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Longitudinal Distribution of Benthic Macroinvertebrate Fauna in a Lesser Himalayan Stream, Uttarakhand

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Abstract: The present study was focused on distributional patterns of benthic macroinvertebrate community at spatial scale in the west Himalayan streams, the Hiyunl. Five stations were selected on the Hiyunl streams from head water to mouth (S1 to S5). The samples were collected bi-monthly during January 2009 to December 2009. The total density of benthic macroinvertebrate community was increased longitudinally from S1 to S5 but differed significantly among the stations. Dipterans (81%) were dominant at S1 while, Trichoptera was dominant at S2 (75%), S3 (80.7%) and S4 (54.5%). However, Ephemeroptera was dominant at S5 (69.29%). At family level, Simulidae was most abundant taxon at S1, while Limnephilidae and Hydropsychidae were at S2 and S3, respectively. Heptageniidae and Chironomidae were dominant at S4 and S5, respectively. Principal Component Analysis (PCA) indicated that the characteristic taxa varied at S1 and S2, but common taxa were observed at S3, S4 and S5. The variation in the taxonomic composition and characteristic taxa at stations were attributed to variation in landuse type and physico-chemical variables.

Key words: Ganga, Himalaya, Spatial variation, Trichoptera, Zoobenthos

Introduction

Longitudinal changes in the faunal composition are more likely to be found where strong environmental gradients occur (Hawkins and Sedell 1981). The type and nature of gradients in the mountain river are especially altitude, slope and current velocity (Suren 1994) substrate size, water conductivity, current velocity and aquatic vegetation (Miserendino 2001). The benthic macroinvertebrates fauna are an important component of aquatic communities; they have large distribution, being found in the sediment, in accumulated leaves, associates with macrophytes between the

rocks and therefore they interact with the environmental conditions (Moretti and Callisto 2005; Würdig *et al.* 2007). In such a way, the benthic organisms are sensible to the habitat characteristics and substratum (Buss *et al.* 2004; Nautiyal et al 2004; Mishra and Nautiyal 2016), water temperature (Camargo and Voelz 1998; Mishra and Nautiyal 2011), pH (Sandin and Johnson 2004), electric conductivity (Buss *et al.* 2002), sedimentation (Smith and Lamp 2008) and riparian vegetation (Silveira *et al.* 2006).

In the India, especially in Himalayan region, the spatial and temporal study is available on the glacier fed river (Singh *et al.* 1994; Ormerod *et al.* 1994; Nautiyal 1997; Julka *et al.* 1999; Semwal and Nautiyal 2009; Nautiyal *et al.* 2013), but not available in the spring fed stream. Therefore the present study was conducted to gain information on distributional patterns of the benthic macro invertebrate fauna at spatial scale in a short spring fed stream; Hiyunl stream. This stream was most ideal for the present study, as it is small in size, as far as snow line and exhibits a rapid transition from alpine to sub-tropical conditions within a very short distance.

Materials and methods

Study Area

The Hiyunl is a small tributary of the glacier-fed river Ganga in the lesser Himalaya. The river flows from an elevation of 2400 m North-West direction and meet the Ganga River at Shivpuri (375 masl). The Hiyunl basin lies between latitude 30^0 15' 30" N to $30^0 26^0$ 25" to and longitude 78^0 42' 30^0 to 75^0 5' 4" E., covering an area of 167.50 sq km (Table 1).

Sampling

Five stations were selected in the Hiyunl stream on the basis of variation in landuse type (forest type and agriculture). Sampling was performed bi-monthly during January 2010 to December 2010 (Table 1). Samples were taken from area of $0.09m^2$ with respect to habitat type (20 samples per station).The standard methods for sampling (Singh and Nautiyal 1990; Nautiyal and Mishra 2013a) and identification (Burks 1953; Pennak 1953; Edmunds *et al.* 1976) were adopted. Counts were performed to obtain abundance (as %).

Significant difference in the density was observed among and between the stations (the Mann–Whitney (U) and Kruskal–Wallis (H) test; PAST software http://nhm2.uio.no/norlex/past). Principal Component

Analysis (PCA) was used to determine the characteristic taxa at each station (CCA; ter Braak & Smilauer 2002.

Results

The physico-chemical characteristics varied among the stations from S1 to S5 in the Hiyunl stream. The air temperature (4-42^{o}C) and water temperature (3-25^{o}C) ranged from S1 to S5. Similarly, dissolved oxygen (7.4-12.5 mgl^{-1}), pH (6.8-7.3), conductivity (80-350 μS^{-1}) and current velocity (0.1-4.8 $msec^{-1}$) also varied from S1 to S5. The total mean density increased from S1 to S5 (except S4). The density differed significantly between the two stations and among the stations. However, the density difference between the stations was observed to significant (Table 1). The total mean density increased from S1 to S5 (except S4). The density differed significantly between the two stations and among the stations. However, the density difference between the stations was observed to significant (Table 1).

Taxonomic composition

Diptera (81%) was dominant stations at S1 while, Trichoptera at S2 (75%), S3 (80.7%) and S4 (54.5%). At station S5 Ephemeroptera (69.3%) was dominant taxa (Figure 2). The composition of other taxa varied with according to their dominant taxa at each station. Longitudinally, Diptera, Trichoptera and Ephemeroptera dominated the assemblages in the Hiyunl stream. Odonates and Annelids exhibited a similar profile though their share was low in the community. Diptera declined abruptly from S1 to S2, while increased from S3 to S5. The communities differed structurally primarily on account of proximity to snow line and high gradients in the Himalayan Rivers Hiyunl. At family level, Simulidae was most abundant taxa at S1 followed by Limnephilidae, while Limnephilidae and Hydropsychidae were dominant at S2 and S3. At S4 and S5 Heptageniidae and Chironomidae was dominant, respectively (Table 2). The taxonomic composition of Simulidae and Chironomidae decreased and increased from S1 to S5, respectively.

Characteristic taxa: Principal Component Analysis

The eigen values for PCA axis 1 (λ=0.501) and 2 (λ=0.293) explained cumulative variance in taxonomic composition and taxon-nvironmental relationships in the Hiyunl stream and caused 5.01 and 29.3% variation in the taxon-environmental relationship, respectively. The characteristic benthic macroinvertebrate taxa varied at station. Simulidae was characteristic taxa at S1while Siphlonuridae, Chironomidae and

Agrionidae were characteristics to the S2. The taxa Hydroosychiidae, Glossosomatidae, Leptoceridae, Rhyacophilidae, Tendipedini, Tipulidae,

Table 1 Geographical co-ordinates of the sampling station in different forest types in Hiyunl Basin. Total density (mean, SE) at different stations in Hiyunl River. Density is calculated from 15 quadrants data at each stations. Kruskal – Wallis test (H-test) and Mann–Whitney tests (U-test) determines significant difference in mean densities (indiv. m^{-2}) among and between the stations in the Hiyunl River. Abbreviations - C-Cobble, P-Pebble, PMB-Prismatic Maturing Boulder, LMB-Large Maturing Boulder, Gravel and St-Silt

Hiyunl Station	**Khuret (S1)**	**Kurialgaon (S2)**	**Nagani (S3)**	**Jajal (S4)**	**Shivpuri (S5)**
Forest	Oak Forest	Pine Oak Forest	Agriculture	Agriculture	Mixed Forest
Stream Order	I	II	III	III	III
Distance from Source (Km)	6	11	21	29	43
Latitude (^{O}N)	30°23' 25"	30° 21'25"	30° 19' 15"	30°18' 15"	30°8'15"
Longitude (^{O}E)	78°19' 30"	78°20' 10"	78°21' 10"	78° 20' 40"	78° 23' 30"
Altitude (masl)	2200	1571	1400	1200	375
Substrate type	C,P,P,MB, St	LMB	C,PMB,St	LMB,C,P, G,St	C, P,G,St
Total Mean Density ±SE (Indiv.m^{-2})	542.36 ± 15.18	617.49 ± 15.31	649.62 ± 16.80	588.07 ±19.66	754.54 ± 39.88
Final p value (U test)	S1-S2 0.003653	S2-S3 0.06448	S3-S4 0.02122	S4-S5 =0.0004915	S1-S5= 2.3E-05
Final p value (H test)	S1-S5=2.312E-06				

Perlodidae, Dryopidae, Dytiscidae and Notonectidae were characteristic at S3, S4 and S5 (Figure 3).

Discussion

In the study, the total mean density increased from S1 to S5 (except S4). The density differed significantly between the two stations and among the stations. However, the density difference between the stations was observed to significant (Table 1). Singh and Nautiyal (1990) suggested that density increased in the mouth zone of the Himalayan river the Bhagirathi. Mishra and Nautiyal (2011) also observed increase in density at mouth zone in the Paisuni river. However at S4, the sudden decline of density was attributed to dumping of the waste materials of road construction in the river which caused habitat loss and fragmented habitat

resulting decline the colonisation of the benthic macroinvertebrate community. The density decline is also attributed to anthropogenic activity like abstraction of water, agriculture (Nautiyal and Mishra 2013a; Mishra and Nautiyal 2013).

Table 2 Percentage composition of benthic macroinvertebrate community in Hiyunl stream.

Taxa	**S1**	**S2**	**S3**	**S4**	**S5**
Heptageniidae	2.27	2.07	3.57	9.62	9.29
Baetidae	2.47	3.66	6.20	2.51	5.57
Ephemerellidae	1.87	2.24	2.96	3.43	2.23
Leptophlebidae	2.20	2.01	4.01	2.70	5.29
Caenidae	2.27	2.13	4.28	3.00	2.88
Siphlonuridae	2.73	2.60	2.25	2.27	4.64
Ecdyonuridae	1.33	3.01	2.47	2.08	2.04
Hydroosychidae	2.66	6.91	9.88	7.84	3.07
Limnephilidae	15.79	16.30	4.61	4.60	2.14
Glossosomatidae	2.07	3.37	2.69	5.39	0.93
Leptoceridae	0.87	3.84	2.47	0.67	0.65
Philopotamidae	5.06	4.25	3.84	5.27	2.69
Brachycentridae	1.40	2.72	2.36	1.65	0.05
Psychomyiidae	1.07	2.30	4.83	4.11	3.11
Rhyacophilidae	0.93	2.95	2.58	2.82	1.25
Simulidae	26.98	2.36	2.96	2.45	1.02
Blepharoceridae	1.20	1.12	0.88	1.10	0.60
Tendipedini	1.87	2.01	2.09	2.21	1.02
Chironomidae	4.40	5.26	4.77	3.68	23.97

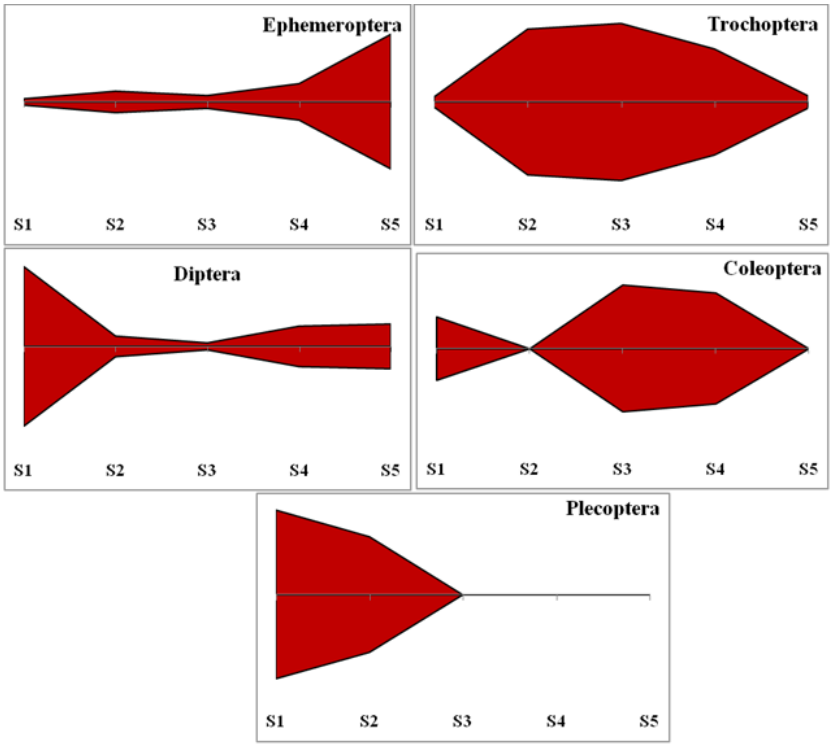

Figure 2 Longitudinal distribution of benthic macroinvertebrate fauna (order) at various stations in the Hiyunl stream.

Longitudinally, Diptera, Trichoptera and Ephemeroptera dominated the assemblages in the Hiyunl stream. Diptera declined abruptly from S1 to S2, while increased from S3 to S5. The communities differed structurally primarily on account of proximity to snow line and high gradients in the Himalayan Rivers Hiyunl. At family level, Simulidae was most abundant taxa at S1 followed by Limnephilidae, while Limnephilidae and Hydropsychidae were dominant at S2 and S3. At S4 and S5 Heptageniidae and Chironomidae was dominant, respectively. The taxonomic composition of Simulidae and Chironomidae decreased and increased from S1 to S5, respectively.

Nautiyal *et al.* (2015) indicated that Trichopterans were dominant in the headwater section of the Himalayan spring-fed streams. The spring-fed Himalayan streams are also dominated by Ephemeroptera in the Khanda Gad (Kumar 1991) and the Gaula (Sunder 1997), while

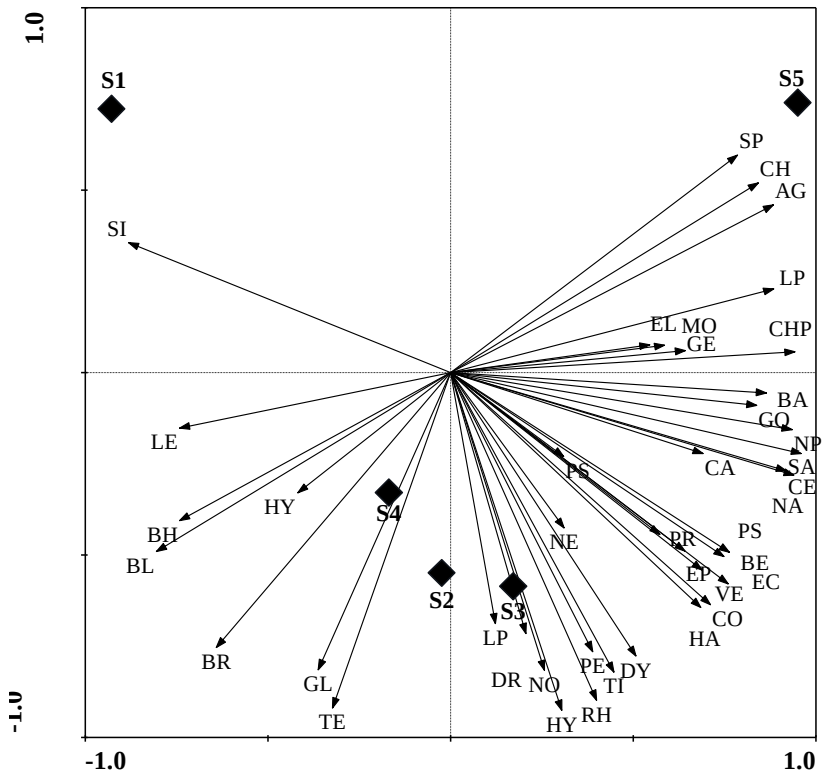

Figure 3 Principal Component Analysis (PCA): The ordination indicates the characteristic taxa through graphical presentation between the taxon (arrows) and station (filled diamond) in the Hiyunl stream. The taxa close to the station are characteristic of that station and encircled. Acronyms: HE-Heptageniidae, BA-Baetidae, EP-Ephemerellidae, LE- Leptophlebidae CA-Caenidae, SP-Siphlonuridae, EC-Ecdyonuridae, HY-Hydroosychidae, LI-Limnephilidae, GL-Glossosomatidae, LP-Leptoceridae, PH-Philopotamidae, BR-Brachycentridae, PSY-Psychomyiidae, RH-Rhyacophilidae, SI-Simulidae, BL- Blepharoceridae, TE-Tendipedini, CH-Chironomidae, PY-Psychodidae, LT-Leptidae, TI-Tipulidae, PE-Perlodidae, PR-Perlidae, CHL-Chloroperlidae, NE-Nemouridae, DR-Dryopidae, HD-Hydrophilidae, EL-Elmidae, HA- Haliplidae, PS-Psephenidae, DY-Dytiscidae, SA-Sialidae, CO-Corixidae, NA-Naucoridae, GE-Gerridae, VE-Vellidae, NP-Nepidae, NO-Notonectidae, BE-Belostomatidae, AGN-Agrionidae, GO-Gomphdae, CE-Coenagridae, CHP-Chlorocyphidae, AG-Agridae, LD- Lipidoptera, MO-Mollusca

Trichoptera was the abundant taxon in the headwater zone of Vindhyan (Central Highlands) river Paisuni (Mishra and Nautiyal 2011). Contrarily, Ward (1944) stated that Ephemeroptera proceed Trichoptera in

alpine glacier fed stream (E, P, T) dominated drifts in early spring and autumn, while Diptera in summer. This is in striking contrast to the present situation where stream of high altitude in the Hiyunl stream are dominated by Trichoptera. The continuum concept models (Vannote *et al.* 1980) may be used to predict the spatial distribution patterns of benthic macroinvertebrate. The characteristic benthic macroinvertebrate taxa varied at station. Simulidae was characteristic taxa at S1while Siphlonuridae, Chironomidae and Agrionidae were characteristics to the S2. The taxa Hydroosychiidae, Glossosomatidae, Leptoceridae, Rhyacophilidae, Tendipedini, Tipulidae, Perlodidae, Dryopidae, Dytiscidae and Notonectidae were characteristic at S3, S4 and S5.

The variation in the characteristic taxa at S1 and S2 was attributed to differences in landuse type at S1 (Oak forest) and S2 (Oak-Pine forest). However, PCA indicated similar characteristic taxa at S3, S4 and S5 because of similar landuse type (Agriculture –Human Activities) at S3 and S4, while at S5 mixed forest landuse is found. Agriculture is both extensive and intensive in this lower stretch of the stream and anthropogenic influences hence become prominent factor because of fertilizer and other inputs. Functionally, the gathering and filtering collectors prevailed in the Hiyunl stream attributed to presence of fine particulate organic natter (FPOM) from agricultural land and habitation as also witnessed in case of other Indian Himalayans rivers (Nautiyal et. al. 2015) and central Indian river (Nautiyal and Mishra 2012; Mishra and Nautiyal 2013b). Vannote *et al.* (1980) suggested that the longitudinal or continuum models predict that invertebrate assemblages will change along the length of rivers as evident in the present study.

Conclusion

The present study indicated that the mean density of benthic macroinvertebrate increased along the river (except S4). The taxonomic composition and function of invertebrate fauna varied along the river length indicated the impact of landuse and physico-chemical variables of the Hiyunl stream. However, at some stations taxonomic composition were observed to be similar with other station. Thus, the present study indicated the variations in the taxa spatially along the river.

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Population Structure, Age Pyramid and Growth Rate of Commercially Important Fish Species, *Labeo calbasu* (Hamilton, 1822) from the Yamuna River, India

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Abstract

The fish samples were collected at random during the months of July 2013 to June 2014 from the Yamuna river at Prayagraj, India. Fishes measured from 12.5 to 65.5 cm (total length) were grouped into 0+ to 10+ age groups. The maximum growth rate was recorded in 1+ age group (18.96 cm) and minimum in 8+age group (2.72 cm).The age groups 2+ to10+ showed that the growth rate as 7.16 cm, 4.71 cm, 6.47 cm, 4.11cm, 4.4 cm, 5.24 cm, 6.33cm and 5.4 cm, respectively. The male was dominant in 0+, 1+, 2+ and 4+ age groups while female was dominant in 3+, 5+, 6+ 7+and 8+ age groups. The bell shaped age pyramid was recorded that revealed the abundance of 3+ age group of *L. calbasu* in the river Yamuna. The collected data indicate that the stock of *Labeo calbasu* may decline in the river Yamuna in coming future.

Keywords: *Labeo calbasu*, Yamuna river, population structure, age pyramid, growth rate.

Introduction

Understanding the population structure of *Labeo calbasu* can provide important information for fish stock and essential aspect to manage their fishery. *L. calbasu* is an economically important fish species in the Yamuna river, India (Singh et al. 1998; Imran et al. 2014; Mayank and Dwivedi 2015). It is very common in the commercial catch of the rivers Narmada, Godavari, Ganga, Yamuna (Chondar 1999; Tripathi et al. 2017), Ghaghara river (Rizvi et al. 2010) and rivers of Vindhyan region (Dwivedi and Nautiyal 2010). It is a large size species with higher consumer preference in Indian-subcontinent (Imran et al. 2015). It is a predominantly herbivorous, illiophage fish that feeds on dead and decaying matter at the bottom so it acts as scavenger and improves the sanitation of rivers, reservoirs, lakes and ponds. It is suitable for composite

fish culture with other carp species such as *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala* and *Cyprinus carpio* (Mohanta et al. 2008; Dwivedi et al. 2018a, b). Its fecundity ranged between 193,000 and 238,000 (Talwar and Jhingran1991; Alam et al. 2000).

Investigation on age and growth of fish is of prime importance in management and forecast of their fisheries (Khan and Khan 2009, Mayank et al. 2018). Age and growth of *L. calbasu* studied by Rao and Rao (1972) Narejo et al. (2009), Dwivedi and Nautiyal (2010). Population structure, age pyramid and growth rate studies are therefore essential in assessing population characteristics that can impact the productivity of fish population or fishery, including life history traits such as age and size of sexual maturity. But nothing is known about *L. calbasu* of the Yamuna river at Allahabad, India. This study will help in formulation of the fishery management policies of *L. calbasu* from the Yamuna river, India.

Methods and materials

Total 288 specimens of *L. calbasu* were sampled monthly from the Sadiapur fish market during July 2013 to June 2014 in the Yamuna river at Prayagraj. Total length (in mm) of fish was measured from tip of the snout to the largest rays of caudal fin. The key scales were removed from the row above (fourth and fifth) lateral line below dorsal fin region. After proper cleaning of the scales (in 5% KOH solution to remove adhering-tissues), the counting of growth rings was performed according to Bagenal and Tesch (1978) and Dwivedi and Mayank (2013). The number of fish of each age group were recorded and converted into percentage to obtain population structure. The age pyramid was prepared by Odum (1971).

Results

The largest size of fish was recorded as 65.5 cm (total length) which showed the healthy stock of *Labeo calbasu* in the Yamuna river, India. In present research, 147 male samples were collected out of 288 samples. Its constituted 51.04% of male and remaining was female. The 0+ to 10+age groups were found in case of female stock while 0+ to 8+ age groups were recorded in male case. The male and female was dominant with 32.65 % and 35.46 %, respectively in 3+age group. The male was dominant over female in 0+, 1+, 2+ and 4+ age groups with 4.76 %, 14.96 %, 20.41 % and 14.28 % of total samples. While female was dominant in 3+, 5+, 6+ 7+and 8+ age groups with contribution of 35.46 %, 7.09 %, 4.96%, 3.54 % and 1.42 %, respectively. 9+ and 10+

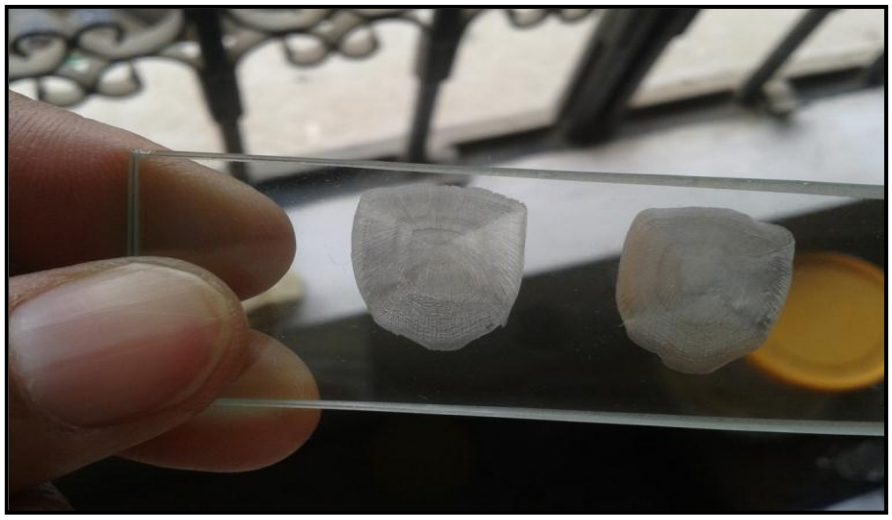

Figure 1 Scales between two slides to avoid curling age group was contributed 0.71% (each age group) of the female stock. According to data females survive more compare to male.

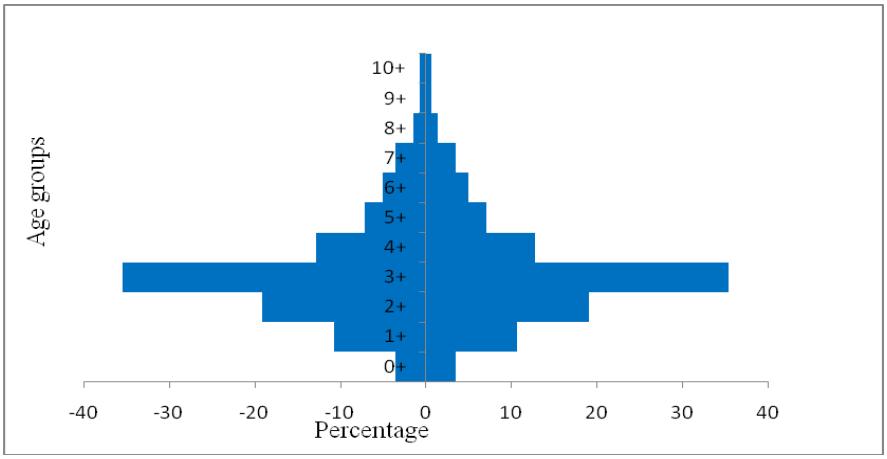

Figure 2 Age pyramid of *L. calbasu* from Yamuna at Allahabad recorded as 20.49%. The 0+, 5+, 6+, 7+ and 8+ age groups were constituted 4.17

A bell-shaped age pyramid was observed which represents the nearly equal population of pre-reproductive (small sized fish) and reproductive age group of *L. calbasu* in river Yamuna. This type of pyramid is the characteristic of stable populations.3+ age group shared maximum 34.03% of total samples. The age groups 1+, 2+, and 4+were constituted 12.85%, 19.79% and 13.54%, respectively. The share abruptly increased between 2+ to 3+ with 14.24%. The percentage abruptly declined between 3+ to 4+ age groups as difference was %, 6.25 %, 4.51 %, 3.12 % and 1.04%,

respectively. The minimum percentage 0.35% (each) was contributed by 9+ and 10+ age groups. Age pyramid revealed the abundance of 3+ age group of *L. calbasu* in the river Yamuna. This fish was over exploited in the past which resulted in less recruitment. This may be the reason behind the minimum contribution of small sized fish.

The cycloid scales of *L. calbasu* are roughly oval in shape with a distinct focus/nucleus. The mean length of fishes were recorded as 18.96 cm in 1+ age group, 26.12cm in 2+ age groups, 30.83cm in 3+ age groups, 37.3cmin 4+ age groups, 41.41cmin 5+ age groups, 45.81 cm in 6+ age groups, 51.05 cm in 7+ age groups, 53.77cmin 8+ age groups, 60.1 cm in 9+ age groups and 65.5cmin 10+ age groups, respectively. The maximum growth rate was recorded in 1+ age group (18.96 cm) and minimum in 8+age group (2.72 cm). The growth rate/increment of 2+, 3+, 4+, 5+, 6+, 7+, 9+ and 10+ age groups was recorded as7.16 cm, 4.71 cm, 6.47 cm, 4.11cm, 4.4 cm, 5.24 cm, 6.33cm and 5.4 cm, respectively. The growth of this fish was greatly affected by some other exotic fishes such as common carp (*Cyprinus carpio*) and Nile tilapia (*Oreochromis niloticus*) in the Yamuna river at Prayagraj. The breeding season of Common carp and Nile tilapia recorded twice or sometime thrice in a year so their population grows rapidly. These exotic fishes are bottom feeder in feeding habit so the competition among them for food and breeding ground increases which may affects the growth rate of this species.

Discussion

In the present study, 0+ to 10+ age groups were recorded for *L. calbasu.* The 1+ to 7+ age group was recorded by Rao and Rao (1972), Dwivedi et al. (2007) and Natarajan (1971) from the Godavari river, Ghaghara river and from Bhabanisagar reservoir while Narejo et al (2009) reported only 0+ to 5+ years of *L. calbasu* from Keenjhar lake (District: Thatta), Sindh, Pakistan. Rizvi et al. (2012) reported the *L. calbasu* of 7.5+ years. In the present study appearance of 10+ age group indicate the survival of this species in Yamuna river is good.

The 3+ age group shared maximum 34.03% of total samples in present study. Similar finding was reported by Bhatia and Dua (2004) in case of *L. calbasu* of Harike wetland, Punjab, India while Rao and Rao (1972) and Dwivedi et al. (2009) reported that 2+ age group was dominated from the Godavari river and Ghaghara river respectively. In present study abundance of mature samples and lack of small sized fish indicate the decline of this species in coming days.

Large water bodies have more favorable environmental conditions for fish growth, such as abundance of energy-rich food and a more stable

environment (Ishikawa et al. 2013; Mayank et al. 2018). The present study showed bell shape age pyramid which indicated the population is in stable condition with slow growing phenomenon.

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Resource use Competence and Invader Potential of *Cyprinus carpio* from the Paisuni River at Bundelkhand Region, India

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Abstract:

Study was undertaken during the period of October 2015 to September 2016 from the Paisuni river, Bundelkhand region, India. Invasive potential of *Cyprinus carpio* (Common carp) was measured through the size structure, age composition and growth increments from the Paisuni river at Bundelkhand region. The total length of fishes varied from 108 to 749 mm in 0+ to 11+ age groups. The mean lengths according to scale reading at ages from 0+ to 11+ years were recorded to be 139, 207, 345, 437, 515, 583, 635, 679, 708, 731, 741 and 749 mm, respectively. The maximum growth increment was recorded in 1styearwith 207 mm and minimum in the 11th year with 08 mm of the life cycle. The maximum exploitation percentage was recorded in 301-400 mm with 26.75% and minimum was recorded in 701-800 mm with 2.88%. Their size structure, age composition and growth increments indicated that the *C. carpio* are powerfully invaded and very well stable from the Paisuni river. Their stock and density (example landing) from the Paisuni river are helping to fishermen community for their livelihood and malnutrition as well as poor men malnutrition.

Key words: *Cyprinus carpio*, invader potential, age and growth, Mahseer, food.

Introduction

Cyprinus carpio (Common carp) is reformed to their own set of local ecological and climatic conditions for the Paisuni river and the Ganga river basin, India (Tiwari et al. 2016; Dwivedi et al. 2016a; Tripathi

et al. 2017a). It is exotic fish species for the India. The quantity of the fish caught in many of the world's rivers is declining and species assemblages are being modified with the disappearance of some native species and the established of exotics (Welcomme 2006; Weber et al. 2010; Toussaint et al. 2016). Many freshwater ecosystems suffer from dense stock of Common carp (Arlinghaus and Mehner 2003). Consequently, ecological conditions and their connectivity to organisms may play a big role in generating growth outcome of non-native species in the natural environments (France and Duffy 2006; Gozlan et al. 2010; Vilizzi et al. 2015; Savini et al. 2010). Invasion of the organism is the indicator of ecological changes and alteration of habitats (Toussaint et al. 2016; Laverty et al. 2017; James et al. 2018).

Riverine fisheries play a significant role in the livelihoods of the fishermen communities (Almeida et al. 2003; Rizvi et al. 2010; Vass et al. 2010; Dwivedi et al. 2014; Imran et al. 2015) and other persons which are involved in fishery activities (Pathak et al. 2011; Dwivedi and Mayank 2017).The fishery resource operation is the chief and economic activities at regional level and globally (Laverty et al. 2017; Tripathi et al. 2017b; Dwivedi et al. 2018a, b; Mayank et al. 2018). Fishes are the top consumers in aquatic ecosystems and their size, age and growth can be used as an indicator of resource use efficiency and invasive potential of fishes within the ecosystems.

Material and Methods

Study was undertaken during the period of October 2015to September 2016 in the Paisuni river at Bundelkhand region, India. The Paisuni river is a perennial river. It arises at 275 m above sea level (m asl) in the Kaimur hills of Vindhyan range and flows ca. 100 km north across the Bundelkhand Plateau to meet the Yamuna river at 80 m asl. The stony substrate occurred from upper and middle stretch while silt clay-sand at lower stretch (Nautiyal et al. 2004). Water levels are found lowest during May-June and highest during July to September, when a 3-5 meter rise in water level forms a broad channel of the River. For the purpose of collection of data on fish size and scale (for age determination) from Karwi wholesale fish market was preferred. Karwi fish market is just by the right side of the Paisuni river and major part of fish catch from the lower stretch of the river is brought to this market for selling.

Fishing was conducted by local fishermen with the help of using drag net, gillnet, cast net, scoop net and hook and line. Total length (TL) of fishes was measured from tip of the snout to the largest fin rays of caudal fin. Collected data were classified at 100 mm intervals for estimation of size group and exploitation frequency of fishes. The number

of samples calculated according to size group and converted into percentage. Near about twenty samples were collected per month while 243 samples were collected for the present study. The scale method has been used in the present investigations, as scales reflect faithfully changes in rate of growth and other valuable life history information. The key scales were removed from the row above lateral line below dorsal fin region (Bagenal and Tesch 1978; Mayank et al. 2015). The scales were cleaned in5% KOH solution to remove adhering- tissues and finally washed in distilled water. The scales were then pressed while drying in order to avoid their curling. The growths of fishes were measured individually in mm. The all measured fishes were arranged according to age wise and calculated mean length for those age groups. The mean length of individual age groups represented that growth.

Results

The size composition (total length) and age composition of *C. carpio* varied from 108 to 749 mm and 0+ to 11+, respectively from the Paisuni river, India. The mean lengths according to scale reading at ages from 0+ to 11+ years were recorded to be 139, 207, 345, 437, 515, 583, 635, 679, 708, 731, 741 and 749 mm, respectively. The maximum growth increment was recorded in 1+ Year (207 mm) and minimum in the 11+ year (08 mm) of the life cycle (Table 1). The fish growth increment was observed to be 138 mm, 92 mm, 78 mm, 68 mm, 52 mm, 44 mm, 29 mm, 23 mm and 10 mm in age of 2+, 3+, 4+, 5+, 6+, 7+, 8+, 9+ and 10+, respectively.

The maximum exploitation of fishes was recorded in 301-400 mm with 26.75% and minimum was recorded in 701-800 mm with 2.88%. The 301 to 400 mm size of fishes most attracted to the fishers for harvesting. This size group of fishes was also easily harvested by middle class fishermen community with three or four persons and medium size of nets (example low cost). The size groups 101-200 mm, 201-300 mm, 401-500 mm, 501-600 mm and 601-700 mm were exploited with 10.70%, 19.34%, 21.81%, 11.93% and 6.58%, respectively (Figure 1). The exploitation of fishes was significantly differentiated by season to season. The largest size of fishes (e.g., individual species) is often considered as a key measure of resource use efficiency. The largest size of *C. carpio* is not distributed equally in the whole stretch of the Paisuni river. The large size of fishes was encountered only in the lower stretch of the Paisuni river.

Table 1 Age and growth of *Cyprinus carpio* from the Paisuni river, Bundelkhand

S. No.	Age groups	Size Classes (mm)	Mean length (mm)	Growth increments (mm)
1	0+	108-179	139	
2	1+	168-281	207	207
3	2+	262-384	345	138
4	3+	365-478	437	92
5	4+	462-559	515	78
6	5+	539-647	583	68
7	6+	635-687	635	52
8	7+	671-698	679	44
9	8+	686-719	708	29
10	9+	708-741	731	23
11	10+	738-747	741	10
12	11+	749	749	08

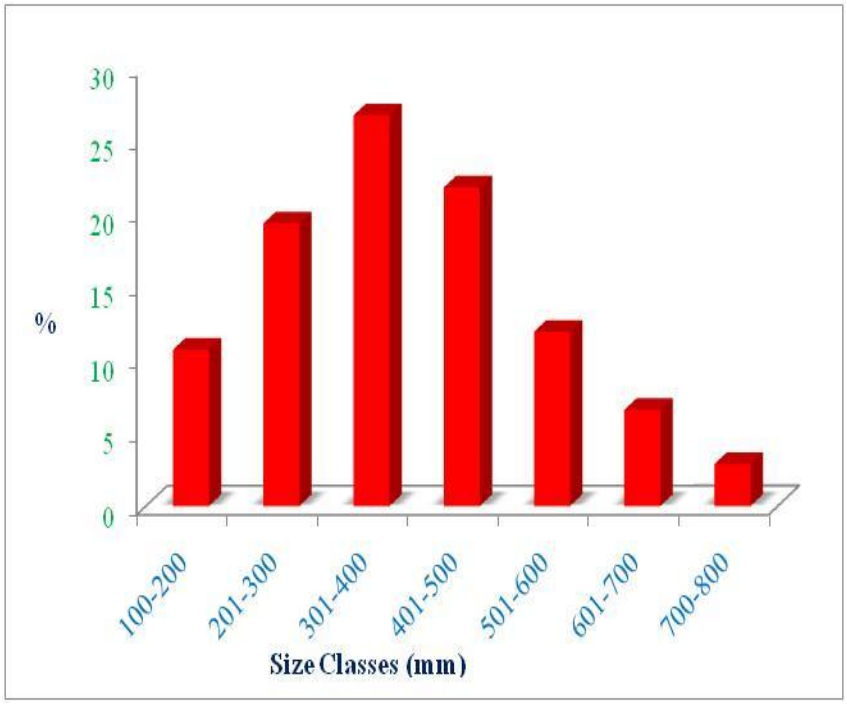

Figure 1 Size composition and exploitation of *Cyprinus carpio* from the Paisuni river, Bundelkhand

The size ranges of fishes indicated that those fishes which had been using resources efficiently are attaining more growth rate compared to other fishes in same age group. The size range data also indicated that the ecosystem functioning are also responsible to individual fish growth in same habitat.

Discussion

The courses of organic material in the food webs were estimated very high from the Paisuni river due to agricultural activities, forest behavior, anthropogenic pollution and pilgrim activities. Although food web is assumed to supply a quantitative structure to link invaded prospective and resource use efficiency of the ecosystem (Pathak et al. 2015, Mayank and Dwivedi 2017; Rooney and McCann 2012). If invaded fish species have a large body size, which is modifying the overall tropic structure of recipient communities (Thompson et al. 2012; Cucherousset et al. 2012; Dickey et al. 2018). Medium size fish species have more potential for resource use efficiency compared to the larger size fish species. Fish body size is given strong relationships between oxygen consumption and body size. Larger sized fishes consume more oxygen per unit time. *Cyprinus carpio* have very high potential for fish faunal homogenization of the Ganga river basin, India (Dwivedi et al. 2016b, 2017). *C. carpio* has food security and livelihood in the Indian sub-continents (Mayank and Dwivedi 2015). The size compositions of fishes in riverine ecosystem have been declined especially for commercially important fishes (Tripathi et al. 2017a). After invasion of *C. carpio* in the Paisuni river, Tor mahsees, *Tor tor* stock dramatically declined due to food and space crisis. These fishes are modifying the food web in the Paisuni river.

Karatas et al. (2007) length in different age groups of *C. carpio* was 18.1, 22.01, 28.7, 33.5, 35.2 and 36.67 cm in a life span of 1-7 years, respectively in the Almus Dam lake in Turkey. According to Vilizzi and Walker (1999) fish attained mean length 20.7, 29.2, 43.6, 44.8, 50.0,51.6, 56.6, 60.6, 62.8, 64.3, 64.4 and 68.6 cm at the end of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 15 years, respectively in the river Murray, Australia. The *C. carpio* attained an average length of 19.0, 26.7, 37.5, 41.1, 45.5, 49.6, 54.9, 59.5, 63.1, 66.2, 70.9 and 76.2 cm, respectively at the end of 1+ to 12+ years of the life. The maximum growth was observed in 1+ year (19.0 cm) and minimum in the 10+ year (3.1 cm) of the life span from the Ganga river at Allahabad, India (Dwivedi and Mayank 2013). The differences in mean length attained in the same period in different regions may be due to variations in the climatic and ecological conditions of the regions (Zambrano et al. 2006; Tempero et al. 2006). Fishing pressure and

fishing style (example degree) are mostly responsible for decreasing of age, size of fishes and recruitment (example damage breeding ground) in lotic ecosystems (Dwivedi et al. 2016b).

It may be concluded that the resource use efficiency and invasive potential of *C. carpio* is most strongly from the Paisuni river at Bundelkhand region, India. Data also indicated that the *C. carpio* stock in near future would be increased (e.g. by size and age) from the Paisuni river at Bundelkhand region. Mahseer (*Tor tor*) stock from the Paisuni river in near future would totally be distorted by non-native fishes. The food web of the Paisuni river supported to herbivorous fishes as like *Oreochromis niloticus* and *C. carpio*. These fishes dominated in the landing of the Paisuni river. Differences in growth rate may be observed when same species inhabit different rivers of same ecoregion (Tahseen et al. 2015; Vilizzi et al. 2015).

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Enriched Orgosa: Bio-organic Fertilizer

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Abstract: Enriched Orgosa is an Bioorganic fertilizer prepared with of Neem (Azadirachta indica) and Karanj (Pongamia pinnata), fortified with trichoderma & mycorrhizal spores along with biomimetic silver nanoparticles as bio stimulators. On application, Enriched Orgosa limits the leaching loss of chemical fertilizers, thus enhance their bioavailability coupled with higher Nitrogen content in the soil (NFE). Apart from this, it also shows pesticidal, anti-nematodal, pH mordant and soil binding activities in the agriculture fields. The surface functionalized Urea/DAP/CAN particles (with Enriched Orgosa) enhance flowability, minimize the moisture pickup, stabilize the surface, enhance appearance and modify nutrient release characteristics. The anti-oxidant property in bioorganic Enriched Orgosa helps to keep longer shelf life period of the products. Application of Bioorganic Enriched Orgosa ranges from agro covering use: diverse food crops, cash crops, vegetables, horticultural crops, plantation, lawns to forestry produce etc. Field trial on sugarcane, Arhar, Potato, Mustard evident from the results that application of 2% Enriched Orgosa with 50 kg bag of nitrogenous fertilizer led to increased yield in crops from 3.94%, 8.98%, 21.33%, and 18.78 %, respectively with reduced input of fertilizer. Bioorganic Enriched Orgosa promotes economic farming and supports farmers by various means like increasing in production, quality of product, increasing keeping quality.

Keywords: Enriched Enriched Orgosa, bioorganic fertilizers, NFE, *Pongamia pinnata*and *Azadirachta indica*

Introduction

Bio-Organic fertilizer is the fermented materials organic matter with addition of other functional beneficial microorganism of your choice.

Organic Matter which help in retaining nutrients ensures efficient uptake of nutrients by the plant. Extensive chemical fertilizers input in farming guarantees high yields (Sultan 2014,)but also causes various environmental problems (Gupta 2010)Being single chemical entity, chemical pesticides have resulted in increased resistance in pests (Kumawat 2014). Besides this, volatilization of chemical fertilizers like Urea can increases with increase in soil temperatures (above 65°F), humidity (above 60%) and pH (>7.0) (Lemus 2011). Thus environmental conditions have major impact on productivity of crops associated with application of chemical fertilizers. Bioorganic farming will overcome these problems upto a certain extent. Bioorganic farming includes creation of diversified, balanced farm ecosystem that will help to restore and harmonize the vital life forces of the farm and to enhance the nutrition, quality and flavor of the food being raised (TFYP 2001) and food quality (Diver 1999). Enriched Orgosa bio-organic Fertilizers contain various types of organic matter and functional microorganisms to help soil nutrient retention, restore soil biodiversity and reduce chemical fertilizer usage by unlocking soil minerals. Being organic in nature, they form the bulk base of the fertilizer to hold the nutrients together, preventing leaching, as they are released slowly into the soil. Application of green manures in the soil is not only beneficial to disease management but also improving plant growth and productivity (Pakeerathan 2009, Lemus 2011), Nitrogen loss could be reduced when coats are applied to fertilizers, (when optimum field conditions are not available, Lemus 2011).

Gnanavelrajah (2011) studied the effect of blending Urea with organic materials possessing antimicrobial property on nitrification and ammonia volatilization in a tropical soil (Gnanavelrajah). Keeping view of the above mentioned considerations, we device a biomimetic input called Enriched Orgosa to cater the some foremost obstructions faced by agriculture practitioners/farmers in today's scenario. *Azadirachtaindica* (Neem) and *Pongamiapinnata* (Karanj) are the major green inputs of Enriched Orgosa (Kumar 2015). The Neem tree is indigenous to India . Neem comprises of 40 different active compounds called Liminoids or Tetranortriperpernoids, known for preventing the insects from feeding, breeding or metamorphosing by hormonal disruptions as a result also prevents from development of resistance in future generations (Sanguanpong and Schmutterer, 1991).

Triterpenes present in Neem extracts has bacteriostatic properties that result in retardation of *Nitrosomonas* activity responsible for Nitrification thus ensuring slow & targeted supply of Nitrogen to the plants. The Karanj cake contains Nitrogen, Phosphorous (as P2O5), and Potassium (as K2O) in 5.1, 1.1 and 1.3 percent respectively and has been reported as useful Organic manure for crops like Sugarcane, Paddy,

Coffee and Oranges . However, Karanj oil is widely used as natural insecticide and is effective against a wide range of pests. In addition, added nano particles together with mycorrhizal and trichoderma spores aids further nutrient uptake efficiency (accelerates chelation process and active state mobilization frequency; increase the apparent solubility of poorly soluble active ingredients; and protects active ingredients against premature degradation etc.). Currently India ranks 33rd in terms of total land under organic cultivation and 88th in terms of the ratio of agricultural land under organic crops to total farming area. Organic farms although yield on an average 10-15% less than conventional farms, the lower yields are balanced by lower input costs and higher margins (Pandey 2011).

Materials & Methods

Quality control parameters were standardized in order to test the efficacy of Enriched Orgosa (Kumar 2015) Enriched Orgosa can be applied as basal application, top dressing, plough sole placement, localized placement, and pellet application etc. Application rates were standardized as per the outcomes of extensive field trials (Kumar 2015) on Sugar cane,potato, Arhar, Mustard. 50 kg/hectare minimum basal dose of Enriched Orgosa can be used for exclusive bioorganic farming.

Table 1: Major crops currently cultivated under BioOrganic farming methods in India

Cereals	Wheat,paddy,jowar, bajra, maize
Pulses	Pigeonpea, Chikpea, Green gram,Blackgram,Chana
Oil seeds	Groundnut, castor,mustard,sesame
Commodities	Cotton,Sugarcane,
Spices	Ginger, Turmeric, Chillies, Cumin plantation Crops, Tea, Cofee,Cardamom.
Fruits	Banana, Sapota,Custard apple and papaya.
Vegetables	Tomato,Brinjal,Cucurbits,ColeCrops,Leafy Vegetables.

Results

Performance of sugarcane, potato, mustard and arhar (*Cajanuscajan*) in the presence of Enriched Orgosa was tested. It was evident from the results that application of 2% Enriched Orgosa with 50 kg bag of nitrogenous fertilizer led to increased yield in crops from 3.94%, 8.98%, 21.33%, and 18.78 %, respectively with reduced input of fertilizer.

Enriched Orgosa also led to significant control over pests and insects and imparted economic benefit to farmers. Based on the results provided above table, bioorganic Enriched Orgosa can be recommended for large scale popularization among the farming community

Table 2: Effect of enriched Orgosa on crops

S. No.	Crop	Control with recommended fertilizer dose (Yield q/ha)	Yield (q/ha) with 50% urea+2% enriched Orgosa	Yield increase over control (q/ha)	% increase over control
1	Sugarcane	782	813	31	3.94
2	Potato	245	267	22	8.98
3	Arhar	22.5	27.3	4.8	21.33
4	Mustard	16.5	19.6	3.1	18.78

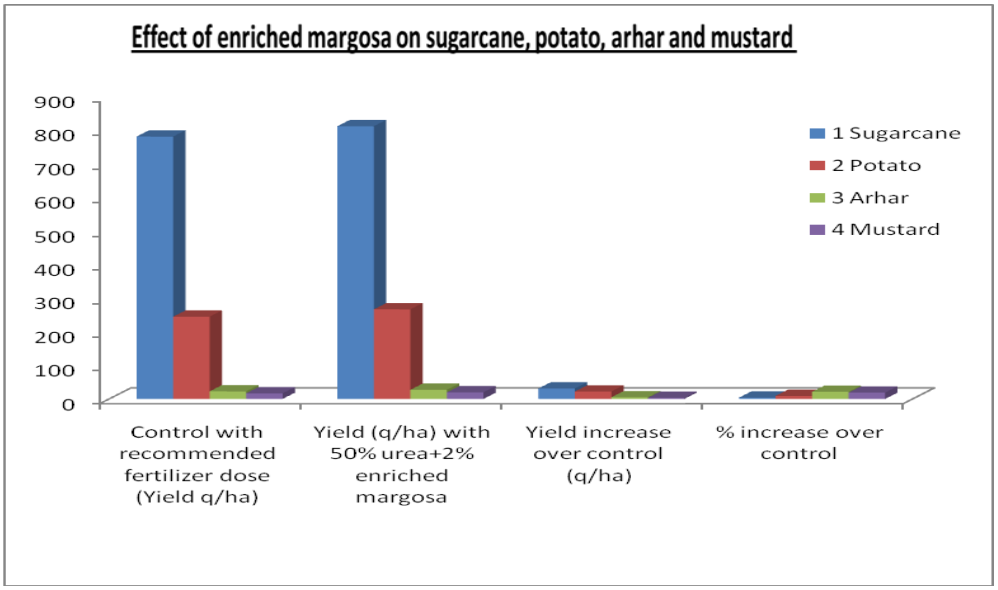

Fig 1: Combine effect of enriched Orgosa on crops.

Discussion

Dominance of Chemical fertilizers in Agriculture cannot be neglected. However, Chemical fertilizer can increase crop productivity, but consequential environmental hazards should also take into consideration with deep sense of seriousness. Along with this, requirement should b to understand the circumference of the Chemical fertilizers inputs, infield and outfield. Chemical fertilizer ensures higher

productivity, but their day-by-day overuse will be responsible for various kinds of environmental hazards. Therefore, there is a need to understand the threshold level and productivity saturation limit of these Chemical Fertilizers. Leaching loss coupled with less nutrient availability could be one of the most probable reasons behind overuse of Chemical Fertilizers. Enriched Orgosa is effective against such type of losses. Enriched Orgosa is an ideal candidate for alkaline, acidic soil and submerged conditions when applied with chemical fertilizers due to its natural pH mordant activities. Bioorganic Enriched Orgosa enhances the overall appearance, farming texture and quality of produce and gives higher 'Returns on Investment' when induced with Urea/NPK/DAP/CAN by enhancing flowability, minimizing moisturization and stabilizing the surface while improving compatibility in end uses. With multidimensional benefits it is a highly economical proposition for the farming community at large.

Conclusion

Bioorganic is a ‘process claim’ rather than a ‘product claim Processing in order to promote biological pesticides in readily usable form is one of the ways of popularizing it. Health conscious Indian citizens have created a demand of an Organic food. Bioorganic Enriched Orgosa is an effort in the same line to encourage Organic farming through sustainable routes. It is very much effective to prevent fertilizer losses (Nitrogen or others) due to leaching, volatilization and denitrification. Coupled with Organic agriculture based practices together with various bionic/ biological agents, there is a need to think sustainably. Organic agriculture era is presently in its beginning phase, therefore to potentially strengthen this, we need to think sustainably, till the time promotes techniques and methodologies that can limit the overuse of Chemical fertilizers

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Effects of EMS Mutant on Different Synthetic Consortia, and their Comparative Studies for Environment Sustainability

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Abstract

Aquatic cyanobacteria and green algae are known for their highly variable and extensive blooms that occur in freshwater and marine environment. The use of microalgae cells is considered as an effective approach for CO_2 fixation and consequently causing possible mitigation of global warming. The microalgae were treated with 4 different concentrations i.e. 0.42, 0.56, 0.72, 1.12 M of Ethyl Methane Sulphonate (EMS) to test that how the mutation affects the synthetic algal communities. All cultures were considered for studying their growth, dried biomass, carbohydrate and CO_2 sequestering efficiency. Indeed, in chemically mutated consortia, the maximum specific growth rate, dried biomass, carbohydrate production and carbonic anhydrase activity were found to be altered when compared with wild type species. This study showed that how the mutagen EMS can affect the algal community and its functioning.

Key words: Microalgae consortia, Chemical mutagenesis, EMS, Photosynthetic acclimation

Introduction

Cyanobacteria and green algae are mostly aquatic and photosynthetic organisms distributed in fresh as well as in saline water (Zimmerman and Cardinale 2014). Because cyanobacteria are Gram negative bacteria, they are quite small and usually unicellular, though; there are some strains that grow in colonies which are large enough to look like green algae (Bose *et al.* 2011). They have the distinction of being the oldest known fossils, more than 3.5 billion years old. In fact, they are one of the largest and most important groups of bacteria on Earth (Renuka

et al. 2013). They have no nucleus, DNA without histone protein and Chla encloses in the photosynthetic membranes.

In fact, blue-green algae are more similar to bacteria and their biochemical and structural characteristics. They are oxygen evolving prokaryotes, and play significant role in global carbon cycle for sequestration of CO_2 during photosynthesis (Power and Cardinale 2009; Gross *et al.* 2014). Thus, they enhanced the accumulation of primary products such as lipid rich biomass that are considered as biofuel agents. Microalgae being fast growing accumulate more lipid and carbohydrates in their biomass, and they reach high densities by absorbing solar energy (Patel *et al.* 2016). The production of large quantities of carbohydrates and lipid rich biomass is highly important for the microalgae biofuels. The ever increasing demand of fuels lead to increase in their prices, instability of fuels, ultimately increase the level of greenhouse gases in the environment (Godwin *et al.* 2017; Cardinale *et al.* 2007). All these factors are responsible for increasing our interest towards the sustainable approach of microalgae consortia primary production (Mahapatra *et al.* 2014; Hena *et al.* 2015; Londt and Zeelie 2013; Chinnasamy *et al.* 2010; Viswanathan *et al.* 2011; Lima *et al.* 2004).

The CO_2 conversion into biomass is high only under conditions where the CO_2 mass loading rate is low. At a high CO_2 mass loading rate, the formation of volatile organic compounds is the main CO_2 biotransformation route (Berg *et al.* 2009). So, there is need of rapid growth of microalgae and more production of biomass but conventional methods are ineffective. There is genetic manipulation applied by EMS mutagen to mutate microalgae for more production of sustainable biomass.

Material and methods

Microalgae consortia development

The microalgae sp. namely *Spirulinaplatensis, Synechocystis PCC6803, Anabaena cylindrica, Scenedesmus dimorphus, Chlorella* sp., were treated with 4 different concentrations i.e. 0.42, 0.56, 0.72, 1.12 M of Ethyl Methane Sulphonate (EMS) to test that how the mutation affects the synthetic algal communities. Microalgae consortia (MC)1 (*Spirulinaplatensis, Synechocystis PCC6803, Anabaena cylindrica* MC2 (*Scenedesmus dimorphus, Chlorella* sp. MC3 (*Spirulinaplatensis, Synechocystis PCC6803, Anabaena cylindrica, Scenedesmus dimorphus, Chlorella* sp*)* (Narwani *et al.*, 2017).All cultures were obtained from National Phytron Facility Centre, IARI, Pusa, New Delhi, India.

Culture conditions

The different consortia were initially cultivated in 500 mL of steam sterilized BG11+ medium. The culture was adjusted to 7.8 and cultures were incubated at 27±1 ºC temperatures and illuminated with an irradiance of 46.25 µmole m^{-2} s^{-1} photons under the regime of 18:06 light-dark period in 500 mL Erlenmeyer flasks with initial cell density of 1.62×10^{6} cells mL^{-1}. All the experiments were carried out in triplicates (n=3) (Patel et al., 2013).

Growth attributes and kinetics

Microalgae cell density was determined using the spectrophotometric methods and cell counting by haemocytometer. One unit OD at 750 nm wavelengths was considered equal to 9.58×10^{6} cells mL^{-1} for different consortia. The method standardized by (Li *et al.* 2010a).

Biomass determination; dry weight (mg/mL)

To determine dry weight, around 25 mL of microalgae suspension was centrifuged in a pre-weighed tube say A at 12000 rpm for 8-10 minutes, by (Ono *et al.,* 1999). Mutagenic strain were developed by using EMS i.e. 5 ml of culture OD at 750 nm containing 10^{8}cells was taken in falcon tubes was estimated by (Patel *et al.,* 2016). The *Chlorophyll estimation was performed by f*rom initial stationary phase, 1 mL of algal suspension was taken for the estimation of chlorophyll by standard method (Rippaka *et al.* 1949). The estimation of carotenoid was calculated by (Jensen 1978). The phycocyanin estimation was also done for both treated and non-treated microalgae at 620 nm by (Bennet and Bogoras 1973). The 100µL supernatant from each eppendorf tube was used for the estimation and determination of total carbohydrate contents (Loewus 1952). The 100 µL supernatant from each was used for the evaluation of total protein content (Lowry *et al.* 1951).

Protein extraction and total cell protein profiling

The total cell protein was isolated from WT and mutant strains using the extraction buffer having composition: 0.1M trisHCl (pH 8.0), 0.01 M $MgCl_2$, 18% w/v sucrose, 40 mM*β*- mercaptoethanol, 2% (w/v) SDS, 5mM ethylene diamine tetra-acetic acid (EDTA), 0.1mM phenylmethanesulphonate fluoride (PMSF). The cultures from late exponential phase were harvested and crushed in liquid nitrogen, added 500-1000 µL extraction buffer in each, incubated at R.T. for 20 minutes, centrifuged at 4°C at 8000 rpm for 5 min, collected the supernatant for analysis. The 35 µg protein from each mutant was used for performing the sodium dodecyl sulphate- polyacrylamide gel electrophoresis (SDS-PAGE) with slight modifications as described by Laemmli.

Quantification of lipid accumulated in microalgae and mutant species

The methods used for extraction of lipid were also given by Bligh and Dyer (1959). For *carbon analysis a* weighed amount (20-50 mg) of the dried biomass was treated with 5 ml of 0.4 N potassium dichromate solution ($K_2Cr_2O_7$) followed by addition of 10 ml of concentrated sulfuric acid by modified Walkley-Black titration method.

Statistical methods

Comparative analysis of growth rates, pigments, biomass, carbohydrate and lipids data of all the mutants of microalgae monocultures and consortia of them and all WT were performed using Graph Pad Prism version 5.0 and involving either repeated measures of one way ANOVA and Dunnett's multiple comparison test or two way ANOVA and Bonferroni posttests, as where needed. Significant differences among comparative study were based on rejection of Null hypothesis including; *p*-values (at 5% probability and 95% confidence level) and Fisher F-test in ANOVA.

Results and Discussion

Specification of mutagen

The EMS mutagen shown as decreased up to 100% to 0% survival rates from 0.42- 1.2 M EMS mutants viable cells density showed in Figure 1 The quantification of living cells on selection plates rates was equivalent to mutation with nonlethal doses). Applied mutagenesis cell viability was examined by chlorophyll fluorescence and microscopically determined wild type with 3 mutagen dose status of cells individually microalgae and their consortia (Figure 1).

Pigments and biochemical

The tolerated temperature in monocultures and consortia with and without EMS treatment were analyzed by chlorophyll fluorescence and microscopic examination of biofilm between 70% to 0% against the course of culture viability and temperature tolerance capability rounds with mutagenesis). Lee *et al.* 2014 proved that random EMS treatment showed characteristically enhanced phenotypes with her wild type in growth and FAME content.

In 26 days cultivation period, microalgae and their consortia experienced fluctuating growth rate (Figure 2). Highest density occurred on day 4 for control and in consortia, than individual's highest yielding monocultures i.e. *Chlorella* sp. and *Spirulina platensis* with EMS mutagen highest density occurred on harvesting day (Figure 2).

Regarding photosynthetic pigments Chlorophyll *a* also increases in mutagen rather than wild type with gross primary productivity enhanced as per species richness facts On the other hand dried biomass yield was higher in wild type microalgae and their consortia (Figure 3). The above results successfully demonstrated that consortia of wild type increased temperature tolerance and selected mutagenesis allow fatty acid industrial scale production. The highest density in all fourtreatment occurred in EMS 1.2 M treatment with a number of 71.7 ± 7.93 x 10^6 cells/mL (Figure 3).

The phases in consortia of WT were less productive with 1.2 M EMS concentration treated consortia had the highest density at mid-log phase. This value was higher than specific growth rate of highest density with 1.2 EMS concentrations (2.39/harvesting day) (Table 1).

Table 1 Quantification of Phycocyanin and Protein

Organism	**Phycocyanin (mg mL^{-1})**	**Protein (mg mL^{-1})**
Chlorella sp. WT	2.998	1.89000
Chlorella sp. mutant	3.018	1.921
Spirulinaplatensis WT	3.879	2.340
Spirulinaplatensis mutant	3.921	2.411
Scenedesmus dimorphus WT	2.786	1.4100
Scenedesmus dimorphus mutant	2.797	1.563
Anabaena cylindrica WT	1.883	1.0030
Anabaena cylindrica mutant	1.896	1.121
Synechocystis PCC6803 WT	2.898	1.0280
Synechocystis PCC6803 mutant	2.931	1.113
Consortia1 WT	3.872	2.183
Consortia 1 mutant	3.868	2.174
Consortia 2 WT	3.734	2.198
Consortia 2 mutant	3.721	2.187
Consortia 3 WT	3.698	2.221
Consortia 3 mutant	3.697	2.211

When compared to control cultivation, specific growth rate in both EMS treatments has higher value, on harvesting day in mid-log state. While in consortia of WT, highest specific growth occurred in day harvesting with a value of 2.21/ harvesting day. Specific growth rate in this experiment showed similar value with the research conducted by Doan and Obbard, 1959 reported that 0.56/day for original species cultivation and 0.58/day for mutant species cultivation with certain EMS concentration. Previous research stated that, cultivation experiment that use higher concentration of EMS would produce lower density, when compared to its original species. It is proven by this research, where specific growth rate went lower from 0.42 to 1.5 M EMS concentration.

Highest Chlorophyll-acontent in both wild type and mutant microalgae has been observed and their consortia are cultivated in

presence of 1.2 M EMS mutagen. Highest carbohydrate content occurred in wild type microalgae and their consortia cultivation thus it was decreased in mutant shown in Figure 4(628µg mL^{-1} in wild type consortia1 on harvesting day). Highest lipid content, shown in occurred in 1.2 M EMS cultivation mutant, inversely compared to biomass value Figure 5). The highest biomass occurred in wild type microalgae consortia cultivation while lipid content in 1.2 M EMS concentration was also considerably high, but this research also discovered that high biomass does not always resulted in high lipid content.

Table 2 Carbon content and carbon fixation rate estimation in different wild type and mutagen microalgae strains with their developing consortia by Walkley-Black titration

Species name	Dried algal Biomass (g/L)	Carbon content CO_2 (C=3.951/g)(1-T/S) 18 day (gm./dry weight)	fixation rate s(f=x1.83) gm./mL18/day
Synechocystis PCC6803.	1.31	0.582	3.898
Synechococystis PCC6803m	1.28	0.591	3.992
Anabaena cylindrica	1.46	0.579	3.878
Anabaena cylindricam.m.	1.42	0.585	3.871
Spirulina platensis	1.61	0.465	3.114
Spirulina platensis m.	1.53	0.521	3.321
Scenedesmus dimorphus	1.41	0.53	3.549
Scenedesmus dimorphus.m.	1.32	0.52	3.543
Chlorella sp.	1.52	0.413	2.766
Chlorella sp. m.	1.48	0.438	2.821
Consortia 1	3.27	0.201	1.346
Consortia 1 m.	3.19	0.221	1.780
Consortia 2	2.42	0.303	2.029
Consortia 2 m.	2.38	0.291	2.056
Consortia 3	2.03	0.304	2.036
Consortia 3 m.	2.00	0.303	2.028

High amount of growth rate wild type microalgae consortia in without EMS, gave more protein content compared to lipid content in the cells. In microalgae consortia, the protein and phycocyanin yield were quite similar their best producing monocultures *Spirulina platensis*. The phycocyanin and protein yield in highest producing strains in monocultures *Spirulina platensis* were 3.921mg/mL^{-1} and 2.411 mg/mL^{-1} respectively on harvesting day. The highest heterogeneous species richness consortium 1 was producing quite less than most producing monocultures (3.872 mg/mL^{-1}phycocyanin and 2.183mg/mL^{-1} on harvesting day (Table1). Another microalgae species that has been tested using EMS method is *Chlamydmonas reinhardtii*. Lee et al (2014) stated

that after randomly mutated by EMS, that species produced more lipid content than its original form. At exponential phase, mutant species lipid content was twice as much as the original species. And at the stationary phase, lipid content in mutant species did not show any significant rises. This fact in line with this research's result where microalgae consortia of wild type and mutant that had been given certain amount of EMS produced more lipid than the original species, at stationary phase. On the other hand just reverse result in carbohydrates production; it was higher in wild type rather than mutant. This research and the one previously mentioned showed that a possibility where EMS could produce more lipid content in microalgae generation that has been mutated by random mutagenesis method and consortia of wild type for bioenergy production.

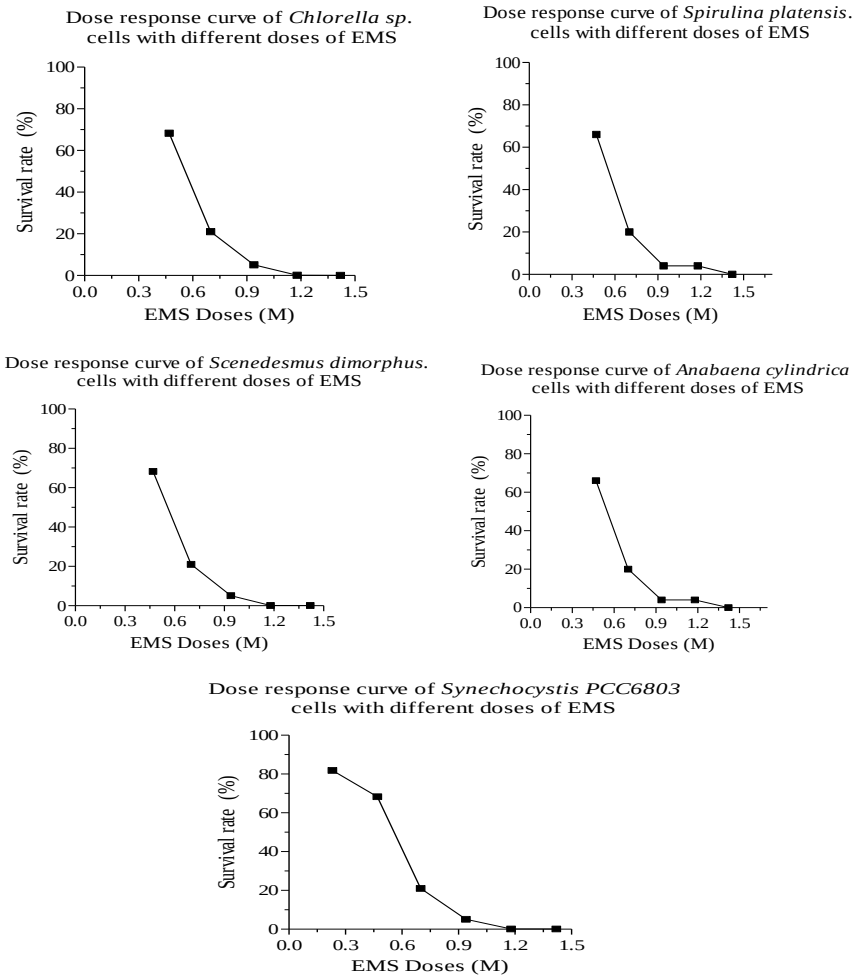

Figure 1 Survivalist performance of cell against different dose of EMS mutagen (a) *Chlorella* sp. (b) *Spirulinaplatensis* (c) *Scenedesmus dimorphus* (d) *Anabaena cylindrica* (e) *Synechocystis* PCC 6803

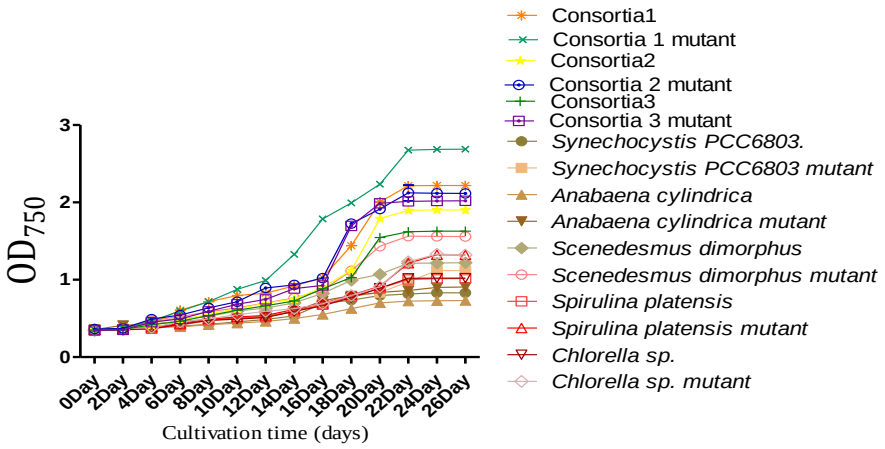

Figure 2 Growth curve of different wild type and EMS mutagen microalgae with their developing consortia.

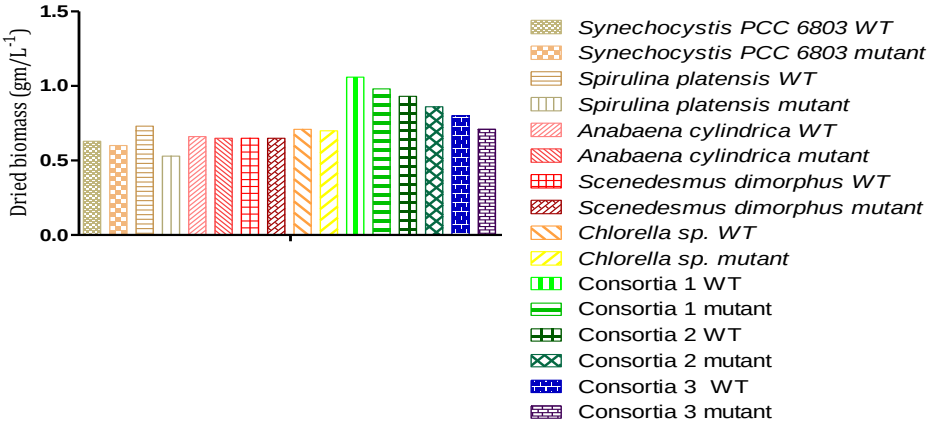

Figure 3 Biomass productions by different wild type and EMS mutagen microalgae with their developing consortia.

Total cell protein profiling of different EMS mutants and WT microalgae modulated progressive photosynthetic mutated proteins

To better understand the metabolism behind the mutant's phenotype, changes in protein expression of these mutants were analyzed. The total cell protein profiling of mutants and WT of 5 microalgae strains revealed an altered expression in proteins of 23, 25, 27, 29 kDa and 55 kDa molecular weight (Figure 6). PS II proteins; Dl, D2, CP43, CP29, 9 kDa protein and the 25 and 27 kDa polypeptides of peripheral LHC II are known to be phosphorylated in light. Light dependent proteolysis of Dl

protein give rise to primary degradation fragments of 23 kDa(Gilmore *et al.* 1996).

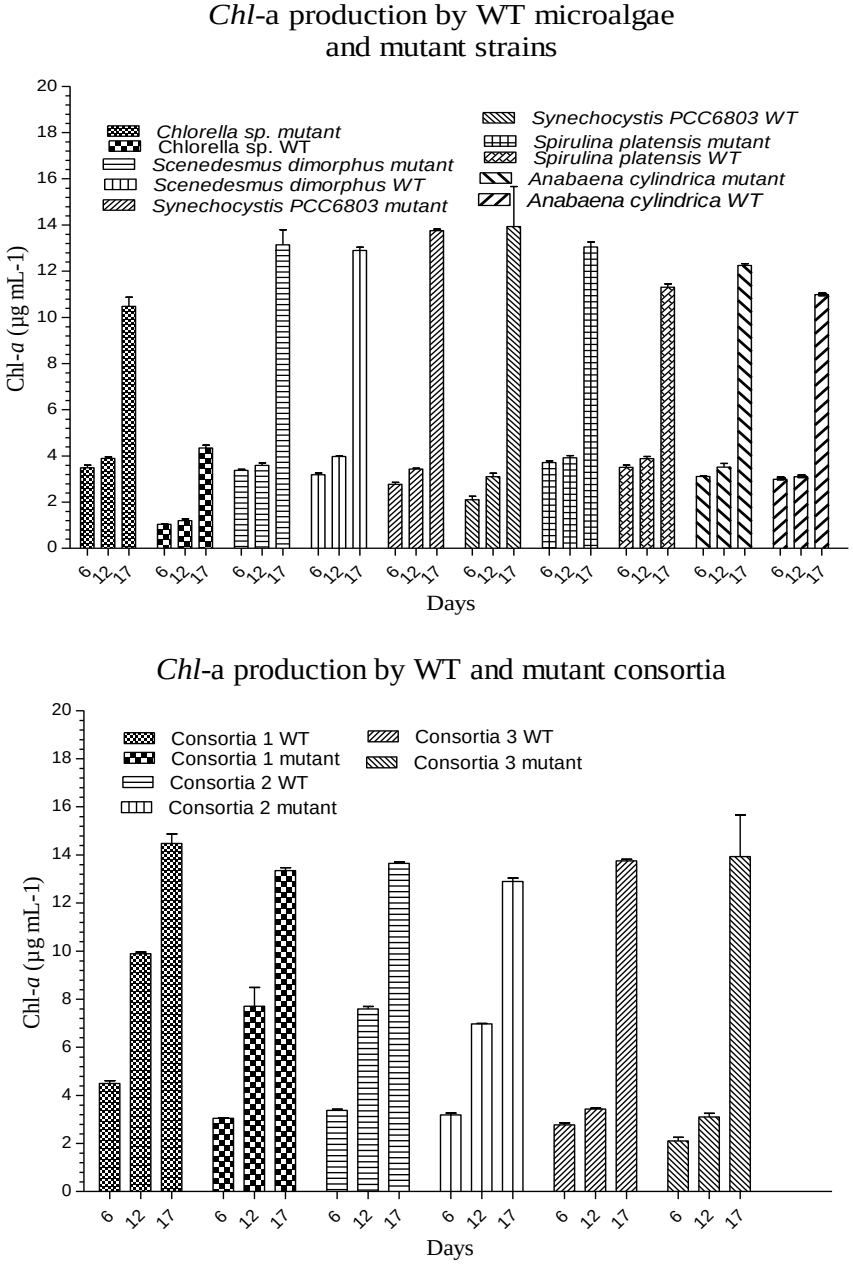

Figure 4 Chlorophyll a quantification of different wild type and mutagen microalgae with their developing consortia

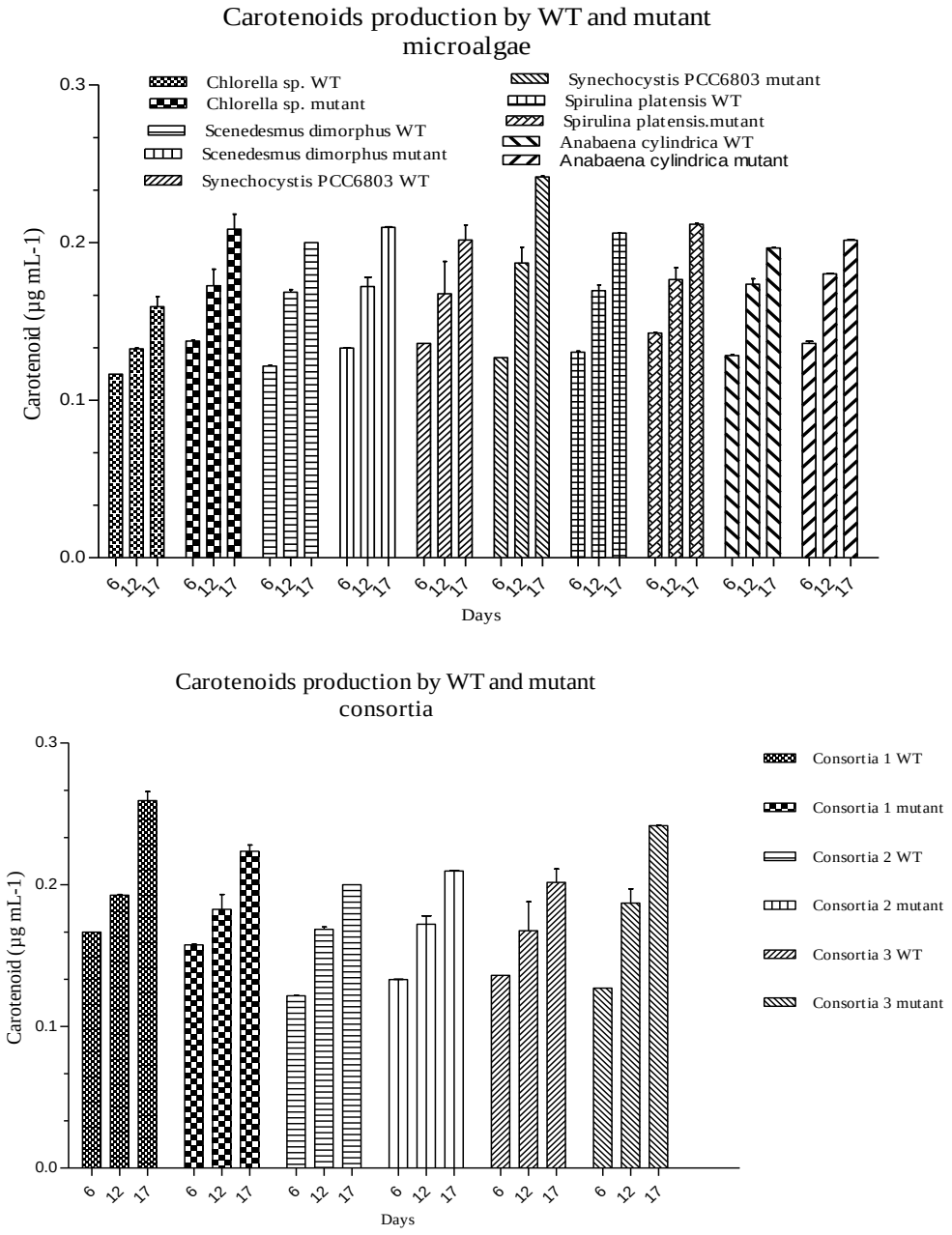

Figure 5 Carotenoid quantification by different wild type and mutagen microalgae with their developing consortia

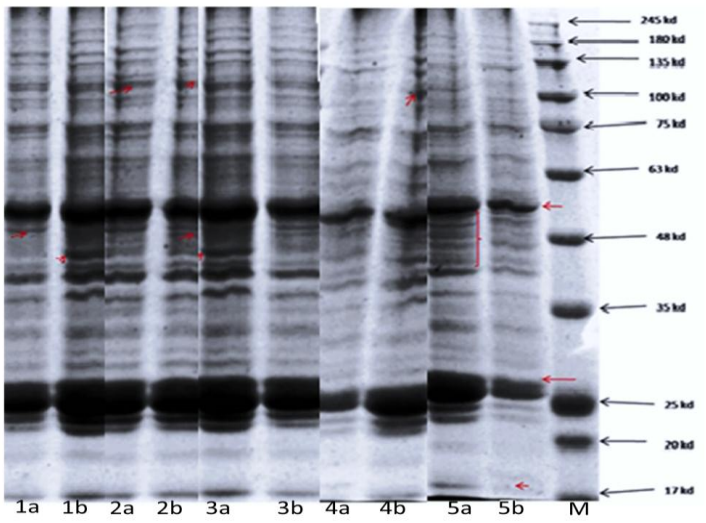

Figure 6 Total protein profiling (1a, b) *Synechocystis PCC6803* WT and mutant (2a, b) *Spirulina platensis* WT and mutant (3a, b) *Scenedesmus dimorphus* WT and mutant (4a, b) Anabaena cylindrical WT and their mutant (5a, b) *Chlorella* sp. WT and their mutant.

Thus based on published literature and correlating protein profiling results, we obtained an over expressed protein product of 23 kDa, perhaps D1 protein. Literature survey revealed that large subunit and small subunit of RUBISCO has molecular weight of 55 kDa and 17 kDa respectively (Campbell *et al.* 1998).

The over-expressed 47 kDa protein in Chlorella sp., Synechocystis PCC 6803 and *Scenedesmus dimorphus* mutant than other mutants and WT microalgae strains indicate the possibility of much efficient light absorption, water oxidation and biosynthesis of D1 and D2 PSII proteins. CP 47 protein is associated with three extrinsic membrane proteins of 33, 24 and 17 kDa in cyanobacteria, green algae and higher plants appear to act as enhancers of oxygen evolution process. They are necessary for high rate of water oxidation. Among these mutants the polypeptides of 25, 23 and 17kDa were observed. The small subunit of rubisco also has molecular weight of 17 kDa, thus further research should be done in future for identifying these polypeptides and probable reason behind its over-expression in mutants (Figure 6).

Carbon content and carbon fixation

The amount of carbon fixation was enhanced in consortia showing that increasing carbon content increase growth, chlorophyll, biomass and carbohydrate indicated that photosynthetic pigments have loss of photosynthetic efficiency. The carbon content of the dried microalgae biomass was higher in wild type microalgae consortia whilst carbon fixation in mutant of microalgae consortia indicates mutant was better efficient for aqueous phase co-productivity and wild type community for sustainable productivity (Table 2). The microalgae consortia were highly CO_2 tolerant than monoculture showing excellent stabilities to high concentration of CO_2 and high temperature. So it was evident that the growth and carbon fixation rate was influenced by carbon.

Conclusion

The use of EMS mutagen does affect carbohydrate and protein content but it increased the lipid content in microalgae consortia of wild type and mutant. The determined optimal dosages for the nonlethal induction of point mutations for % for EMS mutagen appear to be well suited to the generation of tolerances in different microalgae monocultures and their consortia. At the very least, random mutagenesis methods can be used as a first step in a combined approach with genetic modification (that is analyzed through next-generation techniques), to determine suitable target-genes for more focused and comprehensive methods for microalgae consortia development**.**

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Analysis of Dielectric Parameters in Paraelectric Ferroelectric Biphasic Region of Antiferroelectric Liquid Crystal Mixture

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Abstract

Different dielectric parameters have been investigated for antiferroelectric induced mixture W-132A. The relaxation frequency, dielectric strength and distribution parameter have been determined as a function of temperature. Impedance spectroscopy of the material under planar anchoring condition has been carried out in the frequency range of 1 Hz to 10 MHz using Impedance Analyzer of Solartron. Two relaxation modes are observed in SmA* and biphasic region in which high frequency mode is related to soft mode whereas low frequency mode is end-over-end rotation.

Keywords: Impedance spectroscopy, Antiferroelectric Liquid Crystals, Dielectric constant, Dielectric Loss, Relaxation frequency

Introduction

The anti ferroelectric liquid crystals (AFLC) are attractive for tri-state switching behaviour, easy DC compensation, microsecond response hemispherical viewing angle (in plane switching geometry) gray scale capability, wide viewing angle and no ghost effect (Castillo et al. 2004; Quintana et al. 2004; Dabrowski et al. 2004; Lagerwall 1999; Rudquist et al. 2002; Lagerwall et al. 2001). Around 1989-1990 the first case of anticlinic order was identified in chiral smectic (Chandani et al. 1988). In such materials the tilt is in the opposite direction from one layer to next. This means that the local polarization, which appears in the chiral case, also changes sign thiauin every successive layer. AFLCDs are still in the

stage of development and further studies are needed for mass scale applications.

Dielectric relaxation spectroscopy has proven to be a powerful technique to study the dipolar ordering and molecular dynamics of collective and non-collective molecular processes. In the paraelectric (SmA^*) phase, soft mode appears because of the fluctuation of the amplitude of the tilt angle. The dominant Goldstone mode appears in SmC^* phase due to the fluctuation of the azimuthal angle of the director around the helical axis in a planar aligned cell. The weaker modes of vibration in SmC^* phase cannot be observed due to huge fluctuation of azimuthal angle. Te detail investigation of different modes in antiferroelectric phase of this materials have already been reported (Srivastava 2005)**.** In this paper, the detailed dielectric investigation of SmA*-SmC* biphasic region of multicomponent antiferroelectric liquid crystal mixture (namely W-132A) are reported.

Materials & Methods

Complex relative dielectric permittivities $\varepsilon_\perp^*$ ($=\varepsilon_\perp' - j\varepsilon_\perp''$) of planar aligned samples have been acquired in the frequency range of 0.1 Hz to 10 MHz by using Solartron 1260 impedance gain phase analyzer interfaced with 1296 dielectric interface in cooling cycle. Sample cell was placed in Instec temperature controller model HS-1 with mk1 controller. The sample cell consists of indium tin oxide (ITO) coated glass plates having sheet resistance ~25 ohm/□. Two plates have been separated by mylar spacers of the thickness 10 μm. Active capacitance of the dielectric cell has been determined by using standard liquid cyclohexane.

To analyze the measured data, the dielectric spectra has been fitted on the generalized Cole-Cole equation [8]

$$\varepsilon^* = \varepsilon' - j\varepsilon'' = \varepsilon(\infty) + \sum_{i=1}^{2} \frac{(\Delta\varepsilon)_i}{1 + (j\frac{f}{f_{ri}})^{(1-h_i)}} + \frac{A_1}{f^n} - j\frac{\sigma}{2\pi\varepsilon_0 f^k} - jAf^m \quad (1)$$

where $\varepsilon(\infty)$ is relative permittivity in the high frequency limit, $\Delta\varepsilon_i$, f_{ri} and h_i are dielectric strength, the relaxation frequency and distribution parameter ($0 \le h_i \le 1$) of i^{th} mode respectively. The third term of Eq. (1) represents the contribution of electrode polarization capacitance at low

frequencies, where A_1 and n are fitting parameters. $\frac{\sigma}{2\pi\varepsilon_0 f^k}$ Accounts for the contribution of dc conductivity, with σ and k as a fitting parameters, usually k=1. ε_0 (=8.85 pF/m) is the free space permittivity. The measured dielectric absorption $\varepsilon''_\perp$ may contain a contribution above 100 kHz due to finite resistance of ITO coated on electrodes, inductance of leads and capacitance. An additional imaginary term. Af^m is empirically added in Eq. (1) to partially account for this effect, where A and m are fitting constants. The real and imaginary parts of the second term (Cole-Cole term) of Eq. (1) can be written as

$$\varepsilon' = \sum_{i=1}^{2} \frac{\Delta\varepsilon_i [1 + (\omega \tau_i)^{(1-h_i)} \sin(h_i \pi/2)]}{1 + (\omega \tau_i)^{2(1-h_i)} + 2(\omega \tau_i)^{(1-h_i)} \sin(h_i \pi/2)} \quad (2a)$$

$$\varepsilon'' = \sum_{i=1}^{2} \frac{\Delta\varepsilon_i (\omega \tau_i)^{(1-h_i)} \cos(h_i \pi/2)}{1 + (\omega \tau_i)^{2(1-h_i)} + 2(\omega \tau_i)^{(1-h_i)} \sin(h_i \pi/2)} \quad (2b)$$

Different parameters have been estimated by fitting the experimental curve of real ($\varepsilon'_\perp$) and imaginary ($\varepsilon''_\perp$) part on Eq. (1) at different frequencies in the temperature interval from 73^0C to 53.0^0C, and obtained the values of the dielectric strength $\Delta\varepsilon$, relaxation frequency $f_r$and distribution parameters different modes in SmA* and biphasic region of SmA* and SmC*.

Results and Discussion

W-132A is a multi component mixture was procured from R. Dabrowski Institute of Chemistry, Military University of Technology, 00-908, Warsaw (Poland). The mixture was synthesized by mixing two basic multi component mixtures, namely, B-2 and K-128. The ratio of the different individual components has been tailored to optimize the different physical parameters.

Table 1 Weight ratio of different components of mixtures B-2 and K-128.

Components of B-2	*Weight %*
$C_9H_{19}PhPhCOOPhCOOC^*H(CH_3)C_6H_{13}$	38.22
$C_8H_{17}OPhPhCOOPhCOOC^*H(CH_3)C_7H_{15}$	18.52
$C_4H_9O(CH_2)_3OPhCOOPhPhCOOC^*H(CH_3)C_6H_{13}$	9.27
$C_2H5O(CH_2)_2OPhPhCOOPhCOOC^*H(CH_3)C_6H_{13}$	13.99
$C_{10}H_{21}OPhCOOPhCOOC^*H(CH_3)C_6H_{13}$	20.00

Components of K-128	*Weight %*
$C_6F_{13}CH_2CH_2OPhPhCOOPhCOOC^*H(CH_3)C_6H_{13}$	12.13
$C_6F_{13}CH_2CH_2OPhCOOPhPhCOOC^*H(CH_3)C_6H_{13}$	11.87
$C_6F_{13}CH_2CH_2OPhCOOPhCOOC^*H(CH_3)C_6H_{13}$	38.80
$C_6F_{13}CH_2CH_2OPhPhCOO(F)PhCOOC^*H(CH_3)C_6H_{13}$	24.30
$C_8F_{17}CH_2CH_2OPhCOOPhCOOC^*H(CH_3)C_6H_{13}$	12.90

Components of B-2 and K-128 with their weight ratio are shown in Table 1. Phase sequence for W-132A with the transition temperatures (^{0}C) in parenthesis in cooling cycle is as follows:

I$\rightarrow$(85) $\rightarrow$SmA*$\rightarrow$(59) $\rightarrow$SmA*-SmC* biphasic region$\rightarrow$(53) $\rightarrow$SmC*$\rightarrow$(48) $\rightarrow SmC_A^*\rightarrow$(< 0 ^{0}C) $\rightarrow$ Crysta

Two relaxation modes have been observed in SmA* phase and SmA*-SmC* biphasic region. The relaxation mode observed in SmA^* has been identified as soft mode on the basis of the temperature dependence of $\Delta\varepsilon$ and f_r.The value of relaxation frequency was found to be strongly dependent on temperature and decreased from 100.0 kHz to 1.0 kHz with decrease in temperature.Dielectric strength of the soft mode ($\Delta\varepsilon_S$) increases with decrease in the temperature as shown in Figure 1. According to Curie-Weiss law, the reciprocal of $\Delta\varepsilon_S$ should vary linearly with the temperature. The values of $\Delta\varepsilon_s$ have been fitted (Gouda et al. 1991) to the Eq. (3) in the temperature range of 59.7 to 69.5 ^{0}C.

$$\varepsilon_0 \Delta\varepsilon_s = \frac{\varepsilon_0^2 \varepsilon'^2(\infty) C'^2 / \alpha T_C}{\left(\frac{T}{T_C} - 1\right)^{\gamma} + K q_0^2 / \alpha T_C} \qquad (3)$$

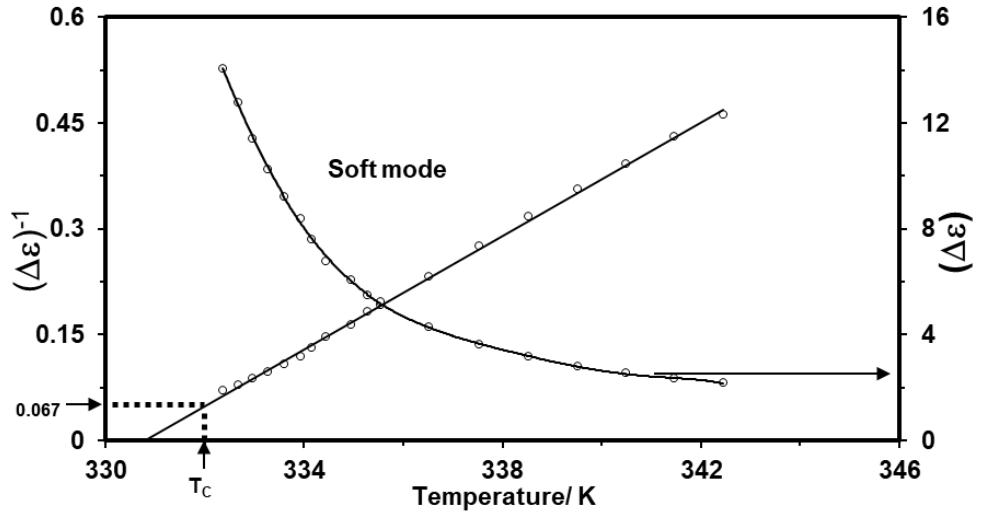

Figure 1 Temperature dependence of dielectric strength $(\Delta\varepsilon)$ and inverse of dielectric strength $(\Delta\varepsilon)^{-1}$ for soft mode in SmA* phase

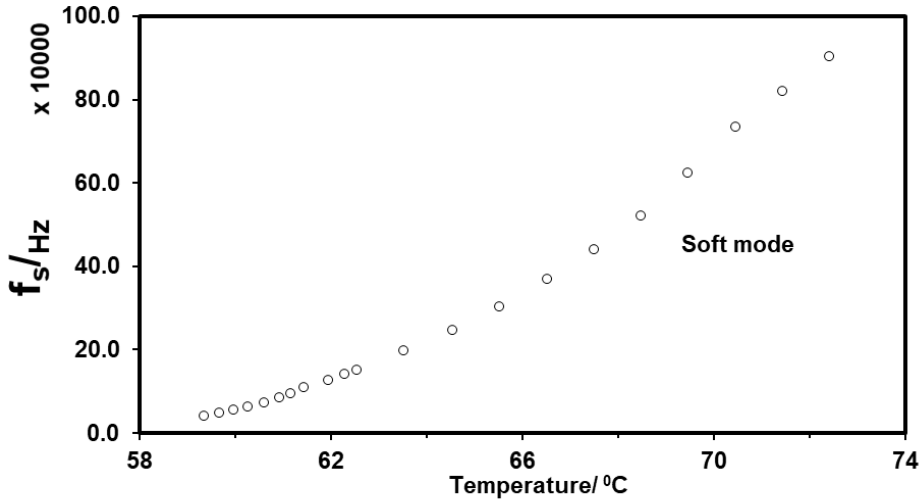

Figure 2 Temperature dependence of relaxation frequency (f $_r$) for soft mode in SmA* phase

where T_C is Curie (paraelectric to ferroelectric transition) temperature. $q_0 = 2\pi / pitch$. $\frac{\varepsilon_0 \varepsilon^2(\infty) C^2}{\alpha}$ term is arising due to the coupling between

tilt and polarization. Kq_0^2/α $\left(K = K_{33} - \varepsilon_0\varepsilon(\infty)\mu^2\right)$ is temperature equivalent energy needed to unwind the helical structure at the transition. C and μ are the coefficients of flexo- and piezo-electric coupling between director gradient and polarization, and between tilt and polarization respectively. K_{33} is the bend elastic constant and γ is a critical exponent which has been incorporated to account for the deviation from the linearity in $1/\varepsilon_S$, if any. From fitting, the exponent γ is found to be 1, which means Curie-Weiss law holds. The value of T_C in Eq. (3) was found to be 59.0 ^{0}C. DSC thermogram also shows a weak and broad peak about this temperature. On the basis of dielectric parameters, we believe that this temperature corresponds to transition from pure paraelectric (SmA*) to a biphasic region of SmA* and SmC* phases. From fitting the value of $\frac{\varepsilon_0\varepsilon^2(\infty)C^2}{Kq_0^2}$ which represents a cut-off value of dielectric strength. is 19.9, also agrees well with the experimental value of dialectic strength at 59.0 ^{0}C Experimentally, the value of dielectric strength at 59.0 ^{0}C is found to be 15, and that means that at T_c, $1/\Delta\varepsilon$ =0.067.The temperature dependence of the soft mode relaxation frequency in SmA* phase is shown in Figure 2. From Landau free energy expansion, the temperature dependence of the soft mode relaxation frequency (f_S) is given by [9].

$$f_s = \frac{1}{2\pi\gamma_s}\left[\alpha(T - T_C) + Kq_0^2\right] \qquad (4a)$$

The temperature dependence of rotational viscosity (γ_S) may be expressed by the well-known Arrhenius equation $\gamma_S = \gamma_0 e^{(E_a/K_BT)}$, where E_a is the activation energy. Hence Eq. (4a) can be written as

$$f_s = \frac{1}{2\pi\gamma_0 e^{(E_a/k_BT)}}\left[\alpha(T - T_C) + Kq_0^2\right] \qquad (4b)$$

The temperature dependence of soft mode relaxation frequency has been fitted to Eq. (4) and activation energy of 0.77 eV is determined. The value of $\frac{Kq_0^2}{\alpha}$ is found to be same as obtained from Eq. (3). The fitting parameters of soft mode are given in table 3.1.
From Eqs. (2) and (3), for γ =1,

$$\Delta\varepsilon_S . f_S = \frac{\varepsilon_0 \varepsilon^2(\infty) C^2}{2\pi} \frac{1}{\gamma_S} \quad (5a)$$

hence

$$\Delta\varepsilon_S . f_S = \frac{\varepsilon_0 \varepsilon^2(\infty) C^2}{2\pi} \frac{1}{\gamma_0 e^{(E_a / k_b T)}} \quad (5b)$$

Variation of $\Delta\varepsilon_S . f_S$ with temperature is shown in Figure 3. Temperature dependence of $\Delta\varepsilon_S . f_S$ has been fitted to Eq. (5b) and the activation energy is found to be 0.75 eV, which compares well with E_a=0.77 eV obtained from Eq. (4). The value of $\frac{\varepsilon_0 \varepsilon^2(\infty) C^2}{2\pi\gamma_0}$ obtained from fitting is 1×10^{17}.

Figure 4 shows that $\Delta\varepsilon$ and f_r have strong temperature dependence even in the biphasic region of SmA* and SmC* indicating that soft mode exists in this region as well. Slopes of $\Delta\varepsilon$ and f_r also show change of slope

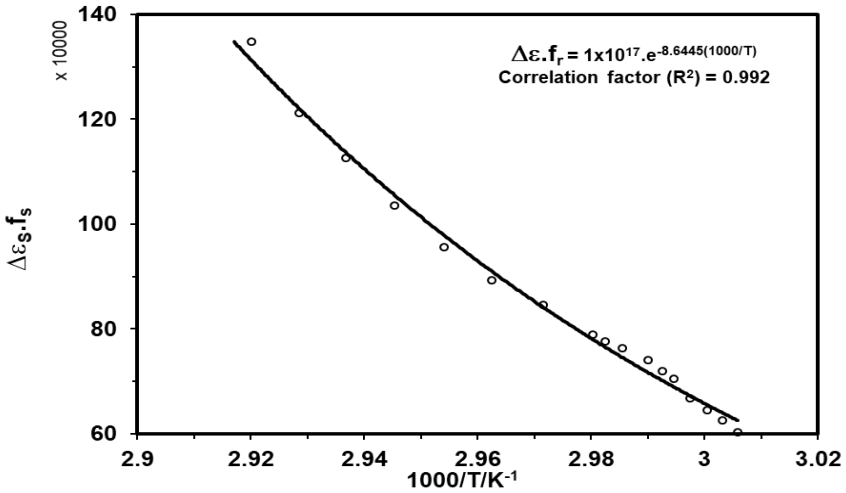

Figure 3 Variation of $\Delta\varepsilon_S . f_S$ with temperature for soft mode in SmA* phase

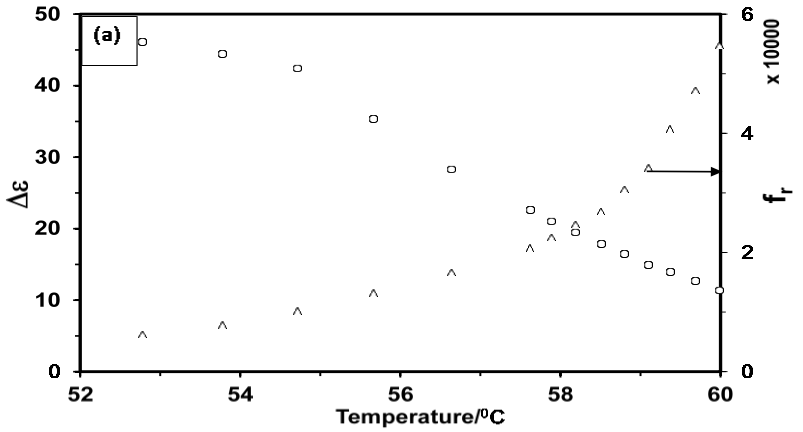

Figure 4 (a) Variation of dielectric strength $(\Delta\varepsilon)$ and relaxation frequency (f_r) with temperature in Biphasic region. at 59 ^{0}C meaning thereby that there is a weak transition and the system goes to a different phase (mixture of SmA* and SmC*) at this temperature. As temperature decreases, SmC* structure dominates and therefore $\varepsilon_\perp$' and $\Delta\varepsilon$ increase. Temperature dependence of these parameters reminds the dielectric behaviour of SmC$_\alpha^*$ phase observed between SmA* and SmC* phase in pure system (Takanishi et al. 1991). Variation of $\Delta\varepsilon$ and f_r with temperature in the biphasic region are shown in Figure 4a and that of $1/\Delta\varepsilon$ in Figure 4b.

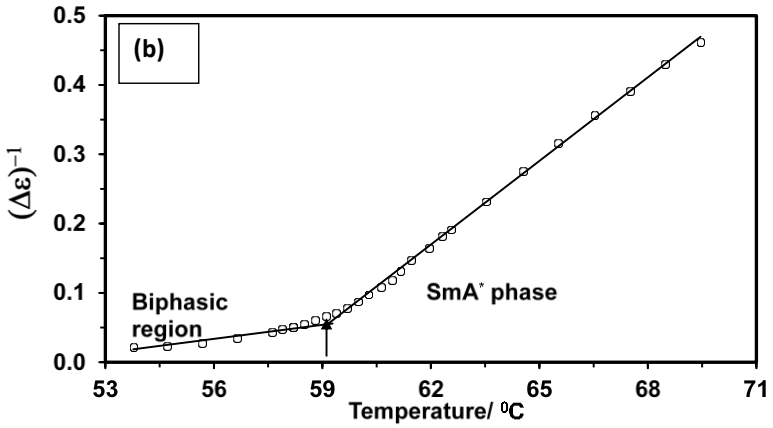

Figure 4 (b) Temperature dependence of inverse of dielectric strength in SmA* and biphasic region. Vertical arrow represents the SmA*-Biphasic region transition temperature

The values of distribution parameters (h) for SmA^*(soft mode) phase are very low (~0.04). The value of *h* obtained for soft mode in mixed phase is ~0.1, which is a high value in comparison to those found in literature for soft mode of SmA^* phase (Mukherjee 2000), but resembles with those of SmC_α^* phase (Takanishi et al. 1991). This fact also suggests the presence of partial tilted structure below 59 ^{0}C.

Low frequency relaxation phenomenon (L_F mode) has also been observed in W-132A mixture as shown in Figure 5. We could observe this relaxation phenomenon both in SmA* and biphasic regions but not below 54 ^{0}C, where SmC^* and SmC_A^* phases exist. This relaxation frequency decreases slowly with decrease in temperature, becomes ~0.2 Hz at 54.7 ^{0}C. This relaxation process may be present in SmC^* and SmC_A^* phases also as observed by Uehara *et al.* (1995) in all the three (SmA^*, SmC^*, and SmC_A^*) phases. Dielectric strength of L_F mode decreases with decease in temperature as shown in Figure 5. The space charge accumulation on the interfaces between liquid crystal and polyamide nylon coating have been taken care by the terms Af^{-n} in ε' and $\sigma / 2\pi\varepsilon_0 f$ in ε'' in Eq. 1, and therefore it may not be due this effect. This mode is attributedto end-over-end rotational mode.Distribution parameters vary from 0.15 at 72.4^{0}C to 0.07 at 54.7 ^{0}C for low frequency relaxation mode.

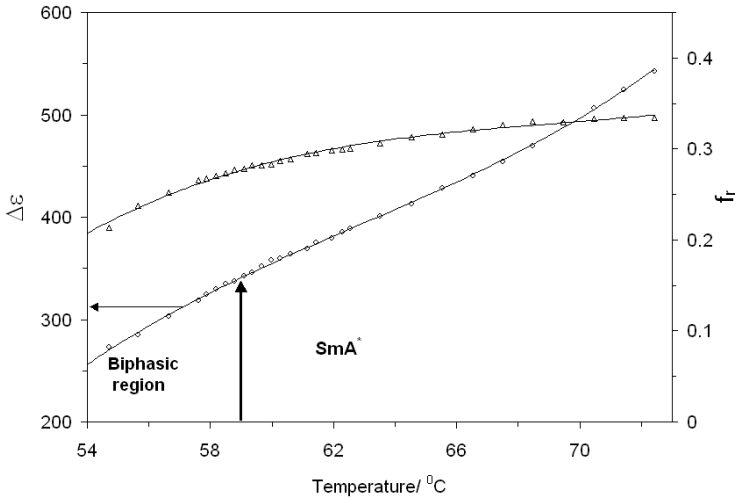

Figure 5 Variation of dielectric strength $(\Delta\varepsilon)$ and relaxation frequency (f_r) with temperature for L_F mode.

Conclusions

Dielectric spectroscopy of the mixture (W-132A) reveals soft mode dielectric relaxation in SmA* and an intermediate mixed phase between SmA* and SmC* phases. Distribution parameter for soft mode of the mixed phase is larger than in SmA* phase. Soft mode in SmA* phase follows the Curie-Weiss law, with Currie temperature Tc = 59 0C. Temperature dependence parameters in biphasic region resemble well with the dielectricbehaviour of SmC_{α}^{*} phase. The observed low frequency mode in the SmA* and biphasic region is due to the end-over-end rotation of the molecules.

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Antioxidant Activity of Methanolic and Aqueous Extract of *Vitisvinifera* Fruit

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Abstract

In humans majority of diseases are mainly due to oxidative stress caused by free radicals. The free radicals (oxidants) are species with very short half-life, high reactivity and damaging activity towards macromolecules like proteins, DNA and lipids. In general, the reactive oxygen species circulating in the body tend to react with the electron of other molecules in the body and these also effects various enzyme systems and cause damage which may further contribute to conditions such as cancer, ischemia, aging, rheumatoid arthritis etc. Antioxidants are compounds which retard or prevent the oxidation and in general prolong the life of the oxidizable matter. Dietary plants contain variable chemical families and amounts of antioxidants. It has been found that plant antioxidants may contribute to the beneficial health effects of dietary plants. In the present paper we have determined the antioxidant activity of Vitisvinifera using DPPH method. The grapes have shown high antioxidant activity.

Keywords: oxidative stress, antioxidants, *Vitisvinifera*, DPPH.

Introduction

Studies around the world have identified that high intake of fruits and vegetables leads to lower incidences of chronic diseases such as cancer and heart diseases (Gupta and Sharma 2006). The reason for this is

attributed to the presence of phytochemicals and these phytochemicals have antioxidant activity (Komes et. al. 2011).

Antioxidants prevent the damage done to the cells by free radicals molecules that are released during the normal metabolic process of oxidation. Some of these free radicals include reactive oxygen free radical species, reactive hydroxyl free radicals, the superoxide anion radical, hydrogen peroxide and peroxyl which generates metabolic products that attack lipids in the cell membranes or DNA. These are associated with several types of biological damage, DNA damage, carcinogenesis, and cellular degeneration related to aging and also contributes to heart diseases and arthritis (Saeidnia and Abdollahi 2012; Anonyms 1995).

Vitisvinifera commonly known as grapes extensively cultivated as an article of food in India. The grapes contains about a tenth portion of pure sugar, which is one of the glucose or fruit sugars and is very wholesome. Vitisvinifera is rich in Vitamin C which helps in fighting with diseases. Grapes are also very rich in phenolic compounds and anthocyanin. Phenolic compounds have specifically been shown to possess various antioxidants functions(Hogan at. al 2009; Dimitrios2006). In this paper we determine the antioxidant activity of methanolic and aqueous extracts of fruits of Vitisvinifera (Grapes) by Free radical scavenging activity (DPPH* method) and reducing power assay.

Materials and Methods

The grapes were collected from the local market. Grapes was thoroughly washed with double distilled water and crushed. The crushed fruits were mixed with 500 ml of different solvents i.e. methanol/water and extract was prepared using steam distillation method. General chemical reagents including ethanol, acetone, sodium carbonate, acetic and hydrochloric acids were supplied by their local representatives. They were of analytical grade and used as received.

Determination of Antioxidant Activity:

The antioxidant activity was evaluated by the following methods.

Free radical scavenging activity (DPPH* method):

The hydrogen atom or electron donating ability of the compounds and standard - BHT was determined from bleaching of purple colored methanol solution of DPPH*. This spectrophotometric assay uses the stable radical DPPH* as a reagent. The diluted working solutions of essential oils of both plants were prepared in methanol (2.0, 1.0, 0.5, 0.25 and 0.062 mg/ml).

Different concentrations of methanloic and aqueous stock solutions of grapes were taken in each test tube and volume was made up to 2ml. Then 2ml of DPPH* solution was added in each test tube and these solutions were kept in dark for thirty minutes. DPPH* was prepared at a concentration of 0.002%. The same procedure was followed for BHT as well. All the samples were tested in triplicate. Later optical density was recorded at 517nm using UV- visible spectrophotometer. Methanol with DPPH* was used as a control. The method was same as used by (Kahalaf et al.2008), with slight modifications. The formula used for the calculation is

$$\% \text{ inhibition of DPPH* activity} = (A - B / A) \times 100$$

Where A= optical density of control

B = optical density of sample.

Reducing Power Assay:

The reducing antioxidant activity of the grapes has been analysed by the method given by Huda Fajan et. al. (2009) with slight alterations. In this method different concentrations of methanloic stock solutions of both essential oils (2.0, 1.0, 0.5, 0. 25 and 0.062 mg/ml) were taken in different test tubes and volume of all the working solution is made upto 1 ml by adding distilled water, in these added 2.5ml of phophate buffer (0.2M, pH - 6.6) and 2.5ml of potassium ferricyanide (1%). The mixture was incubated for 20 min at 50 degrees. Then 2.5 ml trichloro acetic acid (TCA, 10%) was added to each mixture and these were centrifuged for 10 min at 3000 rpm. Then 2.5 ml of the upper layer was mixed with distilled water (2.5ml) and 0.5 ml ferric chloride (0.1%). Then absorbance was recorded at 700nm against a blank using UV - Visible spectrophotometer. The same procedure was repeated with BHT used as standard and sample without plant extract was used as control. Increased absorbance of reaction mixture indicates increase in reducing power.

Results

Antioxidant activity of methanolic and aqueous extract of grapes was evaluated and showed in figure 1.

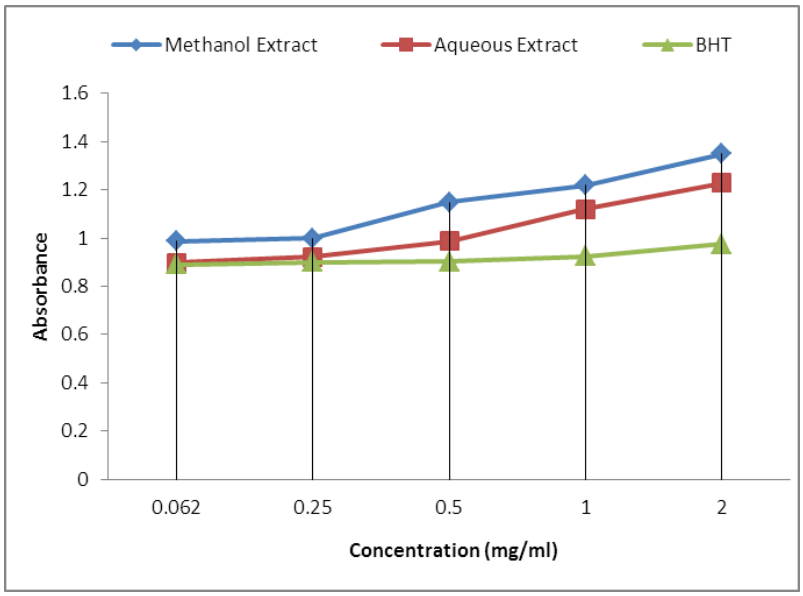

Figure 1 Antioxidant potential of methanolic and aqueous extract of *Vitisvinifera*

Reducing power ability of methanolic and aqueous extract of *Vitisvinifera* were investigated and shown in figure 2.

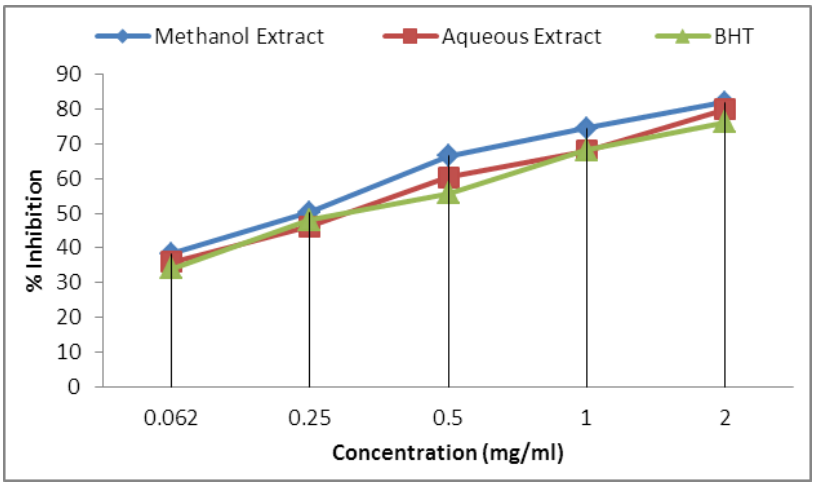

Figure 2 Reducing power ability of methanolic and aqueous extract of *Vitisvinifera*

Discussion

Antioxidant activity of methanolic and aqueous extract of grapes was evaluated by DPPH* assay.Figure 1 shows that percentage inhibition

of methanloic extract of Vitisvinifera is in increasing order with the increase in concentration more precisely 39 %, 50 %, 66 %, 74.4 %, 82 % and for aqueous extarct of Vitisvinifera is found to be 37%, 46.2%, 61 %, 68% and 79.8% respectively. Similar concentration standard BHT exhibited percent inhibition of 34.1%, 48 %, 55.6 %, 68.2% and 76.1%.

Reducing power characteristic of any compound serves as a significant indicator of its potential as an antioxidant and is a supporting feature for its antioxidant activity. Reducing power was found to be significant and the values were found to be (Figure 2) 0.988, 1.0, 1.150, 1.223, 1.350 for methanol extract and 0.898, 0.922, 0.988, 1.112, 1.23 respectively.

The results were found to be better as compared with the standards BHT (0.890, 0.900, 0.903, 0.925 and 0.975) respectively. The activities were statistically significant (Figure 2) when compared with control. Antioxidant activity of extracts is strongly dependent on the solvent due to their diverse antioxidants potentials of compounds having different polarity. In the present research attempt, amongst the two extracts the methanolic extracts showed highest antioxidant and reducing ability in comparison to the aqueous extracts. The greater radical scavenging and reducing ability may be due to the rich content of phenolic compounds and terpenoids (Sharma et. al.2014).

Conclusion

From the results we can conclude that the Vitisvinifera showed significant antioxidant and reducing ability in both the extracts in comparison to standard BHT. The highest activity may be due to the rich content of phenolic compounds and anthocyanin. Plant materials rich in phenolics are increasingly being used in the food industry because they retard oxidative damage and improve the nutritive value. Thus the major constituents of the Vitisvinifera can also be isolated and can be utilized for prevention of various diseases.

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Solid Waste and Its Management: Geographical Region of Allahabad Municipal Corporation

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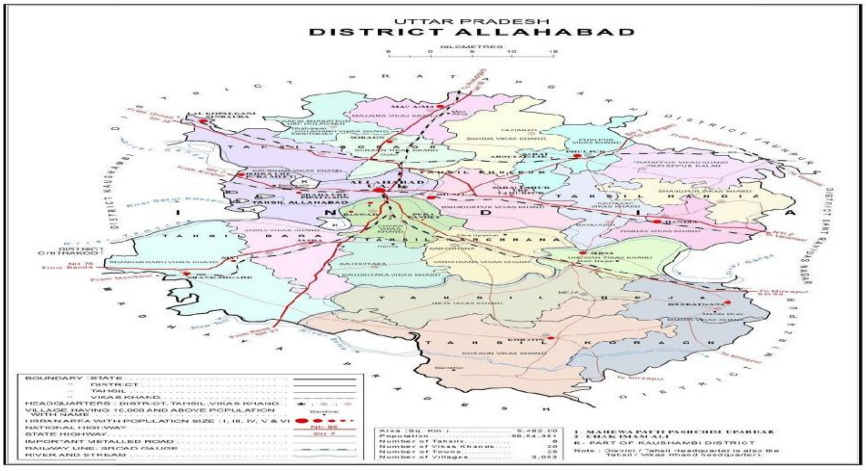
Introduction

Municipal Solid Waste Management (MSWM) refers to a systematic process that comprises of waste segregation and storage at the source, primary collection, secondary storage, transportation, secondary segregation, the resource recovery, processing, treatment, and final disposal of solid waste. The situation of Indian cities are this regard very poor and under developing phase. The management of municipal solid waste in India has surfaced or continued to be a severe problem not only because of environmental and aesthetic concerns but also because of the enormous quantities generated every day. Even though only 31% of Indian population resides in urban areas, this population of 377 million (Census of India, 2011) generates a gigantic 1,43,449 metric tonnes per day of municipal solid waste, as per the Central Pollution Control Board (CPCB), 2014-15 and these figures increase every day with an increase in population. India's sift from the agricultural economy to industrial and service-oriented economy which in result it throwing its rural population into cities. Increased Population and urbanization both escalate the pressure of solid waste management. Many cities in developing word facing the problem of safe disposal of solid. There traditional method of disposal needed more land which becomes scarce day by day. That method posed the challenges of health hazard and same time disastrous to the environment. Causing threat to the ecology of the vicinity and also polluting the water, land, and air (Kansal et Al., 1998). Planning Commission Reported that 377 million people residing in urban area generate 62 million tons of MSW per annum currently and it is projected that by 2031 these urban centres will generate 165 million tons of waste annually and by 2050 it could reach 436 million tons. To accommodate this amount of waste generated by 2031, about 23.5 × 107 cubic meters of landfill space is required and in terms of area, it would be 1,175 hectares of land per year. The area required from 2031 to 2050 would be 43,000

hectares for landfills piled in 20-meter height. Currently, Indian cities directly disposed of over ninety % of the solid waste in the landfill. If India continued Annually, regarding twelve million loads of inert waste are generated in Bharat from street sweeping and Collection and Disposal waste and within the landfill, it occupies regarding third of total MSW. In India, MSWM is ruled by Municipal Solid Waste (Management and Handling) l, 2000 (MSWR) and implementation of MSWR could be a major concern of urban native bodies (ULBs) across the country.

According to Hari Bhari data Allahabad producing total 600 TPD garbage on an average where potential is around 800 TPD. Seadon (2006) clarified that solid waste management is at least four millennia old issue, which forces us to think about the integrated solid waste management. Drawing on the time-targeted action plan for management of MSW by each city and town is essential to the population and developmental growth, otherwise, with the increasing quantity of waste will lead to unhealthy environmental conditions.



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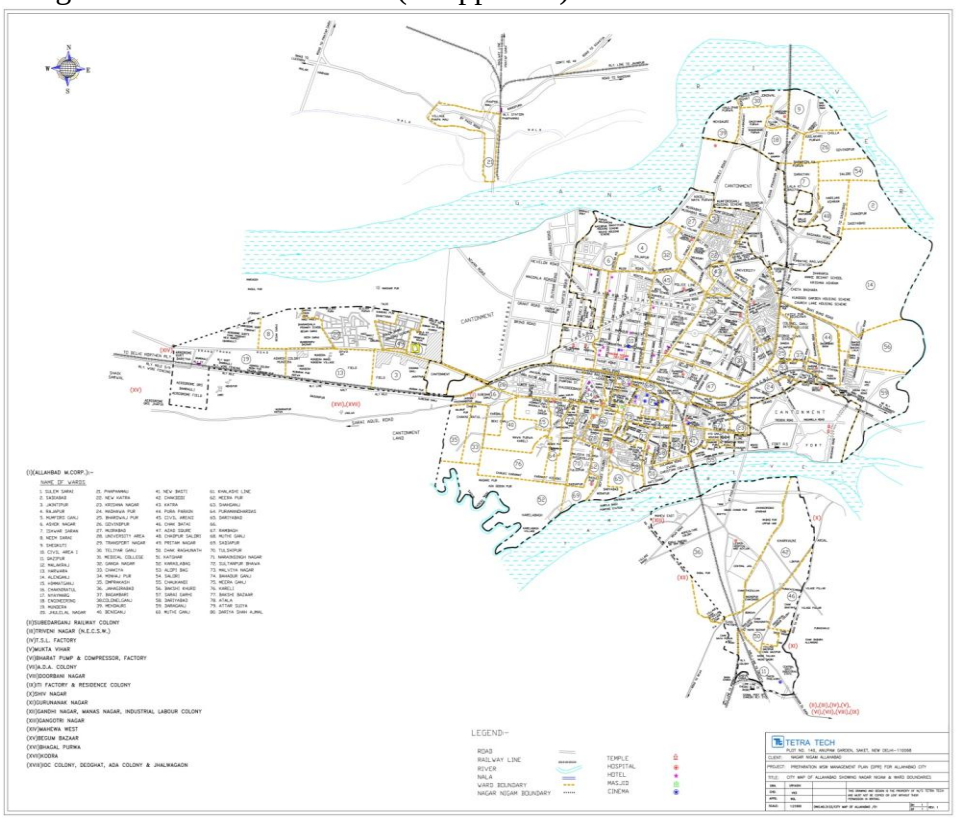
City: An Overview- Geographically, Allahabad is located at 25.45°N 81.84°E in the south eastern part of the Uttar Pradesh. To its south and southeast is the Bagelkhand region, to its east is middle Ganges valley of North India, or Purvanchal, to its southwest is the Bundelkhand region, to its north and northeast is the Awadh region and to its west along with Kaushambi it forms the part of Doab i.e the Lower Doab region. In the north Pratapgarh, in the south Rewa (M.P.), in the east Sant Ravi Das Nagar and in the west Kaushambhi districts are located. The total geographical area of the district is 5482 Sq. The average hight from sea level is 93.57m near jhunsi (city profile: Gov of India). Km.The district is

divided into 8 Tehsils, 20 development Blocks, and 2802 populated Villages. The city has the total population of 1.4 million approx 23 percent of total population of the district which Located at the confluence of Ganga Yamuna and Saraswati (disappeared).



Allahabad Municipal Corporations (AMC) is responsible to manage waste and MSW in The city area of about 72 square km. Allahabad Municipal Corporation is divided into 5 Municipal Zones and total 80 election wards. There are total 200,000 households and about 85,000 commercial customers. Earlier time the city is divided into 20 wards for the purpose of sanitization. The SWM in Allahabad is in critical condition. About 680 MT of solid waste generated in the Allahabad city (Report on the smart city project. The entire collection of waste management divided into the four heads, namely cleaning collection transportation, and disposal. Recently Allahabad Municipal Corporation moved to the PPP system and handed over its MSW to a privet venture named HARI BHARI recyclable. Which providing more systematic and scientific solution to city's MSW. AMC splendid approx 20% of its annual budget and proposed to spent about on MSW in ambitious Smart CITY project on the infrastructure and up gradation.

MATERIAL AND METHOD:A questioner has been ready to search out the final perception of the common subject of the town of Allahabad regarding the various aspects of the municipal solid waste and its consequences and management within the city. Questioner contains queries associated with the kinds, sources, strategies of the collection, storage, transportation etc. of the municipal waste generated within the municipality of Allahabad. The questioner has been provided to regarding one thousand people and some time has been given to fill the answers. Time has been given in order that members of the family will discuss on different issues and proper answer is obtained. Questionnaire has been provided to different types of community and individuals like social unit, shops, government offices, non-public offices etc. homes of each variety has been elite as well as from terribly poor to terribly wealthy households, each ward etc. outlets of each variety has been elite as well as fabric, stationary, food items, physical science and electrics, general stores, medical stores, hardware things, vehicle showrooms, malls etc. there are eighty wards within the Municipality of Allahabad, thus regarding ten questioners are distributed in each ward. Numbers of questioners were also covering both area and population of the ward. Then additional questioners were also distributed within the wards with larger space or larger population. After about one week questioners were collected and numbered in the order that can be simply organized. Few citizens haven't answered the questioner, thus this kind of questioners was discarded out and not assessed for final results. 700 questioners were sorted out for the conclusion. Information obtained from these questioners were organized and results were presented in the graph. These data were analyzed and come to the logical fact.

The city of Allahabad has a poorly planned solid waste management system, or at least the implementation and execution of such a system. During the inspection visit of the city, a vast amount of solid waste such as plastic bags, debris etc was come across which go its way into the sewers and surface drains thus choking them completely. The SWM in Allahabad is in a really critical situation. About 680.0 MT of solid waste is generated every day in the Allahabad municipality. It has been considered that the local residents of municipal generate solid waste at the rate of about 539 grams per capita per day on an average. This all generation of solid waste on an average, includes local inhabitants (comprising the wastes generated by the resident population, shops and commercial establishments, vegetable and fruit markets, industries, slums, construction and demolition and hospital wastes – non-infectious and non-hazardous) and the floating population in the town. But Solid Waste Management (SWM) – AMC has already initiated solid waste management programs in collaboration with a

private partner to progress towards 100% door-to-door collection and disposal of segregated waste. I. To achieve better results and visible improvement in sanitation including SWM for 100% door-to-door collection and disposal of segregated waste, adopt (i) Garbage collection trucks (ii) NFC tagging of all households (iii) Provision of 7500 No's of community dustbins across the city's residential area(iv) Waste to Energy Treatment facility (smart city proposal, prepared by NNA).

Sort of waste:

The main problem in Indian traditional system of SWM is the heavy and undesired work of sorting the waste (CPCB 2014). As a secondary source we find that these type of garbage are generally found as mentioned by Raj Kumar Joshi et al., (2016)

Composition and characteristics of Indian municipal solid waste following major categories of waste are generally found in MSW of India:

- Biodegradable Waste: Food and kitchen waste, green waste (vegetables, flowers, leaves, fruits) and paper.
- Recyclable Material: Paper, glass, bottles, cans, metals, certain plastics, etc.
- Inert Waste Matter: C&D, dirt, debris.
- Composite waste: Waste clothing, Tetra packs, waste plastics such as toys.
- Domestic Hazardous Waste (also called "household hazardous waste") and toxic waste: Waste medicine, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, and shoe polish.

Primary collection of SW

The method of collection of data has been changed theoretically. Now focus shifted to enlarge the coverage area. The concept of DTDC (door to door collection) implemented. The door to Door collection of waste is being carried out by twin bin rickshaw/auto. Hari Bhari and ALLAHABAD Nagar Nigam are at the contract of 30 years inviting a viable model of PPP. To make user charge collection inefficient manner, stop any illegal pilferage of cash and other account reconciliation process easy. We are providing the handheld device to our supervisor. This handheld is using same RFID household tag to identify house details and their fixed service cost details which they have to pay on monthly basis and we are also able to track their previous month's dues. After making all the transaction supervisor need to sync the device with our server to

upload all the data online and deposit the cash to authorized authority (according to Hari Bhari). First time in Allahabad the revenue share model implemented. Hari Bhari paying to Nagar Nigam 10 lakh per month collected by DTDC safai Mitra. But the waste collection still is in limbo for several reasons. Point to note is Outside of the active Hari Bhari concession area (see Fig.1 below), the door-to-door collection is not being carried out. Waste is thrown outside the property from where sweepers of AMC collect waste by means of rickshaw trolley and dump the same into the dustbins or onto streets (open dump).

Allahabad vs. MOUD Benchmarks According to 2015 CDP

Sr. No.	Benchmark details	MOUD benchmark	Current status
1	Household coverage	100%	0%
2	Collection efficiency of MSW	100%	80%
3	Extent of segregation of MSW	80%	0%
4	Extent of MSW recovered	100%	0%
5	Extent of scientific disposal of MSW	100%	0%
6	Efficiency in redressal of customer complaints	100%	Data not available
7	Extent of cost recovery in SWM services	80%	0%
8	Efficiency in collection of SWM charges	90%	0%

Street sweeping

Under the Municipal Act, road/ street sweeping and drain cleaning are the responsibilities of AMC and street sweeping is carried out by 2200 sanitation workers. The waste from drain silt and waste heaps from roadsides are collected and disposed of at nearby open dumps. These unorganized disposal methods have resulted in the accumulation of solid waste on roadsides and vacant plots and in low lying areas and storm water drains.

Transportation

Outside the concession area (see below), waste is being transported by AMC from collection points to a treatment site located at a distance of 19 Km from the city. The transportation makes two or three trips per day to transport all waste to the treatment site in Baswar Allahabad. It takes almost 1.5 to 2.0 hours to make a trip depending on the traffic conditions. The site is located at a distance of 19 Km from the main city on an area of 25 hectares. The facility houses a 500 TPD mechanical composting treatment plant and landfill site. Hari Bhari has also deployed 200 vehicles

across to the city. They are with the attendant. They pick up the garbage and transport it to 15 modern collections and storage center. Where these waste is sort out in the different type of waste like plastic, electronic, silt and hazards.From where they sent it to the recycling center.

Secondary Transportation

The secondary transportation in hanging in the secondary transportation is not being handed over to Hari Bhari which has to be handed over by 12 month period. Nagar Nigam itself takes responsibility for secondary transportation. The reason enumerated by Hari BHari to us is: once the transportation handed over Nagar Nigam's income b from Manpower, Diesel & Maintenance would be gone. 1: Nagar Nigam would have to pay tipping fees to Hari Bhari. This tipping fees secondary transportation. Once secondary transportation is handed over to Hari Bhari, Nagar Nigam's select official's income would directly hamper fund allocations to dubious money churning projects. 2: We have evidence of your seeking help from central Government for Equipment & tipping fees budget, due to lack of fund with Nagar Nigam. Question is if you did not have budget/ fund for this project, with what authority did you enter into an agreement with Hari Bhari on false representation? 3: We have evidence that based on 3rd Party's report, ANN had decided to handover secondary transportation to Hari Bhari vide note sheet and everybody including legal, finance & accounts. But they both still with no resolution.

Disposal

Most waste is collected and treated before disposal. The development of modern & scientific Primary collection centers across 15 locations in the city which helping and handling the waste for processing. All mode of disposal still been used in the city like: open dumping, land filling, waste to energy conversion plant which is newly proposed involve biological aerobic and vermin composting. From direct throwing the garbage in the landfill to adopting a new technology which involves processing, sorting, recycling, composting of waste.

Technology implemented:

Technological improvement in last decade adopted in the city waste management system. Making energy and compost from waste implemented at the pilot level. Allahabad Municipal Corporation adopted a PPP model for the purpose. And understanding between Hari Bhari and AMC to install 150 MT/day Concrete & Debris waste to Eco Brick Plant in the city a move to green disposal, Operation & Maintenance of existing Compost Plant, Operate & Maintain SLF. In an important understanding,

Hari Bhari also builds 6 MWh Power Plant which will meet latest Pollution Emission Norms.

III. Results and Discussion

1. About Dustbin Installation --It has been observed that 69% of the citizens accepted that there are dustbins present in their respective mohalls while only 31% answered no. It shows that about two third of the city has the dustbins and other one third is still lacking the presence of dustbins. So this is the major reason for the inefficient collection of the municipal solid waste and in result a big amount of the solid waste being thrown on the roadsides which further becomes agents of infectious diseases and a place for the search of food material for the castles, dogs, and pigs etc.

2. Secondary storage in Mohalla--Only 27% of the citizens were accepted that secondary waste storage depot is situated in nearby areas of their respective mohalls rest 73% did not agree with this. AMC said the reason for the less secondary storage is that now most of the area is being covered by the waste collection agencies Hari Bhari then there is no need for this secondary storage depot. Due to less secondary waste storage depot, a large amount of the municipal waste is being dumped and thrown on the roadsides near to the dustbins which in turn again creates hazards to health and environment. For the search for the food by cattle, dogs and pigs gathered around and it resists the smooth traffic on the road.

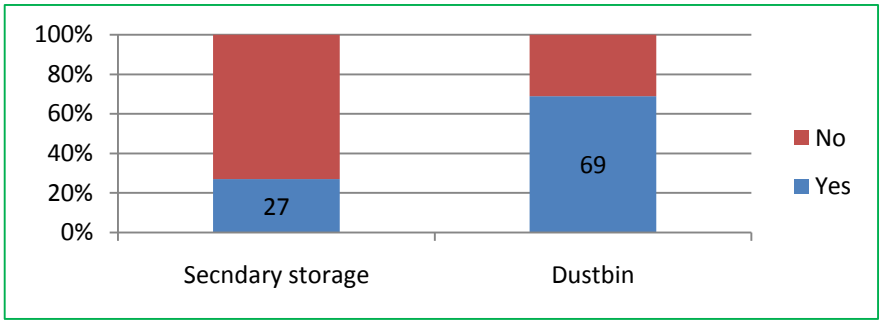


Fig 1 percentage of people in reach of dustbin and secondary storage

3. Waste collection system -- Approx 71% of the citizens consented that method of waste collection in the area is door to door waste collection. In this method the responsibility of the citizen to come out and made the collection when the waste collector comes on the door and whistles came and then they give the waste of their home to him. The waste collector comes with a trolley/rickshaw in which he collects the waste accordingly and goes to next door. About 29% of the people accepted that the waste

collection system was not of the door to door but of community bins type, in which system they have to throw the waste of their homes time to time in large community bins which are kept on the open common area or roadsides. In this collection system when the bins get filled people start to throw the waste in the sides of the bins which again become unaesthetic for the health of the city and becomes the breeding place of the infectious agents. For the search of food for the cattle, dog and pigs gathered around. It concludes that Due to lack of door to door collection method many times people do not go to the community bins but throw their waste on the roads and open area.

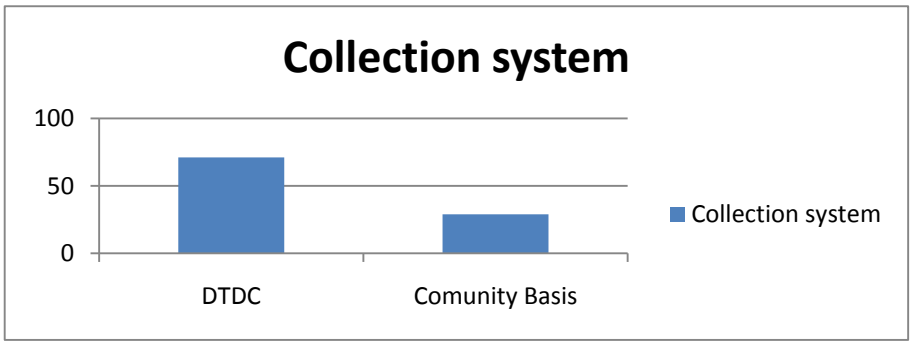


Fig 2

4. Waste collection agency--In Allahabad waste is being collected by two parties respectively the Municipality and private agency both. The private agency is the Hari Bhari Recyclable Pvt Ltd (HBR). The survey resulted that 28% of the citizens are given node that the waste is being collected mostly by the Municipality while 72% are agreeing that waste collection still by the agency is HBR. It has been seen that HBR is more efficient and scientific in the waste collection but the work area of HBR is the cover total area of AMC.

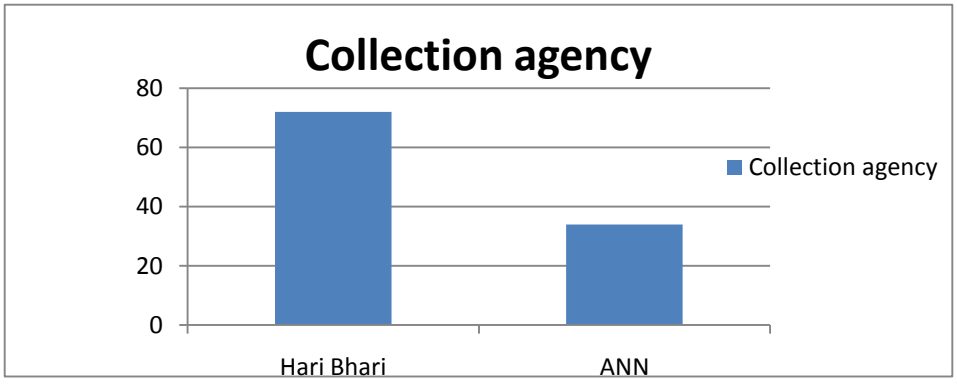
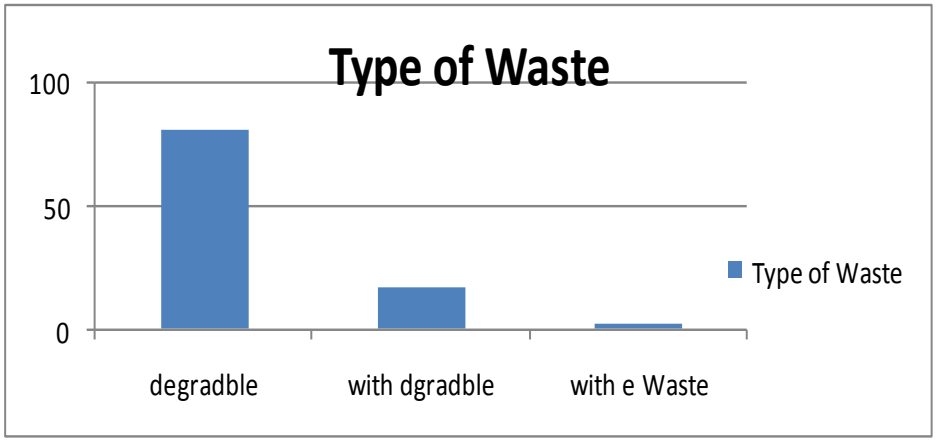


Fig 3

5. Type of waste-During survey it has been found that most the citizens about 81% were agreeing that the daily waste produced from their homes contains only food or flower or degradable item while 17% citizens were agreeing that the daily waste also contains plastic and about 2% were agreeing that the daily waste necessarily contains e-waste.



6. Satisfaction with waste collection-About 68% citizens answered that they are satisfied with the degree of the waste collection while 32% were not satisfied. This higher level of dissatisfaction shows that in most part of the city the waste collection service is not efficient. The reason behind this is that the waste collection is being carried out by the municipality but with fewer resources like less human resources and inefficient vehicles and regularity is also a problem.

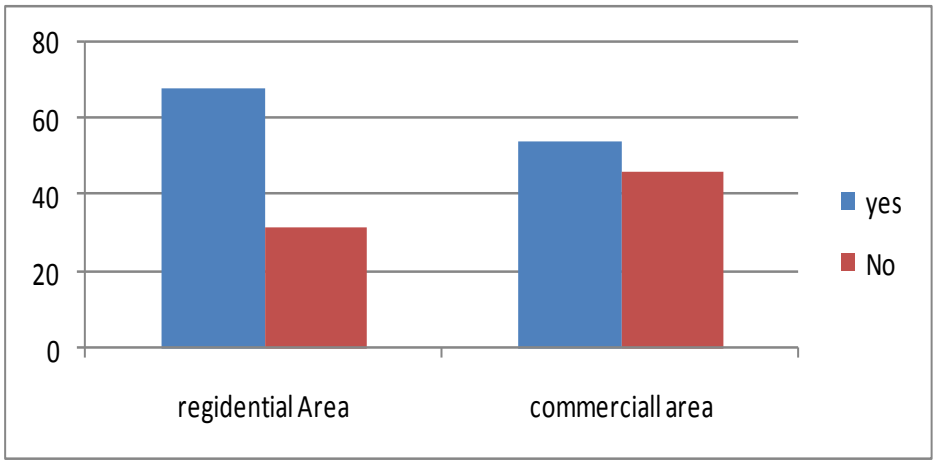
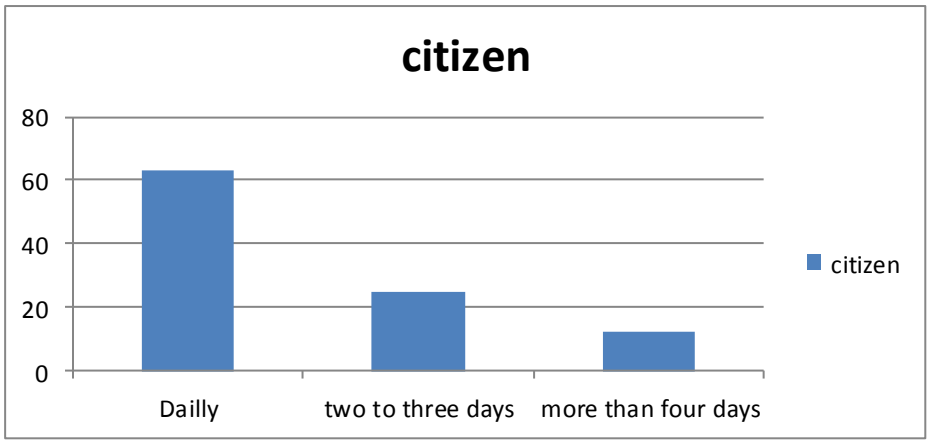
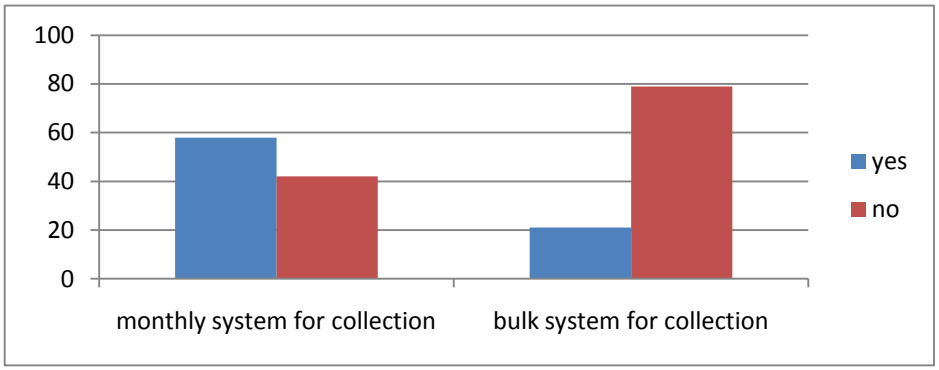


Fig 6: % of satisfaction with waste collection

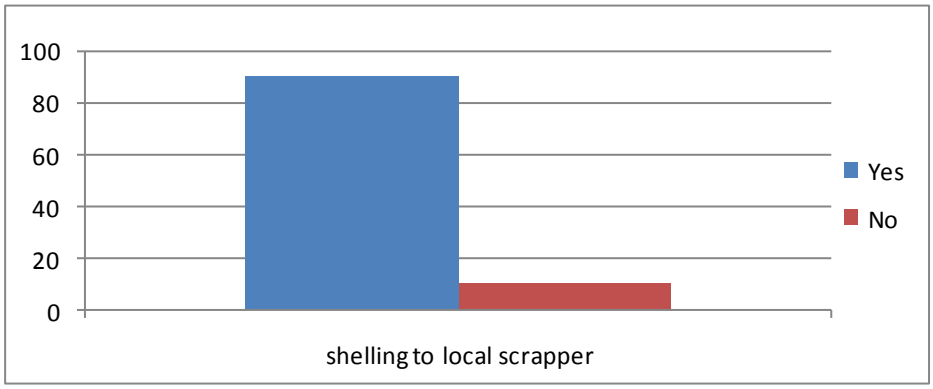
7. Waste collection Frequency-Approx 63% citizen were replied that waste is collected daily, 25% replied for 2-4 days, 12% replied for more than 4 days collection of solid waste.



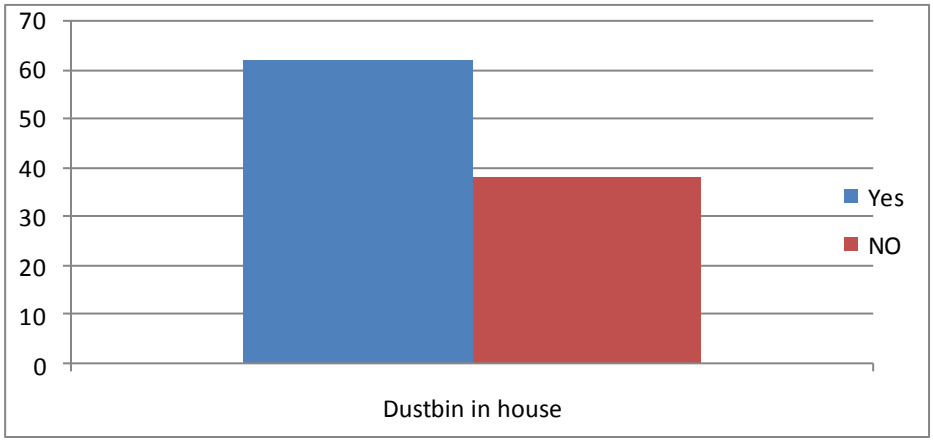
8. Will to pay for waste collection-About 58% of the citizens answered that they are ready to pay for the waste collection service monthly but only 21% annually. The people denied argued that no matter how much they pay but services and especially municipal services can never be in good. So if the people are not ready to pay for the waste collection service then this is a problem of lack of confidence in ANN.



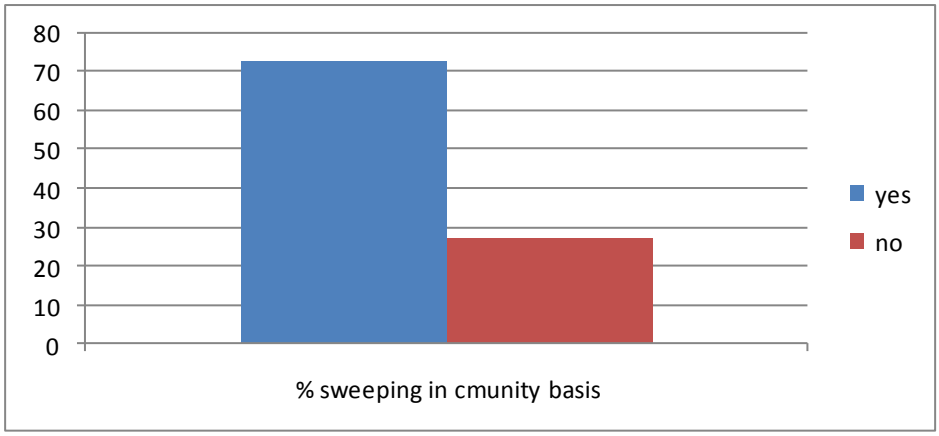
9. Sell waste to scrap vendor - Most of the citizen approx 90% agreed that they sell their solid waste from home to the local scrappers while a very little approx 10% denied this. The reason is that no one wants to have solid waste in their home and also it is very easy to sell these waste to local scrappers also little monitory return on it.



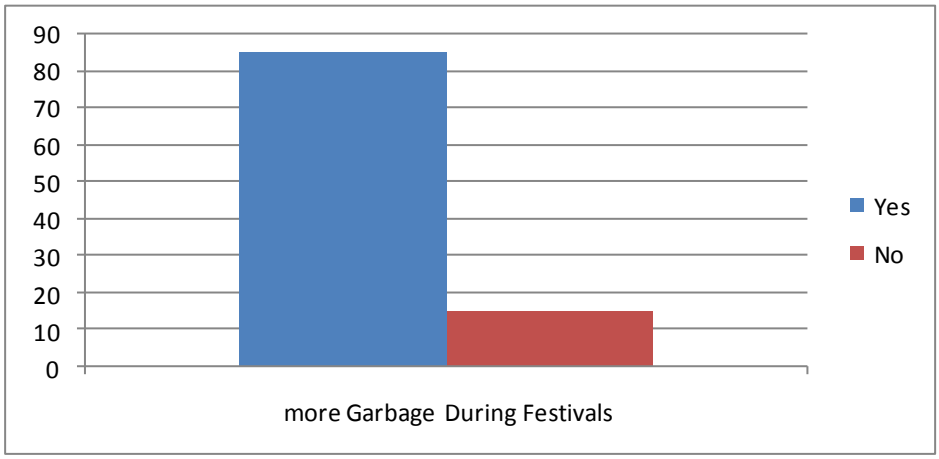
10. Dustbin at home- Most of the people around 62% has answered that they have dustbin at their home while 38% denied. Actually, most of the houses used to have dustbin of different shapes, sizes, and purpose. They use it to collect the solid waste house daily and then emptied these Dustbin waste on the roadsides. It is a good habit of people to have dustbins in their home and it is an old practice too but the disadvantage it is that now it is very difficult to process.



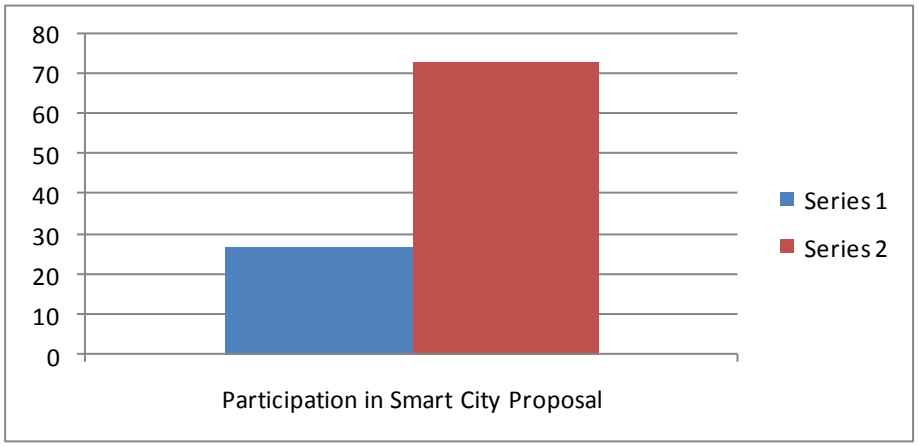
11. Daily sweeping in locality-About 64% of citizens answered positively that daily sweeping take place at their lanes and roads but 36% denied that. Not only has this but it also seen that the areas where daily sweeping take place the sweeping is not proper. The reason for the non- sweeping in certain areas is that there is great lack of sweeper and their supervision is also not very good. Their wages are also not good so some time they go to do some other work too.



12. Waste increases during festive seasons -Most of the people approx 85% were said that the amount of the solid waste is increased during festival season. The reason is that in Indian tradition during the festival the cleanliness of the house takes place. By which a large amount of the solid waste produces there other reason too.



13 Whether participated in dream city project: Proposal for the smart city-Around 27 percent of the citizen were accepted their involvement Smart City project by means of social media, campaign, suggestion. Most of them are youth. Rest have either denied the knowledge of it or not interested in any specific opinion about it.



Suggestions by the respondents through the survey-

a. There should be Door to door collection system-Most of the people are of the view that there should be daily and Door to door collection system of the waste. So that the solid waste may be under control handling, and do not increase very much. If the solid waste is less outside the house then it is very easy to handle it like collecting and processing otherwise municipality or private agencies have to spend their money and resources to handle it. Further with the risk of compromising citizen's health.

b. About dustbin and their location- It has been seen that most of the time dustbins are overflowing; the reason behind this is that the size of the dustbins are not large it would be wise to install large size container in proper location especially away from runs of the road. Many times it was spotted people set fire to garbage. Or due to fire left in waste set a flame in dustbin. Afterward that plastic bin is useless to collect waste of any kind. For roadside dustbin, they ask to increase the number and reduce the size of bin s that they cannot create another problem. Of traffic

c. Protection of dustbins from the animals and stealing- There is also reporting of stealing of dustbin. The bin should be tied or be so heavy that it could be protected. Large size dustbin also is considered as the solution.

d. Separation of waste is needed-- This would be a great solution if the waste separated at the source. For this propose an awareness program needed to teach people how to an where they should dispose their waste in separate dustbins to proper handling and avoid the charges can occur in future.

e. Waste to energy method should be utilized—very few persons are aware the fact that there could be energy generated by the waste. But people are very interested in such green concept. Even most f them do not know that

there is ongoing proposal to set up such plant in their city. They insist to invest more in such infrastructure.

f. Sewage choking main reason to mismanagement-Sewage sludge is also a kind of a municipal solid waste. People raises the issue to get resolves it. In most of the cases it is reported that the solid material that dug out from savage lines left un transported to the side of canal. This sludge should also be disposed or managed because remains in the drain due to which the drains starts to overflow. Basically, the problem of pre-monsoon digging of the drainage system is accounted for it.

g. No Fire No Flame. – Many times it was reported that the collector himself set the fire to solid waste instead of transporting responsibility. When we ask hari bhari for reason they told us. Whenever dispute occurs between HBR & AMC at many clauses they really failed to perform we generally left with no option but stop due several financial and official reasons. The AMC official starts blazing the waste. The very bad odor of burn also makes people often uneasy.

h. Collection transportation--Waste collection and transportation should be carried out only by closed trucks. Every time they transporting the garbage waste from one place to another They do not carry it but the fraction of the waste get scattered on the roadsides which creates an unpleasant unhealthy sometimes inviting to an accidental condition. So the waste collection vehicles should be closed and automated. People are hailed the automated trucks incorporated by HBR.

i. Citizens participation-The sanitation condition should be checked and audited by the civilian too. Many times people reported about dead animal body or negligence made in collection transportation and disposal but the output was nothing. So they need of a mechanism which involvement of a citizen by term basis to take note action regarding irresponsibility of SWM.

This civilian should allow the inspecting all aspects of the sanitation including solid waste management.

J. USE of social media- Information technologies improved and made a healthy reach to every section of society. Though they show less interest in its success but were agree to report and complain system if it is handled by the appropriate authority.Can also be utilized for updating the real-time status of the solid waste like social media and the actual performance in the locality.

Conclusion

Approx 69% citizens answer that there were dustbins in their locality. Only 27% respondents replied that there is secondary storage depot in their locality. Only 72% respondents approved that there is the door to door collection system exist in their locality and 28% respondents answered that there is only community dustbin collection system exist in their locality. The survey revealed that 28% of the citizens are agreeing that the waste is being collected by the Municipality while 72% are agreeing that waste collection agency is HARI BHRI PVT LTD (HBR). It has been found that all the people were agreeing that the waste produced from their homes contains degradable garbage like food or flower and plastic while 80% citizens were agreeing that the waste contains plastic paper/cardboard and about 90% were answered that the waste contains plastic and e-waste. About 68% people answered that they are satisfied with the ways of the waste collection while 32% were not satisfied in a residential area while only 54 % satisfied in the commercial area. Most of the people accepted that they sell their solid waste from home to the local scrappers while a very little part merely 10% denied this. Most of the citizens 62% have answered that they have dustbin at their home while 38% denied. About 64% of citizens answered in the positively that daily sweeping take place at their lanes and roads but 36% denied that. Most of the citizens (85%) were agreeing that the amount of the solid waste is being increased during festival season. around 27 percent of the citizen was accepted their involvement Smart City project by means of social media, campaign, suggestion. other Important suggestions obtained from the citizens through the survey were that there should be daily waste collection, large dustbin size and durable bins, more dustbins on the roadsides and open areas, protection of bins from the animals and stealing captured for personal use, separation of waste must be carried out minimize cost, waste to energy method should be utilized and forwarded, better sewage management with no burning of waste should be take place, closed. waste collection vehicles should be deployed, the involvement of social media like WhatsApp facebook twitter etc. To utilize as feedback also obtain real-time status of waste management, citizen audit of sanitation condition.

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10ण तैनसय थ्तंदबपेए बिंतसमेयैपदहीए स्ण्च – च्तोीए टपदंलण्ैवसपकेंजम डंदंहमउमदज ंदक बिंतंबजमतपेजपबे पद स्नबादवूए न्जजंत च्तंकमीए प्दकपंण *प्दजमतदंजपवदंस श्रवनतदंस विेबपमदजपपिब – म्दहपदममतपदह त्मेमंतबीए* 4; 11द्धए 2013ए 2229. 5518ण

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Qualitative PCR for the detection of Human Papilloma Virus DNAin cervical brushing and its applications

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Abstract

Background: Human Papilloma Virus is the most common type of sexually transmitted disease with double-stranded circular DNA of the genus alpha-papillomavirus. The transmission of this virus occurs by the genital areas of men and women. It is characterized by genital warts which causes discomfort or pain, though they may itch.

Aims: Qualitative PCR for the detection of HPV DNA in cervical brushing and its applications.

Settings and Design: Total of 30 cases were considered having a symptom of genital warts and itching suspected to have HPV. Then DNA is isolated from the silica column method which is studied under nested PCR followed by gel electrophoresis.

Methods and Materials: Isolation of DNA for the quantification of HPV DNA by silica column method and then DNA is quantified by Nested PCR followed by gel electrophoresis.

Results: Among the 30 cases taken from the patients belonging to North India, Dehradun region were checked for the presence of HPV out of 30 samples, 5 were positive and the remaining are of negative patients. The patients who are coming in the age group of 41-60, 5 patients are diagnosed by HPV positive. Hence, the prevalence was calculated to be 16.66% of the positive cases.

Conclusions: HPV is a disease with worldwide significance. This disease is a persistent problem in the developing world and the biggest cause of mortality due to a single pathogen. At every 8 minutes, one woman dies by HPV. Effective treatment requires the rapid detection of HPV.

Keywords: HPV, Nested PCR

Introduction

Cervical cancer is the fifth most common cancer in humans, the second most common cancer in women worldwide and the most common cancer cause of death in the developing countries. In 2012, about 528,000

new cases and 266,000 deaths occurred from cervical cancer worldwide. Around 85% of these occurred in the developing world. In the United States, about 27,000 cases of cancer due to HPV occur each year. About 1% of sexually active adults have genital warts. While cases of warts have been described since the time of ancient Greece, their viral nature was not discovered until 1907. Human Papilloma Virus is the most common type of sexually transmitted disease [1] with double stranded circular DNA with 55–60 nanometer capsid composed of 72 star-shaped capsomers. It is sensitive to temperatures above 56^0C but lower than 70^0C. It is the member of the genus alpha-papillomavirus complex. Around 40 of the HPV types affect the genital areas of men and women, including the skin of the penis, vulva (area outside the vagina), anus, and the linings of the vagina, cervix, and rectum [2]. Around 20 of these types are thought to be associated with the development of cancer. The WHO International Association for Research on Cancer (IARC) identifies 13 of these types as oncogenic (cancer causing). This means there is direct evidence that they are associated with the development of cervical cancer and are considered high-risk [3]. These high risk types of HPV are: 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, and 68 [4]. A person infected with high-risk HPV will show no symptoms so they may never even know they have it. HPV is transmitted by direct skin-to-skin contact with an infected individual. Transmission is usually from vaginal, oral, or anal sexual contact and can occur whether or not warts or other symptoms are present (McDermott-Webster, 1999). Unprotected penetrative intercourse with multiple partners is the greatest behavioral risk for contraction of HPV (Kjaer et al., 2001; Winer et al., 2003) [5].The incubation period ranges from 2 weeks to 8 months. In women, it is characterized by genital warts mostly on the vulva but can also occur near the anus, on the cervix. In men, it is characterized by genital warts appear on the penis and scrotum. Genital warts rarely cause discomfort or pain, though they may itch, Common warts, planar warts and flat warts. An HPV infection is caused by human papilloma virus family, of which over 170 types are known. More than 40 types are transmitted through sexual contact and infect the anus and genitals.

Most HR HPV infections regress spontaneously 6 to 12 months after their appearance, probably due to successful attack by the immune system [6]. Only a small percentage of infections persist. Without surgical treatment, these infections can progress to high-grade lesions and to squamous cell carcinoma or adenocarcinoma of the cervix [7,8,9].

Pap smears are often not obtained during routine medical examinations by primary clinicians who provide care. [10] Some possible explanations for this include the inconvenience, time, and discomfort often involved with

obtaining Pap smears in older patients. Also, clinicians frequently assume that Pap smears are being obtained elsewhere, and many male physicians feel uncomfortable obtaining Pap smears and taking sexual histories [10]. The availability of a noncytologic screening method not requiring a vaginal speculum examination may reduce under screening in women who have access to health care. A self-collected screening method may also be expected to increase access to screening in many resource-poor areas where there are limited numbers of clinicians trained in performing speculum examinations.

The aim of this study was to examine the Qualitative PCR for the detection of HPV DNA in Cervical Brushing and its Application. A total of 30 clinical samples were used in this study. Cervical Brushing samples were taken from the infected cases of Human papillioma virus.

Materials and methods

A total of 30 clinical samples were used in this study. Cervical swab samples were taken from the suspected cases of HPV and further processed in the Central Molecular Research Laboratory (CMRL), Shri Guru Ram Rai Institute of Medical & Health science (SGRRIM & HS), Patel Nagar, Dehradun (U.K.) for the Qualitative PCR for the detection of HPV DNA in cervical brushing. Collection of cervical swab samples and centrifuges it at 13000 rpm for 10 minute at 4^0 C. The sample was separated from cervical swab & then subjected for the isolation of DNA for the quantification of HPV DNA virus by silica column method. Initiate it by taking the pellets and add 20µl ofprotease into it. Then incubate it at 56^0 C for 15 minute. Then add 250µl of absolute ethanol and vertex it. Transfer the total samples in labelled silica column and centrifuge it in 10,000 rpm for 1 minute. Add washing buffer 1&2 with respect to ethanol in 500µl of equal volumes followed by centrifuge each time. Finally put the elution buffer and hold it at 3 minutes at room temp. Again centrifuge it at 10,000 rpm for 1 minute and remove the silica column, ultra purified DNA can be obtained. After DNA is obtained, Master Mix preparation for HPV DNA is done by Nested PCR followed by Gel Electrophoresis.

Results

A total of 30 clinical specimen were collected from the patients with abnormalities in cervix from Gynecology and Obtains Department of Shri MahantIndiresh Hospital Dehradun. Processing was done of all the 28 cases and further DNA was isolated by silica column method. Further the isolated DNA was utilized as target/template.

Observation of the gel under UV-Trans illuminator

After the electrophoretic run of the gel, the gel is placed on the UV Trans illuminator which is used to view DNA or RNA that has been separated by electrophoresis through an agarose gel. The stained gel is exposed to a UVB trans illuminatorlight source causes the DNA/dye to fluoresce and become visible which is than observed in UV trans illuminator.

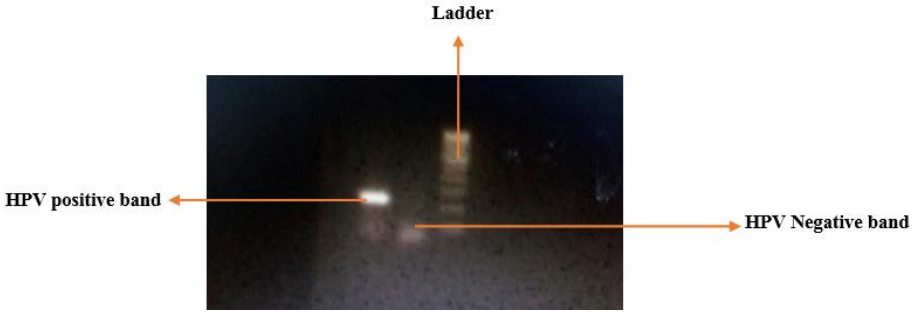

Figure 1 - Visualisation of bands by UV illuminator

HPV positive band:-above 235bp at gene (E6 and E7).

HPV Negative band:-below 235bp at gene (E6 and E7)

Table 1 Number of positive and Negative cases.**Chart-1** Showing distribution of positive and negative cases.

Total number of case for HPV	Positive cases	Negative cases
30	5	25

Table 2. Gender distribution of HPV patients

Gender	Number of cases	Positive Cases	Negative Cases
Male	00	00	00
Female	30	05	25

Table 3. Age wise distribution of HPV

Age (in years)	Number of cases	Positive Cases	Negative Cases
0-20	00	00	00
21-40	13	00	13
41-60	17	05	12
60 Above	00	00	00

Samples were collected in cervical Sampler with cytobrush. Then proceed it into DNA amplification through Nested PCR. Finally observe the bands at early gene (E6 and E7) base pair at 235 by Gel Electrophoresis.
Out of 30 samples, 5 were positive and the remaining are of negative patients. The patients who are coming in the age group of 41-60, 5 patients are diagnosed by HPV positive. Hence, the prevalence was calculated to be 16.66 % of the positive cases

Discussion and Conclusion

HPV is a sexually transmitted disease caused by double stranded circular DNA alpha-papillomavirus of papillomaviridae family. The most common presentation of HPV is Genital warts, common warts appear on the hands, fingers or elbows and flat warts which commonly appear on the face of children, men tend to get flat warts in the beard area and women tend to get them on the legs. The estimated incubation period from HPV infection to genital wart development is 2 weeks to 8 months, with the majority of genital warts appearing 2-3 month after an HPV infection? HPV is the main cause of cancer in the cervix and can also cause precancerous changes to the cells of the cervix, or dysplasia. HPV may also cause cancer of the vulva, which are the external genital organs of the women, as well as penile and anal cancer.

The preventive measure among the individual level included the use of vaccines to Prevent diseases and cancers caused by HPV. The Cervarix and Gardasil vaccines protect against most cases of cervical cancer. Gardasil also protects against most genital warts. HPV vaccines are recommended routinely for boys and girls aged 11-12 years; either vaccine is recommended for boys/men. These vaccines are safe and effective. Another preventive measure which can be used is Condoms. By using it consistently and correctly can lower the chances of acquiring and transmitting HPV-related diseases (e.g., genital warts and cervical cancer). However, because HPV can infect areas not covered by a condom, condoms might not fully protect against HPV. The risk factor of HPV can also reduce by limiting number of sex partners. However, even persons with only one lifetime sex partner can get HPV.

Educational strategies are essential, given several new and highly effective technologies to prevent HPV and related diseases such as cervical cancer. A country empowerment and mobilization is crucial for the prevention and control of HPV.

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रतिनाथ की चाची' उपन्यास के स्त्री पात्रों का विश्लेषणात्मक अध्ययन

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प्रेमचन्द के बाद हिन्दी उपन्यासों की यथार्थवादी परम्परा में नागार्जुन सबसे समर्थ हस्ताक्षर है। भारतीय गॉवों की शोषण से भरी जिन्दगी उनके उपन्यासों का विषय है। इनके समस्त उपन्यास साहित्य में मिथिलांचल को ही कथा–केन्द्र बनाया गया है। समाजवादी चेतना इनकी मूल चेतना है। यह लेखक का कथा–कौशल ही है, जिससे मुख्य पात्रों के साथ गौण पात्र भी पाठकों के मन में अविस्मरणीय स्थान बना लेते हैं। नायिकाओं का चरित्र–चित्रण नागार्जुन ने इस प्रकार है कि उनमें भारतीय नारी का प्रतिबिम्ब दिखाई देने लगता है। प्राचीन काल में स्त्रियों को समाज में अत्यन्त सम्मानजनक स्थान प्राप्त था। यहाँ तक कहा जाता था, कि जहाँ स्त्रियों की पूजा होती है वहीं देवताओं का निवास होता है। परन्तु मध्यकाल आते–आते स्त्रियों की सामाजिक दशा में गिरावट आती गई, अन्ततः वर्तमान में स्त्री शोषण समाज की मुख्य समस्या बन गई। स्त्रियों के प्रति होने वाले अपराध इसका प्रत्यक्ष उदाहरण हैं।

नागार्जुन का रचनाकाल स्वतंत्रता प्राप्ति के पहले से प्रारम्भ होकर बाद तक विस्तृत है। उस समयान्तराल में हो रहे सामाजिक परिवर्तनों को इनके साहित्य में सहजता से देखा जा सकता है। भारतीय नारियों पर होने वाले अत्याचारों को नागार्जुन ने अपने उपन्यासों में बड़ी ही मार्मिक अभिव्यक्ति प्रदान की है। इनमें अनमेल विवाह, विधवा विवाह, वेश्यावृत्ति स्त्रियो के क्रय–विक्रय की समस्यायें प्रमुख हैं। नागार्जुन के स्त्री पात्रों का प्रस्फुटन जीवन की यथार्थ भूमि से हुआ है कल्पना से नहीं। जैसा कि डॉ0 विजय बहादुर सिंह लिखते हैं कि, ''पढ़ी और सुनी हुई दुनिया पर उनका कतई भरोसा नहीं है, वे देखी हुई दुनिया के लेखक हैं। इसलिए उनके चरित्र बेहद प्रमाणिक हैं।[1] इनकी स्त्री पात्र आशावादी हैं, अच्छे भविष्य के लिए वर्तमान के असहनीय कष्ट को धैर्यपूर्वक सहन करती हैं। 'रतिनाथ की चाची' भी एक पिछड़े और गरीब अंचल की यातनादायी जिन्दगी समेटने वाला उपन्यास है। इसमें एक गरीब ब्राह्मण विधवा गौरी के माध्यम से पूरे भारतीय समाज की शोषित नारी की जीवनगाथा उद्घाटित की गयी है।

उपन्यास की प्रमुख पात्र गौरी जिन मानसिक यंत्रणाओं से गुजरती है वह भारतीय समाज की सड़ी–गली परम्परा का बेरहमी से भंडाफोड़ करने के लिए पर्याप्त है।

गौरीः गौरी इस उपन्यास की नायिका है। स्त्री विमर्श पर केन्द्रित यह उपन्यास उत्कृष्ठ कोटि का है। गौरी ऐसी स्त्री के रूप में चित्रित की गयी है, जिसका जीवन अनमेल विवाहके कारण विनाश की कालिमा से ढक गया है। गौरी अपने अतीत को याद करती है, ''सुखी माँ–बाप भरा–पूरा बचपन। कुलीन परन्तु दरिद्र से विवाह। रोगी पति। घुन लगा हुआ दाम्पत्य।''[2] भाग्य की विडम्बना और पिता की कुलीन वर की सनक के कारण गौरी एक दमे के रोगी के साथ ब्याह दी जाती है। पिता की इस भूल के कारण व अभिशप्त जीवन जीने के लिए विवश हो जाती है। ''जयनाथ उन कायर पुरूषों में से हैं जो वासना की पूर्ति के लिए स्त्री का उपभोग छिपकर तो कर सकते हैं, परन्तु प्रत्यक्ष रूप से साहस के साथ सामाजिक उत्तरदायित्व नहीं लेना चाहते।''[3]

जयनाथ के इस दृस्कृत्य के कारण गौरी की शुभंकरपुर में बड़ी बदनामी होती है। परन्तु वह किसी भी प्रकार जयनाथ का नाम नहीं लेती है। समाज की अनेक स्त्रियाँ व्यंग्यवाणों से गौरी को घायल करती है और आनंदानुभूति करती है परन्तु गौरी ने अपने को सँभाला और कहा, ''मैं कुछ नहीं जानती। वह भादों का महीना था, अमावश की रात थी। एक घनी और अँधेरी छाया मेरे बिस्तर की तरफ बढ़ आई। उसके बाद क्या हुआ अपने को होश नहीं रहा.....[4]। ऐसे में उसके सम्मुख दो ही मार्ग शेष बचते हैं या तो समाज के लोगों का अत्याचार और अपमान झेलकर जीवित रहे या अपनी कहानी को छिपाकर जीवनलीला समाप्त कर ले। ऐसे में गौरी साहस से काम लेती है और धैर्यपूर्वक परिस्थितियों का सामना करती है। उसे केवल इस बात का दुःख है कि इस संकट की घड़ी में जयनाथ उसे अकेला छोड़कर भाग गया वह सोचती है ''पूस चढते गए और यह चैत भी बारह दिन बीत गया। चाची को सारी पुरूष जाति से घृणा हो गई, इस मुसीबत का सामना जिसे करना चाहिए वह कहीं बाबा बैजनाथ और काशी विश्वनाथ के इर्द गिर्द गाल बजाता फिरे? छिः! ऐसा था तो मुझे भी साथ ले लिया होता। हे भगवान! पानी में डूब मरने के अतिरिक्त कोई और उपाय नहीं है।''[5] इस प्रकार सामाजिक यंत्रणा सहती हुई वह कोई निर्णय नहीं ले पाती और अंततः विवश होकर अपनी मॉ के पास चली जाती है। उसकी माँ अपनी पुत्री की दशा को देखकर उसके वास्तविक कारण पर विचार करती हुई कहती है, ''दरिद्र कुल में लड़की ब्याहने का ही यह दुष्परिणाम है।''[6] वह एक प्रगतिशील नारी की भाँति स्थिति को स्वाभाविक मान लेती है।

गौरी एक स्वाभिमानी स्त्री है, विधवा हो जाने पर वह पितृगृह में न लौटकर पतिगृह में ही रहना श्रेष्ठ समझती है। ''विवाहिता के लिए पितृकुल का अमृत भी पतिकुल के मॉड या पीने के साधारण जल की तुलना में तुच्छ है।''[7] स्त्री समाज ही गौरी को प्रताड़ित करने में पीछे नहीं रहता लेकिन वह सबको क्षमा कर देती है, यही भारतीय स्त्री की नियति है। गौरी सदियों से शोषित भारतीय नारी का प्रतीक है जो अनमेल विवाह की भेंट चढ़ती है वस्तुतः गौरी आदि से अंत तक सभी विषम परिस्थितियों को चुपचाप स्वीकार करती है। लेखक ने उसकी सहनशीलता का इतना मार्मिक चित्रण किया है कि पाठकों अन्दर चरित्रहीन पुरूषों और सामाजिक कुरीतियो के विरूद्ध विद्रोह की भावना जाग्रत हो जाती है।

चमाइनः रतिनाथ की चाची' में चमाइन एक गौण पात्र है। यह एक नीची जाति की

स्त्री बड़े लोगों के कारनामों पर जमकर प्रहार करती है। वह यह जानती है कि बड़े लोग बड़े से बड़ा कुकर्म करके उसे ढाँक लेंगे जैसा कि वह स्वयं कहती है, ''तुम लोग धनवाली हो, हाकिम भी तुम्हारी तरफदारी करेगा। कितने जोखिम का काम है पेट गिराना। पता चल जाए तो सरकार मेरा सत्यानाश कर देगी.....''[8] चमाइन बहुत ही चतुर स्त्री है। समय की स्थिति को देखकर वह समझ लेती है कि आज वह चाहे जितने पैसे मांगे उसे मिलेंगे, बात ही कुछ ऐसी है। अधिक पैसे मिलने पर तुरन्त पल्टी मारते हुए कहती है, ''भला यह भी कोई कहने की बात है मलिकाइन? आपकी बदनामी क्या हमारी बदनामी नहीं है? पर एक बात कहती हूँ माफ करना बड़ी जात वालों को तुम्हारी यह बिरादरी बड़ी मलिच्छ, बड़ी निठुर होती है मलिकाइन।[9]

दमयन्ती (दम्मो फूफी): दमयन्ती भी एक बाल विधवा है और इस उपन्यास की खलनायिका है। गॉव के कूटनीतिक शतरंज की एक चतुर खिलाड़ी है। ''उसकी एक विशेषता यह भी है कि गाँव की किसी न किसी घटना को बढ़ा–चढ़ाकर उसे मनोरंजन का मुद्दा बना लेती है।''[10] दमयन्ती गौरी के घावों को कुरेद कर आनन्द लेती है, फिर थोड़ी देर में साहनुभूति के दो बोल बोलकर उसे अपनी ओर आकृष्ट कर लेती है। इस पर लेखक कहते हैं, कि ''शिकार को गिरफ्त में करके बाघिन को जितना संतोष होता है, इस समय फूफी के भी संतोष की वही मात्रा थी। बेचारी उमानाथ की माँ को क्या पता कि इस सहानुभूति के पीछे एक डायन का निठुर अट्टहास छिपा है।''[11] दमयन्ती ने गॉव की सभी स्त्रियों को गौरी से बातचीत और व्यवहार करने को मना कर दिया और कहती है उमानाथ को मॉ की समाज किसी भी हाल में माफ नहीं कर सका। वह समाज में ऐसी स्त्रियों का प्रतीक है जो स्वयं गलत होने पर भी दूसरों पर कीचड़ उछालती रहती हैं और मुँहजोर होने के कारण समाज उनका लोहा भी मानता है।

रामपुरवाली: यह गौण पात्र के रूप में पात्रों के सामने आती है। रामपुरवाली एक झगड़ालू प्रवृत्ति की महिला है जो समस्याओं को सुलझाने में नहीं अपितु उलझाने में विश्वास रखती है। वह दम्मों को समर्थन करती हुई कहती है, ''बिल्कुल ठीक अपराधी को सजा मिलनी ही चाहिए।''[12]

गौरी की माँ: गौरी कीमाँ अत्यन्त साहसी महिला है। पति की मृत्यु के बाद भी अकेले ही पच्चीस बीघे खेत सॅभाल लेती है। एक समझदार महिला होने के नाते परिस्थिति को भली–भॉति समझती है। इसलिए जयनाथ को दोषी ठहराने के बजाय परिस्थितियों को दोषी ठहराती है तथा अपनी पुत्री को इस मुसीबत से निकालने का प्रयास करती है। गौरी की माँ अत्यन्त साहसी स्वरूप में दिखाई देती है, अपनी पुत्री की ढाल बन जाती है और छाती ठोकते हुई कहती है, ''देखे कौन क्या बिगाड़ता है? मैं रूई का फाहा नहीं हूँ कि लोग फूँक देंगे और उड़ जाऊँगी, मर्द हो तो सामने आकर कोई कहे।[13] गौरी की माँ गॉव की एक दबंग स्त्री है जो समाज के लोगों को ठेंगा दिखाकर अपनी बेटी का साथ देती है और दमदार आवाज में कहती है, ''बिटिया को मैं प्याज की तरह जमीन के अन्दर दबाकर नहीं रख सकती, इसके चलते चाहे जो कुछ हो। जिस समाज में हजारों की तादाद में जवान विधवाएँ रहेंगी, वहॉ यही सब तो होगा।''[14]

वास्तव में गौरी की एक निडर और दृढ़ निश्चयी चरित्र के रूप में पाठकों

के सामने आती है वह अच्छे से जानती है, समाज उन्हीं को दबाता है जो कमजोर है, डरपोक हैं लेखक गौरी की माँ जैसे पात्र के माध्यम से समाज में परिवर्तन का आवाहन करते हैं।

सुशीलाः सुशीला इस उपन्यास से अत्यंत गौण पात्र हैं, यह भी एक बाल विधवा है। पति की मृत्यु के बाद समाज में शोषण का शिकार होती है। काशी में जाकर एक बदमाश महराज के पल्ले पड़ी जिसने उसका खूब शोषण किया और अंत में एक खत्री दुकानदार के साथ रहने लगती है, उसके घर की मलिकाइन बन जाती है।

हमारे समाज में न जाने कितनी ही गौरी सुशीला जैसी महिलाएं हें जो घुट–घुट के अपना जीवन व्यतीत करती हैं। पुरूष समाज में एक कठपुतली बनकर रह ग यी है, जिनकी विवशता का लाभ उठाकर धनवान लोग उनका हर तरह से शोषण करते हैं। इसलिए नागार्जुन इस उपन्यास में समाज को यही संदेश देते हैं कि प्रत्येक स्त्री शिक्षित एवं स्वावलंबी बने ताकि कोई भी पुरूष उनका शोषण न कर सके। यदि स्त्री चेतनाशील होगी तो वह प्रत्येक कार्य कुशलता से कर सकती है। स्त्रियों को चेतनाशील बनाने के लिए शिक्षा ही एक मात्र साधन है। शिक्षित स्त्री ही जीवन के प्रत्येक क्षेत्र में नई राहें खोल सकती है, नये जीवन मूल्यों और अवधारणाओं को स्थापित कर सकती है।

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दालों एवं अनाजो का पोषण मूल्य एवं स्वास्थ्य पर इनका प्रभाव

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मनुष्यों के आहार में खाद्यान्न का विशेष स्थान है, अनाज एवं दालें मुख्य खाद्य पदार्थ है जो मनुष्यों को आवश्यक पोषक तत्व प्रदान करते है। अनाज एवं दलहन फसलों के गुण और स्वास्थ्य लाभ फाइटोकेमिकल संरचना और फसलों के गुणों से सम्बन्धित सारांश प्रस्तुत करते है। आधुनिकता के दौड़ में फास्ट फूड के प्रचलन से हमारे भोजन में दालों का प्रयोग कम हो गया है। जिसका प्रभाव बच्चों, युवा विशेषकर किशोर, किशोरियों पर पड़ रहा है। समय से पूर्व मोटापा, मधुमेह आदि की संभावनायें बढ़ गई है।

अनाज एवं दालों के रूप में जौ, जई, बाजरा, गेहूँ, मक्का, चावल, मटर, उड़द दाल, अरहर, चना, सोयाबिन आदि शामिल है। जो पोषक तत्वों से परिपूर्ण गुणों, जैव प्रक्रिया, एंटी ऑक्सीडेंट गुणों लाभकारी स्वास्थ्य प्रभाव आदि के लिए जिम्मेदार होते है। अनाजों का पोषक मूल्य अलग–अलग होता है। अनाजें में प्रोटीन, वसा, रेशा, कार्बोज, फॉस्फोरस आदि तथा दालों में वसा (कम मात्रा में), प्रोटीन 20 से 25 प्रतिशत तक होता है। श्वेतासार, कैल्शियम, लौह लवण आदि अच्छी मात्रा में जो हमारे स्वास्थ्य को बनाये रखने में अहम भूमिका निभाते है। अनाज एवं दाल एंटी ऑक्सीडेंट से भरपूर होते हैं। बच्चों में अनाज एवं दालों की कमी से प्रोटीन, ऊर्जा की कमी, कुपोषण, मैरास्मस एवं क्वाशियोरकर जिससे उनका वृद्धि एवं विकास रूक जाता है। दालों में मांस, मछली एवं अण्डे से भी ज्यादा प्रोटीन होता है। अनाज एवं दालों से 90 से 94 कैलोरी उष्णता प्राप्त होती है। अनाज एवं दालों में विटामिन बी1, बी2 निकोटीनिक अम्ल भरपूर मात्रा में पाया जाता है। अनाज एवं दालों से पर्याप्त पोषक तत्व प्राप्त किया जा सकता है।

मुख्य शब्द – एंटी आक्सीडेंट, फाइटोकेमिकल, मैरास्मस, क्वाशियोरकर, कार्बोज

प्रस्तावनाः अनाज एवं दालो में पर्याप्त पोषक तत्व उपस्थित होते है। अनाज और ज्वार बाजरी मुनष्य जाति का मुख्य आहार होता है। ये स्टार्च के मुख्य स्त्रोत है। अनाजो में गेंहूँ, चावल, जव, जई, रागी, बाजरा आदि प्रमुख है। ये स्टार्च के मुख्य स्त्रोत है। इसमें प्रोटीन, कुछ खनिज–लवण और बी0 वर्ग के विटामिन पाया जाता है। ज्वार बाजरी में एमिनो अम्ल की मात्रा अच्छी पाई जाती है। कुछ प्रमुख आहार निम्न है –

गेहूँ: विश्व में सभी भागों में मनुष्य के आहार में गेहूँ नामक अनाज का मुख्य स्थान है। पूरे विश्व मे गेहूँ की खेती की जाती है। गेहूँ के दाने में तीन भाग होता है (1) अकुंर–भाग (2) भ्रूण पोश–जिसमें पर्याप्त मात्रा में स्टार्च व न्युन प्रोटीन होता है।(3) तीसरे भाग में अनाज व आवरण आते है– छिलका, या बीजावरण, हायलिन एवं एल्यूरॉन कोषीय झिल्ली प्रमुख है।

गेहूँ को हम विभिन्न रूपों में प्रयोग करते है जैसे–गेहूँ का आटा, मैदा, गेहूँ की सूजी या रवा। गेहूँ में प्रति 100 ग्रा0 आटे में 12.8 ग्राम प्रोटीन, 1.5 ग्राम वसा 1.2 ग्राम रेशा, 71.2 ग्राम कार्बोज, 0.5 ग्राम फास्फोरस 5.3 ग्राम आयरन, होता है। इसके अतिरिक्त कैरोटीन, थायमिन, नियासीन, राइबोफ्लेविन तथा एस्कार्बिक अम्ल पाया जाता है 100 ग्राम गेहूँ से 348 कैलोरी उर्जा प्राप्त होती है।

चावलः चावल सभी एशियाई देशो में पर्याप्त मात्रा में उत्पन्न किया जाता है। चावल अधिक स्वादिष्ट एवं पोषक तत्वों से भरपूर है। इसके विपरित कुछ मोटे एवं लाल चावल निम्न कोटी के होते है जो सस्ते होने कारण गरीबो द्वारा उपयोग किया जाता है। चावल तीन प्रकार के होते है (1) अरवा चावल (2) उसना चावल जो धान को उबालकर कूटा जाता है (3) मशीन द्वारा कूटा चावल। छिलके रहित चावल में बाहरी आवरण और अकुंर भाग होता है जिसके प्रोटीन 6.8 प्रतिशत होता है। चावल विटामिन बी0 के अच्छे स्त्रोत है इसमें कैल्सियम कम पाया जाता है। आयरन एवं फास्फोरस अच्छी मात्रा में होता है मशीन से साफ चावल में थायमिन की मात्रा कम होती है फलस्वरूप बेरी–बेरी हो जाता है।

मक्काः मक्का विश्व के अनेक देशो में पाया जाता है मक्के का आटा, सत्तू, मक्के का दलिया, पोहे के रूप में प्रयोग किया जाता है। मक्के में 8.12 प्रतिशत प्रोटीन एवं कैल्सियम कम होता है। सम्पूर्ण मक्का थायमिन, पाइरिडॉक्सिन, पेन्टोथेनिक एसिड का अच्छा स्त्रोत है। मक्के में राइवोफ्लेविन, नियासिन कम मात्रा में होता है। पूर्व शालेय बालक के लिए भी मक्का मुख्य आहार हो सकता है। इस आयु में कुपोषण अधिक देखने को मिलता है नियासिन की कमी से पेलाग्रा रोग होता है।

जईः–जई का उपयोग नास्ते के आहार के रूप में होता है। जई में थायमिन, पाइरिडाक्सिन और पेन्टोथेनिक एसिड, रिबोफ्लेविन और नायसिन पर्याप्त मात्रा में होता है जई में प्रोटीन 12.18 प्रतिशत होता है।

जौः जौ का सर्वाधिक उपयोग माल्ट बनाने में किया जाता है माल्ट का उपयोग बच्चों तथा कमजोर लोगों के लिए पौष्टिक दवाई बनाने में होता है जौ में 9.12 प्रोटीन, कैल्सियम पूर्ण होता है जौ में थायमिन, पेन्टोथेनिक अम्ल, पाइरिडॉक्सिन अच्छी मात्रा में होता है।

ज्वार बाजरीः कई देशों में ज्वार–बाजरे उपयोग में आते है इनमे काफिर कार्न, बाजरा, रागी प्रमुख है ज्वार को दो कुटकी, लाल ज्वार आदि।

ज्वारः ज्वार में थायमिन पाइरिडाक्सिन अच्छी तथा नायसिन साधारण मात्रा में होता है, कैल्सियम, आयरन कम तथा फास्फोरस अच्छी मात्रा में होता है।

रागीः रागी में प्रोटीन 6.9 प्रतिशत होता है कैल्सियम बहुत अच्छी मात्रा मे होता है रागी में आयरन, फास्फोरस, थायमिन अच्छी मात्रा में होता है।

दालेः विश्व के करोड़ों लोगों के आहार में दाल प्रोटीन का उत्तम साधन है। दालों को तीन भागों में विभाजित किया जाता है।

(1) चना (2) मटर (3) सेम–अरहर, मूंग मसूर, उड़द चना की दाल।

(1) चना दालः चना दाल रोगियों के लिए फायदेमंद होती है चना में वसा कम होता है जिससे कोलेस्ट्राल के स्तर को कम करने में मदद करता है। इसका ग्लाइसेमिक इंडेक्स कम होता है जो मधुमेह रोगी के लिए महत्वूपर्ण है।

मटरः मटर यह ताजा हरे मटर के रूप में सूखे मटर के रूप में प्रयोग होता है इसमें कार्बोज, प्रोटीन, विटामिन, बी0_2 कैल्सियम, सल्फर, फास्फोरस आदि पाया जाता है।

मसूरः मसूर दाल प्रकृति में गर्म होती है इस दाल का सेवन करने से शरीर में रक्त की मात्रा बढ़ती है एवं दस्त एवं कब्ज की समस्या दूर होती है साथ ही पेट से सम्बन्धित बिमारिया ठीक हो जाती है। मसूर की दाल घी में छौंक कर खाने से आंखों की रोशनी बढ़ती है एवं बवासीर के रोगी को फायदा होता है। मसूर को भीगा कर दूध में फेट कर चेहरे पर लगाने से मुहांसा ठीक हो जाता है।

उड़द दालः उड़द की दाल में आयरन अधिक मात्रा में होता है यह ऊर्जा के स्तर को बढ़ाता है। जो लोग मांसाहार का प्रयोग नहीं करते उनके लिए प्रोटीन युक्त आहार है। इसके उपयोग से कमजोरी, हिस्टीरिया सम्बन्धित रोग से छुटकारा मिलता है। उड़द मधुमेह के रोग को दूर करने के सहायक है।

मूंग दालः मूंग दाल में कैलोरी बहुत कम होता है साथ ही आयरन और पोटैशियम अधिक होता है। मूंग दाल से मुहांसे और सूखी त्वचा से निजात मिलता है साथ ही सुन्दरता बढ़ाने के लिए सर्वोत्तम साधन है। मूंग दाल गैस की समस्या, सूजन को रोकता है ये एण्टीआक्सीडेंट है जो मधुमेह, दिल की बिमारी, कैंसर आदि से लड़ने में सहायक है।

अरहर दालः अरहर दाल को तुअर की दाल के रूप में भी जाना जाता है। अरहर को भारत में प्रथम प्रधानता दी जाती है। अरहर में प्रोटीन, वसा, कार्बोज एवं कई तरह के पोषक तत्व होते है। यह प्रोटीन का सर्वोत्तम स्त्रोत है। यह मुंह के छालों में फायदेमंद है अरहर में फोलिक अम्ल होता है जो गर्भवती महिलाओं के लिए लाभदायक होता है। अरहर से खासी गैस, अम्लता, बवासीर, पेट दर्द, जहर के प्रभाव से छुटकारा मिलता है।

इण्डियन कौसिंल फार मेडिकल रिसर्च के अनुसार परिवार के पांच सदस्यों के लिए मासिक आवश्यकताः

सदस्य	अनाज	दाल
औसत मेहनत करने वाला पुरूष	14.4	27
औसत मेहनत करने वाली महिला	10.8	2.25
1–6 वर्ष का बच्चा	5	1.1
7–12 वर्ष का बच्चा	9	1.8
बुजुर्ग तीसरा बच्चा	9	1.8
कुल–	482	9.65

अन्य अनाजो की तुलना में मोटे अनाजो की पौष्टिकता मे अधिकताः

अनाज	प्रोटीन	कार्बोज	मिनरल	आयरन	कैल्सियम
बाजरा	10.6	1.3	2.3	16.9	38
गेहूँ	11.8	1.2	1.5	5.3	41
चावल	6.8	0.2	0.6	0.7	10
कोदो	8.3	9	2.6	0.6	31
कुटकी	7.7	7.6	1.5	9.3	17

दालो की पौष्टिकताः

सम्पूर्ण दाल	प्रोटीन	कार्बोज	आयरन	थायमिन	रिबोफ्लेविन
चना	20–25	55	5.0	.20	.15
मटर	22	64	5.0	1.3	.85
अरहर	25	61	9.0	1.3	15
मूंग	25	55	9.0	3.50	15

इस प्रकार दालों में 55 से 61 प्रतिशत कार्बोज (स्टार्च के रूप में), 60 से 240 मि0ग्राम प्रति 100 ग्रा0, लौह लवण 5.0 से 10मी0, विटामिन बी1,बी2, निकोटिन अम्ल, थायमिन 1.3 से 3.5 मि0ग्रा0 होता है दालो में विटामिन सी0 का अभाव होता है परन्तु जब दालो को अंकुरित किया जाता है तो विटामिन सी0 बढ़ जाता है दालों में लायसिन एवं थ्रियोनिन अच्छी मात्रा में पाया जाता है जबकि अनाजो में प्रोटीन की मात्रा कम होती है इसलिए अनाजों के साथ दाल में प्रोटीन मिलाकर देने से प्रोटीन की मात्रा प्रभावक पूर्ति करता है एवं कुपोषण दूर होता है। खेसारी दाल B-N oxalyla-B dicimine acid नामक विषैला पदार्थ होता है। जिसके उपयोग से लेथरिज्म हो जाता है जिससे पैरो में लकवा मार देता है दालो को बनाने से पूर्व भिगा देने से टाक्सीन कम हो जाता है विशेषज्ञों की राय है कि अपने समय सारणी में दाल एवं अनाज नियमित रूप से शामिल करे, बच्चों के आहार में अनाज एवं दाल पर्याप्त मात्रा में दिया जाना चाहिए जिससे उनकी वृद्धि एवं विकास में बाधा न पहुंचे सोयाबीन से तरह–तरह के व्यंजन बनाकर विभिन्न बिमारियों मे दिया जाता है जैसे–न्यूट्रीनगेट्स, पनीर, सोया पाप। अनाज एवं दालों की कमी से वृद्धि एवं विकास अवरूद्ध हो जाता है जिससे कुपोषण, एनिमिया, मोटापा, मधुमेह, हृदय रोग आदि हो जाता है इसके अलावा दालों में फाइटोकेमिकल्स, सैपोनिन, एंटी कार्सिनाजेनिक प्रभाव होते है।

अध्ययन का उद्देश्यः इस अध्ययन का उद्देश्य अनाजों एवं दालों के पोषण गुणवत्ता एवं इनका स्वास्थ्य पर पड़ने वाले प्रभाव एवं लाभ का अध्ययन करना है अनाज एवं दालों से पोषक तत्व प्राप्त होते है जो शारीरिक निर्माण, ऊर्जा प्रदान करना रोग प्रतिरोधक क्षमता प्रदान करने में सहायक है।

अनाज एवं दालो से स्वास्थ्य लाभ :

1. अनाज एवं दाल मानव आहार की मूलभूत आवश्यकता है परन्तु यदि अनाजो को अंकुरित करके खाया जाये तो पोषक मूल्य बढ़ जाता है जो स्वास्थ्यप्रद है।
2. अनाज एवं दालों से शरीर सुडौल, रोगमुक्त, स्वास्थ्य एवं सुन्दर दिखता है।
3. अंकुरित अनाज एवं दाल सामान्यतः कच्चे अनाजो में पोषक तत्व अधिक होता है जिससे पाचनतंत्र स्वस्थ्य रहता है तथा प्रतिरक्षा तंत्र को मजबूत करता है एवं ह्रदय रोग तथा आस्टियोपोरोसिस की समस्याओं को दूर करने में सहायक है।
4. भोजन में अनाज एवं दालों से उच्च फाइबर के अलावा दालो के महत्व पर जोर देते है जिसमें एंजाइम अवरोधक, फाइटेट, आक्सलेट, पॉलीफिनोल, सैपोनिन्स और फाइटोस्टेरॉल होते है।
5. दाल (मटर, उड़द, चना, अरहर) प्रोटीन का महत्वपूर्ण स्त्रोत है इनमें उच्च मात्रा में लाईसीन, ल्यूसीन, एसपारटिक अम्ल, ग्लुटामिक अम्ल और आर्जिनिन होता है जो अच्छी तरह से संतुलित आवश्यक अमिनो अम्ल प्रदान करता है।

सुझावः हमारे अनाज में दाल एवं अनाजो को शामिल करना आहार की सिफारिशो को पूरा करने का एक स्वस्थ्य तरीका है जो कई पुरानी बिमारियों के जोखिम से जुड़ा है इन रोगों पर अनाजो एवं दालों के प्रत्यक्ष प्रभाव को प्रदर्शित करने के लिए दृघकालिक यादृच्छिक नियन्त्रित परीक्षक की आवश्यकता है। कुपोषण मे दाल एवं अनाजो के साथ मुंगफली मिश्रीत करके देने से कुपोषण दूर किया जा सकता है।

निष्कर्षः यह समीक्षा विभिन्न अनुप्रयोगों में उनके उपयोग के लिए आशांकन इनके प्रमुख कार्यात्मक गुणों और अवसरों के लिए पल्स प्रोटीन एवं अनाज वर्तमान और उभरती तकनीकी विशेषताओं का अवलोकन करती है। अनाज के छिलके में पर्याप्त रेशा होने के कारण यह स्वास्थ्य की दृष्टि से बहुत महत्वपूर्ण है छिलके युक्त दाल, अनाज, चोकर युक्त आटा आदि खाने से कैंसर, कब्ज एवं विभिन्न रोगों से बचा जा सकता है। होल ग्रेन्ज या साबूत अनाज एवं दाल को ज्यादातर खाये एक चौथाई थाली की मात्रा में। साबूत एवं पूर्ण अनाज गेहूँ, जौ, बाजरा, मक्का, ज्वार, ब्राउन राइस या असंसाधित चावल और इससे बने खाद्य पदार्थ जैसे गेहूँ के आटे से बनाई गयी रोटी, मैदे से बनाई गयी, रोटी वाइट राईस और अन्य संसाधित अनाजो से रक्त शर्करा पर, इन्सूलिन पर कम प्रभाव पड़ता है।

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सुदूर संवेदन एवं भैगोलिक सूचना तंत्रः भू एवम् ग्रहीय विज्ञानों में प्रयुक्त नवीन तकनीकि

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सरांशः सुदूर संवेदन एक तकनीकि है वहीं भैगोलिक सूचना तंत्र (GIS) एक विषेषप्रकार का सॉफ्टवेर है जिसमें आँकड़ों के भंडारण़ परिवर्द्धन विष्लेषण के साथ–साथ रूपान्तरण व नेटवक विष्लेषण की सुविधा भी उपलब्ध होती है। सुदूर संवेदन से अभिप्राय ऐसी तकनीकि से है जिसमें किसी वस्तु की जानकारी बिना वस्तु विषेष को स्पर्ष किये संवेदक द्वारा ली जाती है।
संवेदन के लिए आवष्यक ऊर्जा की प्राप्ति विद्युत चुम्बकीय विकिरण (EMR) से प्राप्त होती है। इस प्रकार यह स्पष्ट है कि बिना विद्युत चुम्बकीय विकिरण (EMR) के सुदूर संवेदन संभव नही है। जब वायुमडल में बादल छाये होते हैं। तो सुदूर संवेदन के लिए राडार (REDAR) का प्रयोग किया जाता है। राडार स्वयं विधुत चुम्बकीय विकिरण विकिरत करते हैं जिससे सौर्यिक विकिरण की अनुपलब्धता की भरपाई हो जाती है। इस प्रकार सुदूर संवेदन दो प्रकार के होते है–सक्रिय सुदूर संवेदन एवं अक्रिय सुदूर संवेदन। चुम्बकीय विकिरण ऊर्जा का प्रमुख श्रोत सूर्य है। विद्युत चुम्बकीय विकिरण का वह परास जो सुदूर संवेदन के लिए उपलब्ध हो होता है। उसे वायुमंडलीय खिड़की कहते हैं। विभिन्न तरंग दैर्ध्य के लिए भिन्न–भिन्न संवेदन कार्य करते हैं।

Key words - सुदूर संवेदन.भैगोलिक सूचना तंत्र. संवेदन तरगं दैर्ध्य

प्रस्तावनाः सुदूर संवेदन तकनिकि का मुख्य विकास बीसवीं ष्षताब्दी में द्वितीय विष्वयुद्ध के समय प्रारम्भ हुआ । चुँकि वायुयानों को एक निष्चित सीमा से ऊचा नही उड़ाया जा सकता अतएव वायव फोटोग्राफी द्वारा किसी बड़े क्षेत्र को एक ही फोटोग्राफ में अंकित करना संभव नहीं है। द्वितीय विष्वयुद्ध में वायव फोटोग्राफी का व्यापक रूप से उपयोग किया गया था।

1950 के दषक में राकेट तकनीक तथा अन्तरिकक्ष विज्ञान के क्षेत्र में USE एवं USSR के मध्य प्रतिस्पर्धा चरम पर पहुँच गया।1955 में USA के राष्ट्रीपति ने यह घोषणा कि 1957–58 के अन्तर्राष्ट्रीय भूभैतिक वर्ष में एक कृत्रिम उपग्रह छोड़ा जायेगा किन्तु इससे पूर्व ही USSR ने 4 अक्टुबर 1957 का स्पूतनिक–नामक अपने प्रथम उपग्रह को प्रक्षेपित कर दिया। भारत में अन्तर्राष्ट्रीय दूरसंवेद का प्रारम्भ 1975 में हुआ जब ISRO ने आर्यभट्ट नामक प्रथम उपग्रह का प्राक्षेपण किया।

उपग्रह दो प्रकार के होते हैं।

(1) सूर्य तुल्यकालिक

(2) भू–तुल्यकालिक

सूर्य तुल्य कालिक उपग्रह पृथ्वी से 800 कि0मी0 की ऊचाई पर स्थापित किये जाते हैं। मुख्यतः भू संसाधनों के सर्वेक्षण एवं षोध कार्य हेतु प्रक्षेपित किये जाते हैं। इन्हें सूर्य तुल्यकालिक इसलिए कहते हैं कि पृथ्वी परिक्रमा ध्रुव से ध्रुव की ओर करते हुए विषुवत रेखा को एक निष्चित स्थानीय समय पे हर बार पार करते हैं।

जबकि भूतुल्यकालिक उपग्रह पृथ्वी की अक्षीय गति से साम्य रखता है और 24 घंटे में एक परिक्रमा पूरी करता है। प्रकार यह हमेषा ही पृथ्वी के किसी भाग के सामने स्थिर होता है। कभी भी यह अकेले पूरी पृथ्वी को आच्छादित नही करता है। धरातल से 36000कि0मी की ऊँचाई पे स्थापित किये जाते हैं। इस प्रकार के उपग्रहों के प्रक्षेपण के लिए भारत अभी भी गैरमुल्को पे आश्रित है। दूरदर्षन के प्रसारण में इन्ही उपग्रहों की भूमिका होती है।

संवेदकः जैसे हमारे षरीर में आँख फिट है उसी प्रकार इन उपग्रहों में संवेदक लगे होते हैं जो परावर्तित ऊर्जा का संसूचन करते हैं। उपग्रह संवेदकों के लिए प्लेटफार्म की तरह कार्य करते है। दूर स्थित वस्तुओं या दृष्य क्षेत्रों के सम्बन्ध में संचित करने योग्य सूचना एकत्रित करने वाली कोई भी यांत्रिक विधि या उपकरण संवेदक कहलाती है। संवेदक किसी खास तरंग दैध्य के लिए ही क्रियाषील होते है। इस प्रकार अलग अलग तरंगदैध्य अलग–अलग संवेदक कार्य करते हैं। विधुत चुम्बकीय विकिरण का एक खास स्पेक्ट्रम ही सुदूर संवेदन के लिए प्रयुक्त होता है इसे ही वायुमडलीय खिड़की कहते हैं। सुदूर संवेदन के लिए उपलब्ध विधुत चुम्बकीय विकिरण में कार्यरत संवेदकों का विवरण निम्नवत है।

संवेदक	विधुत चुम्बकीय विकिरण का परस
1. वायव कैमरा (Aerial Camara)	0.4u m-0.7um
2. बहुस्पेक्ट्रमी क्रमवीक्ष्क (MSS)	0.3um-0.9um
3. .तापीय क्रमवीक्ष्क (TM/ETM	(3-5)um(8-14)um
4. .लद्यतरंग संवेदक (Micro wave sensor)	(1mm-1m)

संवेदकों के अन्दर क्रमवीक्ष्क (Sceanner) लगे होते हैं जो वस्तु द्वारा परावर्तित ऊर्जा को स्कैन करते हैं। क्रमवीक्ष्ण करने के ढंग तथा आन्तरिक बनावट के अनुसार बहुस्पेक्ट्रमी क्रमवीक्ष्क दो प्रकार के होते हैं।

1. **Cross track scanner:** यान के पथ के लम्बवत दिषा में क्रमवीक्ष्ण।
2. **Along Track Scanner:** यान के पथ के अनुदैर्ध्य दिषा में क्रमवीक्ष्ण।

हिवस्कब्रुम क्रमवीक्ष्क अपने धरातलीय उड़ान मार्ग के आर–पार लम्बवत दिषा में अत्यन्त महीन महीन परस्पर समानान्तर एवं –दुसरे को करीब–करीब स्पर्ष करने वाली असंख्या क्रमवीक्ष्ण रेखाओं (Scan lines) को अलग–अलग क्रमवीक्ष्ण करता हुआ सम्बन्धित धरातलीय मार्ग को कवर करता है।

पुषब्रम क्रमवीक्ष्क (Pushbroom MSS)हिवस्कबुम बहुस्पेक्ट्रमी क्रमवीक्ष्क की भाँति इस क्रमवीक्ष्क में कोई घूर्णी अथवा ढोलायमान दर्पण नही होता वरन उसके स्थान पर एक लेंस लगा है जो उड़ान मार्ग के समानान्तर स्थित समस्त क्रमवीक्ष्ण रेखाओं से प्राप्त ऊर्जा को क्रमवीक्ष्क के रैखिक ब्यूह पर फोकस करता है।

पुषब्रम प्रणाली के रैखिक ब्यूह में संवेदन किये जाने वाले प्रत्येक तरंग दैर्ध्य के लिए एक पृथक पंक्ति होती है प्रत्येक पंक्ति में एक हजार या अधिक संवेदक लगे होते हैं। पुषब्रम प्रणाली में रैखिकब्यूह के प्रत्येक संसूचक का वास समय क्मससस ज्पउमद्ध अर्थात किसी धरातलीय विभेदन प्रकोष्ठ में सामने रहने या निवास इसे की अवधि अपेक्षाकृत लम्बी होती है। संवेदन किसी भी तत्व द्वारा परावर्तित विकिरण की मात्रा (अलबेडो) को ही संसूचित करते हैं। इस संसूचित ऊर्जा के मात्रा को ही अंकीय रूप में भंडारित किया जाता है। भंडारण की तकनीकि के आधार पर तीन प्रकार के अंकिय बिम्ब स्वरूप (Digital image format) होते हैं।

1. BIP : प्रत्येक बैण्ड के पिक्सल क्रमषः भंडारित होते हैं अर्थात इस व्यवस्था का प्रमुख तत्व पिक्सल है।
2. BSQ: भंडारण बैण्ड के अनुसार होता है। अर्थात इस व्यवस्था का प्रमुख तत्व बैण्ड है।
3. BIL: प्रत्येक बैण्ड की प्रथम द्वितीय तृतीय पंक्तियाँ क्रमषः भंडारित होती है। इस व्यवस्था का प्रमुख तत्व पंक्ति है।

बहुक्रमवीक्ष्क प्रणाली में मुख्यतः4 बैण्ड होते हैं। जो नीले हरे लाल व अवरक्त विकिरण के तरंगदैर्ध्य को अवषोषित करते हैं। जब अवरक्त विकिरण को लाल को हरा तथा एवं हरा रंग को नीला रंग की बैण्ड से प्रतिस्थापित करते हैं तो इसे false color composite(FCC) कहते हैं । अंकीय बिम्बों की विभेदन क्षमता भी महत्वपूर्ण है जो चार प्रकार की होती है–

1. **स्पेक्ट्रमी विभेदन** : स्पेक्ट्रमी विभेदन किसी संसूचक द्वारा रिकार्ड किये जाने वाले तरंगदैर्ध्य अन्तराल को बताता है। संसूचक के पीक प्रत्युत्तर के 50प्रतिषत क्षेत्र पर रिकार्ड किये गये तरंगदैर्ध्य अन्तराल में उस संसूचक की स्पेक्ट्रमी विभेदन कहते हैं।
2. **स्थानिक विभेदन :** स्थानिक विभेदन दो वस्तुओं के बीच की वह न्यूनतम दूरी है जिस पर उस वस्तुओं के प्रतिबिम्बों को स्पष्ट एवं एक दूसरे से पृथक देखा जा सके ।
3. सामयिक विभेदनः वह न्यूनतम समय जिससे किसी वस्तु का बिम्ब लेकर उसे भडारित किया जाता है।
4. **रेडियोमिय विभेदनः** विधुत चुम्बकीय विकिरण वह न्यूनतम परास जिसे विभेदन संसूचित कर सकता है।सुदूर संवेदन से प्राप्त आँकड़े प्रत्यक्षतः प्रयुक्त नही किये जाते हैं। क्योंकि इसमें अनेकों अषुद्धियाँ होती है इन्हें उपयोग में लाने से पूर्व ठीक करना होता है।

वस्तुतः सुदूर संवेदन से प्राप्त आँकड़ो का क्रय–विक्रय भारत में सरकारी संस्था राष्ट्रीय सुदूर संवेदन संस्थान (NRSC हैदराबाद) द्वारा किया जाता है जो उपग्रहों द्वारा प्रेषित आँकडों के एकत्रीकरण के साथ–साथ इनके परिवर्द्धन का कार्य भी करती है। सुदूर संवेदन से प्राप्त आँकड़ो की सटीक व्याख्या के लिए प्रषिक्षण आवष्यक है जो भारतीय सुदूर संवेदन संस्थान (Institute of Remote Sensing Dehradun) द्वारा संचालित किया जाता है । NRSC एवं IIRS दोनों ही भारतीय अंतरिक्ष अनुसन्धान संगठन (Indian Space research organization ISRO) की इकाईयाँ है। बिना प्रषिक्षण के उपग्रह द्वारा प्राप्त बिम्ब में यह जानना कठिन होता है सीधी रेखा–नहर सड़क अथवा पहाड़ की श्रृंखला है।

संसूचन के समय उपग्रहों की गति एवं ऊँचाई में परिवर्तन के साथ पृथ्वी की घूर्णन गति के कारण भी अंकीय आंकडों में अनेकों विकृतियाँ आ जाती है। संवेदन के लिए प्रयुक्त

दर्पण के कोण में परिवर्तन भी अंकीय आंकडों की षुद्धता को प्रभावित करता है। प्रयोग से पहले इन अषुद्धियों को दूर करना होता है। इस अंकीय बिम्ब परिषोधन कहा जाता है। प्रमुख विकृतियाँ निम्नलिखित है–

परिपथीय आंकडों द्वारा मूल्यांकित विकृतियाँ :–

1. पृथ्वी के घूर्णन द्वारा उत्पन्न विकृतियाँ
2. अन्तरिक्ष यान की गति में परिवर्तन से उत्पन्न विकृतियाँ

भूनियंत्रण सूचनाओं द्वारा मूल्यांकित विकृतियाँ :–

1. अन्तरिक्ष यान की ऊँचाई में परिवर्तन में उत्पन्न विकृतियाँ
2. अन्तरिक्ष यान के नमन में परिवर्तन में उत्पन्न विकृतियाँ

नियमित विकृतियाँ :–

1. क्रमवीक्ष्क दर्पण के वेग में परिवर्तन में उत्पन्न विकृतियाँ
2. क्रमवीक्ष्क विकृतिया–ँ

(क) क्रमवीक्ष्क पंक्ति का मुड़ना, (ख) किसी क्रमवीक्ष्क का एक अन्तराल के पष्चात लगातार अदृष्य होगा। (ग) किसी पंक्ति का ज्यादा चमकदार होना।

उपर्युक्त परिशोधित आंकडा कों क्रांतिवर्धन (Enhancement) किया जाता है

जिससे ये सुस्पष्ट हो जाते हैं और इन्हें विश्लेषित करना सुगम हो जाता है।

इस प्रकार वस्तुओं एवं प्राकृतिक तत्वों के पहचान के आकार् आभा् गठन प्रतिरूप व साहचर्य इत्यादि पहलुओं पर विचार करना होता है। सर्वाधिक महत्वपूर्ण यह है कि इस तकनीकि द्वारा प्राप्त परिणाम तब तक मूल्यहीन है जब तक षोधार्थी प्राप्त परिणाम को क्षेत्र सर्वेक्षण द्वारा जाँच (Cross-verity) नही कर लेता है। इस प्रकार इस तकनीकि द्वारा विस्तृत क्षेत्र का सर्वेक्षण द्वारा न्यूनतम समय में संभव है। परिणामतः इस तकनीकि का प्रयोग भूगोल ,भूविज्ञान् भू– भैतिकी् वायुमंडल ,विज्ञान ,समुद्र विज्ञान हिम अध्ययन पर्यावरण विज्ञान एवं वनस्पति विज्ञान इत्यादि में बहुतायत रूप से किया जा रहा है। इस तकनीकि के अनुप्रयोग को देखते हुए 21वी षताब्दी को भू –सूचना तंत्र Geo- informatics का युग कहा जा सकता है। भौगोलिक सूचना तंत्र (Geographical Information System) को भूगर्भ षास्त्र में Geographical Information System तथा वनस्पति षास्त्र में Botanical Information System के नाम से भी पुकारते है।

अनुप्रयोग (Applications) : सुदूर संवेदन से प्राप्त बिम्ब को GIS सॉफ्टवेयर में इम्पोर्ट कर आवष्यकतानुसार सूचनाओं को प्राप्त करते है। षोधार्थी के पास इस सॉफ्टवेयर पैकेज में मानचित्रण के साथ– साथ त्रिविमिय बिम्ब तैयार करने की सुविधा होती है जिससे स्थान विषेष की ऊँचाई ज्ञात हो जाती है एवं स्थलखण्ड के ढाल का निर्धारण हो जाता है। इस 3D बिम्ब को अंकीय उच्चवच प्रतिदर्ष (Digital Elevation Model) के नाम से पुकारते है।

स्थलाकृतिक मानचित्रों में सरिताओं के लम्बाई को धागे से नापने के दुष्कर व थकाऊ कार्य को जी0 आई0 एस0 सॉफ्टवेयर के उपयोग से सरलता व शुद्धता के साथ किया जा रहा है। अपवाह बेसिनों का आकारमितिय विष्लेषण , वलन एवं भ्रंषों की पहचान , स्थलरूपों का मानचित्रण एवं छायादार उच्चवच का निरूपण GIS के माध्यम से अत्यन्त सुगम हो चुका है। छायादार उच्चवच के माध्यम से पर्वत कटकों एवं भ्रंषों की पहचान ,आसानी से हो जाती है।

सैन्य क्षेत्रों में सुदूर संवेदन का प्रयोग बहुत ही तेजी से बढा। वास्तव में इस तकनीकि का प्राथमिक स्तर पर प्रयोग भी विष्वयुद्ध में ही प्रारम्भ हुआ था। भारत सरकार की घोषित अन्तरिक्ष नीति यह है कि वह इस तकनीकि का प्रयोग केवल नागरिक उददेष्यों से ही करेगी लेकिन कारगिल (2001) की घटना के बाद परोक्ष रूप कार्टोसेट का प्रक्षेपण सैन्य संन्दर्भ में था जिसमें 1 मीटर की छोटी दूर तक की वस्तु को भी चिन्हित (Track) किया जा सकता है। आज भारत इस क्षेत्र में दुनिया के चार चुनिंदा मुल्कों में से है। जिसके पास अपना ग्लोबल पोजिशनिंग सिस्टम (GPS) है। गगन (GAGAN) उपग्रहों का एक GPS नेटवर्क है। यह भारत सहित समस्त दक्षेस देशों को नागरिक सुविधा प्रदान करेगा।

यही नहीं हल्के उपग्रहों के प्रक्षेपण में भारत की क्षमता दुनिया में सर्वोत्तम है। भारत ने 2017 में एक साथ 20 उपग्रहों का प्रक्षेपण कर यह साबित भी कर दिया जिसमें विश्व के विकसित देशों के उपग्रह भी थे।

विभिन्न प्रकार के चट्टानों की पहचान, तेल क्षेत्रों की पहचान समुद्र के जल के तापमान के मापन के मौसम का पूर्वानुमान भी इस तकनीकि माध्यम से बेहतर हुआ है। भूजल स्तर के मानचित्रण के साथ–साथ भूस्खलन वाले क्षेत्रों का मापन भी इस तकनीकि से किया जा रहा है। निष्कर्षतः इस तकनीकि के अनुप्रयोग असीमित है।

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चन्द्रकान्त देवताले की कविता : समय और सभ्यता की प्रामाणिक पहचान

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"ज्यों–ज्यों हमारी वृत्तियों पर सभ्यता के नए–नए आवरण चढ़ते जायेंगें त्यों–त्यों एक ओर तो कविता की आवश्यकता बढ़ती जाएगी दूसरी और कवि–कर्म कठिन होता जाएगा।"[1] बीसवीं सदी में कविता के बारे में 'कविता क्या है' निबंध में आचार्य रामचन्द्र शुक्ल का यह कथन 21वीं सदी में पूरी तरह सच साबित हो रहा है। बहुरूपी और बहुवर्णी इस समय में कवि कर्म कठिन हो गया है हाँ कविता की आवश्यकता बढ़ गयी है। मनुष्य मशीन बन चुका है। चारों तरफ बाज़ार और विज्ञापन का घेरा है। आतंक, मृत्यु और दहशत की छाया है। यों हम विकसित सभ्यता में निवास कर रहे हैं। ऐसे समय में 21वीं सदी में कविता द्वारा सभ्यता के स्याह और सफेद रंग को पहचाननें वाले कवितयों में चन्द्रकान्त देवताले। परिवेश की सूक्ष्म पहचान, समय के होते–होते सितरे और तथ्य को कविता में रूपायित कर चन्द्रकान्त हिन्दी कविता की ज़मीन का विस्तार करते हैं। स्थानीयता की ठोस ज़मीन पर कवि वैश्विक सभ्यता के संकट को उजागर करता हैं बाज़ार और पूंजी की नृशंसता और क्रूरता को बेबाक और संतुलित दृष्टि से कवि रचता है। प्रकृति के अवपव और हमारे जीवन में शामिल; आम जन की व्यथा को चन्द्रकान्त बड़ी संजीदगी से व्यक्त करते हैं। चन्द्रकान्त जी का कविता संसार विपुल और व्यापक हैं। यहाँ उनके काव्य संग्रह 'पत्थर फेंक रहा हूँ' जो साहित्य अकादमी द्वारा पुरस्कृत हो चुका है, उसके द्वारा उनके कवि कर्म की पड़ताल की जाएगी।

जीवन के करूण और कठोर अनुभवों को जब वरिष्ठ कवि चन्द्रकान्त देवताले अपनी कविताओं में व्यक्त करते हैं तो वह समय और सभ्यता की गहन समीक्षा को प्रामाणिक दस्तावेज बन जाती है। संघर्ष और संवेदना के इसी बहुविध रूप को चन्द्रकान्त जी अपने काव्य संग्रह 'पत्थर फेंक रहा हूँ' में व्यक्त करते है। संग्रह की समीक्षा करते हुए वरिष्ठ कवि–आलोचक प्रभात त्रिपाठी का यह कथन उल्लेखनीय है, "चन्द्रकान्त, इतिहास को अपने अन्तर्मन की लिखत की सचित्रता और सस्वतरता में दर्ज करता है। समय को सगुण और साकार रूपों में प्रस्तुत करने की उसकी कोशिश जिस कशिश से संभव होती है, कविता उसी कशिश की सगी है। इसीलिए उसके यहाँ सार्वजनिक सैक्त के मुद्दों और घटनाओं या उसकी बैचेन हिस्सेदारी की उवमा के हस्ताक्षर है। इतिहास उसकी कविता में, रोजमर्रा के अनुभवों के भीतर ही रूपायित होता है। इसलिए यथार्थ के उसके प्रस्तुतीकरण में सक्रिय उसकी पक्षधर दृष्टि को, महज़ सूचनात्मक स्तर पर ग्रहण करना न तो उचित है, नहीं संभव। उसके यहाँ समय की तथ्यधर्मिता ही कविता का एकमात्र

और केन्द्रीय कारक नहीं है। यह तथ्य निरे तथ्य से कुछ अधिक है– जैसी बात को वह कवि की भाषा को मुक्त कल्पना में विन्यास करता है। उसे सार्वजनिक और निजी के एकदम अलग–थलग ख़ानों में बांट कर पढ़ना अव्वल तो नाकाफ़ी है और कई बार ग़लत भी।"[2]

परम्परा और परिवेश को चन्द्रकांतजी कविता में साकार रूप में ढालकर, व्यक्तिगत एवं सामाजिक अनुभवों को गहरी संवेदना के साथ प्रस्तुत करते हैं। संग्रह की कविताओं में दर्ज आम जन–जीवन से जुड़े सवालों, अंधेरे और पतनशील समय से टकराने के लिए बार–बार कविता की प्रासंगिकता को सिद्ध करता है और बताता है कि एक विरूद्ध समयम में कविता सशक्त रचनात्मक अभियान है। इस रचनात्मक अभियान में वह कविता के चमकतें और दहकते शब्दों को आज की तरह प्रयोग करते हुए कहते हैं कि, "पत्थर फेंक रहा हूं'' जो पाठक को जगाता भी है और संघर्ष करने की प्रेरणा भी देता है। चन्द्रकांत जी अपने को उन कवियों की परम्परा में जोड़ते है। जिन्होंने अपने समय में सत्ता के विरूद्ध आवाज लगाई और आज भी चुतौती की तरह उपस्थित हैं कविता में। कविता को इसी संघर्ष और चुनौती की गाथा के रूप में विवेचित करते हुए उनका कहना है, "इसी तरह कुछ कवि आग की तरह लपटों में अदृश्य/या धरती में दफ्न होने के बाद भी/मंडराते हैं चुनौती की तरह/और लिखते रहते हैं कविताएं।"[3]

और फिर काव्य रचना की प्रक्रिया के बारे में लिखते हैं तो खुद कवि की काव्य–पक्षधरता भी स्पष्ट होती है–"हमारे खयालों में खदबदाते है ज्वालामुखी/हम दृश्यों को निचोड़ लेते हैं/अपने फेफड़ों में और फिर गडरिए की तरह/हांकते हैं शब्दों को।"[4]

जीवन के यथार्थ को बहुरंगी और बहुविध रूप में व्यक्त करती उनकी कविता में महज सूचना या तथ्य नहीं है। कविता में निजी और सार्वजनिक अनुभवों को एकमएक कर देने की यह रचना प्रक्रिया चंद्रकांत देवताले को बड़ा और विशिष्ट कवि बनाती है। संग्रह की कविताओं में जीवन के विविध रंग उपस्थित हैं। कवि का सामाजिक और नैतिक दायित्व की विवेचना, दांपत्यप्रेम से भीगी कविताएं, स्थानीय और निजी जीवन से दो–चार होते अनुभव सार्वजनिक अनुभव के साथ सभ्यता और संस्कृति की चिंता भी यहां उपस्थितत है।

संग्रह का आरंभ ही 'आग' नामक कविता से होता है जिसमें चंद्रकांत जीवन की विविध संवेदनाओं को एक साथ जीने और स्वीकार करने की बात करते हैं जो उनके कवि रूप की प्रतिबद्धता को भी जाहिर करता है। आग उनकी कविता का प्रिय विषय है, क्योंकि आग हमारे जीवन को ताप देती है, हमारी संवेदनाओं को जगाती है। 'आग' और 'मृत्यु' जीवन को व्यापक और सृजनात्मक अभिप्राय प्रदान करती है। आग का स्वाद ही कवि के शब्दों में प्रेम और जीवन संघर्ष का अनुभव कराता है।

चंद्रकांत देवताले खबरों और आकड़ों के बीच संवेदनहीन 'एक विरूद्ध संसार में' रहने की जटिलता और कविता के द्वारा अपनी प्रतिबद्धता को जाहिर करना बखूबी जानते हैं, "खबरों के बवडंर और आंकड़ों की आस्थावान हिंसा के बीच एक विरूद्ध संसार में महसूस करते हैं हम अपने को जिसमें हैं और जिसके बाहर भी हम आदिम फिर हठात समकालीन"[5]

इस 'अंधेरे समय में' आग और गुस्से को साथ जीते हुए अपने शब्दों द्वारा कोई सुभाषित या आप्तवचन न कहके कवि सच कहना चाहता है। वह ऐसे संसार में नहीं रहना चाहता है, जहां उसे विरोधी स्थिति न मिले, क्योंकि विरोध और संघर्ष से ही तो

उसकी कविता को धार मिलती है। जीवन का सही अर्थ तो इसी में रहकर पाया जा सकता है।

संग्रह में स्थानीय और निजी जीवन से जुड़ी कविताओं को लिखते हुए कवि उसमें रचना का ऐसा रंग भरता है कि वह सिर्फ निजी जीवन का अनुभव विवेचन ही नहीं रह जाती, बल्कि हमारे समय और सभ्यता का प्रमुख प्रश्न भी बन जाती है। 'एक नीबू के पीछे', 'मोचीराम की याद', 'मुठभेड़ झक्की आदमी से', 'फादर शलप्पा', 'ऐसी ही कविताएं हैं। धूमिल के 'मोचीराम' के बाद चन्द्रकांत देवताले 'मोचीराम की याद' नामक कविता में एक किशोर मोचीराम की याद करते हैं, जो बंजर होती हमारी सभ्यता के बीच अपनी ईमानदारी की खुशबू बिखेर जाता है, जिसकी महक आज भी कवि महसूस करता है, "कोशिश की मैंने वह पंजी रख ले/पर लौटा दिया दो का सिक्का उसने कहते–/बिन मेहनत के पैसे गुम या उड़ जाते हैं अंकल/फिर भद्रजनों के बहाने/बाजार को ठेंगा दिखाते/और मेरे लिए/ईमान की खुशबू बिखेरते वह/ आगे बढ़ गया/'मोचीराम' की याद/मेरे आसमान में चमकते हुए।"[6]

प्रेम की कविता लिखते हुए जिस प्रकार प्रगतिशील कवियों नागार्जुन, शमशेर, केदारनाथ अग्रवाल एवं मुक्तिबोध ने दांपत्य प्रेम की अनूठी कविताएं लिखी हैं, उसी परंपरा में चंद्रकांत जी ने अपने इस संग्रह में दांपत्य प्रेम की अविस्मरणीय कविताएं रची है। पत्नी की उजली और प्रेम से भरी आंखे कवि को सदैव स्वयं की एवं दुनियावी हकीकत से रू–ब–रू कराती रही हैं, उसे ताकत देती रही हैं।

प्रेम की इस अनुभूति में महज सौंदर्य या सहज दांपत्य का गान नहीं है, बल्कि कवि संवेदना की गहराई से पत्नी के इस प्रेम के प्रति कृतज्ञता ज्ञापित करता है, क्योंकि इन्हीं आंखों और कड़क–मुलायम हथेलियों के सान्निध्य में उसके जीवन और कविता को सही मायने मिले हैं, कवि को बिखरने से बचाया है।

इनकी कविताएं दांपत्य प्रेम में भावुक होकर लिखी गई प्रेम कविताएं नहीं हैं, बल्कि यह उस आत्मकेंद्रित मध्यवर्गीय मानसिकता से मुक्त एक ईमानदार कवि के शब्द हैं जो दैनंदिन जीवनानुभव और दांपत्य प्रेम की गहरी संवेदनात्मक अनुभूति के रूप में रूपांतरित हुए हैं। पत्नी का प्रेम उसकी कविता को संस्कार देता है, विपरीत परिस्थतियों में संघर्ष करने की चेतना जगाता है। पत्नी के सान्निध्य और प्रेम ने ही 'मुखौटे खरीदती भद्रजनों की भीड़ से' उसे अलग किया है। पत्नी का प्रेम पाने के लिए और उसे दीवाने की तरह प्रेम करने के लिए कवि बार–बार उसके पास आने का वायदा करता है और कहता है 'मैं आता रहूंगा तुम्हारे लिए'–'मैं आऊंगा हमारी परछाइयों के खुशूबूदार गाते हुए दरख्त के पास।"[7]

चन्द्रकांत जी कविताएं आरंभ से ही सत्ता और फासीवादी ताकतों के विरूद्ध कमजोर की ताकत बनकर आई हैं। इस संग्रह में भी वह एक ईमानदार रचनाकार की तरह सत्ता के विरूद्ध आवाज उठाने के साथ स्वयं कवि रूप की सच्चाई और ईमानदार समाज के प्रति अपनी पक्षधरता की समीक्षा करते हैं। एक ईमानदार बुद्धिजीवी और कवि होने के नाते वह व्यवस्था की विसंगतियों का कारक स्वयं को भी मानते हैं। प्रस्तुत संग्रह में कवि अपनी इसी पक्षधरता को व्यक्त करते हुए अपनी आत्म–समीक्षा भी करता है और अपने कवि को पाखंडियों के खिलाफ औकात बताने वाला सही शब्द लिखने के लिए कहता है–

"तुम कवि को इन पाखंडियों के लिए औकात बताने वाला सही शब्द ढूंढ़ों।"[8]

संग्रह की कविताओं में चंद्रकांतजी हमारे आस–पास में घटित होने वाली घटनाओं के बारे में बार–बार हमारा ध्यान आकृष्ट करते हैं, हमें झकझोरतें हैं। 'बुद्ध के देश में', 'अमरीका गए प्रधानमंत्री', 'रात के जंगल में', 'पुस्तक मेले में', और 'प्याज के विषय में', 'ऐसी ही कविताएं हैं जिसमें कवि हमारे समय को बदलने ही, हमारे अंदर के आदमीपन को जगाने, समय और समाज से हमारे सरोकारों की बात करता है। वह अपनी कविताओं में भाषा के सही मायने खोजते हैं, जनतंत्र में जनता को तलाशते हैं तो वही 'धुंआती धरती के विलाप' सुनने के लिए प्रेरित भी करते हैं। इन विपरीत व्यवस्था एवं अंधेरे समय में गुस्से का समुद्र न उबलने पर कवि आक्रोश भरे शब्द में कहता है–

"अधेंरे की आग में कब से/जल रही भूख/फिर भी नहीं उबल रहा/गुस्से का समुद्र/कब तक? कब तक?/विभिन्न भाषाओं और हथियारों से/हत्यारे करते रहेंगे आदमियत का रक्तरंजित अनुवाद/हम सुनते–पढ़ते–लिखते रहेंगे/स्वतंत्रता की परिभाषा/कब?कब??समझ में आएगा/धुंआती धरती का विलाप"[9]

कहना न होगा कि एक ऐसे समय में, जब बाजार और उपभोक्तावादी संस्कृति की चकाचौंध में सच कहीं खो गया है, जीवन जटिल और अधिक जोखिम भरा हो गया है, कवि को भरोसा है कविता पर जो लोगों के अंदर संघर्ष करने की शक्ति भी जगाएगी और सपनों को सच करने की रोशनी भी देगी।

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