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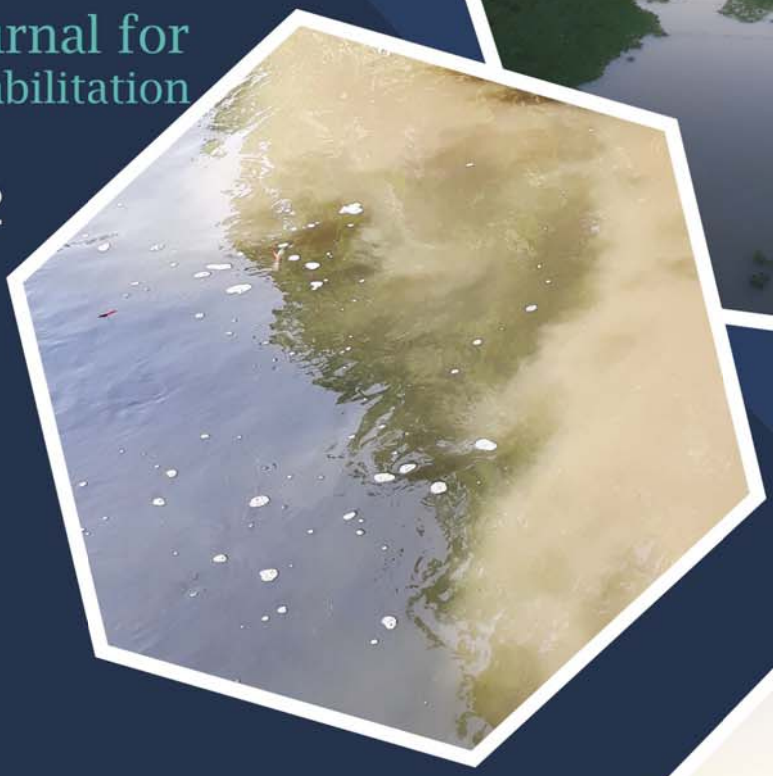

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Distribution pattern of aquatic macrophytes and their biomass in relation to some nutrients in Asan wetland, India

D. S. Malik and Nidhi Joshi

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Abstract

Asan wetland is providing an important unique ecological aquatic habitat for its migratory avian diversity and rich endemic fish species. Asan wetland declared as conservation reserve in 2005 due to its rich biodiversity. The present study revealed that the accumulation of nutrient load is increasing in the wetland from different sources i.e. domestic sewage, forest run off, agricultural practices in its catchment basin and other nonpoint sources. The nitrate was recorded maximum in the range of (3.76 - 5.15 mg/l) in zone D and phosphate was maximum in (2.31- 3.15 mg/l) in similar zone and the minimum concentration of nitrate and phosphate was found as 2.18 - 2.65 and 1.37 - 1.92 (mg/l) in zone A respectively. The species composition and biomass of aquatic macrophytes from different zones of wetland were estimates and their reference index was also calculated to assess the ecological status and maximum percentage *i.e.* (100 %) was found and exhibited that most infestation occurred in zone D. The abundance and presence of macrophytic species are also correlated with the accumulated intake of nitrate and phosphate in water and sediments of wetland. The primary productivity was recorded as (1.02 -8.26 g/m^2/day) and minimum was (0.02-4.10 g/m^2/day) in zone A and macrophyte biomass was also calculated in the range (179- 183 kg/m^2) and minimum was found (55-65 Kg/ m^2). The present macrophyte species, their biomass and productivity were showed that Asan wetland is under mesotrophic state and has potential to enhance its ecological productivity to restore the natural habitats for major faunistic diversity.

Keywords: Asan wetland | Aquatic macrophytes | Nitrate | Phosphate | Nutrients

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Introduction

Aquatic macrophytes serve as an important indicator of nutrient load in littoral zone of wetlands and play an active role in maintaining the ecosystem productivity of the ecosystem. The occurrence of macrophyte species reflects the degree of nutrient enrichment within a shoreline or in littoral zones. Decomposition of dead aquatic plants and leaf litters could be an important source of carbon, nitrogen and

phosphorus particularly in small lakes (Pieczynska, 1993). The abiotic and biotic components can be an indicator of trophic status of wetland as the assemblage of macrophytes (Hauenstein, 2002, Nagasoka, 2004, Li (2009). Littoral zone of wetland may experience patterns of nutrient concentration caused by the natural or artificial inflows as well as by diffuse and non-point sources (Dave, 1992, Drake and Heaney, 1987). Early investigations have shown that aquatic macrophytes reflect the nutrient status of their immediate habitats by their presence or absence and abundance can also be effectively used as biological indicators (Suominen, 1968, Uotila, 1971). The most abundant species of submergent plants are recorded in the wetland were *Myriophyllum spicatum*.L, *Potamogeton pectinatus*, *Ranunculus saniculiforlius* viv, *Ceratophyllum* sp, *Chara* sp. (Burnak and Beklioglu, 2000), these macrophytic species contributed a significant plant biomass to the wetland systems and represent the changing pattern of ecological dynamics of the systems. The macrophytes contributing significant towards the primary as well as biological production of the wetland and serve as the natural habitats for many aquatic major biodiversity. A number of wetlands in India have been studied with emphasis on macrophyte communities (Adoni and Yadav, 1985; Kaul, 1970; Kaul *et al*., 1978; Trishal and Kaul, 1983).

Asan wetland is known as Asan conservation reserve is threatened due to many anthropogenic and natural factors responsible for changing patterns of its ecological dynamics in terms of water quality, sediments, benthos, aquatic macrophytes and faunistic diversity. The high species diversity of migratory birds in Asan conservation reserve and presence of many of globally threatened species makes this wetland as a specific wetland for the conservation of biodiversity and maintain their eco-status sustainably for the promotion of ecotourism centre in Doon Valley of Garhwal Himalaya. Wetlands are often referred to as “biological super markets” for the extensive foodchain and rich biodiversity have been supported by different authors (Whittaker and Likens 1973; Gibbs 1993; Mitsch and Gosselink 1993; Paracuellos 2006). Asan wetland support congregation of large number of migratory and resident’s birds as it has sequential food webs along with mesotrophic status of ecosystem productivity. Aquatic macrophytes have ability to assimilate nutrients via both roots and shoots from the littoral zone of wetland; moreover ammonia prevails in sediment while nitrate does remains in the water. The main environmental conditions of wetlands influencing the distribution of macrophytes include water level fluctuation, depth of water and current velocity (Madsen *et al* 2001: Riis & Hawes 2002; Hrivnak 2005). Aquatic plant biocoenoses respond to environmental changes by modifying their taxonomic composition as well as increase or decrease the plant abundance, while submerged macrophytes respond changes in the environment within years. In shallow low wetland systems, increased nutrient loading results in loss of aquatic vegetation followed by submerged macrophytes have consequences both for diversity and ecosystem productivity. The

submerged macrophytes provide a habitat for other biota and increase the water transparency and nutrient retention in aquatic ecosystems (Carpenter and Lodge 1986; Engelhardt and Ritchie 2001). Different macrophytes species may have a different tolerance to increased nutrient availability in wetland (Portielje and Roijackers 1995). Therefore, a maiden field based scientific study has been made to investigate the macrophyte composition and their biomass from different littoral zones of Asan wetland at Doon valley of Garhwal Himalayan region and contributed to conserve , protection and management sustainable to restore the natural habitats.

Materials and Methods

Study area

Asan wetland is now known as Asan conservation reserve, geographically situated between latitude 30° 24' – 30° 28'N and Longitude 77 ° 40' – 77 °44' E, near the confluence of river Asan and Yamuna Hydel Canal at Doon valley of Garhwal Himalaya in Indian sub-continent. Asan wetland is located in the foot hills of lesser Himalayan zone at Doon valley .Wetland has both shallow and deep water areas with large catchment basin surrounded by forest, agricultural pastures, river basin, and village inhabitants. In the western side of wetland, a barrage (water regulator) is constructed as 287.5 m long and the river bed is 389.4 m above the sea level with the water level of 403.3 m above sea level. The maximum rainfall was received about 250-275 cm. during rainy seasons. Asan

Features	Asan Wetland
Year declared as conservation Reserve	2005
Type of wetland	Man-made
Latitude	30°24'-30°28 N
Longitude	77°40'- 77°44'E
Surface Area	4Km^2
Mean depth (sea level)	403.3 m
Average Rainfall	250 cm

wetland attracts large number migratory as well as local aquatic birds as waterfowl, both waders and divers in winter seasons for the breeding due to the availability of food resources and suitable natural habitats. The four sampling zones were identified to evaluate the aquatic macrophyte status of wetland. The categorization of the zones is done according to the level macrophytic infestation condition. Zone A, which is near the barrage has open water area, Zone B was located in middle part of water reservoir, Zone C contains the direct influx of the Asan River as inlet and Zone D was relatively more infested by the aquatic macrophytes. Each zone was categorized into four sampling stations (Fig. 1).

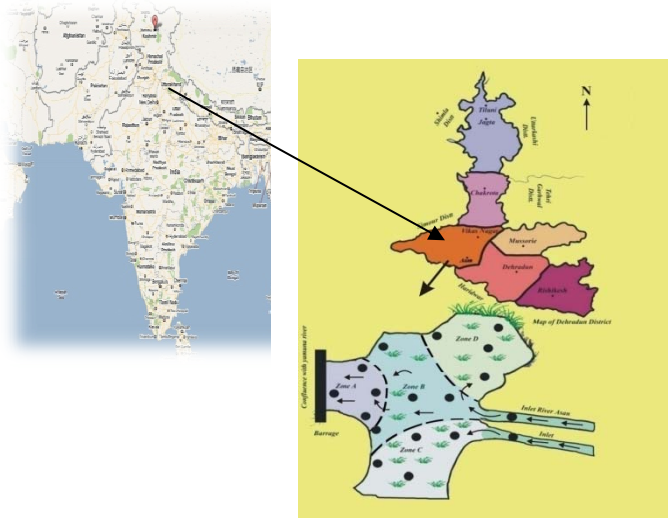


Fig.1: Geo-graphical location and sampling zones of Asan wetland

Methodology

Monthly samplings were done for estimating the macrophytic composition, biomass and other ecological parameters were studied for one year (November 2011 to October 2012). The physical ground surveys were also conducted during the macrophyte's main growth period during rainy season. Several types of macrophytes were identified such as emergent, free floating, submerged types and categorized accordingly. The species of macrophytes were identified with the help of identification key (Fassett, 1960). For analyzing the assessment system, the macrophyte species were classified into groups occurring under same ecological condition. The group of the species with the following ecological qualities was identified: Group A: showing the high abundance on reference conditions and no abundance under non reference conditions. Group B: showed no preference for the reference or non reference condition. Group C: showing high abudance on sites and with very low abundance of group A. (Stelzer, 2003). Macrophytes were sampled in 0.50×0.50 m^2 quadrants (Westlake, 1965, 1971). However for the sampling of some submerged species were collected by Ekman Dredge as methods described in Welch (1948).The plants are kept in the polythene bags and brought to the laboratory. The plants were carefully washed with tap water in the laboratory to remove adhered periphyton and organic and inorganic particulate matter. Next, the plants were oven dried at (80°C) to determine the biomass. The primary productivity of the macrophytes was invested by the Harvest method as described in the (Trivedy and Goel, 1981). The net primary productivity was estimated on the monthly basis. Fresh weights of the plants were taken and net primary production was estimated by adding all the positive values of changes in biomass when values for successive intervals were compared (Vollenweider, 1974). The values of the net primary productivity were assessed both at the individual level of the species. It was expressed in terms of grams per square metre per month (gm^{-2} $month^{-1}$) and the values of annual net primary productivity were expressed in terms of grams per square metre per annum (gm^{-2} yr^{-1}). For obtaining the annual Production, all positive monthly changes of standing crop biomass of a species for each month were added.

Primary productivity by harvest method

Calculation of monthly productivity, the biomass per unit area is estimated at suitable intervals. The productivity in gm dry weight or organic dry (wt/m^2/day) as follows.

$$\text{Biomass} = \frac{b_2 - b_1}{d}$$

Whereas,

$$NPP = \frac{(b_2 \times a_2) - (b_1 \times a_1)}{a_1 \times d}$$

b_1= biomass at time t_1 (g/m^2)

a_1= area covered by macrophyte at time t_1

b_2= biomass at time t_2 (g/m^2)

a_2= area covered by macrophyte at t_2 (m^2)

d = No of days between t_1 and t_2

The most important nutrients accumulated in wetland as phosphate and nitrate in water were contributed significantly for the growth of aquatic macrophytes. Phosphate was determined by Sysrtronics spectrophotometer (Model-Spectronic 20 D Series). The phosphate presented in the water reacts with ammonium molybdate and forms a complex molybdophosphoric acid, which gets reduced to a complex of blue colour in the presence of $Sncl_2$. Hence, the stannous chloride method was followed for estimating phosphate in water sample. Five drops of $Sncl_2$ solution were added to 50 ml of the filterate clear sample in a Erlenmeyer's flask developing a blue colour. The absorption of blue colour in the samples was predicted at the 690nm on the spectrophotometer using a blank solution with the similar quantity of chemicals.The readings were taken at the direct concentration mode and values were expressed in mgl^{-1}.The nitrate was determined with the help of the Spectrophotometer (Spectronic 20 D series), fifty milliliters of samples were taken in a Erlenmeyer flask and add the same amount of silver sulphate solution to it so as to remove the chloride content from the sample. It was then heated on a hot plate and the precipitate of AgCl was filtered after that filtrate was dried in a porcelain basin. Then cool in the desiccators. It was dissolved in 2 ml phenol disulphonic acid, and the contents were diluted to 50 ml to develop the yellow color, 6 ml of ammonia was added to it. The readings were taken in the direct concentration mode and the values were expressed in $mg\ l^{-1}$.

Statistical treatment of the Data

The reference index (RI) was calculated to determine the ecological status by the following formula based on Stelzer (2003).

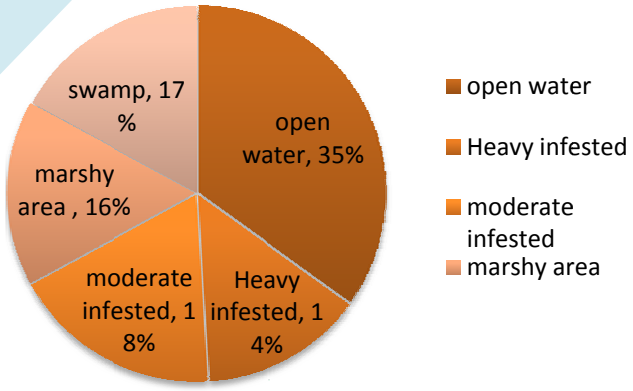
$$RI = \frac{\sum_{i=1}^{nA} Q_{Ai} - \sum^{nC} Q_{Ci}}{\sum_{I=1}^{n_g} Qgi}$$

Where RI= reference index ,QAi= Quantity of the I th species group, Qci= quantity of the ith of the species group C,Qgi = quantity of the ith of all the groups(A,B,C), nA = Total no of species of group A, nC= total no of species of group C, ng =Total no. species (A,B,C).

Result and Discussion

The surface area of Asan wetland is divided into four zones according to their morphometric conditions and accessibility for sampling to measure the nutrient loads of nitrate and phosphate in surface water. The wetland consisted as reservoir for the open water, drained for meet out the emergency need of hydro-power plant at Kulhal i.e. 35% was observed as open water zone, 18 percent of the wetland was taken as moderately infested because in that area the concentration of the nutrients are moderate, whereas 16 percent was taken as marshy area and 14 percent of wetland surface area was heavily infested because there is direct influx of nearby wastes and runoff water and this leads to 17 percent of the area into swampy, the wetland

was categorized according to their macrophyte distribution pattern (Fig. 2).



The wetland received a numbers of nutrients from different point and non-point sources from its catchment basin and it leads to the good growth of aquatic macrophytes in the littoral zones. Different macrophytes were grown in different conditions according to their nature and availability of their growing environmental conditions. Nutrients are the important medium for the growth of several macrophytes in the wetlands. The nitrates and phosphates are bind to the particles of the soil and then it is available to the water and serves as the nutrient medium for the growth of aquatic plants. The present study showed that the value of nitrate and phosphate was maximum in month of the June- July and minimum in August – September. The phosphate and nitrate content were maximum 0.720 and 1.04 mg/l in the zone D and was minimum 0.66 and 0.67 mg/ in zone A (Table 2 & 3). The succession in the Asan wetland occurred and different communities of emergent, marginal, submerged aquatic plants were generated. A total of 23 species of aquatic macrophytes comprising (7) emergents, (3) rooted floated-leaf type, (7) submerged and (6) free floated type were recorded during present study (Table 4). The distribution of macrophytes and their classification according to their nature and presence in the different zones of wetland. The emergent community consists of *Cerotophyllum demersum*, *Polygonium*, Typha, Carex *sp*, *Cyperus* etc and the large marginal communities of *Lantana camara* whereas, 6 percent species are taken as the free floating their roots and some roots are coming upside the water. Large coverage of floating plants are observed like *Lemna sp.*, *Vallisneria sp.* were submerged in large number and 7 number of species are submerged in the different pockets of the wetland. All macrophytic species were arranged according to their presence and abundance and is divided into different groups for developing an assessment system, macrophytes species are growing into different groups. On the basis of most abundant nature of aquatic macrophytes classified into three groups A,B,& C, mainly consisted district genera: *Ipomoea*, *Polygonium*, *Vallisneria*, *Eicchornia*, *Typha* in Group A, *Ceratophyllum*, *Eleocharis*, *Lantana*, *Lemna* ,*Phragmites* in Group B and *Cyperus*, *Myriophyllum*, *Potamogeton*, *Sphagnum* sp. in Group C. The present vegetation number of different groups from different sites of each zones mentioned in Table -5. The reference index was calculated and recorded as ranged between 28.03-40.0%, 37.5-62.96%, 40.0-62.96 % and 40.0- 100% from different sampling sites of Zone A, B, C & D respectively. The resulting index range from 29.03 - 100%. The present reference index revealed the present ecological status of wetland for the proper ranking of the wetland

all the sites denoted that zone D is most infested by maximum species and highest biomass of macrophytes due to shallow depth and maximum load of nitrate and phosphate in water. The Zone C was infested moderately but Zone D was recorded heavy infestation by maximum no. of macrophyte species (Fig.3). The primary productivity minimum (0.02-4.10) was observed in the Zone A and similarly biomass (55-65 Kg/m^3)as each zone contain four sites and the mean of four sites was calculated, whereas the mean values of productivity was recorded 0.11- 4.57, 0.80-7.44, 1.04 - 8. 26 and biomass as 120-134, 156-162, 179-183 Kg/m^3 in zones B, C and D of Asan wetland respectively (Table 6).

Location	Summer	Rainy	Winter	Annual Load
Zone A	0.83-0.97	0.89 -0.99	0.46-0.69	2.18 -2.65
Zone B	0.91-0.97	1.08-1.99	0.45- 0.65	2.44- 3.52
Zone C	0.88 -1.29	0.99- 1.99	0.73 -0.97	2.34- 4.25
Zone D	1.05- 2.06	1.85 – 2.17	0.86- 0.92	3.76- 5.15

Table 2: Seasonal variation of Nitrates (mg/l) in surface water of Asan Wetland

Location	Summer	Rainy	Winter	Annual Load
Zone A	0.23-0.30	1.04- 1.45	0.10 -1.17	1.37 – 1.92
Zone B	0.25-0.34	1.09 -1.52	0.18 -0.22	1.52 - 2.08
Zone C	0.28 -0.41	1.23 -1.59	0.27 -0.30	1.78 - 2.3
Zone D	0.32-0.59	1.69- 2.12	0.30 0.44	2.31- 3.15

Table 3: Seasonal variation of Phosphate (mg/l) in surface water of Asan Wetland

Macrophytes	Emergent	Free Floating	Submergent	Abundance
Eicchornia crassipes		+		+++
Potamogeton crassipes			+	+++
Trapa		+		+++
Cerotophyllum demersum			+	+++
M.trifoliata	+			+
Nuphar lutea		+		++
Isoetes sp.				+
Ranunculus sp.			+	++
Eleocharis sp.	+			+
Carex sp.	+			+++
Myriophyllum sp.			+	+++
Nymphaea candida		+		++
Sphagnum sp.			+	+++
Phragmites australis	+			+
Lantana camera				+
Typha	+			+++
Ipomea cornea		+		++
Polygonium sp.				+++
Vallisneria sp.			+	+++
Hydrilla sp.			+	+++
Lemna paucicostata		+		+++
Scirpus mucorates	+			+
Cyperus digitatus	+			+++

Table 4: Classification of Macrophytes according to their types

+++ = abundantly present

Sites	Species group A					Species Group B					Species Group C				RI (%)
Zone A	IP	Pg	Vall	Eicc	Typ	CP	Elc	Lt	Lm	Prm	Cyp	Myr	Ptm	Sp	
Site 1			8	5	2			28		9					28 .0
Site 2		8		25			10		7	13			5		37.5
Site 3	25	25	15		10		18				27				47.0
Site 4		20	30	10		5	10			1			25		34.32
Zone B															
Site 5	55	10				15		27		20					51.18
Site 6		5		20							10				42.85
Site7			8						7			8			37.5
	25														
Site8	17	5		12		10		10							62.96
Zone C															
Site 9	8		50	20		44		72							40.0
Site 10		25	8	10			2		2				5		73.68
Site 11	55			10		15			47						51.78
Site 12	7		12		15			20							62.96
Zone D															
Site 13		30		5											100
Site 14		62	16		25					8					91
											1				
Site 15				64		27									70
Site 16	8	30			40		72	20	22						40

Table 5: Vegetation table of Wetland site types: numbers representing plant quantity, summed up over different depth zones.

IP: *Ipomoea*,Pg: *Polygonium*, **Vall:** *Vallisneria*, Eicc: *Eicchornia*, Typ: *Typha*, **CP:** *Ceratophyllum*, Elc: *Eleocharis*, **Lt:** *Lantana*, **Lm:** *Lemna*, Prm:*Phragmites*, Cyp: *C yperus*, Myr: *Myriophyllum*, Ptm: *Potamogeton* , Sp:*Sphagnum* sp.

Location	Net Primary productivity ($g/m^2/day$)	Macrophyte Biomass ($Kg/m^{2)}$
Zone A	0.02 – 4.10	55-65
Zone B	0.11- 4.57	120-134
Zone C	0.80-7.44	156-162
Zone D	1.02-8.26	179-183

Table 6: Showing the primary productivity and the macrophyte biomass in Asan

Zone C of Asan wetland

Zone D of Asan Wetland

Fig. 3: Macrophytic growth pattern in Zone C &D of Asan wetland

Discussion

The Asan wetland represents good natural habitats for its rich biodiversity and potential to restore the ecological status. The nutrients remains in high quantity within sediments deposited at littoral zone of wetland and provide as growth medium to different species of aquatic macrophytes. The littoral zone has deposited maximum soil runoff along with accumulation of nutrient concentrations (Drave, 1992; Drake and Heaney, 1987).Nitrate is considered as the important nutrient responsible for primary production in aquatic ecosystem. Higher concentration of nitrate occurred in certain pockets of Asan wetland, due to high input of chemical fertilizer in agriculture fields, increased urbanization and industrialization in Doon valley contributed to increase the nutrient loads and ultimately causes the degradation of ecological status of wetland. The nitrate was maximum (3.76-5.15 mg / l) and minimum (2.18-2.65 mg/l) was reported in the present study. According to Sylvester (1961) the domestic sewage is mainly responsible for greater concentration of nitrates in fresh waters. High nitrate concentration is responsible for primary production of Lake Ecosystem that leads to ultimate environmental degradation (Reynolds, 1991; Kodarkar and chandrashekar, 1995).Similarly, the concentration of nitrate (1.14 mg/l) was recorded in Kalyani Lake due to municipal and other domestic liquid wastes. The phosphate is a key nutrient to enhance the productivity of water in reservoirs (Piska, 2000). The amount of phosphate - phosphorus was related to the locking of phosphorus within the macrophytes and phytoplankton during its bloom (Kaint and Raina, 1990). The phosphate was detected maximum (2.31-3.15mg/l) and minimum (1.37-1.92 mg/l) during the present study in Asan wetland. Whereas, phosphate was recorded as 4.23 mg/l in Gundolav Lake and 0.30 mg/l in Lake Victoria during September-December exhibited the algal blooming and heavy infestations in these two lakes. (Sharma et al, 2010; Lehman and Branstrator 1994). Vaithiyanathan and Richardson (1999) observed distinct changes in the macrophyte species composition in response to phosphorus enrichment. Aquatic macrophytes serve as a major contributor to denote the present ecological dynamics as a whole and especially of the littoral system of wetland. In Asan wetland, twenty three species of the macrophytes were reported in the present study, some macrophytic species are also abundant in the wetland i.e. *Ceratophyllum demersum*, *Trapa*, *Typha*, *Vallisneria*, *Hydrilla*, *Cyperus digitatus* showing their more presence in the wetland in the small pockets. Some species were as *Ipomoea*, *Polygonium*, *Vallisneria*, *Eicchornia*, *Typha* recorded high abundance in reference condition and distributed in the groups according to their presence. Whereas, Schallenberg and Waite (2003) also described eleven macrophyte species occurred in Lake Waihola, which has not yet been seriously degraded by the invasion of exotic macrophytes.Petracco (1995) reported that *Paspalum repens* and *Polygonum spectabile*, *Potamogeton crassipes* and Eicchornia or water hyacinth occasionally develops dense growth at times over the entire water surface of wetland and affected to

ecosystem productivity.Schnitzler *et al.* (1996) studied the response of aquatic macrophyte communities to levels of phosphorus and nitrogen in an old swamp on the upper Rhine plain in eastern France and worked out the utility of some aquatic macrophytes as bioindicators of eutrophication. For each zones of wetland, and unique assessment system was developed based on different reference sites as well as non reference sites were evaluated to determine the ecological status of Asan wetland. The resulting index (RI) value ranged from28.03-40.0% in zone A showed least macrophyte infestation as while 40.0-100% RI value exhibited dense macrophyte infestation in Zone D. The average of RI values occurring on reference sites was defined as a bench mark for ecological quality class "High" (WFD; European Union, 2000). The degradation characteristics have to be described by quantifying the deviation in species composition and abundance from these present as per reference index. Classification with aquatic macrophytes is restricted to sampling zones with sufficient macrophyte cover and therefore fails to indicate extreme eutrophication leading to sampling zone D in Asan wetland, similar infestation pattern noticed in many lakes and reservoirs (Melzer 1999 and Stelzer et al 2004). Moen and Cohen (1989) found a faster growing species (*Potamogeton pectinatus*) to suppress the growth of a slower growing species (*M. exalbescens*) with a relatively dense biomass (300 gDW/m^3). Schaumburg *et al*., (2004) also reported some species in German Lakes *i.e. Isoetes echinospora, Nitella opaca, Myriophyllum sp, Elatine hexandra* etc. in infested pockets of the wetland showed the different rich vegetation and the productivity in that area in small pocketed area of the lakes. The harvested biomass is calculated from different sites and then the aggregate is reported for that zone. The reduction of light reaching the lake floor also inhibit submerged and rooted macrophytes, and sediments become anoxic as large amounts of planktonic biomass are added to them (Kant & Raina, 1990). The population and growth of *Lemna minor* and *Spirodela polyrrhiza* were studied as a measure of eutrophication caused by household detergents (Ansari, 2005). *Myriophyllum spicatum* and E. canadensis responded strongly and their biomass increased significantly (John *et al., (*2001). Many ecologists of the world have been emphasised on the importance of the primary productivity as an important functional attribute of the biosphere because of its controlling effects on the rate of multiplication and growth of the living organisms of the ecosystem (Westlake, 1963). In the present study, the productivity was calculated minimum in the range of 0.02-4.10g/m^2/day and maximum 8.26 g/m^2/day. Wetzel (1975) also reported that a lake becomes eutrophic, when the daily production ranges from 600 to 8000mg $Cm^{-2}day^{-1}$ equivalent to 1.2 to 16.0 g dry matter m^{-2} day^{-1} lower values of annual net production were reported by a number of workers viz., Shardendu and Ambasht (1991) in tropical wetlands (179.00 gm^{-2} yr^{-1}), Hillbricht Illkowsha (1993) in Kikolajskie Lake, Poland (130.66 gm^{-2} yr^{-1}). Kumari and Kumar (2002) in the different ponds of Jharkhand reported low annual productivity values ranging from

4.52 gm^{-2} yr^{-1} in Hizlaghat to 54.11 $gm^{-2}yr^{-1}$ at Singhaara pond. Devi, (2008) also reported the annual primary productivity (0.03 to 0.60 gm^{-2} day^{-1} in the first year and 0.02 to 0.43 gm^{-2} day^{-1} in the second year) in Oksoipat lake, Manipur. The macrophyte communities produced different amounts of biomass, which are responded due to the nutrient enrichment in water and sediments of wetland. The biomass calculated was in the range of 55-65, 120-134, 156-162 and 179-183 Kg/m^2 in the Zones A, B, C & D in different patches of Asan wetland respectively. Sarang *et al*., (2007) recorded the biomass of different species such as *Potamogeton*, *Hydrilla*, *Vallisneria* sp. etc and their biomass ranged between 0.537 - 2.880 Kg/m^2 in different sites during the year.Schallenberg and Waite (2003) also elaborated the biomass of macrophytes ranged from 0–966 g/ $0.12m^2$ (0-8.05 kg m^{-2}) in Lake Waihola. The present study revealed that the species *Potamogeton*, *Trapa*, *Vallisneria*, *Lemna* etc. abrubtly grown in the marshy area. *Cladium jamaicense* and *Typha domingensis*, were dominated in the unenriched and enriched marshes areas respectively. In open-water areas of wetland, macrophytes were characterized by *Eleocharis spp*., *Utricularia spp*., *Chara zeylanica*, and *Nymphaea odorata* in oligotrophic areas and Polygonum *spp.* floating plants in eutrophic areas of Asan wetland. The input of nutrient load should minimize and regulate the input of other industrial effluents in Asan wetland to maintain and restore the natural habitats. The sustainable conservation strategies should be adopted to enhance ecosystem productivity of Asan wetland in relation to its rich biodiversity.

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Climate change and its impact on Indian agriculture

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Abstract

India is a large country with a diverse climate. There is a high dependency of agriculture on the monsoon rains and a close link exists between climate and water resources. Two thirds of the area is rain dependent. Add to this picture the small land holdings, poor cropping mechanisms and low penetration of risk management products. According to World Meteorological Organization, climate change can adversely impact global environment, agricultural productivity and the quality of human life. More importantly in developing countries, it will be difficult for farmers to carry on farming in the increased temperatures. Recognizing this, it is necessary that India should address the issue of climate change and focus on providing better environment to improve quality of human life. With a 0.68 degrees Celsius increase in temperature so far in India, it is expected that there will be pronounced warming in future, particularly during the post monsoon period and winter. There will be an increased frequency of floods during the monsoon and a decrease in winter precipitation with a lower number of rainy days. Climate change affects everyone. But the worst sufferers would be hundreds of millions of small and marginal farmers and people depending upon forests, who are already vulnerable and food insecure. The rise in global temperature on account of climate change would affect agriculture. While in temperate latitudes a rise in temperature would help countries increase food productivity, it will have adverse effects in India and countries in the tropics. The monsoon accounting for 75% of India's rainfall significantly impacts country's agriculture and livelihood of tens of millions of small farmers. Climate change is likely to intensify the variability of monsoon dynamics, leading to a rise in extreme seasonal aberrations, such as increased precipitation and devastating floods in some parts of the country as well as reduced rainfall and prolonged droughts in other areas.The present paper discusses the climate change and its impact on Indian Agriculture.

Keywords: Monsoon rain | Climate change | Global environment | lobal warming | Nutrients

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Introduction

Climate change is the most serious and most difficult environmental challenge that

humanity faces today. It is variously described as the ultimate weapon of mass destruction and a threat worse than terrorism or nuclear war. It was around the middle of the twentieth century that scientists began to take note of the human-action-induced warming of the earth, but real warning bells began to be sounded only from the 1980s, when the process of warming accelerated and more evidence surfaced linking this to human action, mostly the burning of the fossil fuels-coal, oil and gas (Prasad, 2008).

Earth's climate is a result of complex interactions between the sun, atmosphere, oceans, land and biosphere. Change is a fundamental characteristic of the environment. From the ice age of the past to the industrial age of the present, the climate of the earth has been changing. The ice age of the past are examples of climate changes due to natural factors. What is disturbing today is that human activities are leading to an unprecedented acceleration in such changes. The scientific evidence suggests that the earth's climate is changing. The atmosphere is warming, and this trend will continue. By the year 2050, scientists predict that the world will be warmer by an average of between 1.5 ^{0} C and 4.5 ^{0} C. (Kiran B. Chhokar, 2004).

According to World Meteorological Organization, climate change can adversely affect global environment, agricultural productivity and the quality of human life. More importantly in developing countries, it will be difficult for farmers to carry on farming in the increased temperatures. Recognizing this, it is necessary that India should address the issue of climate change and focus on providing better environment to improve quality of human life.

Climate Change

Any long-term change in the statistics of weather over periods of time (range from decades to millions of years) is termed as climate change. Climate change may occur in a specific region, or across the whole earth. (Jayashree A. Parikh, V. M. Balsaraf and P. B. Dwivedi, 2010). Climate change will affect on the health, growth and productivity of crops, livestock, fish, forest and pasture in different ways. It will, also, have an impact on the incidence of pests and diseases, biodiversity and ecosystems. Frequent changes in weather parameters, more importantly temperature and precipitation would not only threaten food production but also access, stability and utilization of food resources. Adaptation to climate change will need to focus on strengthening measures, such as early warning systems; systems to identify climate change "hot spots" and disaster risk management; and evolving sustainable and ecol-friendly farming practices. Other equally important measures call for significantly increase in rural investments to reduce the long-term effects of short-term climate variability on food security, through provision of crop and livestock insurance and incentives that encourage farmers to adopt farm and social forestry, conserve resource and better agricultural and land use practices.

The Intergovernmental Panel on Climate Change (IPCC) provides the most comprehensive statement of what climate experts considers the weather will be like in

this century. It is this projection that we will use as the base-line for assessing and predicting the changes in the 21st century. The IPCC (2001) predicts that human activities will lead to climate warming during this century. Global temperature will rise by 1.5 - 5.8 ^{o}C between 1990 and 2100 (Dasgupta, 2009).

Variations in solar radiation, deviations in the earth's orbit, changes in Gree House Gases (GHGs) concentrations, etc. are the factors that shape climate. Some parts of the climate system, such as the oceans and ice caps, respond slowly in reaction to climate forcing because of their large mass. Therefore, the climate system can take centuries or longer to fully respond to these external forces. (Jayashree A. Parikh, V. M. Balsaraf and P. B. Dwivedi, 2010)

Climate change, more particularly harsher weather conditions, will have impact on the quality, productivity, output and viability of fish and aquaculture enterprises, thereby affecting fishing community. The small-scale fishers may be faced with greater uncertainty as availability, access, stability and use of aquatic food, supplies would diminish, and work opportunities would dwindle. Aquaculture development opportunities will increase in particular in tropical and sub-tropical regions. The climate change in warmer regions offers new opportunities as production in warmer regions will increase because of better growth rates, a longer growing season and the availability of new fish farming areas where it was once too cold.

According to FAO, *"ocean warming, frequent tropical cyclones, flash floods and droughts are likely to bring a devastating impact on food production systems in Pacific islands countries"* The Report on *"Climate Change and Food Security in Pacific Island Countries"* says *"climate change-related disasters have already seriously constrained the development of these islands and reduced food security, especially for households"*.

The climate change will have impact on the predictability and variability in the availability of water and also increase in frequencies of droughts and floods. Worst sufferers would be farmers of the rain-fed agriculture, which covers 60% of all cultivated land in the country. The risk of crop failures will increase in semi-arid zones with prolonged dry seasons forcing people to migrate, when stability of food production cannot be assured. Irrigated areas in large river basins and deltas can also be at risk because of a combination of factors, such as reduced runoff, salinity, increasing floods, sea level rise, urban and industrial pollution. All these in one or the other way will affect the land to maintain the level of agricultural productivity and farm output; cause loss of biodiversity and the reduction in the natural ability of ecosystems to recover.

India is a large country with a diverse climate. Diverse seasons mean diverse crops and farming systems. There is a high dependency of agriculture on the monsoon rains and a close link exists between climate and water resources. Two thirds of the area is rain dependent. Add to this picture the small land

holdings, poor cropping mechanisms and low penetration of risk management products.

Impact on Indian agriculture

India, being a largely agricultural economy, is particularly vulnerable to the impacts of climate change in that sector. The increasing frequency and intensity of extreme weather events will also have a direct bearing on agriculture. With a 0.68 degrees Celsius increase in temperature so far in India, it is expected that there will be pronounced warming in future, particularly during the post monsoon period and winter. There will be increased frequency of floods during the monsoon and a decrease in winter precipitation with a lower number of rainy days Amongst the key impacts will be the faster retreat of Himalayan glaciers, frequent floods and decrease in crop yields. Yield reductions are predicted in wheat and rice due to temperature rise in key growing regions. Until last year, 2009 was the warmest year on record in India since 1901 (+0.913 degrees C above the normal of 24.64 degrees C) now the warmest year is 2010 (+0.93 degrees C).

The IPCC Report (2007) speaks of 'Asian Brown Haze'- a dark layer of pollutants hanging in a cloud seven times the size of India over the Indian Ocean, which adds to then warming. This is an evidence of the developing countries generating the GHGs and being one of the contributions to global warming. For countries like India it is a political setback in the sense that its own defence for climate change at the international forums becomes weak. (S. N. Chary, 2008)

In more detail, the potential impacts on Indian agriculture would look like this: the productivity of most cereals would decrease due to increase in temperature and CO2, and the decrease in water availability. There will be a projected loss of 10-40% in crop production by 2100 if no adaptation measures are taken. A one degree Celsius increase in temperature may reduce yields of major food crops by 3-7%. The length of the growing period in rain fed areas is likely to decrease, especially in peninsular regions. We are also going to see increased climatic extremes such as heat and cold waves, which are likely to increase production variability. IPCC predicts that a 1 m rise in sea level would inundate about 1,700 sq. km of agricultural land in Orissa and West Bengal.

The UN Conference on Climate Change in Copenhagen concluded on 18th December'09 did not yield expected results. Meanwhile it is, therefore, necessary that each individual country should formulate its own action plan to minimize the incidence of carbon emission to the maximum extent possible within its own resources and capabilities and monitor meticulously on an annual basis in the interest of human survival. In so far as India is concerned the common but differentiated responsibilities should focus sharply on the concern, commitment and accountability of all stakeholders for investing adequate resources to support climate change mitigation, adaptation, technology development, transfer and dissemination to make country's agriculture resilient, since the Report on Global Warming sufficiently warns that climate change is likely to affect agriculture adversely

and increase the risks of hunger & drinking water scarcity due to enhanced variability & more rapid melting of glaciers.

Climate change affects everyone. But the worst sufferers would be hundreds of millions of small and marginal farmers and people depending upon forests, who are already vulnerable and food insecure. The rise in global temperature on account of climate change would affect agriculture. While in temperate latitudes a rise in temperature would help countries increase food productivity, it will have adverse effects in India and countries in the tropics. The monsoon accounting for 75% of India's rainfall significantly impacts country's agriculture and livelihood of tens of millions of small farmers. Climate change is likely to intensify the variability of monsoon dynamics, leading to a rise in extreme seasonal aberrations, such as increased precipitation and devastating floods in some parts of the country as well as reduced rainfall and prolonged droughts in other areas.

International Symposium on *"Agro-meteorology and Food Security"* organized in February 2008 in Hyderabad, noted with concern that agricultural productivity has come down over a period of time. Growth of world agricultural output is expected to fall to 1.5% per year over the next three decades and further to 0.9% per year in the succeeding 20 years to 2050. The farmers would have to produce 40% more grain to meet the increasing global demand for cereals, when the world's population would be 7.5 billion by 2020.

Agriculture accounted for 70% of all water use in the world. Per capita use of water has decreased from about 700 cubic meters per year since 1980. More than 1.2 billion people live in areas of physical water scarcity and by 2025 over three billion people are likely to experience water stress. Climate change will manifest its different types of effects on crops and livestock; fisheries and aquaculture; land; water; biodiversity; and trans-boundary pests and diseases as under.

Climate change will affect on the health, growth and productivity of crops, livestock, fish, forest and pasture in different ways. It will, also, have an impact on the incidence of pests and diseases, biodiversity and ecosystems. Frequent changes in weather parameters, more importantly temperature and precipitation would not only threaten food production but also access, stability and utilization of food resources. Adaptation to climate change will need to focus on strengthening measures, such as early warning systems; systems to identify climate change "hot spots" and disaster risk management; and evolving sustainable and ecol-friendly farming practices. Other equally important measures call for significantly increase in rural investments to reduce the long-term effects of short-term climate variability on food security, through provision of crop and livestock insurance and incentives that encourage farmers to adopt farm and social forestry, conserve resource and better agricultural and land use practices.

Climate change, more particularly harsher weather conditions, will have impact on the

quality, productivity, output and viability of fish and aquaculture enterprises, thereby affecting fishing community. The small-scale fishers may be faced with greater uncertainty as availability, access, stability and use of aquatic food and supplies would diminish and work opportunities would dwindle. Aquaculture development opportunities will increase in particular in tropical and sub-tropical regions. The climate change in warmer regions offers new opportunities as production in warmer regions will increase because of better growth rates, a longer growing season and the availability of new fish farming areas where it was once too cold.

Rising sea levels owing to climate change would force communities in low-lying coastal areas and river deltas to move to higher ground level. Similarly, increase in frequency of droughts due to climate change would force farmers and pastoralists, who rely on rainfall to raise their crops and livestock, to migrate to areas in search of land and water. This migration/displacement of people would result in direct conflict and competition between migrants and established communities for access to land and water. It may be difficult for displaced communities to maintain their farming or pastoral traditions. A broad based policy and program that provides opportunities for the displaced communities to earn livelihood outside the agricultural sector may need to be evolved. Governments would have, also, to face challenge to reconcile competing demand and diverse land use needs. In cases, where land rights are informal and different customary land tenure systems coexist, Governments and local communities may need to establish fair and equitable systems of land tenure.

The climate change will have impact on the predictability and variability in the availability of water and also increase in frequencies of droughts and floods. Worst sufferers would be farmers of the rain-fed agriculture, which covers 60% of all cultivated land in the country. The risk of crop failures will increase in semi-arid zones with prolonged dry seasons forcing people to migrate, when stability of food production cannot be assured. Irrigated areas in large river basins and deltas can also be at risk because of a combination of factors, such as reduced runoff, salinity, increasing floods, sea level rise, urban and industrial pollution. All these in one or the other way will affect the land to maintain the level of agricultural productivity and farm output; cause loss of biodiversity and the reduction in the natural ability of ecosystems to recover. Areas projected to experience lower precipitation will need to improve water management system and water storage capacity that can enhance crop productivity. While large irrigation schemes will need to adapt to changes in water supply regimes, small-scale irrigation schemes will need field-based water control measures.

Biodiversity

According to the “2005 Millennium Ecosystem Assessment”, the climate change will cause loss of biodiversity by the end of this century. The significance and utility value of biodiversity for food and agricultural purpose will increase as and when climate changes. Genetic resources are the living materials that

local communities, researchers and breeders use to develop high yielding crop varieties/strains that can adapt to changing needs. Maintaining and using this reservoir of genetic diversity will be the foundation for copping with climate change.

Climate change and agriculture are interrelated. Agriculture contributes, of course partly, to the global warming by spewing GHGs and in turn gets affected by its consequences. However, greenhouse emissions from different farm sectors and the effect of global warming on these sectors have not been quantified, except in few cases, such as wheat. The Indian Council of Agricultural Research (ICAR) has estimated that annual wheat output may decline by four to five million tons with every one degree Celsius rise in temperature. The impact of climate change will have to be mitigated by modifying farming practices by farmers, for which ICAR has already undertaken various studies. These studies emit some light on the emissions of GHGs, such as methane, nitrous oxide and carbon dioxide arising from paddy fields and farm animals. They also explain the impact of climate change on some crops and other farm sectors like fisheries.

The IPCC has developed a range of scenarios, IS92a-f, of future greenhouse gas and aerosol precursor emissions based on CLIMATE CHANGE 1995: IPCC SECOND ASSESSMENT REPORT assumptions concerning population and economic growth, landuse, technological changes, energy availability and fuel mix during the period 1990 to 2100. Through understanding of the global carbon cycle and of atmospheric chemistry, these emissions can be used to project atmospheric concentrations of greenhouse gases and aerosols and the perturbation of natural radiative forcing. Climate models can then be used to develop projections of future climate (IPCC Report, 1995, pp. 22-23).

Regarding India, IPCC made the following observations:

- Temperature in India may rise by 5 ^{0} C.
- Himalaya's glaciers will also be a casualty; they will melt and recede, affecting the quantity of water in some of India's major rivers like Ganga, Brahmaputra and Indus. Gangotri glacier which feeds the river Ganga is now retreating at a rate of 34 metres per year compared to 19 metres in 1971.
- There will be a 20 per cent increase in the rainfall. Hence, the frequency of floods would also be on the side.
- Freak rains will flood desert areas.
- Incidence of cyclones would increase in the Bay of Bengal
- As temperature gets warmer, incidence of Malaria would increase posing a serious public health hazard. Malaria is already on the resurgence.(Chary, 2008, p.211).

Overcome Strategies

India's commitment to addressing climate change issues is reflected in the various steps it has taken over the years in policy initiatives,

development plans, and support to research and to a variety of initiatives and activities for promoting energy conservation, energy efficiency and renewable energy, and in its persistent pursuance of large-scale afforestation programmes. Environmental protection and sustainable development are India's key national priorities. Therefore, even though the climate change convention does not require India to reduce its GHGs emissions, several ongoing activities and programmes as well as new initiatives contribute to achieving this end either directly or indirectly.

At the policy level, India's commitment is reflected in the principal aim of the National Forest Policy of 1988, which is to ensure environmental stability and ecological balance including atmospheric equilibrium, which are vital for sustenance of all life forms, human, animal and plant. The National Agricultural Policy of 2001 states, ' In order to reduce risk in agriculture and impart greater resistance to Indian agriculture against droughts and floods, efforts will be made to achieve greater flood proofing of flood prone agriculture and drought proofing of rain fed agriculture for protecting the farmers from the vagaries of nature.

We need crops and varieties that fit into new cropping systems and seasons. We need to develop varieties with changed duration and varieties for high temperature, drought, inland salinity and submergence tolerance. We also need crops and varieties that tolerate coastal salinity and seawater inundation and varieties which respond to high CO2. Lastly, we need varieties with high fertiliser and radiation use efficiency.

We stress the importance of germplasm. Wild and extant varieties have traits tolerant to high temperature, elevated CO2 etc. These might have been discarded in the past due to low yield potential but can be made use of today as parents for the breeding of tolerant varieties to climate change. There is a need to revisit gene banks with a view to searching for unique traits required for climate change. In this search, indigenous knowledge and farmer's wisdom have immense value.

Better management practices hold the key to adaptation and mitigation. For example, there is raised-bed planting of wheat in the Indo-Gangetic plains which entails 20-25% saving in irrigation water and is suitable for mechanical weeding, and results in reduced herbicide use. We also need better water management and nutrient management of rice paddies. The ICAR has in fact started the "National Initiative on Climate Resilient Agriculture" (NICRA) towards this goal. This programme has three components: strategic research, technology demonstration and capacity building. The strategic research will focus on crops, natural resource management, horticulture, livestock and fisheries and aspects of climatic resilience in the production systems of the northeastern region. The demonstration will be of existing management practices for enhancing resilience of crops/livestock to current climate variability in 100 most vulnerable districts. The capacity building will be of scientists and other stakeholders in

climate resilient agricultural research and its application.

The objectives of the programme are to enhance the resilience of Indian agriculture to climatic variability and climate change through the development and application of improved production and risk management technologies. The challenge will be to see if the research and development and economic viability keep up with the pace of climatic change and enable food security in the decades to come.

Climate change has been a cause of serious concern if the agricultural sector has to grow in the context of country's overall economic growth, to respond to rural households' livelihood, country's food security and poverty alleviation. It may take some years to fully experience the devastating effects of climate change on agriculture but the time is ripe for the Government, private sector and public to have adequate concern, commitment and accountability to mitigate the effects of climate change.

Adaptation in climate policy

The following measures are necessary to better adapt to climate change impacts.

- Effective drought management
- Promotion of efficiency of irrigation and water use and dissemination of conservation management practices.
- Rehabilitation of degraded forests and watersheds
- Research on understanding of climate eco-system social system interaction.
- To develop land use plans, food security programs, fisheries and forestry policies that can help farming community suitably adapt to climate changes.
- To undertake cost/benefit analyses of climate change risks for irrigation or coastal protection and for investment decision.
- Promotion of " best crop-livestock-fish farming practices" through farmers' capacity building and networking.
- Conceptualization and Implementation of "National Adaptation Programme of Action on Climate Change".
- Developing contingency plans to cover new and evolving risk scenarios.
- Breeding of new crop varieties and species (heat-and salt tolerant crops, low-water use crops)

Conclusion

A broad based policy and program that provides opportunities for the displaced communities to earn livelihood outside the agricultural sector may need to be evolved. Governments would have, also, to face challenge to reconcile competing demand and diverse land use needs. In cases, where land rights are informal and different customary land tenure systems coexist, Governments and local communities may need to establish fair and equitable systems of land tenure. Agriculture development in India needs to focus on reducing GHGs emissions through measures, such as significant reduction of deforestation; improving forest conservation

and management; effective control of wildfires; promotion of agro-forestry for food or energy; soil carbon sequestration; restoring land through controlled grazing; improving nutrition for ruminant livestock; efficient management of livestock waste (through biogas recovery); and developing strategies that conserve soil and water resources by improving their quality, availability and efficiency of use. While a National Network Project "Impact, Adaptability and Vulnerability of Indian Agriculture to Climate Change" has been launched with focus on impact of climate change on different sectors of agricultural production" it is necessary to make sufficient investment to support climate change to adaptation, mitigation, technology development, transfer and dissemination among farmers. It is clear that the conception of climate change based on scientific studies of he present and perhaps the immediate past has been accepted as a very likely scenario for the future. To conclude, we should observe best practices in controlling global warming to save humanity from impending environmental catastrophe.

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Prevalence of malaria in the population of Purnia Distrit, Bihar

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Abstract

Prevalence of malaria was studied in Purnia district of Bihar. Various factors such as environmental factors (temperature, rainfall and humidity etc), nature of houses, location of houses, habits of sleeping outside, rearing of animals as well as drainage system were correlated with the prevalence of incidence of malaria. The study indicates the incidence of malaria is more due to abundance of swampy areas in the district, earthen walls of the hut, poor sanitation and poor drainage system. Prevalence of malaria was found more in males in comparison to females which is possibly due to their outdoor activities and habits of sleeping outside the house. The findings of this study indicate that families living in houses with the poorest construction and close to the vector breeding sites should be the primary target for the provision of bed nets. Further the frequency of malaria was more in persons belonging to blood group O.

Keywords: Environmental factors | Outdoor activities | Malaria | Swampy area and Blood group 'O'

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Introduction

Malaria is one of the oldest and major public health problems of the world and is number one killer of children, pregnant women and elderly persons (Greenwood and Mutabingwa, 2002). It has now been identified as the disease most likely affected by climate change (WHO/WMO/UNEP, 1996). In 2008, there were an estimated 243 million cases of malaria, the vast majority of cases (85%) occurring in the African Region. In 2008, malaria accounted for an estimated 863,000 deaths (WHO, 2009). According to a report published in the Lancet, 20th Nov., 2010, In India, malaria causes 205000 deaths per year before age of 70 years (55000 in early childhood, 30000 at ages 4 – 5 years, 120000 at ages 15 – 69 years) and 90% of death occurs in rural areas. Many factors affect increases in malaria cases, including changes in land use, drug resistance, malaria control programs, socioeconomic issues, and climatic factors. The geographical condition and climate of India is favourable to transmission of malarial infection. No study has examined the relationship between malaria epidemics and climatic factors in Purnia district of Bihar. The present paper deals with incidence of malaria in relation to pattern of settlement,

environmental factors and socioeconomic condition in Purnia district (Bihar).

Methods

Purnia is one of the oldest districts of Bihar located at a height of 350meters from the sea level. The district is rich in flora and fauna. It is popularly known as poor's men Darjeeling. Once upon a time it was popularly known as 'Kala Pani'. Monthly malaria case data from June 2010 to May 2011, monthly rainfall, temperature and humidity were recorded in different villages of Purnia district. Literacy was measured as the number of individuals that can both read and write as a percentage of the total population. Purnia has very high vector species diversity and vectors suited to these habitats may be responsible for the observed results.

Results and Discussion

Climate, local ecology, and active control affect the ability of malaria parasites and their anopheline mosquito vectors to coexist long enough to enable transmission. The frequency of transmission, or endemicity, depends on the density and infectivity of anopheline vectors. These features depend on a range of climatic, physical, and population characteristics, for example, rainfall, location of human settlements near or at rivers or other mosquito larval breeding sites, and the density of human populations in a village. The most significant determinant of the intensity of parasite transmission is climate (Snow and Omumbo.2006).

Meteorological factors are important drivers of malaria transmission by affecting both malaria parasites and vectors directly or indirectly (Abebe *et al*., 2011). The three main factors that affect malaria are temperature, rainfall and relative humidity (Pampana, 1969) and, therefore, with spread of the disease. Changes in temperature, rainfall, and relative humidity due to climate change are expected to influence malaria directly by modifying the behaviour and geographical distribution of malaria vectors and by changing the length of the life cycle of the parasite. (Abebe *et al*., 2011). Climate change is also expected to affect malaria indirectly by changing ecological relationships that are important to the organisms involved in malaria transmission (the vector, parasite, and host).

The ambient temperature plays a major role in the life cycle of the malaria vector. Temperatures within the range of 20°C–30°C affect malaria transmissions in several ways:
(a) Development of *Anopheles* is shortened

(b) Biting capacity of mosquitoes is increased, and

(c) Mosquitoes survive long enough to acquire and transmit the parasite.

Temperatures lower than 16 °C or higher than 30 °C have a negative impact on the growth of the mosquitoes (Yang, 2000).

Development of the parasite within the mosquito (sorogonic cycle) is dependent upon temperature. It takes 9 to 10 days at temperature of 28^0C, but stops at temperatures below 16 ^{0}C. The minimum temperature for parasite development of *Plasmodium falciparum and P. vivax* are approximately 18 ^{0}C and 15 ^{0}C respectively (Craig *et al*., 1999).

The daily survival of the vector is also dependent on temperature. At temperature between 16^0c and 36^0C, the daily survival is about 90%. According to Craig et al., (1999) and Jonathan et al., (2006) at temperatures between 28^0C – 32^0C the high proportion of vectors surviving the incubation period is observed. In the present study temperature ranges was quite favourable for the survival of the vector (Table – 1).

Table 1- Mean temperature, rainfall and humidity of Purnia district (Bihar).

Season	Temperature	Rainfall (mm)	Humidity (%)
Winter	18.73^0C	0.80	78.32
Rainy	24.14^0C	9.70	83.66
Summer	27.69^0C	5.48	67.52

Rainfall plays an important role in malaria as it increases relative humidity and thereby the longevity of the adult mosquitoes, besides providing water as the medium for the aquatic stages of the mosquitoes (McMichael and Martens, 1995). No doubt, rainfall provides breeding ground of the mosquitoes, if it is moderate while it destroys breeding sites and flush out larvae, when it is in excess. Rainfall provides breeding sites for mosquitoes to lay their eggs, and ensures a suitable relative humidity of at least 50 to 60% to prolong mosquito survival (Reiter, 2001). Many workers have reported a positive correlation between rainfall and the incidence of *Plasmodium falciparum* (Gupta, 1996 and Bouma *et al*., 1996). However, in the present study average relative humidity was 76.5% which is much suitable for the survival of mosquitoes. Excessive rainfall does not always trigger an epidemic. Gonzalea *et al*, (1997) have observed a negative correlation between rainfall and malaria incidence in a nine years study on Colombian Pacific Costa. According to Hicks and Majid (1937) it was high humidity and not the total rainfall which was key factor leading to an epidemic. A weak correlation between number of rainy days and incidence of malaria has been observed by Singh and Sharma in Madhya Pradesh (2002). However, no such correlation was observed in the present investigation. Rainfall also affects malaria transmission because it increases relative humidity and modifies temperature, and it also affects where and how much mosquito breeding can take place. *Plasmodium* parasites are not affected by relative humidity, but the activity and survival of anopheline mosquitoes are. High relative humidity allows the parasite to complete the necessary life cycle, so that it can transmit the infection to several persons (Pampana, 1969). If the average monthly relative humidity is below 60%, it is believed that the life of the mosquito is so shortened that there is no malaria transmission (Mouchet *et al.*, 1998). The average relative humidity in the present study was found quite suitable for the completion of the life cycle of the mosquito. When the relative humidity drops below 60%, it is believed that malaria transmission cannot occur because of the reduced lifespan of mosquitoes. The peak of malaria incidence during present study was found between September – November, pointing out that increase in vector breeding results in increase

incidence of malaria. Thus pointing out that cases of malaria increases in later part of the rainy season (Madhavan *et al*., 2000).The findings of this study support the results of Wagbatsome and Ogbeidae, 1995; Craig *et al*., 1999; Thomson and Connor, 2001; Mc Michael *et al*., 2003; Thomson *et al*., 2005a and 2005b that transmission of malaria varies by weather, which affects the ability of the main carrier of malaria parasites, anopheline mosquitoes, to survive or otherwise. Tropical areas including Nigeria have the best combination of adequate rainfall, temperature and humidity allowing for breeding and survival of anopheline mosquitoes. The burden of malaria varies across different regions of the world and even within a country. This is driven by the variation in parasite– vector–human transmission dynamics that favour or limit the transmission of malaria infection and the associated risk of disease and death.

The extremes of both low and high population density modify malaria transmission and have profound consequences for estimates of its public health burden (Snow *et. al*., 1999 and Robert *et al*., 2003). There is strong association between malaria incidence and type of house construction (Gamage-Mendis et al. In the present study it was noticed that prevalence of malaria was more in the villages having poorest type of house characterized by incomplete construction with thatched roofs and walls made up of mud in comparison with houses made up of bricks and cement. Further the incidence of malaria was more where number of persons living in a room was more (4 – 5 persons).The risk of malaria was found to be 2.5 fold higher for people living in poorly constructed houses than for those living in houses of good construction. In the present investigation the frequency of malaria was found more in persons whose houses were located near the swamps, river beds and agricultural fields. Frequency of malaria was found more in adult males, as they work in fields located near river beds or swampy areas, suggesting an occupational risk. Forest degradation, increased housing in the local forest and climate changes are strong influences on *Anopheles* populations (Paulo *et al*., 2011) Deforestation changes microclimates, leading to more rapid sporogonic development of *P. falciparum* and to a marked increase of malaria risk (Aw *et al*.,2008). Natural climatic disasters such as floods and cyclones may also have significant relationship with malaria outbreaks (Epstein, 2005). Flood is the regular feature of this zone causing outbreak of the malaria. Further these populations belong to low socio-economic group having very low literacy and as such they are unable to manage preventive measures against bite of mosquitoes and spread of malaria. The prevalence of malaria was found more in persons belonging to blood group O.

Thus the study clearly indicates that in addition to climatic factors, many other variables such as environmental modification (e.g. deforestation, increases in irrigation) blocked swamp drainage), pattern of settlement,, type of houses, population growth, socio-economic condition and limited access of health care system affect malaria transmission.

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Vegetational Analysis of *Pinus roxburghii* forest in Uttarkashi

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Abstract

The present study has been carried out in the district of Uttarkashi, Garhwal, Uttarakhand, India to document the vegetation status of *Pinus roxburghii* forest. To analyze the plant diversity, baseline vegetation survey was conducted by using transect and quadrat method. Total tree diversity ranged from 1.26-1.94 and herb diversity from 3.28-3.65. Shrub diversity ranged from 1.52-2.72.Forests of this region is mainly dominated by *Pinus roxburghii*. *Pinus roxburghii* is the most common resin producing pine species of India and also provide alternate source of fuelwood and leaves for bedding materials. Therefore, an attempt was made to analyze the forest community and structure of a pure *Pinus roxburghii* forest.

Keywords: *Pinus roxburghii* | Plant Diversity | Fuel wood | quadrate | vegetation analysis

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Introduction

Biodiversity is the very basis of human survival and economic well being, and encompasses all life forms, ecosystems and ecological processes, acknowledging the hierarchy at genetic; taxon and ecosystem levels (McNeely *et al*., 1994). High biodiversity favours ecological stability, whereas accelerating species loss could lead to collapse of the ecosystem. The Himalayan embodies diverse and characteristic vegetation distributed over a wide range of topographical variations Himalaya.

For the proper management of a forest, a study on forest inventory is the first requirement. The Himalyan forest vegetation ranges from tropical dry deciduous forests in the foothills to timberline. Forests are the main source of livelihood of the people living in Uttarakhand, Central Himalaya. Forests of this region are mainly dominated by *Pinus roxburghii* and *Quercus leucotrichophora*. *Pinus roxburghii* is the most common resin producing pine species of India and also provide alternate source of fuelwood and leaves for bedding materials, however *Quercus leucotrichophora* is important source of fuel, fodder and other daily

needs of the villagers. Therefore, an attempt was made to analyze the forest community and structure of a pure *Pinus roxburghii* forest.

Materials and Methods

The present study was carried out in the district Uttarkashi. It is located between 38° 28' to 31° 28' North latitude and 77° 49' to 79° 25' East longitude. Two major rivers of India viz. Bhagirathi (called Ganga beyond Deoprayag) and Yamuna have their origin in the snow covered peaks of Gaumukh and Bandarpunch respectively in Uttarkashi. These peaks and rivers are of high reverence to people all over India and are holy centers of pilgrimage since time immemorial. The widely varying climate and topography produce a wide range of vegetation and serve as habitats to diverse species of wild life. Forests occupy a place of pride in the environment of the district not only for the sheer bulk of the area they occupy but also for the richness of variety of vegetation. Pine forests occur between the altitudes of 900-2000 meters and Deodar forests between 2000-3000 meters. Fir and Spruce forests are found over 3000 meters and Kharshu, Birch and Junipers forests upto the height of 4000 meters. Above the fir and Spruce forest zone, alpine pastures are found throughout the district between the heights of 3500 meters to 4877 meters above Sea level.

The phytosociological study was carried in the tree layer by using 10 x 10 m quadrates. A total of 10 randomly placed quadrates were used on each site. The size and number of quadrates were determined by the species area curve (Misra 1968) and the running mean methods (Kershaw 1973). In each quadrate > 30cm circumference (at 1.37 m from the ground) were considered tree. The vegetation data were quantitatively analyzed for abundance, density and frequency (Curtis and McIntosh, 1950). The importance value index (IVI) was determined as the sum of the relative frequency, relative density and relative dominance (Curtis 1959).

Result

Species richness and species diversity

A total of 11 species were recorded from site I out of which 1 tree species *Pinus roxburghii* , 5 shrub species *Asparagus racemoses, Carrisa spinaum, Colebrookia oppositifolia, Rubus ellepticus* and *Lantana camara* and 5 herb species *Apluda mutica, , Carex nubigena, Justicea simplex, Rubia cordifolia, Thalactrum japonica* were reported. All the species were distributed contagiously. On site II 1 tree species *Pinus roxburghii*, 6 shrub species *Asparagus racemoses, Berberis acitica, Carrisa spinaum, Colebrookia oppositifolia, Pyracantha crenulata* and *Rubus ellepticus* and 5 herb species *Apluda mutica, Artemisia nilagarica , Justicea simplex, Rubia cordifolia, Thalactrum japonica* were reported.On site III 1 tree species *Pinus roxburghii*, 3 shrub species *Berberis asitica, Carrisa spinarum and Colebrookia oppositifolia* and 3 herb species *Artemisia nilagarica Carex nubigena* and *Thalactrum japonica* were reported.

Discussion

One of the foundations for conservation of biological diversity in forest landscapes understanding and managing the disturbance regimes of landscape under past-natural and

natural conditions (Spies and Turner1990). Conservation biologists worn that 25% of all species could become extinct during the next 20 to 30years. The causes for the loss of species and fragmentation of natural habitats. In the present study, plant biodiversity is assessed by quantitative analysis of forest vegetation in different forest including various disturbances do not provide time for the ecosystem recovery and widen the forest gap and fragmentation of the land in the region.

Site /Altitude	Species	Frequency (%)	Density (Trees ha-1)	TBC (m 2 ha-1)	IVI	A/F ratio
Site- I (1000m-1200m)	*Pinus roxiburghii*	100	560	56.94	300	0.056
Site-II (1200m-1400m)	*Pinus roxiburghii*	100	540	53.26	300	0.054
Site-III (1400m-1600m)	*Pinus roxiburghii*	100	500	26.79	300	0.051

Table 1: Phytosociological analysis of tree species in three altitudinal zone of study sites.

	Species	Frequency (%)	Density	IVI	A/F ratio
Site I	*Asparagus racemoes*	6.77	0.23	1.33	0.500
	Carrisa spinaum	50.00	3.89	14.36	0.156
	Colebrookia oppositifolia	3.65	0.17	0.80	1.25
	Rubus ellepticus	3.13	0.14	0.67	1.38
	Lantana camara	16.67	0.62	3.38	0.223
Site II	*Asparagus racemes*	9.90	0.31	1.58	0.319
	Berbaris asiatica	2.60	0.07	0.40	1.075
	Carrisa spinaum	3.65	0.11	0.58	0.86
	Colebrookia oppositifolia	8.33	0.38	1.55	0.540
	Pyracantha crenulata	24.48	0.66	3.69	0.110
	Rubus ellepticus	12.50	0.48	2.18	0.313
Site III	*Berbaris asiatica*	43.23	1.96	8.05	0.105
	Carrisa spinaum	17.71	0.70	3.09	0.223
	Colebrookia oppositifolia	4.69	0.18	0.80	0.806

Table 2: Phytosociological analysis of shrub species in three altitudinal zone of study sites

	Species	Frequency (%)	Density (Trees ha-1)	IVI	A/F ratio
Site I	*Apluda mutica*	17.71	0.64	3.36	0.204
	Carex nubigena	8.85	0.34	1.73	0.438
	Justicea simplex	7.55	0.24	1.37	0.429
	Oxalis corniculata	2.34	0.08	0.42	1.375
	Rubia cordifolia	9.11	0.88	2.93	1.063
	Thalactrum japonica	1.04	0.09	0.31	8.400
Site II	*Apluda mutica*	18.23	0.72	2.96	0.216
	Artemisia nilagarica	2.60	0.11	0.44	1.61
	Justicea simplex	7.29	0.14	0.87	0.255
	Nepta leucophylla	22.92	0.68	3.26	0.130
	Oxalis corniculata	26.56	1.36	4.96	0.193
	Rubia cordifolia	27.08	1.33	4.95	0.182
	Thalactrum japonica	61.98	2.99	11.20	0.078
Site III	*Artemisia nilagarica*	7.81	0.21	1.06	0.341
	Carex nubigena	18.23	0.65	2.81	0.194
	Thalactrum japonica	10.42	0.34	1.55	0.317

Table 3: Phytosociological analysis of herbs species in three altitudinal zone of study sites.

Trees	**Family**	**Site 1**	**Site 2**	**Site 3**
Pinus roxburghii	Pinaceae	+	+	+
Shrubs				
Asparagus racemosus	Liliaceae	+	+	
Berbaris asiatica	Acanthaceae		+	+
Carrisa spinaum	Aocynaceae	+	+	+
Colebrookia oppositifolia	Lamiaceae	+	+	+
Pyracantha crenulata	Rosaceae		+	
Rubus ellepticus	Rosaceae	+	+	
Lantana camara	Verbenaceae	+		
Herbs				
Apluda mutica	Poaceae	+	+	
Artemisia nilagarica	Asteraceae		+	+
Carex nubigena	Cyperaceae	+		+
Justicea simplex	Acanthaceae	+	+	
Rubia cordifolia	Rosaceae	+	+	
Thalictrum japonica	Ranunculaceae	+	+	+

Table 4: Species richness in three different sites:

The *Pinus roxburghii* forest was characterized by low species richness. Among the distribution pattern of the species most of the species in oak forest and pine in all the site was distributed contagiously and few species in oak forest were distributed randomly. Contagious

distribution has been reported by several workers Greig-Smith (1957); Kershw (1973); Singh and Yadav (1974). Odum (1971) have emphasized that contagious distribution is the commonest pattern in nature. Kumar and Bhatt (2006) also reported contagious distribution pattern in foot-hills forests of Garhwal Himalaya. Shannon weiner index ranged between 1.26 and 1.94 in three altitudinal sites. The shrub diversity ranged between 1.52 and 2.72. The tree diversity index analyzed for the forest was lower than that reported (2.85) by the earlier workers (Upreti *et al*. 1985). The diversity was lowest for the altitudinal zone 1400-1600 m asl.

The present study highlights a very poor status of total species richness in the entire forest area along with regulation of tree species at various altitudes. Our findings revealed that lower elevational cover types had comparatively higher number of species than less number of species at higher elevation cover types. It implies that higher elevation forest types should be conserved with necessary implementations.

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Effects of consanguinity on Badhiya Muslims of Purnia district, Bihar

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Abstract

In consanguineous marriages, the ancestors are common. The product of such marriages tends to produce an increase of the abortions, still births and various types of genetic disorders. Such marriages are receiving widespread attention of Geneticists, Sociologists, Anthropologists and Demographers due to their effects on fertility, mortality, morbidity as well as increase manifestation of deleterious homozygotes which are supposed to influence the demographic and genetic structure of the population.

Keeping the importance of consanguinity, the present work was designed which aimed to know the effects of consanguinity on fertility, mortality and congenital malformations in Badhiya Muslim of Purnia district, Bihar (which are migrant of West Bengal). The study reveal high incidence of foetal loss, infant mortality as well as congenital malformations in children of consanguineous marriages in comparison to non-consanguineous marriages. Due to bad effects, it is suggested that such marriages should be discouraged and if such marriage is practiced, genetic counseling is necessary before selection of mate.

Keywords: Consanguinity | Badhiya Muslim | Genetic counseling | Purnia district

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Introduction

Marriage takes place either among relatives or non relatives. Individuals having certain portion of their genes common by descent are termed as relatives and marriage between such individuals is known as consanguineous marriage. Consanguineous marriage is practiced all over the world. More than two billion people of various religious and ethnic backgrounds live in countries where a large proportion of marriages are concentrated between blood relatives (Bittles,2001) Consanguinity has been reported as the most important cause of genetically associated mortality in developing countries (Guo,1993). Couples who are related by blood are more likely to experience the death of an offspring than those not related by blood.

Badhiya Muslims of Purnia district are migrant of Malda and Murshidabad district of West Bengal. Consanguineous marriage is prevalent among them. Keeping the importance of consanguinity, the present work was carried out which deals with the effects of consanguinity on foetal loss, infant mortality and congenital malformations.

Material and Methods

The present work was carried out in different villages of Badhiya Muslims located in Purnia district (Bihar). For the outcome of pregnancy and congenital malformations, all together 108 families were interviewed (58 consanguineous and 50 non consanguineous). The outcomes of pregnancy have been analyzed. Socio-economic status of these families was found similar. Mothers were extensively interviewed and pregnancy and pregnancy history including live births, abortions, stillbirths, infant mortality and any malformation/deformity in dead or live born were noted.

Results and Discussion

The mean maternal and paternal age was observed to 17.4 and 20.2. From 1112, 608 (54.68%) of the newborns were from consanguineous marriages, while 504 (45.32%) from non consanguineous marriages. Out of 977 newborns, were males and were females. Out of these 37 were diagnosed with congenital malformations (Table-3). In consanguineous marriages the frequency of abortions and still births were found to be 8.2% and 10.7% respectively (Table – 1). In non consanguineous marriages the frequency of abortions and stillbirths were 3.6% and 4% respectively. Thus gross foetal loss was more (18%) in consanguineous marriages in comparison to non consanguineous marriages (7.6%). The observations were consistent with other studies in literature (Jacob and Jayabal, 1971; Hussain and Bittles, 1998; Verma *et al*., 1999, Bhasin and Nag, 2002)

Table 1 - Foetal loss in Badhiya Muslims of Purnia district (Bihar).

	Consanguineous	Non- consanguineous
Total Pregnancies	608	504
Abortions	50 (8.2%)	18 (3.6%)
Still births	65 (8.2%)	20 (4.0%)
Gross foetal loss	115 (18.9%)	38 (7.6%)

Rate of infant mortality in consanguineous marriages was found to be 10.57% while in non consanguineous marriage, it was 4.62% (Table – 2). Many studies across the world have reported elevated mortality rates in the offsprings of consanguineous marriages as compared to those of non consanguineous marriages (Schull *et al*., 1965, 1970,1972: Hussain, 1971: Shami *et al*.,1989,1990;) and many others. In India too, the same trend has been observed. But on the other hand, some studies have also reported that parental consanguinity does not contribute to increase offspring mortality or decreased number of survivers (Jonh and Jayabal, 1971; Bittles *et al*., 1985 and 1987).

Table 2 – Infant mortality rate in Badhiya Muslims of Purnia district (Bihar).

	Consanguineous	Non consanguineous
Total birth	473	476
No. of sex	M -273	M-250
	F-200	F- 226
Infant death	M-24 (5.07%)	M-10 (2.1%)
	F- 26 (5.5%)	F- 12(2.2%)
Total mortality	50 (10.57%)	22 (4.62%)

Congenital means a condition that is present at birth. It can be defect or illness which is a result of hereditary or environmental conditions unlike an acquired illness or disorder. Consanguineous marriages have been described as an important factor contributing to increased congenital malformations. The etiology of congenital malformation is genetic (30 – 40%) and environmental (5 – 10%). Among the genetic etiology, chromosomal abnormality constitutes 6.1%, single gene disorder 25% and multifactorial 20 – 30%): however, far nearly 50% of congenital malformations the cause is yet to be known (Rajangam and Devi, 2007). In the present investigation the frequency of congenital malformation was found to be 3.77% in consanguineous marriages and 0.792% in non consanguineous marriages (Table – 3). Tayebi *et al.* (1910) has reported frequency of congenital malformations 2.8% and 0.9% respectively in consanguineous and non consanguineous marriages. A higher percentage of congenital heart disease was found in the offsprings of consanguineous marriages in Aligarh, India (Badaruddoza *et al*., 1994). In the present study, the gender of the foetus did not affect the prevalence of congenital malformation, both genders were equally affected. These findings are consistent with Karabasi *et al*., 2003: Biri *et al.*, 2005 and Tayebi *et al*., 1910. However, the results from this study were incontrast to those reported by Golalipour *et al*. (2005), where male new born were more affected than females.

Table 3 – Prevalence of congenital malformations in Badhiya Muslims of Purnia district (Bihar).

	Consanguineous	Non consanguineous
Polydactyly	5(0.82%)	1 (0.198)
Syndactyly	2 (0.328)	0.00
Foot deformative	3 (0.493)	0. 00
Short limbs	4 (0.657)	1 (0.198)
Hand defects	2 (0.328)	1 (0.198)
Dwarfism	2 (0.328)	1 (0.198)
Cleft lip	2 (0.328)	0
Visual impairment	3 (0.493)	2 (0.396)
Total	23 (3.27%)	6 (0.793%)

Increased incidence of foetal loss, infant mortality and congenital malformations in the offspring of consanguineous couple most likely arises from homozygous expression of recessive genes inheritable from their common ancestors (Khlat and Khoury, 1998).

In conclusion, study reveals high incidence of foetal loss, infant mortality as well as high incidence of congenital malformations in

children of consanguineous marriages. Keeping the harmful effects of consanguineous marriages, it is suggested that such marriages should be discouraged for betterment of future generation. If such marriage is practiced then genetic counseling is necessary before selection of mate.

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Variability and Correlation studies in cowpea (*Vigna unguiculata*)

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Abstract

Genotypic coefficient of variation, heritability and genetic advance were assessed in 30 genotypes of cowpea. (*Vigna unguiculata* (L.) Walp). Genotype differed significantly for all characters studied. Almost all characters showed high heritability values. High heritability coupled with high genetic advance was observed for plant height, number of pods per plant and number of branches per plant and high GCV observed for leaf area index followed by days to 50% flowering indicating thereby the preponderance of additive gene effects for this characters.

Interrelationships between seed yield per plot, number of pods per plant, and their component traits were studied. Days to maturity had highly significant positive correlation with days to 50% flowering both genotypically and phenotypically. Protein content is significant but negatively associated with days to maturity. Number of clusters per plant showed strong positive significant correlation with protein content .Pod length exhibited significant positive correlation with protein content. Number of seeds per pod exhibited positive significant correlation with protein content and strongly correlated with pod length Seed yield per plot exhibited strong positive significant correlation with clusters per plant, number of pods per plant It also shows moderately positive significant correlation with protein content. Components of seed yield *viz.* number of pods per cluster and number of clusters per plant appears to provide reliable criteria for effective selection in cowpea.

Keywords: Cowpea | grain yield | variability and correlation | character association

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Introduction

Cowpea [*Vigna unguiculata* (L.) Walp] is an important leguminous vegetable crop mainly grown both in *kharif* and spring summer season crop in most parts of India. Cowpea is diploid with chromosome number of 2n = 22.Cowpea belongs to family Leguminaceae, Sub family Fabaceae, is a genus having 170 species.. Cowpea contains three cultivated species *viz.,V. unguiculata, V. cylindrica, V. sequipedalis.* It is early, multiseasonal and

multipurpose crop. Cowpea seeds are good source of protein (24.8%), fat (1.9%), CHO (63.6%), vitamin A (0.00074), Thiamine (9) (0.00014) Riboflavin (mg) (0.00042), Niacin (mg) (0.00281).

The present study was taken up to understand the variability, heritability estimates, expected genetic advance and correlation studies. For selection of the important traits of the seed yield in cowpea.. Genotypic coefficient of variation (GCV) was highest leaf area index (45.17%) followed by days to 50% flowering (40.04%), plant height (34.71%),

Yield is a complex entity and is associated with a number of component character. These Characters are themselves interrelated. Such a interdependence of the contributory factors often affect their direct relationship with yield thereby making correlation coefficient unreliable as selection indices .It is however, desirable to know the degree to which different component characters are correlated among themselves as well as with the both at genotypic and phenotypic levels. The present investigation was, therefore undertaken to determine correlation coefficients both at genotypic and phenotypic levels in cowpea.

MATERIALS AND METHODS

Thirty cowpea indigenous type genotypes were grown in RBD with three replications in 2010.With 1.80 cm long and 2.40cm broad of each genotype was sown keeping 45cm spacing between rows. Observations were recorded on five random plants for days to 50% flowering, days to maturity, plant height, leaf area index, chlorophyll content 45 and 65 DAS number of branches per plant, no. of clusters per plant, no. of pods per plant, protein content, no of seeds per pod, pod length, seed yield per plot and 100 seed weight.

The data were subjected to statistical analysis and the various genetic parameters such as PCV, GCV, heritability and genetic advance were worked out by making use of appropriate formula (Singh and Chaudhary, 1977 and Johnson *et al.*, 1955.The plot means were used for statistical analysis (Panse and Sukhatme, 1967). The phenotypic and genotypic correlations were calculated according to formulae suggested by fisher (1954); Al-Jibouri *et al*. (1958) and Singh and Choudhari (1977) which were compared with table r values at n-2 d.f.

RESULT AND DISCUSSION

The performance of 30 genotypes for 14 characters with the estimate of phenotypic and genotypic correlation coefficient among 14 characters is presented in Table 2.

High GCV observed for leaf area index (45.17%) followed by days to 50% flowering (40.04%), plant height (34.71%), number of branches per plant (27.99%), number of pods per plant (24.84%), number of clusters per plant (24.73%) and for days to maturity (18.01%).

Heritability was higher for plant height (99.95%), days to 50% flowering (99.73%) followed by days to maturity (99.34%), number of branches per plant (98.78%), number of pods per plant (97.70%), 100 seed

weight (96.71%), number of clusters per plant (96.69%) which shows the selection for these characters will be beneficial**.** High heritability coupled with high genetic advance was observed for plant height (99.95% and 91.62%), number of pods per plant (97.70% and 64.82%) and number of branches per plant (98.78% and 73.45%)

The genotypic correlation coefficients were worked out for all the characters and presented in table 6.In general genotypic correlation coefficients were higher in magnitude over the respective phenotypic correlation coefficients except for the association in few pairs of characters.

Days to maturity had highly significant positive correlation with days to 50% flowering both at phenotypic and genotypic level. Plant height showed significant positive correlation with days to 50% flowering and days to maturity both at phenotypic and genotypic level. Number of branches per plant exhibited strong positive correlation with days to 50% flowering and days to maturity and plant height at genotypic as well as phenotypic level.

Chlorophyll content Index (65 DAS) was found to have positive-significant correlation with Chlorophyll content Index (45 DAS) both at phenotypic and genotypic level. Protein content is significant but negatively associated with days to maturity. Number of clusters per plant showed strong positive significant correlation with protein content while it had moderately negatively significant correlation with number of branches per plant. Also it is highly significant but negatively correlated with Days to 50 % flowering, days to maturity and plant height. Number of pods per clusters showed strong positive significant correlation with number of cluster per plant and protein content while it had moderately negative but significant correlation with number of branches per plant. It had significant negative association with days to 50 % flowering, days to maturity and plant height both at phenotypic and genotypic level. Pod length exhibited significant positive correlation with protein content both at phenotypic and genotypic level. Number of seeds per pod exhibited positive significant correlation with protein content and strongly correlated with pod length Seed yield pert plot exhibited strong positive significant correlation with clusters per plant, number of pods per plant. It shows moderately significant correlation with number of pods per plant phenotypically. It also shows moderately positive significant correlation with protein content and moderately negative significant correlation with days to 50% flowering, days to maturity and number of branches per plant both at phenotypic and genotypic level.

Days to maturity exhibited strong positive correlation with days to 50 per cent flowering. Tyagi *et al*. (2001) observed similar trends of results for days to maturity and plant height at both phenotypic and genotypic levels. Number of clusters per plant is negatively significantly correlated with the days to 50% flowering, days to maturity, plant height and Number of branches per plant. Analogous results are reported by Venkatesan *et al*. (2003) for plant height and number of branches per plant.

Sr. No	Characters	GM	RANGE	GCV %	PCV %	H^2b %	GAM 1%
1.	Days to 50% flowering	70.64	33.33-100.33	40.04	40.09	99.73	105.56
2.	Days to maturity	114.56	64.66-137.66	18.01	18.07	99.34	47.40
3.	Plant height (cm)	85.07	47.40-137.60	34.71	34.72	99.95	91.62
4.	Number of branches per plant	14.95	10.66-22.53	27.99	28.16	98.78	73.45
5.	Leaf area Index	1.26	0.57-3.66	45.17	47.80	89.29	112.69
6.	Chlorophyll content Index (45 DAS)	32.86	26.14-37.46	10.32	11.15	85.54	25.19
7.	Chlorophyll content Index (65 DAS)	32.53	24.62-39.93	10.12	12.12	69.74	22.31
8.	Protein content (%)	19.62	17.38-23.63	8.54	8.74	95.36	22.02
9.	Number of clusters per plant	4.96	3.26-7.20	24.73	25.15	96.69	64.20
10.	Number of pods per plant	9.92	6.60-14.40	24.84	25.13	97.70	64.82
11.	Pod length (cm)	11.76	10.26-15.46	10.17	10.76	89.38	25.39
12.	Number of seeds per pod	10.53	8.80-13.80	10.86	11.28	92.63	27.60
13	100 seed weight (g)	9.87	8.33-15.16	17.05	17.34	96.71	44.27
14.	Seed yield per plant (g)	11.26	9.46-14.66	10.08	11.25	80.44	23.88
15.	Seed yield per plot (g)	433.86	335-576.66	11.76	12.84	83.90	28.45

Table 1: Estimate of genetic variability for fifteen characters in cowpea

CONCLUSION

The experimental studies revealed substantial amount of genetic variability among the genotypes under study. In general, phenotypic coefficients of variation were higher in magnitude than genotypic coefficient of variation. The characters LAI and days to 50% flowering showed comparatively higher estimates of genotypic and phenotypic coefficients of variation indicating high level of variability and ample scope for effective improvement. The higher estimates of heritability coupled with high genetic advance as percentage of mean indicated additive gene action for the above characters. The characters Seed yield per plot exhibited strong positive

significant correlation with clusters per plant (r=0.496**), significant correlation with protein content number of pods per plant (0.384*). (r=0.483**). Also shows moderately positive

Sr. No	Character	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches/ plant	LAI	CCI 45 DAS	CCI 65 DAS	Protein content (%)	No of clusters /plant	No of pods/cluster	Pod length (cm)	No. of seeds /pod	100Seed Weight (g)	Seedyield/ plant (g)
1	Days 50% to flowering	G 1 P	0.886** 0.882**	0.687** 0.685**	0.534** 0.530**	-0.026 -0.024	-0.163 -0.153	0.301 0.249	-0.340 -0.331	-0.589** -0.576**	-0.587** -0.579**	0.000 0.000	-0.070 -0.068	-0.047 -0.046	-0.404* -0.369*
2	Days to maturity	G P	1	0.570** 0.568**	0.506** 0.501**	0.019 0.025	-0.156 -0.145	0.236 0.197	-0.403* -0.394*	-0.641** -0.632**	-0.642** -0.635**	-0.171 -0.164	-0.253 -0.240	0.004 0.002	-0.436* -0.402*
3	Plant height (Cm)	G P		1	0.810** 0.805**	-0.031 -0.028	-0.212 -0.194	0.246 0.210	-0.352 -0.344	-0.477** 0.469**	-0.497** -0.474**	0.015 0.015	0.011 0.011	-0.086 -0.085	-0.325 -0.295
4	No. of branches/ plant	G P			1	0.142 0.133	-0.112 -0.113	0.319 0.260	-0.311 -0.297	-0.446* -0.435**	-0.445* -0.437*	-0.169 -0.155	-0.161 -0.157	-0.201 -0.197	-0.440* -0.400*
5	LAI	G P				1	-0.309 -0.253	-0.267 -0.200	0.121 0.114	-0.225 -0.227	-0.234 -0.232	-0.025 -0.023	-0.006 0.000	0.333 0.316	0.103 0.069
6	CCI 45 DAS	G P					1	0.667** 0.668**	-0.044 -0.053	0.279 0.247	0.273 0.245	0.028 0.037	0.039 0.042	-0.109 -0.095	0.027 0.020
7	CCI 65 DAS	G P						1	-0.252 -0.206	-0.102 -0.094	-0.108 -0.099	-0.029 0.000	0.009 0.025	-0.117 -0.106	-0.090 -0.072
8	Protein content (%)	G P							1	0.589** 0.562**	0.592** 0.568**	0.430* 0.372*	0.436* 0.406*	0.319 0.300	0.384* 0.354
9	No. of clusters/ Plant	G P								1	0.998** 0.996**	0.038 0.050	0.042 0.040	-0.092 -0.087	0.496** 0.447*
10	No. of pods /plant	G P									1	0.039 0.043	0.046 0.039	-0.097 -0.094	0.483** 0.440*
11	Pod length (Cm)	G P										1	0.990** 0.934**	0.028 0.020	0.163 0.131
12	No. of seeds /pod	G P											1	0.061 0.042	0.158 0.148
13	100 seed weight (g)	G P												1	0.124 0.108
14	Seed yield/ plot (g)	G P													1

Note - r=0.361- at 5% level, 0.461-1 % level.
*, ** Significant at 5 and 1 per cent, respectively

Table 2: Estimates of genotypic and phenotypic correlation coefficient in cowpea.

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Man and Nature in Indian Thought

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Abstract

Indians have a vivid concept about the spiritual and material dimensions of man from time immemorial. It has originated from the precious treasures of Indian culture, namely the *Vedas*, *Upanishads* epics and *Puranas*. Indian philosophy elaborates on the ultimate objectives of human birth, human beings duties to environment, society and family etc. Man is an indispensable and integral component of universe. The utilization of natural resources is based on human restraint, confined to desirable needs and necessities. Nature is not a commodity to be consumed for human fulfilment. Western concept of conceiving environment as a utilitarian agency was alien to India. Indian worshipped the natural object as personifications of Gods and Goddesses. Ancient bards put forwarded balanced and comprehensive philosophy of nature as is revealed in the study of epics, *Puranas* and the works of Kalidasa etc. The greatest danger to contemporary society is ecological catastrophe. Globalization has accelerated the pace of ecological disequilibrium on an unprecedented scale. An urgent return to the purity of principles practiced in ancient India is the call of the hour. This return should not be in the form of fundamentalism of nature with a revivalist mindset. This paper explores in detail the different dimensions of environmental philosophy practiced by Indians.

Keywords: Indian ecology | Indian culture | Ecological disequilibrium | Deep eco-consciousness | Anthropocentricism | Globalisation

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Introduction

Indian philosophy has always had a unique concept about the spiritual and physical life of human beings from time immemorial. It originated from the Vedas, *Puranas* and epics of India. Indian culture clearly defines the duties and responsibilities of man to nature and other creatures in the universe. This concept originated not only from Vedas and epics but also from the great Indian classical literary works of *Kalidasa* and *Bhasa*. In Indian concept there is no separate existence for man apart from nature. Man and nature are not radically different entities in Indian thought. It is much relevant a debate about on so a serious topic in the context of environmental crisis.

Vedic concept

Rig Veda the first literary work of ours presents the noble concept of man nature relationship in the universe. The hymns of Rig Veda view man only as the manifestation of the same reality of cosmos with equal importance. It is deeply rooted in the Indian philosophical concept of Monism (*Advaitha)*. "Nobody thought of an existence that was apart from nature, which is the basis of man's existence. His duty is to protect nature and accept what nature offers". (V. Rajeev: 2008). In our ancient tradition and in literature Nature was worshiped with same importance given to other deities. "Man and nature were in perfect harmony, enjoying the abundance and the bliss of the supreme. The sacred rivers like *Ganga, Yamuna Saraswathy and Kaveri* were worshiped as mother goddesses from ancient time. According to Vedic Tradition the cause of existence of man in the universe is due to the blessings of nature and the compassion of mother earth and her prosperity. The majority of Vedic hymns are the prayers of man to nature goddess. Rig Veda refers mainly the Sun God (*Savithav*) the source of energy, Water (*Varuna*) the god of water and other gods like *Ushas, Yama, Rudra, Puusha, and Agni* also were the manifestations gods. "In the incipient golden era, the spiritual vision, thoughts and actions of mankind were not contaminated by corruption of any kind. Man and nature were in perfect harmony, enjoying the abundance and the bliss of the supreme". (Swami Gururethnam Jana Thapaswi: 2010). Human beiges pray for the blessings and abundance of harvest and prosperity. "The Veda wants every member of a society to have a vocation and to work not only for one's livelihood but also to achieve noble ends. *Ushas*, the Goddess of Dawn, is associated with men's active life." (*Avinash Chandra Bose*: 1965)

Many of them are fertility Goddess also. Rig Veda narrates the spiritual transition of man to a stage were man and nature are one and same. This is already pointed out in the last chapters of *Eashavasya Upanishad of Shuklayajurveda.* Here it explains that all the micro and macro materials in the universe are preserved by the sprit of God. This cosmos is God itself. All the living and inanimate objects are the manifestations of God. The earth is the limbs of God, Atmosphere is the abdomen, sky is the head, sun and moon are eyes and four corners are the years. Universe & Physical mass are the two stages (phases) of the Almighty. That means all the organic and non organic substance in the universe is the manifestations of God. Worship them; live with them, because these two are one and same. This unique spiritual relation of man and nature is the core concept of Indian ecology.

The *Purushasuktha* in Rig Veda is the scientific truth of the structure and components of the cosmos. The prime cause of Vedic history is that, all the living and non living creators and natural phenomenon in the planet are the part of the divine power. "It has been believed that the very sound of the Vedic hymns, called 'Sabda Brahman', The Veda as a mere succession of sounds, sets in to motion blissful vibrations in the atmosphere and works for the wellbeing and peace of the whole world. The invocation of universal peace forms

a solemn close to *Yajnas*" (*Avinash Chandra Bose*: 1965).

The river, mountain, stars and trees are divine and sacred to Indians. Like Rig Veda, The Atharva Veda is also filled with prayers to nature and man's organic relationship with the eco-systems. Among this *Bhoomisukatha* is also has equal importance. It is also known as *Mathrubhumisukthom*, as mother earth is considered as the mother of all the organic and inorganic substance in it. In Atharva Veda the earth is the holy mother and all the creatures in the universe are the offspring of the earth; the eternal sky is the universal father. The mother earth is to be worshipped as Adithi, the goddess. The noble sky is the brother and it dissolves all the sins and showers blessings on creatures. Make it remain lively as it is, this is the duty of human being. Man must not become an obstacle in the course of Nature's journey forward. This is the holy message the Atharva Veda gives.

"*The Hindu system worship was not confined to the propitiation of Gods and demigods, for the whole of the nature were in some sense divine. ….. Not only men, but animals and plants were and still are holly, notably the cow.*" After cow, Snake was perhaps the most revered animal of ancient India. (Basham, A. L., 1992) Even the mountains and rocks were also considered as divine. Trees were also worshiped. Each village had its sacred tree and sacred groves where supernatural powers and Goddess were present. Sacred groves are very common in South India where Serpent Gods were worshipped. To Indians, everything in the universe is divine with religious sanctity. This shows the cult of deep eco- consciousness of our ancient people and their harmonious life with nature.

The four Vedas were brought to earth by Gods. The *Agnideva* brought Rig Veda, *Aadithya* brought *Yagurveda*, *Vayudeva* brought Samaveda and Seer *Angiras* brought Atharva Veda to earth. It is nowhere available in Indian classical literature like the *Bhoomisuktha* in Atharva Veda with a balanced ecological consciousness. The chief deity of this Veda is Mother Earth. She is cute; she is the only dependent to all the creatures in the universe. She is the never-ending resources of abundances and prosperity. The divine Vedic hymns came in to being through the worship of nature. Man also has a sense of humble dependence on nature. The Vedic hymns give the best illustrations of ecocentrism. His duty is to protect Nature and to accept what nature offers. The Vedic society was not dependant on agriculture only. "Rg Vedic society was essentially pastoral. This did not preclude agriculture although agrarian activities are more frequently described in the later session of the text." (Romila Thapar: 2006) The Vedas emblazon that the mother earth and its eco systems should be nourished and protected. "The Hindus have received their religion through revelation, the Vedas. They hold that the Vedas are without beginning and without end….The moral, ethical and spiritual relations between soul and soul and between individual sprits and the father of all sprits". (Swami Vivekananda: 2002) The Vedas and Vedanta philosophy are the basis of Indian thought.

Western concept

(ANTHROPOCENTRISM)

In modern and western concept man and nature are different entities. Man is the supreme and he has the power to interfere in the natural discourse of nature. In India it starts from the intrusion of colonial powers. The western concept of world is anthropocentric where man is the centre of the universe. The western concept of colonial modernity reinforced this man centred philosophy. As a result eco-centrism was replaced by anthropocentrism. "Anthropocentrism is the placing of humanity at the centre of everything, so that other forms of life will be regarded only as resources to be consumed by human beings"(V. Rajeev: 2008). The ancient ecological concept of India which is known as *Vedic or Aarsha* in other terms is the same as eco-centric. The advent of Christianity to India and its man-centred philosophy flourished the dualistic concept of man and nature. According to it man is the supreme power of nature everything in the nature is created for him and for the fulfillment of his requirements. The duty of man is to suppress and rule over all other powers in nature. But in contrary Indian philosophy man has no separate existence among this two. While the western concept of nature is of exploitation, that of India is of surrender. Only after the arrival of Industrial capitalism man starts to loot nature in unprecedented level. Nature and man are the parts of the same organic body in Indian concept. Man does not deserve any importance than other living beings in our universe. He is only a component of nature like other creatures, but when the cult of *Yajna* was developed for the physical attainments through sacrifice and for the blessings of Gods. "The Vedic activism aimed at both the material welfare and spiritual enlightenment of the individual as well as of the society…… The Veda not only prescribes the acts of sacrificial rites but also advocates activism in general." *(Kashikar* .C. G: 1965)

Nature in Indian classical literature

Like the Vedas the Indian classical literature also celebrates man-nature relationship. Indian epics and classical literature attributes humanness to natural phenomenon. Among this, renowned poet Kalidasa's works are the first and foremost to imbibe a deep ecological awareness. Among the works of Kalidasa, *Abhijana Shakunthalam* stands first for the sublime man- nature relationship. All the acts of this drama debate verbally this noble idea of divine nature. There the duties of The King, human being, sages and the duties of women are connected with nature. In *Shakundalam* when Dushiyantha sees Shakunthala the first time, the King describes her beauty of her in terms taken from nature; lips as pretty and tender as tender leaves; arms as the small branches of trees; body as beautiful as a flower dazzling youth, Shakunthala's beauty bears a close resemblance to the objects of nature. The words of Anasuya in the first act are "*I suspect, Father Kanua likes the Jasmine flowers more than you as he has engaged you for watering them."* To Kalidasa Man and nature are one organic body. To him nature is not a world apart from the world of man. The order is first nature, then man. The reply of Shakunthala is "*The Bakula tree dazzle in the breeze with her*

tender leaves of fingers retreating back; so let me go to her." In Shakunthalam in no way the natural objects are separated from human being. The relation of man with nature is brotherly with one sprit. This philosophy of man and nature is spread everywhere in Shakunthalam.

All duties of Shakunthala are in association with the Forest Goddess. When Shakunthala requests them to give her permission to go to her husband's palace, Kanva replayed this words "Shakunthala never took water without pouring water to the plants and flowers. She never touches and gives pain to the tender leaves because of her affection to them. The first flowering of them is a celebration for her. So she requests permission to go to her husband's house. When Shakunthala bids to go, she embraces the *Vanagyolsna* (wild Jasmine) and says "*May I bid fair well to this wild jasmine plant who is a sister to me?*" To Kanva Shakunthala and the jasmine plant are his children. She requests Kanva to let her know when the deer abandoned its mother and brought up by her would have its calf. How beautiful is the banks of river *Malini* and its banks that is so gentle and pure! How many beautiful scenes are inscribed in words by the great poet? This is the most sublime picture of man-nature relationship. Here nature and human being are identified.

Ruthusamhara is filled with beautiful pictures of nature that captivates man. What varied feelings, the six seasons of *Greeshma, Varsha, Sarath, Hemanth, Shisira*, and Vasantha stir deep in our minds! The human minds also undergo transformation as the seasons change. Which other great poetic work has made all this as human experience?

Conclusion

Not only Kalidasa's work, but all the poets in India also envisage the concept of an idealistic world of man nature relationship and deep eco-consciousness. The return to this ideological time is the need of the present day of globalization. Let us remember the words of Russo: Back to nature.

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Toxicological effects of lead on certain enzymological and biochemical parameters in *Cirrhina mrigala*

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Abstract

Lead is found to be the most toxic of heavy metals so the present research is designed to study toxicological effects of lead on certain enzymological and biochemical parameters in tissue and blood. Fish were exposed to sublethal dose of lead chloride ($PbCl_2$) for 40 days. The tissue extracts were taken and tested for the activity of key enzymes of glycolysis and Kreb's cycle along with their biochemical components. In blood, the level of glucose increased by 115.38%. Pyruvic acid and lactic acid decreased by 25.97% and 37.5% respectively. In liver, the glycogen content increased by 104.2%. The activity of glucose-6- phosphatase increased in liver and gills. Inhibition in the activity of LDH in liver and muscle indicates decreased rate of glycolysis. Elevation in the activity of PDH and SDH in liver, gill and muscle shows that in fish the rate of oxidative metabolism is increased to withstand the toxic stress.

Keywords: Tissues | Enzymes | Blood | Biochemical parameters | Lead

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Introduction

Heavy metals are common persistent pollutants of aquatic ecosystem entering them through numerous diverse anthropogenic and natural sources (Moore, 1991). Aquatic systems are very sensitive to heavy metal pollutants and the gradual increase in the level of such metals in aquatic environment, mainly due to anthropogenic sources, became a problem of primary concern (Thirumvalan. R., 2010). This is due to their persistence, as they are not usually eliminated either by biodegradation or by chemical means, in contrast to most organic pollutants.

Lead (Pb) is one of the most toxic of heavy metals and its compounds are included in the grey list of international conventions (Taylor *et al*., 1985). Lead enters the aquatic environment through erosion and leaching from soil, lead-dust fall out, combustion of gasoline, municipal and industrial waste discharges, run-off water deposits from streets and other surfaces as well as precipitation (Department of Water And Forestry (D.W.A.F.), 1996). Lead that is emitted into the atmosphere can be inhaled, or it can be ingested after it settles out of the air. It is rapidly absorbed into the bloodstream and is believed to have adverse

effects on the central nervous system, cardiovascular system, kidneys, and the immune system (Bergeson, Lynn L, 2008).

Chemical changes disturb the equilibrium (homeostasis) of ecosystems and thus prevent their normal functioning. In polluted water bodies, concentrations of compounds containing both essential metals and those playing no part in an organism's functioning (lead) may increase to toxic levels (Jezierska and Witeska 2001). The above affect individual development of plants and animals. Among animal species, fish are the inhabitants that cannot escape from the detrimental effects of these pollutants (Olaifa *et al*., 2004; Clarkson, 1998; Dickman and Leung, 1998). Fish are widely used to evaluate the health of aquatic ecosystems because pollutants build up in the food chain and are responsible for adverse effects and death in the aquatic systems (Farkas *et al*., 2002; Yousuf and El-Shahawi, 1999). So an attempt has been made in the present research to study the effect of heavy metal lead (Pb) on certain physiological activities and biochemical parameters in tissue and blood.

MATERIALS AND METHOD

The fish, *Cirrhina mrigala* were purchased from the local fish market having an average length 12±3 cm and wt 200±2 gms The fish were then kept in different aquaria for conduction of various experiments. The fish were acclimatized to laboratory conditions in aquaria for a few days. In one aquarium the fish were kept as control specimens given the same food and environment as that of the experimental fish except that they were not given the dose of heavy metal compound. Inorganic salt of heavy metal lead namely lead chloride anhydrous ($PbCl_2$) was the experimental toxicant. To observe the chronic effects of lead, sublethal dose (1/10 concentration of 96 hr LC_{50}) of the heavy metal compound was given for 40 days. During exposure period the fish were conditioned to feeding on packed fish food at the rate of 2% of body weight. The fish were fed once daily at 11am.

For the estimation of activities of enzymes of glycolysis and kreb's cycle, 10% of W/V homogenates were prepared in 0.25 M sucrose solution for tissues namely liver, gills and muscles. The homogenates were refrigerated in cold at 1000x g for 20 min. and clear supernatant fluids were used as the source of enzymes. The activities of Lactate Dehydrogenase (LDH), Pyruvate Dehydrogenase (PDH), Succinate Dehydrogenase (SDH) enzymes were estimated by the triphenyltetrazolium chloride method of Srikantan and Krishnamoorthi (1995). The activity of Glucose-6-Phosphatase was determined by adopting the method of Swanson (1955). Glycogen in liver was estimated by the method of Hassid and Abrahim (1957). The method of Lowery et al (1951) was adopted for the estimation of total proteins.

Blood from the caudal vessel of both control and experimental fish was drawn with the help of heparinized needles for the estimation of the levels of glucose, lactic acid and pyruvic acid. Glucose was determined by the method of Folin and Wu (1929). Pyruvic acid was determined by the method of Friedmann and

Haugen (1944). Lactic acid in blood was estimated according to the method of Barker (1963). The significance of the difference between control and experimental means was calculated by Students't' test (Wardlaw, 1985)

Observation and Results

1. Enzymological studies

LIVER (Table-1)

The activity of Glucose-6-Phosphatase increased by 38.91% after 40 days of exposure. The activity of lactate dehydrogenase (LDH) decreased after 40 days of exposure (39.45%). Increase was observed in the activity of pyruvate dehydrogenase (PDH) and succinate dehydrogenase (SDH) after 40 days of exposure by 103.5% and 40.47% respectively.

GILLS (Table-2)

Increase in the activity of Glucose-6-phosphatase was observed after 40 days (9.27%). The activity of lactate dehydrogenase decreased after 40 days of exposure. However increase of 27.78% was recorded in the activity of pyruvate dehydrogenase (PDH) after 40 days of exposure. The activity of succinate dehydrogenase (SDH) increased after 40 days (41.49%).

Muscle (Table –3)

Decrease was observed in the activity of lactate dehydrogenase (LDH) after 40 days of exposure. However no significant change was observed in the activity of PDH during exposure period. Increase by 40.13% was observed in the activity of Succinate dehydrogenase (SDH) after 40 days of exposure.

2. BIOCHEMICAL STUDIES

Blood (Table-4)

The blood glucose level increased after 40 days of exposure by 115.38%. The fish were hypolectemic after chronic exposure to lead. Pyruvic acid level decreased in the blood after 40 days of exposure by 25.97%.

Liver (Table-4)

On chronic exposure to lead, glycogen content of liver increased by 104.2%.

ENZYMES	CONTROL	40 DAYS
GLUCOSE-6-PHOSPHATASE [a]	233.39±0.02	324.22±0.04***
LACTATE DEHYDROGENASE [b]	4.79±0.02	2.90±0.03***
PYRUVATE DEHYDROGENASE [b]	3.14±0.04	6.39±0.02***
SUCCINATE DEHYDROGENASE [b]	5.09±0.01	7.15±0.04***

Values are mean±SD; n=6, NS= not significant

*significant, *p<0.05, **p<0.01, ***p<0.001

[a]µg inorganic phosphate/mg Protein/hr

[b]µg formazon/mg Protein/hr

Table-1: Alterations in liver enzyme activities in *Cirrhina mrigala* exposed to lead (Pb) for 40 days

ENZYMES	CONTROL	40 DAYS
GLUCOSE-6-PHOSPHATASE [a]	27.72±0.05	30.29±0.01***
LACTATE DEHYDROGENASE [b]	4.87±0.02	4.73±0.08*
PYRUVATE DEHYDROGENASE [b]	3.73±0.04	5.60±0.04***
SUCCINATE DEHYDROGENASE [b]	6.49±0.01	8.66±0.05***

Values are mean±SD; n=6, NS= not significant

*significant, *p<0.05, **p<0.01, ***p<0.001

[a]µg inorganic phosphate/mg Protein/hr

[b]µg formazon/mg Protein/hr

Table-2: Alterations in gill enzyme activities in *Cirrhina mrigala* exposed to lead (Pb) for 40 days

ENZYMES	CONTROL	40 DAYS
LACTATE DEHYDROGENASE [b]	8.03±0.02	6.69±0.01***
PYRUVATE DEHYDROGENASE [b]	11.05±0.04	10.97±0.07NS
SUCCINATE DEHYDROGENASE [b]	4.51±0.03	6.32±0.03***

Values are mean±SD; n=6, NS= not significant

*significant, *p<0.05, **p<0.01, ***p<0.001

[b]µg formazon/mg Protein/hr

Table-3: Alterations in muscle enzyme activities in *Cirrhina mrigala* exposed to lead (Pb) for 40 days

PARAMETERS	CONTROL	40 DAYS
BLOOD		
Glucose [a]	0.13±0.01	0.28±0.01***
Lactic Acid [a]	0.08±0.01	0.05±0.05**
Pyruvic Acid [a]	0.77±0.03	0.57±0.03***
LIVER		
Glycogen [b]	0.70±0.05	1.43±0.07***

Values are mean±SD; n=6, NS= not significant

*significant, *p<0.05, **p<0.01, ***p<0.001

[a] mg/ml of blood

[b] mg/gm wet weight of tissue

Table-4: Alterations in biochemical parameters in *Cirrhina mrigala* exposed to lead (Pb) for 40 days

Discussion

The toxic effects of heavy metals arise from their action on biological systems. 'Enzymes' are the common targets of toxicants and undergo marked alterations in their activities with the period of exposure and tissue.

After 40 days of exposure, blood sugar level increased showing increased rate of glycogenolysis as the activity of G-6-Pase also increases after 40 days but simultaneous increase in the liver glycogen may be due to the increased rate of glycogensis. Hinston et al (1983) reported an increase in the blood glucose level in the fish *Channa punctatus* exposed to pollutants. R. Vinodhini et al (2008) also observed increase in blood glucose level in *Cyprinus carpio* after exposure to mixture of heavy metals, lead (Pb), cadmium (Cd), chromium (Cr) and nickel (Ni) for 32 days. Patil and Dhande (2000) also reported increased blood glucose level in *Channa punctatus* exposed to mercuric chloride. Almeida et al (2001) also found increase in blood glucose level in *Oreochromis mossambicus* exposed to cadmium.

Decrease in lactic acid content and increase in the liver glycogen shows increased rate of glycogenesis *i.e.* formation of liver glycogen from lactic acid. Sastry et al (1987), Sastry and Sunita (1983) and Lowe Jinde and Niimi (1984) reported decrease in lactic acid in the liver of *Heteropneustes fossilis* and *Channa punctatus* exposed to lead (Pb) and chromium (Cr) respectively.

Decrease in the activity of lactate dehydrogenase (LDH) in liver, gills and muscle on chronic exposure to lead (Pb) indicates decreased rate of glycolysis. Similar decrease in LDH activity was noted in the early developmental stages of African Catfish, *Clarias graiepines* on exposure of lead nitrate ($Pb(NO_3)_2$) (Alla G. M. Osman et al 2006). Singhal (1994) also observed decrease in activity of lactate dehydrogenase (LDH) in liver, gill, muscle and kidney of catfish *Hetropneustes fossilis* on exposure to sublethal concentrations of lead nitrate ($Pb(NO_3)_2$).
Inhibition in the activity of LDH is evidenced by decrease in the pyruvic acid level of blood showing decreased rate of glycolysis. Similar decrease in pyruvic acid was recorded by Rajeshwari et al (1990) in *Clarias batrachus* on exposure to cadmium.

Oxidative metabolism prevailed in liver and gills and muscles after 40 days of lead exposure. The evidence in favour of this comes from the increase noted in the activity of PDH and SDH in liver, gill and muscle (40 days). Impairment of glycolysis and favouring of oxidative metabolism shows that pyruvic acid utilized in the oxidative metabolism was derived from an alternative source. Similar increase in the PDH and SDH activities was observed in different tissues of *Channa punctatus* exposed to chromium (Sastry and Sunita, 1983). Increase in SDH activity was noted on exposure of cadmium for 30 days in *Channa punctatus* (Sastry *et al*., 1997).

Conclusion

Increase in the activity of SDH and decrease in LDH in different tissues clearly shows that in fish, the rate of oxidative metabolism is increased to withstand the toxic stress. Elevation in the activity of enzymes of Kreb's

cycle in different tissues suggest that metabolic rate of fish exposed to lead (Pb) was higher than control fish, indicating hypermetabolic state of the fish.

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Impact of Tourism on Environment

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Abstract

Tourism is the world's largest industry with over 10 percent of GDP globally directly related to tourism activities. In 2000 tourism contributed 11% for world GDP, 8% for world employment, 7.9% for world exports and 9.4% for world investment.

After the debate at the Rio Earth Summit in 1992 the concept of sustainability has become a fundamental issue in tourism. The concept of sustainability when applied to tourism can be perceived and interpreted in various ways. Sustainable tourism means achieving a particular combination of number and types of visitors, the cumulative effect of whose activities at a given destination together with the actions of the servicing businesses can continue into the foreseeable future without damaging the quality of the environment on which the activities are based.

Keywords: Eco-Tourism | Sustainability | Pollution | Environmental Conservation

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Eco tourism is responsible travel to national areas and sustains the well being of local people. It is an amalgamation of interests arising and sustains the well being of local people. It is an amalgamation of interests arising out of environmental, economic and social concerns. Negative impact from tourism occurs when the level of visitor use is greater than the environment's ability to cope with this use within the acceptable limits of change. It can put enormous pressure on area and lead to impacts such as soil erosion, increased pollution, discharges into the sea, natural habitat loss, increased pressure on endangered species and heightened vulnerability to forest fires. It often puts strain on water resources and it can force local population to compete for the use of critical resources. The range of issues which need to be stressed when debate is on eco tourism is how can we provide the movement of million of people across boundaries and many many millions within - the boundaries to deliver a sustainable product particularly where eco systems are fragile and yet an attraction for tourist gaze and the responsible action on the part of tourists and tourism industry. There is also need for policy initiatives that would help to promote tourism

as well as efforts to control its damaging impact on environment. The aim of this paper is to discuss the measures for providing the eco tourism and responsibility on the part of tourists and tourism industry to conserve environment.

Introduction

Environment is the concern of mankind. After the debate at the Rio Earth Sumit in 1992 the concept of sustainability has become a fundamentally issue in tourism. The concept of sustainability when applied to tourism can be perceived and interpreted in various ways. Sustainable tourism means achieving a particular combination of number and types of visitors, the cumulative effect of whose activities at a given destination together with the actions of the serving business can continue into the foreseeable future without damaging the quality of the environment on which the activities are based.

Men have been fascinated by travel and tourism from the earliest historical place. He always has had the urge to discover the unknown, to explore new and strange places, to seek changes of environment and to undergo new experiences. However, international organizations support tourisms for its contributions to the world place, the benefits of mixing peoples and cultures, the economic advantages which it can ensure and the fact that tourism is a relatively 'clean' industry. The importance of tourisms was highlighted when the UN general assembly designated 1967 as the International Tourism year. It recognized that tourism is a basic and desirable human activity. The so called Manila Declaration supports the view that tourism is an activity essential to the life of nations because of its direct effects on social, cultural, educational and economic sectors of societies.

There are various definitions of tourism. Theobaid (1994) suggested that etymologically, the word 'tour' is derived from the Latin 'tornare' and the Greek 'tornos' meaning ' lathe or circle, the movement around a central point or axis.

The Macmillan Dictionary defines tourism as the business of providing services for people who are travelling for their holiday. Wikipedia defines it as travel for recreational, leisure or business purpose.

Therefore, tourism is an amalgam of phenomena and relationships, rather than a single one. These phenomena and relationships arise from movement of people and their stay in various destinations. The journey and stay are outside the normal place of work and residence and the movement is temporary.

Tourism is an activity comprising three elements.

1. The consumer or visitor who is undertaking the activity or transaction.
2. The product which is the activity or transaction itself, usually the obtaining of goods or services and.
3. The service which is the body supplying the goods / services or the environment in which the event takes place.

Over the decades tourisms has over the decades tourism had experienced continued

growth and deepening diversification to become one of the fastest growing economic sectors in the world. Tourism has become a throwing global industry with the power to shape developing countries in both positive and negative ways. No doubt it has become the fourth largest industry in the global economy.

Development of tourism in India

Early Development

The first conscious and organized efforts to promote tourism in India were made in 1945 when a committee was set up by the Government under the Chairmanship of Sir John Sargent, the then Educational Adviser to the Government of India (Krishna, A.G., 1993). Thereafter, the development of tourism was taken up in a planned manner in 1956 coinciding with the Second Five Year Plan. The approach has evolved from isolated planning of single unit facilities in the Second and Third Five Year Plans. The Sixth Plan marked the beginning of a new era when tourism began to be considered a major instrument for social integration and economic development.

But it was only after the 80's that tourism activity gained momentum. The Government took several significant steps. A National Policy on tourism was announced in 1982. Later in 1988, the National Committee on Tourism formulated a comprehensive plan for achieving a sustainable growth in tourism. In 1992, a National Action Plan was prepared and in 1996 the National Strategy for Promotion of Tourism was drafted. In 1997, the *New Tourism Policy* recognises the roles of Central and State governments, public sector undertakings and the private sector in the development of tourism were. The need for involvement of Panchayati Raj institutions, local bodies, non-governmental organizations and the local youth in the creation of tourism facilities has also been recognised.

Present situation and features of tourism in India

Today tourism is the largest service industry in India with a contribution of 6.23% the national GDP ad providing 8.78% of the total employment. India witness's more than 5 million annual foreign tourists' arrivals and 562 million domestic tourist visits. The tourism industry in India generated about US $ 100 billion in 2008 and that is expected to increase to US 275.5 billion by 2018 at a 9.4% annual growth rate. The ministry of Tourism is the nodal agency to the development and promotion of tourisms in India and maintains the "incredible India" campaign.

According to World Travel and Tourism council, India will be a tourism hotspot from 2009-2018, having the highest 10-year growth potential. As per the Travel and Tourism competitiveness Report 2009 by the World Economic Forum, India is ranked 11th in the Asia Pacific region and 62nd overall, moving up three places on the list of world's attractive destinations. It is ranked the 14th best tourist destination for its natural resources and 24th for its cultural resources, with many World Heritage Sites, both natural and cultural, rich fauna, and strong creative industries in the country. India also bagged 37th rank for its air transport network. The India travel and tourism industry ranked 5th in the long-term (10-year)

growth and is expected to be the second largest employer in the world by 2019.

The first-ever Indian Tourism Day was celebrated on January 25, 1998. The Year 1999 was celebrated as *Explore India Millennium Year* by presenting a spectacular tableau on the cultural heritage of India at the Republic Day Parade and organising India Tourism Expo in New Delhi and Khajuraho. Moreover, the campaign ***'Visit India Year 2009'*** was launched at the International Tourism Exchange in Berlin, aimed to project India as an attractive destination for holidaymakers. The government joined hands with leading airlines, hoteliers, holiday resorts and tour operators, and offered them a wide range of incentives and bonuses during the period between April and December, 2009.

International travel and tourism

It has had a remarkable record of consistent growth, expanding faster than the worlds GDP in the last four decades. During the last 40 years, travel and tourisms has been growing 7.2% in volume and 12.3% in value per year.

There were 696.7 million tourists around the world in 2000 and 692.7 million in 2001 (the fall in 2001 in due to past Sept. 11, 2001). International tourists have increased by more than 1500% in the past thirty years. The WTO forecast the tourism's absolute contribution to the world economy by 2005 world is US $ 1369 billion in tax revenue. The high flying region will be Asia where growth between 7% and 10% is expected that will eventually lead the region to capture half of international travel by 2005.

Adventure tourism and Holiday tourism

India's vast geographical diversity provides a vast potential for adventure tourism and hence the travel agents and tour operators very often specialize in certain fields offering package deals for groups as well as the individuals. Mountaineering trekking and rock climbing, ballooning and hang gliding, camel treks and desert safaris, white water rafting and river exploration are some of the exciting offers. Apart from this there are sports like skinning, scuba diving and underwater coral viewing angling, wildlife, and bird watching, golf, tennis badminton, polo, swimming and motor rallies amongst other sports.

Need assessment of impact of tourisms on environment

All ecosystems, including human communities have thresholds of tolerance for pollution and disturbances beyond which, the system may suffer anything form temporary upsets to complete destruction. The negative impacts from tourism occur when the level of visitor use is greater than the environment's ability to cope with this use within acceptable limits of change. Uncontrolled conventional tourisms poses potential threats to many natural areas around the world. It can put enormous pressure on an area and lead to impacts such as soil erosion, increased pollution discharges into sea, natural habitat loss, increased pressure on endangered species and heightened vulnerability to forest fires. It often puts strains on water resources, and it can force local populations to compete for the use of critical resources. One definition of eco-tourisms is "the practice of low impact educational,

ecologically and culturally sensitive travel that benefits local communities and host countries (Honey, 1999). Many of the ecotourism projects are not meeting these standards. Even if some of the guidelines are being executed the local communities are still facing other negative impacts. South Africa is one of the countries that are reaping significant economic benefits from eco tourisms but negative effects – including forcing people to leave their homes, gross violations of fundamental rights, and environmental hazards – far out-weigh the medium terms economic benefits (Miller, 2007).

Developmental activities have taken a toll on the environment and has resulted in loss of biodiversity. One of the major causes of the degeneration of environment is unplanned and unchecked developmental activities in the tourists destinations. Tourism though beneficial for the country's economy harms nature when it is not planned properly. People who come to enjoy the scenic beauty often litter the places with polythene and left over food without thinking about its adverse impact on the environment. The Dal Lake Srinagar which was one pristine has lost its nature due to tourist's pressure and is new covered with animal carcasses, sewage and weeds. The lake has shrunks as it was unable to handle the pollution caused by constant tourist's influx.

Tourisms industry also involves construction of hotels and lodges. These lodges are created near or on the banks of a lake or a river. The sewage water flows into lake water or sea, polluting its marine ecosystem. Tourisms also results in disorderly and scattered tourists facilities which generally are not eco friendly and that leads to aesthetic degradation of the landscape. It also has negative impact on the natural resources as it contribute to soil erosion, increase pollution and discharges into the sea, natural habitat loss and increase pressure on endangered species.

Trekking activities in mountainous region often result in over consumption of food. Tour bases are also a cause of pollution as they emit CFC, CO_2 and other green house gases as they often leave their motor running for hours so that tourists could return to air conditioned comfort.

Water disposal system is also a serious problem in most of the tourist distinction all over the world. For *e.g.* in Kumarkom and Vemband Lak in Kerala wastes from the houseboats has boasted the growth of algae which causes a serious damage to ecosystem.

Environmental impact of tourism

Positive impacts

1. Direct financial contribution and contribution to Govt. revenues – Tourisms directly contribute to the conservation of sensitive areas and habitat. Tourisms expenditures and the export and import of related goods and services generate income to the host economy and can stimulate the investment necessary to finance growth in other economic sectors. The World Travel and Tourisms Council estimated that travel and tourisms direct, indirect and personal tax contribution worldwide was over US $ 800 billion in 1998 - a figure it expects to double by 2010.

2. Improved environmental management and planning – Sound environmental management of tourisms facilities and especially hotels can increase the benefits to natural environment. One of the core elements of sustainable tourisms development in community development, which is a process and a capacity to make decisions that consider the long term economy, ecology and equity of all communities
3. Raising environmental awareness – Tourisms has the potential to increase public appreciation of the environment an to spread awareness of environmental problems when it brings people into closer contact with nature and the environment. Tourisms also helps raise local awareness of the financial value of natural and cultural sites and can stimulate a feeling of pride in local and national heritage and interest in its conservation.
4. Protection and preservation of environment – It contributes to environmental protection, conservation and restoration of biological biodiversity and sustainable use of natural resources. Because of their attractiveness, prestine sites and natural areas are identified as valuable and the need to keep the attraction alone can lead to creation of national parks and wild life parks.

Negative impacts

1. Depletion of natural resources

(a) Water and especially fresh water, is one of the most critical natural resources. The tourisms industry generally overuses water resources for hotel, swimming pools, golf courses and personal use of water by tourists. This can result in water shortages and degradation of water supplies as well as generating a greater volume of waste water.

In dryer regions like the Mediterranean, the issue of water scarcity is of particular concern. Becuae of the hot climate and the tendency of tourists to consume more water when on holiday than they do at home, the amount uses can run upto 440 liters a day. This is almost double what the inhabitants of an average Spanish's city use.

In average of golf course in a tropical country such a Thailand needs 1500 kg of chemical fertilizers, pesticides and herbicides per year and uses as much water as 60000 rural villagers.

(b) Local resources – Tourisms can create greater pressure on local resources like energy, food and other raw materials that may already be in short supply. Greater extraction and transport of these resources exacerbates the physical impacts association with their exploitation. Because of the seasonal characters of the industry, many destination have ten times more inhabitants in the high season as in the low season. A high demand is placed upon these resources to meet the high expectations tourists often have (proper the heating, hot water etc).

(c) Land degradation – Important land resources include minerals, fossil fuels, fertile soil, forests, wetland and wildlife. Increased construction of tourism and recreational facilities has increased the pressure on these resources and on scenic landscapes. Direct impact on natural resources, both renewable and nonrenewable, in the provision of tourist facilities can be caused by the use of land for accommodation and other infrastructure provision, and the use of building materials.

Forests often suffer negative impacts of tourism in the form of deforestation caused by fuel wood collection and land clearing. For example, one trekking tourist in Nepal - and area already suffering the effects of deforestation - can use four to five kilograms of wood a day.

2. Pollution –

(a) Transport by air, road and rail is continuously increasing in response to the rising number of tourists activities.

Transport emissions and emission from energy production and use are linked to acid rain, global warming and photochemical pollution. Air pollution not only affects human beings but non living material also such as metals, wood paint, textile etc.

The beauty of the wonderful monument of India - The Taj Mahal has been destroyed by air pollutants sulphur dioxide emitted from nearby Mathura oil Refinery.

One study estimated that a single transatlantic return flight emits almost half the CO2 emissions produced by all other sources (Lighting, heating, car use) consumed by an average persons yearly (Mayer Hillman, Town and Country Planning Magazine, September, 1996, Source MFOE).

(b) Solid waste and Littering – In areas with high concentration of tourist's activities and appealing natural attraction, waste disposal is a serious problem and improper disposal can be major despoiler of the natural environment rivers, science, areas and roadsides.

The Wider Caribbean Region, stretching from Florida to French Guiana, receives 63,000 port calls from ships each year, and they generate 82,000 tons of garbage. About 77% of all ship waste comes from cruise vessels. The average cruise ship carries 600 crew members and 1,400 passengers. On average, passengers on a cruise ship each account for 3.5 kilograms of garbage daily - compared with the 0.8 kilograms each generated by the less well-endowed folk on shore.

Source: Our Planet UNEP magazine for environmentally sustainable development, volume 10 No. 3, 1999.

3. Sewage

Construction of hotels, recreation and other facilities often leads to increased sewage pollution. Wastewater has polluted seas and lakes surrounding tourist attractions, damaging the flora and fauna. Sewage runoff causes serious damage to coral reefs because it stimulates the growth of algae, which cover the filter-feeding corals, hindering their ability to survive. Changes in salinity and situation can have wide-ranging impacts on coastal environments. And sewage pollution can threaten the health of humans and animals.

4. Aesthetic Pollution

Often tourism fails to integrate its structures with the natural features and indigenous architectural of the destination. Large, dominating resorts of disparate design can look out of place in any natural environment and may clash with the indigenous structural design.

A lack of land-use planning and building regulations in many destinations has facilitated sprawling developments along coastlines, valleys and scenic routes. The sprawl includes tourism facilities themselves and supporting infrastructure such as roads, employee housing, parking, service areas, and waste disposal.

Physical Impacts

Attractive landscape sites, such as sandy beaches, lakes, riversides, and mountain tops and slopes, are often transitional zones, characterized by species-rich ecosystems. Typical physical impacts include the degradation of such ecosystems.

An ecosystem is a geographic area including all the living organisms (people, plants, animals, and microorganisms), their physical surroundings (such as soil, water, and air), and the natural cycles that sustain them. The ecosystems most threatened with degradation are ecologically fragile areas such as alpine regions, rain forests, wetlands, mangroves, coral reefs and sea grass beds. The threats to and pressures on these ecosystems are often severe because such places are very attractive to both tourists and developers.

Physical impacts are caused not only by tourism-related land clearing and construction, but by continuing tourist activities and long-term changes in local economies and ecologies.

Physical impacts of tourism development

- **Construction activities and infrastructure development**

The development of tourism facilities such as accommodation, water supplies, restaurants and recreation facilities can involve sand mining, beach and sand dune erosion, soil erosion and extensive paving. In addition, road and airport construction can lead to land degradation and loss of wildlife habitats and deterioration of scenery.

In Yosemite National Park (US), for instance, the number of roads and facilities have been

increased to keep pace with the growing visitor numbers and to supply amenities, infrastructure and parking lots for all these tourists. These actions have caused habitat loss in the park and are accompanied by various forms of pollution including air pollution from automobile emissions; the Sierra Club has reported "smog so thick that Yosemite Valley could not be seen from airplanes". This occasional smog is harmful to all species and vegetation inside the Park. (Source: Trade and Environment Database)

- **Deforestation and intensified or unsustainable use of land**

Construction of ski resort accommodation and facilities frequently requires clearing forested land. Coastal wetlands are often drained and filled due to lack of more suitable sites for construction of tourism facilities and infrastructure. These activities can cause severe disturbance and erosion of the local ecosystem, even destruction in the long term.

- **Marina development**

Development of marinas and breakwaters can cause changes in currents and coastlines. Furthermore, extraction of building materials such as sand affects coral reefs, mangroves, and hinterland forests, leading to erosion and destruction of habitats. In the Philippines and the Maldives, dynamiting and mining of coral for resort building materials has damaged fragile coral reefs and depleted the fisheries that sustain local people and attract tourists.

- **Physical impacts from tourists activities**

Trampling – Tourists using the same trail over and over again trample the vegetation and soil, eventually causing damage that can lead to loss of biodiversity and other impacts. Such damage can be even more extensive when visitors frequently stray off established trails.

Trampling impacts on vegetation	**Trampling impacts on soil**
Breakage and bruising of stems	Loss of organic matter
Reduced plant vigor	Reduction in soil macro porosity
Reduced regeneration	Decrease in air and water permeability
Loss of ground cover	Increase in run off
Change in species composition	Accelerated erosion
Source: University of Idaho	

- **Anchoring and other marine activities**

In marine areas (around coastal waters, reefs, beach and shoreline, offshore waters, uplands and lagoons) many tourist activities occur in or around fragile ecosystems. Anchoring, snorkeling, sport fishing and scuba diving, yachting, and cruising are some of the activities that can cause direct degradation of marine ecosystems such as coral reefs, and subsequent impacts on coastal protection and fisheries.

There are 109 countries with coral reefs. In 90 of them reefs are being damaged by cruise ship anchors and sewage, by tourists breaking off chunks of coral, and by commercial harvesting for sale to tourists. One study of a cruise ship anchor dropped in a coral reef for one day found an area about half the size of a football field completely destroyed, and half again as

much covered by rubble that died later. It was estimated that coral recovery would take fifty years. Source: Ocean Planet

- **Alteration of ecosystems by tourist activities**

Habitat can be degraded by tourism leisure activities. For example, wildlife viewing can bring about stress for the animals and alter their natural behavior when tourists come too close. Safaris and wildlife watching activities have a degrading effect on habitat as they often are accompanied by the noise and commotion created by tourists as they chase wild animals in their trucks and aircraft. This puts high pressure on animal habits and behaviors and tends to bring about behavioral changes. In some cases, as in Kenya, it has led to animals becoming so disturbed that at times they neglect their young or fail to mate.

How global environmental impacts affect tourism

Natural disasters

Catastrophes like floods, earthquakes, wildfires, volcanoes, avalanches, drought and diseases can have a serious effect on inbound and domestic tourism and thus on local tourism industries. The outbreak of the foot and mouth disease epidemic in England earlier this year (2001), for instance, has severely affected Great Britain's inbound tourism market. A BHA/Barclays Hospitality Business Trends Survey found that 75% of hotels in England, 81% in Scotland and 85% in Wales continued to be affected by the foot and mouth outbreak, and over 60% forecast a decline in business in the June-September 2001 period.

Climate change

Tourism not only contributes to climate change, but is affected by it as well. Climate change is likely to increase the severity and frequency of storms and severe weather events, which can have disastrous effects on tourism in the affected regions. Some of the other impacts that the world risks as a result of global warming are drought, diseases and heat waves.

Malaria, the world's largest killer, has resurfaced in Spain, and it is estimated that changes in climate will result in parts of the country becoming a suitable habitat for malaria-carrying species of mosquito by the 2020s. Source: WWF [PDF]

These negative impacts can keep tourists away from the holiday destinations. Global warming may cause:

- Less snowfall at ski resorts, meaning shorter skiing seasons in the Alpine region. In already hot areas like Asia and the Mediterranean, tourists will stay away because of immense heat, and out of fear of diseases and water shortages.
- Harm to vulnerable ecosystems such as rainforests and coral reefs because of rising temperatures and less rainfall. A major risk to coral reefs is bleaching, which occurs when coral is stressed by temperature increases, high or low levels of salinity, lower water quality, and an increase in suspended sediments.
- Rising sea levels, the result of melting glaciers and polar ice. Higher sea levels will threaten coastal and marine areas with widespread floods in low-lying countries

and island states, increasing the loss of coastal land. Beaches and islands that are major tourism attractions may be the first areas to be affected.

- Increased events of extreme weather, such as tornadoes, hurricanes and typhoons. These are already becoming more prevalent in tourist areas in the Caribbean and South East Asia. Hurricane Mitch in 1998, for instance, heavily affected tourism in the Caribbean. Wind damage, storm waves, heavy rains and flooding caused major losses in the local tourism sector.

According to the Spanish Forestry Service ICONA, between 1985 and 1994 almost 250,000 hectares of forest burned. In recent years the number of forest fires has increased following periods of extreme dryness. Now, large areas of forest and parkland may be closed off to visitors. Source: WWF

Need of eco-tourisms

The international Eco tourisms society defines eco tourism as responsible travel to natural areas that conserves the environment and improves the well being of local people this means that those who implement and participate in eco – tourisms activities should follow the following principles.

- Minimize impact
- Build environmental and cultural awareness and respect.
- Provide positive experiences for both visitors and hosts.
- Provide direct financial benefits for conservation.
- Provide financial benefits and empowerment for local people.
- Paise sensitivity to host countries political, environmental and social climate.
- Support international human rights and labour agreements.

Needless to say eco tourism expects the visitors to be responsible travelers who respect nature's splendors and would be minimally destructive to mother nature's bounty. A true ecotourism does not mean any harm to the fragile life cycle of nature. Eco-tourisms is fast becoming the most preferred form of tourism with increasing awareness on the preservation of nature and native cultures. Ecotourism's also actively encourages and supports the diversity of local economics by making self sustained with tourist's related income.

Eco-tourisms need to be promoted with the following guidelines.

1. Arrange and promote meaningful contact between tourists and local people.
2. Support indigenous people / business by buying local goods and services.
3. Link commercial tourisms to local conservation programmes. Development sustainable tourist's facilities that minimize environmental damage.
4. Provide economic support for development and management of natural resources.

As a responsible tourist it is our responsible to not to throw any degradable waste material like tins and bottle etc. and to bring back all the waste material. Noise pollution should be consciously reduced and one should respect the

sancity of the local culture. One should also avoid using fuel for cooking at the campsite and water sources should not be polluted.

One should be avoid cutting any kind of flora or fauna in the form of cuttings so that we can protect the naturally rich areas especially in Himalayas. We should also respect the local traditions of the particulars place. In short eco tourism can be categorized as a tourisms programme that is "Nature based, ecologically sustainable, where education and interpretation is a major constituent and where local people are benefited".

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Electrical conductance properties of terpolymer resin: synthesis, characterization and its applications

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Abstract

Terpolymer resins (4-HBAF-IV) were prepared by the condensation of 4-hydroxybenzoic acid [4-HB] and adipamide [A] with formaldehyde [F] in the presence of acid catalyst at 127 ºC with molar proportion 4:1:5. The purity of newly synthesized terpolymer has been tested and confirmed by thin layer chromatography (TLC) technique. Compositions of terpolymers have been determined by elemental analysis. The number average molecular weights ($\overline{Mn}$) have been determined by conducto-metric titration in non-aqueous medium. Electronic spectra, infrared spectra and nuclear magnetic resonance spectra were studied to elucidate the structure. The electrical properties of 4-HBAF-IV copolymer were measured over a wide range of temperature (303-453K), activation energy of electrical conduction has been evaluated and plot of log α vs 1000/T is found to be linear over a wide range of temperature, which can be ranked it as semiconductor.

Keywords: Terpolymer Reson | Electrical conductivity

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Introduction

The terpolymers offer novelty and versatility; hence they occupy the pivotal position in the field of material science. The progress in the field terpolymers has been extremely rapid, as they generally useful in packaging, adhesives and coatings in electrical sensors and organometallic semiconductors. Semiconductor materials are the foundation of modern electronics, including radio, computers, telephones, and many other devices. Such devices include transistors, solar cells, many kinds of diodes including the light-emitting diode, the silicon controlled rectifier, and digital and analog integrated circuits. Although a variety of conjugated organic molecules are known as semiconductors, the carrier mobility in them is usually low. This is due to the difficulties in, which electrons jumps form one molecule to another and hence, the carrier mobility in the compound of this type increases with increasing molecular size. The synthesized polymer resins showing versatile applications and properties attracted the attention of scientists and introduce the recent innovations in the polymer chemistry.

These polymers can be used as high energy material [1], ion-exchanger [2], semiconductors [3], antioxidants [4], fire proofing agent [5], optical storage data [6], binders [7], molding materials, [8] etc. The semiconducting properties of polymer resins have gained sufficient ground in recent years. The work on organic conducting polymers is carried out extensively due to their wide applications in areas such as chemically modified electrodes, sensors *etc*. An industrially useful semiconducting material has been reported by Dewar *et al*. The conductivity of an 8-hydroxyquinoline-oxamide-formaldehyde polymer resins has been reported over a wide range of temperature. Pal *et al.* has reported electrical conductivity of salicylic acid-biuret/dithio-oxamide / dithiobiurettrioxane polymer resins. Masram D. T. and coworkers reported the conducting polymers predicted to be the futuristic materials for the development of light emitting iodes, antistatic and EMI materials, sensors, optoelectronic devices and rechargeable batteries due to their unique conduction mechanism and greater environmental stability. Since delocalized electrons and conjugation impart semiconducting properties to compounds, the present study deals with synthesis, structural characterization of a new copolymer synthesized from 4-hydroxy acetophenone, catechol with formaldehyde and its electrical conductivity measurement study.

Materials and Methods

Experimental

All Chemicals were AR grade or chemically pure grade. 4-hydroxybenzoic acid, adipamid were purified by rectified spirit, formaldehyde (37%) (AR grade, Merck) were used. All other solvents and the indicators were of the analytical grade procured from India and DMF and DMSO (HPLC grade) were used.from India.

Synthesis of 4-Hydroxybenzoic acid – Adipamide - Formaldehyde Terpolymer resins.

A mixture of 4-hydroxybenzoic acid(0.2 mol) and adipamide (0.1 mol) with formaldehyde (0.3 mol) was carried out in the presence of 2M (200 ml) HCl as catalyst by molar ratio of 4:1:5 of reacting monomers, was taken in a round bottom flask fitted with water condenser and heated in an oil bath at 125ºC ± 2ºC for 5 hrs with occasional shaking to ensure thorough mixing. The temperature of electrically heated oil bath was controlled with the help of dimmer stat. The brown coloured resinous product was immediately removed from the flask as soon as reaction period was over and then purified. The reaction is shown as in Fig. 1.

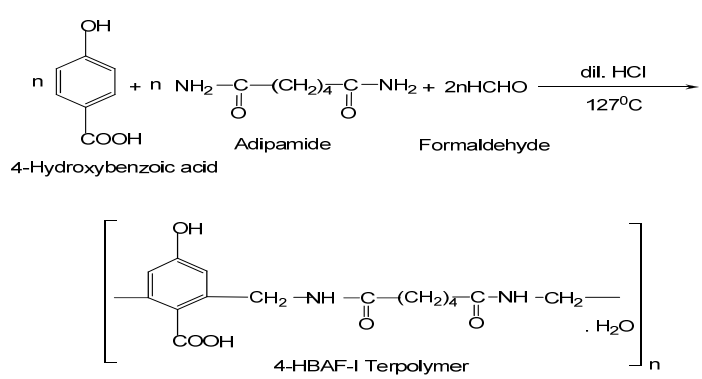

Fig.: 1 Reaction scheme for 4-HBAF terpolymer resin.

Physicochemical and elemental analysis

The copolymer resin was subject to micro analysis for C, H and N on an Elementer Vario EL III Carlo Ebra 1108 elemental analyzer. The number average molecular weight ($\overline{Mn}$) was determined by conductometric titration in DMSO medium using ethanolic KOH as the titrant by using 25 mg of sample. A plot of the specific conductance against the milliequivalents of KOH requires for neutralization of 100 g of polymer was made. Inspection of such a plot revealed that there were many breaks in the plot. From this plot, the first break and the last break were noted. The calculation of ($\overline{Mn}$)by this method is based on the following consideration. On the basis of average degree of polymeration, DP the average molecular weight has to be determined by following equation.

$$\overline{DP} = \frac{\text{Total milliequivalent of base required for complete neutralization i.e. last break}}{\text{Milliequivalent of base for smallest interval i.e. first break}}$$

($\overline{Mn}$) = DP x Repeat unit weight

Viscosity measurements of newly synthesized terpolymer resin have been carried out at 303 K in freshly double distilled DMSO using Tuan-Fuoss viscometer. The viscosity measurements were carried out at six different concentrations ranging from 0.5% to 3.0% in constant temperature bath. The plot of intrinsic viscosity determination is presented in fig.2.

Intrinsic viscosity was determined by using Huggins and Kraemers relation [15-17]:

ηsp /C = [η] + k1 [η] 2 C……..Huggins relation

ln ηr/C = [η] - k2 [η] 2 C……Kraemer relation.

From the above Huggins and Kraemer relation, it is clear that the plots of ηsp /C and ln ηr/C versus C would be linear giving the slopes k1 and k2 respectively. Intercept on the axis of viscosity function gave intrinsic viscosity value in both the plots. The values of the intrinsic viscosity obtained from both the plots have been found to be in close agreement with each other. The calculated values of constant k1 and k2 satisfy the relation k1+ k2=0.5 favorably which is in good agreement with the trend observed and explained by earlier workers.

Spectral Analysis

Electron absorption spectra of tercopolymer (4-HBAF-IV) were recorded in 200 to 800 nm range by using Shimadzu automatic recording double beam spectrophotometer (UV-VIS-NIR Spectrometer) UV-240 at Sophisticated Analytical Instrument Facility, Punjab University; Chandigarh having 10 nm optical paths supplied with the instruments was used. An infra-red spectrum of 4-HBAF-IV polymer was recorded in the region 4000 to 400 cm-1 were scanned in KBr pellet on Perkin Elmer Model 983 spectrophotometer at Sophosticated

Analytical Instrument Facility, Panjab University, Chandigarh. A Nuclear Magnetic Resonance (1H NMR) spectrum of newly synthesized polymer resin has been scanned on 90 MHz for proton using Bruker Avance II 400 NMR Sepctrometer in deuterated dimethyl sulphoxide (DMSO-d6) at Sophisticated Analytical Instrumentation Facility, Panjab University, Chandigarh. Scanning electron micrograph of polymer has been scanned and magnification by scanning electron microscope at Sophisticated Test and Instrumentation Centre, STIC, Cochin University, Cochin.

Electrical Conductivity

Resin was palatalized and thin layer of colloidal graphite in acetone was applied on both sides of the pellets. The colloidal graphite on either side of pellets functioned as electrode. A typical sample holder was designed for the purpose of resistivity measurement and pellet is mounted on it. For measurement of resistivity at different temperature, a suitable electrical furnace was used. Hewlett-Packard 4192 Impendance Analyser 5Hz-13MHz was used to measure the electrical conductivity of all terpolymers resins. The temperature variations of resin were studied by placing the sample holder along with the pallet in the electric furnace that was then heated slowly. The resistances of the sample pallets were measured by two probes (terminals) method. Resistivity (ρ) was then calculated using the relation:

$$\rho = R.\ X\ A/l$$

The DC resistivities were measured from 313 to 423 K. The electrical conductivity (σ) varies exponentially with the absolute temperature according to the well-known relationship:

$$\sigma = \sigma 0 \exp -Ea/kT$$

The relationship has been modified as:

$$\text{Log}\ \sigma = \log\sigma 0 + -Ea/2.303kT$$

According to this relation, a plot of Log σ Vs 1/T would be linear with negative slope. From the slope of the plots, the activation energy was calculated.

Results and Discussion

Electronic Spectral Analysis

The electronic spectrum of the resin was recorded in dimethylsulphoxide (DMSO) at room temperature with a UV-240 Shimadzu double beam spectrophotometer. 4-HBAF-IV terpolymer samples gave two characteristics band in UV-visible spectra at 320-350 nm and 240-250 nmin fig.2. These observed positions for the absorption bands have different intensities. The more intense band 240-250nm is due to (π→π*) allowed transition of quinoline ring, which readily attains coplanarity and shoulder merging (loss of fine structure) and also due to chromophore groups like >C=N, groups and the less intense 320-350 nm may be due to (n→π*) forbidden

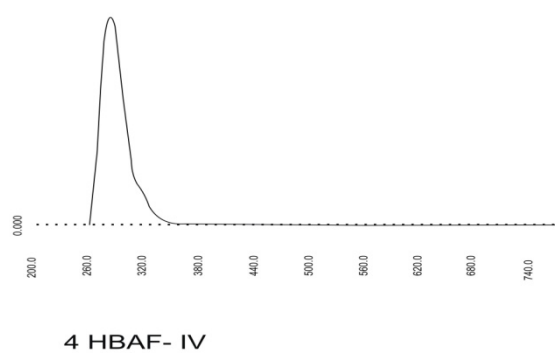

Fig. 2: Electronic spectra of 4-HBAF-IV tepolymer resin.

transition in >C=N groups. Thus π→π* transition indicates the presence of aromatic nuclei and to n→π* transition indicates the presence of –NH and OH groups.

Infra-Red Spectral Analysis

Infrared spectra in the region 400-4000 cm-1 were recorded on a Perkin-Elmer with KBr pellets. The IR spectrum of the newly synthesized 4-HBAF-IV formaldehyde terpolymer resin is depicted in fig 3. The broad and strong band appeared in the region 3348 cm^{-1} stretching vibration of phenolic hydroxyl(OH)group exhibiting intermolecular hydrogen bonding. The broad and strong band appeared in the region 2994.0 cm^{-1} may be due to >NH stretching (amide/imides). The sharp band obtained at 3130 cm^{-1}(aryl C-H stretching), 828 cm^{-1} indicate the presence of -CH_2 group (-CH_2 bridge), 710 cm^{-1} indicate the presence of -CH_2 group(-CH_2- rocking),1273 cm^{-1} (-CH_2 plane bending). The band at 1464cm^{-1} may be ascribed to aromatic skeletal ring. The bands at 1007-1009 cm^{-1}, 1095-1096 $cm^{-1}$and 1117-1118 cm^{-1} may be suggested the presence of 5,7,8-substituted aromatic ring.

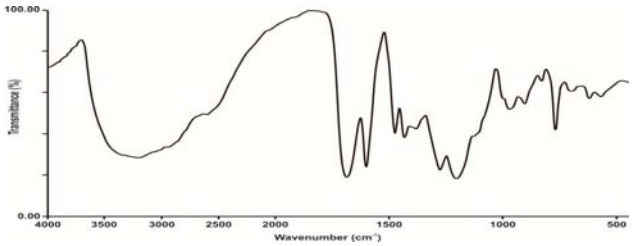

Fig.3: Infra Red Spectra of 4-HBAF-IV terpolymer resin.

NMR Studies

The NMR was scanned at 300MHz with duterated dimethylsulfoxide (DMSO) solvent The NMR spectrum of the 4-HBAF-IV terpolymer shown in fig.4 exhibited signals in the region of 2.58 (δ) ppm is due to methylene proton of Ar-CH_2-N moiety. A strong signal at the range of 4.5 (δ) ppm may be due to protons of -NH bridge. The signal obtained at 4.68 (δ) ppm may be assigned to Ar-CH_2-Ar The multiple signal (unsymmetrical pattern) in the region of 7.3 (δ) ppm may be due to aromatic protons [21-24,27,28]. The signal obtained at 7.45(δ) ppm may be due to -CH_2-CH_2-CO-NH The signal obtained at 8.85 (δ) ppm may be assigned to the proton of phenolic -OH involved intramolecular hydrogen bonding.

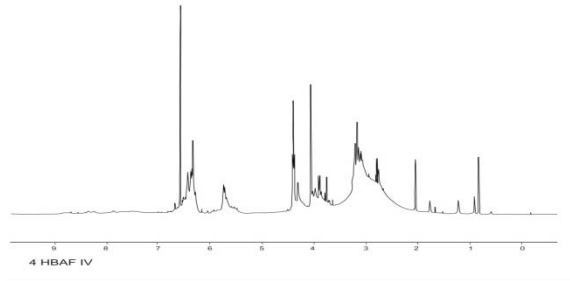

Fig. 4: NMR spectra of 4-HBAF-IV terpolymer resin.

Scanning electron microscopy (SEM)

The morphology of the synthesized and purified terpolymer resins under investigation has been reported by scanning electron microscopy which is shown in Fig. 5. The SEM photographs exhibits such spherulties which are the aggregate of crystalline present along with the some amorphous regions. The amorphous region shows secondary structural

feature such as corrugations and having shallow pits. The spherulites structure of the 4-HBAF-IV terpolymer resin, indicates the presence of crystalline structure of the polymer. But the corrugation in the surface area with deep pits, shows the amorphous nature of the terpolymers. Thus SEM micrographs of 4-HBAF-IV terpolymer resin indicates the presence of transition structures between crystalline and amorphous.

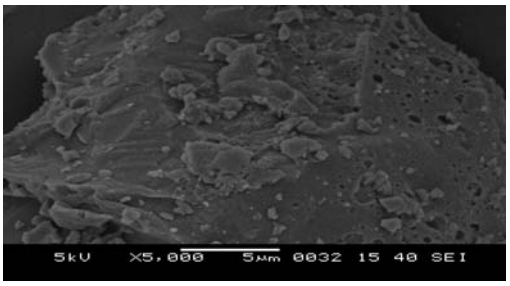

Fig. 5: Scanning electron microscopy of 4-HBAF-IV resin**.**

Electrical Conductivity for 4-HBAF-IV Resin

The DC resistivity of 4-HBAF-IV copolymer resin was measured in the temperature range of 303K to 453 K by applying a constant voltage (50 volts) across the pellet. The temperature dependence of the electrical conductivity of terpolymer is plotted in Fig.6. From the results of electrical conductivity data following points are drawn.

- The values of electrical conductivity of 4-HBAF-IV terpolymer resins vary between 2.4731 x 10^{-8} ohm^{-1} cm^{-1} at 303K and 9.3073 x 10^{-4} at 453K.
- The plots of log σ versus 1/T is found to be linear in the temperature range under study, which indicate that the Wilson's exponential law $\sigma = \sigma_o \exp(\Delta E/kT)$ is obeyed.
- The energy of activation (Ea) of electrical conduction calculated from the slopes of the plots is found to be in the range of 1.04 x 10^{-4} ev.
- Electrical conductivity of each of these terpolymer resins increases with increase in temperature. Hence, these terpolymers may be ranked as semiconductors.

The electrical conduction of polymeric material depends upon incalculable parameters such as porosity, pressure, method of preparation, atmosphere etc; activation energy (Ea) is not affected by these parameters and, therefore, it is fairly reproducible. The magnitude of activation energy depends on the number of electrons present in semiconductor materials. The more the number of Л – electrons lowers the magnitude of activation energy and vice versa.

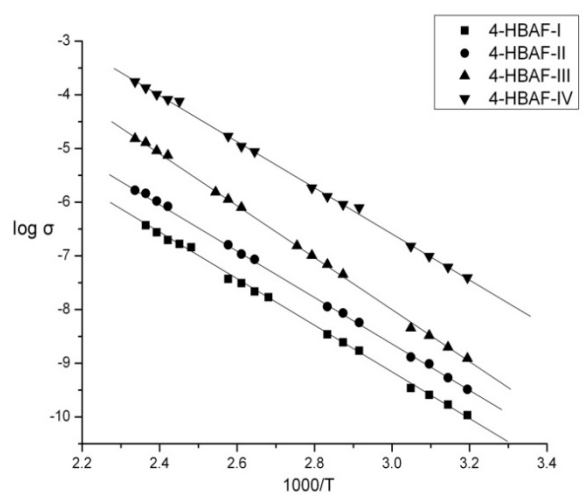

Fig.6: Electrical Conductivity Plot of 4-HBAF-IV Terpolymer Resin.

Conclusion

A resin 4-HBAF-IV based on condensation reaction of 4-hydroxybenzoic acid adipamide with formaldehyde has been prepared by simplest route. SBDF resin is soluble in diethyl ether, DMSO, DMF, aqueous KOH/NaOH (8% solution) and found to be acid resistant in hot condition also. Electrical conductivity of the resin increases with increase in temperature. Hence, the resin may ranked as semiconductors. The concerted research effort was carried out to aim at developing organic materials that would possess the good electrical properties as the inorganic semiconductors.

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Diversity of Spiders in Agro-ecosystems of Barshitakli, District Akola, Maharashtra

Amit B. Vairale

Received: April 01, 2012 | **Accepted**: Feb 28, 2013 | **Online**: May 15, 2013

Abstract

Spiders are among the most abundant insectivorous predators of Terrestrial ecosystem. Spiders play an important role in insect pest control without any harm to agro-ecosystem. Recently in agricultural fields reduced pesticide use and ecological sustainability have lead to increased interest in spiders as potential biological pest control agents. Spiders act as natural biological control agent in agro-ecosystem. Considerably insect populations increases when release from predations by spiders. Regularly use of pesticides in agricultural fields which decreases the spider populations.

Spider species abundance in agro-ecosystem can be high as undisturbed natural ecosystem. Spiders act as pest control creature, which feeds on crop destructive insects. Spiders are beneficial bio-control agent of insect pest in agro-ecosystem. A survey of Spiders was carried out in Agro-ecosystems of Barshitakli, District Akola. During the present study I have reported 52 species of Spiders belonging to 14 Families and 22 genera. Spiders of Families Araneidae, Clubionidae, Eresidae, Gnaphosidae, Hersilidae, Lycosidae, Oxyopidae, Philodromidae, Salticidae, Scytodidae, Tetragnathidae, Theridiidae, Thomisidae, Uloboridae were recorded during the investigation.

Keywords: Diversity | Agro-ecosystems | Spiders

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Introduction

Recently in agricultural fields reduced pesticide use and ecological sustainability have lead to increased interest in spiders as potential biological pest control agents. Spiders act as natural biological control agent in agro-ecosystem. Considerably insect populations increases when release from predations by spiders. Regularly use of pesticides in agricultural fields which decreases the spider populations.

Spider species abundance in agro-ecosystem can be high as undisturbed natural ecosystem. Spiders act as pest control creature, which feeds on crop destructive insects. Spiders are

beneficial bio-control agent of insect pest in agro-ecosystem. A survey of Spiders was carried out in Agro-ecosystems of Barshitakli, District Akola.

During the present study 52 species are reported of Spiders belonging to 14 Families and 22 genera. Spiders of Families Araneidae, Clubionidae, Eresidae, Gnaphosidae, Hersilidae, Lycosidae, Oxyopidae, Philodromidae, Salticidae, Scytodidae, Tetragnathidae, Theridiidae, Thomisidae, Uloboridae were recorded during the investigation.

During the investigation the abundance of Five Family Spiders species were more. The Orb waver spiders of Family Araneidae and Jumping spiders of Family Salticidae are widely distributed. The Orb waver spiders of Family Araneidae form web and the insect pest entangled in web spiders feeds on them. The members of Salticidae family i.e. jumping Spiders they directly capture the insect pest and feeds on it.

During the study 52 species belonging to 22 genera of 14 Spider Families. On the above result and discussion it is clear that the Spiders are very much important creature. Spiders are act as good Pest controller. Avoid the regular use of pesticides in agricultural fields which decreases the spider populations, so species abundance of spider in agro-ecosystem can be high. Spiders are beneficial bio-control agent of insect pest in agro-ecosystem.

Sr. No.	Family	Genera	Species
1	Araneidae	04	10
2	Clubionidae	01	02
3	Eresidae	01	01
4	Gnaphosidae	02	05
5	Hersilidae	01	01
6	Lycosidae	02	06
7	Oxyopidae	02	05
8	Philodromidae	01	01
9	Saltisidae	02	08
10	Scytodidae	01	01
11	Tetragnathidae	01	02
12	Theridiidae	01	02
13	Thomisidae	02	07
14	Uloboridae	01	01
Total		**22**	**52**

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