the other. In competition two species may have a negative effect on one another. It occurs between two or more organisms for a limited amount of food, water, shelter or other resources. Competition may be between the individuals of the same species (intraspecific competition) or between the individuals of different species (interspecific competition). Mutualism refer to the interaction that is strongly beneficial to both species. In predation one animal kills another animal or plant for food. The species that capture, kills and eats up is called predator or enemy and that which is held is called the prey. The predator cannot survive without the prey.

Intraspecific interactions include cannibalism, colonization, aggregation, social organisation etc. Cannibalism is an interaction in which larger members of a species eat up the smaller member of the same species. Colonization is the grouping of free living protozoan's to form colonies. Aggregation refers to the tendency among animals to concentrate in numbers larger than found in normal distribution. Social organizations operate in animal populations as shown by ants, bees, termites among insects, certain birds and fishes.

The distribution and growth of plants and animals in an ecosystem are controlled by both abiotic and biotic features of the environment. Any factor which affects the growth and survival of a populations is called limiting factor.

Ecosystem Resilience

In ecosystem, the substances are constantly flowing through it and there exist sufficient supplies of energy in it. The capacity of an ecosystem to self regulate to self maintain is called homeostatics (homeo-same, statis standing) or ecosystem resilience. Ecosystems have remarkable ability to resilience, i.e., to recover from certain degree of natural and man induced perturbations through feed back mechanisms.

Ecological Pyramids

In pond system the organisms at the beginning of food chain are relatively abundant, while those at the end are few. The trophic structure and function at successive tropic levels, i.e., Producers – Herbivores – Carnivores is known as ecological pyramid. These are of these types:

(i) Pyramid of numbers showing number of organisms at each level.

(ii) Pyramid of bionass showing the total day weight and total amount of living matter.

(iii) Pyramid of energy showing the rate of energy flow and productivity at successive trophic levels.

Cycling of Mineral Elements and Gases in an Ecosystem

The life on earth, including the plants and animals, the non-living environment such as land, water and air, the relationship of one individual with the other, the interaction of living and non-living organisms etc. constitute biosphere, the world of life. Green plants as well as animals enjoy a unique position in the biosphere. The energy that makes the living system work comes from the sun. Green plants are capable of locking the sun's radiant energy into food stuffs through the process of photosynthesis or earbon as assimilation:

$$\mathbf{6}CO_2 + 6H_2O \frac{h\nu}{Chlorophyll} C_6H_{12}O_6 + 60_2$$

Life is thus dependent upon the energy from sun. The food stuff produced by the green plants through photosynthesis is not only utilized by green plants and animals but oxygen, byproduct of photosynthesis is most essential for all organisms, chemical processes (respiration) that unlock the potential energy of the food stuffs. This indicates that animals, in contrast to the plantrs (prime producers), are the prime consumers. For example, sheep or rabbit feed directly upon plants, while animals like lion and tigers, depend upon rabbit and sheep. Thus sheep and rabbit are prime consumers, while lion and tigers are secondary consumers.

The atmosphere and nature waters must be replenished with CO_2. Most of the CO_2 is returned to atmosphere and natural waters by plants and animals through the process of respiration. Bacteria and fungi also return CO_2 to atmosphere and natural water into the soil by acting chemically upon the dead plants, animals and their wastes. Coal, petroleum etc. are also the part of CO_2 cycle and are formed in nature by living organisms.