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SHRIMP DISEASES IN THE SHRIMP FARMS OF SELECTED DISTRICTS OF GUJARAT

Prakash V. Parmar[1], Rekha P. Nanjiyani[1], Temkar G.S.[1*], S.I. Yusufzai[1] and K.H. Vadher[1]

[1]College of Fisheries Science, Junagadh Agricultural University, Veraval - 362 265, Gujarat, India.

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ABSTRACT

The aquaculture production has been grown very steadily worldwidebecause it is one of the widely expanding protein producing sector. The increase in per capita fish production is leading to rapid increase and expansion in aquaculture industry. This causes some constraints like availability of quality seeds and emergence of pathogens and diseases. Along the Gujarat state shrimp aquaculture also grows rapidly, but in last 5 years disease causing scenario hampers the aquaculture production. The samples were collected from different shrimp farms of Gujarat during August 2018-March 2019. The baseline farm data along with their disease history was reported. During the study White spot syndrome virus (WSSV) and Enterocytozoonhepatopenaei (EHP) diseases were reported in different shrimp farms.

Keywords : *Diseases, aquaculture, shrimp.*

INTRODUCTION

The aquaculture production has been grown very steadily worldwide, mainly because of its wide expansion. If we see the last 5 years production scenario of fisheries sector, there is clear dominance of aquaculture production was reported. The main reason for this situation is the overexploitation of marine resources through capture fisheries. The Indian aquaculture sector is mainly contributed by shrimps, but presently there is lots of constraints were reported in shrimp aquaculture such as disease problems, poor quality of seed *etc.*In India major aquaculture production is came from extensive and semi-intensive culture system, with major contribution is from marine and brackish water fed-carnivorous species, which were

mainly causes the major environmental concerns. The unutilized feed and the wastages from the cultured species causes large amount of organic pollution load in the water body, where effluents get discharged. Ultimately, this causes various environmental concerns like eutrophication, degradation of water quality *etc.*

The present scenario along Indian coast represents that along south east coast of India contributes for major shrimp cultivation activities, so it becomes hub for the shrimp cultivation (Selvin*et al.*, 2009) in India. The shrimp cultivation in India is started from 1990th Century (Gunalan*et al.*, 2011), earlier the cultivation was started with *Penaeusmonodon*shrimp, but due to White spot syndrome virus (WSSV)and certain natural constraints, *Litopenaeusvannamei*was introduced in India in 2008 (CAA, 2010; Srinivas*et al.*, 2016b). As per Srinivas and Venkatrayalu (2016), the Pacific white leg shrimp occupied more than 90% of the farmed shrimp production of India. There were various hatcheries developed all over India, for shrimp seed production of *L. vannamei*. The Andhra Pradesh is the leading producer of shrimps from India (Srinivas *et al.*, 2016a).

The major problems which causes negative impact on shrimp farming were lack of availability of quality seed, high feed cost, diseases *etc.*Earlier there is rapid growth of shrimp farming was observed which gives us an economic boom, but recently due to the various disease outbreaks in shrimp farming this business becomes as risk bearing eventand which negatively impacted as industrial development goes slowdown (Flegel, 2006).

MATERIALS AND METHODS

The present study was conducted along the Gujarat state of India. Shrimp samples were collected from shrimp farms of the selected districts of Gujarat state *i.e.*GirSomnath, Bharuch, Surat, Navsari and Diu (U/T). In Gujarat state along these districts significant numbers of shrimp culture practices were going on. Study was conducted from August 2018 till March 2019.

Total 76 numbers of shrimp farms were visited during the study period and total 1,345 nos. of shrimp samples were collected for disease diagnosis study (Table 1).

The collected samples were screened for White spot syndrome virus(WSSV), *Enterocytozoonhepatopenaei* (EHP), Acute hepatopancreatic necrosis disease (AHPND), Infectious myonecrosis (IMNV) and Infectious hypodermal and haematopoietic necrosis (IHHNV) using standardizedPCR protocols.

RESULTS AND DISCUSSION

Along Gujarat state there is 376,000 ha estimated potential brackish water area for shrimp farming, but presently out of that only 884 ha area is under cultivation process (Tandel*et al.*, 2017).The major species which was reported throughout the cultivation survey was *L. vannamei*. During the present survey the major diseases which were reported from the Gujarat state shrimp farming were White spot syndrome virus (WSSV, 8 farms) and*Enterocytozoonhepatopenaei* (EHP, 4 farms; Fig. 1).The majority of shrimp farms along Saurashtra region were started in last 5 years, with most of them having Polythene lining, whereas in rest of the Gujarat state from Bharuch, Surat, Navsari and Diu mostly shrimp farms were earthen ponds. In the present study 1,345 samples were collected from which 237 pools were made, out of that120 samples (24 pools) were WSSV positive and 55 samples (11 pools) were EHP positive, while AHPND, IMNV, IHHNV were absent in all the samples.

White spot syndrome virus (WSSV) has a wide host range among decapod crustaceans,

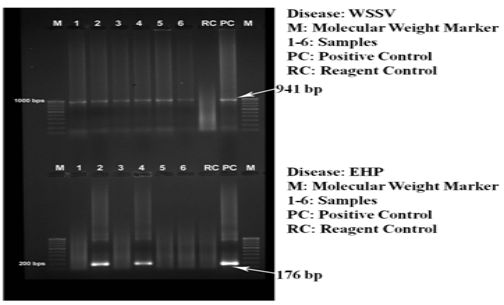
so reasonably it becomes very much lethal for the commercially cultivated penaeid shrimp species (Lo *et al.*, 1996; Flegel, 1997; Flegel and Alday-Sanz 1998). The recent report on current viral diseases for Indian shrimp aquaculture shows that White spot syndrome virus (WSSV), Hepatopancreatic parvovirus (HPV), Monodonbaculovirus (MBV) and Infectious hypodermal and hematopoietic necrosis virus (IHHNV) were some of the diseases which significantly affected the culture practices, along with Loose shell syndrome (LSS) was also reported from late 1998 in India(Tandel*et al.*, 2017). This similar report also stated that recently in India,Monodon slow growth syndrome (MSGS), a component of which seems to be Laem-Singh virus (LSNV) is reported for *L. vannamei* culture (Tandel*et al.*, 2017).

Flegel and Alday-Sanz, (1998) observed in their study all along the Asia continent reported that, the White spot syndrome virus (WSSV) and Yellow head virus (YHV) were major diseases observed, which causes significantly negative impact on the shrimp farming business of Asia.While study in the Andhra Pradesh reported the major disease outbreaks for *L. vannamei* culture were,White spot syndrome virus (WSSV), Black gill disease (BGD), Running mortality syndrome (RMS), Loose shell syndrome (LSS), White faecal syndrome (WFS), White muscle disease (WMD) and Infectious hypodermal and haematopoietic necrosis (IHHN) to the aquaculture industry at Nellore district of Andhra Pradesh (Srinivas *et al.*, 2016c). Whereas Gunalan*et al.*, (2014) described one report on disease occurrence in *L. vannamei* shrimp culture systems from east region of India, where authors stated that six different diseases were reported during their study such as from Andhra Pradesh *viz.*, BGD, IHHNV, WMD, White gut disease and Muscle cramp disease; where from Tamil Nadu *viz.*, WMD, White gut disease; and from Orissa *viz.*, IHHNV were observed. The recent study on *P. vannamei*culture ponds of Andhra Pradesh, India were reported that Andhra shrimp culture practices hampered with multiple diseases such as Running mortality syndrome (RMS), White spot syndrome virus (WSSV), White faeces/white gut syndrome and a microsporedian, *Enterocytozoonhepatopenaei* (EHP) infection (Kummari*et al.*, 2018).

Table 1. Study area of Gujarat State.

State	District	Number of visited Villages	Total no. of farms visited
GUJARAT	Gir-Somnath	05	31
	Bharuch	05	22
	Navasari	03	12
	Surat	01	03
	Amreli	01	05
	Diu	01	03

Fig. 1.Nested PCR gel image for WSSV and EHP.



CONCLUSION

As the food demand increases peoples started to move towards the aquaculture sector for fulfillment of hunger. But presently due to large scale indiscriminate culture practices without maintaining sustainability causes lots of problems in the aquaculture. In the present study 1,345 samples were collected, from which 120 samples were affected by White spot syndrome virus and 55 samples were affected

by *Enterocytozoonhepatopenaei*, whereas other diseases *viz.*, AHPND, IMNV, IHHNV were not reported during present study.

ACKNOWLEDGEMENT

This work has been done from the grant received from the NFDB, Hyderabad and NBFGR, Lucknow. So, the authors are thankful to NFDB, Hyderabad and NBFGR, Lucknow for providing grant for the present study.

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SOCIO-ECONOMIC STATUS OF FISHERMEN CO-OPERATIVE SOCIETIES OF BHANDARA DISTRICT OF MAHARASHTRA, INDIA

P. A. Telvekar[1], A. D.Sonone[2], M. R. Hadge[3] and A. S. Ninawe[4]

[1,2,3]College of Fishery Science, Seminary Hills,
Nagpur - 440 006, Maharashtra, India.
[4]Department of Bio-technology, CGO Complex,
Lodhi Road, New Delhi-110003, India

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ABSTRACT

The present investigation reveals the socio-economic status of fishermen co-operative societies of Bhandara district. The major fish species caught by the fishermen in Bhandara district are found to be Indian major carps, exotic carps, catfishes and murrels. The assessment of gender participation in the fishermen co-operatives comprised of 348women members compared to 4474 male members. The women members play major role in pond preparation and activities related to seed production of major carps. The study indicates that only 29 % of societies in the district are having their own fishing crafts, which directly affects the months of active fishing, fish yield and profit accrued by the societies. The off-season livelihood activities of members are fish seed production, fish catching in rivers and odd jobs in agriculture. The computer literacy rate among the fishermen co-operatives is almost negligible which has been a hurdle for record keeping and maintenance.

Keywords: *Fishermen co-operatives, socio-economic status, fishing crafts, literacy*

INTRODUCTION

In many countries, Fishermen Co-operativesare useful in solving socio-economic problems of poverty hit Fishermen, fighting against their ignorance and their exploitation by middlemen and providing credit facilities and other facilities of equipment's and marketing. The Societies are run, managed and administered by members and the profit is shared among the members. The different activities like assembling, storage, sale, purchase, market information, pricing,

weighing facility, cold storage, processing and transport and advancement of financial assistance to Fishermen are performed by Fisheries Co-Operative societies. In India the District Bhandara is situated in North-Eastern extreme of the Vidarbharegion is called Lake District of Maharashtra. This district along with adjoining Gondia district (which has been carved out of Bhandara), is blessed with numerous natural water bodies like lakes, ponds and village tanks. The manmade tankslocally called'MalguzariTalao' are also a characteristic feature of District Bhandara. The district has total 6022waterbodies with 12510 ha area suitable for fishing, of which about 9567 ha has been under fishing. Most of these water bodies are leased out to the Fishermen Co-operative Societies which has a good network in the district. However, the fish production in the district is found to be less, though the sizable water resourcesare available. The fishermen co-operative societies are major stakeholders in the fisheries sector in Bhandara District. The Co-operative Society are important in fish trade and marketing. However, socio-economic condition of fishermen is one of the concerns in inland fisheries sector.

In view of this, the study was taken to assess the social economic status of cooperative societies in Bhandara District of Maharashtra. The data was collected on the 51 co-operative societies in the district.

MATERIALS AND METHODS

Bhandara District comprises an area of 4087 km2 and has population of 1200334 with almost the same no. of male and female of which 19.48% are Urban & Rest are Rural as per population data survey 2011. It is located at 21.10 latitude N and 79.39 longitude E. The district is known for Rice producing centre and also for the lakes and reservoirs for good source fishery resources. For the present investigation, information on socio-economic conditions of 51 Fish co-operative Societies from Bhandara district of Maharashtra was collected through questionnaires. The data for investigation was collected by arranging discussion with management board of Fishermen Co-operatives with the help of survey schedule format. Various socio-economic parameters were studied for analysis of societies such as gender pattern in membership to societies, active fishing month, fishing gear used, ownership to fishing boats, fish species caught, fish marketing, offseason livelihood activity etc.

RESULTS AND DISCUSSION

Gender pattern in Membership to societies

The analysis of data on gender wise membership showed very meager participation of women in the fishermen co-operative societies. The registered membership in 51 fish cooperative societies represented 4822 members, of which only 348 members were women. This may be due to the less participation of women in active fishing and in decision making too.

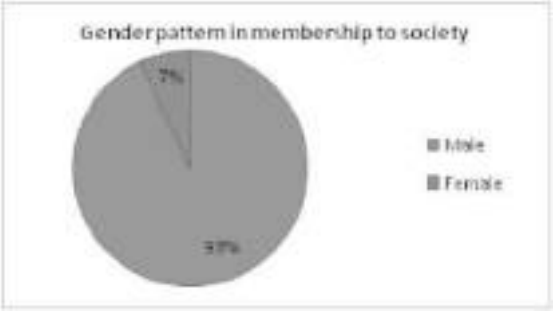


Fig.-1.Gender pattern of membership in fishermen co-operatives in Bhandara District.

Active fishing months

The district Bhandara has a tropical climate. In winter, there is much less rainfall than in summer. Although, the district is blessed with abundant water bodies, most of these are seasonal, the major reason for less

number of active fishing months. The fishing season generally starts from the month of August every year stretching till late summer. The present study reveals 65% of fishermen engaged for 1 to 3 months of active fishing, 21% fishermen engaged for 4 to 6 months and only 14 % fishermen having more than 6 months of engagement in active fishing.

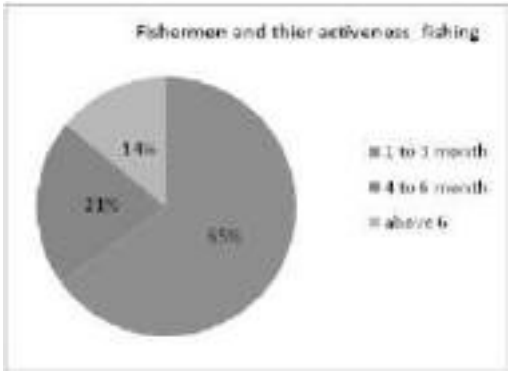


Fig.-2.Percentage of fishermen having active fishing months in Bhandara District.

Fishing gears used

The gill nets and drag nets are most commonly used fishing gears in the Bhandara district. The gills nets are used by every fishermen society while, drag nets by 78.43 % of societies, cast nets by 15.69 % societies and traps by 11.76% societies. The drag nets with 200 mts. of head rope are used in shallow water bodies to flush out most of the fish. The traps are used for catching fish species like Murrels, eels and catfishes etc.

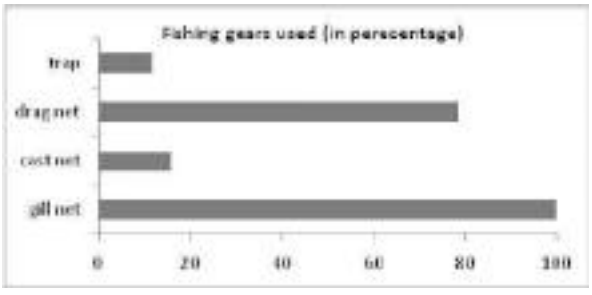


Fig.-3.Percentage of fishing gears used in Bhandara District.

Ownership to fishing crafts

The smaller fishing crafts called Donga, Hodi's and 'Nava's are commonly used fishing crafts in the District. It is found that only 29 % fishermen have their own Donga's and 71% fishermen don't not have their own fishing crafts. The fishing is done in groups called 'toli', which hires 'Donga' from fishermen societies having their own fishing crafts. The poor fishermen use tire tubes and thermocol blocks for fishing in lakes and reservoirs.

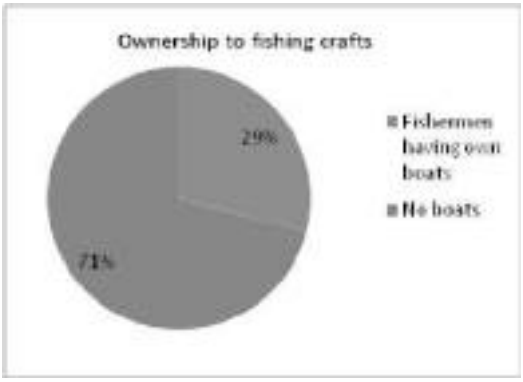


Fig.-4.Percentage of fishing gears used in Bhandara District.

Fish Species being caught

The fish species which are commonly caught in the waterbodies of the district are Rohu, Catla, Mrigal, Common carps, Ompokbimaculatus, Ompokpabda, Heteropneustesfossilis, Channamarulius, Channastriatus, Mystusseenghala, Mastacembalusarmatus, Wallagoattu, Salmostomata spp., Oreochromismossambicus, Notopterusnotopterus, Notopteruschitala, Labeocalbasu etc.

Fish marketing system

Each fishermen society catches about 50-250 kg of fish per day of active fishing season. The fish has good demand in local markets as well as cities like Nagpur and Raipur nearby. The fish is sold through

commission agents cum wholesalers generally. The percentage of fish sold by the Co-operative society on its own is 6 % while 94% fish is sold to the commission agents cum wholesalers. There are hardly any facilities of icing and refrigeration available on the lakes. Therefore, the bulk of catch is quickly taken to the main market at Bhandara, from where it is transported to various consuming centres.

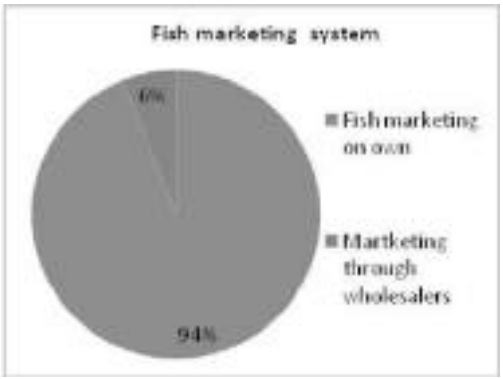


Fig.-5.Fish marketing system in Bhandara District.

Fish species stocked by societies

The stocking of quality fish seed of desired species and in required quantity is necessary for reviving fishery resources in water bodies. The fisheries co-operatives often stock water bodies they have taken on lease. In Bhandara district, the societies annually stock their water bodies with Indian Major Carps, Common carps and in some cases freshwater prawns for enhancing fish production. However, the fish stocking is depends on availability of fish seed. The district has one Government owned Carp fish seed production CentreatShivanibundh. Similarly, the Co-operative societies have developed wet bundh breeding in traditional Mogarabundhs. The rest of fish seed is procured from Kolkata and Raipur by the societies. The fish seed of Indian major carpsare stocked by almost all societies, Exotic carps by 80.39 %, Clariusbatrachus by 45.1%, Channa spp. by 17.64 % and seed of other fishes by 11.76% societies.

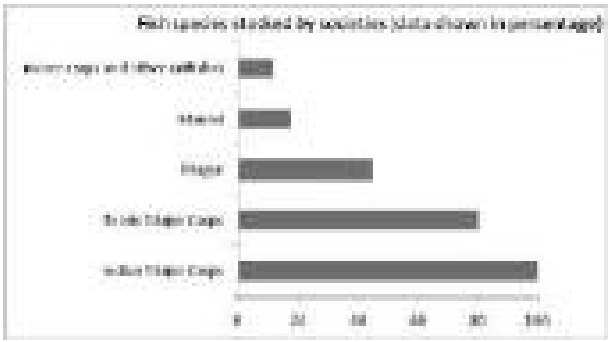
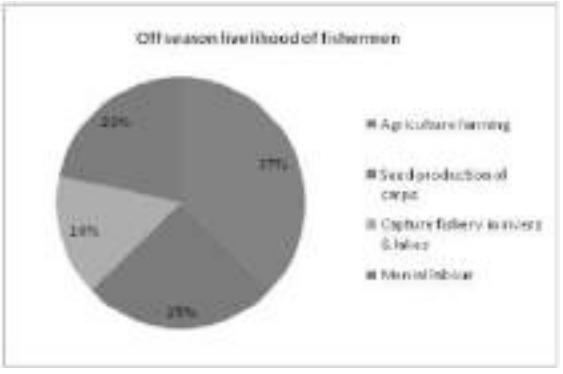


Fig.-6. Fish marketing system in Bhandara District.

Off season livelihood of fishermen

In Bhandara District, the fishing is carried out mostly for 6 to 8 months in a year. The most of water bodies in the district are seasonal which also aggravate the problem of livelihood for fishermen. During the off season, members of fishermen co-op. society are engaged in agriculture activities. It is observed that 37 % fishermen take to agriculture related activities during lean season, 25 % fishermen in fish seed production, 16 % in fishing in rivers and 22 % in menial labours.



Indebtedness of societies

The fishermen need credit facilities to start their enterprise. The fishermen co-op. societies in BhandaraDistrict receive profits in the range of Rs.45000/- to Rs. 8,00,000/-. It is also found that 84.32 % societies do not avail any loan from any financial institutions, while 15.68 % avail loans for their occupational

needs.

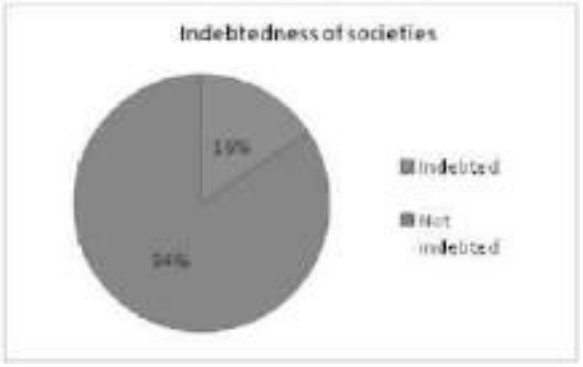


Fig.-7. Indebtedness of fishermen societies in Bhandara District.

Training received by society members

It could reveal that, the skill based training on farm made feed preparation; fish culture in seasonal water bodies, fish seed production and hatchery management as well as cage culture etc. is needed by the members of most of societies. The training mainly on "Improved fish culture practice, fingerling production, value addition and improved fish harvesting methods" is also needed by the fishermen. It is found that 98.22 % fishermen have not received any skill based training while only 1.78 %.

Fig.-8.Trained fishermen societies in Bhandara District.

Computer literacy in fishermen societies

Most of the fishermen co-operative societies do not have Information Technology related facilities. It also observed that 96.02 % members either have no access to IT facilities or any IT related competency. Only, 3.92 % fishermen have any kind of computer literacy.

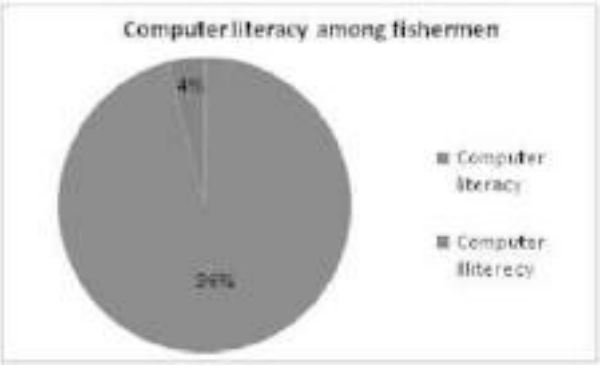


Fig.-9. Computer literacy among fishermen of Bhandara District.

CONCLUSION

Among the 51 fish co-operatives societies involved in fish culture and capture fishery in dams and reservoirs have not represented adequate number of women member participation. Most of the members are lacking computer literacy, also the societies do not possess adequate number fishing crafts andare following the traditional fishing methods.The training and extension programmes for fishermen are very much needed to be carried out in the district on scientific lines. The fish culture practices during off-season months need to be promoted among the fishermen groups. As a strategy for sustaining the fishery resources, the fish farmers cooperative need to promoted with welfare schemes for fisherman through adoption of best fishery management policy, social and technical support for improvement of livelihood the conditions of fishermen in Bhandaradistrict of Maharashtra.

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EFFECT OF SEED TREATMENT ON SEEDLING VIGOUR AND MORTALITY OF BAEL (AEGLE MARMELOS L.)

Surya Narayan
Department of Horticulture
K.A.P.G., Collage Prayagraj, 211001, (U.P.), India

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ABSTRACT

The experiment was conducted at the Department of Horticulture, Kulbhasker Ashram Post Graduate Collage, Allahabad, Uttar Pradesh with a view to standardize suitable stratification duration and hormone concentration for Bael seed treatment. There were seven treatment combinations (T1 to T10) including a control. Different duration of seed stratification i.e., 24hours,48 hours and 72hours were tried along with the 100ppm,200ppm and 300 ppm GA3 seed treatment . Treated seeds were sown in the polythene bags (25x15 cm size, 200gauge thick) containing soil, sand and FYM mixture (1:1:1). It was interesting to note that the effect of stratification duration and hormone treatment concentration was found to be significant for seed germination, transplanting success, seedling mortality percentage and rate of seed germination. Treatment T6 (48hrs+300ppmGA3) yielded highest percentage, (84.00) of seed germination while the lowest percentage value (37.25) was recorded in T9 (72hrs+300ppmGA3) treatment and the transplanting success was also lowest in T9. The seedling mortality percentage was maximum (79.25) with T9 where as lowest percentage value (22.00) was observed for T6 treatment. It may be concluded that T6 treatment can be recommended for the better stand establishment of Bael nursery.

Keywords: *Stratification, treatment, GA3, nursery, bael , mortality, seedling, germination, seed.*

INTRODUCTION

Bael is more resistant to biotic and abiotic stresses. Seedlings of this species have poor buddable size attainability. Their long lasting effect on guava makes orchard remunerative. Increased demand of Bael

(Aegle marmelos L.) buddlings in traditional as well as nontraditional areas of India due to its peculiar character of diverse use, medicinal value, tolerance to biotic and abiotic stresses, higher benefit cost ratio and positive government policies emphasized to chalk out some feasible and acceptable measures for the better stand-establishment of saplings at the nursery stage. Bael buddlings are prepared thorough budding on seedling root - stock which is obtained through seeds. In nature, Bael seed has poor germination and higher seedling mortality, owing to adverse edaphic conditions during nursery stage. Therefore it becomes imperative to standardize suitable stratification time and exact hormone concentration for seed treatment for flourishing the Bael nursery-industry. Certainly, these tactics are the most important component to provide sound base for propagation, once time and concentration is standardize, we shall be able to grow healthy seedlings with faster rate.

Keeping these aspects in view, the experiment was under taken to ascertain the effect of the stratification and hormone treatment on seed germination, rate of seed germination, transplanting success and mortality of seedlings.

MATERIALS AND METHODS

The experiment was conducted at the Department of Horticulture, Kulbhasker Ashram Post Graduate Collage, Allahabad, Uttar Pradesh during the year 2016-17 with a view to standardize suitable stratification duration and hormone concentration for Bael seed treatment. There were ten treatment combinations (T1 to T10) including a control. Different duration of seed stratification i.e., 24hours, 48 hours and 72hours were tried. Soaked seed were put in layers under different strata of moist sand for varying duration. GA3 hormone @ 100ppm, 200ppm and 300 ppm was used for seed treatment after stratification. Treated seeds were sown in the polythene bags (25x15 cm size, 200gauge thick) containing soil, sand and FYM mixture (1:1:1).

RESULTS AND DISCUSSION

Seed germination in Bael started after 3 days of seed sowing and completed within 27 days in all the treatment. Seed germination under different treatments ranged between 37.25 to 84.00 percent. The percentage of seed germination as influenced by treatments differed significantly The maximum seed germination (84.00 %) was recorded in treatment T6 (48 hrs stratification+300 ppm GA3) which was significantly superior to all other treatments and the value was lowest (37.25%) in T9 (72 hrs stratification+300 ppm GA3). The findings of the study supported and corroborated the findings of Bisla et al., (1984) in Bael and Govind and Chandra, (1993) in Khasi Mandrin. The lowest percentage of seed germination obtained with treatment T9 indicated adverse effect of longer duration of stratification coupled with toxic concentration GA3 which augmented seed decay and partial damage of seed too. Over tendering of seed coat and ultra concentration of GA3 might be corroded the plume and radicle of the seed resulting failure of germination. The possibility of exo-osmosismay not be denied. Dewey, (1960); Paliwal & Gandhi (1968) and Ayers and Westcot (1976) also observed the same causes.

There was insignificant difference on the rate of Ber seed germination as it was conspicuously influenced by various duration of stratification and seed treatment. However, the faster rate of seed germination was recorded in T9 (72 hrs stratification+300 ppm GA3) i.e.8.25 mean days followed by T8 (72 hrs stratification+2ppm GA3) i.e.,9.01 mean days). The slowest rate of seed germination was recorded T10 (control) i.e., 15.52 mean days). Similar result were also recorded by Bahuguna

Table-1 Effect of stratification duration and hormone concentration on seed germination and rate of seed germination in Bael (Aegle marmelos L.)

Treatments	Seed germination (%)								*Rate of seed germination*
	3 DAS	**6 DAS**	**9 DAS**	**12 DAS**	**15 DAS**	**18 DAS**	**21 DAS**	**27 DAS**	***Mean days taken in seed germination***
T_1 (24hrs+100pp mGA3)	2.95 (9.89)	22.66 (23.29)	43.33 (35.4)	48.33 (37.06)	53.66 (40.92)	56.00 (45.12)	56.00 (45.12)	56.00 (45.12)	10.43
T_2 (24hrs+200pp mGA3)	3.05 (10.3)	22.66 (25.29)	45.33(38.40)	50.33 (40.06)	58.66 (45.92)	60.00 (50.12)	60.00 (50.12)	60.00 (50.12)	10.25
T_3 (24hrs+300pp mGA3)	3.25 (10.30)	24.66 (28.29)	47.33 (40.4)	53.33 (45.06)	60.66 (48.92)	61.00 (52.12)	61.00 (52.12)	61.00 (52.12)	10.01
T_4 (48hrs+100pp mGA3)	2.36 (8.83)	25.66 (30.29)	49.33 (44.4)	55.33 (48.06)	63.66 (52.92)	64.00 (53.12)	64.00 (53.12)	64.00 (53.12)	11.40
T_5 (48hrs+200pp mGA3)	3.60 (10.82)	25.66 (30.33)	51.33 (45.76)	61.66 (51.75)	64.66 (53.5)	65.00 (53.72)	65.00 (53.72)	65.00 (53.72)	11.24
T_6 (48hrs+300pp mGA3)	5.63 (13.55)	27.66 (31.64)	57.66 (49.41)	64.00 (51.13)	83.33 (68.91)	84.00 (69.35)	84.00 (69.35)	84.00 (69.35)	11.03
T_7 (72hrs+100pp mGA3)	2.63 (10.75)	24.53 (33.21)	39.85 (39.44)	42.25 (41.44)	44.25 (42.44)	44.25 (42.44)	45.49 (43.21)	45.49 (43.21)	9.24
T_8 (72hrs+2 00pp mGA3)	2.33 (6.75)	23.53 (30.21)	39.25 (38.44)	40.25 (39.44)	41.25 (40.44)	41.25 (40.44)	41.25 (40.44)	41.25 (42.44)	9.01
T_9 (72hrs+3 00pp mGA3)	2.23 (5.75)	22.53 (28.21)	37.25 (37.44)	37.25 (37.44)	37.25 (37.44)	37.25 (37.44)	37.25 (37.44)	37.25 (37.44)	8.25
T_{10} (control)	2.53 (8.75)	20.53 (23.21)	33.25 (32.44)	43.12 (39.21)	48.00) 41.04)	49.54 (42.32)	50.74() (43.49)	50.74 (43.49)	15.52
C.D. at 5%	2.01	3.24	3.11	2.89	2.75	3.01	3.01	3.01	2.36

Note: figures in parentheses are average transformed value.

and Pyarelal, (1993) in case of Acacia. There was a noticeable and significant effect of treaments on transplanting success. All those treatments respond poor in seed germination also were poor in transplanting success. Though seeds were sown in polythene bags and gently transplanted into the field.

The differences due to various treatments in respect of seedling mortality differed significantly The mortality of Bael seedling range between 22.00 to 79.25 per cent within 56 days of seed sowing. The highest mortality was recorded (79.25%) in T9 (72 hrs stratification+300 ppm GA3).followed by 68.25 per cent in T8 (72 hrs stratification+200 ppm GA3) and the value was lowest (22.00%) in T6

Table-2 Effect of stratification duration and hormone concentration on seedling mortality and transplanting success in Bael (Aegle marmelos L.)

Treatments	*Seedling mortality (%)*					*Transplanting success (%)*
	28 DAS	**35 DAS**	**42 DAS**	**49 DAS**	**56 DAS**	
T_1 (24hrs+100ppmGA3)	12.00 (22.30)	23.09 (32.04)	28.93 (34.91)	35.01 (38.03)	35.01 (38.03)	74.43
T_2 (24hrs+200ppmGA3)	11.00 (21.30)	21.09 (30.04)	26.93 (32.91)	30.91 (34.03)	30.01 (34.03)	75.25
T_3 (24hrs+300ppmGA3)	10.99 (21.10)	20.89 (29.94)	26.63 (32.81)	30.01 (33.93)	30.01 (33.93)	76.01
T_4 (48hrs+100ppmGA3)	8.99 (20.10)	19.99 (29.64)	25.66 (31.41)	29.00 (33.13)	29.00 (33.13)	79.40
T_5 (48hrs+200ppmGA3)	8.63 (19.55)	19.66 (28.64)	24.66 (30.41)	26.00 (32.13)	28.00 (32.13)	81.24
T_6 (48hrs+300ppmGA3)	7.63 (15.55)	17.66 (24.64)	20.66 (27.41)	22.00 (28.13)	22.00 (28.13)	91.03
T_7 (72hrs+100ppmGA3)	45.63 (39.75)	48.53 (40.21)	50.85 (43.44)	58.25 (52.44)	58.25 (52.44)	49.24
T_8 (72hrs+2 00ppmGA3)	58.33 (51.75)	62.53 (55.21)	65.25 (57.44)	68.25 (58.44)	68.25 (58.44)	39.01
T_9 (72hrs+3 00ppmGA3)	62.23 (55.75)	69.53 (58.21)	77.25 (62.44)	79.25 (65.44)	79.25 (65.44)	35.25
T_{10} (control)	46.63 (39.95)	49.53 (41.21)	51.85 (44.44)	59.25 (53.44)	59.25 (53.44)	65.52
C.D. at 5%	2.31	3.54	3.42	3.89	2.95	4.43

Note: figures in parentheses are average transformed value.

(48 hrs stratification+300 ppm GA3) treatment. Similar results were also found by Awang and Hamzah (1986) in Acacia. Bael seed soaking more than 48 hours was proved detrimental in term of seed germination and mortality Therefore soaking hours should not constitute more than 48 hours to achieve better survival of Bael seedlings. Obviously, more leaching had toxic effect of hormone on tender seedlings and higher osmotic pressure, imbalanced nutrient level lead to mortality of the seedlings The findings are in the conformity of the findings of the Sharma et al., (1984) and Gupta,(1989).

Based on the result obtained from investigation it can be concluded that seed soaking for 48

hours followed by 300 ppm seed treatment with GA3 resulted best performance with regards to percent seed germination (84.00%) and least seedling mortality (22.00%). of Chinese bael.

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SEASONAL AND TEMPORAL VARIATIONS IN AEROMYCOFLORA OF BARHALGANJ, GORAKHPUR

S.N. Sharma[1], Rajiv Ranjan[2] and Neeraj Srivastava[3*]

[1]Department of Plant Pathology, National P.G. College, Barhalganj – 273402, Gorakhpur, (U.P.), India

[2]Department of Botany, M.L.K. P.G. College, Balrampur – 271201, , (U.P.), India

[3]Department of Botany, St. Andrew's (P.G.) College, Gorakhpur – 273001, , (U.P.), India

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ABSTRACT

In the present investigation, fungal air spora of Barhalganj, Gorakhpur has been studied in different seasons of the year from January to December, 2018. Three sites named Pidahani, Shukulpuri and Newada were selected for the study of seasonal and temporal variations. The maximum air fungal spora was obtained in winter season and minimum in dry and hot months of summer. Different seasons exhibited different dominant fungal species. The population of air fungi varied at three trapping periods, i.e., 7 A.M., 1 P.M. and 7 P.M. in different seasons.

Keywords : *Aeromycology, aeromycoflora,seasonal variations, temporal variations.*

INTRODUCTION

Cunningham (1873) started aerobiological investigations in India. He microscopically examined the air spora of Calcutta prison and reported the changes in atmospheric spore content due to rainfall. Rajan *et al.* (1951) made some fragmentary reports about air spora, but no quantitative information was available till that time. Sreeramulu and his students made sincere efforts in the field of aerobiological studies in India. They reported the air spora of paddy fields in Andhra Pradesh (Sreeramulu, 1960; Sreeramulu and Seshavataram, 1962; Sreeramulu and Ramalingam, 1963, 1964, 1966; Sreeramulu, 1972).

Barhalganj (26°17'13"N 83°30'32"E) is situated on the left bank of the Ghaghra river, a tributary of the Ganges. It is a town of Gorakhpur District, situated in the sub-Himalayan-belt of Uttar Pradesh (India). It provides an interesting locality for aeromycological investigations due to its humid tropical climate. The fungal air spora of Gorakhpur has been studied and reported by several workers (Mishra and Kamal, 1968;

Mishra and Srivastava, 1971; Kamal and Singh, 1974, 1975; Verma and Kamal, 1982; Srivastava et al. 1990; Srivastava, 2014). However, the aeromycoflora of Barhalganj has not yet been studied. In the present investigation, seasonal and temporal distribution pattern of air fungal spora of Barhalganj town of the year 2018 (January to December, 2018) has been studied and analysed.

MATERIALS AND METHODS

(I) Sites of Investigation

Three sites named Pidahani, Shukulpuri and Newada (located towards East, West and North of Barhalganj town, respectively) were selected for the study of seasonal and temporal variations of aeromycoflora.

(II) Climatic Conditions

Based on temperature and rainfall of the town Barhalganj (26°17'13"N 83°30'32"E), the year can be divided into three seasons – summer (March to June), rainy (July to October) and winter (November to February). The summer has high temperature (maximum up to 46 to 48°C), decreased humidity and hot winds, whereas the winter is characterized by low temperature (minimum up to 4 to 6°C). In rainy season, there is heavy and frequent rainfall (a maximum precipitation of about 350 mm.). The temperature is moderately high with high relative humidity and it drops slowly at the end of the season.

(III) Isolation of Aeromycoflora

The spores of fungi present in the air were trapped by **"Gravity Plate Method"** (Frankland and Hart, 1887). The culture medium used for isolation was Martin's Streptomycin – Rose Bengal Agar. Five Petri plates of 30 mm. diameter containing this culture medium were exposed for five minutes in the area of investigation, three times on each day of sampling (Morning - 7.00 hr., Noon - 13.00 hr. and Evening - 19.00 hr.). The Petri plates were placed on a stand, at a height of one meter above the ground level. This sampling was done for one year (January to December, 2018) at 15 days intervals. The exposed Petri plates were incubated for seven days at 25±2°C to obtain mixed culture. The fungi appeared in the mixed culture were purified by single spore culture and identified. Total number of colonies per plate and number of colonies of individual species were recorded separately. Quantitative studies were made by calculating the average colony count per Petri plate during one month.

Gravity Plate Method Technique used for trapping fungal spores is convenient and economic. However, it has some limitations like sensitivity to fungal spore size, wind speed and aerodynamic effects, and also the small volume of air sampled intermittently (Gregory, 1961). However, the method has been employed extensively by various workers for trapping and studying the air spora (Frankland and Hart, 1887; Saito, 1922; ZoBell and Mathews, 1936; Richards, 1954 and Werf, 1958).

RESULTS AND DISCUSSION

In the present investigations, 45 fungal species were isolated from various samples (Table – 1), as follows:

1.	Zygomycotina	=	04 Species
2.	Ascomycotina	=	06 Species
3.	Deuteromycotina	=	33 Species
4.	Mycelia Sterilia	=	02 Species

(I) Qualitative Analysis

It is evident from Table – 1 that qualitatively, maximum number of fungal species in one month were trapped in November and minimum in May. However, different fungi differed in the time of their occurrence. Only two species *viz., Alternaria humicola* and *Aspergillus niger* were recorded in every month of the year.

(II) Quantitative Analysis

A perusal of Table – 1 shows that March

Table – 1 Monthly Distribution of Air Fungal Spora
(January to December, 2018)

Sr. No.	*Fungal* species	Months											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1	*Acrophialophor a fusispora* (Nicot) Gams	-	+	-	-	-	-	-	-	-	+	-	+
2	*Alternaria alternate* (Fr.) Keissl.	-	+	+	+	+	-	-	-	-	-	-	-
3	*A. humicola* Oudemans	+	+	+	+	+	+	+	+	+	+	+	+
4	*Alternaria* sp.	-	+	+	+	-	-	-	-	-	-	-	-
5	*Aspergillus aculeatus* Iizuka	-	-	-	+	-	+	+	+	-	+	-	-
6	*A. amstelodami* (Mangin)Thom &Church	-	-	-	-	-	-	-	-	-	-	+	+
7	*A.carneus*(van Tiegham) Blochwitz	+	+	+	+	+	-	-	+	-	-	-	+
8	*A. chevalieri* (Mangin)Thom &Church	-	-	-	-	-	-	-	+	-	+	-	-
9	*A. flavipes*(Bain. &Sart.)Thom&Ch urch	-	-	-	-	-	-	-	+	-	+	-	-
10	*A. flavus*Link	-	-	-	+	+	+	+	+	+	-	+	-
11	*A. fumigatus* Fresenius	+	-	-	-	-	-	+	+	-	+	+	-
12	*A. nidulans* (Eidam)Wint.	+	-	+	+	+	+	+	+	+	+	+	-
13	*A. niger*van Tiegham	+	+	+	+	+	+	+	+	+	+	+	+
14	*A. niveus* Blochwitz	-	-	-	-	-	-	-	-	-	-	-	-
15	*A. ochraceous* Wilhelm	-	-	+	-	-	-	-	-	-	-	+	-
16	*A. regulosus* Thom&Raper	-	-	-	+	-	+	-	-	-	-	-	-
17	*A. sydowii*(Bain. &Sart.)Thom&C hurch	+	+	-	+	-	+	+	+	+	+	+	+
18	*A. tamarii*Kite	-	-	-	-	-	+	-	+	-	-	-	-
19	*A. terreus*Thom	-	-	-	+	-	-	+	+	+	+	-	-
20	*A. versicolor* Berkeley & Broome	-	-	-	-	-	+	-	-	-	-	+	-

Table – 1 Monthly Distribution of Air Fungal Spora
(January to December, 2018)

21	*Cladosporium cladosporioides* (Fres.) de Vries	+	+	+	-	-	-	-	-	+	+	+	+
22	*C. herbarum* Link ex Fr.	+	+	+	-	-	-	-	-	-	-	+	+
23	*Cladosporium* sp.	+	+	-	-	-	-	-	-	-	+	+	+
24	*Corynespora cassicola* (Berk. & Curt.) Wei.	-	-	-	-	-	-	-	+	+	-	-	-
25	*Curvularia lunata* (Walk) Boed.	-	+	+	+	+	+	+	+	+	+	+	+
26	*C. palliscens* Boed.	-	+	-	+	+	+	+	+	+	+	+	+
27	*C. subutata* (Nees) Boed.	-	+	-	-	-	+	+	+	-	-	-	-
28	*Epicoccum purpurescens* Ehrenb. ex Schlecht.	+	+	-	-	-	-	-	-	-	-	-	+
29	*Fusarium moniliforme* Sheldon	-	+	+	+	-	+	+	-	-	+	+	-
30	*F. oxysporum* Schlecht. emend. Snyder & Hansen	-	+	-	-	-	-	-	-	-	-	-	+
31	*Mucor hiemalis* Wehmer	-	-	+	-	-	-	-	-	+	-	-	-
32	*Nigrospora sphaerica* (Sacc.) Mason	+	+	+	-	-	-	-	+	+	-	+	+
33	*Paecilomyces variotii* Bain	-	-	+	+	-	+	+	+	+	-	+	-
34	*Penicillium citrinum* Thom	-	+	+	-	+	-	-	-	-	+	-	+
35	*P. oxalicum* Currie & Thom	+	-	-	+	-	+	-	+	+	+	-	-
36	*P. purpurogenum* Stoll	+	-	-	-	-	-	-	-	-	+	+	+
37	*Periconia igniaria* Booth	+	-	+	-	-	-	-	-	-	-	+	+

38	*Phaeotrichoconis crotalariae* (Sal & Rao) Subram.	-	-	-	-	+	-	+	-	-	-	-	-
39	*Rhizopus nigricans* Ehrenberg	-	-	-	-	+	-	-	-	-	-	-	+
40	*Scopulariosis bravicaulis* (Sacc.) Bain	-	-	-	+	-	-	-	-	-	-	+	-
41	*Syncephalastrum racemosum* (Cohn.) Schroeter	-	-	-	-	-	-	-	+	-	-	+	-
42	*Trichoderma viride* Pers. ex Fr.	-	-	+	-	-	-	+	-	+	-	-	-
43	*Trichothecium roseum* Link. ex Fr.	+	-	+	-	-	-	-	-	+	-	-	-
44	White Mycelia Sterilia	+	+	-	+	-	+	+	+	+	+	+	-
45	Black Mycelia Sterilia	-	+	-	+	-	+	+	+	+	+	+	+
	Month wise Total No. of species Collected	16	20	18	19	11	17	17	22	18	20	23	19
	Average Colony Count per Plate	6	12	24	5	2	4	4	5	3	12	13	4

+ = Present- = Absent

Table – 2 Colony Counts at Three Sampling Periods in Different Months

Month & Year	Morning (8.00hr.)	Noon (12.00hr.)	Evening (18.00hr.)
January, 2018	24	40	54
February, 2018	31	62	142
March, 2018	126	166	180
April, 2018	45	20	58
May, 2018	12	10	14
June, 2018	30	20	40
July, 2018	28	26	30
August, 2018	44	42	32
Sept., 2018	12	15	22
October, 2018	55	64	80
Nov. 2018	113	40	69
Dec. 2018	25	40	74

month was found to be the richest and May, the poorest in fungal flora. Colony counts during three sampling timings (Morning - 7.00 hr., Noon - 13.00 hr. and Evening - 19.00 hr.) also showed variation (Table – 2). During winter season, the maximum fungal population was obtained in the evening followed by noon and morning, except in November when maximum count was obtained in the morning. During summer also, maximum fungal population was recorded in the evening, but the morning counts were more than the noon counts. No precise pattern was recorded during the rainy season.

The aeromycoflora nearly remained the same in the rainy season, instead of expected increase due to high moisture content, optimum temperature and enriched vegetation, suitable for growth and multiplication of fungi. This may be due to heavy and frequent rainfall which removes spores from the air (Hirst, 1955). However, towards the end of rainy season/start of winter in October, air fungal spora started to increase. This may be due to infrequent and lesser rainfall, and harvesting and threshing operations of Kharif Crops done by farmers in the adjoining areas.

Data of the entire year clearly show that 4 fungal genera *viz., Alternaria, Aspergillus, Curvularia* and *Penicillium* were recorded throughout the year in every month. The most dominant genus reported during this study was *Aspergillus* (16 species were reported).

The present investigation clearly reveals that there is a wide range of variation in the periodicity of the aeromycoflora of Barhalganj in different seasons during the year 2018. Quantitatively, maximum mycoflora was obtained in the beginning of summer, *i.e.*, March. This is due to dry conditions of the month which is most suitable for dispersal of fungal spores. It causes maximum spore load in the air. Harvesting and threshing operations of Rabi crops in the adjoining areas of Barhalganj town also increase aeromycoflora. These agricultural operations increase the air spora (Gregory, 1961). Higher temperature and lower humidity of late summer adversely affected the aeromycoflora. Poorest mycoflora was reported in May due to non-viability of spores at high temperature.

Lowest fungal population was obtained in the noon of summer due to very high temperature and low humidity, unfavourable for the viability of fungal spores.

No clear distribution pattern of aeromycoflora was recorded in the rainy season, in three sampling times. This is due to uncertainty in the time of rainfall.

No fungi of Basidiomycotina was recorded in the present investigation. The culture medium used for this study might have been unfavourable for the germination of basidiomycetous spores.

In the present study, the commonest air fungi reported are *Aspergillus, Alternaria, Cladosporium, Curvularia* and *Penicillium.* Other mycologists and aerobiologists (*Loc. cit.*) have also reported these fungal genera as dominant air fungal spora from different localities.

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SYNTHESIS, CHARACTERIZATION AND EVALUATION OF 1H-(Benzoimidazol-2-yl)-thiophen-3-yl-diazene FOR ITS BINDING AGAINST Cd^{2+} , Hg^{2+} AND Pb^{2+}

Santosh Kumar Srivastava
C.M.P. College, Prayagraj. (U.P.), India

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ABSTRACT

Nature has provided us all type of materials. Among these some are beneficial while others are harmful for us. Nevertheless the terms beneficial and harmful are not absolute. Any particular substance may be beneficial up to certain limit and harmful beyond the limit. The resulting binder L2 was well characterized through various spectroscopic studies. Later on the metal complexes were isolated followed by their characterization.

Keywords : *Diazocoupled, donars, ligand, analyte, complex.*

INTRODUCTION

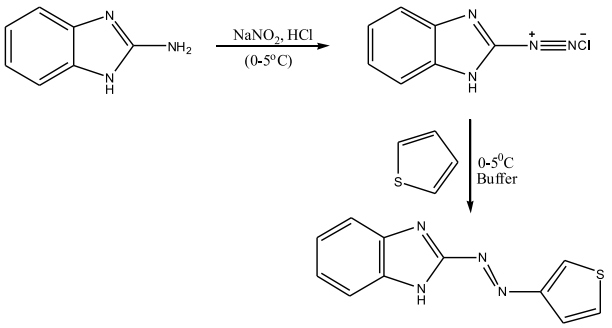
Since the chosen metal ions were of soft nature i.e. small charge and large size hence a ligand having hard donors as shown above was designed for the same purpose. In the transport phenomenon i.e. removal of a particular cationic analyte from a solution depends upon its decomplexation phenomenon. Hence a ligand with mismatch of its donors with the cationic analyte was designed .

In the light of this concept a ligand was constructed upon the skeleton of 2-aminobenzimidazole through a very simple reaction protocol of diazo coupling at low temperature (0-5°C) under buffered condition.The thiophen was chosen for coupling.

2.1. SYNTHESIS OF 1H-(Benzoimidazol-2-yl)-thiophen-3-yl-diazene:

The present ligand L2, was synthesized through diazo coupling reaction 2-aminobenzimidazole over thiophene. A low temperature of 0-5°C was maintained throughout diazotization of 2-aminobenzimidazole and coupling reactions. The entire procedure can be understood

through following reaction scheme;



Scheme 2.1: Synthetic scheme for ligand L2

2.2. SPECTRAL CHARACTERIZATION OF THE LIGAND:

Yield: 90%, M.P. 1680C, **IR ν_{max}/cm^{-1}:** 3378, 2930, 1627, 1602, 1557, 1443, 1375, 1298, 1101, 1011, 958, 845, 734, 642, 566; **^{1}H NMR:** δH(300 MHz; CDCl3; Me4Si): δ= 6.96 (d, 1H, H-Ar), 7.20 (m, 2H, H-Ar), 7.26 (m, 2H, H-Ar), 7.70(m, 2H, H-Ar), 11.36 (s, 1H, -NH) ppm; **13C NMR** (100 MHz, DMSO-d^6):115.4, 122.9, 121.3,125.6, 126.7, 137.9,135.2, 141.5 ppm; **MS m/z (ESI)=** 229.05, Calc. for C11H8N4S=228.05.**CHN** Calculated for C11H8N4S: C, 57.88%, H, 3.53%, N, 24.54%, O, 14.05%; Found 61.30%, H, 4.18%, N, 27.40%, O, 6.54%.

2.3. EVALUATION OF BINDING ABILITY OF THE LIGAND L2:

2.3. (I). THROUGH COMPLEXATION STUDIES:

The ethanolic solution (20 ml) of chloride salts of Pb^{2+}, Hg^{2+}, and Cd^{2+} were added separately to the ethanolic solution of ligand L2 with constant stirring over a time period of 15 minutes. The reaction mixtures were further stirred for one more hour followed by their reflux for two hours on a water bath. The resulting solids were filtered on a Buchner funnel followed by their washings with aq. ethanol and finally dried under vacuum.

Table-2.1: Analytical data and physical properties of the ligand and complexes:

Formulae	Found (Calcd), %			
	Carbon	Hydrogen	Nitrogen	Metal
$[Cd(C_{11}H_8N_4S)Cl_2]$	32.10 (31.90)	1.96 (1.89)	13.61 (13.53)	27.31 (26.98)
$[Pb(C_{11}H_8N_4S)Cl_2]$	26.09 (26.10)	1.59 (1.48)	11.06 (11.10)	40.92 (40.12)
$[Hg(C_{11}H_8N_4S)Cl_2]$	26.44 (26.42)	1.61 (1.56)	11.21 (11.18)	40.14 (40.15)

Table-2.2: Physical properties of complexes:

Formulae	Colour	% Yield	Molecular Weight	m.p°C
$[Cd(C_{11}H_8N_4S)Cl_2]$	Pale yellow	64	411.89	>220
$[Pb(C_{11}H_8N_4S)Cl_2]$	Dark brown	76	505.96	>235
$[Hg(C_{11}H_8N_4S)Cl_2]$	Brown	85	499.96	>300

2.3.(I). A. IR SPECTRAL STUDIES:

The IR data of the ligand and its metal complexes were presented in table 2.3. Again the IR spectra of complexes were compared with that of the free ligand in order to determine the co-ordination sites involved in complexation. There were some characteristic peaks in the ligand spectrum which were ex[ected to change the peak positions upon complexation. Upon comparison, it was found that the (N=N) stretching vibration in free ligand L2 was at 1627 cm-1 which gets shifted to 1610-1599 cm-1 in complexes, indicating the participation of azo nitrogen in co-ordination (M-N).New bands found in the spectra of complexes in the region 550-558 cm-1 have been assigned to (M-N) mode, where as the band at 434 cm-1 in case of [Hg(C11H8N4S)Cl2] showed that the mercury forms the complex with thiophene ring L2.

Table-2.3. IR spectral data of Ligand L2 and its various metal complexes:

Formulae	ν(N-H) cm^{-1}	ν(N=N) cm^{-1}	ν(C=N) cm^{-1}	ν(C-S) cm^{-1}	ν(M-N) cm^{-1}	ν(M-S) cm^{-1}
$C_{11}H_8N_4S$	3378	1627	1557	734	-	-
$[Cd(C_{11}H_8N_4S)Cl_2]$	3367	1610	1568	756	552	-
$[Pb(C_{11}H_8N_4S)Cl_2]$	3374	1608	1574	752	558	-
$[Hg(C_{11}H_8N_4S)Cl_2]$	3371	1599	1580	785	550	434

2.3 A (1):1HNMR SPECTRAL STUDIES:

Table-2.4: NMR spectral data of L2 and its various metal complexes:

Formulae	δ_H(300 MHz; $CDCl_3$; Me_4Si), ppm				
$C_{11}H_8N_4S$	**6.96** (d, 1H, H-Ar)	**7.20** (m, 2H, H-Ar)	**7.26** (m, 2H, H-Ar),	**7.70** (m, 2H, H-Ar)	**11.36** (s, 1H, -NH)
$[Cd(C_{11}H_8N_4S)Cl_2]$	6.94	7.18	7.25	7.68	11.35
$[Pb(C_{11}H_8N_4S)Cl_2]$	6.92	7.19	7.27	7.69	11.33
$[Hg(C_{11}H_8N_4S)Cl_2]$	6.51	7.15	7.23	7.68	11.31

As it is evident from the 1H NMR spectral data (table 2.4) given above that metal underwent complexation with the ligand moiety without involving –NH of the benzimidazole as this signal is maintained in all the cases. Very minute amount of chemical shifts were observed in other protons which is quite on similar line reported in literature for similar type of cases.

The metal:ligand stoichiometry in solution stage was worked out through Jobs plot and it was 1:1 as it was in the solid stage. The corresponding jobs plots have been shown below;

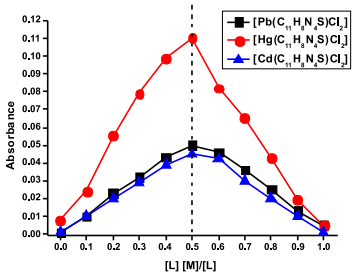
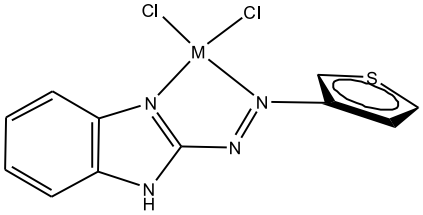


Figure-2.1 Job's Plot Study

Hence on the basis of above analytical andspectroscopic data following tentative structures can be proposed;



Where MCl_2=$CdCl_2$and $PbCl_2$

Figure-2.2 Most probable structure of the complex formed formetal ion Cd^{2+} and Pb^{2+}

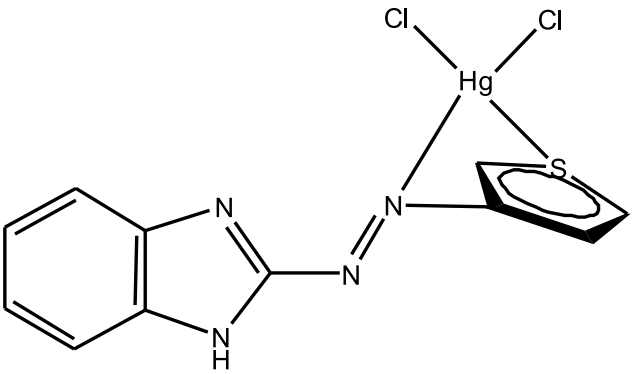


Figure-2.3: Most probable structure of the complex formed with $HgCl_2$

2.3. (II).THROUGH TRANSPORT STUDIES:

2.3. (II).B.TRANSPORT EXPERIMENT:

The all glass transport cell used in the present studies was quite similar to the one used by Lamb et.al. A chloroform solution (20 ml) containing desired concentration of carrier ligand L2 was used as liquid membrane which was separated through a glass tube from an aqueous solution of desired concentration of the metal salt (source phase) and distilled water (receiving phase). Volume of the source phase and the receiver phase were 2 ml and 50 ml respectively. The liquid in the source phase and the receiver phase were kept at the same level. The liquid membrane phase was well stirred using a magnetic stirrer.

Known volume (1 ml) were withdrawn from the receiver phase at definite time intervals and were analyzed for concerned metal ions using an atomic absorption spectrophotometer. The effect of counter ions on the transport phenomenon was also studied by taking different salts of the same metal in the source phase. For each run a corresponding control experiment was also performed in which everything was same expecting no carriers were taken in the membrane phase.

2.4. RESULTS AND DISCUSSION

In all the cases i.e. in all metals ligand combination studies, the rate of transport of

the metal ions was found to be faster initially but as the time elapsed it slowed down. The trend in one representative case is shown in (figure 2.4).

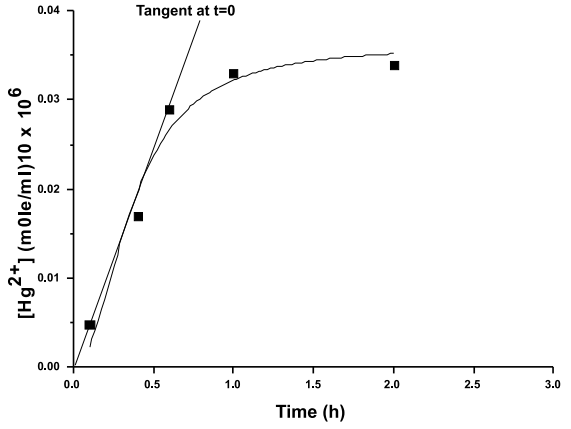


Figure-2.4:A typical plot showing variation in the concentration of Hg^{2+} in the receiver phase with time, in the case of $HgCl_2$ using carrier ligand L1 (source phase concentration=0.1M)

The trend shown in figure 2.4 can be understood in terms of postulated mechanism of the carrier mediated transport through liquid membrane based on facilitated diffusion model. The whole process is visualized to consist of four steps.

a) Cation in the source phase moves in to the membrane phase accompanied by the anion and its complexation by the ligand L2.
b) Complex-anion pair moves across the membrane.
c) Decomplexation takes place at the receiver phase/membrane phase interface and the cation and anion are released into the receiver phase and Carrier ligand L2 returns to source phase to repeat the cycle From this postulated mechanism it is apparent that as the concentration of the metal ion in the receiver phase increases, the transport of the metal in the reverse direction also sets in, diminishing the net rate of transport of the metal ion from the source phase to the receiver phase. In the present study, therefore transport data have been discussed in terms of initial rates of transport (J_c) determined from the tangent at the time t=0 of the curve obtained by plotting concentration against time e.g. figure 2.1.

Data on the initial rates of transport (J_c) of mercury, cadmium and lead the mercury ion using ligand L2 as carrier ligand are recorded in table 2.5 (a) to (c).Table 2.5: Variation of the rate of transport of metal ion (J_c) with salt concentration in the source phase:

(a) CADMIUM ION:

Sample	Initial concentration in source phase (M)	J_c (mol/h)×10^6
$CdCl_2$	1.0	1.3000
	0.5	1.4000
	0.1	0.0500
	0.01	0.0140
	0.001	0.0060

(b) LEAD ION:

Sample	Initial concentration in source phase (M)	J_c (mol/h)×10^6
$PbCl_2$	1.0	2.0000
	0.5	1.0000
	0.1	0.1061
	0.01	0.0070
	0.001	0.0018

© MERCURY ION:

Sample	Initial concentration in source phase (M)	J_c (mol/h)×10^6
$HgCl_2$	2.0	74.151
	1.0	24.336
	0.5	6.032
	0.1	0.329
	0.01	0.038

An observation of the values of Jc in table 2.4 for above ions using the ligand L2 as carrier (table 2.5 a-c) reveals that the carrier ligand L2 is showing maximum affinity for the Hg^{2+} for the transport phenomenon.

$$Hg^{2+} >> Pb^{2+} > Cd^{2+}$$

As already stated that the rate of transport, Jc should depends on

a) The ease of complextation (determined by rates) of the metal ion with the carrier ligand L2,
b) The rate of transport of the carrier metal complex from the source phase boundary to the receiver phase boundary, and
c) The rate of decomplexation at the receiver boundary.

Dataon initial rate of transport (Jc) of different metal ions from the source phase to the receiver phase in the case of carrier ligand L2 are recorded in tables 2.5 a-c. In the control experiment where carrier ligand was absent in the membrane phase no detectable transport of the metal ion from source phase to the receiver phase was observed. The rate of transport (J_c) in all the cases depends on the concentration of the metal ion taken in the source phase. The plots of log (J_c) against log as, as being the activity of the solute taken in source phase were found to be straight line. One typical plot for the Hg^{2+} using L2 as carrier ligand is shown in figure 2.5 as illustration. This straight line plot is although similar to the plots obtained by Lamb et.al. was equal to 2 whereas in our case it is less than 2. The value of the slope equal to 2 was rationalized by Lamb et.al. using the theoretical treatment given by Ward and Reusch and Cussler .

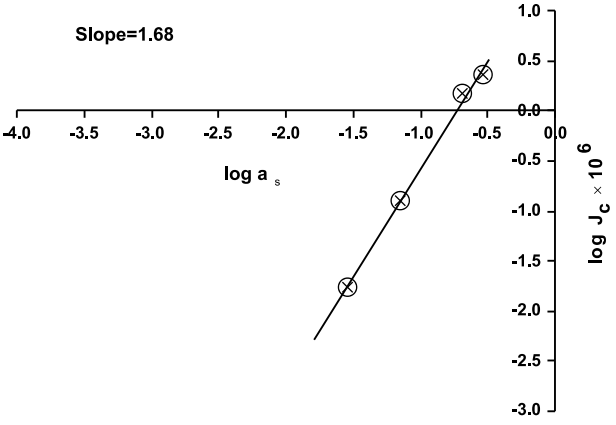


Fig.-2.5 Variation of log Jc with log as for mercuric chloride using carrier ligand L2, (10-3M) in the membrane phase, the value of activity was taken from the reference 6 & 7.

The value less that 2 of the slope of the log Jc versus log as plots in the present experiment can be assigned to one or more of the following reasons:

i. The flux Jc in equation (1 – 5, Chapter 3) is the steady state flux whereas in the present study initial values, Jc have been considered.
ii. We have worked with much higher concentration range in the source phase than those used in the experiment of Lamb et.al. and therefore, inequality (equation 2, chapter 3) is not likely to remain valid in our case. In the experiment of Lamb et.al. also, negative deviation from the straight line plot (log Jc versus log as) i.e. values of the slopes less than 2 were observed at higher concentration of the salt in the source phase and were assigned to the non-validity of inequality (2).
iii. Derivation of equation (1) – (5) (chapter 3) was restricted to uni-univalent electrolytes which was not the case in the present experiment.

The value of J_c was also found to increase with the increase in concentration of the ligand in the membrane phase which is an expected trend. The data in one particular case are summarized in Table 2.6 as an illustration.

Table-2.6 Variation of the rate of transport of Mercuric ion* with concentration of carrier ligand (L2) in the membrane phase.

Sample	Concentration of the carrier (M)	J_c (mol/h)×10^6
$HgCl_2$	0.1	1.2437
	0.01	0.9835
	0.001	0.6412
	0.0001	0.4586
	0.00001	0.1590

*Conentration in the source phase = 0.1M.

2.5. VARIATION OF TRANSPORT RATE WITH ANIONS:

It has been noted by Lamb et.al. and also by Christensen et.al. that the rate of cation transport is greatly affected by the nature of the accompanying anions. Prompted by these facts we investigated the anion effect in our system also. For the transport of mercury ions through chloroform liquid membranes containing L2 ligand as carriers, the data on anion effect is shown in table 2.7 and figure 2.6 which corroborate the correlation discovered by Lamb et.al. Since the rate of transport of the mercury was the fastest oof the carrier ligand L2, the data on anion effect have been obtained for the ligand L2 only are shown in table 2.7 and figure 2.4.

Table-2.7 Variation of Jc with the free energy of hydration

Cation type	Anion Type	$\Delta G_{g\rightarrow w}A$ (kcal/mol)*	(log J_c) ×10^6
Hg^{2+}	ClO_4^-	50.3	-0.164
	NO_3^-	69.5	-0.287
	Br^-	72.5	-0.308
	Cl^-	75.8	-0.313
	SO_4^{2-}	238.7	-2.193

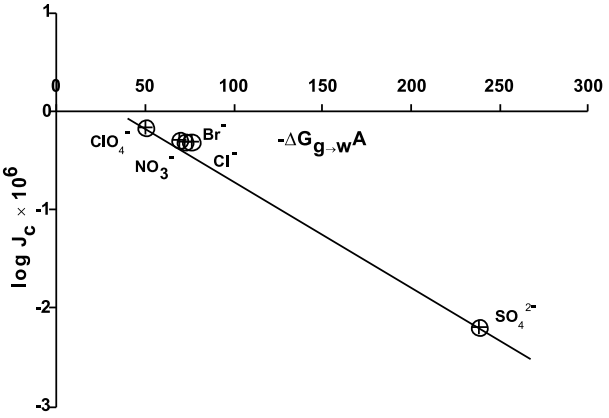


Figure-2.6 Plot of log Jc against $\Delta Gg \rightarrow wA$ **for carrier ligand L2, (0.1M)**

NOTES:

1. L2 (10-3 M) used as carrier ligand in the membrane phase.
2. Concentration of the cadmium ion on the source phase=0.1 M
3. Concentration of the cadmium ion on the source phase=0.1 M
4. Concentration of the cadmium ion on the source phase=0.1 M

Although the data on the transport of Hg^{2+} ions appears consistent with the correlation discovered by Lamb et.al.. The slope of log Jc versus $\Delta Gg \rightarrow wA$ plot (figure 2.3) is too steep for Hg^{2+}. This steepness may indicate that there is almost no correlation between Jc and $\Delta Gg \rightarrow wA$ This indication is further corroborated by the data on the transport of mixture of Hg^{2+} and Pb^{2+} ions having different accompanying anions (Table 2.7). The data on the rate of transport using ligand L2 as carrier were obtained for the following mixtures:

a) $HgCl_2 + Pb(SCN)_2$

b) $Hg(NO_3)_2 + Pb(NO_3)_2$

c) $HgI_2 + PbCl_2$

Table-2.8 Rate of transport of Hg2+ and Pb2+ ion in the mixture of their salts using L2 as carrier Ligand.

Mixture* of salts in the source phase	J_c(mol/h)×10^6	
	Hg^{2+}	Pb^{2+}
$Hg(NO_3)_2$ + $Pb(NO_3)_2$	0.0255	0.0012
$Hg(SCN)_2$ + $PbCl_2$	0.0016	0.0015
$HgCl_2$ + PbI_2	0.0316	0.0087

*Initial concentration of each salt in the source phase = 0.001M

These mixture were chosen keepingin mind the correlation between J_e and $\Delta Gg \rightarrow wA$ and the values of $\Delta Gg \rightarrow wA$ listed in table 2.7. According to the correlation discovered by Lamb et.al. more negative is the value of $\Delta Gg \rightarrow wA$, for the accompanying anion, slower is the transport of the cation. The data in table 2.7, however, indicates that irrespective of the choice of accompanying anion the transport of Hg^{2+} was always faster than the transport of Pb^{2+}.

Thus the correlation between J_e and the free energy of anion hydration of the accompanying anion does not have a general validity.

Thus the transport phenomenon studies suggested following order

$$Hg^{2+} >> Pb^{2+} > Cd^{2+}$$

The above order can be well understood in terms of hard soft acid base (HSAB) theory. As the donor atoms are soft /borderline hence they prefer the softest acceptor among the chosen ones i.e. mercury. The mercury was the last option for the donors in the light of its softest nature among the chosen metal ions.

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EFFECT OF DIFFERENT NUTRIENT MEDIA ON GROWTH PARAMETER OF CABBAGE (BRASSICA OLERACEAE VAR. CAPITATA L.) IN BUNDELKHAND REGION

Ravi Shanker Mishra, S. S. Singh and Ashutosh Mishra
Faculty of Agriculture
Mahatma Gandhi Chitrakoot Gramoday Vishwidayalya
Chitrakoot, Stana, (M.P), India

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ABSTRACT

At the experiment was at Research Farm, Rajoula, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (Madhya Pradesh) with Randomized Block Design. Analysis of variance for the design of the experiment indicated highly significant differences for all the characters viz. plant height (cm), number of unfold leaf, number of folded leaf, leaf length (cm), leaf width(cm), stem length(cm), head weight (g) , size of head length(cm), size of head width(cm), yield per plot (Kg.), the maximum plant height observed 18.27 (T9) with combination 50% R.D.F + Vermicompost(10Tons/ha.) for 30, 45 and 60 DAS while minimum 11.45 control (T0) at 30 DAS, 45 DAS 12.37 and 60 DAS minimum 13.20 (T10) with manure combination R.D.F+ Vermicompost (10Tons/ha.).The maximum number of unfold leaf, number of folded leaf, leaf length, leaf width, stem length,. The genotypic correlations were higher than phenotypic ones in magnitude for all the characters and showed positive association at genotypic level and phenotypic level.. Direct effects for different characters of cabbage affected by organic manure with different treatment by other traits viz., plant height, number of unfold leaf (2.303), number of folded leaf (0.372), leaf length (0.878), leaf width(3.906), stem length(1.892) observed @ 30 DAS, 45 DAS and 60 DAS, using RDF, FYM, Goat manure and vermicompost combination.

Keywords: *Cabbage, FYM, vermicompost, goat manure, growth parameter.*

INTRODUCTION

Cabbage (Brassica oleracea L.) In India, where large number of people is vegetarian, leafy vegetables play an important role in their nutrition. Among the leafy vegetables cabbage is an important crop, which occupies first name among cole crops, cabbage is grown during winter season in sub-tropical and in summer season in temperate regions in India. It is one of the most popular winter growing vegetables, which have attained the position of commercial importance. Now-a-days this crop has also been recognized good for truck gardening. Cabbage thrives best in cool weather and possesses wide adaptability and tolerance to higher degree of severe winter and even low temperature nearing to frost. All crops of this group have developed from wild cliff cabbage known as coleworts from which name "Cole" is derived. Cabbage belongs to the natural order crucifereae genus Brassicaoleraceae and variety capitata. "A cabbage head is made up of numerous thick over lapping smooth tender leaves which cover a smooth terminal bud". There is great variation in the cultivation of cabbage. These differ in size, shape and colour of leaves. The varieties of cabbage commonly grown may be classified in the following groups viz. Round head or ball types viz. golden Acre, pride of India, Flat head or Drum type viz. Pusa drum head and Savoy type chieften.

MATERIALS AND METHODS

The experiment under present investigation was conducted in a well prepared field during Rabi 2015-16 at Agriculture Farm, Rajoula, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (Madhya Pradesh). The place of experiment in Chitrakoot is situated at 25°10' North latitude and 80085' East longitude. The altitude is about 200m above mean sea level. The soils are sandy loam deficient in Phosphorus, Boron and Zinc. Three level of Organic manure using RDF, FYM, Green manure and Goat manure with twelve combinations (T0 to T12). The experiment consisted of 13 treatments .Control (To), R.D.F (T1), 75% R.D.F (T2), 50% R.D.F(T3), R.D.F + F.Y.M,(T4), 75% R.D.F + F.Y.M (T5), 50%R.D.F + F.Y.M(T6), R.D.F + vermicompost (T7), 75%R.D.F + vermicompost (T8), 50% R.D.F + vermicompost (T9), R.D.F + Goat manure (T10), 75% R.D.F + Goat Manure (T11), 50%R.D.F + Goat Manure(T12). with Randomized Block Design. To study the effect of FYM vermicompost and goat manure on growth parameter of cabbage.

RESULTS AND DISCUSSION

Growthparameter

1.Plant height:

The data of crop growth in table 4.2.1. It was observed that Plant height with three levels i.e. 30 DAS, 45 DAS and 60 DAS, using RDF, FYM, Vermicompost and Goat manure combination. The maximum plant height observed 18.27 (T9) with combination 50% R.D.F + Vermicompost(10Tons/ha.) and minimum 11.45 control (T0) with a general mean 14.15 at 30 DAS while, 45 DAS maximum plant height observed 22.90 (T9) and minimum 12.37 (T10) with manure combination R.D.F+Goat manure (7.5Tons/ha.) with a general mean 15.20. The 60 DAS, highest plant height observed 23.67 (T9) and minimum 13.20 (T10) with a general mean 16.18. To enhance the productivity of this crop, application of organic manures with rock phosphate, phosphorus solubilising bacteria and seed treatment with rhizobium are of great importance.

2. Number of unfolded leaf:

The data of No. of unfolded leaf showed in table 4.2.2 @ three levels i.e. 30 DAS, 45 DAS and 60 DAS, using RDF, FYM, Green manure and Goat manure combination. The maximum

No. of unfolded leaf observed 10.17 (T9) and minimum 5.07 (T12) with a general mean 6.36 at 30 DAS while, 45 DAS maximum No. of unfolded leaf observed 11.93 (T9) and minimum 6.07 (T7) with a general mean 7.39 and 60 DAS maximum No. of unfolded leaf observed 12.50 (T9) and minimum 7.07 (T12) with a general mean 8.34.

3. Number of folded leaf:

The data of No. of folded leaf showed in table 4.2.3 with three levels i.e. 30 DAS, 45 DAS and 60 DAS, using RDF, FYM, Green manure and Goat manure combination. The maximum No. of folded leaf observed in T9 (16.23) and

Table-4.1: Genotypic correlation coefficients for different growth characters of cabbage affected by organic manure with different treatments in year 2015-16

	Treatments	Plant heaight			Number of unfolded leaf			Number of folded leaf			Leaf length			Leaf width			Stem length		
		2015-16			2015-16			2015-16			2015-16			2015-16			2015-16		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T0	Control	11.45	12.42	13.27	6.00	7.07	8.07	11.27	12.22	13.27	2.80	3.21	3.69	2.95	4.17	4.79	13.67	14.50	15.80
T1	R.D.F (100:80:80)	13.60	13.63	15.60	6.07	6.60	7.53	10.27	11.27	11.07	3.41	3.66	4.25	5.11	4.96	5.79	14.27	15.27	15.73
T2	75%R.D.F (75:60:60)	15.67	16.40	17.13	6.07	7.00	8.00	11.07	14.42	15.27	3.30	3.81	4.84	5.29	4.51	6.31	13.67	14.67	15.73
T3	50%R.D.F (50:40:40)	11.70	12.93	13.67	5.47	6.40	7.40	9.07	10.33	10.67	3.47	4.23	4.74	5.01	5.33	6.37	13.53	14.53	15.80
T4	R.D.F+F.Y.M (15Tons/ha.)	12.03	13.80	14.55	5.60	6.53	7.60	10.53	11.53	12.60	2.95	4.25	4.83	4.97	5.26	7.21	12.40	13.40	14.07
T5	75%R.D.F+F.Y.M (15Tons/ha.)	15.67	15.20	16.03	7.40	8.40	9.40	10.87	11.87	12.93	3.47	4.29	5.43	4.87	5.16	6.61	14.87	15.93	16.67
T6	50%R.D.F+F.Y.M (15Tons/ha.)	14.03	14.40	15.17	6.67	7.67	8.67	8.80	9.80	10.77	3.53	4.18	5.10	5.23	5.81	6.96	13.80	15.20	16.27
T7	50%R.D.F +Vermicompost (10Tons/ha.)	14.17	15.00	15.77	5.47	6.07	7.07	10.40	11.40	12.43	3.64	4.33	5.40	5.17	5.38	6.73	14.00	14.93	16.00
T8	75%+R.D.F+Vermicompost (10Tons/ha.)	15.47	15.43	16.27	5.27	6.27	7.40	11.13	12.13	13.93	3.53	4.68	5.33	5.37	5.62	7.05	13.07	14.07	15.07
T9	R.D.F+Goat manure (7.5Tons/ha.)	18.27	22.10	23.67	10.17	11.93	12.50	16.23	19.07	20.33	5.20	6.53	7.26	7.65	7.93	8.72	17.93	17.80	19.17
T10	R.D.F+Vermicompost (10Tons/ha.)	11.99	12.37	13.20	5.47	6.47	7.47	11.40	12.37	13.33	3.61	4.97	5.05	4.98	6.07	6.90	14.07	15.00	16.20
T11	75%R.D.F+Goat manure (7.5Tons/ha.)	14.27	15.37	16.17	5.40	6.33	7.40	8.67	9.67	10.73	3.48	4.79	5.55	5.47	5.60	6.94	13.07	14.07	15.40
T12	50%R.D.F+Goat manure (7.5Tons/ha.)	**14.30**	**14.53**	**15.30**	**5.07**	**6.07**	**7.07**	**9.20**	**10.20**	**11.20**	**3.69**	**4.87**	**5.71**	**5.98**	**6.37**	**7.49**	**13.20**	**14.20**	**15.93**
	Maximum	**18.27**	**22.10**	**23.67**	**10.17**	**11.93**	**12.50**	**16.23**	**19.07**	**20.33**	**5.20**	**6.53**	**7.26**	**7.65**	**7.93**	**8.72**	**17.93**	**17.80**	**19.17**
	Minimum	**11.45**	**12.37**	**13.20**	**5.07**	**6.07**	**7.07**	**8.67**	**9.67**	**10.67**	**2.80**	**3.21**	**3.69**	**2.95**	**4.17**	**4.79**	**12.40**	**13.40**	**14.07**
	Mean	**14.15**	**15.20**	**16.18**	**6.36**	**7.39**	**8.34**	**10.92**	**12.33**	**13.30**	**3.60**	**4.50**	**5.21**	**5.24**	**5.62**	**6.76**	**14.12**	**14.98**	**16.07**
	SEm+- =	**1.65**	**1.88**	**1.91**	**0.75**	**0.75**	**0.70**	**1.10**	**1.11**	**1.16**	**0.23**	**0.27**	**0.37**	**0.24**	**0.32**	**0.34**	**0.87**	**0.99**	**0.99**
	CD 5% =	**4.96**	**5.65**	**5.74**	**2.23**	**2.24**	**2.09**	**3.30**	**3.32**	**3.48**	**0.70**	**0.82**	**1.11**	**0.72**	**0.95**	**1.01**	**2.60**	**2.96**	**2.96**
	CV =	20.39	21.92	20.93	20.95	18.15	14.90	17.82	15.97	15.52	11.34	10.67	12.39	7.93	9.84	8.65	10.76	11.50	10.71

minimum T11 (8.67) with a general mean 10.92 at 30 DAS while, 45 DAS maximum No. of folded leaf observed T9 (19.07) and minimum T11 (9.67) with a general mean 12.33. At 60 DAS, highest No. of folded leaf observed 20.33 (T9) and minimum 10.67 (T3) with a general mean 13.30.

4. Leaf length:

Organic manure is an important major nutrient source which determines the productivity of green gram. The response cabbage to organic mode of nutrition is a primary concern in its cultivation.The data of leaf length showed in table 4.2.4 @ three levels i.e. 30 DAS, 45 DAS and 60 DAS, using RDF, FYM, Green manure and Goat manure combination. The maximum leaf length in T9 (5.20) and minimum T0 (2.80) with a general mean 3.60 at 30 DAS while, 45 DAS maximum leaf length observed T9 (6.53) and minimum T0 (3.21) with a general mean 4.50. At 60 DAS, highest leaf length observed 7.26 (T9) and minimum 3.69 (T0) with a general mean 5.21.

5. Leaf width:

The data of leaf width of cabbage showed in table 4.2.5 @ @ three levels i.e. 30 DAS, 45 DAS and 60 DAS, using RDF, FYM, Green manure and Goat manure combination. The maximum leaf width in T9 (7.65) and minimum T0 (2.95) with a general mean 5.20 at 30 DAS while, 45 DAS maximum leaf length observed T9 (7.93) and minimum T0 (4.17) with a general mean 5.62. At 60 DAS, highest leaf width observed 8.72 (T9) and minimum 4.79 (T0) with a general mean 6.76.

6. Stem length:

The data of stem length of cabbage showed in table 4.2.6 @ three levels i.e. 30 DAS, 45 DAS and 60 DAS, using RDF, FYM, Green manure and Goat manure combination. The maximum stem length in T9 (17.93) and minimum T0 (12.40) with a general mean 14.12 at 30 DAS while, 45 DAS maximum leaf length observed T9 (17.80) and minimum T4 (13.40) with a general mean 14.98. At 60 DAS, highest stem length observed 19.17 (T9) and minimum 14.07 (T0) with a general mean 16.07.

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STUDIES ON THE ROLE OF BENEFICIAL SOIL FUNGI ON REDUCING DISEASE INCIDENCE OF WILT AND ROOT-KNOT NEMATODE, MELOIDOGYNE INCOGNITA ON TOMATO

Archana U. Singh
Division of Nematology
Indian Agricultural Research Institute,
New-Delhi-110012, India

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ABSTRACT

A survey of tomato crops in Faridabad area showed two types of plants i.e., heavily damaged plants with both wilt fungus and root-knot nematode and the other group with plants looking not so badly damaged. Wilt fungus (pathogenic) was identified as *Fusarium oxysporum f. sp. lycopersici* while root-knot nematode as *Meloidogyne incognita*. The rhizosphere soil supporting both the above types of plants showed species of *Aspergillus, Cladosporium oxysporum, Paecilomyces lilacinus, Penicillium* spp and *Trichoderma viride*, the healthy looking ones showing more no. of fungal genera and species. It was observed through in vitro tests each of the fungal species (more in number) isolated from healthy looking plants were very highly potential against root-knot nematode and the pathogenic fungus.

Key words: *Nematode, tomato, fungi, wilt, biological control.*

INTRODUCTION

Significant amount of research has been conducted on the interactions between the fungi and nematodes where the nematodes was found to predispose the plant to fungal attack thus resulting in synergistic effect (Jatala, 1986; Abawi and chen,1998) However, in some instances some plants have been encountered (looking apparently healthy) to be affected by both wilt fungus and root-knot nematode. (Mittal and Goswami, 2001) So, it was desired to study the role of beneficial soil fungi which have earlier been reported to reduce disease incidence of both wilt fungus and root-knot nematode in case of tomato plant.

Keeping in view, the present objective was carried out. A survey was conducted in vegetable growing area of Faridabad and showed two types of tomato plants i.e., a)

heavily damaged plants with both wilt fungus on aerial parts and root-knot galls on roots and b) plants looking not so badly damaged inspite of apparent symptoms of both the two pathogens being distinctly present. This prompted us to initiate the present investigation through systemic studies on the interactions of the fungus and root-knot nematode infecting the common host tomato.

MATERIALS AND METHODS

The tomato plants from the fields infected with root-knot nematode along with rhizosphere soil was uprooted separately from both, severely wilted symptoms with heavy damage and those with not so heavily affected ones. The wilt indices from both types of tomato plants as well as soil population of root-knot nematode along with no. of galls, eggmasses and eggs/eggmass was recorded. The soil adhering to both types of plants were separately processed through the soil dilution plate technique in order to identify the frequency of occurrence of pathogenic fungi. Fungi was also isolated from the galled roots after surface sterilization with 0.1% $HgCl_2$ for 30 seconds. These surface sterilized root pieces were than transferred to Potato Dextrose Agar slants and incubated at 25+2 C for 15 days. The fungi growing on wilted roots after repeated sub-culturing and purification was identified as *Fusarium oxysporum f. sp. lycopersici* (pathogenic). A number of fungi i.e, *Aspergillus niger, Paecilomyces lilacinus, A. fumigatus, Trichoderma viride, Penicillum spp.* and *Fusarium oxysporum f. sp. lycopersici* was also encountered from rhizosphere soil in cases of a) severely wilted and b) with not so heavily affected ones. All these above fungal species were subjected to in-vitro tests (Larvicidal and ovicidal).

For the in-vitro tests each of the fungal species were further allowed to grow in Erlnmeyer's flask containing Potato Dextrose broth and then incubated at 25+2 C for 15 days. The culture filtrate from each was taken as the standard extract while two dilutions namely S/10 and S/100 was also prepared. For the larvicidal test about hundred freshly hatched juveniles of *M. incognita* were exposed to each of the above dilutions of fungus filtrates. Observations was recorded after 24, 48 and 72 hrs keeping adequate check in water. Further, for the ovicidal test, three eggmasses were surface sterilized with HgCl (0.1%) for 30 seconds and then soaked in different dilutions of the fungus filtrates for 48 hrs and then transferred to distilled water. Observations were recorded daily till it ceases to hatch.

RESULTS AND DISCUSSION

Results presented in Table 1 clearly shows that biomass in terms of g/ plant of average of 5 replicates for apparently less wilted plants was significantly more (12.0) as compared to heavily wilted ones (8.4) and was almost at par with the plants showing no symptoms (12.8). The wilt index (0-4 scale) for the heavily wilted ones exhibited complete wilting of all leaves and terminal portion of the stem (4.0) as compared to the less wilted ones showing only wilting of lower leaves (2.0).

Maximum number of galls/plant (26.0) was recorded in plants showing heavily wilted symptoms as compared to less wilted (24.5) ones. Similarly, no. of eggmasses/plant (75.0) and no. of eggs/eggmass (130.0) were more in heavily wilted plants respectively. However, similar trend was observed for the larval population of *M. incognita* in heavily wilted plants.

Investigating the fungal flora (Table-2) of both heavily wilted plants and less wilted ones it is clearly observed that the number of fungi as well as the frequency was much more in less wilted plants than heavily wilted ones in soil rhizosphere. The fungal flora isolated from

Table-1 Plant biomass, wilt index and nematode population from heavily wilted and less wilted plants in farmer's field.

Plants from of	Biomass (g)	Wilt index	No. of galls/ plant	No.of egg masses/ plant	No. of eggs/ eggmass	No. larvae/ 500g soil
1. Heavily Wilted	8.4	4.0	26.0	75.0	130.0	1280.0
2. Less Wilted	12.0	2.0	24.5	30.0	40.0	850.0
3. Without symptoms	12.8	0.0	0.0	0.0	0.0	0.0

eggmasses of above two types of plants also showed similar trend. This also revealed that the number of mycoflora in case of healthy looking plants were more than the heavily wilted ones particularly the ones having already being reported to be fungal bioagents. (Cayrol et al, 1989; Alam et al, 1993 and Desai et al, 1972). Further, the pathogenic fungus *Fusarium oxysporum f. sp. lycopersici* appears to be dominant in the soil rhizosphere of heavily wilted plants.

Table-2 Frequency of fungal flora consistently associated with eggmasses and rhizosphere of both heavily wilted and less wilted tomato plants.

Fungi	Heavily wilted		Less wilted	
	Eggmass	Soil rhizosphere	Eggmass	Soil rhizosphere
Aspergillus niger	0.0	10	40	10
A. fumigatus	10	0.0	30	20
Cladosporium oxsporum	0.0	0.0	40	0.0
Paecilomyces lilacinus	0.0	10	10	20
Trichoderma viride	10	0.0	0.0	30
Penicillum sp.	0.0	20	0.0	10
Fusarium oxysporum f. sp. lycopersici	20	40	0.0	10

The data presented in Table-3 reveals that *A. niger* is showing extremely toxic effect and killing 100% of *M. incognita* juveniles after 48 hrs, followed by *A. fumigatus* showing 100% kill after 72 hrs. *C. oxysporum* and *P.lilacinus* shows more than 45 % kill of *M. incognita* juveniles after 48 hrs of exposure period. Both these fungi are also known to be egg-parasitic or opportunistic fungal bioagents (Cayrol et al, 1989 and Khan & Esfahni, 1990). However, *F.oxysporum* and *Penicillum* spp. did not show much larvicidal effect. As regards the emergence of *M. incognita* larvae from eggmasses kept in the culture filtrates of different isolated fungi, it was found that minimum hatching (98) of *M. incognita* larvae occurred in case of eggmasses soaked in the culture filtrate of *A. fumigatus* (520) as compared to maximum in water. (Table-4)

Table-3 Larvicidal tests of fungal filtrates against *M. incognita*

Fungus (SE)	Time of exposure in hrs (% kill of *M. incognita*) 24	48	72	96
F. oxysporum	20	32	40	47
A. niger	92	100	100	100
A. fumigatus	88	95	100	100
P. lilacinus	42	58	65	78
C. oxysporum	30	45	54	58
T. viride	65	72	94	100
Penicillum sp.	22	30	36	40
Control	2	6	8	9

Table-4 Emergence of *M. incognita* larvae from eggmasses kept in culture filtrates of different isolated fungi.

Fungi	Hatching after 48 hrs soaking of 3 eggmasses each in different culture filtrates of isolated fungi At transfer	2	4	6	8	10	12 days
A. niger	35	55	64	85	92	106	106
A. fumigatus	22	48	56	70	86	98	98
F. oxysporum	48	86	118	170	230	310	325
C. oxysporum	45	62	94	112	145	188	200
P. lilacinus	28	42	68	105	130	160	165
T. viride	30	46	55	84	95	120	130
Penicillum sp.	42	60	78	104	130	180	210
PD broth	90	100	150	210	280	396	450
Control	105	128	205	282	340	465	520

Similarly, Goswami and Mittal (2002) studied the effect of some fungal bioagents against root-knot nematode, *Meloidogyne incognita* infecting brinjal. In-vitro studies showed that *Aspergillus niger* was found to be highly toxic followed by *Aspergillus fumigatus* exhibiting 85% mortality at 1: 10 dilution while *Paecilomyces lilacinus* and *Geotrichum candidum* showed least mortality. *Aspergillus niger* and *A. fumigatus* showed maximum inhibition of hatching and *G. candidum* the least.

As the scanning of literature has clearly shown that commercial products of *P. lilacinus* (Bicon), *A. niger* (Kalisena) and *T. viride* (Trichoguard) is already proved to be very promisimg bioagents in the eco-friendly management of Root-knot nematode and many pathogenic as well. In the present investigation in addition to confirming the larvicidal and ovicidal effect of same fungi as mentioned above is attributed to the crop health and suppression of root-knot nematode population. This also helps in suppressing the intensity of pathogenic fungus, *Fusarium oxysporum f. sp. lycopersici.* (Krinche and Wyss, 1982; Goswami *et al.*, 2001 and Noguera, 1983). Thus, the crop showing healthy plants inspite of being attacked by both wilt fungus and root-knot nematode was dominated by the fungal bioagents (*A. niger, A. fumigatus, T. viride, P.lilacinus* and *C. oxysporum*). This would be a guidance for the eco-friendly management of both the damaging pathogens like root-knot nematode and wilt fungus.

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EFFECT OF FYM AND CALCIUM ON THE UPTAKE OF Pb BY RADISH (RAPHANUS SATIVUS L.)

Dinesh Mani, Bechan Singh* and Vipin Sahu
Sheila Dhar Institute of Soil Science, Department of Chemistry,
University of Allahabad, Prayagraj-211002, (U.P.), India.

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ABSTRACT

A field experiment was conducted on alluvial soil (ENTISOLS) of Sheila Dhar Institute Experiment farm, Prayagraj in order to find out the possible effect of FYM and calcium on yield and phytoaccumulation of Pb in radish. Pb was applied as PbCl2@ 0,10 and 20 mgkg-1 and organic matter was applied as FYM@ 0, 10 and 20 t ha^{-1} and calcium was applied as $CaCO_3$ @ 0%,1%and 2%. The application of FYM 20 t ha^{-1} and Ca 2% increased the dry biomass yield of radish by 18.28% over the control. The application of 20 mgkg^{-1} Pb maximum reduced dry biomass yield of radish by 15.25% compared to control and registered the highest accumulation of Pb in shoot and root of radish by 2.8 mgkg-1, 3.4mgkg-1respectvely.Therefore, 20 t ha^{-1} FYM and Ca 2% application may be recommended to enhance dry biomass of radish. The response of FYM and Ca was observed ameliorative in Pb-contaminated plots. Organic amendments like FYM may effectively reduce the bio-availability of heavy metals in soils due to its high content of organic matter. Calcium is very effective in decreasing the metal bio-availability due to the introduction of additional binding sites for heavy metals and due to pH effects.

Key words: *Lead, FYM, uptake, phytoaccumulation, radish*

INTRODUCTION

Toxic heavy metals are accumulated in agricultural soils due to human activities such as industrialization, mining, and agricultural practices (Nagajyoti et al. 2010; Ali et al. 2013a; Abbas et al. 2017; Hou et al. 2017). Presence of high contents of heavy metals in soils results in bioaccumulation of heavy metals due to enhanced absorption of heavy metals by crops (Muchuweti et al., 2006).

Plant uptake of metals from soils is affected by different physico-chemical and biological reactions occurring in soils and various plant factors (Sun et al., 2001). Phytoavailability of metals in the soil is affected by cation exchange capacity (CEC), pH, redox potential, soil texture and organic matter (OM) contents (Mellis et al., 2004). Organic matter is the most important factor that influences phytoavailability of metals due to its content and nature (Karaca, 2004b).

In the environment, lead is known to be toxic to plants, animals and microorganisms. Since Pb2+ is not biodegradable, once soil has become contaminated, it remains for a long-term, leading to a harmful effect on biological systems (Pehlivan et al. 2009). Lead contamination poses serious human health problem, namely brain damage and retardation (Cho-Ruk et al. 2006). It inhibits various physiological and biochemical processes of fundamental significance (Kosobrukhov et al. 2004) causing visible toxicity symptoms and an ultimate reduction in vegetative and reproductive growth (Rossato et al. 2012). Pb being a toxic metal disrupts the total chlorophyll content of plants and decreases root expansion by restricting the cell division and cell elongation (Eun et al. 2000; McDermott et al. 2011).

Addition of organic matter amendments, such as compost, fertilizers and wastes, is a common practice for immobilization of heavy metals and soil amelioration of contaminated soils (Clemente et al., 2005). The effect of organic matter amendments on heavy metal bioavailability depends on the nature of the organic matter, their microbial degradability, salt content and effects on soil pH and redox potential, as well as on the particular soil type and metals concerned (Walker et al., 2003, 2004).

The present research work was, therefore, undertaken assess the effect of Pb ,FYM and Ca interaction on dry biomass yield of radish, Pb concentration in shoot and root of radish.

MATERIALS AND METHODS

Plant material and Experimental layout

The Sheila Dhar Institute Experimental Site, covers an area of 1 hactare, is located at Prayagraj in northern India at 25057 , N latitude, 81050, E longitude and at 120 ± 1.4 m altitude. A sandy clay loam soil, derived from Indo-Gangetic alluvial soils, situated on the confluence of rivers Ganga and Yamuna alluvial deposit, was sampled for the study. The texture was sand (>0.2 mm) 55.54 %, silt (0.002–0.2 mm) 20.32 % and clay (<0.002 mm) 24.25 %. The detailed physico-chemical properties of the investigated soil have been given in the Table 1 .

Table-1 Physico-chemical properties of SDI Experimental soil used under the investigation

Parameters	Soil
pH	7.8 ± 0.2
EC(dS/m) at ^{0}C	0.28 ± 0.03
Organic carbon (%)	0.56 ± 0.15
CEC [C mol (p^+)/kg]	19.6 ± 0.6
Total nitrogen (%)	0.07 ± 0.02
Total phosphorus (%)	0.038 ± 0.01
Total Pb (mg/kg)	9.60 ± 2.7
DTPA-extractable Pb (mg/kg)	1.56 ± 0.57

± values indicate standard error having three replications. EC electrical conductivity, CEC cation exchange capacity, DTPA diethyl tri-amine penta-acetic acid, SDI Sheila Dhar Institute

Table-2 Treatment combinations used under the field experiment at Sheila Dhar Institute

Symbols	Treatment combinations
T_1	Control
T_2	Pb 0 mgkg^{-1}+ FYM 10 t ha^{-1}+ Ca 1%
T_3	Pb 0 mgkg^{-1}+ FYM 20 t ha^{-1} + Ca2%
T_4	Pb10 mgkg^{-1}
T_5	Pb10 mgkg^{-1}+FYM 10 t ha^{-1}+ Ca 1%
T_6	Pb10 mgkg $^{-1}$+FYM 20 t ha^{-1} +Ca 2%
T_7	Pb20 mgkg^{-1}
T_8	Pb20 mgkg^{-1}+ FYM 10 t ha^{-1} +Ca 1%
T_9	Pb20 mgkg^{-1}+ FYM 20 t ha^{-1} +Ca 2%

Experimental Layout

After systematic survey factorial experiment was conducted to study the effect of FYM and calcium on yield and phytoaccumulation of lead in radish. The experiment was replicated thrice with nine treatments and conducted in completely factorial randomized block design (factorial RBD). After 24 hr of the treatment seeds were sown. Soil moisture was maintained by irrigating the crops at interval of 5-6 days radish was grown successively in the 27 plots (each of $1m^2$ in area).The treatments of Pb X FYM and Ca consisted of 0,10,20 $mgkg^{-1}$ Pb ,0, 10,20 t ha^{-1} FYM and 0,1, 2% Ca .The source of Pb and Ca were $PbCl_2$ and $CaCO_3$.

SOIL SAMPLING

The larger fields were divided into suitable and uniform parts, and each of these uniform parts was considered a separate sampling unit. In each sampling unit, soil samples were drawn from several spots in a zigzag pattern, leaving about 2 m area along the field margins. Silt and clay were separated by pipette method and fine sand by decantation (Chopra and Kanwar 1999).

Extraction for Lead (Pb) content in soil

For total Pb content, one gram of soil was mixed in 5 ml of HNO3 (16 M, 71 %) and 5 ml of HClO4 (11 M, 71 %). The composite was heated up to dryness. The hot distilled water was added. The contents were filtrated, and volume was made up to 50 ml. The clean filtrate was used for the estimation of heavy metals (Pb) by atomic absorption spectrophotometer (AAS) (AAnalyst600, PerkinElmer Inc., MA, USA). For available Pb, 5 gram of soil was mixed with 20 ml DTPA solution {Di-ethyl-tri-amine-pent acetic acid (DTPA) solution [1.97 g (0.05 M) DTPA powder, 13.3 ml (0.1 M) Tri-ethanol amine and 1.47 g (0.01 M) $CaCl_2$ were dissolved in distilled water (Lindsay and Norvell 1978) and were made up to 1 litre after adjusting the pH to 7.3] was added} and the contents were shaken for 2 h and then filtered through Whatman filter paper No. 42. The clean filtrate was used for the estimation of Pb by the AAS.

PROCESSING OF PLANT SAMPLES

Plants were harvested after 60 days having higher phytochemicals at their maturity stage as suggested by Mani et al. (2012). Plant samples were carefully rinsed with tap water followed by 0.2 % detergent solution, 0.1 N HCl, deionized water and double distilled water. Samples were then soaked with tissue paper, air-dried for 2–3 days in a dust and contaminant free environment, placed in clean paper envelopes, dried in a hot-air oven at a temperature of 45°C, and ground to a fine powder. Plant biomass dry weights were recorded. shoot and root were separated and analysed.

Determination of Lead in plant extract

One gram of ground plant material was digested with 15 ml of tri-acid mixture containing conc. HNO_3 (16 M, 71 %), H_2SO_4 (18 M, 96 %) and $HClO_4$ (11 M, 71 %) in 5:1:2). The composite was heated on hot plate at low heat (60°C) for 30 min, and the volume was reduced to about 5 ml until a transparent solution was obtained. After cooling, 20 ml distilled water was added and the content was filtered through Whatman filter paper No. 42 (Kumar and Mani 2010). Total Pb was determined by the AAS.

SOIL CHEMICAL ANALYSIS

Soil pH was measured in a suspension of 1:2.5 soil water ratio by Elico digital pH meter (ModelLI127, ElicoLtd., Hyderabad, India). Double Distilled Water was used for preparing of all kinds of solutions. Organic carbon of soil was determined by rapid chromic acid di-gestion method of Walkley and Black. Cation exchange capacity (CEC) was determined by neutral 1N ammonium acetate. Total nitrogen was determined by micro-Kjeldahl method (Glass Agencies, Ambala,

India) containing digestion mixture of sulphuric acid, selenium dioxide and salicylic acid. Available sulphur extracted with $CaCl_2$ solution (0.15%) was determined by turbidimetric method. Total phosphorus was determined by hot plate digestion using HNO_3 (16M, 71%) and extracted by standard ammonium molybdate solution (Chopra and Kanwar, 1999).

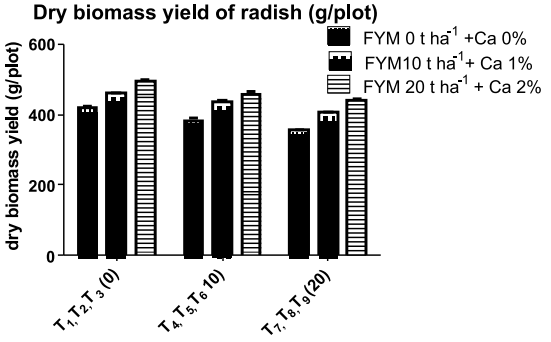
STATISTICAL ANALYSIS

The experimental results were expressed as mean ± standard error of mean (SEM) of three replicates. Graphpad Prism (version 5.04, GraphPad Software, USA) software was used for drawing Figures.

RESULT AND DISCUSSION

Effect of FYM, Ca and lead Interaction on dry biomass yield of radish

The data (fig.1) show highly significant of Pb, FYM and Ca and interaction of Pb, FYM and Ca on influencing the dry biomass yield of radish. Addition of FYM and Ca increased the dry biomass of radish 18.28%(T_3) over the control added single dose of Pb 10 mgkg^{-1} (T_4) 20mgkg^{-1}(T_7) individually reduced the dry biomass of radish by 8.60% and 15.25% over the control, respectively. The addition of combined treatment Pb 10 mgkg^{-1} + FYM 20 t ha^{-1} + Ca 2%(T_6) and Pb 20mg kg^{-1} + FYM 20 t ha^{-1}+ Ca 2% (T_9) individual increased the dry biomass yield of radish by 9.04% and 4.76% .



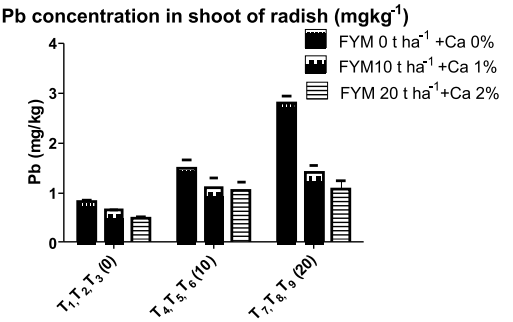
(Applied Pb in mgkg^{-1})

Fig.-1. Effect of FYM, Ca and lead Interaction on dry biomass yield of radish

Effect of FYM, Ca and lead Interaction on lead concentration in shoot and root of radish

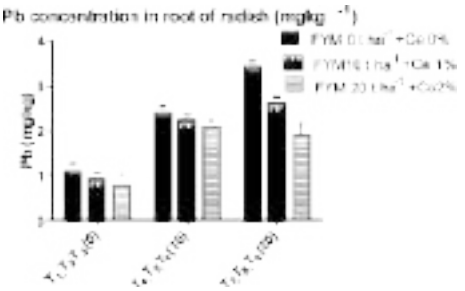
The data (Fig 2and 3) show a highly significant effect of Pb, FYM and Ca and the interaction of Pb, FYM and Ca on the uptake of Pb by both the shoot and root of the radish. There is an indication that the relative Pb uptake is often greater in the control than in the plots treated with Pb. The application of high dose of lead @ 20 mgkg-1 (T_7) increased the maximum concentration of lead in radish shoot and root by 2.8 mgkg-1 and 3.4 mgkg^{-1} but high dose of FYM @20 t ha-1 and Ca 2%(T_3) treated plots decreased the lowest concentration of Pb in shoot and root of radish by 0.48mgkg-1and 0.75 mgkg^{-1}.

The Pb was reduced in FYM treated plot. An ameliorative effect of FYM was observed in lead contaminated soil. The results of present study showed that FYM may effectively immobilized Pb in soil.FYM and Ca have potential to reduce Lead accumulation in both shoot and root of radish.



(Applied Pb in Mgkg-1)

Fig.-2. Effect of FYM, Ca and lead Interaction on lead concentration in shoot of radish



(Applied Pb in mgkg-1)

Fig.-3. Effect of FYM, Ca and lead Interaction on lead concentration in root of radish

The increasing level of Pb increased the Pb concentration in both root and shoot of radish but when it was applied with FYM and Ca,then Pb concentration reduced both in shoot and root. The overall effect of FYM and Ca on the concentration of lead was variable application of combined treatment of Pb @ of 20 $mgkg^{-1}$ + FYM @ of 20 t ha^{-1} + Ca 2%(T_9) increased the accumulation of Pb concentration in shoot and root of plant by 1.1 $mgkg^{-1}$ and 1.9 $mgkg^{-1}$.

CONCLUSION

It was observed that FYM application 20 t ha^{-1} and Ca 2% increased the yield of radish by 18.28 % over the control and decreased Pb concentration particularly in shoot and root of radish by 2.8 $mgkg^{-1}$ and 3.4 $mgkg^{-1}$, respectively. However, application of Pb without FYM and Ca application reduced the yield of radish and increased Pb concentration particularly in shoot and root of radish.

The reduced uptake of Pb was observed in FYM and Ca treated plots. The authors conclude that the application of applied FYM @ of 20 t ha^{-1} and Ca 2 % can reduce Pb uptake in shoot and root of radish grown in Pb contaminated soils.

The following conclusion could be drawn from the present investigation:

- Pb is not beneficial for plant growth and reduces the plant growth and yield of plant because it has tendency to accumulate in shoot and root of the vegetables grown in Pb polluted soils.
- Treatment of FYM to the soil possibly reduced Pb in edible part of plants and help to minimize the risk to the health of people living in metal contaminated area.
- Calcium is very effective in decreasing the metal bio-availability due to the introduction of additional binding sites for heavy metals and due to pH effects.

A more detailed study is required to grow radish or other vegetable crops in contaminated area and to evaluate their growth and distribution of heavy metals in different edible parts of Plants.

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EFFECT OF DIFFERENT COMBINATIONS OF GROOMING AND BATHING ON MILK YIELD AND COMPOSITIONAL QUALITY OF RAW MILK DURING RAINY SEASON IN CROSS-BRED COWS

Aslam, Ramesh Pandey, Neeraj, Gaurav Jain and Ngangkham James Singh
Department of Animal Husbandry & Dairying, SHUATS- Pryagraj (Allahabad), (U.P.), India

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ABSTRACT

The present study was undertaken to find out the Effect of different combinations of grooming and bathing on milk yield, compositional quality of raw milk during rainy season in cows on twelve apparently healthy cows, randomly selected and housed in tail to tail barn under similar management conditions at SHUATS dairy farm, Allahabad with treatments as T_0 (Cows milked without grooming and bathing), T_1 (Cows groomed and bathed once a day), T_2 (Cows groomed and bathed twice a day) and T_3 (Cows groomed and bathed thrice a day). All sanitary precautions were undertaken to produce clean milk by dry full had method of milking. Per day milk yield (kg) of cows under different treatments were recorded and representative sample of milk were used to determine the compositional quality of raw milk for per cent fat, Solids Not fat (SNF), acidity, specific gravity of raw milk. Statistical analysis of data on milk yield, SNF and compositional quality of raw milk as influenced by effect of different treatments of grooming and bathing in cross-bred cows revealed significant differences on per day milk yield, and per cent fat in milk, excluding acidity, specific gravity which have shown non-significant differences. Results of the experiment indicated that the per day milk yield and compositional quality of raw milk adjudged on the basis of different treatments as found best in T_3 followed by T_2, T_1 and control including their superiority of T_3 over rest of the treatment of grooming and bathing in rainy season.

Keywords : *Grooming, bathing, milk yield, compositional quality, raw milk, rainy season.*

INTRODUCTION

Current human population (2017) in India is estimated to be 1.34 billion, of which nearly 70% lives in rural areas. Since about 80% of rural population is dependent on agriculture for their livelihood, development in agriculture and its allied activities thus becomes vital for rural prosperity. Dairy animals are an important source of food, particularly of high quality protein, minerals,

vitamins and micronutrients; they supply huge amount of essential nutrients to the human population. Milk provides proteins with a wide range of amino acids that match human needs. Thus increasing dairy production is expected to have significant impact on food supply to people since many rural poor small holders will have direct access to more food of dairy origin. In India, as compared to other food sectors, the milk production increased from a mere 17 million tonnes during 1950-51 to 160.35 million tonnes in 2015-16. The annual growth rate in milk production in India stood at 6.27% during 2014-15 as compared to the global average of 2.2%. Increase in milk production boosted the per capital availability of milk to the population of the country. In 1950-51, the per capita milk availability was only 130/gram per day while today the national average (320g) is above the ICMR recommended level of 280 gram per day. (Srivastava, 2017).The composition of milk and its quality are important for the dairy industry and human health because milk and its composition are related to the milk processing ability whereas quality concern is the need of time. Milk fat is the main milk ingredient considered important for payment but now the payment criteria in India and worldwide also, includes per cent protein, total solids, total microorganism count and somatic cell count in per ml milk along with compulsory determination of freshness.

India is self-sufficient in milk and world's largest milk producer with about 155 million tonnes of milk production in 2015-16 accounting for about 18% of the world's milk production. Milk production is growing at about 6.5 annually for the last two years as against 4.7% over the earlier 10 year period. Milk is India's single largest agriculture commodity in value terms and is more than the combined value of paddy and wheat put together. (Rath. 2017).

MATERIALS AND METHODS

All cross-bred cows of SHUATS Dairy farm were subjected to Californian Mastitis Test (CMT) and positive reactors were discarded. Twelve apparently healthy cows free from any noticeable injuries on udder and kept under similar management conditions in tail to tail barn of SHUATS dairy farm were randomly selected.

Sanitary precautions like clipping of long hair on the udder and flank, washing of hind quarters, wiping udder with towel soaked in 3% Dettol solution, tying tail with legs etc. were taken care prior to collection of milk samples. Cows were milked by full hand method of milking. Dry hand method of milking was followed. Two streams of fore milk from each quarter of udder were discarded as per recommendation of Singh and Prasad (1989). Milk yield of experimental animals were recorded and representative sample of 200 ml milk were collected directly in to sterilized conical flasks of 250 ml capacity and cotton plugs were replaced immediately. Samples of milk were brought to the laboratory for determination of chemical quality of raw milk. Four different treatments including control for the present experiment were as follows:

T_0: Cows milked without grooming and bathing

T_1: Cows groomed and bathing once a day

T_2: Cows groomed and bathed twice a day

T_3: Cows groomed and bathed thrice a day

Parameters of study

A. Milk yield (kg)

B. Compositional parameters:

(I) Per cent butter fat in milk

(II) Per cent Solids Not Fat (SNF) in milk

(III) Per cent acidity of raw milk

(IV) Specific gravity (sp.gr.) of milk

RESULTS AND DISCUSSION

Lowest mean of milk yield in kg was

recorded as 2.63 in T_0 followed by 2.73 in T_1, 2.84 in T_2 and 4.35 in T_3, the difference in these values were found significant indicating thereby a significant effect of different combination of grooming and bathing on milk yield in kg.

Lowest mean of per cent fat in raw milk was recorded as 4.1 in T_1 followed by 4.9 T_0, 4.29 in T_2 and 4.28 T_3. The different in these values were found non-significant in indicating thereby a effect of different combination of grooming and bathing on per cent fat in raw milk.

Lowest mean of per cent SNF in raw milk was recorded as 8.55 in T_0 followed by 8.55 T_3, 8.56 in T_2 and 8.57 in T_1 the different in these values were found significant indicating these by an significant effect of different combination of grooming and bathing on per cent SNF in raw milk.

Lowest mean of per cent acidity in milk was recorded as 0.14 in T0 followed by 0.14 T_3, 0.15 T_1 and 0.15 T_2. These values were found non-significant indicating thereby an effect of different combination of grooming and bathing on per cent acidity in milk.

Lowest mean of specific gravity of milk was recorded as 1.028 in T_0 followed by 1.028 in T_1, 1.028 in T_2 and 1.028 in T_3. These values were found non-significant indicating thereby a non-significant effect of different combination of grooming and bathing on specific gravity of milk.

Table- 1 Mean value of combinations of grooming and bathing on milk yield and compositional quality of raw milk during rainy season in cross-bred cows

Parameters	**Different combinations of grooming and bathing on milk yield and compositional quality of raw milk during rainy season in cross-bred cows**			
	T_0	**T_1**	**T_2**	**T_3**
Milk yield*	2.63	2.73	2.84	4.35
Per cent butter fat**	4.9	4.1	4.29	4.28
SNF*	8.55	8.57	8.56	8.55
Percent Acidity**	0.14	0.15	0.15	0.14
Specific gravity**	1.028	1.028	1.029	1.028

***significant, **non- significant**

CONCLUSION

Results of the study revealed significant effect of different combination of grooming and bathing on milk yield, per cent fat, per cent SNF and specific gravity in raw milk of cross-bred cows. However per cent butter fat, percent acidity and specific gravity of raw milk were not-significantly influenced by different treatments of grooming and bathing composition in cross-bred cows in rainy season, milk yield and SNF were significantly influenced by different treatment of grooming and bathing composition in cross-bred cows in rainy season.

The highest milk yield of cows per day (kg) was recorded in T_3 (4.35), followed by T_2

(2.84), T_1 (2.73), and T_0 (2.63) in rainy season. The milk yields of cows tend to vary inversely with the percentage fat content of the milk. Various statistical investigations, by the method of correlation, support this observation. Such investigations have shown the existence of a significant negative coefficient of correlation between the two variables, percentage fat content of the milk and yield of milk. Therefore adoption of grooming and bathing of cow's body for five minutes before milking to activate the blood speculation in the animals of body. May be recommended to dairy farmers as an effective routine practice to obtain higher milk yield

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EFFECT OF DIFFERENT ORGANIC MANURES ON PRODUCTION OF CABBAGE *(BRASSICA OLERACEAE* VAR. CAPITATA *L.)* IN BUNDELKHAND REGION

Ravi Shanker Mishra, S. S. Singh and Ashutosh Mishra
Faculty of Agriculture
Mahatma Gandhi Chitrakoot Gramoday Vishwidayalya
Chitrakoot, Stana, (M.P), India

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ABSTRACT

At the experiment was at Research Farm, Rajoula, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (Madhya Pradesh) with Randomized Block Design. Analysis of variance for the design of the experiment indicated highly significant differences for all the characters viz. head weight (g) , size of head length(cm), size of head width(cm), yield per plot (Kg.), The head weight, size of head length, size of head width, yield per plot were exhibited in (T9) with combination R.D.F+Goat manure(7.5Tons/ha.). The genotypic correlations were higher than phenotypic ones in magnitude for all the characters and showed positive association at genotypic level and phenotypic level. level with head weight whereas, positive and significant correlation with all the traits. Direct effects for different characters of cabbage affected by organic manure with different treatment and revealed that yield per plot exhibited by other traits viz., head weight (1.696), size of head length(3.394), size of head width(1.769) observed @ 30 DAS, 45 DAS and 60 DAS, using RDF, FYM, Goat manure and vermicompost combination.

Key Words:- *Cabbage, FYM, vermicompost, goat manure, yield parameter.*

INTRODUCTION

Cabbage (Brassica oleracea L.) In India, where large number of people is vegetarian, leafy vegetables play an important role in their nutrition. Among the leafy vegetables cabbage is an important crop, which occupies first name among cole crops, cabbage is grown during winter season in sub-tropical and in summer season in temperate regions in India. It is one of the most popular winter growing vegetables, which have attained the position of commercial importance. Farm yard manure play an important role in the development of humus in the soil which is very essential for the growth and development of vegetables,

particularly the cole crops. It helps in the development of leaves and ultimately helps in compactness of cabbage head. On an average the well rotten FYM contains 0.5 % N, 0.2 % P_2O_5, 0.5 % K_2O by (Singh *et al.*, 1991).

Farm Yard Manure (FYM) is among the important soil amendments to which farmers have access in mixed farming systems. In addition to its nutrient supply, FYM improves the physicochemical conditions of soils. The widespread use of FYM greatly depends, among others, on proper application methods, which increase the value, reduce costs, and enhance effectiveness. Often, FYM is used for vegetable crops, which have high productivity and fetch high cash value. The droppings of goats are also good organic manure. It contains higher nutrients then Farm Yard Manure and composed. It is generally utilized as organic manure contain on an average 3 % of nitrogen. 1 % of phosphorus and 2 % of potassium. Vermicompost is a mixture of warm-casting, organic materials, humus, living earth worms, cocoons and other organism (Bhiday 1994). It contains 1-1.50 % N, 0.50-0.75 % P, and 2-2.5 % Kmore than simple composed in available forms but it depends upon the feed stuffs. Surface dweller like Eisenia Foetida, Perionyx excavates and Eudrilus euginal are employed to convert any organic will bete in to humas rich vermicompost.

MATERIALS AND METHODS

The experiment under present investigation was conducted in a well prepared field during *Rabi* 2015-16 at Agriculture Farm, Rajoula, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (Madhya Pradesh). The place of experiment in Chitrakoot is situated at $25^0$10' North latitude and $80^0$85' East longitude. The altitude is about 200m above mean sea level. The soils are sandy loam deficient in Phosphorus, Boron and Zinc. Three level of Organic manure using RDF, FYM, Green manure and Goat manure with twelve combinations (T_0 to T_{12}). The experiment consisted of 13 treatments .Control (To), R.D.F (T1), 75% R.D.F (T2), 50% R.D.F(T3), R.D.F + F.Y.M,(T4), 75% R.D.F + F.Y.M (T5), 50%R.D.F + F.Y.M(T6), R.D.F + vermicompost (T7), 75%R.D.F + vermicompost (T8), 50% R.D.F + vermicompost (T9), R.D.F + Goat manure (T10), 75% R.D.F + Goat Manure (T11), 50%R.D.F + Goat Manure(T12). with Randomized Block Design. To study the effect of FYM vermicompost and goat manure on growth parameter of cabbage.

RESULTS AND DISCUSSION

Yield parameter

(1) Head weight and length:

The data of head weight of cabbage showed in table 4.2.7, using RDF, FYM, Green manure and Goat manure combination. The maximum head weight in T9 (1.26) and minimum T0 (0.44) with a general mean 0.93, and head length observed maximum T9 (12.71) and minimum T0(5.54) with a general mean 9.27.

(2) Head width and yield per plot:

The data of head width of cabbage showed in table 4.2.8, using RDF, FYM, Green manure and Goat manure combination. The maximum head width in T9 (14.77) and minimum T0 (8.47) with a general mean 11.43, and yield per plot (Kg) observed maximum T9 (24.45) an minimum T0 (20.40) with a general mean 22.69.

CONCLUSION

The experiment consisted of 12 treatments .Control (To), R.D.F (T_1),75% R.D.F (T_2), 50% R.D.F(T_3), R.D.F+F.Y.M,(T_4), 75%R.D.F + F.Y.M(T_5), 50% R.D.F + F.Y.M (T_6) , 50% R.D.F+ Vermicompost (10Tons/ha.)(T_7), 75% R.D.F. + Vermicompost (10Tons/ha.) (T_8), R.D.F+Goat manure (7.5Tons/ha.) (T_9), R.D.F + Vermicompost (10Tons/ha.) (T_{10}),

75%R.D.F+Goat manure (7.5Tons/ha.) (T_{11}) 50%R.D.F+Goat Manure (T_{12}) and T9 treatment is superior for the all character. Forgoing results and inferences revealed that presence of wide spectrum of exploitable variability in the material studied with respect to direct selection for yield parameters and Head weight (Kg), Head length(cm), Head width (cm), Yield per plot (Kg) indirect selection for days to maturity to yield improvement can be made possible in cabbage through breeding programme.

Table-4.1 Genotypic correlation coefficients for different growth characters of cabbage affected by organic manure with different treatments in year 2015-16

	Treatments	**Head weight (Kg)**	**Head length(cm)**	**Head width (cm)**	**Yield per plot (Kg)**
		2015-16	**2015-16**	**2015-16**	**2015-16**
T0	Control	0.44	5.54	8.47	20.40
T1	R.D.F (100:80:80)	0.82	8.33	10.03	22.18
T2	75%R.D.F (75:60:60)	0.74	7.51	10.33	22.30
T3	50%R.D.F (50:40:40)	0.87	9.00	10.27	22.73
T4	R.D.F+F.Y.M (15Tons/ha.)	0.96	9.00	11.13	22.83
T5	75%R.D.F+F.Y.M (15Tons/ha.)	0.88	8.79	10.93	22.45
T6	50%R.D.F+F.Y.M (15Tons/ha.)	0.97	8.69	11.13	23.11
T7	50%R.D.F +Vermicompost (10Tons/ha.)	1.02	9.85	10.97	23.07
T8	75%+R.D.F+Vermicompost (10Tons/ha.)	1.05	10.47	12.37	23.15
T9	R.D.F+Goat manure (7.5Tons/ha.)	1.26	12.71	14.77	24.45
T10	R.D.F+Vermicompost (10Tons/ha.)	1.00	10.64	12.37	22.63
T11	75%R.D.F+Goat manure (7.5Tons/ha.)	1.09	9.83	12.53	22.97
T12	50%R.D.F+Goat manure (7.5Tons/ha.)	1.13	10.50	12.90	23.18
	Maximum	**1.26**	**12.71**	**14.77**	**24.45**
	Minimum	**0.44**	**5.54**	**8.47**	**20.40**
	Mean	**0.93**	**9.27**	**11.43**	**22.69**
	SEm+- =	0.06	0.51	0.34	0.45
	CD 5% =	0.19	1.54	1.03	1.36
	CV =	11.56	9.57	5.24	3.46

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SYNTHESIS,CHARACTERIZATION AND EVALUATION OF (1H-BENZOIMIDAZOLE-2-YL)-FURAN-3-YL-DIAZENE FOR ITS BINDING AGAINST Cd^{2+} , Hg^{2+} , Pb^{2+}

Santosh Kumar Srivastava
C.M.P. College, Prayagraj. (U.P.), India

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ABSTRACT

The synthesis characterization of (1H Benzoimidazole-2-yl)-furan-3-yl-diazine and its subsequent evaluation for its binding behavior against lead, cadmium and mercury. The carrier mediated transport through liquid bilayer membrane involving a very simple glass apparatus used as oe of the method to evaluate the binding ability of the binders synthesized under present study.

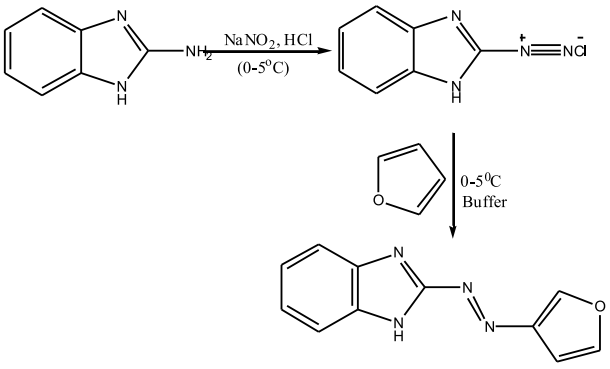
Keywords : *Diazocoupled, binder, complex, synthesis, IR.*

INTRODUCTION

Since the chosen metal ions were of soft nature i.e. small charge and large size hence a ligand having hard/borderline donors designed for the same purpose. As it has been described that in the transport phenomenon i.e. removal of a particular cationic analyte from a solution the decomplexation phenomenon is the crucial one. Hence a ligand with mismatch of its donors with the cationic analyte was designed. In the light of this particular concept a ligand was constructed upon the skeleton of 2-aminobenzimidazole by its diazo coupling over furan moiety at low temperature (0-5°C) under buffered condition.

1.1. SYNTHESIS OF 1H-(Benzoimidazol-2-yl)-furan-3-yl-diazene:

The present ligand was synthesized through diazo coupling reaction of 2-aminobenzimidazole over furan. A low temperature of 0-5°C was maintained throughout diazotization reaction of 2-aminobenzimidazole and its coupling reactions. The entire procedure can be understood through following reaction scheme;



Scheme 1.1: Synthetic scheme for ligand 1

1.2. SPECTRAL CHARACTERIZATION OF THE LIGAND:

Yield: 88%, M.P. 188°C, **IR ν_{max}/cm^{-1}**: 3383, 2932, 1629, 1609, 1554, 1450, 1377, 1302, 1105, 1025, 958, 859, 751, 635, 578; ^{1}H NMR: δ_H(300 MHz; $CDCl_3$; Me_4Si): δ= 6.30 (d, 1H, H-Ar), 7.26 (m, 2H, H-Ar), 7.40 (m, 2H, H-Ar), 7.67(m, 2H, H-Ar), 11.45 (s, 1H, -NH) ppm; **^{13}C NMR** (100 MHz, DMSO-d^6):143.0, 142.5, 141.5, 140.3, 137.9, 122.9, 115.4, 109.9ppm; **MS m/z (ESI, M+H)=** 213.07, Calc. for $C_{11}H_8N_4O$=212.0$_4$. CHN Calculated for $C_{11}H_8N_4O$: C, 62.26%, H, 3.80%, N, 26.40%, O, 7.54%; Found 61.30%, H, 4.18%, N, 27.40%, O, 6.54%.

1.3. EVALUATION OF BINDING ABILITY OF THE LIGAND L1:

1.3.(I). THROUGH COMPLEXATION STUDIES:

For this purpose the ethanolic solution (20 ml) of chloride salts of Pb^{2+}, Hg^{2+} and Cd^{2+} were added separately to the ethanolic solution of ligand L1 with constant stirring over a time period of 15 minutes. The reaction mixtures were further stirred for one more hour followed by their reflux for two hours on a water bath. The resulting solids were filtered on a Buchner funnel followed by their washings with aq. ethanol and finally dried under vacuum.

Table-1.1 Analytical data and physical properties of the ligand and complexes:

Formula	Found (Calcd), %			
	Carbon	Hydrogen	Nitrogen	Metal
$[Cd(C_{11}H_8N_4O)Cl_2]$	31.48 (30.97)	7.68 (7.46)	13.35 (14.08)	26.78 (26.34)
$[Pb(C_{11}H_8N_4O)Cl_2]$	25.68 (25.35)	6.27 (6.02)	10.89 (10.31)	40.27 (39.98)
$[Hg(C_{11}H_8N_4O)Cl_2]$	26.01 (25.87)	6.35 (6.12)	11.03 (11.67)	39.49 (40.01)

Table-1.2 Physical properties of complexes:

Formula	Colour	% Yield	Molecular Weight	m.p. °C
$[Cd(C_{11}H_8N_4O)Cl_2]$	Pale Yellow	79	420.10	>250
$[Pb(C_{11}H_8N_4O)Cl_2]$	Light Brown	68	514.17	>220
$[Hg(C_{11}H_8N_4O)Cl_2]$	Brown	52	508.17	>300

1.3. (I) A.IR SPECTRAL STUDIES:

The IR data of the ligand and its metal complexes were presented in Table 1.3. The IR spectra of complexes were compared with that of the free ligand in order to determine the co-ordination sites involved in chelation. There were some guide peaks in the spectra of ligand, the position of these peaks were expected to change upon chelation.

Upon comparison, it was found that the (N=N) stretching vibration in free ligand was at 1629 cm-1 which gets shifted to 1607-1612 cm^{-1} in complexes, indicating the participation of azo nitrogen in co-ordination (M-N).New bands found in the spectra of complexes in the region 553-595 cm^{-1} were assigned to (M-N) mode.

Table-1.3 IR spectral data of Ligand L1 and its various metal complexes:

Formula	ν(N-H) cm^{-1}	ν(N=N) cm^{-1}	ν(C=N) cm^{-1}	ν(C-N) cm^{-1}	ν(C-O) cm^{-1}	ν(M-N) cm^{-1}	ν(M-O) cm^{-1}
$C_{11}H_8N_4O$	3383	1629	1595	1302	1105	-	-
$[Cd(C_{11}H_8N_4O)Cl_2]$	3373	1612	1590	1374	1075	553	485
$[Pb(C_{11}H_8N_4O)Cl_2]$	3380	1602	1570	1364	1102	555	-
$[Hg(C_{11}H_8N_4O)Cl_2]$	3378	1607	1578	1390	1104	595	-

1.3. (I) B. ^{1}HNMR SPECTRAL STUDIES:

Table-1.4 NMR spectral data of L1 and its various metal complexes:

Formulae	δ_H(300 MHz; $CDCl_3$; Me_4Si)				
$C_{11}H_8N_4O$	**6.30** (d, 1H, H-Ar)	**7.26** (m, 2H, H-Ar)	**7.40** (m, 2H, H-Ar)	7.67 (m, 2H, H-Ar)	**11.45** (s, 1H, -NH)
$[Cd(C_{11}H_8N_4O)Cl_2]$	6.26	7.23	7.39	7.65	11.46
$[Pb(C_{11}H_8N_4O)Cl_2]$	6.29	7.28	7.38	7.66	11.40
$[Hg(C_{11}H_8N_4O)Cl_2]$	6.28	7.28	7.39	7.65	11.42

As it is evident from the 1H NMR spectral data given above that metal underwent complexation with the ligand moiety without involving –NH of the benzimidazole as this signal is maintained in all the cases. Very minute amount of chemical shifts were observed in other protons which is quite on similar line reported in literature for similar type of cases.

The metal ligand stoichiometry in solution stage was worked out through Jobs plot and it was 1:1 as it was in the solid stage. The corresponding jobs plots have been shown below;

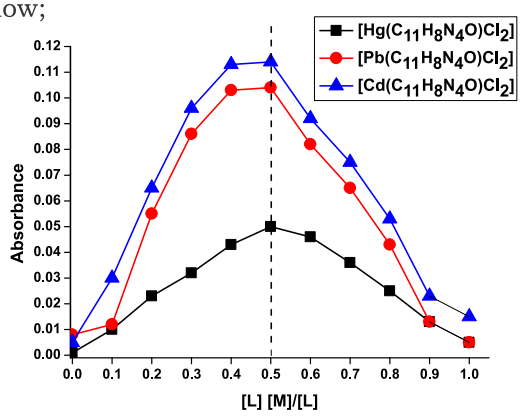
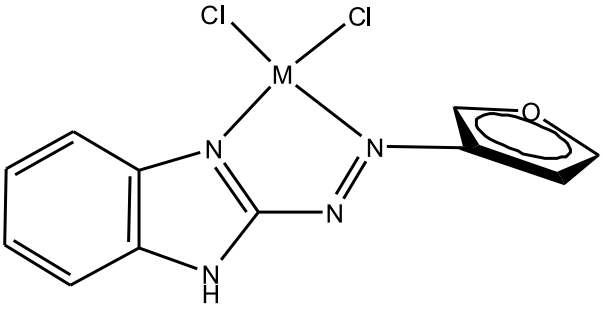


Figure-1.1 Figure showing 1:1 ratio from Job's Plot Study

Hence on the basis of above analytical and spectroscopic studies following tentative structures can be proposed;



Where MCl_2=$PbCl_2$ and $HgCl_2$

Figure-1.2 Most probable structure of the complex formed

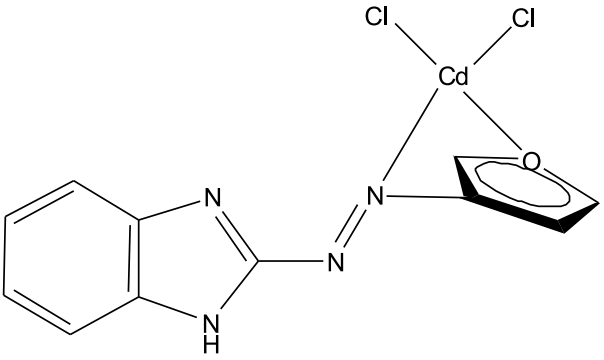


Figure-1.2 Most probable structure of the complex formed with $CdCl_2$

1.3. (II). THROUGH TRANSPORT STUDIES:

1.3. (II).A.TRANSPORT EXPERIMENT:

The glass transport cell used in the present studies is well known. A chloroform solution (20 ml) containing desired concentration of carrier ligand was used as liquid membrane which was separated through a glass tube from an aqueous solution of desired concentration of the metal salt (source phase) and distilled water (receiving phase). Volume of the source phase and the receiver phase were 2 ml and 50 ml respectively. The liquid in the source phase and the receiver phase were kept at the same level. The liquid membrane phase was well stirred using a magnetic stirrer.

Known volume (1 ml) were withdrawn from the receiver phase at definite time intervals and were analyzed for concerned metal ions using an atomic absorption spectrophotometer (Perkin Elmer 373). The effect of counter ions on the transport phenomenon was also studied by taking different salts of the same metal in the source phase. For each run, a corresponding control experiment was also performed in which everything same was expecting that no carriers were taken in the membrane phase.

1.4. RESULTS AND DISCUSSION

In all the cases i.e. in all metals ligand combination studies, the rate of transport of the metal ions was found to be faster initially but as the time elapsed it slowed down. The trend in one representative case is shown in (figure 1.3). The trend shown in figure 1.3 can be understood in terms of postulated mechanism ofthe carrier mediated transport through liquid membrane based on facilitated diffusion model.

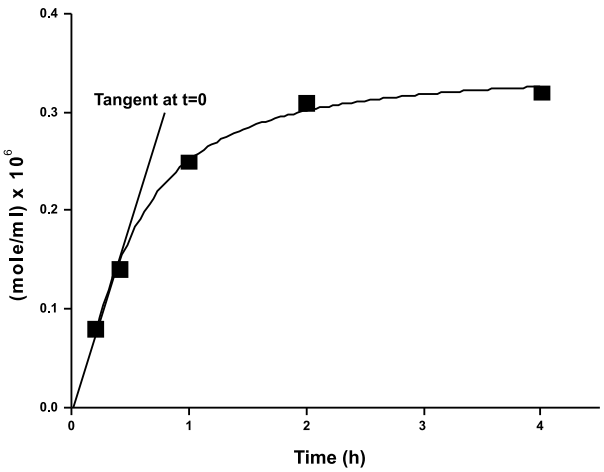


Figure-1.3 A typical plot showing variation in the concentration of M^{2+} in the receiver phase with time, in the case of $CdCl_2$ (source phase concentration=0.1M)

The whole process is visualized to consist of four steps;

a) Cations in the source phase moves into the

membrane phase accompanied by the anions and its complexation by the corresponding ligand L1.

b) Complex-anion pair moves across the membrane.

c) Decomplexation takes place at the receiver phase/membrane phase interface and the cations and anions are released into the receiver phase; and

d) Ligand returns to source phase to repeat the cycle.

From this postulated mechanism it is apparent that as the concentration of the metal ion in the receiver phase increases, the transport of the metal in the reverse direction also sets in, diminishing the net rate of transport of the metal in the reversedirection also sets in, diminishing the net rate of transport of the metal ion from the source phase to the receiver phase. In the present study, therefore transport data have been discussed in terms of initial rates of transport (J_c) determined from the tangent at the time t=0 of the curve obtained by plotting concentration against time e.g. figure 1.3.

Data on the initial rates of transport (J_c) of the different cations i.e. Pb^{2+}, Cd^{2+}, Hg^{2+} ion using ligand L1 as carrier ligand are recorded in table 1.4 a to c.

A scrutiny of the values of Jc for above ions using the ligand L1 as carriers (table 1.1a-c) reveals that the carrier ligand L1 is showing maximum affinity for the Cd^{2+}.

In view of postulated mechanism the rate of transport, Jc should depend on;

a) The ease of complextation (determined by rates) of the metal ion with the carrier ligand,

b) The rate of transport of the carrier metal complex from the source phase boundary to the receiver phase boundary, and

c) The rate of decomplexation at the receiver boundary.

Table-1.4: Variation of the rate of transport of metal ion (Jc) with salt concentration in the source phase:

(a) CADMIUM:

Sample	Initial concentration in source phase (M)	J_c (mol/h)×10^6
$CdCl_2$	1.0	12.9200
	0.5	4.7270
	0.1	0.0860
	0.01	0.0710
	0.001	0.0250

(b) LEAD:

Sample	Initial concentration in source phase (M)	J_c (mol/h)×10^6
$PbCl_2$	1.0	6.1370
	0.5	1.4800
	0.1	0.3580
	0.01	0.0328
	0.001	0.0121

(c) MERCURY:

Sample	Initial concentration in source phase (M)	J_c (mol/h)×10^6
$HgCl_2$	1.0	2.0000
	0.5	1.0000
	0.1	0.1061
	0.01	0.0070
	0.001	0.0018

Data on initial rate of transport (J_c) of different metal ions from the source phase to the receiver phase in the case of different carrier ligands are recorded in tables 1.4 a to c. In the control experiment where carrier ligand was absent in the membrane phase no detectable transport of the metal ion from source phase to the receiver phase was observed.

The rate of transport (J_c) in all the cases

depends on the concentration of the metal ion taken in the source phase. The plots of log (Jc) against log as, as being the activity of the solute taken in source phase were found to be straight line. One typical plot for the Cd^{2+} using L1 as carrier ligand is shown in figure 1.4 as illustration. This straight line plots though similar to the plots obtained by Lamb et.al. was equal to 2 whereas in our case it is less than 2. The value of the slope equal to 2 was rationalized by Lamb et.al. using the theoretical treatment given by Ward and Reusch and Cussler.

Following the reasoning given by Ward [225], Reusch and Cussler derived the following equation:

$$J_C = \frac{DkK\,C_L}{1}\left(\frac{C_s^2}{1 + kKC_s^2}\right) \quad \text{------ (1)}$$

Where D is the diffusion coefficient of the complex in the membrane, 1 is the length of the diffusion path, C_s is the concentration of the cation in the source phase, C_L is the concentration of the ligand in the membrane phase, k is the partition coefficient of the salt between aqueous phase and the ligand membrane phase and K is the equilibrium constant for the equilibrium:

Metal Salt +Ligand ⟷ Complex

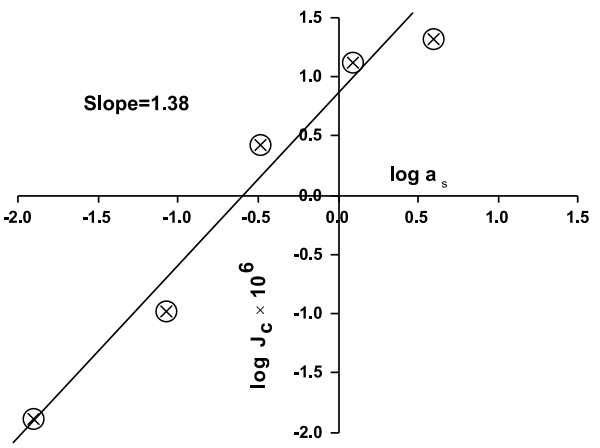


Figure-1.4 Variation of log Jc with log as for cadmium chloride using carrier ligand L1, (10-3 M) in the membrane phase. The values of activity coefficient were taken from reference 5 and 6.

In the membrane phase:

Equation 1 was written in terms of activities to read as;

$$J_C = \frac{Dk\,K\,C_L}{1}\left(\frac{a_s^2}{1 + k\,K\,a_s^2}\right) \quad \text{------ (2)}$$

$$\text{If } k\,K\,a_s^2 \text{ or } k\,K\,C_s^2 << 1 \quad \text{------ (3)}$$

Equation (1) and (2) reduced to

$$J_C = \frac{Dk\,K\,C_L}{1} C_s^2 \quad \text{------ (4)}$$

$J_C = \frac{Dk\,K\,C_L}{1} C_s^2$ --- (4) and $J_C = \frac{Dk\,K\,C_L}{1} a_s^2$ ---- (5)

respectively. Thus plot of log J_c against log a_s should be a straight line of the slope equal to 2.

Value less that 2 of the slopes of the log J_c verses log as plots in the present experiment can be assigned to one or more of the following reasons.

i. The flux Jc in equation (1) - (5) is the steady state flux whereas in the resent study initial values, Jc have been considered.

ii. We have worked with much higher concentration range in the source phase than those used in the experiment of Lamb et al. and therefore, inequality (2) is not likely to remain valid in our case. In the experiment of Lamb et.al. also, negative deviation from the straight line plot (log J_c versus log a_s) i.e. values of the slopes less than 2 were observed at higher concentration of the salt in the source phase and were assigned to the non-validity of inequality (2).

iii. Derivation of equation (1) – (5) was restricted to uni-univalent electrolytes which was not the case in the present experiment.

The value of J_c was also found to increase with the increase in concentration of the ligand in the membrane phase which is an expected

trend. The data in one particular case i.e. cadmium ion are summarized in Table 1.5 as an illustration.

Table-1.5 Variation of the rate of transport of Cadmium ion* with concentration of carrier ligand (L1) in the membrane phase.

Sample	Concentration of the carrier (M)	J_c (mol/h)×10^6
$CdCl_2$	0.1	0.8971
	0.01	0.6242
	0.001	0.4850
	0.0001	0.1560
	0.00001	0.0946

*Conentration in the source phase = 0.1M.

1.5. VARIATION OF TRANSPORT RATE WITH ANIONS:

It has been noted by Lamb et.al. (1980) also by Christensen et.al.(1980) that the rate of cation transport is greatly affected by the nature of the accompanying anion. In fact these authors (Bradshah et. al. 1978 and Lamb et. al. 1980) have discovered a correlation between the rate of cation transport and free energy of hydration of the accompanying anion ($\Delta G_{g\rightarrow w}A$) Plot of log Jc for potassium ion through chloroform liquid membrane containing dibenzo-18-Crown-6 as carrier (figure 1.5), against free energy of hydration of the accompanying anion obtained by Lamb etal. is reproduced in figure 1.6**[3].**

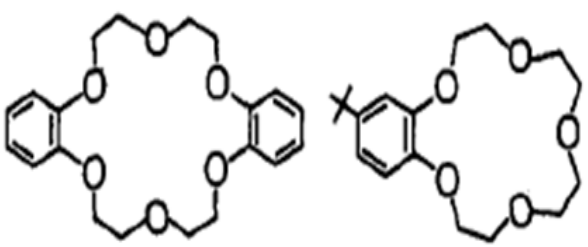


Figure-1.5 Showing carrier ligand used by Lamb et al.

The variation of Jc with the accompanying anion (figure 1.6) wasrationalized by Lamb et.al. using equation (5). This equation predicts that Jc is a function of k, where k is related to the Gibbs free energy of partitioning between water and the membrane phase, ΔG_p

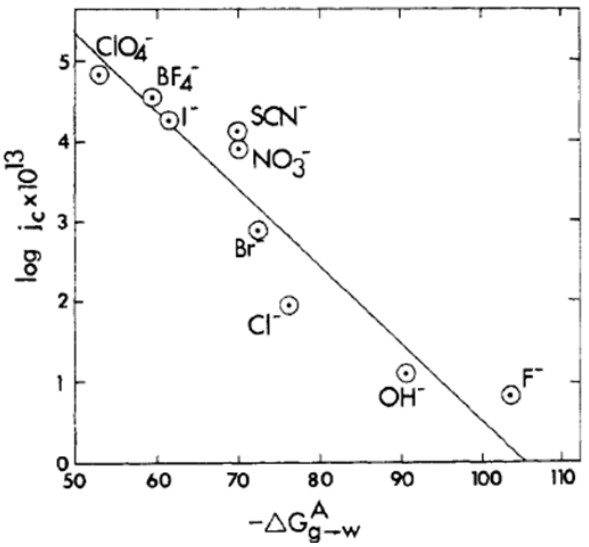


Figure-1.6 Plot of log j_c vs. -$\Delta G_{g\rightarrow w}A$ for several anions (taken form reference 206)

According to the equation

$\Delta G_p = -R\,T\,\ln k$ ------ (6)If all other terms in equation (5) are included in constant B, then combing equation (5) and (6) gives

$$J_C = B_{exp}\left(-\frac{\Delta G_p}{RT}\right) \quad \text{----- (7)}$$

The term ΔG_p can be divided into its component parts

$$\Delta G_p = \Delta G_p^C + \Delta G_p^A + \Delta G_p^{CA} \quad \text{------ (8)}$$

Where the first two terms represent the free energies of partitioning of the cation and anion, respectively and ΔG_p^{CA} represents the free energy of interaction of the energy of

transferring the anion from cation with the anion in the membrane phase. If $\Delta G_{g\to m}A$ represents the free energy of transferring the anion from the gas phase to the membrane phase, and $\Delta G_{g\to w}A$ that from the gas phase to water, then

$$\Delta G_P^A = \Delta G_{g\to m}A - \Delta G_{g\to w}A \quad \text{------ (9)}$$

Therefore

$$\Delta G_p = \Delta G_P^C + \Delta G_{g\to m}A - \Delta G_{g\to w}A + \Delta G^{CA} \quad \text{-- (10)}$$

Equation 7 and 10 predicts a simple correspondence between log J_c and $\Delta G_{g\to w}A$ only if it is assumed that all other ΔG terms comprising ΔGp in equation 10 are constant or compensate each other for all anions. While such an assumption is overly simplistic, figure 1.6 demonstrates that the change in log J_c withincreasing $\Delta G_{g\to w}A$ is fairly regular. Regardless of the reasons for the regular behavior, the data obtained by Lamb et.al. (figure 1.6) shows that there is an empirical correlation between cation transport rate and free energy of hydration of the anion.

The discovery of correlation (figure 1.6) made by Lamb et.al. is prima facie, quite attractive because as pointed out by lamb et.al.**[3]** the anion effect may be exploited in tat transport of cations across membranes can be tuned on or off simply by altering the anion present in the source phase. In addition the same anion effect has potential in separating or detecting anions themselves.

Prompted by these facts we investigated the anion effect in our system also. For the transport of cadmium ions through chloroform liquid membranes containing ligand L1 as carrier, the data on anion effect is shown in table 1.6 and figure 1.7 which corroborate the correlation discovered by Lamb et.al.

Since the rate of transport of the cadmium was the fastest of the carrier ligand L1, the data on anion effect have been obtained for the ligand L1 only are shown in table 1.6 and figure 1.7. Although the data on the transport of Cd^{2+} ions appears consistent with the correlation discovered by Lamb et al. The slope of log Jc versus $\Delta G_{g\to w}A$ plot (figure 1.7) is too steep for Cd^{2+}. This steepness may indicate that there is almost no correlation between J_c and $\Delta G_{g\to m}A$.

Table-1.6. Data showing the variation of Jc with anion types and their free energies of hydration

Carrier Ligand	Anions type	Conc. In source phase (M)	$\Delta G_{g\to m}A$ (kcal/mol)*	(log J_c) ×10^6
L1	NO_3^-	1.0	69.5	0.68
	Cl-	1.0	75.8	0.59
	SO4-	1.0	238.7	0.15

*Reference 7 and 8

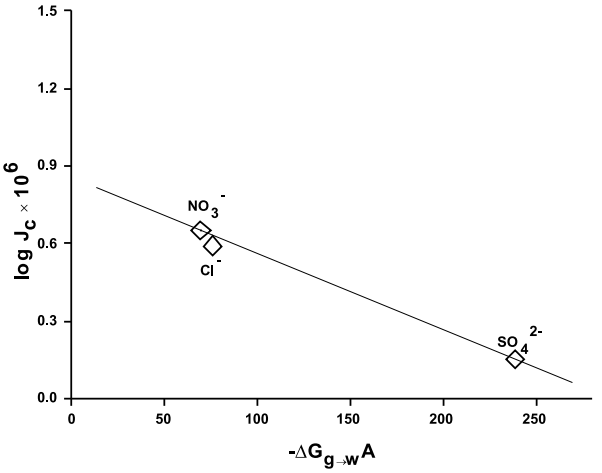


Figure-1.7 Plot of log Jc against – for carrier ligand L1, (0.1M)

This indication is further corroborated by the data on the transport of mixture of Cd^{2+} and Pb^{2+} ions having different accompanying anions (Table 1.7). The data on the rate of transport using ligand L1 as carrier were obtained for the following mixtures:

a) $CdCl_2 + Pb(SCN)_2$

b) $Cd(NO3_{)2} + Pb(NO3_{)2}$

c) $CdI_2 + PbCl_2$

These mixture were chosen keeping in mind the correlation between J_c and $(\Delta G_{g\to w}A)$ and the values of $(\Delta G_{g\to w}A)$ listed in table 1.5. According to the correlation discovered by Lamb et al. more negative is the value of, $(\Delta G_{g\to w}A)$ for the accompanying anion, slower is the transport of the cation. The data in table 2.6, however, indicates that irrespective of the choice of accompanying anion the transport of Cd^{2+} was always faster than the transport of Pb^{2+}.

TABLE-1.7 Rate of transport of Cd^{2+} and Pb^{2+} ion in the mixture of their salts using L1 as carrier Ligand.

Mixture* of salts in the source phase	Jc(mol/h)×10⁶	
	Cd^{2+}	Pb^{2+}
$Pb(NO_3)_2 + Cd(NO_3)_2$	0.0255	0.0012
$Pb(SCN)_2 + CdCl_2$	0.0016	0.0015
$PbCl_2 + CdI_2$	0.0316	0.0087

*Initial concentration of each salt in the source phase = 0.001M

Thus the correlation between Jc and the free energy of anion hydration of the accompanying anion does not have a general validity.

TABLE-1.7 Variation of Jc with the free energy of hydration $(\Delta G_{g\to w}A)$ of the accompanying anion:

Cation type	Anion Type	$(\Delta G_{g\to w}A)$ (kcal/mol)*	(log J_c) ×10⁶
Cd^{2+}	I^-	61.4	-0.176
	NO_3^-	69.5	-0.014
	Br^-	72.5	-0.419
	Cl^-	75.8	-1.060

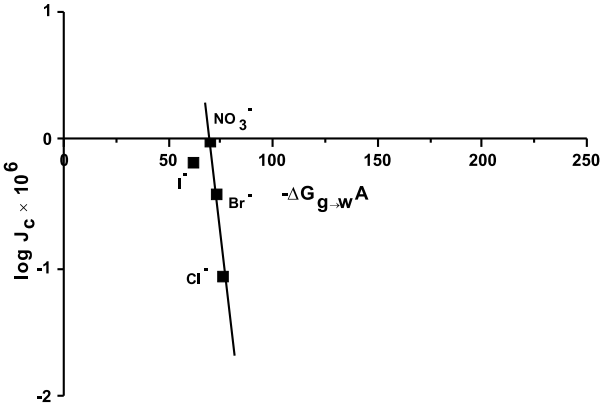


Figure-1.9 Plot of log Jc against – for carrier ligand L1, (0.1M)

CONCLUSION

1. L1 (10-3 M) used as carrier ligand in the membrane phase.
2. Concentration of the cadmium ion on the source phase=0.1 M
3. Concentration of the cadmium ion on the source phase=0.1 M
4. Concentration of the cadmium ion on the source phase=0.1 M

The transport phenomenon studies suggested following order

$$Cd^{2+} > Pb^{2+} > Hg^{2+}$$

The above order can be well understood in terms of hard soft acid base (HSAB) theory[9]. As the donor atoms are hard/borderline hence they prefer the hardest acceptor among the chosen ones i.e. cadmium. The mercury was the last option for the donors in the light of its softest nature among the chosen metal ions.

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ADOPTION OF INDIAN SUPER FOOD "SATTU" IN THE DAILY DIET OF WOMEN FOR BETTER HEALTH OUTCOMES

Sadhana Vaish
KVK, Thariaon, Fatehpur
Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, (U.P.), India

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ABSTRACT

Sattu is ideal for the overall nourishment of the human body. It is also beneficial for growing children, pregnant women and senior citizens. It is easily available, easily made and easily digested. Since it adds a good dose of nutrition to the diet, it is extremely beneficial for glowing skin and flowing hair. A study in 10 villages of two blocks in Kanpur district on 200 women was undertaken on the development of package on low cost recipes of *bajra*, maize and groundnut for women with the objectives of assessing consumption pattern and constraints of selected crops among rural and urban women and to develop the package of selected recipes with nutrient composition and organoleptic acceptability of selected recipes. It was observed that people suffering from celiac disease cannot tolerate gluten. Being rich in fiber content, *bajra* works very well in diabetes. The high amount of fiber present in corn helps lower cholesterol levels and also reduces the risk of colon cancer. Those suffering from anaemia have shown positive effects after consuming corns. The pantothenic acid present in corns helps with the physiological functions of the body. Groundnuts are rich in energy and contain many health benefiting nutrients, minerals, antioxidants and vitamins that are essential for optimum health. Groundnut are especially, rich in mono-unsaturated fatty acids like oleic acids that help to lower LDL or bad cholesterol and increase HDL or good cholesterol. Diet rich in mono-saturated fatty acids helps to prevent coronary artery disease and strokes by favouring healthy blood lipid profile.

Key words: *Adoption, super food, diet, health outcomes.*

INTRODUCTION

Sattu is extremely popular as a summertime beverage in tropical countries. A large portion of sattu is carbohydrates giving an instant burst of energy and easily absorbed in the bloodstream. *Kharif* crops are grown with the onset of monsoon in different parts of the country and these are harvested in

September-October. Important crops grown during this season are paddy, maize, jowar, *bajra*, tur (arhar), moong, urad, cotton, jute, groundnut and soybean. Crops like *bajra* (pearl millet), maize and groundnut are considered as low cost crops and can be grown in varied climate of the country. Most of the rural women consume these crops seasonally, while, urban women who know nutritive value, health benefits of it and are also aware about these crops, consume these whole of the year, women in U.P. consume these coarse cereals (*bajra*, maize, groundnut etc.) only in winters. Due to the psychological effect that these have warm tendency, women consume these crops only in winters. While, in Rajasthan and Maharashtra, these crops are consumed whole of the year, due to less rainfall and high temperature and less fertile land. But, these crops should be consumed because of their health benefits. In whole of the world *bajra* and groundnut are best suitable and most important in conditions of post-menopause, anemia and heavy bleeding. According to the age group, some women, above the age of 50 years, sometimes have problem in digesting *bajra* and groundnut due to its richness in proteins. Sattu is a good nutritive option for both urban and rural community in India, because farmers prefer to produce *bajra*, maize and groundnut in *Kharif* season rather than other crops. Rural and urban community uses these crops because these are easily available. *Bajra*, maize and groundnut are higher in nutritive value and by using this human being may live healthy life. *Bajra*, maize and groundnut are cheap and easily available in India.

MATERIALS AND METHODS

The study was conducted in Kanpur district of Uttar Pradesh. Two blocks namely Kalyanpur and Sarsaul and 10 villages namely Gambheerpur, Baikunthpur, Ishwariganj, Naramau Kachhar, Bagdaudhi Kachhar, Tilsehri, Pali, Phuphuwar, Tajpur and Bausas were randomly selected from these blocks. Four localities namely Arya Nagar, Vishnupuri, Govind Nagar, Ratan Lal Nagar were also selected for the study purpose. Total 200 women were selected (1:1) in this study area. Dependent and independent variables such as age, caste, education, nutrients, food habits etc. were used. Statistical tools such as chi-square, arithmetic mean, percentage, correlation coefficient and standard deviation were used appropriately.

Table-1. Distribution of women according to age group

Age group (years)	Rural (N_1 = 100)	Urban(N_2 = 100)	Total
20 – 30	22 (11.0)	33 (16.5)	55 (27.5)
30 – 40	40 (20.0)	28 (14.0)	68 (34.0)
40 – 50	38 (19.0)	39 (19.5)	77 (38.5)
Total	100 (50.0)	100 (50.0)	200 (100.0)
x^2	4.331 (NS)	P > 0.05	

(Figures in parenthesis indicate percentage of respective values)

RESULTS AND DISCUSSION

Table 1 shows that distribution of women respondents according to age group, 19.0 per cent rural and 19.5 per cent of urban women were belonged to 40 to 50 years age group, whereas 20.0 per cent of rural and 14.0

Table-2. Nutrients intake of rural and urban women

Sl. No.	Nutrient intake	Rural			Urban		
		Mean±SD	RDA	Deficit %	Mean±SD	RDA	Deficit %
1.	Protein (g)	29±9	50	-42	37±11	50	-26
2.	Fat (g)	11±4	20	-45	25±4	20	+25
3.	Calories (Kcal)	1802±121	2400	-25	2400±101	2200	+9
4.	Calcium (g)	326±38	400	-18.5	390±18	400	-2.5
5.	Phosphorus (mg)	300±45	400	-25	376±29	400	-6
6.	Iron (mg)	16±6	30	-46.6	23±6	30	-23
7.	Thiamin (mg)	0.7±0.2	1.1	-36	0.9±0.1	1.0	-10
8.	Riboflavin (mg)	0.7±0.3	1.4	-50	0.8±0.4	1.3	-38
9.	Niacin (mg)	11±3	14	-21	16±4	12	+33
10.	Pantothenic acid (mg)						
11.	Vitamin C (mg)	22±9	40	-45	32±6	40	-20
12.	Vitamin E (mg)	1.1±0.3	0.8	+37.5	0.6±0.6	0.8	-25
13.	Magnesium (mg)	280±29	350	-20	372±33	350	+6.3

per cent of urban women belonged to 30 to 40 years age group. 11.0 per cent of rural and 16.5 per cent of urban women were belonged to 20 to 30 years age group.

Table 2 reveals the average nutrients intake of the rural and urban women respondents, protein intake of rural women is 29 g, which is 42.0 per cent low from RDA whereas, average protein intake of urban women 37 g which is 26.0 per cent low. Average fat intake by rural women 11 g, which is low by 45.0 per cent from RDA while average intake 25 g fat by urban women respondents, which is 25.0 per cent more from RDA. Average calories intake by rural women 1802 Kcal, which is low 25.0 per cent from RDA whereas, urban women take calories 9.0 per cent excessive from RDA. Average calcium 326 g is taking by rural women, which is low 18.5 per cent than RDA, whereas, 2.5 per cent low by urban women. Average 16 mg iron is taking by rural women, which are low by 46.6 per cent from RDA while 23 mg iron is taking by urban women, which are 23 per cent low from RDA. In the selected size of sample urban and rural women were taking less protein, calcium, phosphorus, iron, vitamin B and vitamin E while they should take rich protein, calcium, iron, vitamin E and C as recommended in their diet. Because protein helps in developing RBC that is why women should include protein rich diet in their food. Women face menstruation and menopause stages, in both stages high amount of iron is needed because of these two stages women should also include iron in their diet. Calcium also plays an important role in healthy bones for women. Women should also include vitamin C in their diet because vitamin C and calcium helps in digestion of iron.

Table 3 shows that distribution of women respondents according suffering from disease, 90.0 per cent of rural and 58.0 per cent of urban women were suffering from anaemia, whereas, 22.0 per cent of rural and 32.0 per

Table-3. Rural and urban women suffering from diseases that are benefited from consumption of Sattu

Sl.No.	Disease	Rural	Urban	Total
1.	Anaemia	90 (90.0)	58 (58.0)	148 (74.0)
2.	Arthritis	22 (22.0)	32 (32.0)	54 (27.0)
3.	High blood pressure	5 (5.0)	46 (46.0)	51 (25.5)
4.	Tuberculosis	4 (4.0)	5 (5.0)	9 (4.5)
5.	Cancer	9 (9.0)	2 (2.0)	11 (5.5)
6.	Acne	5 (5.0)	3 (3.0)	8 (4.0)
7.	Obesity	11 (11.0)	29 (29.0)	40 (20.0)
8.	Alzimer	-	2 (2.0)	2 (1.0)
9.	Cardio vascular disease	4 (4.0)	20 (20.0)	24 (12.0)
10.	Kidney disease	-	13 (13.0)	13 (6.5)
11.	Hemophilia	-	6 (6.0)	6 (3.0)
12.	Nose bleeding	6 (6.0)	-	6 (3.0)
13.	Malnutrition	32 (32.0)	1 (1.0)	33 (16.5)
14.	Excess menstruation bleeding	13 (13.0)	9 (9.0)	22 (11.0)

cent of urban women respondents were suffering from arthritis. 32.0 per cent of urban women respondents were suffering from arthritis. 32.0 per cent of rural and only 1.0 per cent of urban women has suffering malnutrition while 11.0 per cent of rural and 29.0 per cent of urban women were suffering from obesity. 9.0 per cent of rural and only 2.0 per cent of urban women were suffering from cancer whereas 5.0 per cent of rural and 46.0 per cent of urban have suffering from high blood pressure. 4.0 per cent of rural and 5.0 per cent of urban women respondents were suffering from tuberculosis while 4.0 per cent of rural and 20.0 per cent of urban women respondents were suffering from cardio vascular disease. 13.0 per cent of rural and 9.0 per cent of urban women were suffering from excess menstruation bleeding, whereas 6.5 per cent of respondents were suffering from kidney disease.

Women in the selected sample who were suffering with diseases should consume Sattu in different forms because of its nutrients and health benefits. It is a wonder food for those who are suffering from gas, acidity and constipation too. Plus, it is a low glycemic index (the glycemic index ranks foods on how they affect our blood sugar levels) food, so it is good for diabetics, and being low in sodium, sattu works for hypertensive people too. Sattu sherbets keep the skin glowing and hydrated. Sattu has also traditionally been used to treat hair problems because it provides rich nutrients to the hair follicles. The iron in sattu also keeps you feeling energized and gives a healthy glow to your face.

CONCLUSION

Women in both urban and rural areas lack in consumption of daily required nutrition with few exceptions. Therefore, a ready to eat super food like sattu is a good option for all. Sattu is extremely versatile as far as cooking is concerned. Uttar Pradesh and Bihar have been historically robbed by "litti chokha" (sattu-stuffed balls of flour baked in coal fire, served

with spiced mashed potato and vegetable curry) way before Shilpa Shetty's attempt. Sattu can be made into laddoos which make for a delectable sweet dish for the health conscious. One can also use sattu for stuffing puris, rotis and kachauris, the results are delicious. Made by the dry-roasting process that seals in all the nutrients, sattu is rich in protein, fibre, calcium, iron, manganese and magnesium. In fact, 100 gram of sattu contains 20.6 percent protein, 7.2 percent fat, 1.35 percent crude fibre, 65.2 percent carbohydrates, 2.7 percent total ash, 2.95 percent moisture and 406 calories. Therefore, Sattu is a super food that should be consumed by all age groups for a sharp mind and a healthy body.

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EFFECTS OF ORGANIC AND INORGANIC FERTILIZER ON VEGETATIVE AND REPRODUCTIVE CHARACTERISTICS OF CHRYSANTHEMUM (CRYSANTHEMUM SP. L.) CV. HIMANGI

Manoj Kumar Singh
Department of Horticulture
Kulbhasker Ashram Post Graduate College, Prayagraj-211002 (U.P.), India

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ABSTRACT

To study the influence of organic and inorganic on quality and yield components in CHRYSANTHEMUM to boost the productivity potential combined application microbial and chemical fertilizers had a great influence at all the growth stages of the crop. Significant differences in all parameters like, plant height, number of leaves, leaf area and number of branches due to the combined application of microbial fertilizer and chemical fertilizer. Maximum plant height (65.23 cm) was observed in Treatment-5 containing NPK+ Phosphobacteria (each 7g / pot). The maximum number of flowers (37.25) per plant was produced in T5 treatment and the maximum number of flower (27.25/plant). The highest number of branches per plant (26.25) was recorded in treatment T5. Highest flower weight was observed in T5 was (72.23g) Total number of leaf observed 185.33 per plant was observed in T-5, and leaf area fairly gives a good idea of photosynthetic capacity of the plant. Significant differences were noticed with regard to leaf area index among the treatments at all growth stages.

Keywords: *DAP, urea, Phosphobacteria, chemical fertilizer and egg plant.*

INTRODUCTOIN

Chrysanthemum (Crysanthemum sp. Linn.) is well responsive to nutrition and found to have great variability with varieties ,climatic conditions and soil fertility. It,s voracious feeder trait may be utilize to maximize productivity. It belongs to family Composite. Plant is herbaceous, annual with erect or

semispreading in habit. It also behaves like a herb. CHRYSANTHEMUM is popular flower of India. It can be grown throughout the year in almost all the states of India except at higher altitudes. The important CHRYSANTHEMUM growing countries in the world are India, Bangladesh, Pakistan, China, Cyprus, Egypt, Japan, Philippines, Syria and Western Europe (Anon 2001). In India, major CHRYSANTHEMUM producing states are Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh (Anonymous, 2004). The varieties of CHRYSANTHEMUM show a wide range of flower shapes ,ranging from oval or cup-shaped to long club shaped; and from white, yellow with varying shades . It is quite high in cut flower value and can be well compared with other major flower . Farmers may boost-up their socio-economic status by growing CHRYSANTHEMUM if assured and remunerative yield obtained from this crop.

MATERIALS AND METHODS

The experiment was carried out in a Completely Randomized Block each unit Design (CRBD) at the Department of Horticulture, Kulbhasker Ashram Post Graduate College ,Allahabad during the year 2016-17. The mechanical compositions, physical and chemical properties of experimental soil, which was used for pot culture study. The soil physical and chemical properties such as pH, Nitrogen (Jackson, 1958), Phosphorus (Jackson, 1958) and potassium (Peach and Tracey,1956) contents were analyzed. The raised seed bed of 3x1.5m size was prepared,and CHRYSANTHEMUM seedlings were planted in five centimeter depth in the rows spaced at 55 cm to the trial pot. The treatments, were T-1 DAP+ Azospirillum (7g / pot),T-2 DAP+Phosphobacteria (7g / pot), T-3 DAP+Potassium mobilizer (7g / pot),T-4 NPK Mixture +Azospirillum (10g /pot), T-5 NPK mixture +Phosphobacteria (7g / pot), T-6 NPK mixture +Potassium mobilizer (7g / pot), T-7 Urea+ Azospirillum (each 7g /pot), T-8 Urea+ Phosphobacteria (each 7g / pot), T-9 Urea+ Potassium mobilize (7g / pot), T-10 Urea (Control). (each 7g / pot) . Five plants were selected randomly from plot to record yield contributing characters. All practical managements included; mulching, weeding and other agronomic treatments were done mechanically. Irrigation was done based on plant requirements. In maturity time, flower yield, number of flower bud per plant, total plant height, shoot length, root length, number of branches per plant, number of leaves and leaf area per plant, flower length and flower width were measured. The collected data were analyzed statistically by F-test to examine the treatment effects and the mean differences were adjudged by Duncan sMultiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The present study was observed that the application of microbial and chemical fertilizers combined application had a great influence at all the growth stages of the crop. Significant differences in all parameters like, plant height, number of leaves, leaf area and number of branches due to the combined application of microbial fertilizer and chemical fertilizer. Maximum plant height (65.23cm) were observed in T5 (Table1). The data on shoot length (36.25cm), and root length (51.25cm) as influenced by the combination of biofertilizers and chemical fertilizers showed significant differences among the treatments at all the stages. The highest number of branches per plant (26.25nos) was recorded in treatment T5 . Highest flower weight was observed in T5 (72.23g) Total number of leaf observed 185.33 per plant was observed in T-5,and leaf area fairly gives a good idea of photosynthetic capacity of the plant. Significant differences

were noticed with regard to leaf area index among the treatments at all growth stages. The treatment 5 showed significantly higher leaf area (1720.23 cm2).The increase in leaf area index could be attributed to increased cell division and elongation resulting in increased leaf expansion, more number of leaves due to beneficial influence of biofertilizers which release growth promoting substances and enhances the availability of nitrogen. From the data it appeared that flowering of CHRYSANTHEMUM were positively influenced by sources of nutrients applied. The maximum number of flowers (37.25/plant) per plant was produced in T5 treatment and the maximum number of flower bud (18.33/plant).Similar results were also reported by Naidu et al., (1999) revealed that the morphological parameters were affected significantly due to the application of different combination of organics, chemicals and biofertilizers.Nitrogen fertilizer use has played a significant role in increase of crop yield (Modhej et al., 2008). Significant increase in plant height, number of leaves, number of branches and number of flower bud due to influenced by environmental conditions and management practices. Prabhu et al., (2003) their studies indicated that plant height is increased by the application of organics and biofertilizers, attributed to the increased uptake of nutrients in the plants leading to enhanced chlorophyll content and carbohydrate synthesis and increased activity of hormones produced by Azospirillum and phosphate solubilizing bacteria.The Phosphobacteria increased phosphate availability in soils which in turn helped better proliferation of root growth and uptake of other nutrients to the greater extent. So that the enlargement in cell size and cell division, which might have helped in plant height, number of leaves, branches number of flower per plant. These results are in agreement with those reports of Nanthakumar and Veeraraghavathatham(2000), Anburani and Manivannan (2002),and Wange and Kale (2004) in brinjal.Fundamentally, K+ is very water soluble and highly mobile and transported in the plants xylem (Lack and Evans, 2005). Membrane transport of potassium can be mediates either by potassium channels, utilizing the membrane potential to facilitate transport of potassium down its electrochemical gradient,or by secondary transporters . In plants,potassium act as regulator since it is constituent of 60 different enzyme systems of drought tolerance and water-use efficiency. In addition, current study has showed that to optimum growth, crops need more potassium than needed (Simonsson et al., 2007)Aminifard et al., (2010) with study responses of eggplant to different rates of nitrogen under field conditions were reported that fertilization with 100 Kg/ha nitrogen resulted in the highest average fruit weight and fruit yield. Pal et al., (2002) were reported that eggplant fruit yield increased with increase in nitrogen up to187.5 kg/ha.Only microbial treated plants could not increase the vegetative growth of plants and the reason may be that they released nutrients at a slower rate. On the other hand,the only application of inorganic fertilizer was also less effective than the combined application. These results were inconformity with the findings of Rahman etal. (1998) found that the vegetative growth and yield of berry was the highest with the combined application of manures andfertilizers. For eggplant, the integrated use of urea and poultry manure also resulted in a higher nutrient uptake Jose et al., (1988).The use of synthetic fertilizers causes a great impact on the environment and the cost of these fertilizers is increasing over the years.The farmers need to raise the crops by organic farming that will reduce the costs and will

decrease the impact on the environment.

In addition, organic farming will reduce the additional burden of environmental pollution that is caused while manufacturing these synthetic fertilizers at the source (Rathier and Frink, 1989). Now it is a well established fact that organic fertilizers provide enough requirements for proper growth of the crop plant and may enhance the uptake of nutrients, increase the assimilation capacity and will stimulate the hormonal activity as well (Tomati et al., 1990). The use of biofertilizers useful as it increases soil porosity, aeration and water holding capacity, therefore a practically paying proposal. Azospirillum, a nitrogen fixing organism has been reported to be beneficial and economical on several crops.They improve the growth and yield as well as productivity of the crop. Vanangamudi et al., (1989) also reported similar increase in per cent germination and shoot length of chilli with increase in nitrogen application (0 150 kg/ha). Prabhu et al. (2003) reported that increased N and P rates increased the plant height, branch number per plant in brinjal phosphate solubilizing Bacteria (PSB) are a group of beneficial bacteria capable of hydrolysing organic and inorganic phosphorus from insoluble compounds. Chen et al., (2006) P-solubilization ability of the microorganisms is considered to be one of the most important traits associated with plant phosphate nutrition P-solubilizers are biofertilizers which solubilizes the fixed phosphorus in soil and makes it available for plants. The microbes, Fraturia aurantia belonging to the family Pseudomonaceae, is a beneficial bacteria capable of mobilizing potash to plants in all types of soil especially, low K Content soil. Such bacterial population in the soil form can increase the availability of potash to the plants. Wange and Kale (2004) reported that, the results revealed significant improvement in vegetative characters such as plant height and number of leaves per plant in brinjal over the recommended biofertilizer with combine

Table-1. The effect of organic and inorganic fertilizer on vegetative characteristics of CHRYSANTHEMUM plant

Treatments	Plant height(cm)	Shoot length (cm)	Shoot /plant(no)	Leaves/plant (cm)	Leaf area/plant (cm2)	Root/plant (no)	Root length (cm)
T_1	50.11	20.01	12.21	120.12	1110.21	11.20	30.25
T_2	52.33	22.41	14.24	142.01	1320.25	13.22	32.22
T_3	51.12	21.01	13.21	130.11	1201.22	12.02	31.02
T_4	62.21	32.01	23.10	162.21	1500.20	22.23	52.36
T_5	65.23	36.25	26.25	185.33	1720.23	25.14	55.65
T_6	61.51	33.41	24.00	154.00	1445.01	23.02	51.25
T_7	45.44	30.00	9.25	95.33	950.23	8.35	35.36
T_8	48.25	31.02	10.23	100.23	1000.25	9.36	38.44
T_9	46.21	29.22	9.89	96.65	960.56	8.55	36.25
T_{10}	36.23	15.64	5.54	55.65	565.85	4.56	25.68
MSE+_	8.25	4.22	2.14	12.02	45.36	1.20	3.36

Table-2. The effect of organic and inorganic fertilizer on reproductive characteristics of CHRYSANTHEMUM plant

Treatments	Anthesis time (DAP)	Flower bud /plant (no)	Flower bud opening/plant (no)	Single Flower weight (g)	Flower yield/plant (kg)	Flower yield (Q/ha)
T_1	70.11	21.01	13.21	30.21	1.100	130.25
T_2	72.33	23.41	15.24	42.25	1.320	132.22
T_3	71.12	22.01	14.21	33.22	1.200	131.02
T_4	66.21	33.01	24.10	60.20	2.230	252.36
T_5	65.23	37.25	27.25	72.23	2.540	255.65
T_6	66.51	34.41	25.00	70.01	2.320	251.25
T_7	75.44	31.00	10.25	45.23	0.830	135.36
T_8	78.25	32.02	11.23	60.25	0.930	138.44
T_9	76.21	30.22	10.89	26.56	0.850	136.25
T_{10}	96.23	16.64	6.54	16.85	0.456	100.68
MSE+_	9.25	5.22	3.14	4.36	0.120	33.36

chemical fertilizer. The information on the role of organics on morphophysiological traits in brinjal is meager. Hence, there is a need to study the influence of organic and inorganic on quality and yield components in brinjal to boost the productivity potential.

The cost of inorganic fertilizers has been enormously increasing to an extent that they are out of reach of the poor, small and marginal farmers. It has become impractical to apply such costly inputs for a crop of marginal returns. The use of biofertilizers in such situation is therefore a practically paying proposal. Based on the above results, it was concluded that, the application of microbial and chemical fertilizers was found more beneficial and significantly improved morpho-physiological traits, growth parameters, and yield components in tomato. The benefit cost ratio was found lesser in using both biofertilizer and chemical fertilizer compared to using chemical fertilizer alone in tomato crop cultivation.

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SYNTHESIS CHARACTERIZATION AND EVALUATION OF (1H-BENZOIMIDAZOL-2-YL)- (1H-PYRROL-3-YL)-DIAZENE FOR ITS BINDING AGAINST Cd^{2+} , Hg^{2+} , Pb^{2+}

Santosh Kumar Srivastava
C.M.P. College, Prayagraj. (U.P.), India

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ABSTRACT

The complex were isolated by interacting corresponding chloride salts with the ligands separately. The metal complexes were isolated and processed properly and characterized finally. IR and NMR were the main tools for characterization.

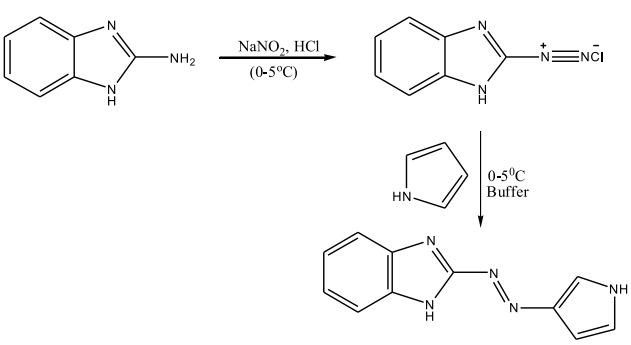
Keywords : *NMR, IR, binder, complex, ligand.*

INTRODUCTION

Since the chosen metal ions were of soft nature i.e. small charge and large size hence a ligand having hard donors was designed for the same purpose. As we have described earlier that in the transport phenomenon i.e. removal of a particular cationic analyte from a solution depends upon its decomplexation phenomenon. Hence a ligand with mismatch of its donors with the cationic analyte was designed. In the light of this particular concept another ligand L3 was constructed upon the skeleton of 2-aminobenzimidazole through a very simple reaction protocol of diazo coupling at low temperature (0-5^{0}C) under buffered condition.

3.1. SYNTHESIS OF (1H-BENZOIMIDAZOL-2-YL)-(1H-PYRROL-3-YL)-DIAZENE:

The present ligand L3 was synthesized through diazo coupling reaction 2-aminobenzimidazole over pyrrole. A low temperature of 0-5^{0}C was maintained throughout diazotization of 2-aminobenzimidazole and coupling reactions. The entire procedure can be understood through following reaction scheme; Scheme



Scheme 3.1: Synthetic scheme for ligand L3