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	the irrigated fields. Thus, this study attempted to evaluate the quality of these minerals whether they can be useful for agricultural purposes. Analysis revealed that up to 150 cm of the profile depth of the rock was mainly composed of gypsum (95%) with the predominance of oxides of S (43.5-46.6% SO_3^{-2}) and Ca (32.1-33.5% CaO). The oxides in the sampled rock followed the order of: SO_3^{-2}> $CaO>SiO_2>Al_2O_3>Fe_2O_3>MgO>Na_2O>K_2O>TiO_2>MnO>P_2O_5$ with the finest particle size (81.7-90%) dominating over other sizes. This study has come to the conclusion that Adigudom gypsum deposit can be used as rock for crops through enhancing sodicity management and sulphur nutrition. [Nature and Science 2010;8(3):9-14]. (ISSN: 1545-0740). **Keyword**: Adigudom gypsum, agromineral, microdams, sodic soils, sulphur nutrition	
3	**lorphology, Fecundity and diet of *Galeoides decadactylus* (Pisces: Polynemidae) (Bloch, 1795) off Nigerian)ast** *EMMANUEL B.E, GBESAN, K and OSIBONA, A.O. Department of Marine Sciences, Faculty of Sciences, University of Lagos Akoka, Lagos, Nigeria. monetemi@yahoo.com **Abstract:** *Galeoides decadactylus* (Bloch) is one of the three species of the family polynemidae commonly called the threadfins, found in warm tropical surface water of the Atlantic on the continental shelf of West Africa. They are important in the trawl fisheries of Nigeria. The specimens used for this study were collected off Nigerian coast from Lagos to Calabar between December, 2003 and November, 2004. In this study the length-frequency distribution, length - weight relationship, condition factor, sex ratio, fecundity, food and feeding habits of *Galeoides decadactylus* were examined. Measurements recorded for each fish were standard length (SL) and total length (TL) to the nearest 1mm and weight to the nearest 0.1g. Sexes of fish were determined by visual and microscopic examination of the gonads. Fecundity was estimated from the ripe ovaries (stage v) by the gravimetric method. The Gonadotropic Index (GI) and the Condition Factor (K) were calculated. Food items were quantified by two methods, the numerical and frequency of occurrence methods. The total length of 259 specimens examined ranged between 12.0cm and 28.3cm (standard length 9.9cm to 20.8cm). Specimens exhibited negative allometric growth. The condition factor increased with individual size. Females had a slightly higher condition factor than males. The sex ratio was 1:0.46 (male:female). The number of eggs per female ranged between 58 001 and 279 279. There was a negative correlation between log-fecundity and log-weight than between log-fecundity and log length. The major food items were crustaceans, molluscs, pisces and annelids. There were no distinctions in the feeding habits of the species in relation to size. The fish was euryphagus species and highly fecund. [Nature and Science 2010;8(3):15-23]. (ISSN: 1545-0740). **Key words:** *Galeoides decadactylus*, fecundity, allometric growth, condition factor, euryphagus.	Full Text
4	**Elemental Analysis of Satluj River Water Using EDXRF** Prem Singh[*] and J.P. Saharan[$] [*]Dept. of Physics, S.D. College (Lahore) Ambala Cantt., [$]Dept. of Chemistry, S.D. College (Lahore) Ambala Cantt. Corresponding author: [*] pspundir1@gmail.com **Abstract:** A systematic study was carried out to explore the concentration of different low-Z elements present in the water samples of Satluj River in Himachal Pradesh, India. Water samples from four different locations were collected and analyzed for elemental analysis. In this study, energy dispersive x-ray fluorescence (EDXRF) technique has been employed. The degree of elemental pollution and the suitability of the river water for drinking purpose were assessed. A close look at the elemental concentration in water samples of different locations shows variation in concentrations but elements are within the safe limits as prescribed by Bureau of Indian Standards (BIS) and World Health Organization (WHO). The concentration of Ca and Fe is little higher. "[Nature and Science. 2010;8(3): 24-28]. (ISSN: 1545-0740)". **Keywords:** EDXRF, Water Quality, x-ray tube, Pollution, Elemental Analysis	Full Text
5	**CATTLE BABESIOSIS AND ASSOCIATED BIOCHEMICAL ALTERATION IN KALUBYIA**	Full Text

	GOVERNORATE. **Ola, F. A. Talkhan**; Mervat E. I. Rdwan.*; Ali. M. A**** * Veterinary Hospital –Benha University **Animal Health Research Institute, Shebin El-kom. drofscience@ymail.com **Abstract :** Members of genus babesia are tick transmitted intra erythrocytes proto zoon parasites, many species are of considerable economic importance in live stock industry, additionally some species are zoonotic and affected on human health, so this investigation performed to differentiated between traditional and some modern methods for diagnosis of bovine babesiosis, a total of 100 animals from private farms located in different places in Kalubia aged from 1-3 years the samples were collected from clinically infected animals that suffered from fever (41 C°) , Anorexia, depression, weakness, pale mucos membrane, emaciation, weight loss hemoglobin urea with accelerate heart and respiratory rates and animals appearan healthy in contact with this animals, laboratory examination two blood samples were collected from each animals from juglar vein samples with anticoagulant for blood film stain and PCR while second without anticoagulant for biochemical the result of our study revealed a great significant Increase in urea , creatinine, AST, Alt and globulin in clinical cases of babesia bigemina but non significant changes in sub clinical cases Also the result revealed significant increase in serum iron ,Total iron binding capacity transfferin total protein, However There are non significant increase in albumin and A/G ration. 2010;8(3):29-36]. (ISSN: 1545-0740). ***Keywords:*** Babesiosis, Cattle, Early diagnosis, Pathogenic Alteration.	
6	**Awareness of Urban and Rural People Regarding Polythene Ban in Rajshahi Division, Bangladesh** [1,2]Abul Hasnat Md. Shamim, [2]Md. Abu Taleb and [3]Md. Anisur Rahman [1]Department of Environmental Management Engineering, Faculty of Environmental Science & Technology, Okayama University, Okayama 700-8530, Japan [2]School of Agriculture & Rural Development, Bangladesh Open University, Gazipur-1705, Bangladesh [3]School of Social Science, Humanities & Language, Bangladesh Open University, Gazipur-1705, Bangladesh abulhasnats@yahoo.com **Abstract:** The awareness of the urban and rural people regarding the ban on polythene bags was studied in Rajshahi division. Information was collected from urban and rural people to know their views after a period of 4 years of ban on polythene bags. The surveys included interview schedule, observations and discussions with the users. The largest part of the respondents were congratulated the decision of the government on ban of polythene bags. About 97.3 % of urban and 76 % of rural people was in favour of ban of polythene and a few of the respondents (2.7 %) were in disfavour in case of urban whereas in rural it was 24 %. Majority of the users were ignorant about the hazardous impacts of polythene bags on the health (urban 24 and rural 1.3 %). [Nature and Science 2010;8(3):37-40]. (ISSN: 1545-0740). **Keyword**: Awareness, polythene bags, ban and environment.	Full Text
7	**Biochemical Studies on Nephroprotective Effect of Carob (*Ceratonia siliqua* L.) Growing in Egypt** Mahgoub M. Ahmed Molecular Drug Evaluation Dep., National Organisation for Drug Control and Research (NODCAR). Egypt dr_mahgoub1@yahoo.com ABSTRACT: Reactive oxygen species and free radicals are involved in the nephrotoxicity induced by the synthetic anticancer drug cisplatin. The nephroprotective effects of carob pods and leaves (100 and 200 mg/kg, p.o.) was investigated using cisplatin (10 mg/kg body weight, i.p.) to induce oxidative renal damage in mice. The results showed that cisplatin administration caused abnormal renal functions in all studied mice. Serum urea and creatinine concentrations were significantly highered (P<0.5) in the cisplatin alone treated (control) group compared to the normal group. The concentrations of serum creatinine and urea in the carob pods (200 mg/kg body weight) treated group were reduced to 57.5% and 51.5%, respectively, with respect to the control group. Also, cisplatin induced decline of renal antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) activities, but the treatment of carob pods and leaves (100 and 200 mg/kg, p.o.) significantly attenuated the cisplatin-induced nephrotoxicity. Both pods and leaves of carob at 100 and 200 mg/kg increased the concentration of reduced glutathione (GSH) and protected against the increase of cisplatin-	Full Text

	induced lipid peroxidation. In addition, treatment with cisplatin increased the activity of cathepsin D, RNase II, DNase II and acid phosphatase. The treatment of carob pods and leaves (100 and 200 mg/kg, p.o.) improved the activity of lysosomal enzymes nearly to the normal group. In conclusion, carob leaves and pods may be effective to protect from oxidative renal damage and the leaves are the better nephroprotective agent than pods. The protection may be mediated partially by preventing the decline of renal antioxidant statues. [Nature and Science 2010;8(3):41-47]. (ISSN: 1545-0740). **Key words**: nephrotoxicity; carob; cisplatin; antioxidant enzymes; lysosomal enzymes	
8	**Genotypic Variability for Agronomic and Yield Characters in Some Cowpeas (*Vigna unguiculata* (L.) Walp.)** D. O. Idahosa[1] J. E. Alika[2] and A. U. Omoregie[1] 1. Department of Crop Science, Ambrose Alli University, Ekpoma, Nigeria 2. Department of Crop Science, University of Benin, Nigeria. E-mail: danielidahosa@yahoo.com **Abstract:** Cultivated species of crops are usually variable because of artificial selection under diverse environments of which cowpea is not exception. Consequently, genotypic variability study was conducted with eight parent line cowpeas to evaluate some genetic parameters namely coefficient of variation, genetic variance and heritability estimates in the broad-sense. Per se mean performance was variable among the genotypes for all characters investigated which indicated the superiority of some parent lines. Highly significant heritability effects were observed for all characters except for 100-seed weight (42.2%) which expressed moderate heritability estimate. Days to 50% flowering, pod length, pod weight and grain yield characters showed that some levels of genetic variability existed. Consequently, progress could be made from selection and improvement for those characters. [Nature and Science 2010;8(3):48-55]. (ISSN: 1545-0740). **Keywords:** Genotypic variability, genetic variance, coefficient of variation, heritability, cowpea.	Full Text
9	**Effects Of Organic, Organomineral And NPK Fertilizer Treatments On The Quality Of *Amaranthus Cruentus* (L) On Two Soil Types In Lagos, Nigeria** *Makinde Esther. A., **O. Fagbola., **E. A. Akinrinde, and ***E.A. Makinde *Department of Botany, Lagos State University, Ojo Lagos.Nigeria. ** Department ofAgronomy, Universityof Ibadan.Ibadan.Nigeria. *** Federal College of Agriculture. Ibadan leyesam@gmail.com **ABSTRACT:** Under tropical soils, the precise requirement of inorganic fertilizer and its possible substitute is yet to be validated for the production of *Amaranthus cruentus* L. The nutrient requirement of *A. cruentus* under two soil types and yield quality under field conditions. Field experiment was conducted at two locations in Lagos State: Ikorodu (Orthic Luvisol) and Lagos State (LASU) Ojo Campus (Dystric Fluvisol) to investigate the effects of organic and organomineral and NPK fertilizer treatments on the quality of *Amaranthus cruentus L.* Eight fertilizer treatments. (1) Control (no fertilizer), (2) Pacesetter's Grade B (PGB) 100 %, (3) PGB + NPK (75:25), (4) PGB + NKP (50:50), (5) Kola Pod Husk (KPH) 100 %, (6) KPH + NPK (75:25), (7) KPH + NPK (50:50) and (8) NPK (100 %) were tested at first planting. Residual effects of the fertilizers were assessed in the second and third planting periods. The experiment was arranged in a randomized complete block design in four Replications. Parameters assessed include proximate analysis. Data were analysed using ANOVA. The KPH + NPK (75:25)resulted in significant ($p<0.05$) higher crude protein content (19.8 and 14.9 %), ether extract (8.5 and 8.2 %) while crude fibre (9.5 and 10.8 %) was lower than control at Ikorodu and LASU respectively. The KPH and PGB had high potential in *A. cruentus* production. At Ikorodu, KPH + NPK (75:25) was the best while at LASU, PGB + NPK (75:25) was optimum. KPH + NPK (75:25) gave highest crude protein content, ether extract and lowest crude fibre in *A. cruentus.* [Nature and Science 2010;8(3):56-62]. (ISSN: 1545-0740). **Keywords:** *Amaranthus cruentus*, organomineral fertilizer, quality and soil type	Full Text
10	**Analysis on the Parking demand of the Commercial Buildings Considering the Public Transport Accessibility** **——Commercial Buildings in Beijing as an Example**	Full Text

	Huanmei Qin [1], Qing Xiao [1], Hongzhi Guan [1], Xiaosong Pan [1] 1. Beijing Key Laboratory of Traffic Engineering, Beijing University of Technology, Beijing 100124, China hmqin@bjut.edu.cn **Abstract:** Parking index is the fundamental basis for the buildings' parking supply in city. Researches on the parking demand takes prepare for establishing the buildings' parking index. Based on the parking survey of the commercial buildings in Beijing, this paper first analyzes the parking demand of the shopping centre and supermarkets. Further it analyzes the relationship between the parking demand of the commercial buildings and the public transport accessibility. The conclusion is that the parking demand rate of the shopping centre and supermarkets decreases with the increasing of the public transport accessibility. It also provides the parking demand rate under the different levels of the public transport accessibility and the parking demand model with the accessibility. The conclusions are valuable for the researches on the parking demand and the making of the parking index for the commercial buildings. [Nature and Science. 2010;8(3):63-68]. (ISSN: 1545-0740) **Key words:** commercial buildings; public transport accessibility; parking demand analysis; parking index	
11	**Probiotic Activity of *L. acidophilus* against Major Food-borne Pathogens Isolated from Broiler Carcasses.** Sherein* I. Abd El-Moez[1], Ahmed F.Y.[2], Samy A.A. [1], Aisha R.Ali[3] 1. Department of Microbiology and Immunology - National Research Center Cairo Egypt. 2. Department of Animal Reproduction and A.I. - National Research Center Cairo Egypt. 3. Serology unit -Animal Health Institute Cairo Egypt *shereinabdelmoez@yahoo.com, yfahmed54@yahoo.com, Ayman_Samy@hotmail.com **Abstract***: C.jejuni E.coli and S. typhimurium* are the principal food borne pathogens in poultry industry. The first experiment tested the effectiveness of different strains of Lactobacillus as *in vitro* as probiotic against *C. jejuni E.coli* O157 *and S. typhimurium* Result showed that *L.acidophilus* isolated from colostrums of mare and goat showed the widest inhibition zone against *C. jejuni E.coli* O157 *and S. typhimurium* strains compared to the use of *L.acidophilus* isolated from goat and cattle milk. The second experiment evaluate the efficiency of *L. acidophilus* isolated from mare colostrums showing highest *in vitro* inhibition activity against tested strains as *in vivo* probiotic against *C. jejuni* isolated from broiler carcasses. The result showed great inhibition of *C. jejuni E.coli* O157 *and S. typhimurium* strains by the use of *L.acidophilus* in comparing to the use of antibiotics. In the second experiment; four groups of adult albino rats were used; group (1) control negative, group (2) rats orally administrated by *L. acidophilus* only from the start of experiment till the 14th day, group (3) rats challenged only with *C. jejuni* and group (4) orally administrated by *L. acidophilus* from the start of experiment till the 14th day at the 7th day they were challenged with *C. jejuni*. Result showed that the third group showed the highest rate of reisolation of *C.jejuni* (0.80±0.16 from fecal swabs and 0.84±0.17 from the internal organs) as well as major pathological lesions in the tested organs in the form of granulomatus reaction in the lung tissue infiltration of inflammatory cells in the lung tissue thickening of wall of blood vessels with alveolar emphysema. Congestion hemorrhages of renal blood capillaries and coagulative necrosis of the renal tissue as well as degeneration and necrosis of hepatocytes with proliferation of fibrous tissue. The forth group pretreated with L. acidophilus Showed lower rate of isolation of *C.jejuni* (0.08±0.02 from fecal swabs and 0.04±0.01 from internal organs. The pathological findings of the internal organs showed minor lesions in the form of interstitial pneumonia and inflammatory cellular infiltration in the lung Swelling and degeneration of renal epithelium and hepatocytic degeneration with infiltration of inflammatory cells. The second group which was only treated with *L.acidophilus* showed no reisolation of *C.jejuni* as well as no pathological lesions were detected except a minor lesion in the liver in the form of diffused vacuolar degeneration in hepatocytes. Results develop a safe method for competing food borne pathogens in edible animals and suggest the need for probiotics to hinder the spread of highly pathogenic zoonotic bacteria transmitted by animal food by products. [Nature and Science 2010;8(3):69-78]. (ISSN: 1545-0740). **Key words**: *C. jejuni;* L. *acidophilus;* probiotics; *in vivo,* antibiotic sensitivity, rat.	Full Text
12	**Tracking the Invasion Pathway: Assesment of α-Diversity and Invasiveness of Alien Ornamental Plants of Srinagar(Kashmir, J&K), India** Shabana Aslam[1], *Khursheed Ahmad Ganaie[2], AQ John[3] and GH Dar[1]	Full Text

	1. Department of Botany, University of Kashmir, Srinagar, J& K, India190006 2. Department of Botany, Islamia college of Science and Commerce, Srinagar, J& K, India 190006 3. Division of Floriculture, Medicinal and Aromatic plants, SKUAST- Kashmir, J& K, India 191121 Shabana_botany@yahoo.com; khursheedtrali@yahoo.co.in **Abstract:** The valley of Kashmir is famous for its marvellous landscape which attracts tourists from all along the globe. The landscaping of this heavenly abode predominantly involves alien ornamental plants. The present study puts on record the alien ornamental flora of Srinagar Kashmir, and thus, is a first compilation of alien ornamental flora of the region. The study enlists the occurrence of 271 exotic ornamental species distributed in 187 genera, belonging to 85 families, therefore piling up the total number of alien plant species in the Kashmir Himalayas to 704. The taxonomic composition analysis of alien ornamental flora of the region revealed that dicots are represented by 223 species (82%) belonging to 151 genera and 65 families while as monocots comprised of 39 species (15%) dispersed in 28 genera and 13 families. Gymnosperms are represented by 9 species (3%), 8 genera and 7 families. Asteraceae (11.07%), Rosaceae (9.59%), Oleaceae (4.79%) are the largest families of exotic ornamental plants introduced into the Kashmir Himalayas. Out of 85 families, 42 are represented by a single genus and single species. The highest number of alien ornamental species have come from the continent Asia (31%) followed by Europe (30%) and North America (20%). The study reports the occurrence of 133 alien ornamental species for the first time from Kashmir Himalayas. Our analysis of alien species establishment and invasion is not in consonance with Williamson's tens rule and proposes that human assisted species selection, introduction and establishment change the entire dimensions of tens rule to maximum values in invasion biology. [Nature and Science 2010;8(3):79-95]. (ISSN: 1545-0740). **Key words:** Exotic, alien, ornamental flora, Kashmir, Himalayas, New records	
13	**Influence of dietary commercial Beaker's yeast, *Saccharomyces cerevisae* on growth performance, survival and immunostimulation of *Oreochromis niloticus* challenged with *Aeromonas hydrophila*.** H A M, Osman[1], Taghreed, B Ibrahim[1], W E, Soliman[1] and Maather, M Monier[2] 1. Hydrobiology Dept. National Research Center Dokki, Egypt. 2. Fish diseases and management Dept.Fac.of Vet.Med.Seuz Canal Univ.Egypt. dr.hussien_osman@yahoo.com **Abstract:** Eight weeks feeding trials were conducted to examine the effect of dietary commercial brewer's yeast, (Beaker's yeast), *Saccharomyces cerevisiae* on growth performance, survival and immunostimulation of Nile tilapia, *Oreochromis niloticus*. Brewer's yeast supplemented at 0, 1, 2, 3 and 6 gm/kg diet A, B, C, D and E respectively. Each diet was fed to triplicate group of *O. niloticus* with initial body weight at 77.39 ± 5.33 g at 8 weeks feeding period. Control group fed non supplemented diet at total period of experiment. Final weight, weight gain, specific growth rate (SGR), condition factor (CF) were recorded, and the optimum growth performance were obtained with 3.0 g yeast/kg diet. Physiological and biochemical parameters (RBCs count, Hb concentration, HCT value, glucose and lipids of fish), cellular immune parameters (total leucocytic count, phagocytic activity) and hormonal immune parameters (Total protein, albumin, globulin and lysozyme concentration) were significantly elevated than the control group(fed on A diet) and improved in *O. niloticus* fed brewer's yeast up to 3.0 g/kg diet. After experimental period (8 weeks) fish from each group were challenged by pathogenic *Aeromonas hydrophila* IP, kept under observation for 7 days, total fish mortality, clinical signs were recorded, and mortality percent decreased with the increase of yeast level in fish diets. [Nature and Science 2010;8(3):96-103]. (ISSN: 1545-0740). **Keywords:** *Oreochromis niloticus* ; brewer's yeast ; growth performance ; immuno-stimulation ; condition factor ; immune promoters ; *Aeromonas hydrophila*.	Full Text
14	**Quadratic Model for Predicting the Concentration of Dissolved Iron Relative to the Initial and Final Solution pH during Oxalic Acid Leaching of Iron Oxide Ore** Chukwuka I. Nwoye Department of Materials and Metallurgical Engineering, Federal University of Technology, Owerri, Nigeria. chikeyn@yahoo.com **Abstract**: Model for predicting the concentration of dissolved iron (relative to the initial and final solution pH)	Full Text

	during leaching of iron oxide ore in oxalic acid solution has been derived. The model; $$\gamma^2 - \beta\gamma - \left(\frac{0.001N}{\%Fe}\right) = 0$$ was found to calculate the concentration of dissolved iron being dependent on the values of the initial and final leaching solution pH measured during the leaching process. It was found that the validity of the model is rooted on the expressions D = 1000%Fe where both sides of each expression are correspondingly approximately almost equal. The maximum deviation of the model-predicted values of %Fe (dissolved) from the corresponding experimental values was found to be less than 28% which is quite within the acceptable range of deviation limit of experimental results. The value of the assumed coefficient of the dilution (N) was calculated to be 197.527. [Nature and Science 2010;8(3):104-109]. (ISSN: 1545-0740).	
15	**Model for the Calculation of the Concentration of Sulphur Removed during Oxidation of Iron Oxide Ore by Powdered Potassium Chlorate** Chukwuka I. Nwoye Department of Materials and Metallurgical Engineering, Federal University of Technology, Owerri, Nigeria. chikeyn@yahoo.com **Abstract**: Model for the calculation of the concentration of sulphur removed (during oxidation of iron oxide ore by powdered potassium chlorate) has been derived. The model; $$\%S = \left(\frac{0.0717}{\text{Log}\alpha}\right)$$ was found to predict the concentration of sulphur removed, very close to the corresponding %S values obtained from the actual experimental process. It was found that the model is dependent on the values of the weight input of the oxidant ($KClO_3$) during the desulphurization process. The validity of the model is believed to be rooted in the expression $[(\alpha)^{\beta\%S}] = T/\gamma k_n$ where both sides of the expression are approximately equal to 2. The positive or negative deviation of each of the model-predicted values of %S from those of the corresponding experimental values was found to be less than 30% which is quite within the range of acceptable deviation limit of experimental results. [Nature and Science 2010;8(3):110-114]. (ISSN: 1545-0740). **Keywords**: Model, Sulphur Removed, Iron Oxide Ore, Oxidation, Potassium Chlorate.	Full Text
16	**Electrogastrograhy As A Diagnostic Tool For Overlapping Dyspepsia In Irritable Bowel Syndrome Patients** Engy Yousry Elsayed[1], Mohamed Omar[2], Aml Ameen[3] from [1]Internal Medicine,[2] Tropical medicine, [3]Radiodiagnosis departement, Ain Shams University, Cairo, Egypt ashorengy@yahoo.com **Abstract: Introduction:** Distinguishing between irritable bowel syndrome (IBS) and functional dyspepsia can be challenging because of the variations in symptom patterns, which commonly overlap. Although the principles of electrogastrography (EGG) have been known for years, it is contrvesial whether alteration of gastric electrical activity (GEA) could be of clinical relevance in functional gastrointestinal disorders. **Aim of the work** was to assess the role of electrogastrography and gastric emptying in diagnosis of overlapping dyspepsia in patients with irritable bowel syndrome (IBS). **Subjects and methods:** 120 patients with IBS were compared with 60 healthy controls. EGG was performed before and after a standard meal. Furthermore, gastric emptying (GE) and symptom scores were assessed. **Results:** Of 120 IBS patients, 52 (43.3%) had dyspeptic symptoms as well as delayed gastric emptying. IBS patients with overlapping dyspepsia showed significantly more bradygastria (26.9%) than controls (5.9%) ($P < 0.01$) , also they had statistically significant lower PR compared to non dyspeptic patients(2.1±1.3 vs. 2.9±1.6 respectively $P<0.05$), moreover gastric emptying time was delayed in IBS patients with overlapping dyspepsia (14.7±1.8) compared to those without dyspeptic complaints and controls (10 ±1.27 & 10.6±2.1 respectively)	Full Text

	(P<0.01). **Conclusion and recommendation:** IBS patients with overlapping dyspepsia frequently reveal impaired gastric emptying and increased bradygastria, lack of a postprandial increase in the EGG amplitude, which may have pathophysiological significance in these patients .Using both EGG and gastric emptying test can aid in the detection of functional disorders associating IBS and therefore achieve greater patient satisfaction with their treatment. [Nature and Science 2010;8(3):115-120]. (ISSN: 1545-0740). **Keywords:** Electrogastrography, functional dyspepsia, gastric emptying, irritable bowel syndrome	
17	**Medicinal and Aromatic Plants Diversity of Asteraceae in Uttarakhand** Vinod Kumar Bisht*[1] &Vineet Purohit[1] [1]Herbal Research & Development Institute, Gopeshwar - 246 401, Uttarakhand, India. *E-mail: vksbisht@gmail.com; vksbisht@rediffmail.com **Abstract**: Geographically Uttarakhand represents six eco-climatic regions from 300 m asl to 7817 m asl, and abode to a variety of medicinal and aromatic plants, and their products are being used by local communities from time immemorial. Asteraceae is the largest family of medicinal and aromatic plants in Uttarakhand. The species of the family are growing from low altitude of Tarai Bhabar to the alpine. There are annual, biennial or perennial herbs, under shrubs, shrubs. This paper includes the database on various aspects of medicinal plants of the family Asteraceae in the state. The database on various aspects includes species richness, genera richness, medicinal use and altitude for the different species of the family Asteraceae. Nature and Science. 2010;8(3):121-128]. (ISSN: 1545-0740). **Key Words:** asteraceae, diversity, medicinal and aromatic plants	Full Text
18	**An issue of improvement in Annual land use planning** Bolormaa Batsuuri Faculty of Earth Sciences of National University of Mongolia, Ulaanbaatar 14201, Mongolia. bolor_8315@yahoo.com **Abstract:** The part where the mathematic modeling and GIS modeling are being established and formulated is the major system of decision supporting system, and taking into account the criterions of making the GIS modeling, \in this thesis\ it will be easily established using all types of relevant information. Models that base on relevant information and criterions are most likely to effectively serve the decision makers and the users of the modeling. In order to follow the world standard and freely transfer geographic information in an international environment, the process of reforming meta data standard of GIS in Mongolia is basing on researches of international meta data standard of GIS (ISO 19115). Therefore the meta data standard have been processed adapting into certain conditions of Mongolia. The territory of Ulaanbaatar city is selected as the research object and including the total territory, researches on today's pressing issues of land administration, land legislation, land cadastre, and land planning have been made thoroughly and the objectives of this thesis have been put forward in resolving issues in urban land use planning. When processing the land use planning of the capital in 2009, taking into account the results from the 3.3.1 and using the GIS analyzing and GAP assessment tools, it is now possible to extend the serving area. Two types of construction standards those are observed in Mongolia used in order to set\establish serving area of commerce in Ulaanbaatar city. [Nature and Science 2010;8(3):129-138]. (ISSN: 1545-0740). **Keywords:** Annual land use planning, Geographic information system, assessment, land administration, meta data	Full Text

Effect of Metal Pickling and Electroplating Industrial Sludge-Borne Heavy Metals on Wheat (*Triticum aesativum*) Seedling Growth

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Abstract:

A pot culture study has been undertaken to evaluate the effect of rolling and pickling industrial sludge amendments on growth response and bioaccumulation of heavy metal in wheat seedlings. Processed acidic waste was first treated with three doses of lime (0, 0.5 and 1%) and then mixed with two soils in different ratios (0, 10 and 20%). Samples were filled in earthen pots (2Kg/pot) one week before planting and seven days old wheat seedlings (3 per pot) were transplanted in these pots and pots were kept in glass house. Temperature of glass house was maintained at 22 ± 2^0C and moisture contained at 50% of water holding capacity.

DTPA extractable heavy metals and metals in seedlings increased with increasing doses of industrial sludge amendments. Biomass and growth has been also found to increase with increasing rate of sludge. Lime enhanced the biomass and reduced the heavy metal concentrations. Although 20% treatments in both soils showed a significant enhancement in shoot length but metals like Pb was found beyond permissible limit. The heavy metal in wheat seedlings follow the trend Zn>Pb>Cu>Cd. Lime has a negative correlation with availability and uptake of heavy metals. Results showed that application of lime treated industrial sludge to soil could be useful in order to increase crop growth in the glass house. [Nature and Science 2010;8(3):1-8]. (ISSN: 1545-0740).

Key words: pot culture, industrial waste, bioaccumulation, DTPA extractable metals.

1. Introduction:

The concern about heavy metals is that they are non-biodegradable and may therefore accumulate in the environment. Thus, one of the development challenges facing this decade is how to achieve a cost effective and environmentally sound strategies to deal with the global waste crisis (Alloway and Aryes, 1997). The crisis has also threatened the assimilative and carrying capacity of the earth, which is our life support system.

Not only the developed countries but developing countries like India is also facing the problem of huge quantity of solid waste releasing per day in environment. Some of them like industrial and hospital waste come under hazardous and some time it is also carcinogenic due to its composition. The National Capital Territory of Delhi, India, with a population more than 14 million, covering an area of 1483 sq Km has emerged as one of the biggest centers of small-scale industries in the country. It has 21 industrial areas, generating an enormous quantity of industrial waste per day (Office of the Commissioner of Industries, Delhi, 1996). Disposal of this perpetual quantity of waste remains a major problem. Land disposal of waste is a very old method because organic wastes obtained from different sources (Municipal, Industrial, or zoo technical) has two advantages: it avoids accumulation of wastes in the environment and it provides organic matter and nutrients for soil (Narwal et al., 1983).

Although the nutrient content of wastes makes them attractive as fertilizers, land application of many industrial and sewage sludge are constrained by the presence of heavy metals, hazardous organic chemicals, salts, and extreme pH (Cameron et al., 1997). On the other hand land application of industrial/sewage sludge is the potential source for metals accumulation in crops, which in turn will transfer to food chain posing a potential health hazard to human being (Cameron et al., 1997). Investigations illustrate the benefits of sludge are extremely important, since there is still a general reluctance among agriculturists to recognize the economic value of the sludge in order to improve the soil organic status without contaminating the environment (Korentejar, 1991). From most of the research works it is proved that the industrial and municipal waste have high amount of N and P (Mohammad and Battikhi, 1997). So, there is an increasing interest in the agricultural application of sludge due to the possibility of recycling valuable components: N, P and other plant nutrients (Gupta and Sinha, 2007).

Soil is a vital resource for sustaining two human needs of quality food supply and quality environment. Plants grown on a land polluted with municipal, domestic or industrial wastes can absorb

heavy metals in the form of mobile ions present in the soil solution through their roots or through foliar absorption. These absorbed metals get bioaccumulated in the roots, stems, fruits, grains and leaves of plants (Fatoki, 2000). By considering above facts this study was proposed to assess the effect of industrial sludge on growth and yield of wheat seedling under glasshouse conditions. Heavy metal concentrations were determined in the sludge and soil to characterize plant soil interactions of the sludge borne heavy metals on different soil types. In the best of our knowledge a very few study have been undertaken for the phytoremediation of any type of industrial sludge, hence, it is the first attempt in this field.

2. Materials and methods:

2.1. Collection of samples and preparation

Industrial sludge samples from metal finishing industries were collected from Wazirpur industrial area of Delhi. This is situated northwest part of Delhi, covering an area of 210 acre, is a big source of solid wastes generation, producing more than 30% of total solid waste of Delhi (Office of the Commissioner of Industries, Delhi, 1996). We collected 30 waste samples from 3 blocks of study site in three seasons i.e. Monsoon, Winter and Summer.

Waste samples stored in a transparent poly bags and fresh samples were used to measure pH, Electrical Conductivity, Moisture Content (%) and Water Holding Capacity (WHC). Then processed samples were subjected to a proper mixing to form a single representative sample. Analyses were done for the potential bioavailable heavy metals (Lindsay and Norvell, 1978) and total heavy metal concentration (EPA 3050 method). To neutralize the acidity of waste it was treated with lime in different ratios (0, 0.5, and 1%).

Two different soil types were collected from New Delhi, India. The site 1 soil (S1) is sandy loamy farmland soil while site 2 (S2) is a sandy nursery soil. The lime treated sludge samples were mixed to soils in 3 different ratios (0, 10 and 20%) and used to fill earthen pots (2Kg/pot) one week before planting. Wheat *(*HD1553*)* seeds were collected from National Seed Corporation, New Delhi (NSC) and seven days old seedlings were transplanted, 3 per pot, into pots. The experiment was performed under glasshouse conditions.

2.2 Soil and plant analysis

Soil samples were analyzed at two different times during the experiment: at initial stage of experiment and after 28 days of growth. The soil samples, which were analyzed at the end of experiment, consisted of soil sample and wheat seedling roots. Samples were analyzed for heavy metal content (available and total heavy metal) of four metals (Pb, Cd, Zn and Cu).

Wheat seedlings were allowed to grow for 28 days in the glass house before the harvesting. The above-ground parts were separated from the roots, which were left in the soil for analysis. Plant materials were washed several times with tap water and then with ionized water. Now foliages were dried at 60^0C to determine its dry mass. Above ground plant samples were analyzed for total heavy metal content (Allen et al., 1986).

2.3 Translocation factor (*f*)

The accumulation of metals in the plant parts when taken up from soil was determined as *f* factor, also known as transfer coefficient (Smith, 1996).

2.4 Statistical analysis:

All the data were analyzed using one way ANOVA test using GPIS software (1.13) (Graphpad, California, USA) and different correlations and regressions has been done for statistical analysis of data by using SPSS version 11.5.

3. Results and discussion:

3.1 General properties of waste and soils:

The dried sludge had a solid content of 93.5%. All the parameters like electrical conductivity, organic carbon and cation exchange capacity were more in industrial sludge in comparison to soils (data not shown), except pH i.e. very low in waste (3.05±0.03). Heavy metals were (Zn, Pb, Cu, and Cd) analyzed and compared to current heavy metal guidelines (USEPA, 1993) were depicted in Table 1. The heavy metal guidelines exceeded for Pb (440±0.36 mg/Kg) only. A high Zn, Cu and Cd concentration in this waste is because more than 70% industries are involved in metal pickling and electroplating. Giri and Bhattacharyya, (1999) also reported that industrial waste from metal finishing industries have a high quantity of macro and micronutrients as well as heavy metals, which is consistent with this study. In our study total and available heavy metals in waste have following trend; Zn>Pb>Cu>Cd.

Soil pH is one of the major factors controlling the availability of heavy metal in soils (Brady, 2000). Background pH values of the site1 and site 2 soils were 8.76±0.03 and 8.22±0.04 respectively (data not shown). In control soils total metal concentrations were more in site1 soil than site 2 soil and showed the following trend; Zn>Pb>Cu>Cd. For high concentration of heavy metals in site 1 soil is might be due to its location. It is situated within 5Km radius of Badarpur Thermal Power Station (BTPS) and it is assumed that fly ash and other

pollutant are likely to contaminate this soil. Analytical results indicated that in control soils values of all heavy metals were below the literature levels of a typical soil except Pb (19ppm).

3.2 Heavy metal accumulation and translocation in wheat seedlings:

For both soils, total heavy metal as well as DTPA-extractable heavy metal contents increased linearly as the waste percentage increased in soil (Fig1). Rappaport et al., (1988) also reported that amount of DTPA-extractable Cd, Cu, Ni, Mn, and Zn increased linearly with rate of sludge application. Due to the acidic nature of waste, its amendment increased the pH and decreased the availability of metals as pH is also one of the soil factors that governs the availability of metals in soils (Norwal et al., 1983). Tables 2 showing that availability of all studied DTPA-extractable metals were also depend on soil pH, OC and CEC.

In the present study, correlation analysis (r) was performed in order to investigate the relationship between the DTPA extractable metals in different amendments of the electroplating sludge and the total accumulation of metal in the plant parts (Table 3). It was observed that all the metals in plants were highly correlated with the available metals of the soil at the end of experiment, except, Zn and Pb. Many other researchers were also reported the same and were consistent with this study (Karcka, 2004).

Copper is one of the most important essential elements for plants and animals (Alloway, 1995). Fig 1A showed that guideline limits of 25ppm for Cu doesn't exceeded in any soil. Effect of industrial amendments and lime were found to follow the similar trend like Zn. Cu concentrations in seedling tissue did not reach phytotoxic levels 20-100ppm (Smith, 1996) in any treatments (Fig 2A). The normal transfer coefficient for Cu in plants is between 0.01-0.1 (Kloke et al., 1984) and it consisted with this study (0.03-0.12). So, Cu in this study is not responsible for any type of phytotoxicity.

In normal situation Zn acts as micronutrient but at higher concentration it becomes phytotoxic (Alloway, 1995). It is evident from the Fig 1B that Zn concentrations were above the guideline limits after the waste amendments in both soils. The value within the bar showed the availability of metal as the percent of total metal in soils. Waste amendments increased the Zn concentration in all treatments (McBride et al., 2003). But the increment was more in site 1 soil than site 2 soil due to background level in soils. Lime amendments significantly ($P<0.05$) reduced the availability of DTPA extractable metals in all treatments as compared to its counterpart without lime treatment. This can be explained by the increase in soil pH following lime amendment, and the reduced solubility of these metals in soil at high pH. Wong et al., (2001) and Vulkan et al., (2000) also reported that lime amendments reduced the availability of metals in amended soils.

Fig 2B showed the Zn concentration in wheat seedling tissue after the 28 days of growth and the value within the bar showed the transfer coefficient (*f*). Zn concentration didn't reach phytotoxic levels (100-400ppm) in any treatment (Fifield and Hannies, 2002). Normal transfer coefficient (*f*) of Zn for the plants was found 1-10 (Kloke et al., 1984). But in our study it was below this value and it ranges 0.25-0.57. As evident from the Fig 2A transfer coefficient was also more in site 1 soil than site 2 soil and lime have negative effect on transfer coefficient. The higher Zn concentration of site 1 soil transfers more Zn and thus uptake of Zn by seedlings.

Cadmium is an important heavy metal pollutant, the presence of which in agricultural soils and crops is of great concerns. Naturally occurring Cd concentration in soils ranges from 0.001-3ppm (Alloway, 1995). Waste amendment also increased the total and bioavailable Cd in the soils, which supports the study of McBride, (2003). Cd availability to crops is affected by: soil pH, CEC, soil texture, crop species and interrelationship of Cd with other elements in soil (Table 3). In contrary Tsadilas (1995) reported that available Cd is only pH dependent and independent on other physiological properties of soil like CEC, OC etc.

Cd level decreased significantly in the soil types over the 28 days due to accumulation of Cd in plant tissue (Hooda et al., 1997). We observed that most of the Cd is retained by the roots and not transferred to the shoots which show that wheat is an accumulator for metals (Fig 2C). The uptake of Cd into the wheat seedling did not reach the phytotoxic levels of (5-30ppm) except seedlings from 20% waste amended (without lime) site 1 soil. The plant transfer coefficient for Cd in plants tissue is 1-10 (Kloke et al., 1984). So for transfer coefficient all the plants have less value (0.09-0.30) than this limits and transfer coefficient. Lime reduced the uptake of Cd as well as transfer coefficient (*f*).

Lead, being the zootoxic metal, needs to be monitored in plants parts used by humans and animals (Alloway, 1995). Lead occurs naturally in all plants. In the environment, lead exists almost entirely in inorganic form. Significant reductions were observed in Pb concentration for both soils during this study. Fig 1D showed that the total and bioavailable Pb concentration in both control and waste amended soils. Lead concentration of both soils were below the permissible limits (750-1200µg/g) set by the USEPA, 1993. Up to seedling

stage not much variation obtained in this study, which showed that Pb is not much more mobile in soil system, which was consistent with the findings of Kabata-Pendias and Pendias, (1991); and Valtcho et al., (2004).

Uptake of the Pb in the seedling was low and did not reach the phytotoxic level of 30-300ppm (Alloway, 1995) as depicted in Fig 2D. A normal plant transfer coefficient (*f*) value for Pb in wheat seedling is between 0.01-0.1 (Kloke et al., 1984), therefore the transfer coefficient for both soils was high only in without lime treated waste amendments. Lime reduces the transfer coefficient as well as uptake of the Pb by wheat seedlings. Higher transfer coefficient and uptake of Pb in the seedling tissue occurred in site1 soil due to its background level.

3.3 Growth:

The shoot length, fresh mass and dry weight of wheat seedlings were depicted in table 4. Industrial sludge amendments increased plant growth significantly as compared to the control ones. But 10% waste amendments were found more significant over 20% amendments in both soils. This emphasized the potential short-term beneficial effects of sludge to soils as an organic soil conditioner. From these findings it evident that soil amendment above 10% is not good because it also provides heavy metals to plants and growth become retarded. Plants from site 1 soil exhibited a good growth compare to its counterpart due to its background level.

Lime amendment demonstrated a positive effect on plants growth at each sludge amendment level, which was likely due to increased in pH and reduction in the availability of heavy metals. Most agricultural crops grow well when soil pH is between 6.0-7.0, because nutrients are more available at pH about 6.5 (Soummare et al., 2003). However heavy metal behavior still differs individually and other soil physical properties, like textures might play an important role in heavy metal behavior in soils (Maclean et al., 1987).

4. Conclusion:

In this study it was observed that the industrial sludge from metal finishing industries was highly acidic and had a high amount of heavy metals. Lime had the positive effect and reduced the availability, uptake as well as transfer coefficient in all treatments. The industrial sludge affected the yield of the wheat seedlings positively compared with control plants. However no phytotoxic effects could be proven, because phytotoxic levels were not exceeding in wheat seedling tissues. Although it was a pot culture study and could not draw the actual picture but may be used as baseline data for further analysis. For land application of sludge, needs to possibly take in to consideration the environmental conditions, crop plated, soil type and sludge type. This might lead to the unrestricted industrial sludge on agricultural land, causing a decrease in technological costs for wastewater treatments plants (and subsequent financial profit) to eliminate heavy metals in sludge.

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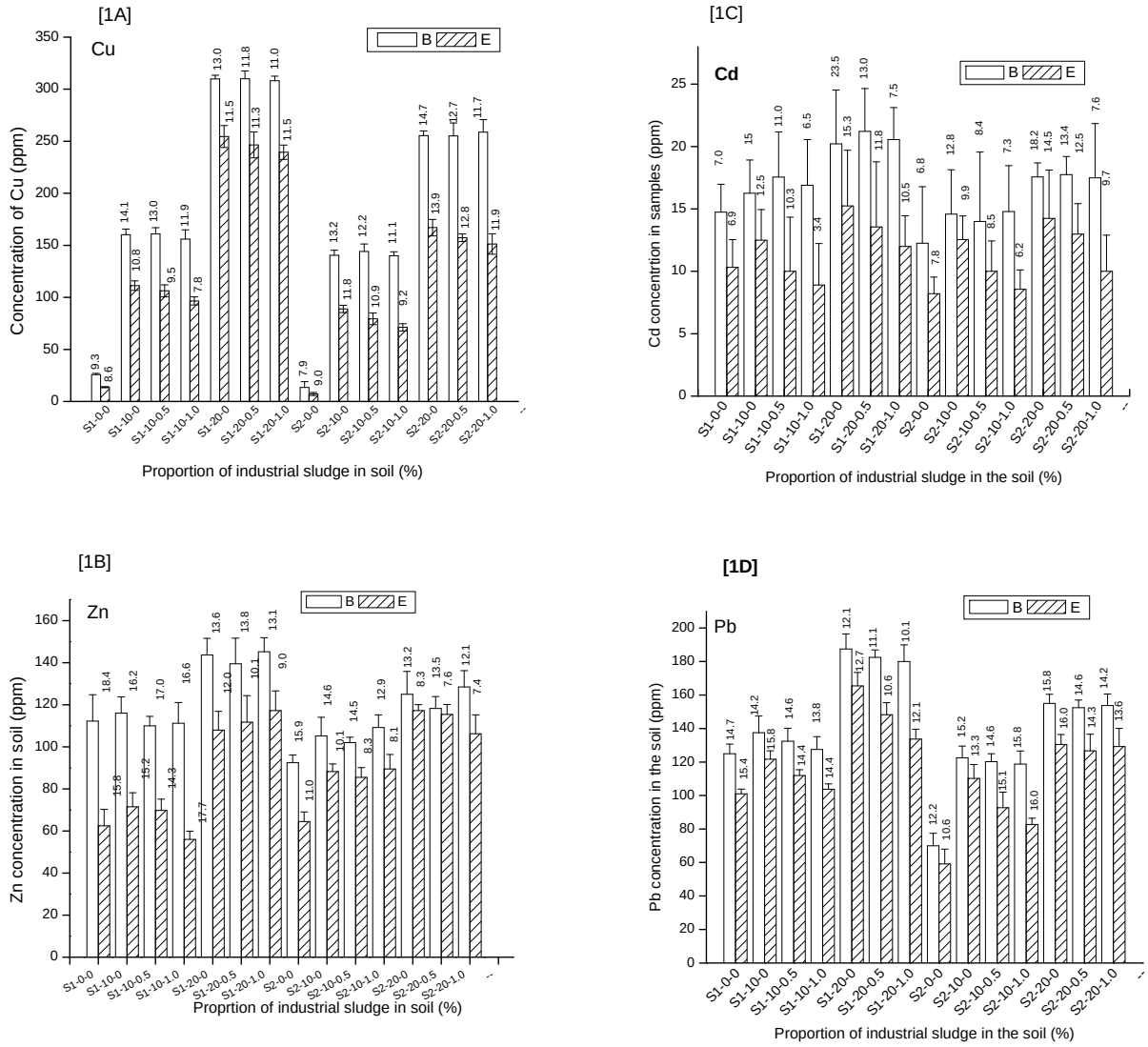

Figure 1: Showing the metals concentration (ppm) in control and industrial sludge amended soils at beginning (B) and (E) of experiment. Values between vertical bars indicate percentages availability of metals. Values are the mean of three data with SD (±)

Notation; e.g.S1/S2$_1$-10$_2$- 0.5%$_3$: 1-Site1/2 soil; 2-percentage of the waste; 3-percentage of lime treatment

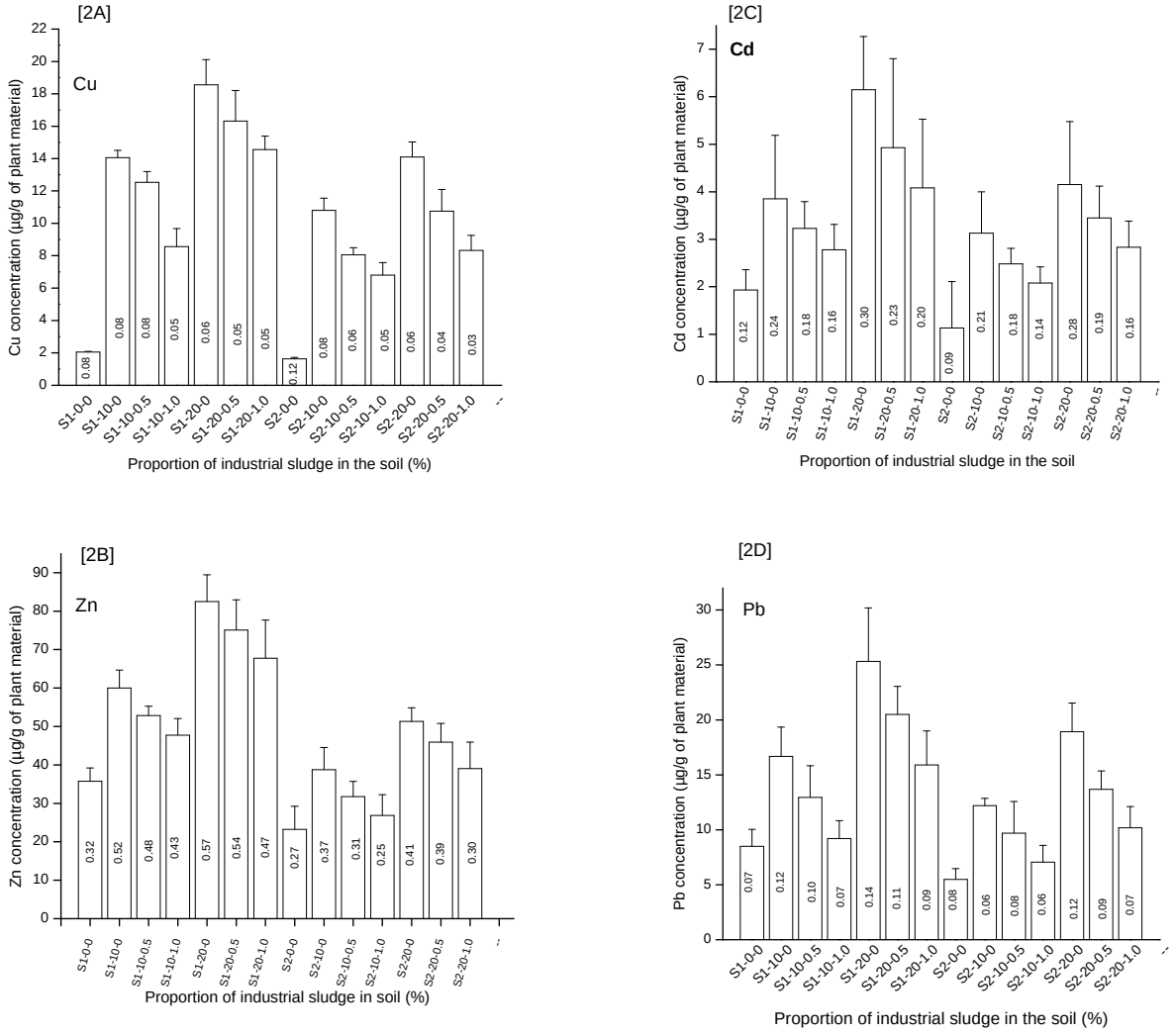

Figure 2: showing the total metal concentration (µg/g of plant material) in wheat seedling tissues in all treatments. f factor indicated within vertical bars. Values between vertical bars indicate percentages availability of metals. Values are the mean of three data with SD (±)
Notation; e.g.S1/S2$_1$-10$_2$- 0.5%$_3$: 1-Site ½ soil; 2-percentage of the waste; 3-percentage of lime treatment

Table 1: Heavy Metals content of Industrial sludge and soils (mg/Kg) on dry wt. basis with std deviation

Metals	Total metal content					Extractable metal content		
	Industrial Sludge	Limits values in sludge* (mg/Kg)	Soil		Limits values in soil* (mg/Kg)	Industrial Sludge	Soil	
			Site1	Site2			Site1	Site2
Zn	1290±0.52	**2800**	42.25±0.58	22.25±0.48	**130-200**	44.25±0.27	10.63±0.02	4.69±0.02
Cu	410±0.44	**1500**	25.75±0.12	13.48±0.15	**60-100**	31.72±0.56	2.40±0.02	1.06±0.01
Cd	30.16±0.21	**30**	4.21±0.12	2.25±0.11	**1-3**	1.15±0.01	1.03±0.06	0.83±0.02
Pb	440±0.36	**300**	65±0.21	50±0.39	**19**	56.12±0.11	8.34±0.12	5.84±0.06

*C.E.C. (1986)

Table 2: Linear regression coefficient values* (R^2) between soil DTPA-extractable metals and pH, organic carbon, CEC in soil at harvesting stage

Metals	R^2 value in Site 1 soil			R^2 value in Site 2 soil		
	pH	OC	CEC	pH	OC	CEC
Cu	0.72	0.65	0.53	0.85	0.89	0.94
Zn	0.09	0.08	0.10	0.09	0.06	0.02
Cd	0.96	0.91	0.80	0.81	0.70	0.82
Pb	0.25	0.15	0.05	0.39	0.14	0.09

*at 0.05 level of significance

Table 3 Correlation coefficients (r) between soil available metals at the end of experiment and metal concentrations in seedlings of wheat plants

Metals	Site 1 Soil	Site 2 Soil
Cu	0.90	0.81
Zn	0.86	0.78
Cd	0.81	0.83
Pb	0.86	0.76

*at 0.05 level of significance

Table 4: Average shoot length, fresh and dry mass after 28d of growth

Treatments	**Shoot length (cm)**	**Fresh mass (g/plant)**	**Dry mass (g/plant)**
S1-0-0	28.3	10.2	1.02
S1-10-0	35.2	13.2	1.22
S1-10-0.5	37.7^{c}	15.2	1.45^{ac}
S1-10-1.0	40.1^{b}	17.5	1.61^{a}
S1-20-0	39.8^{b}	14.2	1.31^{b}
S1-20-0.5	41.3^{a}	18.5^{c}	1.68^{ac}
S1-20-1.0	44.5^{ac}	21.2^{bc}	1.98^{ab}
S2-0-0	25.2	9.8	1.0
S2-10-0	30.3	12.3	1.14
S2-10-0.5	33.5	13.2	1.28^{ac}
S2-10-1.0	35.8^{c}	15.6	1.34^{a}
S2-20-0	36.8^{b}	15.2	1.35^{b}
S2-20-0.5	39.1^{b}	16.9^{c}	1.45^{ac}
S2-20-1.0	42.5^{ab}	18.8^{bc}	1.69^{ab}

Notation; e.g. $S1/S2_1$-10_2- $0.5\%_3$: 1-Site1/2 soil; 2-percentage of the waste; 3-percentage of lime treatment. [a] $p<0.001$; [b] $p<0.01$; [c] $p<0.05$ compared to control.

Rocks for crops: Assessment of the Quality of Adigudom Gypsum for crop production in the northern highlands of Ethiopia

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Abstract: Significant proportions of the landmasses of Ethiopia are covered by massive and continuous Rocky Mountains of different geological origin and composition, which can be useful even for organic farming. In the last decade, in fight against the recurrent drought in the north Ethiopian State of Tigray more than 46 dams have been constructed with a cumulative storage capacity and irrigable area of 49.91 million m^3 and 3115 ha, respectively. However, in the irrigated fields of these dams, salt minerals like *thenardite* (Na_2SO_4), *halite* (NaCl), *zincobloedite* ($Na_2Zn(SO_4)_2.4H_2O$), and a*northoclase* ($(Na,K)(Si_3Al)O_8$ have been observed recently, which can cause sodicity thereby crop productivity can be impaired gradually. A list of management options should be tabled urgently before the problem is aggravated. Large gypsum deposit was found in the localities of the irrigated fields. Thus, this study attempted to evaluate the quality of these minerals whether they can be useful for agricultural purposes. Analysis revealed that up to 150 cm of the profile depth of the rock was mainly composed of gypsum (95%) with the predominance of oxides of S (43.5-46.6% SO_3^{-2}) and Ca (32.1-33.5% CaO). The oxides in the sampled rock followed the order of: SO_3^{-2}> $CaO>SiO_2>Al_2O_3>Fe_2O_3>MgO>Na_2O>K_2O>TiO_2>MnO>P_2O_5$ with the finest particle size (81.7-90%) dominating over other sizes. This study has come to the conclusion that Adigudom gypsum deposit can be used as rock for crops through enhancing sodicity management and sulphur nutrition. [Nature and Science 2010;8(3):9-14]. (ISSN: 1545-0740).

Keyword: Adigudom gypsum, agromineral, microdams, sodic soils, sulphur nutrition

1 Introduction

Dependence on rainfed agriculture coupled with the erratic nature of rainfall is one of the main causes of widespread food insecurity in the country. Droughts occur every 3-5 years in northern Ethiopia and every 8-10 years for the whole country, with severe consequences for food production (Haile, 1988). Hence a sustainable increase in food production to achieve self-sufficiency depends, at least in part, on how Ethiopia addresses its dependence on rainfall.

Tigray is one of the most land-degraded states of Ethiopia (Hurni, 1993). The region is characterized by subsistence farm households raising predominantly cereal and vegetable crops for local consumption and sale. Crop production in the region has failed to keep pace with population growth due to recurrent droughts, environmental degradation, and war. In response to severe environmental degradation and population-resource imbalance, the government of Ethiopia has initiated a major rural development program called SAERT (Sustainable Agricultural and Environmental Rehabilitation) through which several small dams have been constructed. The water development program is intended to rehabilitate degraded environments, enhance the adoption of irrigation practices, and ultimately increase agricultural productivity and sustainability (MUC, 1994).

Well-designed and constructed small water bodies such as microdams can have multiple benefits for their surrounding communities. Beyond making water available for the irrigation of field crops, microdams may provide water for garden cultivation, trees and other vegetation, and water for cattle. Other productive uses may include fishing and harvesting aquatic plants and animals. To this effect, so far 46 microdams have been constructed over the period of 1996 to 2001 (COSAERT. 2001). However, microdam creation in Tigray is associated with important socioeconomic benefits there are environmental concerns that these new sources of water may have caused specifically salinity and sodicity. Recently, The financial support of the Ethiopian Agricultural Research Organization is duly acknowledged for conducting the study. sodium adsorbed on the clay minerals. Results from field experiments in many parts of the world showed that gypsum applied at several tonnes per hectare decreases the sodium adsorption ratio, physically improves the infiltration rate and significantly increases yields (Peter van Straaten 2002).

Gypsum applied at the surface or subsoil, is reported to reduce phytotoxicity in acid soils (Alva and Sumner 1989; Sumner 1995 as cited in Peter van Straaten 2002). The mechanism for this reduction is the downward movement of soluble calcium and the subsequent exchange with

aluminium in the subsoil (Mc Ray and Sumner 1990; Sumner 1995 as cited in Peter van Straaten 2002). Besides, gypsum is a low cost source of elemental sulphur. Thus, this study attempted to evaluate whether the quality of this rock suitable for managing the newly emerging agricultural problems.

2 Materials and Methods

2.1 Study area

The study site is located in the northern highlands of Ethiopia in Adigudom (13° 16' 50''N and 39° 28''E) at an altitude of 1960 m on the Mekelle plateau in Tigray Region (Fig. 2).

2.2 Geological setting

The geological setting of Adigudom is mainly composed of igneous and sedimentary rocks. Among the ingenious units, medium grained dolerite dominates. The sedimentary units include agula shale formations, limestone and coguina (fully fossiliferous limestone). The agula shells comprise alternate layers of calcareous marls. Shales and limestones contain many minor inclusions of dolerite (Corbeels, *et al*., 1998). These rocks give rise to stony, calcareous and fine textured soil parent materials.

2.3 Sampling and analytical method

A composite sample of gypsum from Adigudom rock deposit was collected to evaluate its quality. In addition, profile samples of rocks were also collected from 0-40, 40-60, 60-90, 90-140 and 140-160 cm. Physical, chemical and mineralogical analyses were conducted in the Laboratory of the National Geological Survey of Ethiopia in Addis Abeba. The grain size distribution was determined using pipette method. X-ray diffractometer was used to study the crystal structure and the software DIFFRAC ^{plus} Eva (DIFFRAC ^{plus} Manual, 1999) was used to analyse the results. Varian Spectra 50-B Atomic Absorption Spectrometry (AAS) was used to measure the compositions of oxides in the

rocks whereas, moisture and loss on ignition were determined gravimetrically.

3 Results and Discussions

3.1 Mineralogical analysis

Mineralogical analysis revealed that gypsum is the predominant mineral of the rock deposit ranging from 95.2% in lower horizons to 98.3% in the upper horizons of the profile (Table 1). Anhydrite was found in the range of 1.7 -2.2% and increased with depth whereas quartz ranged from 1.7 to 3.1% showing a downward increment (Table 1). Generally, the mineral sequences of the analysed rock samples are gypsum>anhydrite>quartz

3.2 Chemical analysis

The chemical analysis revealed SO_3^{2-} to be the most dominant oxide, ranging between 45.1-46.6%, followed by CaO, ranging between 32.14-32.89%. In general, oxides in the sampled rocks were found to be in importance order of $SO3^{2-}$ >CaO>SiO_2>Al_2O_3>Fe_2O_3>MgO>Na_2O>K_2O>TiO_2>MnO>P_2O_5 (Table 2). Loss on ignition and water percentage were also varied from 1.48 to 3.2 and 17.7 to 19.4%, respectively.

3.3 Grain size distribution

Dominant grain size distribution of the sampled rocks was found to be with an effective diameter of 0.04 mm, which is ranging between 81.7-90%, followed by grain size of 0.016 mm amounting to 41.2-50% (Table 3). The finer particle size, the greater the geometric surface area and degree of contact between the soil and gypsum particles and thus, the greater the gypsum dissolution rates.

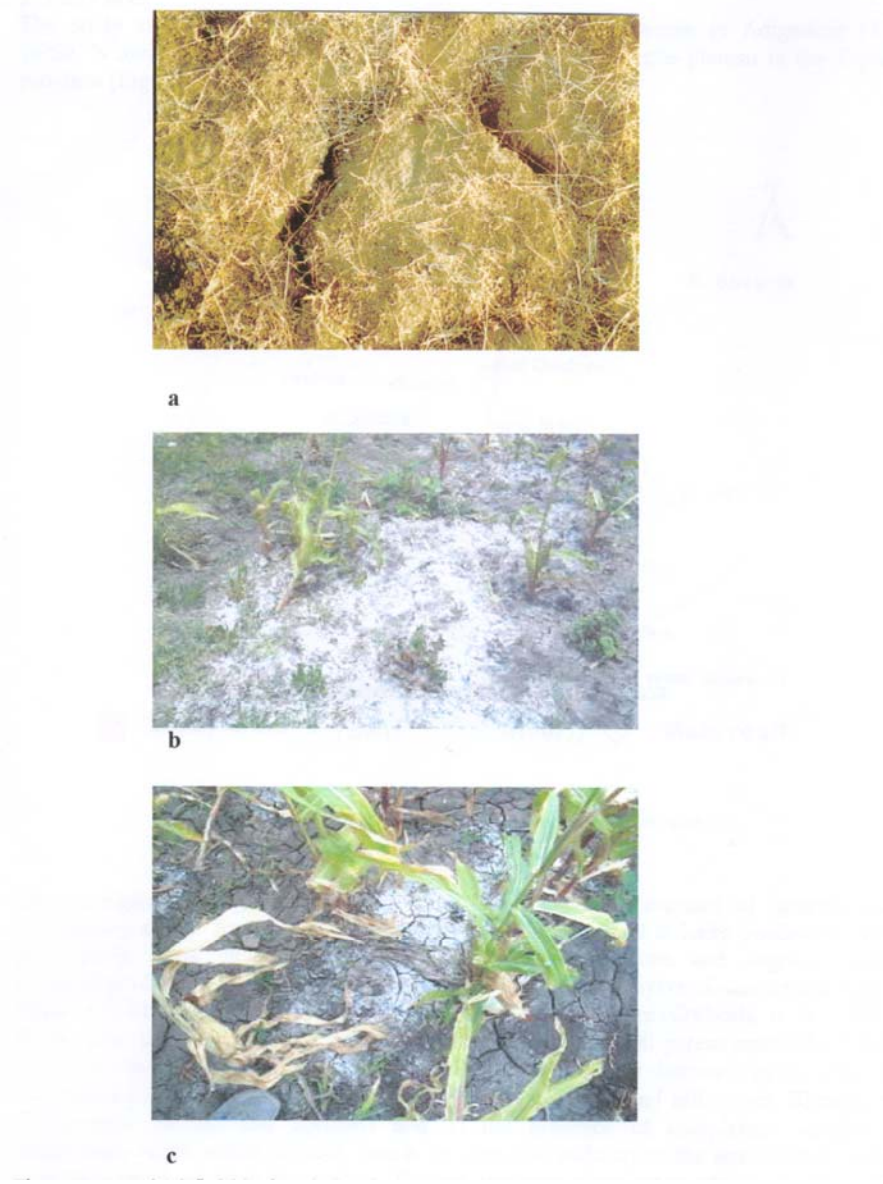

Fig 1. a) Vertisols field before irrigation and b & c- salt patches developed under maize cultivation after irrigation, Adigudom, North Ethiopia

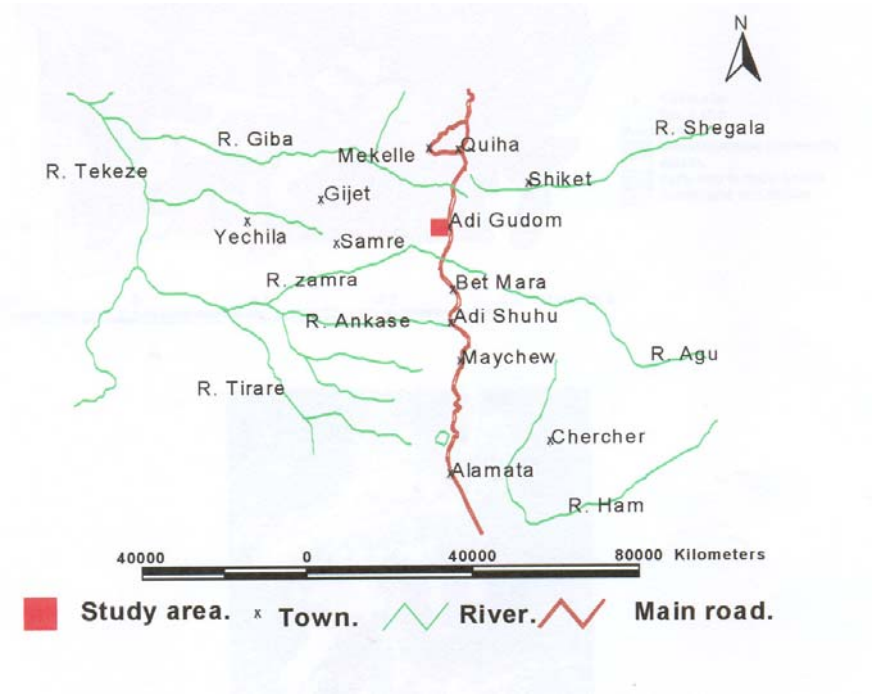

Fig.2. Location map of Adigudom.

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Table 1. Mineralogical composition of Adigudom gypsum

Horizon, cm	Gypsum	Anhydrite	Quartz
0-40	98.3	-	1.7
40-60	98.3	-	1.7
60-95	97.8	-	2.2
95-140	95.2	2.2	2.6
140-150	96.9	-	3.1
Composite sample	95.7	1.9	2.4
Mean	95.0	0.7	2.3

Table 2. Chemical composition of Adigudom gypsum

Horizon cm	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O	K_2O	MnO	TiO_2	P_2O_5	SO_3^{2-}	H_2O	LOI
0-40	0.91	0.39	0.23	32.4	0.05	0.02	0.01	0.01	0.02	0.01	45.7	19.2	1.78
40-60	0.62	0.09	0.13	33.5	0.01	<0.01	<0.01	0.01	0.02	0.01	46.6	19.4	1.48
60-95	1.76	0.64	0.42	32.1	0.10	0.03	0.03	0.02	0.03	0.03	45.4	17.7	3.16
95-140	1.17	0.79	0.27	32.7	0.09	0.07	0.02	0.01	0.02	0.01	45.1	18.5	2.46
140-150	1.87	0.83	0.45	32.9	0.11	0.25	0.17	0.04	0.02	0.01	45.5	17.7	4.06
Composite	0.77	0.22	0.16	32.9	0.05	0.17	0.12	0.01	<0.01	<0.01	46.4	19.1	1.70
Mean	1.2	0.49	0.28	32.8	0.07	-	-	0.015	-	-			

Table 3. Grain size distribution of Adigudom gypsum

Horizon cm	<0.00063 %	<0.0025 %	<0.0063 %	<0.016 %	<0.04 %
0-40	12.7	17.2	26.0	46.8	90.0
40-60	9.3	11.1	16.2	43.6	87.9
60-95	13.0	14.2	16.9	48.0	90.0
95-140	14.4	15.2	18.9	41.2	81.7
140-150	11.2	21.1	31.1	50.0	86.7
Composite	13.6	13.6	19.1	58.4	83.6
Mean	15.4	15.4	21.4	48.0	86.7

4 Conclusions

Wallace (1998) reported that dehydrated gypsum ($CaSO_4.H_2O$) provided a guaranteed analysis of 55 to 92% having 79.1% of $CaSO_4$. Thus, it is evident from the results that quality of Adigudom gypsum is comparable to the standards of guaranteed analyses. Therefore, considering the high levels of calcium and sulphur as well as its predominant fineness, Adigudom gypsum can be served as agro-geologically important mineral deposit to enhance crop productivity by solving sodicity and sulphur nutrition problems (Peter van Straaten 2002).

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Morphology, Fecundity and diet of *Galeoides decadactylus* (Pisces: Polynemidae) (Bloch, 1795) off Nigerian coast

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Abstract: *Galeoides decadactylus* (Bloch) is one of the three species of the family polynemidae commonly called the threadfins, found in warm tropical surface water of the Atlantic on the continental shelf of West Africa. They are important in the trawl fisheries of Nigeria. The specimens used for this study were collected off Nigerian coast from Lagos to Calabar between December, 2003 and November, 2004. In this study the length-frequency distribution, length - weight relationship, condition factor, sex ratio, fecundity, food and feeding habits of *Galeoides decadactylus* were examined. Measurements recorded for each fish were standard length (SL) and total length (TL) to the nearest 1mm and weight to the nearest 0.1g. Sexes of fish were determined by visual and microscopic examination of the gonads. Fecundity was estimated from the ripe ovaries (stage v) by the gravimetric method. The Gonadotropic Index (GI) and the Condition Factor (K) were calculated. Food items were quantified by two methods, the numerical and frequency of occurrence methods. The total length of 259 specimens examined ranged between 12.0cm and 28.3cm (standard length 9.9cm to 20.8cm). Specimens exhibited negative allometric growth. The condition factor increased with individual size. Females had a slightly higher condition factor than males. The sex ratio was 1:0.46 (male:female). The number of eggs per female ranged between 58 001 and 279 279. There was a negative correlation between log-fecundity and log-weight than between log-fecundity and log length. The major food items were crustaceans, molluscs, pisces and annelids. There were no distinctions in the feeding habits of the species in relation to size. The fish was euryphagus species and highly fecund.
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Key words: *Galeoides decadactylus*, fecundity, allometric growth, condition factor, euryphagus.

INTRODUCTION

Galeoides decadactylus is one of the three species of the family polynemidae found in warm tropical surface water of the Atlantic on the continental shelf of West Africa. It is usually distinguished by its lower portion of the pectoral fin detached to form nine or ten short free rays (Schneider 1990).

G. decadactylus is a moderately elongated fish, slightly compressed with the standard length about three times longer than the body depth. It has an inferior mouth with a fleshy translucent blunt snout. It occurs in shallow coastal waters, also in estuaries (Schneider 1990). It is a carnivorous fish feeding on variety of crustaceans such as shrimps and crab parts. It is of great importance as protein source for man and coastal tribes all over the world (Kusemiju and Osibona 1998). The threadfins are important in the trawl fisheries of Nigeria in which two of the genera *Galeoides* and *Pentanemus* form 10% and 20% respectively of the total catch landings (Longhurst 1964).

Fecundity has been defined by Bagenal (1968) cited by Osibona and Kusemiju (1998) as the number of ripe eggs in the female gonad prior to the next spawning period. Knowledge of fecundity is paramount to the understanding of population dynamic (Kelly et al 1996). They reported further that fecundity was correlated to fish weight. However, Nagasaki (1958) and Osibona and Kusemiju (1998) reported close correlation between fecundity and body weight than between fecundity and length although there could be weight loss during period of egg maturation. Despite the importance to the fisheries economics of African Seaboard Countries of the two species (*G. decadactylus* and *Pentanemus quiquarius*), very little information on their biology is available. Other information include preliminary studies on growth rates in fish from Sierra Leone area (Longhurst 1962, 1963b), their escapement from trawls in the same fishery (Longhurst 1959, 1960a) their elementary chemical composition (Watts 1958) and the growth and fecundity of *P. quinquarius* off Aiyetoro coast (Kusemiju and Osibona 1998).

The main objectives were to examine the growth pattern, fecundity, food and feeding habits of this species as a complement to the already existing information on the biology of this fishery resource in West Africa.

MATERIALS AND METHODS

The specimens used for this study were collected between December, 2003 and November, 2004 with beam trawl (M.V. Massey, a 13.2m long inshore trawler with a 125hp caterpillar engine). The trawl net of 3 inches (7.62cm) wing and 2 inches (5.08 cm) cod end was used. Specimens were preserved in adequate ice block from the point of collection to the laboratory. They were labeled and then transferred into the freezer pending further analysis. Fish samples were thawed in the open air in the laboratory and body wiped

dry. Measurements recorded for each fish were standard length (SL) and total length (TL) to the nearest 01cm and weight to the nearest 0.1g. Sexes of fish were determined by visual and microscopic examination of the gonads. The unsexed fishes (juveniles and young adults) were regarded as immature. The gonadal maturity stages classification was adopted after Kelly *et al.* (1996). Mature ovaries were removed, weighed and then preserved in Gilson's fluid.

Fecundity: Fecundity was estimated from the ripe ovaries (stage v) by the gravimetric method after Kelly *et al*. (1996). The potential individual fecundity (FPI) was calculated according to the equation:

$$FPI = \sum_{n=1}^{n=5} \left[W_{susp} \times \left(\frac{C_n}{W_n} \right) \right] \times \left(Wsum/W_{sub} \right)$$

where W_{susp} is total suspension weight (sucrose + eggs); (n is average egg count of the nth 0.5ml sample; W_n is weight of the nth 0.5ml sample; W_{sum} is total weight of eggs in the Ovary and W_{sub} is weight of eggs in the suspension.

Gonadotropic index: The Gonadotropic Index (GI) was calculated using the formula:

$$G.I = \frac{\text{Ovary weight}}{\text{Fish weight}} \times 100$$

given by Sturm (1978).

Stomach content: The stomach contents were analyzed to establish the food habits of the fish. Since the fish were frozen immediately after catching their stomach contents were representative of their last meals. Food items were quantified by two methods, the numerical and frequency of occurrence methods (Hyslop 1980; Costal et al. 1992). In the numerical method the number of each food item was expressed as the percentage of the total number of food items found in the stomachs while in the frequency of occurrence method, the occurrence of food items was expressed as the percentage of the total number of stomach containing food.

Length-Weight relationship: The length-weight relationships for each sex and the combined sexes were calculated using the equation.

Log weight = log a + b log length.

Where a and b are regression constants.

Condition factor: The condition factor was calculated for the males, females and combined sexes using the condition factor method of Bannister (1976):

$$K = \frac{100W}{L^3}$$

Where K = condition factor, L = total length (mm) and W = weight in grams.

In order to test whether b – values obtained in the linear regressions were significantly different from the isometric value (3), a t – test ($H0 \neq b = 3$) with a confidence level of 99 % ($P < 0.01$) was applied, expressed by the following equation (Sokal and Rolif 1987).

RESULTS

Length-frequency lengths of 259 specimens examined ranged from 12.0cm to 28.3cm (standard length 9.9cm to 20.8cm). The length frequency distribution of *G. decaqdactylus* showed a Unimodel size distribution (Figure 1). This result indicated that *G. decadactylus* attained one size group of total length ranging from 12.5 to 20.1cm and mean 16.1cm.

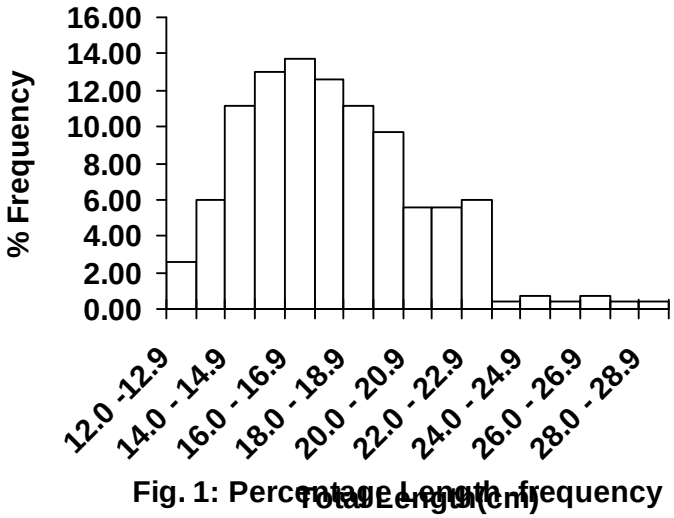

Fig. 1: Percentage Length-frequency distribution of *G. decadactylus* off Nigerian coast

Length-weight relationship of *G. decadactylus*

The total lengths of *G. decadactylus* off Nigerian Coast ranged from 12.0cm to 28.3cm (standard length 9.9 – 20.8cm) while the weights ranged from 18.6g to 230.5g. The log length – log weight relationship for this species is as shown in Fig. 2. The length-weight relationship regardless of sex or year class reflected the general increase of weight with increasing length.

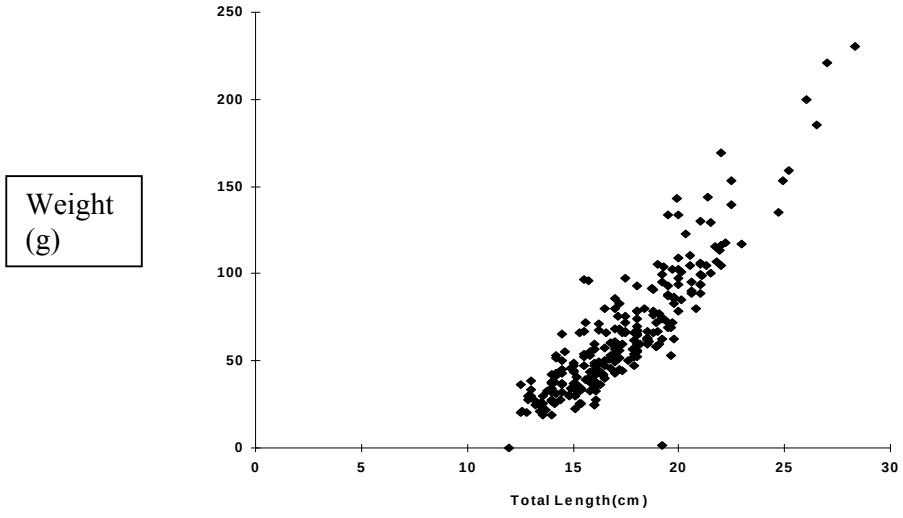

Fig. 2: Length - Weight relationship of (combined sexes) *G. decadactylus* off Nigerian coast.

The exponential relationship of the log length and log weight for both combined and individual sexes are shown in Table 1.

TABLE 1**:** Length-weight relationship of *G. decadactylus*

TL (cm)	Individual	Length-weight relationship	N	r	t	p
12.9 – 27.0	Male	Log W = Log-1.6480 + 2.7568 Log L	178	0.867	– 2.0391	<0.01
13.5 – 28.3	Female	Log W = Log-1.8643 + 2.9295 Log L	81	0.843	– 0.335	<0.01
12.9 – 28.3	Sexes combined	Log W = Log-1.6948 + 2.7962 Log L	259	0.868	– 1.728	<0.01

N = number of individual species, r = coefficient, t = absolute value of the t comparing calculated slope to 3, p = significant different.

The b values obtained were: 2.7568, 2.9295and 2.8211 for male, females and combined sexes.

In order to confirm whether b-values obtained in the linear regressions were significantly different from the isometric value (3), a t-test (Ho ≠ b =3) with a confidence level of ≠ 75% ($\alpha < 0.01$) was applied, expressed by the following equation (Sokal and Rolif 1987).

$$t_s = \frac{b - 3}{s_b}$$

Where t_s is the t test value, b the slope and s_b the standard error of the slope (b).

Condition factor The size and sex variation in condition factors are presented in Table 2 and the values varied from 1.49 to 3.96. Female specimens had higher condition factors than males. The K-value however increases with increase in fish size for both male and female specimens and for the combined sexes.

Table 2: Condition factor in relation to sex and size of *G. decadactylus* off Nigerian Coast.

Total Length /Size Group(cm)	Number of Specimen	Range of K-factor	Mean of K-factor
		Male	
12.0 – 20.9	172	149 - 3.23	2.36
21.0 – 29.9	6	2.19 - 3.76	2.17
		Female	
12.0 – 20.9	59	1.69 - 3.41	2.40
21.0 – 29.9	22	2.08 - 3.96	3.02
		Combined sexes	
12.0 – 20.9	231	1.49 - 3.41	2.45
21.0 – 29.9	28	2.08 - 3.96	3.02

Fecundity of *G. decadactylus*

The number of eggs in the ovary ranged between 58 001 for a 175mm total length fish to 279 277 for a 220mm total length fish with a mean fecundity of 168 639. Logarithm – transformed length or weight/ fecundity (Figs. 3 and 4), data gave the following equations:

Log F = Log 7.3109 + 1.7526 Log L
(n = 10, r = 0.2272)

Log F = Log 5.4213 + 0.1900 Log W
(n = 10, r = -0.0508).

Eggs in matured ovaries were of different diameters. T he egg diameter ranged between 227 μm and 317μm increasing with maturation of the ovaries. The ripe and ripe-running eggs were pale and deep yellow respectively.

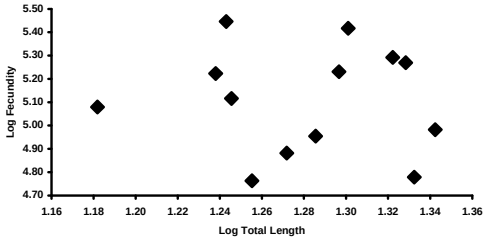

Fig. 3. The relationship between Log fecundity and Log total length of *G. decadactylus* off Nigerian Coast.

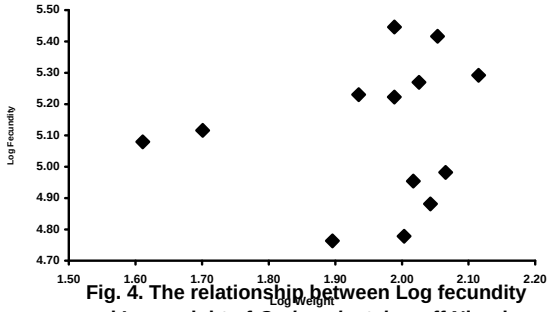

Fig. 4. The relationship between Log fecundity and Log weight of *G. decadactylus* off Nigerian Coast.

Gonadotropic Index (G.I): The gonadotropic indices of this species ranged from 0.91% to 9.57%. The mean value obtained was 5.24%.

Food and feeding habits of *G. decadactylus***:** The stomach contents of 259 *G. decadactylus* were examined. 94 (36.15%) had empty stomachs. A summary of the food items is presented in Table 3 and Fig. 5.

TABLE 3: Summary of food items of *G. decadactylus*

Food Items	Frequency of Occurrence		Numerical Method	
	Number	Percentage	Number	Percentage
Crustacea				
Penaeus notialis	154	24.76	382	14.19
Palaemon hastatus	109	17.52	217	8.06
Crab	72	11.58	139	5.16
Calanoids	18	2.89	1740	64.65
Cladocera	1	0.16	40	1.48
Pisces				
Fish parts	50	8.04	56	2.08
Fish eggs	1	0.16	9	0.33
Annelida				
Nereis sp	28	4.50	50	1.85
Molluscs				
Neritina sp	8	1.29	26	0.96
Aloidis trigona	12	1.93	32	1.18
Sand grains	3	0.48	-	-
Unidentified mass	166	26.69	-	-

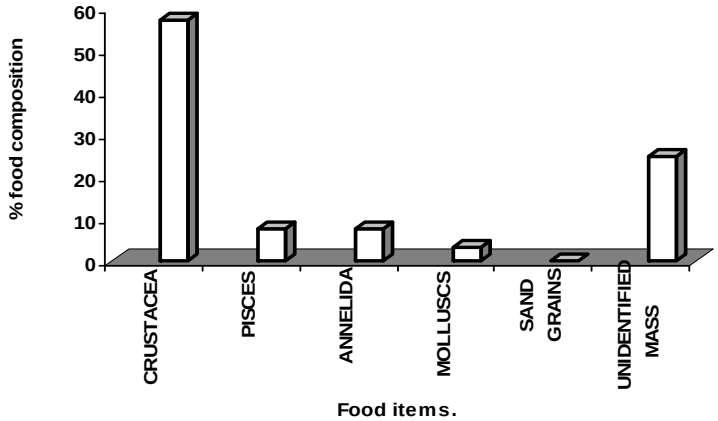

Fig. 5. Summary of food items of *G. decadactylus*.

Food in relation to size of *G. decadactylus***:** The specimens were divided into two size groups to facilitate a comparison of their food habit. The first size group (12.0 -20.9cm) comprised mostly of small sized fishes while 21.0cm to 28.3cm group consisted of mature fishes. The summary of the percentage composition of the two size categories were represented in Table 4 and Figure 6, Table 5 and Figure 7.

TABLE 4: Food in relation to size, 12.0 – 20.9cm of *G.decadactylus***.**

Food Items	Frequency of Occurrence		Numerical Method	
	Number	Percentage	Number	Percentage
Crustacea				
Penaeus notialis	122	24.40	289	13.20
Palaemon hastatus	85	11.00	170	7.76
Crabs	55	3.20	108	4.93
Calanoids	16	3.34	1510	68.98
Cladocera	-	-	-	-
Pisces				
Fish parts	28	5.60	43	1.96
Fish eggs	21	4.20	9	0.41
Annelida				
Nereis sp	21	4.20	33	1.50
Molluscs				
Neritina sp	8	1.60	25	1.14
Aloidis trigona	8	1.60	2	0.09
Sand grain	3	0.60	-	-
Unidentified mass	133	26.60	-	-

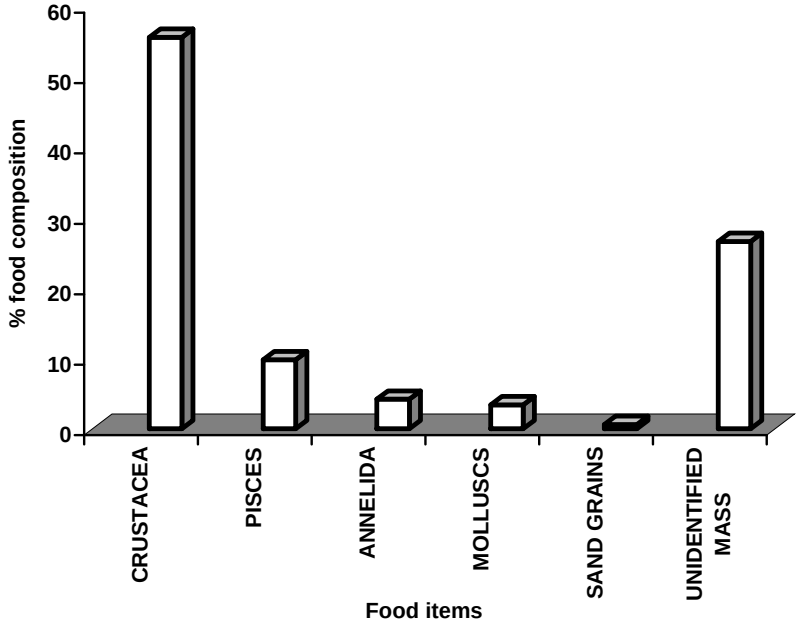

Fig.6. Food in relation to size 12.0 – 20.9 cm of *G. decadactylus*.

TABLE 5: Food in relation to size, 210 – 283mm of *G.decadactylus*

Food Items	Frequency of Occurrence		Numerical Method	
	Number	Percentage	Number	Percentage
Crustacea				
Penaeus notialis	32	23.88	93	19.21
Palaemon hastatus	24	17.91	47	9.71
Crabs	17	12.68	31	6.40
Calanoids	3	2.23	230	47.52
Cladocera	1	0.74	40	8.26
Pisces				
Fish parts	10	7.46	13	2.68
Fish eggs	-	-	-	-
Annelida				
Nereis sp	10	7.46	17	3.51
Molluscs				
Neritina sp	4	2.98	12	2.47
Aloidis trigona	-	-	1	0.20
Sand grain	-	-	-	-
Unidentified mass	33	24.62	-	-

Fig.7. Food in relation to size 21.0 – 28.3 cm of *G. decadactylus*.

Both size groups fed on the same type of food, crustaceans being the most important, however larger food items were more important in the diet of the large size group. The larger sized of *P. notialis, P. hastatus*, and crabs were more important in the diet of the large size group, the small size group fed on pre-adult and juveniles of the crustaceans and calanoids.

DISCUSSION

The length-frequency distribution of *G. decadactylus* showed that the fish exhibited unimodal distribution, which is one age group off Nigerian Coast. The frequency distribution study is one of the methods used for determining age of fishes. The method has been successfully used by Fagade and Olaniyan (1972) to age the bonga fish, *Ethmalosa fimbriata* in which three age groups were reported off Lagos coast. Kusemiju and Osibona (1998) reported a unimodal distribution in *Pentanemus quinquarius* off Aiyetoro coast.

The logarithmic plot of weight against length indicated a linear relationship. This relationship indicates that an increase in length leads to increase in weight. The correlation coefficients (r) were very high between the lengths and weights in *G. decadactylus* for both sexes, indicating a moderately strong relationship between the variables. The values of the regression coefficient (b) for the males, females and combined sexes were less than 3 showing that *G. decadactylus* had a negative allometric growth since the P-values is less than 0.01 this is a statistically significant relationship between Log weight and log length at 99% confidence level, for *G. decadactylus*. It was also confirmed that the b-values obtained for the specimens were significantly different from the isometric value (3).

The mean condition factor increased as the fish size increases. Female specimens had higher condition factors than males. The condition factor values are useful in comparing the healthiness of fish from different habitats or to indicate the sustainability of the environment in which the fish are caught. Kusemiju and Osibona (1998) also reported that the mean condition factor increased as the fish length increased in *P. quinquarius* off Aiyetoro coast.

There was negative relationship between the logarithm of fecundity and length/weight. There was, however, a different correlations between log fecundity/weight (r = -0.0508) and log fecundity / length (r = -0.2272). In this study, specimens of the same length or weight had variable fecundity. This was also reported by Kusemiju and Osibona (1998) on other species of the threadfin, *P. quinquarius*. This meant that the fecundity was variable irrespective of the weight or length of *G. decadactylus*. The variable in the fecundity may be as a result of differential feeding success (Bagenal 1978) and the size of the female parents (Fryer and Iles 1972).

Longhurst (1965) reported that 16.8% of the *G. decadatylus* examined were hermaphrodites with a suggestion that the fish exhibited protandrous sex change but in this study there was no hermaphrodites observed. There were occurrences of ripe and ripe running fishes throughout the study periods showing that the fish spawned throughout the periods. High values of the gonadotrophic indices in December indicated a peak spawning season, however minor spawning peak occurred in January. Ugbor (1984) reported that high values of the gonadotropic indices occurred in December and minor spawning peak in May. The fecundity ranged from 58 000 to 279 277 per female. This species had high fecundity compared to other species which attained similar lengths at sexual maturity. The large number gives room for eggs and fry that may be lost as a result of exposure to high mortality arising from environmental perturbation and predation (Ikomi and Jessa 2003).

The overall sex ratio was 1:0.46. The study showed that males specimens were significantly more abundant than the females a deviation from the expected 1:1 (male:female). This agreed with Ugbor (1984) where it was reported that males were significantly more abundant than females in the same species off Lagos coast.

The food items in the stomachs of *G. decadactylus* suggested that it is euryphagus (i.e. feeding on a wide range of organisms). The specimens of *G. decadactylus* had a high number of empty stomachs, 94 specimens (36.15%). This agreed with Longhurst (1960b) that high percentage of empty stomach (69.6%) was reported for offshore fishes and 39.0% for estuarine population of fishes. The high proportion of empty stomach observed was associated with seasonal variation of food or with feeding regimes.The species was observed to feed on varieties of active and sedentary benthic animals. Occurrence of detritus in the form of sand was also observed. This also indicated that the species is demersal and bottom feeder in addition to its inferior mouth location (Holden and Reed 1991). The diet constituted mainly of crustaceans, Pisces, annelids and molluscs. Crustaceans (*P. notialis*, crabs, calanoids and cladocera) were the most important diet of the species. These except calanoids and cladocera were in agreement with what was reported by Longhurst (1957) and Onyia (1973) on the same species. A comparison of the food of the species with food fed on by other member of the Scianid Community such as *Brachydeuterus auritus* and *Vomer sepinnis* showed that all fed on varied crustacean as reported by Marcus (1986). This also reduces inter specific competition among the species.

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Elemental Analysis of Satluj River Water Using EDXRF

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Abstract: A systematic study was carried out to explore the concentration of different low-Z elements present in the water samples of Satluj River in Himachal Pradesh, India. Water samples from four different locations were collected and analyzed for elemental analysis. In this study, energy dispersive x-ray fluorescence (EDXRF) technique has been employed. The degree of elemental pollution and the suitability of the river water for drinking purpose were assessed. A close look at the elemental concentration in water samples of different locations shows variation in concentrations but elements are within the safe limits as prescribed by Bureau of Indian Standards (BIS) and World Health Organization (WHO). The concentration of Ca and Fe is little higher. "[Nature and Science. 2010;8(3): 24-28]. (ISSN: 1545-0740)".

Keywords: EDXRF, Water Quality, x-ray tube, Pollution, Elemental Analysis

1. Introduction

Water is one of the most important natural resources. It is said to be our life because we need it for drinking, bathing, relaxing, fishing and irrigating purpose. Water is also used to produce energy and also we navigate in it. The water quality undergoes rapid changes due to contamination. The quality of ground water is continuously changing as a result of natural and human activities. River pollution has been a matter of global concern. Water is polluted due to different phenomenon [Sharma, 2004; Gupta *et al* 2009]. As a result of this, there is an increased emission of the dangerous elements into water, soil and air as well. The natural elements, which cause water pollution are gases, soil, minerals, humus materials, waste created by animals and other living organisms present in water. Several stomach, lever and skin diseases spread due to polluted water. Many investigations have found a correlation between cardiovascular deaths and water composition [Olı´as *et al*, 2004]. The disorder of teeth and bones is due to consumption of fluoride-rich water [Susheela, 1999].

Satluj River rises from beyond Indian borders in the Southern slopes of the Kailash mountain near Mansarover lake from Rakas lake, as Longcchen Khabab River in Tibet. It is the largest among the five Rivers of Himachal Pradesh. It leaves Himachal Pradesh to enter the plains of Punjab at Bhakhra, where the world's highest gravity dam has been constructed on this river. The upper tracts of the Satluj valley are under a permanent snow cover. The prominent human settlements that have come on the banks of the Satluj River are Namgia, Kalpa, Rampur, Tattapani, Suni and Bilaspur. The Satluj River is well fed with surface inflows of water and the under water springs contribute significantly to its water quantity and quality. Satluj is multipurpose in character and has great bearing on the socio-economic conditions of Himachal Pradesh. The River receives toxic metals, organic and inorganic pollutants from different sources like soil erosion, illegal construction activities and many other activities. The present study was motivated to substantiate the importance of the cleaning operation by analyzing the four water samples collected from different locations of Satluj River.

EDXRF technique is a powerful, fast and non-destructive multi-elemental technique in the basic and applied research to determine the elemental composition of various types of samples, e.g., archaeological, biological, geological or environmental samples and is capable of detecting elements up to the limit of ppm [He *et al*, 1991]. This technique uses x-rays to cause characteristic fluorescence emission from the specimen atoms. Those characteristic signals are detected to identify which elements are present, and their relative intensities can be used to quantify the amounts of those elements. This technique has been used for a long time for the elemental analysis [Abraham *et al*, 1999; Malmqvist, 1990; Cahill *et al*, 1990] of the specimen from biological sciences, archaeology, environmental science and earth-science.

2. Review of Literature

Joshi et al. [Joshi *et al*, 2006] have used EDXRF technique has been employed to determine the concentrations of different elements in water samples collected from different locations of famous Nainital Lake including tap water and spring water sample from Nainital (Uttarakhand). Bandhu et al. [Bandhu et al, 2000] have studied the elemental concentration of the aerosol samples collected from industrial, commercial and relatively cleaner zones from the city of Chandigarh using EDXRF and PIXE techniques. Negi et al. [Negi *et al*, 1987] have reported the urban aerosol composition for both major and trace elements, determined using EDXRF technique, in four major cities of India, namely, Bombay, Banglore, Nagpur, and Jaipur. The study on the sandflies of the Satluj

river valley [Sharma *et al*, 2009] and the snow and glacier melt in the Satluj River at Bhakra Dam in the western Himalayan region [Singh *et al*, 2002] are available in the literature.

3. Experimental details

3.1 Sample collection and preparation

Water samples from the four different locations of the Satluj River at Rampur (slnram), Tattapani (slntat), Suni (slnsun) and Bilaspur (slnblp) in Himachal Pradesh were collected in plastic containers of 5000 ml capacity. The sample containers were cleaned thoroughly with distilled water before using. Each sample was passed through a coarse 2 mm screen to remove organic debris and then through a 250 lm nylon screen into a pre-cleaned plastic container. These samples were prepared within two days from time of collection. Each sample was dried in an oven at constant temperature of 50°C. After drying, each sample was ground using a freezer-mill. The thin samples were prepared by mixing and pressing the powder. Each sample was glued onto a Mylar film. To be sure that the sample holder was not going to introduce analytical errors, blanks were previously checked. A total of 12 samples (three from each location) were analyzed, corresponding to a minimum of three replicates per sample, to reduce the risk of analytical error.

The water samples were analyzed using EDXRF technique, available at Panjab University, Chandigarh, without any chemical pre-treatment. The targets were mounted into a target holder specially made for irradiation of thin target. The targets were irradiated using a Cu anode x-ray tube (Panalytical x-ray generator, model PW 3830 4kW). The tube voltage was kept at 29 kV and current 12 mA. The spectra were recorded using a Le(Ge) detector coupled to a PC based multichannel analyzer (MCA) through a spectroscopy Amplifier. The resolution of the Le(Ge) detector is about 143 eV at 5.89 keV. Measurements were carried out in vacuum of 10^{-2} Torr for optimum detection of elements. This set-up resulted in considerably improved peak-to-background ratio in the region of Rayleigh and Compton-scatter peaks. Three spectra were taken for each target using a PC-based multichannel analyzer (Canberra, Model S-100). Further to minimize the systematic errors, different spectra for each target were taken from different positions of the same target and on different occasions. The background spectrum in the region of elastic and inelastic-scatter peaks, taken with no target placed at its position, was found to be smooth. The partial x-ray spectrum of one water sample from Bilaspur is shown in Figure 1.

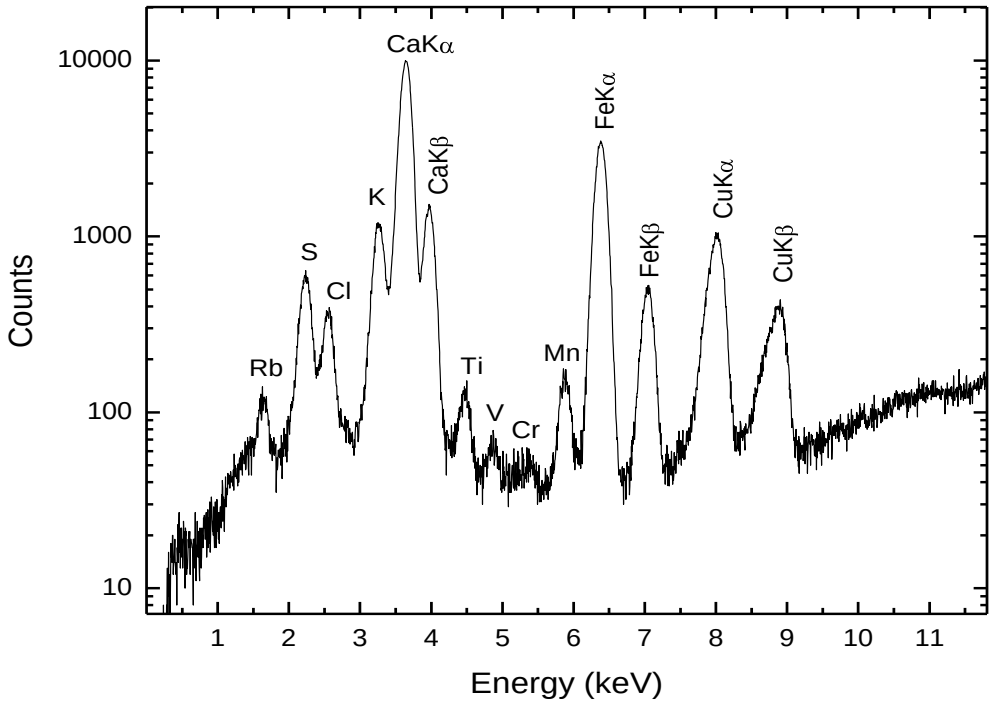

Fig.1 EDXRF spectrum of Bilaspur water sample

3.2 Data Analysis

The energies of the characteristic x-rays were used to identify the elements present in the water samples. The photopeak areas in each spectrum were analyzed using the indigenously developed computer code PEAKFIT [Singh *et al*, 1995]. The concentration

of the elements was calculated using the iteration on the masses of the samples and the relation

$$m_j = \frac{N_{ij}}{I_o G \varepsilon \sigma_{ij} \beta_i} \qquad (1)$$

where m_j is the concentration (μg/cm^2) of the element j present in the sample, Nij is the net counts per unit time for ith group of x-rays of element j, I_oG is the intensity of the exciting radiation incident on the sample visible to the detector, ε is the detector efficiency for the jth element, σ_{ij} is the theoretical x-ray fluorescence cross-section at the incident photon energy. These cross-sections were interpolated from the tabulations of Puri et al. [Puri *et al*, 1995]. All the calculations were done using more intense Cu Kαβ incident photon energy from Cu x-ray tube.

The $I_oG\varepsilon$ values were determined over the energy range 1-8 keV by measuring the $K\alpha$ and $K\beta$ x-rays from the different targets excited by the Cu *K* x-rays and using the relation

$$I_o G\varepsilon = \frac{N_{KX}}{m\left[\sigma_{KX}^{\alpha}\beta_{KX}^{\alpha} + \sigma_{KX}^{\beta}\beta_{KX}^{\beta}\frac{(I_oG)_{\beta}}{(I_oG)_{\alpha}}\right]} \qquad (2)$$

where N_{KX} is the counts/s under the $K\alpha$ or $K\beta$ x-ray peak of the element in the spectrum. The superscripts α and β correspond to the incident Cu $K\alpha$ and $K\beta$ x-rays, respectively. σ_{KX}^{i} ($i = \alpha, \beta$) is the *K* x-ray fluorescence cross-section for the target element at the Cu $K\alpha$ and $K\beta$ x-ray energies, respectively, and has been interpolated from the tables of Puri *et al.* [Puri *et al*, 1995]. $\frac{(I_oG)_{\beta}}{(I_oG)_{\alpha}}$ is ratio of intensities of the $K\beta$ and $K\alpha$ x-rays emitted from the Cu x-ray tube. The $I_oG\varepsilon$ values obtained in measurements using the Le(Ge) detector are shown in Figure 2. The self-absorption correction factor (β_i), which accounts for absorption of the incident and emitted photons from the target, was evaluated using the relation

$$\beta = \frac{1-\left[\exp(-1)\left(\mu_1 \sec\theta_1 + \mu_2 \sec\theta_2\right)m\right]}{\left(\mu_1 \sec\theta_1 + \mu_2 \sec\theta_2\right)m} \qquad (3)$$

where μ_1 and μ_2 are the total mass-attenuation coefficients (cm^2/gm) of the target element corresponding to the incident and emitted photon energies, respectively. θ_1 and θ_2 are the angles formed by the incident and the emitted photons with normal to the target surface respectively, *m* is thickness of the target in gm/cm^2. For the geometry used in the present measurements, θ_2 is taken to be 0° as the fluorescence x-rays are presumed to strike the detector perpendicular to its surface. The values of μ_1 and μ_2 were taken from the tables of Hubbell and Seltzer [Hubbell *et al*, 1995], and Storm and Israel [Storm *et al*, 1970]. The beta correction is about 0.999 as thin samples were used.

4. Results and discussions

The EDXRF analysis applied in elemental analysis of water samples from Satluj River. Elements such as S, Cl, Ca, Ti, V, Cr, Mn and Fe are measured. The final concentration of the elements present in the different samples is given in Table 1. The Cu Kα and Cu Kβ peaks are of the x-ray tube anode used. It can be seen from the peak heights that there is no variation between the fractions for elements such as K, Ca, Ti and Fe. In regard to the concentration change of the heavy metals along the Satluj River, water samples showed the little higher concentrations of Ca and Fe. The concentration of calcium may be due to nearby prevalence of mountain chains with high calcium contents. Calcium is responsible for the hardness of the water. The hardness of the water leads to encrustation of water supply structure. It can be explained that dilution, precipitation, adsorption to sediments and local anthropogenic input probably affect metal concentrations in the Satluj River water.

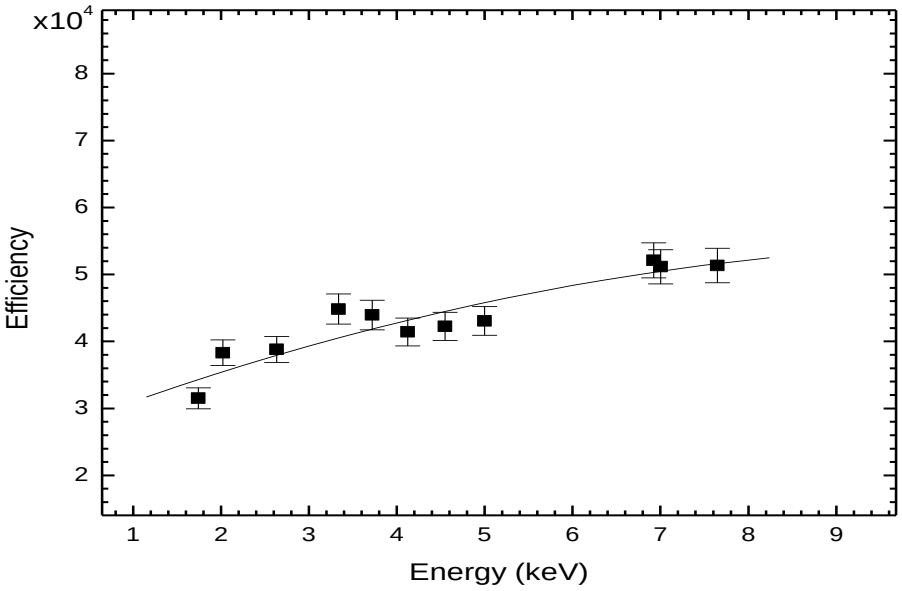

Fig.2 Plot of loGε Vs the detected photon energy

Table 1. Elemental concentration in Satluj River water at different locations

Element	Slnram	Slnsun	slntat	Slnblp
S (μg/cm^2)	46.4	40.9	70.2	38.2
Cl (μg/cm^2)	8.7	16.1	13.2	14.3
Ca (μg/cm^2)	188.4	151.9	169.9	176.9
Ti (μg/cm^2)	ND	.29	ND	.96
Cr (μg/cm^2)	.062	ND	ND	ND
Mn (μg/cm^2)	.043	ND	ND	.54
Fe (μg/cm^2)	3.4	3.8	2.178	14.2

ND → not detected

The energies of elements observed in the present work are given in the Table 2. Samples were analyzed using EDXRF technique without any chemical pre-treatment. A close look at the elemental concentration in table for water samples of different locations shows variation in concentrations but all elements are within the safe limit. The EDXRF method has proven to be a useful tool for elemental analysis of water samples. The strength of the technique relies on simple preparation of the samples, a reasonable time of measurement, and a non-complicated data analysis. Besides, the calculated concentrations are accurate and reliable.

Table 2. Energies of K x-rays of the elements observed in the present work

Atomic number	Element	Kα (keV)	Kβ (keV)
16	S	2.307	2.468
17	Cl	2.621	2.815
20	Ca	3.690	4.012
22	Ti	4.508	4.931
23	V	4.949	5.427
24	Cr	5.411	5.947
25	Mn	5.895	6.492
26	Fe	6.400	7.059

5. Conclusions

It is always necessary to monitor the environment, for essential as well as toxic elements in order to understand the correlation of the environment with the biological system. The EDXRF analysis of water samples of Satluj River at Rampur, Tattapani, Suni and Bilaspur in Himachal Pradesh, India, shows that the concentrations of toxic

elements are less than the safety limits. Our study confirms that cleaning operation has reduced the contents of toxic elements from the Satluj River water, which is now quite safe for drinking as well as irrigation purpose. The indigenous technologies should be adopted to make water fit for drinking after treatment such as defluoridation, desalination, etc. These evaluations seem to be helpful in planning future experiments to achieve high accuracy for important elements in water solutions. EDXRF analysis can, therefore, be used to monitor River water quality and provide useful information for regulatory organizations, such as regional councils and governmental bodies. Our study reveals that EDXRF can be used to measure the elemental concentrations in different water samples.

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CATTLE BABESIOSIS AND ASSOCIATED BIOCHEMICAL ALTERATION IN KALUBYIA GOVERNORATE.

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Abstract : Members of genus babesia are tick transmitted intra erythrocytes proto zoon parasites, many species are of considerable economic importance in live stock industry, additionally some species are zoonotic and affected on human health, so this investigation performed to differentiated between traditional and some modern methods for diagnosis of bovine babesiosis, a total of 100 animals from private farms located in different places in Kalubia aged from 1-3 years the samples were collected from clinically infected animals that suffered from fever (41 C°) , Anorexia, depression, weakness, pale mucos membrane, emaciation, weight loss hemoglobin urea with accelerate heart and respiratory rates and animals appearan healthy in contact with this animals, laboratory examination two blood samples were collected from each animals from juglar vein samples with anticoagulant for blood film stain and PCR while second without anticoagulant for biochemical the result of our study revealed a great significant Increase in urea , creatinine, AST, Alt and globulin in clinical cases of babesia bigemina but non significant changes in sub clinical cases Also the result revealed significant increase in serum iron ,Total iron binding capacity transfferin total protein, However There are non significant increase in albumin and A/G ration. 2010;8(3):29-36]. (ISSN: 1545-0740).

Keywords: Babesiosis, Cattle, Early diagnosis, Pathogenic Alteration.

Introduction

Cattle and buffaloes play an important role in our life. They comprise the main source of milk and meat. The general health condition of them was impaired by the parasitic diseases generally and blood parasites specially. Babesia is considered one of the most important blood parasites affecting cattle and buffaloes.

Negative microscopic examination doesn't exclude the possibility of infection as in very early and chronic stage of disease and in subclinical infection the detection of babesia in Gimsa- stained blood smear was chllicult 50 it was necessary to develop xeno dignosis and molecular detection, these techniques are more reliable in this respect because they directly determine the presence of viable parasites and parasite DNA respectively. Particularly PCR have revolutionized this approach **(Annetta Zinil *et al.* 2003).**

Material and Methods

Animals:

Total 100 animals bovine aged from 1-3 years were examined for the existence of the bovine babesiosis. Samples were collected from animals that showed clinical signs suspected to be bovine babesiosis and from apparently healthy in contact animals. The animals from private farms located in Kaliobia Governorate.

Samples

The blood samples were collected from the juglar vein by using steril sharp needle with wide pore two samples were collected from each animal the samples that used for blood smear and PCR analysis were collected in clean and dry test tube containing Di-sodium EDTA as anticoagulant. For biochemical examination for separation of serum for determination of serum Asparate amino transferase (AST) and alanine animo transferase (ALT) **Reitman and Frankel , (1957)**, urea **Patton and Crouch , (1997)** creatinine **Henry, (1974)** total protein **peters, (1968)** albumin **Rodkey, (1965)**, iron

Bauer, (1984) total Iron binding capacity **Fairbanks and Klee , (1987)**

Blood smear:

Some precautions should be taken into account like using very clean, dry glass slides, clean, dry regular edges speeder slides, sharp sterile needle, and absolute methyle alcohol.

Giemsa stain stock solution:

Giemsa powder (0.5g) dissolved in glycerin absolute(33ml),the powder was dissolved in glycerin with vigorous shaking. Then the mixture was added to one liter methyle alcohol. The stain was transferred to a tightly stopper brown bottle and stored in dark place for two months the stain was filtered through filter paper prior to use. PCR procedure: polymerase chain reaction.

Blood film:

- Three thin blood film were prepared and left in air to dry and fixed in absolute methyle alcohol for 1-2min.
- Staining with freshly filtered and diluted Giemsa stain for 30-45 minutes then washed with distal water to remove excess of stain.
- The Slides were left to dry, then put one drop of cider oil examined under oil immersion lens according to **(Coles, 1986).**

Examination of blood film for babesia

1/4 – 1/2 inch from the end of the film and transferred from one side of film to other (cross – sectional method) to give constant and representative examination according to **Barrent (1965)** animal can be considered negative if the three slides were negative.

Serum samples for biochemical examination:

Serum were separated by centrifugation at 300 rpm for 10 minutes then clear supernatant serum aspirated carefully into dry sterile labeled wails and used for serum analysis to differentiated between liver, kidney function and iron in clinically infected animals and animals apparently health in contact .

A total of 15 bovine blood samples included in this study collected from ----- with clinical suspicion of babesiosis. Blood samples submitted in EDTA containing tubes and stored at -20°C until subsequent DNA purification

1- DNA extraction from blood

The DNA was extracted from each sample by chloroform- isoamyl extraction method (All buffers used according to *Sambrook et al. (1989).*

Blood samples typically were obtained as 1 ml of whole blood stored in EDTA vacutainer tubes . To each 1 ml sample, add 0.8 ml 1X SSC buffer, and mix. Centrifuge for 1 minute at 12,000 rpm in a microcentrifuge. Remove 1 ml of the supernatant and discard into disinfectant. Add 1 ml of 1X SSC buffer, vortex, centrifuge as above for 1 minute, and remove all of the supernatant. Add 375 ul of 0.2M NaOAc to each pellet and vortex briefly. Then add 25 ul of 10% SDS and 5 ul of proteinase K (20 mg/ml H2O) (Sigma P-0390), vortex briefly and incubate for 1 hour at 55°C. Add 120 ul phenol/chloroform/isoamyl alcohol and vortex for 30 seconds. Centrifuge the sample for 2 minutes at 12,000 rpm in a microcentrifuge tube. Carefully remove the aqueous layer to a new 1.5 ml microcentrifuge tube, add 1 ml of cold 100% ethanol, mix, and incubate for 15 minutes at -20° C. Centrifuge for 2 minutes at 12,000 rpm in a microcentrifuge. Decant the supernatant and drain. Add 180 ul 10:1 TE buffer, vortex, and incubate at 55°C for 10 minutes. Add 20 ul 2 M sodium acetate and mix. Add 500 ul of cold 100% ethanol, mix, and centrifuge for 1 minute at 12,000 rpm in a microcentrifuge. Decant the supernatant and rinse the pellet with 1 ml of 80% ethanol. Centrifuge for 1 minute at 12,000 rpm in a microcentrifuge. Decant the supernatant, and dry the pellet in a Speedy-Vac

for 10 minutes (or until dry). Resuspend the pellet by adding 200 ul of 10:1 TE buffer. Incubate overnight at 37 C, vortexing periodically to dissolve the genomic DNA. Store the samples at -20°C

2 - PCR

Specific PCR has been used to detect the gene encoding for *B. bigemina* 18S ribosomal RNA (18SrRNA) within the DNA extracts of the suspected animals for infection.

Forward and reverse primers were designed using primer premier 5 software with contribution of genebank data for *Babesia bigemina* isolate BRC02 18S ribosomal RNA gene, partial sequence(accession no. FJ426361.1). The primers sequences were:

Forward: GAGAAACGGCTACCACAT;

Reverse CATTACCAAGGCTCAAAA

The PCR master mix was comprised of PCR buffer (300 mM Tris, 75 mM ammonium sulfate, pH 9.0), 2.5 mM MgCl, 400 µM dNTPs, 20 pmol of each primer, and 2 U µl–1 taq DNA polymerase. The PCR cycling parameters were one cycle of 94 ° C for 5 min, 35 cycles of 94° C for 30 s, 49° C for 30 s and 72 ° C for 1 min, with a final extension step of 72° C for 10 min. PCR products were analyzed by electrophoresis on 1.5% agarose gel documented with documentation system.

Statistical analysis:

Data were analyzed using T-Test as described by **Petrie and Waston 1999**

Results

The results obtained in the PCR assay showed 11 out of 15 samples positive for *B. bigemina of* expected molecular weight 409 base pair.

Number of examined animals were 100 aged from 1-3 years were examine for bovine babesiosis about 38 calves suffered from fever (41°C) anaroxia, depression, weakness, pale mucous membrane. Emaciation, weight loss haemoglobin urea and accelerated heart and respiratory rates. The rest of examine animals were apparently healthy.

Blood film:

Examination of Giemsa stained blood smears with oil immersion lens revealed intra-erythrocytic double (pear shaped) of B. bigemina in 38 (out of 100) blood samples of examined animals while the other 62 examined animals appear free from developmental stages of B. bigemina in blood smears.

PCR- Based Molecular Diagnosis of *Babesia bigemina*

The occurrence of bovine *Babesia* sp. in Egypt has been reported. An infection with *Babesia spp.* was suggested based on diagnosis by light microscopy of blood smears of a cow **(Brossard and Aeschlimann, 1975).** The aim of this study was the molecular – based early diagnosis of *B. bigemina* in Egypt.

Laboratorial diagnosis of clinical infection by babesia in cattle is usually based on the detection of the parasite in Giemsa-stained blood smears. Early detection of babesiosis in animals is very important to control the infection. Although serological tests can be used to detect circulating antibodies, cross-reactivity with antibodies directed against other species of piroplasms has been reported **(Papadopoulos *et al.*, 1996).** Moreover, antibodies tend to disappear in long-term carriers, whereas babesia persist. Therefore, animals with a negative serological test can still be the source of the infection. Several PCR-based diagnosis procedures

for the identification of these parasites have been developed **(Figueroa *et al.*, 1993; Birkenheuer *et al.*, 2003; Criado-Fornelio *et al.*, 2003; and Rampersad *et al.*, 2003)**

Regarding to the biochemical changes in serum of both clinical and subclinical cases table (1) revealed that there were highly significant increase in serum iron , globulin and AST, also significant increase in urea, albumin, A/G ratio and total iron binding capacity in case of subclinical cases also there were a highly significant increase in serum urea, creatinine, AST, ALT, iron, Total iron binding capacity , Total protein and Globulin and significant increase in transferase in case of clinically affected cases .

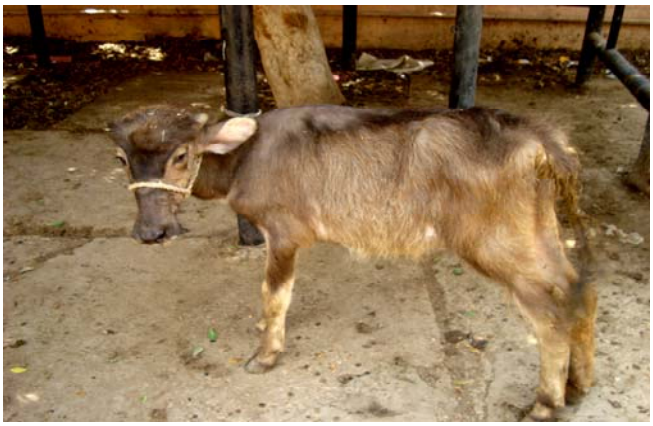
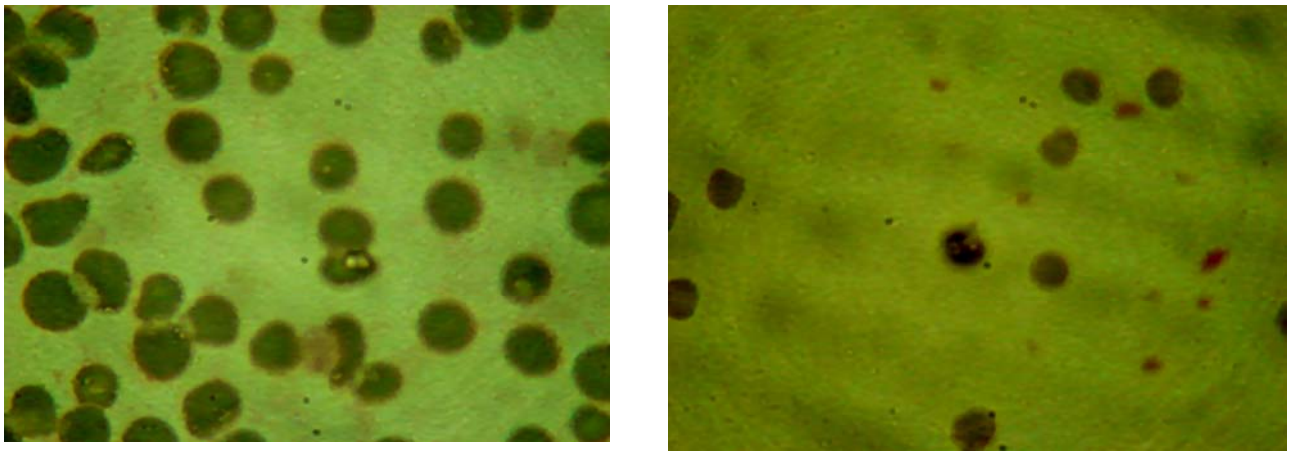


Figure (1): Emaciated, Anoroxia and off food

Figure (2); Animal infected with ticks

Figure (3): tick born disease and mange

Clinical Signs of Babesiosis in Animals



(A) (B)

Figure (4):Giemsa stained blood film showing intraerythrocytic double pyriform (pear shape) of B. bigemina inside RBCs

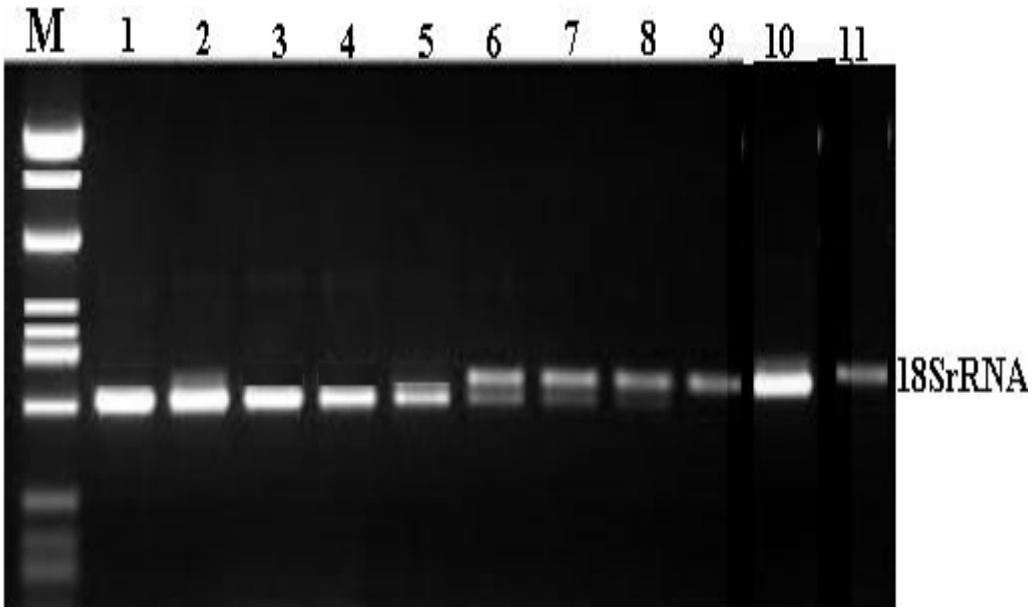


Figure (5): The PCR product of amplified *Babesia bigemina* 18SrRNA gene separated on 1.5% agarose gel electrophoesis .

Table (1). Serum biochemical parameter in clinical, subclinical Babesiosis and Healthy control cattle.

P / Group	urea	creatinine	AST	ALT	Iron	TIBC	Transferin	T.prot	Albumin	globulin	A/G ratio
Control Group	15.45 ± 0.9	0.9 ± 0.03	40.3 ± 1.35	36.4 ± 1.14	130.8 ± 1.91	80.5 ± 1.24	0.58 ± 0.03	6.3 ± 0.07	3.5 ± 0.05	2.8 ± 0.06	1.2 ± 0.06
Subclinical group	20.14* ± 1.18	1.01 ± 0.05	71.6** ± 3.3	40.6 ± 1.41	161.4** ± 1.68	88.7* ± 2.06	0.62 ± 0.015	6.4 ± 0.05	3.11* ± 0.09	3.3** ± 0.09	0.9* ± 0.07
clinical group	34.0** ± 1.33	1.5** ± 0.04	132.1** ± 1.68	74.2** ± 1.87	168.2** ± 1.5	101.2** ± 2.45	0.7* ± 0.015	6* ± 0.06	2.6** ± 0.03	3.4** ± 0.07	0.8** ± 0.02

* Significant variation at ($P \leq 0.01$) ** highly significant variation at ($P \leq 0.001$)

DISCUSSION

Babesiosis is one of the most important diseases in our countries because it occurs sometimes in acute forms with serious recognized clinical manifestations yet lowering the productive performance of the affected animals.

The clinical picture in animals suffering from babesiosis Fig. (1, 2 and 3) include high temperature (90-91°C), loss appetite, cessation of rumination, anemia, laboured breathing and haemoglobin urea, such finding could be due to destruction of large number of erythrocytes by blood parasite resulting in hemoglobinaemia and consequently hemoglobinurea **Bron *et al.* (1992)**. On other hand, **Egell (1996) and Radostits *et al.* (2002)** attributed the sudden onest of high fever (40-41°C) as response to affect of un specific toxic substances produced during the metabolism of babesia on thermoregulatory.

Then the heart rate was increased, marked dyspnea was then developed and visible mucous membranes were first conjested but very soon became pale and in the terminal stages became icteric.

The method of chocice to detect babesia in blood of infected animals especially in acute cases was blood film examination **(Bose, *et al.* 1995)** in the present work, examination of Giemsa stained blood smear revealed intra-erythrocytic double pyriform (pean shaped) of B. bigemina inside RBCs of infected animals this is agreement with **Ahmed (1980), Smith (1990), Homer (2000) and Ali (2005)** added that round, oval and irregular froms may be observed depending on the developmental stage of B. bigemina inside erythrosytes,

Animals detected by blood film examination it was 38 out of 100 blood film represent 38% our result was in agreement with **El-Bahi (1989)** demonstrated babesia species in blood smears of 38.5% of tested cattle in Fayoum Fig. (4)

Exploitation of both the highly conserved and hypervariable sequences within the 18S rRNA gene permits design of a platform primers capable of early detection and specific pathogen identification in a single rapid detection platform. PCR analyses, permitting identification of definitive pathogen characterization of the species. Diagnostic accuracy of our assay was evaluated against conventional light microscopy-based methods. This assay may be a useful early diagnostic for *B. bigemina*, Fig (5).

Our present study indicate that the serum protein and globulin pattern was significantly altered by babesia bigemina infection. There was a highly significant increase in total protein and globulin in serum of infected clinical cases and these in accordance with data recorded in cattle **Ashmawy, et al (1994),** in calves by **Dwivedi and Gaytan, (1980)** and In buffaloes **Abd El-maksoud, et al (2000)** .

The increased value of globulin was attributed to the stimulation of immune system by the antigens of invaded parasites **El-Sayed and Rady, (1999)** and **Norimine, et al (2004).** Also the decrease in serum Albumin value is associated with the acute phase of many infectious diseases **Allen** and **Kuttler, (1981).** In addition, Albumin may be decreased due to decreased protein synthesis capacity of the affected Liver or prolonged insufficient caloric intake **Barbara, et al., (2008)**. It could be also attributed to loss of protein from distrusted RBCS and Its excretion in urine as albuminuria in addition to the malnutrition status occur during the disease **Henley and Judith, (1985).**

Concerning the effect of babesia Bigemina infection on activity of liver enzymes, the obtained results revealed a highly significant increase in serum AST and ALT. These results were in agreement with other previous studies reported by **Allen and Kuttler, (1981) Camacho, et al (2005)** and **Barbara, et al (2008).** The increase in enzymes activity may attributed to sever anemia that lead to hypoxic and toxic liver damages. Also massive hemolysis may occur which in conjunction with hypoxia may lead to hepatic cell degeneration and glomerular dysfunction leading to increase in AST, ALT and Bun, **Allen and Kuttler, (1981).**

Also there was a highly significant increase in both serum urea and creatinine level which in agreement with the result obtained by **Camacho et al, (2005)** and **Barbara, et al, (2008).**

Initially, increased urea and creatinine levels may be attributed to the rapid distraction of RBCs via phagocytosis in the reticulo-endothelial system **Ajayi, et al. (1979), Allen and Kuttler (1981)** and so the massive haemalysis occur during the period of infection with babesia bigemina and hypoxia lead to hepatic cell degeneration and glomerular dysfunction resulting in increased level of serum urea and creatinine.

Concerning the serum trace elements changes in babesia infected animals, the present data revealed a significant increase in iron, total iron binding capacity and iron saturation which was similar to that recorded by **El-Sayed and Rady, (1999)** and **Abd El-Maksoud**, **et al (2005)** such changes may be attributed to the hemolytic anemia induced by blood parasites and possibility of free radicals invading erythrocytes leading to distraction of their membrane **Academic and Itoh, (1992).** It could be concluded that babesiosis is a life threatened diseases accompanied by disturbance in serum protein Fractions, hepatic and renal dysfunction. The clinical infection were easily detected early by microscopic examination of giemesa stained blood smear but not subclinical cases in which there was an extremely low

parasitemia so PCR assays capable of detecting extremely low parasitemia as occur in carrier animals or subclinical infection and differentiating isolates, Table (1).

Conclusion

Clinical infection of cattle Babesiosis can be easily detected early by microscopic examination of giemesa stained blood smear but not in subclinical cases in which there was an extremely low parasitemia. PCR assays capable of detecting extremely low parasitemia as occurind in carrier animals or subclinical infection and differentiating isolates.

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Awareness of Urban and Rural People Regarding Polythene Ban in Rajshahi Division, Bangladesh

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Abstract: The awareness of the urban and rural people regarding the ban on polythene bags was studied in Rajshahi division. Information was collected from urban and rural people to know their views after a period of 4 years of ban on polythene bags. The surveys included interview schedule, observations and discussions with the users. The largest part of the respondents were congratulated the decision of the government on ban of polythene bags. About 97.3 % of urban and 76 % of rural people was in favour of ban of polythene and a few of the respondents (2.7 %) were in disfavour in case of urban whereas in rural it was 24 %. Majority of the users were ignorant about the hazardous impacts of polythene bags on the health (urban 24 and rural 1.3 %). [Nature and Science 2010;8(3):37-40]. (ISSN: 1545-0740).

Keyword: Awareness, polythene bags, ban and environment.

INTRODUCTION

Polythene is a form of plastic and it is non-biodegradable: won't rot. Polythene and/or plastic bags are widely used for transporting a range of small consumer goods, and in some regions, also serve secondary roles for conveying drinking water (Simpson, 2007), oil and disposing of human and other domestic wastes (Njeru, 2006). While annual production and use statistics are not available from industry sectors, environmental groups estimate that between 500 billion and 1 trillion plastic bags are used globally each year (CBC News, 2007). Since their inception, uncontrolled disposal of these bags has been causing environmental problems worldwide including Bangladesh, and many regional and national governments are beginning to take action.

Indiscriminate use of polythene bags is a very common feature in Bangladesh which creates a lot of problems on environment and also public health. Polythene bags even one piece of it can cause blockage in the drainage systems of the cities. As a result, it creates water-logging, germination of bacterial and water born diseases, spread of mosquitoes, etc. and also bad smells.

Polythene has harmful effect on soil, water and air. International Rice Research Institute (IRRI) found that polythene bags, by preventing sunlight exposure of the soil, destroy the beneficial bacteria causing loss of soil fertility (www.bapa.info/activities/ban_polythene.html, verified-October, 2008). Where the bags are burned either for energy or mass reduction purposes, heavy metals and the toxic organic compounds (e.g., polychlorinated dibenzo-p-dioxins and furans [PCDD/Fs; commonly referred to as "dioxins"] and polyaromatic hydrocarbons [PAHs]) can be produced (Sierra, 2008) that helps pollute air as well as affect on health.

A number of regulatory instruments have been used worldwide to reduce the plastic bag problem, ranging from traditional command and control approaches such as bans, voluntary codes of practice and marketing of alternative bags to economic tools such as taxes or levies. The African countries of Eritrea, Zanzibar, and Somaliland have banned plastic bags (Germain Nicolas, 2005 and CBC News, 2007) as have China, Taiwan, Thailand, Papua New Guinea, Nepal, Philippines and several states of India (UNEP, 2005 and Clapp, 2008). One of the most successful regulatory case studies comes from Ireland where economic instruments were applied. A 15-euro cent levy or surcharge was imposed on plastic bags provided by grocery stores and other shops, which reduced bag use by 90 %. As early as 1989, Italy had also introduced a 6-euro cent tax (about 5 times higher than production cost) on plastic bags, making the bags more expensive than their 'eco-friendly' alternatives (UNEP, 2005) Voluntary initiatives have also been attempted in some regions. In Canada, most major grocery chain stores accept plastic bags for recycling (UNEP, 2005), and recycling initiatives are being used in Egypt and Senegal (Cawthorne, 2007).

The use of polythene and plastic does no have a long history in Bangladesh. But within a year it reached other places of the country. There were more than 1500 factories of plastic materials in Bangladesh, where 400 produced polythene bags. These factories produced

about 130 million polythene bags daily. About 10 million of them were thrown everyday as wastes on the streets, drains and on water bodies leading to serious environmental hazards (World Environment Day, 2005). So, government banned the uses of polythene bags in Dhaka city on 1 January 2002, and followed nationwide ban on 1st of March (www.wbbtrust.org/plastic/polybag, verified- April, 2009).

MATERIALS AND METHODS

The present survey was carried out in Rajshahi city and three villages Raninagar, Parchouka and Monakasha of Shibgonj upozilla of Chapai Nawabgonj district during 2006. Information was collected from 150 respondents comprising of 75 urban and 75 rural people. The data collection methods were applied for this research included interview schedule, observations and discussions with the respondents. The following questions were asked: (1) Do you know about the polythene bag banning? (2) Did you used to use polythene bag before banning? (3) Do you use polythene bag after banning? (4) Do you know the hazardous effects of polythene on soil, air, water and health? and (5) Do you support the banning of polythene bags?

RESULTS AND DISCUSSION

The collected data of personal profile of respondents were presented in **Table 1**. This table shows that most of the urban and rural peoples were between young and middle groups. Educational points of view, 26.7 % rural respondents were college and university level whereas 73.3 % were in urban respondents (**Table 1**). In case of occupation, majority of the rural respondents were non-service (66.7 %). On the other hand, in urban areas 44 % respondents were non-service.

Table 1 Personal profile of the respondents (Total=150 persons)

Variables	Categories	Rural		Urban	
		75 persons		75 persons	
		No.	%	No.	%
Age	Young (20-34 years)	30	40.0	28	37.3
	Middle (35-50 years)	30	40.0	32	42.7
	Old (51-65 years)	15	20.0	15	20.0
Education	Illiterate level	10	13.3	1.0	1.3
	Primary level	20	26.7	9.0	12.0
	High school level	25	33.3	10	13.3
	College level	15	20.0	25	33.3
	University level	5.0	6.7	30	40.0
Occupation	Service	25	33.3	42	56.0
	Non-service	50	66.7	33	44.0

The awareness of the respondents towards the ban on polythene or plastic bags in their daily life usages were presented in the **Table 2**. It reveals that 97.3 % of urban and 76 % of rural people were in favour of ban of polythene by the government of Bangladesh (**Table 2**). A few of the respondents (2.7 %) were in disfavour in case of urban whereas in rural it was 24 %, a little bit higher than that of urban. Those respondents were in disfavour claimed that it is very difficult to carry bags to the market every time. They also reported that paper bag tears while carrying vegetables or something like that.

Table 3 presents the bad impacts of polythene use by the respondents. Regarding the impact of polythene on soil 36 % rural and 50.7 % urban people reported that it reduces soil fertility which ultimately decreases the productivity of agricultural land. International Rich Research Institute (IRRI) also found the same results (www.bapa.info/activities/ban_polythene.html, verified- October, 2008). About the impact of polythene on air pollution, 28 % of rural and 61.3 % of urban respondents claimed that after burning it produces hydrogen cyanide and other poisonous gases that pollute air (**Table 3**). On the topic of water, 45.3 % rural and 78.7 % urban respondents stated that polythene blockage drainage that created some water born diseases like allergies. Pradhan (2000) and Jilani (2002) pointed that coloured polythene contain harmful toxic metals like chromium and copper which cause allergies. Besides these bad impacts, under the health aspect the respondents stated that polythene bags dumped near households can lead to breeding mosquitoes which cause dengue fever (1.3 % rural and 24 % urban). Next

Table 2 Awareness of the respondents towards ban on polythene use (Total=150 persons)

Awareness	Rural		Urban	
	75 persons		75 persons	
	No.	%	No.	%
Favourable	57	76.0	73	97.3
Unfavourable	18	24.0	2.0	2.7

Table 3 Hazardous impacts of polythene use perceived by respondents (Total=150 persons)

Hazardous Impacts	Rural		Urban	
	75 persons		75 persons	
	No.	%	No.	%
Soil Polythene bag reduces the soil fertility and soil productivity	27	36	38	50.7
Air Burning of the polythene produce poisonous gases that pollute air	21	28	46	61.3
Water It blockage the drains causing water logging that creates water born diseases	34	45.3	59	78.7
Health Throwing polythene bags near house hold that can lead to the breeding of mosquitoes which cause dengue fever etc.	1.0	1.3	18	24.0

Table 4 In general, summary of the questionnaire survey result (Total=150 persons)

Question Subject	Percentage of Respondents (%)
(1) Know about the polythene bag banning	60
(2) Used to use polythene bag before banning	80
(3) Use polythene bag after banning	45
(4) Awareness regarding ban on polythene bag	87
(5) Support the banning of polythene bag	90

to nothing rural respondents were aware of the fact that polythene may responsible for dengue fever. In general, the summary of the questionnaire of survey results were given in **Table 4**. The results indicate that about 45 % of the respondents were still use polythene bag, although 90 % of them supported the banning.

CONCLUSION

Most of the respondents were aware of the ban on polythene in both the rural and urban people. Majority of the urban respondents were also aware of the hazardous impact of polythene on soil air and water pollution. A few of them had unfavourable attitude regarding ban on polythene as they actually have faced such type of problems after the implementation of ban. Most of the rural respondents were unaware of the ill impacts of polythene on health.

In this respect, it can be suggested that various campaigns against the use of polythene bags should be organized nationwide. Support for the development of environmentally-friendly alternative bags like jute bags etc., which will be helpful for saving environment at the same time beneficial for jute industry. The countrywide local policies should include environmental awareness as an integral part.

Finally, the government and related bodies should ensure that cheap environment-friendly alternative of polythene bags are available to make sure that these bags do not make a return again.

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Biochemical Studies on Nephroprotective Effect of Carob (*Ceratonia siliqua* L.) Growing in Egypt

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ABSTRACT: Reactive oxygen species and free radicals are involved in the nephrotoxicity induced by the synthetic anticancer drug cisplatin. The nephroprotective effect of carob pods and leaves (100 and 200 mg/kg, p.o.) was investigated using cisplatin (10 mg/kg body weight, i.p.) to induce oxidative renal damage in mice. The results showed that cisplatin administration caused abnormal renal functions in all studied mice. Serum urea and creatinine concentrations were significantly highered (P<0.5) in the cisplatin alone treated (control) group compared to the normal group. The concentrations of serum creatinine and urea in the carob pods (200 mg/kg body weight) treated group were reduced to 57.5% and 51.5%, respectively, with respect to the control group. Also, cisplatin induced decline of renal antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) activities, but the treatment of carob pods and leaves (100 and 200 mg/kg, p.o.) significantly attenuated the cisplatin-induced nephrotoxicity. Both pods and leaves of carob at 100 and 200 mg/kg increased the concentration of reduced glutathione (GSH) and protected against the increase of cisplatin-induced lipid peroxidation. In addition, treatment with cisplatin increased the activity of cathepsin D, RNase II, DNase II and acid phosphatase. The treatment of carob pods and leaves (100 and 200 mg/kg, p.o.) improved the activity of lysosomal enzymes nearly to the normal group. In conclusion, carob pods and leaves may be effective to protect from oxidative renal damage and the leaves are the better nephroprotective agent than pods. The protection may be mediated partially by preventing the decline of renal antioxidant statues.
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Key words: nephrotoxicity; carob; cisplatin; antioxidant enzymes; lysosomal enzymes

INTRODUCTION

Cisplatin is a widely used antineoplastic agent for the treatment of metastatic tumors of the testis, metastatic ovarian tumors, lung cancer, advanced bladder cancer and many other solid tumors **(Sweetman, 2002).** The cytotoxic action of the drug is often through its ability to bind DNA to form cisplatin-DNA adducts **(Goldstein and Mayor, 1983).** Although higher doses of cisplatin are more efficacious for the suppression of cancer, high dose therapy manifests irreversible renal dysfunction and other toxicities yet **(Simic and Jovanovisc, 1986 and Halliwell and Cross, 1994).** Various data indicate that cisplatin induces oxidative stress **(Ajith *et al*., 2002)**, lipid peroxidation **(Bompart, 1989 and Matsushima *et al*., 1998)** and DNA damage **(Liberthal *et al*., 1996).** Therefore administration of antioxidants has been shown to ameliorate cisplatin-induced nephrotoxicity in various species of animals **(Somani *et al*., 2000).** The mechanism of protective effects of antioxidants against cisplatin nephrotoxicity is not fully known.

Ceratonia siliqua L., Fabacae (Carob) has been widely cultivated in Mediterranean countries for years. This tree was distributed by Arabs in the Mediterranean area **(Kumazawa *et al*., 2002).** The plant is grown locally in Egypt, and the pods are used mainly for preparing a popular beverage. Leaves and pods of carob exerted diverse physiological function as antioxidant activity **(Kumazawa *et al*., 2002 and Rasheed, 2006).**

Custódio *et al*. (2009) investidated the Antioxidant activity and *in vitro* inhibition of tumor cell growth of carob tree (*Ceratonia siliqua*). The methanol extracts of the carob tree showed significant radical scavenging activity and a remarkable ability to inhibit tumor cell proliferation. Carob pods and leaves extracts contain antiproliferative agents that could be practical importance in the development of functional foods and/or chemopreventive drugs**.** In addition leaves and pods of carob are rich in polyphenols and flavonoids **(Rasheed, 2006).**

In the present study, the protective effects of carob pods and leaves by two doses (100 and 200 mg/kg, p.o.) on cisplatin-induced renal damage in mice were evaluated.

MATERIALS AND METHODS

Preparation of samples

Carob (*C. Siliqua*) pods and leaves samples were obtained from Experimental Station of Medicinal Plants, Giza. The pods and leaves were grinded to fine powder before extraction. Such powdered samples were kept in dark bottles.

Chemicals

Cisplatin (1mg/ml) Onco-Tain DBL was from Mayne Pharma PLC, UK., Reduced glutathione (GSH), 5,5-dithiobis (2-nitrobenzoic acid) (DTNB), EDTA and thiobarbituric acid (TBA) were from Sigma-Aldrich Co, St Louis,

USA. All other chemicals and reagents used were of analytical grade.

Animals

Albino male mice (30±6 g) were used in the present study. The mice were obtained from the animal house of the National Organization for Drug Control and Research (NODCAR), Egypt. The animals were kept under standard laboratory conditions of light/dark cycle (12/12h) and temperature (25±2˚C). They were provided with a nutritionally adequate standard laboratory diet.

Animals' diet

The basal diet consists of casein 10%, cotton seed oil 4%, salt mixture 4%, vitamin mixture 1%, carbohydrates (sucrose, starch 1:1) 80.8% and choline choride 0.2% **(American Institue of Nutrition, 1980).**

Plant extracts

One hundred gram of pods and leaves of carob were separately extracted by percolation with 70% ethanol. The extracts were filltered, concentrated under vacuum and freeze dried.

Experimental design

Animals were divided into 6 groups of 6 animals each.

Group I treated with vehicle (gum acacia, 1%) was kept as normal.

Group II injected with a single dose of cisplatin (CIS) (10 mg/kg b.wt., i.p.) was kept as control

Group III and IV were trearted with pods extract (P.), 100 and 200 mg/kg b.wt.

Group V and VI were treated with leaves extract (L.), 100 and 200 mg/kg b.wt.

The pods and leaves extracts were freshly prepared as fine suspension in gum acacia and administered by oral gavage one h before and 24 h and 48 h after cisplatin injection. Seventy two hours after cisplatin injection, animal were killed by cervical decapitation. Blood was collected and the separated serum was used for the estimation of creatinine **(Bartless *et al*., 1972)** and urea **(Patton and Crouch, 1977).** After decapitation, kidney was rapidly removed and washed in cold isotonic saline. The kidney was divided into two portions. The first one was homogenized in 50 mM phosphate buffer (pH 7) using an electronic homogenizer to prepare 10 % w/v homogenate. The homogenate was centrifuged at 3000 rpm for 10 min. at 4˚C and the supernatant was used for the estimation of total protein **(Lowry *et al*., 1951)**, lipid peroxidation (TBARS) measured as malondialdehyde (MDA) **(Ohkawa *et al*., 1979)**, superoxide dismutase (SOD) **(Marklund and Marklund, 1974)**, catalase (CAT) **(Takahara *et al*., 1960)**, Glutathione peroxidase (GPx) **(Rotruck *et al*., 1973)**, reduced glutathione (GSH) **(Ellman, 1959)** and glutathione-S-transferase (GST) **(Habig *et al*., 1974).** The second portion was used for lysosomal isolation according to **Harikumar *et al*., (1989).** The activities of four lysosomal acid hydrolases were measured. Cathepsin D, RNase II, DNase II and acid phosphatase activities were determined according to the method of **Gianetto and de Duve (1955)** and **Barett and Heath (1977).**

Statistical analysis

The results are expressed as Mean±SEM. The collected data were statistically analysed by the least significant differences (LSD) at the level 5% of the probability procedure according to **Snedecor and Cochran (1980).**

RESULTS

Intravenous cisplatin administration caused abnormal renal functions in all injected mice. Serum urea and creatinine concentrations were significantly increased ($P<0.5$) in the cisplatin alone treated (control) group compared to the normal group (Table 1). The concentrations of serum creatinine and urea in the carob pods (200 mg/kg body weight) treated group were reduced to 57.5% and 51.5%, respectively, with respect to the control group. Similarly, the concentrations of urea and creatinine in the carob leave (200 mg/kg) treated group were reduced to 62.8% and 65.2%, respectively.

The activities of renal SOD, CAT and GPx in the cisplatin plus carob pods or cisplatin plus carob leaves administered group are given in Table 2. Renal SOD activity was decreased significantly ($P<0.05$) in the cisplatin alone treated group compared to the normal group. The SOD activity in the carob pods and leaves (200 mg/kg body weight) administered groups were increased significantly ($P<0.05$) when compared to that of control group.

Table (1): Effect of carob pods and leaves on serum urea and creatinine in mice treated with cisplatin (CIS).

Groups	Urea (mmol/L) Mean±SE	Creatinine (mmol/L) Mean±SE
Normal	6.8±1.1	28.1±4.2
Control (CIS)	23.1±2.1[a]	260.4±50.2[a]
P100+ CIS	15.7±1.0[b]	152.6±13.6[b]
P200+ CIS	11.2±1.2[b]	110.7±27.9[b]
L100+ CIS	14.2±1.4[b]	108.2±10.9[b]
L200+ CIS	8.6±1.0[b]	90.5±12.2[b]

Values are Mean±SEM (n=6 animals). [a] p<0.05, (Student´s *t test*) significantly different from normal group. [b] p<0.05, significantly different from control group. P, pods and L, leaves of carob.

Table (2): Effect of carob pods and leaves on renal SOD, CAT and GPx in mice treated with cisplatin (CIS).

Groups	SOD (nmol/min/mg protein) Mean±SE	CAT (nmol/min/mg protein) Mean±SE	GPx (nmol/min/mg protei) Mean±SE
Normal	22.2±2.6	160.9±6.8	253.1±6.1
Control (CIS)	10.6±1.9[a]	87.7±2.8[a]	130.7±3.5[a]
P100+ CIS	15.2±2.8[ns]	139.1±2.6[b]	157.2±3.0[ns]
P200+ CIS	17.2±3.1[b]	156.9±2.8[b]	222.9±4.1[b]
L100+ CIS	17.9±2.7[b]	1452.8±3.3[b]	220.1±3.2[b]
L200+ CIS	19.1±3.6[b]	158.1±5.2[b]	248.2±5.2[b]

Values are Mean±SEM (n=6 animals). [a] p<0.05, (Student´s *t test*) significantly different from normal group. [b] p<0.05, significantly different from control group. ns, non significant different from control group. P, pods and L, leaves of carob.

The activity of CAT in the cisplatin alone treated group was found to be decreased significantly (P<0.05) when compared to the normal group. Treatment of carob pods and leaves effectivity prevented the cisplatin induced decline of the CAT activity. Similarly, GPx activity was decreased significantly in cisplatin treated group. The enzyme activity was significantly increased (P<0.05) except at low dose of carob pods that could not prevent the decline of GPx activity.

The concentration of renal GSH was significantly decreased (P<0.05) and that of malondialdehyde was significantly increased (Table 3) in cisplatin treated animals. Administration of carob pods or leaves prior to cisplatin injection increased GSH and decreased the MDA concentrations.

Administration of cisplatin induced significant decrese in renal GST activity in comparison to normal value Table (3), whereas, carob pods and leaves (200 mg/kg) significantly ameliorated the effect of cisplatin compared to cisplatin group.

The effects of cisplatin treatment on lysosomal enzyme activities are presented in Table 4. Cisplatin treatment increased the activities of the four lysosomal enzymes; cathepsin D, acid phosphatase, DNase II and RNase II, significantly (P<0.05) compared to normal group. Administration of carob pods or leaves by two doses prior to cisplatin injection significantly (P<0.05) ameliorated the effect of cisplatin in all enzyme activities, compared to control group.

Table (3): Effect of carob pods and leaves on renal GSH, TBARS and GST in mice treated with cisplatin (CIS).

Groups	GSH (n mol/ mg protein) Mean±SE	TBARS (n mol/mg protein) Mean±SE	GST (nmol/min/ mg protein) Mean±SE
Normal	5.0±0.6	1.5±0.20	20.1±3.9
Control (CIS)	2.4±0.5 [a]	3.6±0.26 [a]	11.9±1.2 [a]
P100+ CIS	3.8±1.0 [ns]	3.1±0.16 [ns]	15.1±4.0 [ns]
P200+ CIS	4.2±0.7 [b]	1.8±0.19 [b]	18.9±3.5 [b]
L100+ CIS	3.9±0.2 [b]	1.9±0.15 [b]	17.1±5.1 [b]
L200+ CIS	5.1±1.1 [b]	1.6±0.21 [b]	19.0±3.0 [b]

Values are Mean±SEM (n=6 animals). [a] p<0.05, (Student´s *t test*) significantly different from normal group. [b] p<0.05, significantly different from control group. ns, non significant different from control group. P, pods and L, leaves of carob.

DISSCUTION

Cisplatin has been shown to cause nephrotoxicity in patients **(De Conti *et al*., 1973 and Daugarrd *et al*., 1988)** as well as in a variety of animal species **(Mckeage *et al*., 1993 and Badary *et al*., 1997 a,b).** A minimum dose of cisplatin (5 mg/kg b.wt, i.p.) was sufficient to induce nephrotoxicity in rats **(Boogaard *et al*., 1991 and Ravi *et al*., 1995).** A higher dose of cisplatin (10 mg/kg b.wt. i.p) corresponds to that currently being used in clinical practice. Administration of cisplatin exerts significant increase in serum urea and creatinine concentrations compared to normal group, which clearly indicates the acute renal failure. The effect of cisplatin was similar to those previously described **(Heidemann *et al*., 1989; Mckeage *et al*., 1993 and Somani *et al*., 2000).** Carob pods and leaves ameliorated cisplatin-induced nephrotoxicity as indicated by significant less increase in serum urea and creatinine concentrations.

Table (4): Effect of carob pods and leaves on renal Cathepsin D, Acid Phospha-tase, DNase II and RNase II in mice treated with cisplatin (CIS).

Groups	Cathepsin D (nmol/min/mg protein)	Acid phosphatase (nmol/min/ mg protein)	DNase II (nmol/min/ mg protein)	RNase II (nmol/min/ mg protein)
Normal				
Mean±SE	30.0±9.5	45±0.02	0.10±0.02	0.30±0.04
Control (CIS)				
Mean±SE	68.2±10.1 [a]	97±0.09 [a]	0.52±0.01 [a]	0.81±0.09 [a]
P100+ CIS				
Mean±SE	35.2±5.9 [b]	52±0.09 [b]	0.26±0.07 [b]	0.62±0.05 [b]
P200+ CIS				
Mean±SE	34.1±6.8 [b]	48±0.07 [b]	0.21±.05 [b]	0.48±0.06 [b]
L100+ CIS				
Mean±SE	31.2±9.7 [b]	51±0.09 [b]	0.20±0.08 [b]	0.53±0.08 [b]
L200+ CIS				
Mean±SE	29.2±8.9 [b]	48±0.06 [b]	0.18±0.06 [b]	0.44±0.07 [b]

Values are Mean±SEM (n=6 animals). [a] p<0.05, (Student´s *t test*) significantly different from normal group. [b] p<0.05, significantly different from control group. P, pods and L, leaves of carob.

The renal antioxidant status, such as SOD, CAT, GPx activities and GSH concentration are significantly decreased in the cisplatin alone treated group of animals compared to normal group. The decline of antioxidant status partially explains the mechanism of nephrotoxicity induced by cisplatin. The renal accumulation of platinum and covalent binding of platinum to renal protein could, also, play a role in the nephrotoxicity **(Litterst and Schweitzer, 1988).** Cisplatin induced suppression of renal antioxidant enzyme activities was also supported by the published experimental results **(Ajith *et al*., 2002 and Cetin *et al*., 2006).**

Carob pods and leaves (200 mg/kg b.wt. i.p.) along with cisplatin could significantly improve the depletion of the renal antioxidant system.

GSH depletion increases the sensitivity of organ to oxidative and chemical injury. Studies with a number of models show that the metabolism of xenobiotics often produced GSH depletion **(Mitchell *et al*., 1973, Jollow *et al*., 1974 and Ahmed and Zaki, 2009).** The depletion of GSH, also, seems to be a prime factor that permits lipid peroxidation in the cisplatin treated group. Treatment of carob pods and leaves reduced the depletion of GSH levels and provided protection to the kidney. The protection of GSH is by forming the substrate for GPx activity that can react directly with various aldehydes produced from the peroxidation of membrane lipid.

The intiation and propagation of lipid peroxidation in the cisplatin treated group could be caused by the decreased SOD activity. Such

decreased activity may be either due to loss of copper and zine, which are essential for the activity of enzyme or due to reactive oxygen species-induced inactivation of the enzyme protein **(Sharma, 1985 and De Woskin and Riviere, 1992).**

The activity of CAT and GPx, also, decreased in the cisplatin treated group, which in turn increased the hydrogen peroxide concentration and enhanced the lipid peroxidation. Hence the concentration of MDA, as a result of lipid peroxidation, increased in the cisplatin treated group. Treatment with leaves and pods of carob prevented the lipid peroxidation by enhancing the renal SOD, CAT and GPx activities. It is well known that many phenolic compounds, which are found in carob, exert powerful antioxidant effects. They, also, inhibit lipid peroxidation by scavenging reactive oxygen species (ROS), such as OH^0 **(Shahidi and Wanasundara, 1992).**

From the data presented (Table 4), it is clear that cisplatin treatment in general resulted in increase in the activity of all lysosomal enzymes under study. In the carob pods and leaves treated groups this effect was improved nearly to the normal group.

There is a correlation between lipid peroxidation and the release of lysosomal enzymes from lysosomes. Hence the process of lipid peroxidation activates phospholipases and removes the peroxidized lipid from the membrane **(Kappus, 1985).** The oxidation of unsaturated fatty acids in biological membranes by free radical leads to a decrease in membrane fluidity and disruption of membrane structure and function **(Haragushi *et al*., 1997).**

The increase in activities of RNase II and DNase II is a mater of concern, since this can lead to indiscriminate degradation of RNA and DNA ultimately resulting in necrosis of the cells in the tissues, i. e. kidney and liver **(Patel *et al*., 2005).** Also, **Gianetto and de Duve (1955)** reported that the cathepsin D activity increased substantially in experimental thyrotoxicosis. It was found that the acid phosphatase activity increased after cisplatin treatment (Table 4). **Panya *et al*. (2003)** showed that lysosomal acid phosphatase preferentially acts on nucleotides and that AMP is the preferred substrate. The concerned action of activated nucleases and acid phosphatase would lead not only to the breakdown of nucleic acids but also to the further dephosphorylation of mononucleotides, thereby leading to the acceleration of the process of cell degeneration.

Ethanolic extract of carob leaves possessed strong radical scavenging activity *in vitro* as measured by DPPH assay. Furthermore, the *in vivo* studies confirmed the antioxidant efficacy of this extract as well as its hepatoprotective activity **(Rasheed, 2006).** Polyphenols in carob pods have antioxidant activity **(Kumazawa *et al*., 2002).** In addition the crude polyphenol extracts of carob pods showed strong antioxidant activity **(Harbore, and Baxter, 1999).** The protective effect of carob pods and leaves, in the present study, against cisplatin-induced nephrotoxicity is in harmony and supports the previous reports indicating the antioxidant and cytoprotective potential of carob pods and leaves.

In conclusion, carob pods and leaves improve the nephrotoxicity of cisplatin in mice. The nephroprotective effects of carob pods and leaves may be partially mediated by preventing the cisplatin-induced decline of renal antioxidant status and lysosomal membrane damage.

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Genotypic Variability for Agronomic and Yield Characters in Some Cowpeas (*Vigna unguiculata* (L.) Walp.)

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Abstract: Cultivated species of crops are usually variable because of artificial selection under diverse environments of which cowpea is not exception. Consequently, genotypic variability study was conducted with eight parent line cowpeas to evaluate some genetic parameters namely coefficient of variation, genetic variance and heritability estimates in the broad-sense. Per se mean performance was variable among the genotypes for all characters investigated which indicated the superiority of some parent lines. Highly significant heritability effects were observed for all characters except for 100-seed weight (42.2%) which expressed moderate heritability estimate. Days to 50% flowering, pod length, pod weight and grain yield characters showed that some levels of genetic variability existed. Consequently, progress could be made from selection and improvement for those characters. [Nature and Science 2010;8(3):48-55]. (ISSN: 1545-0740).

Keywords: Genotypic variability, genetic variance, coefficient of variation, heritability, cowpea.

1. Introduction

Cowpea (*Vigna unguiculata* (L.) Walp.) is one of six major cultivated crop species of the family *leguminosae* distributed throughout the tropics (Padulosi and Ng, 1997; Pasquet, 2001). It is the second most important grain legume crop after groundnut as well as second only to cereals (Blade *et al.,* 1997). Millions of relatively poor people in developing countries in the tropics rely on it for their livelihood. This is because there is a chronic-protein deficiency in every home in virtually every developing country. Hence, it is a key staple food crop for the ever increasing population both in the rural and urban areas. Because the cowpea is native to West Africa where wild and weedy forms exist in many parts of the region (Ng and Marechal, 1985), it is one of the most variable species and genetic variability is the basis of genetic enhancement (Singh, 2003).

Cultivated species of crops are usually variable because of artificial selection under diverse environments of which cowpea is not exceptional. Moreover, genetic variability among characters is of vital importance in selecting the desirable genotypes for breeding programmes. Parental selection for cowpea improvement requires knowledge of the likelihood of improving characters of interest based on the amount and type of genetic control of the character(s). The amount of control is influential because improvement of a character with very small genetic control relative to environmental influences will be difficult due to heritability (Ragsdale and Smith, 2003).

Heredity is generally expressed as the proportion of the observed total variability that is genetic. In other words, selection of superior genotypes is proportional to the amount of genetic variability (Obilana and Fakorede, 1981). Thus, heritability serves as a guide to the reliability of phenotypic variability in any selection programme and hence determines its success (Hamdi, 1992). As a result, the present study is targeted at estimating genotypic variability and heritability of agronomic and yield characters in eight parent line cowpea genotypes as this will assist in providing useful information in a breeding work.

2. Materials and Methods

From twenty-eight germplasm screened, eight seemingly hopeful lines based on per se performance in two earlier experiments were selected to serve as parent lines (Table 1) and used in this study. The experiment was carried out at two locations viz Rubber Research Institute of Nigeria, Iyanomo, near Benin (Lat. 6° 09′ 24″ , Long. 5° 31′ 27″ E, Alt. 304.8m) and the Teaching and Research Farm, Ambrose Alli University, Ekpoma (Lat. 6° 08′ E, Long. 6° 42′ N, Alt. 460m). The eight genotypes were sown to the field under rainfed condition in a randomized complete block design (RCBD) in three replicates on 12th and 28th April 2008, respectively. Plots consisted of 5m long single rows. Seeds of each entry were sown at 30cm intra– and 60cm inter–rows spacing with one seed per stand. All agronomic and plant protection practices were followed.

Data were recorded from 5 randomly selected plants from the 3m–mid rows of each replicate on plant height, LAI, days to 50% flowering, 50% maturity, pod length, pod weight, seeds per pod, seed weight and grain yield. Data were subjected to ANOVA using SAS software model. Means separation was performed with Student–Newman–Keuls Test, coefficient of variation, genetic variance using the formula.

Pooled locations

$$\sigma^2 g = \frac{MSg - MSg \times e}{r \times \ell}$$

Where,

$\sigma^2 g$ = Genetic variance;

MSg = Mean square of genetic variance;

MSg x e = mean squares of genetic and error variances;

$r \times \ell$ = replicate by location

Broad-sense heritability for pooled data over locations was estimated as described by Eckebil *et al* (1977). Thus, for pooled locations

$$h^2 b(\%) = \frac{\sigma^2 g}{\sigma^2 g + \frac{\sigma^2 g \times \ell}{\ell} + \frac{\sigma^2 e}{r\ell}} \times 100$$

Where, $\sigma^2 g$ is genetic variance; $\sigma^2 e$ is the error variance; ℓ is the locations; $r\ell$ is replicate × location; $\sigma^2 g \times \ell$ is the variance due to genotype by location.

Table 1. Name, pedigree and geographic origin of the eight cowpea genotypes

Entry	IITA –Prefix Genotype	Pedigree Name	Origin
1	*TVu*–1120	Dan–Tamanin	Nigeria
2	*TVu*–1153	325	USA
3	*TVu*–1157	53C	South Africa
4	*TVu*–16627	ILCA–12646	Not available
5	*TVu*–16629	ILCA–12648	Not available
6	*TVu*–16630	ILCA–12665	Not available
7	*TVu*–1242	53–C–82	South Africa
8	*Ekp–br.*		Ekpoma brown(local cultivar)

3. Results

The pooled analysis showed significant variations for location, genotypes for all characters and genotype–environment interaction for days to 50% flowering, pod length and 100–seed weight. Mean performance of the different parental lines indicated variations for all characters studied (Table 2). Highest plant height was observed in parent line *TVu*–16627 (74.73cm) followed by *TVu*–16630 (64.47cm) and *Ekp.–br*. (47.73cm). Similarly, *TVu*–16627 had the largest leaf area index (LAI) value of 4.19, followed by *Ekp.–br*. (3.81) and *TVu*–1153 (3.23). For days to 50% flowering, parent line *TVu*–16629 had longer days of 57.17 and closely followed by *Ekp.–br*., *TVu*–1120 and *TVu*–1157 with 50.33, 48.17 and 45.50 days respectively. Similar trends was observed for days to 50% maturity with the longest days occurring in parent line *TVu*–16629 (73.33), followed by *Ekp.–br*. (68.00), *Tvu*–1153 (66.00), *TVu*–1120 (65.67) and *TVu*–1157 (64.67).

Pod length also revealed significant differences among the parent genotypes. *Ekp.–br.* (18.85cm) had the longest pod length and followed by *TVu*–16627 (16.83cm) while least pod length was observed in *TVu*–1242 (10.57cm). Pod weight also followed the same trend as in pod length among the genotypes. Parent line *Ekp.–br*. had the heaviest pod weight (2.42g) and followed by *TVu*–16627 (2.07g) while the least pod weight also occurred in *TVu*–1242 (0.88g)(Table 2). Highest mean number of seeds per pod was observed in parent line *TVu*–16629 (14.47), *Ekp.–br*.(13.90) and *TVu*–16627 (12.05). However, only parent genotype *Ekp–br.* (13.40) had the highest seed weight. The highest grain yield (1131.1Kg/ha) as compared to other parent lines was recorded in *TVu*–16627 (Table 2).

There were large variations in coefficient of variation and genetic variance in all characters evaluated (Table 3). Highest genetic variance was found in seed yield (57977.5). In all characters, high heritability was observed except for 100–seed weight which was moderately inherited (42.2%).

Table 2: Per se mean values of nine characters in eight parent line cowpea genotypes evaluated over pooled location

	C H A R A C T E R S								
Genotype	Plant ht(cm)	Leaf Area Index (LAI)	50% Flowering	50% Maturity	Pod length (cm)	Pod weight (g)	Seeds per Pod	100-seed wt. (g)	Grain Yield (Kg/ha)
TVu-1120	30.7	1.57	48.17	65.67	14.35	1.19	10.13	8.97	432.8
Ekp.-br.	47.73	3.81	50.33	68.00	18.85	2.42	13.90	13.40	353.5
TVu-1153	39.10	3.23	42.33	66.00	13.47	1.27	7.45	11.75	274.3
TVu-16627	74.73	4.19	43.67	63.50	16.83	2.07	12.05	11.15	1131.1
TVu-1157	31.17	0.83	45.50	64.67	11.55	1.00	8.77	9.57	136.6
TVu-16629	36.57	1.39	57.17	72.33	14.2	1.98	14.47	11.02	389.2
TVu-1242	36.72	2.74	44.67	63.00	10.57	0.88	6.95	10.20	77.8
TVu-16630	64.47	2.70	43.50	62.67	13.05	1.46	10.97	9.05	203.1
Mean	45.148	2.55	46.917	65.729	1.397	1.534	10.585	10.64	375.28
LSD(0.05)	14.024	1.58	3.95	4.38	1.4	0.41	2.14	1.26	5.85

Table 3. Percentage values of coefficient of variation (CV), genetic variance (σ^2g) and heritability in broad-sense (h^2b) of nine agronomic and yield characters in cowpea genotypes over pooled locations

Character	CV	σ^2g	h^2b
Plant height (cm)	26.27	0.001	89.9
Leaf area index (LAI)	52.41	0.01	98.9
Days to 50% flowering	7.12	1.68	81.9
Days to 50% maturity	5.63	0.44	84.7
Pod length (cm)	8.37	2.21	87.6
Pod weight (g)	22.65	1.56	95.9
Seeds per pod	17.10	0.39	90.7
100-seed weight (g)	9.99	0.24	42.2
Grain yield (Kg/ha)	105.1	57977.5	53.8

4. Discussion

The present study revealed significant genotypic differences in mean plant height and LAI characters among the parent genotypes. Memon *et al.,* (2005) reported that the expression of a trait depended on its genetic control and in this case, among the parent lines used in this study. Moreover, the large variability evident among the genotypes for LAI character also revealed significant differences in mean leaf area development which may be due to increased meristematic activity which would have enhanced leaf expansion (Nalayini and Kandasamy, 2003). Previous studies had reported high heritability in the broad–sense in cowpea for plant height character (Sharma and Singhania, 1992; Tyagi *et al.,* 2000); LAI (Roquib and Patnaik, 1990; Sharma and Singhania, 1992). Thus, this study is in conformity with earlier findings for the characters being investigated. A negligible genetic variability was estimated for plant height and LAI indicating that environmental influence affected the expression of these characters.

Days to 50% flowering and 50% maturity revealed narrow mean differences among the genotypes studied for the characters. Earliness has been reported to be an important agronomic character measured by such criterion as days from sowing to maturity (Fery and Singh, 1997). Parental genotype *TVu*–16630 had the least number of days to reach maturity with a delay in days to 50% maturity in *TVu*–16629. In cowpea, the post flowering (maturity) is a major difference between the two maturity groups (early and late) because of the striking difference in grain–filling periods. Flowering and maturity characters showed high heritability effects. The high heritability estimates observed in this study for both characters confirmed earlier findings (Siddique and Gupta, 1991; Tyagi *et al,* 2000). Low genetic variance for days to 50% flowering with a negligible genetic effect on days to 50% maturity was observed indicating the presence of much environmental factors in the characters expression.

The mean pod length varied widely among the genotypes. However, two parent line genotypes *Ekp.–br*. and *TVu*–16627 had much longer pods when compared to others thus indicating the presence of genetic variability for the character. Thus, the study revealed some measure of genetic variance indicating that the character was genetically controlled

and could be selected for in improvement programme. High heritability was observed in this study which also confirmed earlier reports in cowpea (Siddique and Gupta 1991; Tyagi *et al.,* 2000). The per se mean performance of the different genotypes indicate some measures of different genetic constitution. Genotypes *Ekp.–br.* and *TVu*–16627 were outstanding in pod weight character when compared to others. High broad–sense heritability estimate was obtained in earlier findings (Ogunbodede and Fatunla, 1985; Pathmanathan *et al.,* 1997). A relatively low estimate of genetic variance was observed for pod weight.

Mean number of seeds per pod showed substantial variability among genotypes. More seeds were produced by *TVu*–16629 and *Ekp–br*. Heritability effect was high for the character thus confirming earlier reports (Damarany 1994; Tyagi *et al.,* 2000). Low genetic variance was however noticed for seeds per pod indicating that selection for the character may not be effective. Per se mean performance showed close variations in seed weight character among the genotypes except for genotype *Ekp.–br*. which had highest seed weight. Moderate heritability value was observed for the character. However, very low genetic variability was found for seed weight character in this study.

Mean values indicated sufficient variability for grain yield among the genotypes. More grain yield was produced by *TVu*–16627. Grain yield had been reported to vary considerably under most local conditions (Okeleye *et al.,* 1999; Remison, 2005). The reports of several investigations indicate that yield portion of cowpea plant are moderately to highly heritable under most environmental conditions. Siddique and Gupta (1991) demonstrated that additive gene effects govern seed yield. In this study, high broad–sense heritability was observed for grain yield which support previous reports (Fery and Singh, 1997; Tyagi *et al.,* 2000). Furthermore, a relatively high genetic variance was observed which suggest the possibility for selection and improvement on the character.

Conclusion

The study revealed the superiority of some lines. *TVu*–16627, *TVu*–1120, *TVu*–16629 and *Ekp.–br*. thus may be selected due to their better mean performance in most of the characters for evolving high yielding genotypes of cowpea.

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Effects of Organic, Organomineral and NPK Fertilizer Treatments on the Quality of *Amaranthus Cruentus* (L) On Two Soil Types In Lagos, Nigeria

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ABSTRACT

Under tropical soils, the precise requirement of inorganic fertilizer and its possible substitute is yet to be validated for the production of *Amaranthus cruentus* L. The nutrient requirement of *A. cruentus* under two soil types and yield quality under field conditions. Field experiment was conducted at two locations in Lagos State: Ikorodu (Orthic Luvisol) and Lagos State (LASU) Ojo Campus (Dystric Fluvisol) to investigate the effects of organic and organomineral and NPK fertilizer treatments on the quality of *Amaranthus cruentus L.* Eight fertilizer treatments. (1) Control (no fertilizer), (2) Pacesetter's Grade B (PGB) 100 %, (3) PGB + NPK (75:25), (4) PGB + NKP (50:50), (5) Kola Pod Husk (KPH) 100 %, (6) KPH + NPK (75:25), (7) KPH + NPK (50:50) and (8) NPK (100 %) were tested at first planting. Residual effects of the fertilizers were assessed in the second and third planting periods. The experiment was arranged in a randomized complete block design in four Replications. Parameters assessed include proximate analysis. Data were analysed using ANOVA. The KPH + NPK (75:25)resulted in significant ($p<0.05$) higher crude protein content (19.8 and 14.9 %), ether extract (8.5 and 8.2 %) while crude fibre (9.5 and 10.8 %) was lower than control at Ikorodu and LASU respectively. The KPH and PGB had high potential in *A. cruentus* production. At Ikorodu, KPH + NPK (75:25) was the best while at LASU, PGB + NPK (75:25) was optimum. KPH + NPK (75:25) gave highest crude protein content, ether extract and lowest crude fibre in *A. cruentus.*
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Keywords: *Amaranthus cruentus*, organomineral fertilizer, quality and soil type

1.Introduction

Edible species of the genus *Amaranthus* namely: *A. cruentus, A. dubius. A caudatus* and *A. hypochondriacus* are common in *Nigeria. Amaranthus cruentus* is a Mexican and Guatemalan species which is useful both as a grain or leaf vegetable type. The grain types have white seeds. The vegetable types have dark seeds. It is probably the most adaptable of all amaranth species, and it flowers under a wider range of day length better than the others. *A. cruentus* was most likely introduced to Africa by Europeans *Amaranthus cruentus and A. hypochondraicus* are characteristically very vigorous with broad leaves and protein rich edible seeds. The *A. cruentus* crop is variously known with broad leaves and protein rich edible seeds. The *A. cruentus* crop is variously known locally as '*tete'* (Yoruba), 'green,' (Igbo) or 'aleho' (Hausa), it is a tender herbaceous plant with edible leaves and tender stem. Its importance lies basically in it ease of cultivation and the quality of the leaves and tender stem. With other ingredients such as pepper, "egusi", melon, it is used to make soup. *Amaranthus cruentus* leaves contain 3.5% protein and 1.5 % carbohydrate as well as 0.75 % minerals and 6.7 % vitamins (Saunder and Becker, 1983). *Amaranthus cruentus* is cultivated and consumed all over the country and it can be rated among the top five of the most important national vegetables. The average consumption of *A. cruentus* leaves in the tropics is estimated at about 20 – 25g per head per day which is below the recommended rate of 100 g per head per day (Olufolaji, 1996). Protein from *A. cruentus* leaves provides as much as 25 % of the daily protein intake during the harvest season. It is grown all the year round (Denton and Olufolaji, 2000).

The seeds of *A. cruentus* contain about 16-18% protein while maize 9-10 % protein (NCR1984). *Amaranthus cruentus* leaves are similarly rich in protein content. Higher amino acid lysine content of the seeds makes the seeds even more important nutritionally. The protein has much lysine mixture as found in milk (Tayo, 1996).

On the other hand, the carbohydrate content of the *A. cruentus* leaves and seeds is 30-60 % with the seed having higher protein-calorie content needed for growth and energy (Tayo, 1996).The nutritional quality of *A. cruentus* is similar to that of leaf vegetables. However, because the dry-matter

content is often high, an equivalent amount of fresh *A. cruentus* often provides 2 to 3 times the amount of nutrients found in other vegetables (Saunders and Backer, 1983).

Kola pod husk and PGB fertilizers are among wastes generated in the kolanuts plantation and in the processed municipal wastes, respectively. Farmers are aware of the availability of these wastes but no farmer has put these into use in vegetable production. Most times, these wastes are dumped at dumpsites and incinerated.

Titiloye *et al*. (1985) reported 45 different waste materials rich in the following nutrient elements: N, P, Ca, Mg, Zn, Cu, Fe and Mn. Farm wastes represent a potential source of nutrients that could be harnessed to boost agricultural production (Solomon and Ogeh, 1995). Organic materials such as FYM, poultry manure, green manure, crop residues, water weeds, city wastes etc. have been reported as suitable substitute for inorganic fertilizers to maintain sustainable crop production and environmental quality (Pawar, *et al.,* 2003). Reports on the positive responses of crops to the various organic fertilizers cut across all the classes of agricultural crops including leaf vegetables (Schippers, 2000; Adebayo and Akanni 2002).

used to amend the organic fertilizer at a ratio of 3:1, organic for 75:25 mixture and at 1:1 organic for 50:50 mixture level. The field experiment was set up at Ikorodu and LASU. In these sites, eight fertilizer treatments were used; (i) Control (no

This study was therefore, set up to investigate the effects of two organic materials: kola pod husk and Pacesetter Grade B organic fertilizer used alone or in combination with NPK 15:15:15 on the yield, nutrient uptake and yield quality of *A. cruentus* in two ecological areas of Lagos State. The organic materials were chosen because they are locally available.

2. Materials and Methods

The Study Area

There were two study sites, namely Ikorodu farm settlement and Lagos State University (LASU) Ojo Campus. The two locations belong to two soil types Ikorodu (Orthic Luvisol) and LASU (Dystric Fluvisol). Ikorodu is located in the rain forest area of south west, Nigeria (6^0 37'N; 3^0 53'E) and the altitude is about 15.50 meters above sea level; LASU is located at Ojo in Badagry Division of Lagos State of Nigeria. It is located at the swamp forest area of southwestern Nigeria. ($6^0$27'N; $3^0$130'E and the altitude is about 6.1 meters above sea level). The dominant vegetation of Lagos State is the swamp forest consisting of the fresh water and mangroves, swamp forest both of which are influenced by bi-modal rainfall pattern with peaks in July and October ranges from 1584.5 to 1605.91 mm.

Sample Collection

Organic materials used were Kola Pod Husk (KPH) and Pacesetter Grade B fertilizer (non fortified sorted city refuse wastes plus cow dung, PGB). The KPH was obtained from the Kola processing unit of Cocoa Research Institute of Nigeria (CRIN) and PGB fertilizers was obtained from the Pacesetter Organomineral Fertilizer Plant at Bodija, Ibadan. The KPH was oven dried at 70^{o}C to constant weight and milled to pass through 2mm sieve before analyzing. The test crop was *Amaranthus cruentus* variety (ED 82/1019) early maturing type. The optimum N requirement (67.5 kg N ha^{-1}) for *Amaranthus cruentus* was

fertilizer), (ii) KPH (100 %), (iii) KPH + NPK (75:25), (iv) KPH + NPK (50:50), (v) PGB (100 %), (vi) PGB + NPK (75:25), (vii) PGB + NPK (50:50), (viii) NPK (100 %).

Experimental Layout

The experiment was laid out in a randomized complete block design (RCBD) with four replications, per location. Land area for the experiment was 27 x 16 per location. *Amaranthus cruentus* seedlings were raised and transplanted to seedbeds at a spacing of 10 cm by 20 cm, using one seedling per hole. Harvesting was done at 6 weeks after transplanting. The experiment was repeated without any fertilizer application at the second and third planting periods.

Chemical Analysis

Pre-cropping chemical analysis of the experimental soil was carried out before land preparation and repeated at the first, second and third harvest to determine the nutrient status of the soil. The soil samples were air dried, crushed and sieved to pass through 2 mm sieve after which they were analyzed for total N using macro kjeldahl procedure as described by Jackson (1958).

Available phosphorus was by the Bray 1 method as described by Bray and Kurtz (1945). Exchangeable acidity was determined by the titration method as outlined in IITA manual series. No. 1 (IITA, 1979); Exchangeable K, Ca and Mg were determined by extraction with 1M ammonium acetate at Ph 7.0 and the amount of K and Ca in the filtrate were determined using a Corning Flame Photometer with appropriate filter. While Mg was determined using a Perking-Elmer Atomic Absorption Spectrophotometer (AAS). Effective cation exchangeable capacity (ECEC) of the soil samples was determined by summation of all cations and the exchangeable acidity together.

Proximate Analysis of Plant

The plant materials were analysed for crude protein, ether extract, crude fibre, moisture content and ash

Data Collection

Data were collected on the, proximate analysis.

Data Analysis

Analysis of variance was carried out on data collected and means separated using Duncan's multiple range test.

3 Results

Pre-cropping chemical analysis

The soil at Ikorodu was less acidic Ph (6.1) compared with that of LASU (Ph 5.3). In addition, the soil at Ikorodu had higher organic carbon and N content compared to that of LASU . The available P was similar at the two locations. Exchangeable bases at Ikorodu was twice that of Ojo while exchangeable acidity at LASU was half that of Ikorodu. However the micronutrient content was similar.

The Grade B organic fertilizer contained more N than KPH. The carbon content in PGB was less than that of KPH. The P and K in KPH were more than that of PGB. Calcium, Mg and micronutrients contents of the two fertilizers were similar.

Effects of different fertilizers on proximate analysis of leaves *A. cruentus* at first field cropping at Ikorodu and LASU

The 100 % NPK produced significantly ($P < 0.05$) more crude protein contents (18.8 %) than all other treatments at Ikorodu while at LASU, 15.9 % was obtained at KPH + NPK (75:25) mixture (Table 1). At Ikorodu, 100 % KPH enhanced significantly ($P<0.05$) more crude fibre value (15.7 %) than all other treatments while at LASU, 10.9 % was obtained at PGB + NPK (50:50) mixture. The KPH + NPK (50:50) mixture produced significantly ($P<0.05$) more ether extract than all other treatments at both locations. Control produced significantly ($P<0.05$) more ash content (17.5 and 22.5 %) than all other treatments at Ikorodu and LASU respectively (Table 1).

Table 1. Effects of different fertilizers on Proximate analysis of leaves of *A. cruentus* at 6 WAS at first field cropping at Ikorodu and LASU

	Treatments	Ikorodu					LASU				
		Crude Protein	Crude Fibre	Ether Extract	Moisture Content	Ash %	Crude Protein	Crude Fibre	Ether Extract	Moisture Content	Ash %
1	Control	10.63f	13.90e	2.59g	12.75a	11.95h	12.75g	10.30b	5.09e	14.77a	15.15e
2	PGB (100%)	13.13c	14.30c	2.27h	12.18c	15.91d	15.75f	10.87a	5.15d	11.2f	18.88d
3	PGB+NPK (75:25)	12.56d	12.15g	5.52b	10.52g	15.79e	15.88d	10.93a	2.82h	9.88h	19.14c
4	PGB+NPK (50:50)	14.13d	15.32g	5.08d	11.40e	14.41f	15.81e	10.93a	3.04g	10.70g	18.94d
5	KPH (100%)	12.13b	15.71a	3.09f	11.09f	17.53a	17.56b	8.42d	5.42b	12.25d	22.54b
6	KPH+NPK (75:25)	13.19c	14.09d	4.53e	12.45b	16.62b	17.69a	9.83c	3.82f	12.89c	23.18a
7	KPH+NPK (50:50)	13.56b	12.99f	5.69a	11.81d	16.06c	17.38c	10.83a	9.51a	11.99e	19.21c
8	KPH (100%)	18.81a	11.58h	5.10c	12.18c	11.9g	12.63g	10.49b	5.12c	13.51b	14.62f

PGB = Pacesetter Grade B: KPH = Kola pod husk; NPK = NPK 15:15:15

Means having the same letter(s) in the same column are not significantly different at 5%. Duncan multiple rang test (DMRT).

Residual effects of different fertilizers on proximate analysis *A. cruentus* at second field cropping at Ikorodu and LASU

Soil that previously treated with KPH + NPK (50:50) and PGB + NPK (75:25) mixture significantly (P<0.05) produced more crude protein (19.8 and 14.9 %) than other treatments at Ikorodu and LASU respectively, at both locations (Table 2). 100 % NPK significantly (P<0.05) enhanced percent crude fibre (CF) value (13.4 and 14.9 %). The lowest CF was recorded at PGB + NPK (75:25) mixture (9.5 %) at Ikorodu, while at LASU 10.8 % was obtained at where PGB + NPK (50:50) mixture was previously applied (Table 2). Soil previously treated with PGB + NPK (50:50) and (75:25) mixture significantly (P<0.05) enhanced ether extract (8.5 % and 8.2 %) respectively than other treatments at Ikorodu and LASU. Soil previously treated with PGB + NPK (50:50) mixture significantly (P<0.05) produced more moisture content (11.9 %) than other treatments at Ikorodu, while at LASU 13.5 % was obtained where KPH + NPK (50:50) mixture was previously applied. At both locations 100 % KPH significantly (P<0.05) produced more ash content (18.7 and 19.85 %) than other treatments (Table 7).

Residual effects of different fertilizers on proximate analysis of *A. cruentus* at third field cropping at Ikorodu and LASU

At the third cropping, soil previous treated with 100 % KPH and KPH + NPK (50:50) moisture significantly (P<0.05) enhanced more crude protein value (10.3 and 2.5 %) than other treatments at Ikorodu and LASU respectively (Table 3).

Crude fibre (10.7 and 15.5 %) was significantly (P<0.05) enhanced at control in Ikorodu and LASU respectively. Soil previously treated with 100 % KPH significantly (P<.0.05) increased either extract value (5.9 and 9.9 %) than other treatments at Ikorodu and LASU respectively. Significantly (P<0.05), more moisture content (11.2 and 15.2 %) was at 100 % NPK and control in Ikorodu and LASU respectively. Soil previously treated with KPH + NPK (50:50) and KPH + NPK (75:25) mixture significantly (P<0.05) enhanced more ash content (32.1 and 23.4 %) than other treatment at Ikorodu and LASU, respectively (Table 3).

Table 2. Residual effects of different fertilizers on proximate analysis of leaves of *A. cruentus* at 6 WAS at second field cropping at Ikorodu and LASU

		Ikorodu					LASU				
	Treatments	Crude Protein	Crude Fibre	Ether Extract	Moisture Content	Ash %	Crude Protein	Crude Fibre	Ether Extract	Moisture Content	Ash %
1	Control	7.00h	12.70b	2.48g	10.77f	14.09f	1.25h	13.15c	1.89h	11.80c	14.91f
2	PGB (100%)	9.38f	12.63c	2.88e	11.69c	13.95g	14.68b	10.83h	7.65b	10.45h	17.37c
3	PGB+NPK (75:25)	10.00e	9.48h	6.63b	10.99e	14.89e	14.88a	10.96g	8.23c	10.86f	15.85e
4	PGB+NPK (50:50)	13.13d	10.56g	8.48a	11.91a	15.96b	14.44c	11.57e	7.08c	11.99b	11.52h
5	KPH (100%)	13.35c	12.52d	3.46f	10.69b	16.71a	6.25d	11.25f	3.29f	11.46e	19.65b
6	KPH+NPK (75:25)	19.50b	12.15e	5.34c	11.85b	15.05c	3.31e	12.92d	3.37e	11.70d	16.74a
7	KPH+NPK (50:50)	19.75a	13.38a	5.26c	10.60h	14.91d	2.88f	13.79d	3.95d	13.45a	16.40d
8	KPH (100%)	7.25g	11.17f	2.16d	11.55d	12.63h	2.19g	14.94a	2.10g	10.51g	13.84g

PGB = Pacesetter Grade B; KPH = Kola pod husk; NPK = NPK 15:15:15
Means having the same letter(s) in the same column are not significantly different at 5%

Table 3. Residual effects of different fertilizers on proximate analysis of leaves of *A. cruentus* at 6 WAS at third field cropping at Ikorodu and LASU

		Ikorodu					LASU				
	Treatments	Crude Protein	Crude Fibre	Ether Extract	Moisture Content	Ash %	Crude Protein	Crude Fibre	Ether Extract	Moisture Content	Ash %
1	Control	2.81g	10.71b	2.24f	7.35h	28.53c	1.44f	15.50a	2.12h	15.17a	11.18h
2	PGB (100%)	5.38e	7.70h	3.14f	8.84e	31.80b	1.88d	12.16d	7.83e	10.37h	20.50d
3	PGB+NPK (75:25)	4.88f	8.58e	5.55c	9.48c	22.77f	1.88d	11.60e	7.77f	10.47g	17.64f
4	PGB+NPK (50:50)	5.50d	11.80a	5.46d	8.67f	23.38e	1.94c	12.46c	9.85b	10.82f	20.09f
5	KPH (100%)	10.25a	9.98d	5.69a	11.24a	20.38g	2.06b	7.23h	9.93a	10.89e	22.38b
6	KPH+NPK (75:25)	7.31c	8.50f	4.54e	10.49b	17.57h	1.88d	12.63b	7.86c	12.77b	17.02g
7	KPH+NPK (50:50)	9.88b	8.45g	5.61b	8.11g	32.12a	2.50a	9.49f	7.83d	11.63c	20.52c
8	KPH (100%)	1.4h	10.05c	2.55g	9.08d	23.78d	1.49e	7.46g	11.14d	11.14d	23.41a

Means having the same letter(s) in the same column are not significantly different at 5%

4 Discussion

The fertilizer treatments at first cropping produced significantly (P<0.05) higher percent crude protein (CP), ether extract and ash than control at both locations. This was in agreement with the report of Manga *et al*. (2004) that protein content can be increased with any of the N fertilizer application. The percent crude fibre (CF) and moisture content (MC) were higher at NPK and control treatment at both locations. This was showing poor quality of *A. cruentus* produced and that good source of fertilizers were needed to improve its yield quality. At the second and third field cropping, the residual effects of fertilizer treatments on *A. cruentus* on percent CP were higher at Ikorodu compared to LASU. The KPH and PGB as organic and organomineral fertilizer enhanced significantly (P<0.05) higher percent CP and ether extracts. This was above the critical level obtained (13-17 % and 0.3 100g-1) for CP and ether extracts at 100 % NPK at both locations as reported by Oyenuga and Fetuga (1975); Rubatzky and Yamaguchi (1997). The increase in CP might be because N is an important element in protein synthesis. This observation was in agreement with earlier reports of Abidin and Yasdar (1986). Since P uptake was increased, it was not surprising that CP increment was due to its role in protein synthesis. Brady (1974) reported that P functions in the production of albumen which is a form of protein.

The availability of P in the soil at the end of first and second cropping where KPH + NPK and PGB + NPK (50:50) and (75:25) mixture were previously applied might result to other elements being made available for growth and yield of *A. cruentus*. This observation confirmed the earlier work of Ojo and Olufolaji (1997) that the presence of P in soil increase quality of yield of *A. cruentus*. Recent findings by Alabi and Odubena (2001) indicated that leaf chlorophyll, K:Na and C:N ratio of organic fertilizer treated crops were found to be higher than NPK treated crops. These contents might have been responsible for better plant growth and yield quality of crops under organic treatment compared to NPK treatments.

The quality of yield of *A. cruentus* was sustained throughout the growth period at the three cropping periods with KPH and PGB as organominerals fertilizers.

Conclusion

The quality of *A. cruentus* dropped at the continuous use of NPK which showed high CF content hence, the quality increased with organic and organomineral fertilizer application.

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Analysis on the Parking demand of the Commercial Buildings Considering the Public Transport Accessibility

——Commercial Buildings in Beijing as an Example

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Abstract: Parking index is the fundamental basis for the buildings' parking supply in city. Researches on the parking demand takes prepare for establishing the buildings' parking index. Based on the parking survey of the commercial buildings in Beijing, this paper first analyzes the parking demand of the shopping centre and supermarkets. Further it analyzes the relationship between the parking demand of the commercial buildings and the public transport accessibility. The conclusion is that the parking demand rate of the shopping centre and supermarkets decreases with the increasing of the public transport accessibility. It also provides the parking demand rate under the different levels of the public transport accessibility and the parking demand model with the accessibility. The conclusions are valuable for the researches on the parking demand and the making of the parking index for the commercial buildings.[Nature and Science. 2010;8(3):63-68]. (ISSN: 1545-0740)

Key words: commercial buildings; public transport accessibility; parking demand analysis; parking index

1. Introduction

The parking index of the buildings is the important basis for the construction of city's parking facilities. It's very important for the sustainable development of urban transport. The national parking standards in China are "Parking Planning and Design Rules" and "Parking Construction and Management Temporary Rules" which were promulgated by Ministry of public security of the people's republic of China and Ministry of housing and urban-rural development of the people's republic of China in 1989. Today these standards can't meet the requirements of the rapid economic development and motorization in city. In recent years, many cities in China have established there own standards according to their own features.

Most of these standards only consider the parking demand and ignore the influence of public transport on parking demand. With the promotion of Transit-Oriented Development mode, the services of transportation system are improving and becoming more important in the parking demand factors. Considering the influence of the public transport accessibility on the parking demand, this paper analyze the parking demand of shopping centre and supermarkets and bring forwards the parking demand rates of these commercial buildings under the different levels of the public transport accessibility by the parking demand survey data in Beijing. This research will hope to provide new thinking for the parking demand analysis of commercial buildings and other buildings and further give references for the establishment of parking standards.

2. Survey introductions

Generally, the commercial buildings include shopping centre, supermarket, market, restaurants and entertainments etc. This paper chooses the typical shopping centre and supermarket as research objects. The selection of survey places mainly depends on the regional location and scale of the buildings. The survey places selected should have adequate parking lots and the information of them is easy to gain (Zhou, 2004; Nan, 2005). So this paper selected 17 survey places which were investigated at the peak parking period between December of 2008 and March of 2009 in Beijing as shown in figure.1.

The survey contents have three aspects. (1) the information of the buildings include GFA (Gross Floor Area), usage status, location of the matched parking lots, the number of parking spaces and the parking fee

etc; (2) the information of public transport around of the buildings with the radius of 500 meter include the distance from the building to the public transport stops and the frequency and routes of the buses or metros etc; (3) parking features include the parking demand at the peak parking period and the flow of customers of the buildings. The first two parts were gained by site investigation and the third part by investigators who count the number of vehicles entering and leaving the parking lot (Guan, 2003).

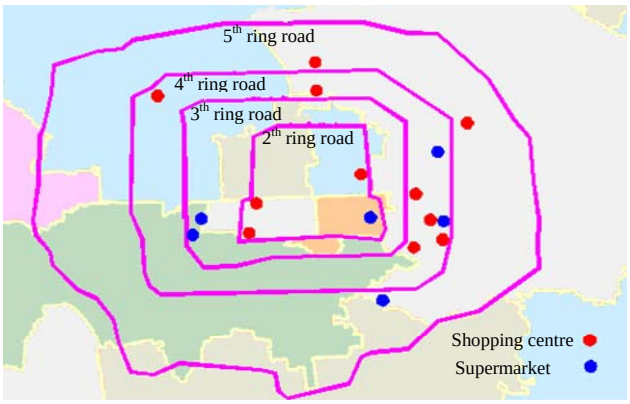

Figure 1. Distribution of Parking Survey Places of the Commercial Buildings in Beijing

3. Analysis on the Parking Demand of commercial buildings

The general research method of the parking demand of buildings is Parking Demand Rate which could obtain parking demand number per unit land index by analysis of the relationship between the parking demand and land index of the buildings (Li, 2007). It always chooses the land indices with better relativity and high maneuverability such as GFA, the number of employment post or seats. The typical formulation of Parking Generation Rate model is just like this:

$$P_i = \sum_{j}^{n} R_{ij} L_{ij} \qquad (1)$$

Where:

P_i: the peak parking demand of the i^{th} region;

R_{ij}: the unit parking generation rate of the j^{th} land use type of the i^{th} region;

L_{ij}: the land use index value of the j^{th} land use type of the i^{th} region;

n: the number of the land use types in the i^{th} region.

There are many land use indices of the buildings. In view of the maneuverability, GFA is chosen to analyze the parking demand. To test the rationality of the selection of GFA, SPSS is used to analyze the correlation between GFA and the parking demand by the survey data as shown in table 1. When the Pearson correlation bigger and the Asymp. Sig. smaller, the correlation in variables is more remarkable. The correlation indices of shopping centre and supermarkets are both above 0.70. This proves that the correlation is good. So this paper takes GFA as unit of parking demand rate (1 per 100 square meters of GFA).

Table 1. Correlation Test between Utilizable Building Area and Parking Demand

	Pearson correlation	Asymp.Sig. (2-sided)
Shopping centre	0.79	0.004
supermarket	0.70	0.083

Table 2. Means and Range of Parking Demand Rate of Business Buildings

Building type	Number of samples	Mean per 100 sq m	Parking demand range per 100 sq m	Parking standard of 2003* per 100 sq m
shopping centre	10	0.64	0.48~1.71	0.65
supermarket	7	0.93	0.74~1.61	

Note: *quote from《Guidelines for construction project's planning and design in Beijing》2003

From Figure 2 and Table 2, the parking demand rate of commercial buildings is between 0.22 and 1.97 per 100 square meters. The mean parking demand rate of shopping centre is 0.64 per 100 square meters and supermarket is 0.93 per 100 square meters. Both of them are close to or higher than the standard index of 2003 in Beijing. This proves that the parking demand increases rapidly. The range of the parking demand rate is 0.48~1.71 per 100 square meters for shopping centre and 0.74~1.61 per 100 square meters for supermarkets, which take 85% of parking demand as upper limit and 15% as lower limit.

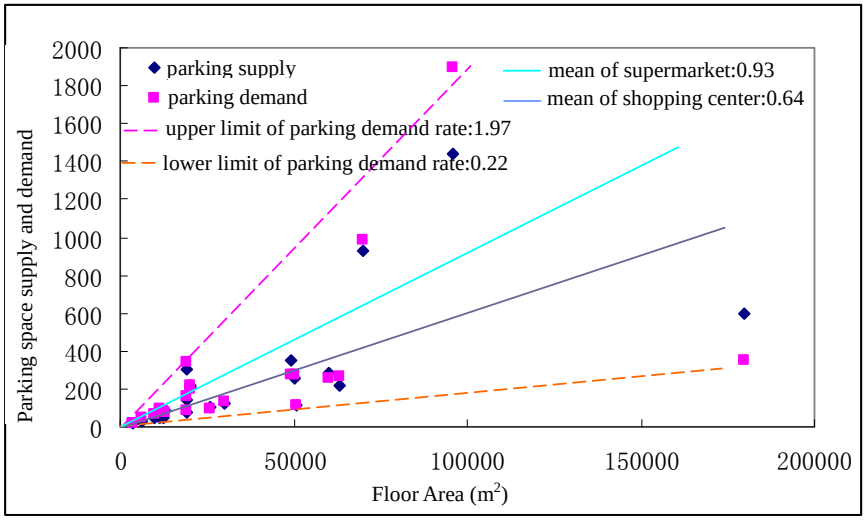

Figure 2. Peak Parking Demand of Business Buildings

4. Analysis on the effect of public transport accessibility on parking demand of the commercial buildings

4.1 Definition and calculation for public transport accessibility

There are many scholars have researched on the public transport accessibility (Zhao, 2005; Murray, 2003; Morris, 1979; Zhang, 2009). The scholars in Britain have considered the public transport accessibility in the analysis of parking demand in early time. They have considered that the parking spaces could be reduced in the region or buildings with high public transport accessibility around and encouraged the transfer of traffic modes to the public transportation.

The calculation of public transport accessibility is based on the distance between the buildings and public transport stops and the public transport service level (Simon, 2003). The distance is expressed with walking time and the service level is expressed with waiting time for the public transport. The formulation is as follows:

$$AI_q = \frac{30}{T_{mi} + T_{ni}} + \frac{1}{2}\sum_j \frac{30}{T_{mj} + T_{nj}} \qquad (2)$$

$$AI = \sum AI_q \qquad (3)$$

$$T_m = St/V \qquad (4)$$

$$T_n = 0.5 \times 60/a + k \qquad (5)$$

Where:

AI_q: the public transport accessibility index for the q^{th} kind of public transport modes around the building.

AI: the public transport accessibility index for the building.

T_{mi}: the walking time(minute) from the building to the public transport stop on the optimal route *i*.

T_{ni}: the average public transport waiting time(minute) on the optimal route *i*

T_{mj}: the walking time(minute) from the building to the public transport stop on the other route *j*.

T_{ni}: the average public transport waiting time(minute) on the other route *j*.

St: the distance(meter) between the building and the public transport stop.

V: the average walking speed(meter per minute)

k: the reliability coefficient, the railway is 1 and the bus is 2.

a: the average arrival rate(vehicle per hour) of transit vehicle

Usually the routes are bidirectional at the public transport stop. The direction with high travel efficiency is considered in the calculation model for the public

transport accessibility index. The optimal route is generally the one with small accessibility time. Sometimes the travelers have to change the trip routes to the trip destination. This will increase the trip delay. So the Equivalent Doorstep Frequency (EDF) of other selected route value need a reduction by a weight coefficient which is 1/2 in this paper. The walking speed *V*, distance *St* and average arrival rate a are all obtained by the survey data. The average walking speed *V* is 65.79 meter per minute based on the on-site observation including thirty shopping traveler samples. It is close to the value of walking speed in traffic engineering which is 70 meter per minute (Ren, 2008). So the public transport accessibility of the commercial buildings in the survey can be calculated by the survey data and the above formulation.

4.2 The relation between the public transport accessibility and parking demand of commercial buildings

The public transport service level around the buildings has some effect on the trip mode choice on a certain extent and that further affect the parking demand attracted by the buildings. With the public transport accessibility and high hour parking demand obtained by the survey data, the relation analysis between the public transport accessibility and parking demand is as follows:

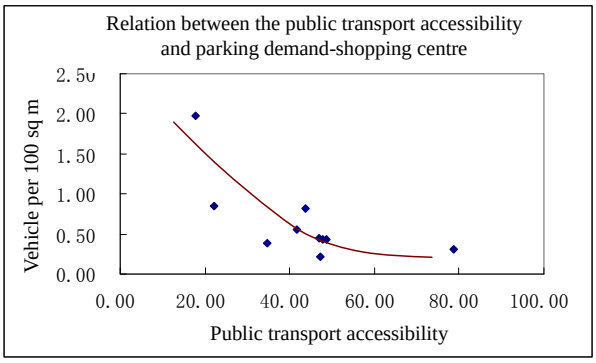

Figure 3. Relation between the Public Transport Accessibility and Parking Demand of the Shopping Centre

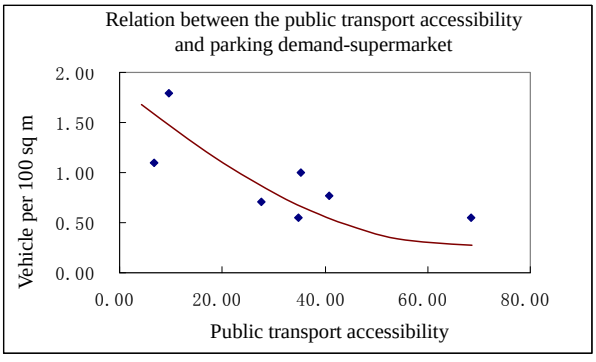

Figure 4. Relation between the Public Transport Accessibility and Parking Demand of the Supermarkets

From figure 3 and 4, we can see that it has strong relation between the public transport accessibility and parking demand of the shopping centre and supermarkets. On the whole, the parking demand decreases with the increase of the public transport accessibility. The public transport accessibility has effect on the parking demand of business buildings. When the public transport accessibility index is under 40, the parking demand decreases obviously with the increase of the accessibility. When the public transport accessibility index is above 60, the parking demand decreases little with the increase of the public transport accessibility. This shows that to increase the public transport accessibility in a certain range will greatly decrease the parking demand in a region.

Considering the practical maneuverability of parking index, this paper classifies the public transport accessibility into four levels for shopping centre and three levels for supermarkets. The higher level denotes the higher public transport service level and the accessibility and the lower parking demand rate. The parking demand rate under different public transport accessibility levels is shown in table 3 and 4. From these tables, we can see that the parking spaces supply can be reduced greatly in the area with high public transport accessibility. This will contribute to the establishment of the parking index of commercial buildings.

Table 3. Parking Demand Rate under Different Public Transport Accessibility Levels of the Shopping Centre

public transport accessibility of shopping centre	1	2	3	4
AI	20	20~40	40~60	60
parking demand rate per 100 sq m	1.97	0.62	0.48	0.31

Table 4. Parking Demand Rate under Different Public Transport Accessibility Levels of the Supermarkets

public transport accessibility of supermarkets	1	2	3
AI	20	20~60	60
parking demand rate per 100 sq m	1.45	0.76	0.56

In order to quantify the relation between the parking demand rate and the public transport accessibility, the relation formula is obtained by the mathematics analysis software. R^2 is the correlation

coefficient. The values of R^2 for shopping centre and supermarkets are all bigger than 0.6. This proves that the accuracy of the model is high.

$$\alpha_{shoppingcentre} = 28.61 * AI^{-0.53} \quad R^2=0.625 \quad (6)$$

$$\alpha_{supermarkets} = 3.11 * AI^{-0.40} \quad R^2=0.612 \quad (7)$$

5. Conclusions

This paper analyzes the parking demand of the shopping centre and supermarkets in the commercial buildings based on the parking survey data in Beijing. Further it analyzes the relation between the parking demand and the public transport accessibility. The conclusions are that the parking demand decreases with the increase of the public transport accessibility. When the public transport accessibility index is under 40, the parking demand decreases obviously with the increase of the accessibility. When the public transport accessibility index is above 60, the parking demand decreases little with the increase of the public transport accessibility. This paper also gives the parking demand rate under different accessibility levels and the relation model. The conclusions will give some important references for the parking demand analysis of urban commercial buildings and the establishment of the parking index of buildings.

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Probiotic Activity of *L. acidophilus* against Major Food-borne Pathogens Isolated from Broiler Carcasses.

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Abstract*: C.jejuni, E.coli* and *S. typhimurium* are the principal food borne pathogens in poultry industry. The first experiment tested the effectiveness of different strains of Lactobacillus as *in vitro* as probiotic against *C. jejuni, E.coli* O157 *and S. typhimurium* Result showed that *L.acidophilus* isolated from colostrums of mare and goat showed the widest inhibition zone against *C. jejuni, E.coli* O157 *and S. typhimurium* strains compared to the use of *L.acidophilus* isolated from goat and cattle milk. The second experiment evaluate the efficiency of *L. acidophilus* isolated from mare colostrums showing highest *in vitro* inhibition activity against tested strains as *in vivo* probiotic against *C. jejuni* isolated from broiler carcasses. The result showed great inhibition of *C. jejuni, E.coli* O157 *and S. typhimurium* strains by the use of *L.acidophilus* in comparing to the use of antibiotics. In the second experiment; four groups of adult albino rats were used; group (1) control negative, group (2) rats orally administrated by *L. acidophilus* only from the start of experiment till the 14th day, group (3) rats challenged only with *C. jejuni* and group (4) orally administrated by *L. acidophilus* from the start of experiment till the 14th day at the 7th day they were challenged with *C. jejuni*. Result showed that the third group showed the highest rate of reisolation of *C.jejuni* (0.80±0.16 from fecal swabs and 0.84±0.17 from the internal organs) as well as major pathological lesions in the tested organs in the form of granulomatus reaction in the lung tissue infiltration of inflammatory cells in the lung tissue thickening of wall of blood vessels with alveolar emphysema. Congestion hemorrhages of renal blood capillaries and coagulative necrosis of the renal tissue as well as degeneration and necrosis of hepatocytes with proliferation of fibrous tissue. The forth group pretreated with L. acidophilus Showed lower rate of isolation of *C.jejuni* (0.08±0.02 from fecal swabs and 0.04±0.01 from internal organs. The pathological findings of the internal organs showed minor lesions in the form of interstitial pneumonia and inflammatory cellular infiltration in the lung Swelling and degeneration of renal epithelium and hepatocytic degeneration with infiltration of inflammatory cells. The second group which was only treated with *L.acidophilus* showed no reisolation of *C.jejuni* as well as no pathological lesions were detected except a minor lesion in the liver in the form of diffused vacuolar degeneration in hepatocytes. Results develop a safe method for competing food borne pathogens in edible animals and suggest the need for probiotics to hinder the spread of highly pathogenic zoonotic bacteria transmitted by animal food by products. [Nature and Science 2010; 8(3):69-78]. (ISSN: 1545-0740).

Key words: *C. jejuni;* L. *acidophilus;* probiotics; *in vivo,* antibiotic sensitivity, rat.

1. Introduction

Foodborne diseases (FBD) represent an important public health problem that significantly affects people's health and withdraw serious socio-economic implications (Younus et al, 2007) .The principal food borne pathogens are (*C. jejuni, Cl. perfringens E. coli O157:H7 L. monocytogenes* Salmonella spp *S. aureus and T. gondii*) (Oliver et al, 2009) Our study will take into account C. jejuni as one of the major pathogenic bacteria in poultry industry. It is recognized that FBD produce economic losses in developing as well as developed countries (Lengsfeld et al, 2007). The problem of FBD and its associated costs is multi factorial and its prevention and control requires a multidisciplinary (Sivapalasingam et al, 2004). Campylobacter is the most common cause of human intestinal infectious disease in many countries (Lengsfeld et al, 2007). Early studies established that this disease was primarily due to thermotolerant *C. jejuni* and *C. coli* are one of the major causes of bacterial food borne enteric infection. The reported incidence of campylobacteriosis continued to rise. Campylobacter is ubiquitous in the environment and can be recovered from the faeces of most domestic and wild animals (Lengsfeld et al, 2007).

Preventing the emergence and spread of

antimicrobial resistant food borne pathogens requires avoiding misuse and overuse of antibiotics thus there is a need to develop a safe method for competing food borne pathogens as well as to raise the immune response of the animals to compete infections. Nowadays the use of probiotics should be a main target to hinder the spread of food borne pathogens and to raise the immune response of the animals which were proved to have different beneficial aspects as it Adhere to surfaces of the host mucous membrane. Release endogenous microbicides (lactic acid bacitracin and hydrogen peroxide) competitive with pathogens (deplete nutrients) and modulate the host immune response (Musa et al, 2009).

Our study aim to develop a safe method for raising the animal immune response to be capable to compete pathogenic infection and in turn to get safe animal by products for human consumption and as well to restrict over misuse of antibiotics.

2. Materials and Methods

Isolation and enumeration of intestinal microflora

Thirty broiler carcasses were aseptically collected immediately after defeathering from a commercial processing markets carcasses were. Carcasses were placed in sample bags in an ice box containing crushed ice and transported to the lab within 30 min. Carcasses tested samples were diluted with saline solution (1:10) and mixed using Stomacher for 1–2 min. After dilution 100 µl of each sample was plated onto the following media: MacConkey agar no 3 (0xoid) for *E. coli* Selenite -F- broth (Oxoid) incubated at 37°C for 16-18 hrs then streaked onto Salmonella-Shigella agar (Oxoid) plates for isolation of Salmonella; plates were incubated at 37°C for 24–48 hr Charcoal agar media (Oxoid) for Campylobacter isolation and kept at 37°C for 24–48 hrs at microaerophilic condition another plate was incubated at 42°C for 48 hrs for the isolation of *C.jejuni* (Quinn et al, 2002) Individual colonies from inoculated plates were picked and separately inoculated onto slope agar for further investigations.

Identification of the isolates was carried out by Gram's Method (Cruickshank et al, 1975) and biochemical tests (Quinn et al, 2002).

Cultivation of the collected samples:

Goat milk samples as well as colostrums were collected under possible aseptic conditions in a sterile cork screw tubes then were streaked onto De Man-Rogosa-Sharpe agar (Oxoid) M.R.S. agar plates using layer plate method for anaerobic incubation (Oxoid Manual, 1982). Plates were incubated at 37°C for 48-72 hrs (Collins and Lyne, 1976).

Isolation and purification of *Lactobacillus* species:

The suspected colonies from M.R.S. plates were picked and separately inoculated into tubes each containing 5 ml M.R.S. broth .The tubes were incubated at 37ºC for 24 hrs under 5% CO_2 tension. After incubation each broth sample was examined microscopically culturally according to (Konman et al 1983, Sneath et al, 1986) and biochemically identified (Quinn et al, 2002) using Oxidase test Catalase production test Indole test Nitrate reduction test Triple sugar iron agar medium used for H_2S production test Sugar fermentation test using the following sugars fructose melibiose mannose cellibiose mannitol sucrose and lactose Gelatin liquefaction test Arginine hydrolysis test production of gas (CO_2) from glucose production of ammonia from arginine fermentation of ribose from gluconate ability of growth at 15ºC and 45ºC.

***In vitro* use of *Lactobacillus* as probiotic; Well diffusion assay (Sgouras et al, 2004):**

Mueller Hinton agar plates divided into three groups; group (A) inoculated with *C.jejuni* group (B) inoculated with *E.coli* O157 and group (C) inoculated with *S. typhimurium* and wells were drilled out using pasture pipettes 50 µl aliquots of cell free cultures supernatant in fresh M.R.S. broth of *L.acidophilus* isolated culture was suspended in the agar wells. Plates were incubated for 48 to 72 hrs under microaerophillic conditions at 37°C inhibition zones around wells showed positive.

***In vivo* use of *Lactobacillus* as probiotics (Strompfova et al, 2005):**

L. acidophilus strain showing positive zone of inhibition by *in vitro* sensitivity test was selected for evaluating its probiotics activity in rats to evaluate its *in vivo* probiotics activity against *C. jejuni* by reisolation of *C. jejuni* from fecal swabs at different intervals after inoculation and reisolation from the different organs after scarification of the animals.

Preparation of *L. acidophilus* culture (Strompfova et al, 2005):

L. acidophillus (isolated from goat colostrums) was inoculated into MRS broth (Oxoid) and incubated at 37°C for 24 hrs then the bacterial cells were harvested by centrifugation at 2000 g for 10 min at 4°C and the bacterial pellet was resuspended in a saline solution (0.85% pH 7.0) to obtain the concentration 10^8cfu/ml. The culture was stored at 4°C before application.

Experimental animals

Twenty non pregnant adult albino rats weighing about 300- 400 grams were used for experimental studies. They were divided into four groups; 5 animals each. Group (1) control negative given saline solution (0.85% pH 7.0) group(2) was orally administered *L. acidophilus* strain (0.5 ml per day; 1.5 x 10^8 cfu/ml of saline solution) with a syringe for 14 days group (3) was challenged with *C. jejuni* at the day 7 with dose (1ml; $5x10^9$ of viable organism / ml) as one oral dose. Group (4) was orally administered *L. acidophilus* strain (0.5 ml per day; 1.5 x 10^8 cfu/ml of saline solution) with a

syringe for 14 days and at the day 7 they were orally administered with *C. jejuni* (1 ml; $5x10^9$ of viable organism / ml) as one oral dose. All groups of animals were fed the commercial diet and had access to feed and water. All animals were examined for the reisolation of *C.jejuni* from faecal samples collected from each rat on days 9 12 15 and 18 and at the end of experiment (day 21). All animals were scarified at the end and their internal organs were tested for the reisolation of *C.jejuni* and the internal organs were pathologically examined for detection the severity of lesions in challenged group with *C.jejuni* only in comparing with findings in group pretreated with *L.acidophilus* before challenging with *C.jejuni*.

Statistical analysis: Statistical analysis was carried out using "Student t" test and Analysis of Variance as outlined by (Snedecor and Cochran, 1980).

3. Results

On screening for the most common pathogenic bacteria isolated from poultry meat to human thirty poultry meat samples were collected form different markets in Egypt for screening of Campylobacter Salmonella as well as *E.coli*. Biochemical analyses and serotyping were carried out for identification of *C.jejuni S. typhimurium* and *E.coli* O157. As shown in **Table (1)** the rate of isolation of tested bacteria from poultry carcasses varied greatly; the most predominant isolates were Campylobacter spp. which was isolated with an incidence of 0.70±0.13 from which *C. jejuni* predominate which was isolated with an incidence of 0.63±0.12 followed by *E.coli* which was isolated with an incidence of 0.57±0.10 among which *E.coli* O157 showed an incidence of 0.67±0.01 then Salmonella spp. (0.33±0.06) among which *S. typhimurium* was isolated with a rate of 0.13±0.02.

Table (2) and figures (1 2 and 3) showed that the most effective antibiotics that the different tested stains showed high sensitivity against them were in order as follows; ofloxacin 5 µg/ml with an incidence (100.00 %) followed by tobramycin 10 µg/ml (97.37%) then garamycin 10 µg/ml (65.79%) then amoxycillin/ clavulinic acid 30 µg/ml (39.47%) then Tetracycline 30 µg/ml (23.68%) and finally Erythromycin 15 µg/ml (15.79%). **Figure (4 5 and 6)** showed that all tested strains showed great sensitivity toward *L.acidophilus* isolated from mare and goat colostrums followed by different milk samples from goat and cows by testing using agar well diffusion test.

As shown in **Table (3)** the incidence of diarrhea reaches 0.00% in group (1) which was used as control negative and group (2) treated with *L. acidophilus* only. In group (3) 80.00% of the tested rats showed severe diarrhea with reisolation of *C.jejuni* from diarrhatic cases in this group. Mortality rate was 0.00% in all groups while it reaches 20.00% in group (3). The morbidity rates due to *C. jejuni* in group (4) previously treated with *L.acidophilus* before challenging with *C.jejuni* showed diarrhea with an incidence of 20.00% associated with the reisolation of *C.jejuni* from the fecal sample of diarrhatic rat.

Results in **Table (4)** revealed that the rate of isolation of *L. acidoplilus* and *C.jejuni* from feacal sample reaches 0.00±0.00 in group (1) 0.80±0.16 and0.00±0.00 in group (2) 0.72±0.14 and 0.08±0.02 in group (3) and finally 0.00±0.00 and 0.80±0.16 in group (4) respectively. While the rate of isolation from internal organs of rats after death or scarification was 0.00±0.00 in group (1) 0.20±0.04and 0.00±0.00 in group(2) 0.20±0.04and 0.04±0.01in group (3) and finally 0.00±0.00 and 0.84±0.17 in group (4) respectively

Lesions occurred in the internal organs of dead or sacrificed rats infected with *C.jejuni* alone or after administration of *L.acidophilus* showed great difference in the rate of isolation of *C.jejuni* as well as in the pathological finding. Group 4 which was challenged with *C. jejuni* only and not given probiotics showed granulomatus reaction in the lung tissue infiltration of inflammatory cells in the lung tissue thickening of wall of blood vessels with alveolar emphysema **(fig.7)** Kidney tissue showed congestion and hemorrhages of renal blood capillaries **(fig.10)** and coagulative necrosis of the renal tissue **(fig.11)** degeneration and necrosis of hepatocytes and proliferation of fibrous tissue in the liver tissue was shown **(fig.14)**. Macroscopically the livers showed hepatomegaly and sever congestion kidney showed large abscesses while the lungs showed sever pneumonia. On the contrary group 4 which was pretreated with *L.acidophilus* before being challenged with *C.jejuni* lesions were less severe in comparing with group 3; lesions were in the form of interstitial pneumonia and inflammatory cellular infiltration in the lung **(fig.8)** swelling and degeneration of renal epithelium in the kidney **(fig.12)** and hepatocytic degeneration with infiltration of inflammatory cells in the liver **(fig.15)**. While group 2 given only *L.acidophilus* showed that lung **(fig.9)** and kidney **(fig.13)** tissues appears within normal limits while liver **(fig.16)** showed diffused **v**acuolar degeneration in hepatocytes.

4. Discussion

Thirty poultry carcasses were collected form poultry markets in Egypt for screening of for Campylobacter and Salmonella as well as *E.coli*. Serotyping was carried out for identification of *S. typhimurium* and *E.coli* O157. As shown in **Table (1)** the rate of isolation of tested bacteria from poultry carcaces varied greatly; the most predominant isolates were Campylobacter spp. which was isolated with an incidence of 0.70±0.13 from which *C. jejuni*

predominate which was isolated with an incidence of 0.63±0.12. The following predominating bacteria was *E.coli* which was isolated with an incidence of 0.57±0.10 among which *E.coli* O157 showed an incidence of 0.67±0.01 while the rate of isolation of Salmonella spp. was 0.33±0.06 among which *S. typhimurium* was isolated with a rate of showed rate of 0.13±0.02. These results agree with (Schlundt et al, 2004) who described five of the most important emerging food-borne zoonotic pathogens: *Salmonella* spp. *Campylobacter* spp. enterohaemorrhagic *E. coli Toxoplasma gondii* and *Cryptosporidium parvum.* Also (Chavoerach et al, 2004) proved contamination of chicken meat with *C. jejuni* causes human enteritis.

Figure 1, 2 and 3 showed that all tested strains showed great sensitivity toward *L.acidophilus* isolated from goat colostrum by testing using agar well diffusion test. Results match with the findings of Reid and Burton (2002) who reported that *Lactobacillus* spp. isolated from the genital tract have probiotic activities which contribute to health restoration and maintenance. Also results agree with Abd El-Moez et al, 2008 who showed high activity of *in vitro* use of *L. acidophilus* as probiotic against *E.coli* Bacillus *C.diversus E. feacalis* and *Y. enterocolitica* followed by *L. casei rhamnosus* and De Vuyst and Leroy (2007) who proved that lactic acid bacteria display numerous antimicrobial activities and the antimicrobial production by probiotic LAB plays a role during *in vivo* interactions occurring in gastrointestinal tract hence contributing to gut health. (Gupta et al, 1996) Observed that *L. acidophilus* strains showed inhibitory activity towards *S. typhi S. aureus E. coli P. vulgaris* and *Y. enterocolitica*. Our results disagree with that of (Koga et al, 1998) who reported that none of the *Lactobacillus* spp. was able to inhibit the growth of *S. enteritidis S. typhimurium E. coli* and *S. aureus*. Probiotics have shown to protect against variety of pathogens as *E. coli* (Chateau et al, 1993) and Salmonella as well as Campylobacter (Stern et al, 2001).

Table (2) revealed the incidence of diarrhea reaches 0.00% in group (1) which was used as control negative and group (2) treated with *L. acidophilus* only. While in group (3) 80.00% of the tested rats showed severe diarrhea with reisolation of *C.jejuni* from diarrhatic cases in this group. Mortality rate was 0.00% in all groups while it reaches 20.00% in group (3).On the other hand the morbidity rates due to *C. jejuni* among tested groups of rat revealed that in group (4) which was previously treated with *L.acidophilus* before challenging with *C.jejuni* one animal showed diarrhea with an incidence of 20.00% associated with the reisolation of *C.jejuni* from the fecal sample of diarrhatic rat. Results agree with (Paulius et al, 2006) who proved that the use of probiotic reduced morbidity and mortality of growing rabbits during fattening period. Our study agree with (Corr et al, 2007) who found that probiotics can significantly protect mice against infection with the invasive food borne pathogens as and protected pigs against diarrhea. Also match with Ogawa et al (2007), Casey et al (2007) who proved that probiotics were reduced the severity and duration of diarrhea in rabbit infected with *E.coli* O157. Also results agree with (Chavoerach et al 2004) who proved that *C. jejuni* should be controlled at the farm level by using orally given probiotics to prevent colonization of chicken with campylobacter.

Results in **Table (4)** revealed that the rate of isolation of *L. acidoplilus* and *C.jejuni* from feacal sample reaches 0.00±0.00 in group (1) 0.80±0.16 and0.00±0.00 in group (2) 0.00±0.00 and 0.80±0.16 in group (3) and finally 0.72±0.14 and 0.08±0.02 in group (4) respectively. While the rate of isolation from internal organs of rats after death or scarification was 0.00±0.00 in group(1) 0.20±0.04 and 0.00±0.00 in group(2) 0.00±0.00 and 0.84±0.17 in group (3) and finally 0.20±0.04 and 0.04±0.01in group (4) respectively. These findings agree with (Shu et al, 2000) who proved that probiotics reduce pathogen translocation to visceral tissues. Shah (2000) Mentioned that a number of health benefits have been claimed for probiotic bacteria such as *L. acidophilus Bifidobacterium spp.* and *L. casei*. As well as the findings of (Chateau et al 1993, Corr et al, 2007) who found that probiotics have shown to protect against variety of pathogens as *E. coli* Salmonella and Campylobacter respectively. Also results agree with (Murry et al, 2006) suggested that diets supplemented with the botanical probiotic containing *Lactobacillus* supports growth for broilers similar to the basal diet supplemented with antibiotic and coccidiostat and with lower feed to gain ratio. Also the botanical probiotic may reduce *C.perfringens* and *C. jejuni* in market-age broilers.as well as (Casey et al, 2007) characterized lactobacillus for its antimicrobial activity against *Clostridium difficile* enteropathogenic *Escherichia coli* (EPEC) verocytotoxigenic *E. coli* (VTEC) and *C. jejuni*. They added that lactobacilli displayed variations in their antimicrobial activity with few strains showing inhibitory activity against all pathogens. Also findings agree with (Shu et al, 2000) who found that supplementing lambs infected with *E. coli* O157:H7 with a mixture of probiotics including *L. acidophilus* in the diet can reduce total number of *E. coli* O157:H7 shed in the feces. Also Shah, 2000 selected Lactic acid bacteria as a competitive exclusion product that would inhibit *E.coli* O157:H7 in the intestinal tract of live cattle. Results agree with Murry et al, 2006 found that *L. acidophilus* and *L.plantarum* were have inhibitory properties against *E.coli S. aureus S. agalactiae S. uberis S. Enteritidis* and *B. pumilus*. Also results agree with Likotrafit et al, 2004 who proved the capability *of Lactobacillus* against *E.coli* and observed its ability to

decrease viability of *E.coli*. As well (Lema et al, 2001) found that supplementation of cattle with *L. acidophilus* reduce the prevalence and magnitude of fecal *E. coli* O157.

Lesions occurred in the internal organs of dead or sacrificed rats infected with *C.jejuni* alone or after administration of *L.acidophilus* showed great difference in the rate of isolation of *C.jejuni* as well as in the pathological finding. Group 4 which was challenged with *C. jejuni* only and not given probiotics showed granulomatus reaction in the lung tissue infiltration of inflammatory cells in the lung tissue thickening of wall of blood vessels with alveolar emphysema **(fig.7)** Kidney tissue showed congestion and hemorrhages of renal blood capillaries **(fig.10)** and coagulative necrosis of the renal tissue **(fig.11)** degeneration and necrosis of hepatocytes and proliferation of fibrous tissue in the liver tissue was shown **(fig.14)**. Macroscopically the livers showed hepatomegaly and sever congestion kidney showed large abscesses while the lungs showed sever pneumonia. These results agree with Brashears et al, 2003 who described the histopathological changes occurred in the internal organs of experimentally infected guinea pigs with *Campylobacters* revealing that the majority of hepatic cells showed degenerative changes mainly cloudy swelling and hydropic degeneration as well as focal coagulative necrosis of hepatocytes. Hepatic sinusoids contain fatty changes with intensive lymphocytic aggregation seen inside the hepatic sinusoids and blood vessels. This picture was previously described by Marsalkova et al, 2004 who inoculated ducks with *C.jejuni* and resulted in swollen hepatic cells with partial occlusion of hepatic sinusoids some of them contain vacuoles of sharp borders (fatty changes) Intensive leukocyte aggregation mainly lymphocytes in hepatic sinusoids. Hepatic cells were seen with cloudy swelling. Brashears et al, 2003 illustrates that the lung tissues showed interstitial mononuclear cells infiltration that revealed foccal areas of interstitial pneumonia associated with thickening of interalveolar septa and diffuse interstitial haemorrhage lung tissues showed perivascular mononuclear cell infiltration and perialveolar blood capillaries that were engorged with blood. Also renal tubules revealed mononuclear cellular infiltration with destruction of epithelial lining of renal tubules; some renal tubules showed necrobiotic changes and cast formation. Moreover degenerative changes of epithelial lining of tubules. Severe congestion of blood vessels and blood capillaries with haemorrhages degenerative changes in renal tubules showing mononuclear cellular infiltration with destruction of epithelial lining. On the contrary group 4 which was pretreated with *L.acidophilus* before being challenged with *C.jejuni* lesions were less severe in comparing with group 3; lesions were in the form of interstitial pneumonia and inflammatory cellular infiltration in the lung **(Fig.8)** swelling and degeneration of renal epithelium in the kidney **(fig.12)** and hepatocytic degeneration with infiltration of inflammatory cells in the liver **(fig.15)**. While group 2 given only *L.acidophilus* showed that lung **(fig.9)** and kidney **(fig.13)** tissues appears within normal limits while liver **(fig.16)** showed diffused vacuolar degeneration in hepatocytes. Our study agrees with Corr et al, 2007 who found that probiotics can significantly protect mice against infection with the invasive food borne pathogens as *L. monocytogenes* and *S. typhimurium*. Also results match with the findings of Atassi et al, 2006 challenged mice with *E.coli* O115 and O119 after being fed on 10% skim milk containing *L. acidophilus* ($1.5x10^{8}$ CFU) for 1 week they found 100% survival rate whereas controlled unprotected mice showed 53.3% and 73.3% survival rate respectively. These results confirmed the probiotic effect of *L. acidophilus* against colonization of *E. coli* in the animal tissues as well as enhancing their immune response.

Table (1) Rate of isolation of pathogenic bacteria from poultry carcasses.

Isolated strains	**Positive no**	**Positive %**	**Mean ±SE**
Campylobacter spp.	2	6.67	0.06±0.01
C. jejuni	19	63.30	0.63±0.12
Total Campylobacter spp.	**21**	**70.00**	**0.70±0.13**
E.coli	15	50.00	0.50±0.09
E.coli O157	2	6.70	0.67±0.01
Total *E.coli*	**17**	**56.70**	**0.57±0.10**
Salmonella spp.	6	20.00	0.20±0.04
S. typhimurium	4	13.30	0.13±0.02
Total Salmonella spp.	**10**	**33.30**	**0.33±0.06**
Total bacteria isolated	**48**	**160.00**	**1.60±0.29**

Total number of Samples=30

Table (2): Antibiotic agar diffusion test against pathogenic strains isolated from poultry carcasses.

Isolates / Antibiotic	Campylobacter (2)		*C. jejuni* (9)		*E.coli* (15)		*E.coli* O157 (2)		Salmonella (6)		*S. Typhimurium* (4)		Total (38)	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Amoxicillin /Clavulinic acid 30 µg/ml	1	50.00	5	55.6	4	26.67	1	50.00	2	20.00	2	50.00	15	39.47
Erythromycin 15 µg/ml	1	50.00	2	22.22	2	13.33	0	0.00	1	16.67	0	0.00	6	15.79
Garamycin 10 µg/ml	2	100.00	9	100.00	9	60.00	1	50.00	3	50.00	1	25.00	25	65.79
Ofloxacin 5 µg/ml	2	100.00	9	100.00	15	100.00	2	100.00	6	100.00	4	100.00	38	100.00
Tetracycline 30 µg/ml	1	50.00	4	44.44	2	13.33	0	0.00	1	16.67	1	25.00	9	23.68
Tobramycin 10 µg/ml	2	100.00	9	100.00	15	100.00	2	100.00	6	100.00	3	75.00	37	97.37

No between brackets showed total no of tested isolates
No and % illustrate the sensitive strain toward different antibiotics

Table (3): Incidence of Diarrhea among different groups of rats

	Morbidity rate			Mortality rate		
Rats Groups	**No**	**%**	**Mean ± SE**	**No**	**%**	**Mean ± SE**
Group 1	0/5	0.00	0.0±0.00	0/5	0.00	0.0±0.00
Group 2	0/5	0.00	0.0±0.00	0/5	0.00	0.0±0.00
Group 3	4/5	80.00	0.8±0.36	1/5	20.00	0.2 ±0.09
Group 4	1/5	20.00	0.2 ±0.09	0/5	0.00	0.0±0.00

Group 1 control negative
Group 2 *L.acidophilus* alone from day 1 to day 14 daily oral doses
Group 3 *C.jejuni* alone at day 7 one oral dose
Group 4 *L. acidophilus* followed by *C.jejuni* at day 7 one oral dose

Table (4) Reisolation of *L.acidophilus* and *C.jejuni* from feacal swabs at different intervals and from internal organs after scarification.

Tested Isolates	Fecal sample (day of sampling)					Mean ± SE	Internal organs (Site)					Mean ± SE
	Day 9	Day 12	Day 15	Day 18	Day 21		Liver	Kidney	Spleen	Lung	Intestine	
L.acidoplilus												
Group 1	0/5	0/5	0/5	0/5	0/5	**0.00±0.00**	0/5	0/5	0/5	0/5	0/5	**0.00±0.00**
Group 2	1/5	4/5	5/5	5/5	5/5	**0.80±0.16**	0/5	0/5	0/5	0/5	5/5	**0.20±0.04**
Group 3	0/5	0/5	0/5	0/5	0/5	**0.00±0.00**	0/5	0/5	0/5	0/5	0/5	**0.00±0.00**
Group 4	1/5	4/5	4/5	4/5	5/5	**0.72±0.14**	0/5	0/5	0/5	0/5	5/5	**0.20±0.04**
C.jejuni												
Group 1	0/5	0/5	0/5	0/5	0/5	**0.00±0.00**	0/5	0/5	0/5	0/5	0/5	**0.00±0.00**
Group 2	0/5	0/5	0/5	0/5	0/5	**0.00±0.00**	0/5	0/5	0/5	0/5	0/5	**0.00±0.00**
Group 3	2/5	4/5	5/5	5/5	4/4	**0.80±0.16**	5/5	5/5	2/5	4/5	5/5	**0.84±0.17**
Group 4	0/5	0/5	0/5	1/5	1/5	**0.08±0.02**	0/5	0/5	0/5	0/5	1/5	**0.04±0.01**

NB: Total no of each group is 5 *One animal in group 3 was found dead on the day 19 of the experiment

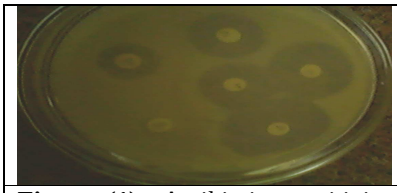
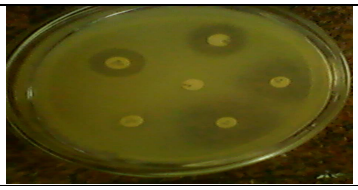
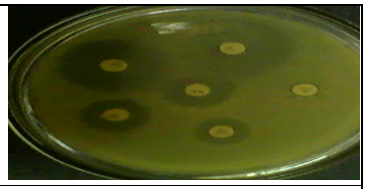
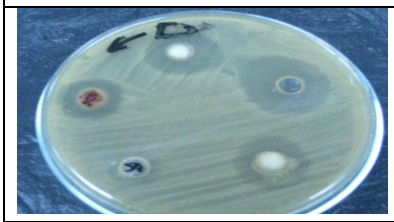
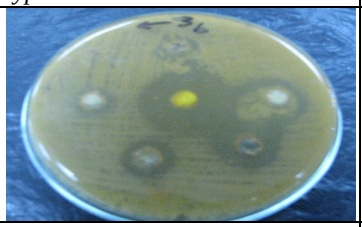
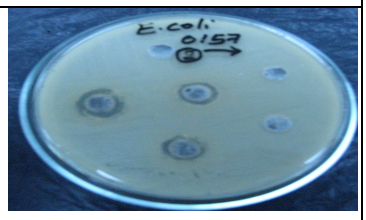
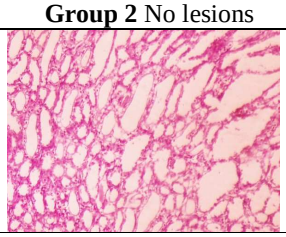
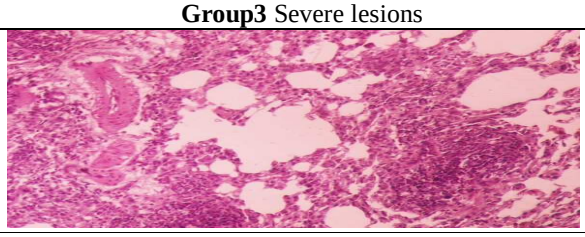
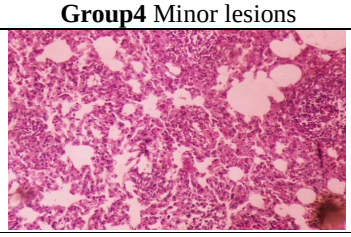
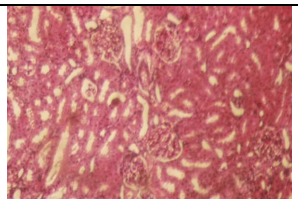
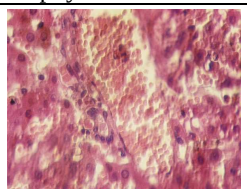
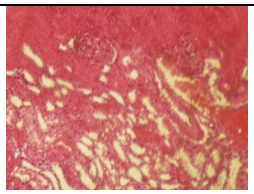
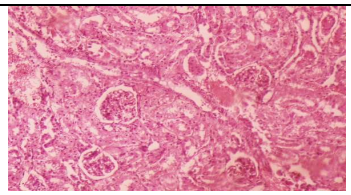
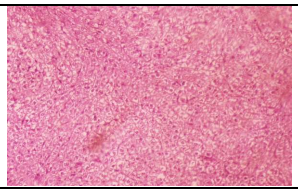
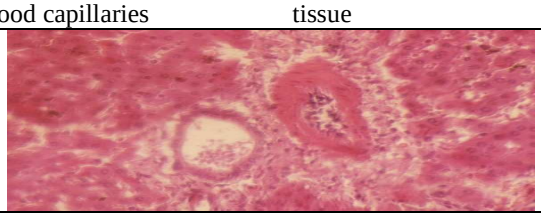
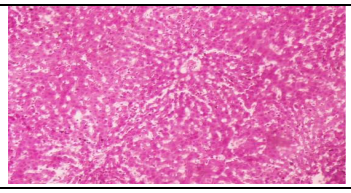
		

Figure (1): Antibiotic sensitivity test against *C.jejuni*	**Figure (2):** Antibiotic sensitivity test against *S. typhimurium*	**Figure (3):** Antibiotic sensitivity test against *E.coli* O157
		
Figure(4): Probiotic activity of *L.acidophilus* isolated from milk of different species against *C.jejuni*	**Figure(5):** Probiotic activity of *L.acidophilus* isolated from milk of different species against *S. typhimurium*	**Figure (6):** Probiotic activity of *L.acidophilus* isolated from milk of different species against *E.coli* O157

The widest zone of inhibition shown by *L. acidophilus* isolated from mare then from goat colostrums as shown in plates. The widest zone of inhibition was shown toward *C. jejuni* against *L.acidophilus* isolated from colostrums of mare.

Histopathological changes in the three treated groups

	Group 2 No lesions	**Group3** Severe lesions	**Group4** Minor lesions
Lung			
	Figure (9): lung tissue within normal limits	**Figure (7):** Granulomatus reaction in the lung tissue infiltration of inflammatory cells in the lung tissue thickening of wall of blood vessels with alveolar emphysema	**Figure (8):** Interstitial pneumonia and inflammatory cellular infiltration
Kidney		 	
	Figure (13): kidney tissue within normal limit	**Figure (10):** Congestion and hemorrhages of renal blood capillaries **Figure (11):** Coagulative necrosis of the renal tissue	**Figure (12):** Swelling and degeneration of renal epithilium
Liver			
	Figure (16): Diffused vacuolar degeneration in hepatocytes	**Figure (14):** Degeneration and necrosis of hepatocytes and proliferation of fibrous tissue	**Figure (15):** Hepatocytic degeneration with infiltration of inflammatory cells

5. Conclusions

Overall the present results indicated the ability *L.acidophilus* to survive and to colonize the digestive tract of rats during its application to increase lactic acid bacteria population and to decrease the population of *C.jejuni* in faeces and internal organs and decrease its pathogenic effect on different body organs. Moreover the applied strain did not induce any stress in group taking *L.acidophilus* only and as well no pathological lesions were found in internal organs of this group except in the liver which show diffused vacuolar degeneration in hepatocytes. Therefore *L.acidophilus* may have the potential to enhance intestinal health in Lab. animals after their applications as well as it help in their ability to overcome *C.jejuni* infection.

6. Recommendations

Researchers suggest the need of probiotic as safe method for competing food borne pathogens in poultry products to hinder the spread of food borne pathogens instead of using antibiotics which leave residues in poultry carcasses causing human consuming the animal by products to take small doses of different antibiotics and in turn develop acquired multiple drug resistance bacterial flora toward different antibiotics.

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Tracking the Invasion Pathway: Assesment of α-Diversity and Invasiveness of Alien Ornamental Plants of Srinagar(Kashmir, J&K), India

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Abstract: The valley of Kashmir is famous for its marvellous landscape which attracts tourists from all along the globe. The landscaping of this heavenly abode predominantly involves alien ornamental plants. The present study puts on record the alien ornamental flora of Srinagar Kashmir, and thus, is a first compilation of alien ornamental flora of the region. The study enlists the occurrence of 271 exotic ornamental species distributed in 187 genera, belonging to 85 families, therefore piling up the total number of alien plant species in the Kashmir Himalayas to 704. The taxonomic composition analysis of alien ornamental flora of the region revealed that dicots are represented by 223 species (82%) belonging to 151 genera and 65 families while as monocots comprised of 39 species (15%) dispersed in 28 genera and 13 families. Gymnosperms are represented by 9 species (3%), 8 genera and 7 families. Asteraceae (11.07%), Rosaceae (9.59%), Oleaceae (4.79%) are the largest families of exotic ornamental plants introduced into the Kashmir Himalayas. Out of 85 families, 42 are represented by a single genus and single species. The highest number of alien ornamental species have come from the continent Asia (31%) followed by Europe (30%) and North America (20%). The study reports the occurrence of 133 alien ornamental species for the first time from Kashmir Himalayas. Our analysis of alien species establishment and invasion is not in consonance with Williamson's tens rule and proposes that human assisted species selection, introduction and establishment change the entire dimensions of tens rule to maximum values in invasion biology. [Nature and Science 2010;8(3):79-95]. (ISSN: 1545-0740).

Key words: Exotic, alien, ornamental flora, Kashmir, Himalayas, New records

1. Introduction

Nature gave birth to life on the floor of planet Earth and then life diversified into a large number of living forms or species on the back of a long temporal continuum. The heterogeneous spatial scale of Earth fueled this diversification with high degree of rigidity, evolving an estimated millions of number of species. The continental drift stemmed isolated continents in which species evolved to the dictation of their unique physical (abiotic)-biotic environments. This resulted in specific continental biotas, stabilizing particular continental ecosystems. In addition, the continents offered huge dispersal or bio-geographical barriers limiting intercontinental species dispersal and thus lending rigidity and uniqueness to the continental biotas and evolutionary processes. This is the geological pattern of biogeography of species and communities entrenched in millions of years. The diversity of a particular continent is uniquely organized on the trophic shelf with unique species-species interaction, across trophic level energy flow and nutrient cycling. This functional or ecological organization and niche specialization of component species lend life and stability to the particular ecosystems. This is Nature's way of running and controlling life, life processes, ecosystem and ecosystem sustaining services. Any disturbance which alters this functional organization strikes at the heart of ecosystem, impairing ecosystem functioning, ecosystem stability and survival.

According to Pysek et al 2002, alien species also called exotic, introduced, non-native species are defined as plant species in a given area outside the native distributional range, whose presence is due to intentional or unintentional human involvement. The industrial development and globalization bridged huge distances between continents and countries with modern means of transportation (Jenkin 1996). This high order mobility of human beings served as a dispersing force for living species—plants, animals, insects, bacteria, viruses and other organisms nullifying and overcoming the usual bio-geographical or dispersal barriers which isolated them over millions of years (Jenkin 1996, Davis 2003). Globalization of trade, with enhanced transport, resulted in amplified intercontinental translocation of species (accidental as well as deliberate), causing homogenization or globalization of floras (Mckinney and Lockwood 1999, Drake *et al.* 1989, Olden 2006). This has greatly altered the composition of biodiversity in different ecosystems (Vitousek *et al.* 1996; Mack *et al.* 2000).

The anthropogenic facilitated dispersal exposes species to new environments. All the introduced species do not survive in the new environment (Carey 1996, Lewis and Kareiva 1993) and the niche availability proves decisive. Some species find the new environmental complex suitable for their growth and reproduction and thus get established (Williamson 1996) with 33% maximum values of establishment in case of intentional and careful introduction (Williamson and Fitter 1996). Without direct human intervention, some of these non-native species are capable of independent growth, and sustain self-replacing populations. Such plants are categorized as 'Naturalized'. According to Williamson's ten rule, 10% of these naturalized exotic species turn invasive which means that they produce reproductive offspring often in large numbers and have the potential to spread to large areas (Williamson 1996, Pysek *et al.* 2004).This group of alien species-Invasive alien species is the nuisance group with tremendous negative ecological and biological implications. In the new introduced habitat the alien species enjoy competitive advantage in the utilization of resources and release from their native range enemies- stiff competitors, pathogens, parasites, predators or herbivores and many more others (Nunez et al 2008, Theubad and Simberloff 2001; Hierro et al 2004). This advantage coupled to high fecundity and high clutch size synergistically enhances the proliferation of these alien invasive species (Bazazz 1986) which then speedily change the contours of community composition and ecosystem function (Simon and Townsend 2003, Gibbs and Wainhouse 1986, Oak 1989). This high order reproduction and proliferation of alien invasive species leave the native species in an ecologically suffocating environment with impaired growth and reproduction (Gentle and Druggin 1997, Parker et al 1999). In case of animal invasive species, this population explosion in the introduced environment explodes on their prey populations be it plant or animal causing their shrinkage and sublimation to extinction. Thus invasive species are notoriously known for extinction of species and erosion of biodiversity (Vitousek et al 1996; Olden 2006). Globally invasive species are ranked as second worst cause of species extinction and biodiversity loss (Wilcove et al. 1998, Stein et al. 2008, Richardson et al. 1989). This threat drove ecologists and biologists to seriously study all aspects of alien species biology so that the biodiversity and ecosystems services are protected from their ill effects (Allandorf and Lundquist 2003). In Kashmir Himalayas the exotic ornamental plants are deliberately introduced for varied landscaping purposes (Shabana 2009). The present study was undertaken with a view to assess the species and taxonomic diversity of these exotic ornamentals, tracing their origin or nativity, studying their rate of establishment and invasiveness since no such specific study has been undertaken till date from this region.

2. Materials and methods

2.1. Study Area

Situated in the North western extremity of India, the Jammu and Kashmir State is depicting a bewildering variety in its topography, culture, tradition, people and natural splendour. The State is bordered by Pakistan, Afghanistan and China from west to east; from south to east, the boundary of the State touches Punjab and Himachal Pradesh.

The Kashmir Valley or the Vale of Kashmir, the central part of the Jammu and Kashmir State, is a beautiful valley enclosed in a magnificent amphitheatre of mountain ranges, the Great Himalayas and the Pir Panjal. It extends between the latitudes 32°17′N to 36°58′N and longitudes 37°26′E to 80°30′E, with an average altitude of about 1650 m from the mean sea level, and an annual precipitation of about 794.7 mm. Traversed throughout by the river, the Valley is about 187 km long and 116 km wide, formed by Jhelum River (Fig. 1).

2.2. Floristic study

The ornamental flora of district Srinagar (Kashmir India) was scanned for exotic species. The specimens were collected and then identified upto the level of species and variety. Only alien species were included in the list. A species was listed as alien or exotic following Pysek et al (2002) which envisages that there is no evidence that it has any area in the subcontinent (India) where it is native. Following Pysek et al (2002), the nativity of the species was recognised at the continental level viz Asia (barring the subcontinent India), Africa, Australia, North America, South America, and Europe. The species which have been raised through hybridisation by various gardeners and nursery men have been listed as species of Garden Origin. Previous floristic reports of the occurrence of a species from the region are given and those taxa not collected and characterised till date were ranked as first reports from the region. The voucher specimen of all collected and characterised species have been deposited in KASH-Kashmir University Herbarium. The assessment of alien species establishment was carried out using all previous records of all nurseries and our own observations of a decade.

2.3. Terminology used

Introduction means importing exotic species into the region, establishment means successful survival of this species while as naturalization means ability to form self sustaining populations.

3. Results

The exotic ornamental flora of central Kashmir is represented by a total of 271 species belonging to 187 genera and 85 families. The taxonomic composition analysis of alien ornamental flora revealed that dicots are represented by 223 species (82%) belonging to 151 genera and 65 families while as monocots comprised of 39 species (15%) dispersed in 28 genera and 13 families. Gymnosperms in the region are represented by 9 species (3%), 8 genera and 7 families. Of the 85 families within which the 271 species of alien ornamental plants are distributed, 10 families account for 46.86 % (127 species) of the total alien ornamental flora. The families are, Asteraceae (11.07%), Rosaceae (9.59%), Oleaceae (4.79%), Papilionaceae (3.69%), Salicaceae (3.69%), Amaryllidaceae (3.32%), Caryophylaceae (3.32%), Liliaceae (3.32%), Amaranthaceae (2.58%), Brassicaceae (2.21%). Among 85 families, 42 families are represented by one genus with one species each. Out of these, 30 families belong to dicots, six to monocots, and six to gymnosperms. These families include Alstroemeriaceae, Araceae, Araucariaceae, Arecaceae, Balsaminaceae, Begoniaceae, Buddlejaceae, Buxaceae, Caesalpeniaceae Campanulaceae, Cannabaceae, Cannaceae, Capparidaceae, Convolvulaceae, Cornaceae, Cycadaceae, Ericaceae, Euphorbiaceae, Ginkgoaceae, Hydrophyllaceae, Juglandaceae, Lythraceae, Meliaceae, Mimosaceae, Myrtaceae, Passifloraceae, Phormiaceae, Pinaceae, Platanaceae, Poaceae, Portulaceae, Punicaceae, Rutaceae, Sapindaceae, Simaroubaceae, Tamaricaceae, Taxaceae, Taxodiaceae, Theaceae, Tropaeolaceae, Ulmaceae and Verbenaceae.

Habit analysis of the alien ornamental flora of campus revealed that herbs (134) predominated shrubs (75) and trees (62) in number. Herbaceous perennials account for 27.30% of total alien flora followed by herbaceous annuals which contribute 22.14%. The species belong to different life forms as classified below:

Table 1. **Deciduous Trees**

Species	**Family**	**Origin**	**Flowering period**	**Voucher specimen number (by Shabana & Dar)**	**Primary Published source**
Acer negundo,L.	Aceraceae	NAM	Apr-May	003	Ara et al. (1995)
Acer palmatum,Thunb. var Atropurpureum	Aceraceae	AS	Apr	004	**FR**
Ailanthus altissima,Swingle	Simaroubaceae	AS	Jun	111	Ara et al. (1995)
Albizia julibrissin, Durazz var. Rosea	Mimosaceae	AS	Jun-Jul	001	Ara et al. (1995)
Castanea sativa,Mill.	Fagaceae	EU;AS;AF	Jun-Jul	041	Dar et al. (2002)
Catalpa bignonioides, Scop.	Bignoniaceae	NAM	May-Jun	175	Ara et al. (1995)
Celtis australis,L.	Ulmaceae	EU;AS	Mar-May	009	Ara et al. (1995)
Cercis siliquastrum,L.	Papilionaceae	EU;AS	Apr-May	151	Singh & Misri (1974)
Crataegus laevigata	Rosaceae	EU;AS;AF	Apr-May	005	**FR**
Cydonia oblonga, Mill.	Rosaceae	AS	Apr	073	Dar et al. (2002)
Ficus carica,L.	Moraceae	EU	May-Jul	211	Dar et al. (2002)
Fraxinus excelsior,L.	Oleaceae	EU;AS	Apr	002	Stewart (1972)
Fraxinus americana,L.	Oleaceae	NAM	Apr	186	**FR**
Ginkgo biloba, L.	Ginkgoaceae	AS	Apr	150	Javeid (1964)
Gleditsia tricanthos,L.	Caesalpiniaceae	NAM	May-Jun	121	**FR**
Juglans regia,L.	Juglandaceae	AS	Mar-Apr	248	Ara et al. (1995)

Koelreuteria paniculata,Laxm.	Sapindaceae	AS	Jul	006	Singh & Misri (1974)
Laburnum anagyroides, Medic.	Papilionaceae	EU	Apr	123	Ara et al. (1995)
Lagerstroemia indica,L.	Lythraceae	AS	Jul-Aug	011	Ara et al. (1995)
Magnolia kobus, DC.	Magnoliaceae	AS	Apr-May	033	Ara et al. (1995)
Magnolia liliflora, Desr.	Magnoliaceae	AS	Apr-May	063	Ara et al. (1995)
Magnolia x *soulangiana*,Soul.	Magnoliaceae	GO	Apr-May	100	**FR**
Malus domestica, Borkh.	Rosaceae	EU;AS	Apr	176	Dar et al.
Melia azedarach, L.	Meliaceae	AS	May	152	Ara et al. (1995)
Morus alba, L.	Moraceae	AS	Apr	200	Dar et al. (2002)
Morus nigra, L.	Moraceae	AS	Apr	007	Dar et al. (2002)
Platanus orientalis,L.	Platanaceae	EU;AS	Apr	162	Stewart (1972)
Populus alba,L.	Salicaceae	EU;AS;AF	Mar-Apr	024	Javeid (1972)
Populus balsamifera,	Salicaceae	NAM	Mar-Apr	026	Stewart (1972)
Populus deltoides, Marsh	Salicaceae	NAM	Mar-Apr	025	Ara et al. (1995)
Populus nigra,L.	Salicaceae	EU;AS;AF	Mar-Apr	031	Ara et al. (1995)
Prunus amygdalus, Batsch.	Rosaceae	AS;AF	Mar	101	Dar et al. (2002)
Prunus armeniaca,L.	Rosaceae	AS	Mar	122	Dar et al. (2002)
Prunus avium,L.	Rosaceae	EU;AS;AF	Mar	225	Dar et al. (2002)
Prunus cerasus,L.	Rosaceae	EU;AS	Apr	112	Dar et al. (2002)
Prunus cerasifera,Ehrh.	Rosaceae	EU;AS	Apr	042	Stewart (1972)
Prunus cerasifera var issardi	Rosaceae	EU;AS	Apr	074	**FR**
Prunus cerasifera var Rosea	Rosaceae	EU;AS	Apr	043	**FR**
Prunus persica,Batsch.	Rosaceae	AS	Apr	102	Dar et al. (2002)
Punica granatum,L.	Punicaceae	EU	May-Aug		
Pyrus communis,L.	Rosaceae	EU;AS	Apr	032	Dar et al. (2002)
Pyrus pashia, Ham.ex DC.	Rosaceae	AS	Apr	008	Ara et al. (1995)
Quercus robur,L.	Fagaceae	EU	Apr	023	Singh & Kachroo (1976)
Robinia pseudoacacia,L.	Papilionaceae	NAM	May	124	Stewart (1972)
Salix alba,L.	Salicaceae	EU;ASAF	Mar-Apr	013	Javeid (1972)
Salix aegyptica,	Salicaceae	EU;AS	Mar-Apr	015	Ara et al. (1995)
Salix bablyonica,L.	Salicaceae	AS	Mar-Apr	018	Javeid (1972)
Salix caprea,L.	Salicaceae	EU;AS	Feb-Mar	017	**FR**
Salix fragilis,L.	Salicaceae	EU	Mar-Apr	019	Ara et al. (1995)
Salix matsudana,Koidz. var	Salicaceae	AS	Apr	014	**FR**

Tortuosa, Hort.					
Sophora japonica,L.	Papilionaceae	AS	Aug	016	Stewart (1972)
Sophora japonica,L. var Pendula	Papilionaceae	AS	Aug	113	**FR**
Tamarix parviflora,,DC.	Tamaricaceae	EU	Apr	010	Singh & Misri (1974)

Table 2. **Evergreen Trees**

Species	**Family**	**Origin**	**Flowering period**	**Voucher specimen number (by Shabana & Dar)**	**Primary Published source**
Cupressus macrocarpa, Hartw. var *Cashmeriana*	Cupressaceae	NAM	Feb-Apr	034	**FR**
Cupressus sempervirens, L.	Cupressaceae	EU;AS	Feb-Apr	021	Ara et al. (1995)
Cryptomeria japonica D.Don	Taxodiaceae	AS	Feb-Mar	161	Dar et al. (2002)
Eriobotrya japonica, Lindl.	Rosaceae	AS	Oct-Dec	027	Dar et al. (2002)
Magnolia grandiflora, L	Magnoliaceae	NAM	Jun-Jul	022	Ara et al. (1995)
Olea europaea,L.	Oleaceae	EU	-	259	Stewart (1972)
Pinus halepensis,Mill.	Pinaceae	EU;AS	Jul-Aug	118	Ara et al. (1995)
Taxus baccatta, L.	Taxaceae	EU;AF; NAM	Sept-Oct	177	Dar (2004)
Thuja orientalis,L.	Cupressaceae	AS	Feb-Apr	020	Ara et al. (1995)

Table 3. **Deciduous Shrubs**

Species	**Family**	**Origin**	**Flowering period**	**Voucher specimen number (by Shabana & Dar)**	**Primary Published source**
Hydrangea arborescens,L.	Hydrangeaceae	NAM	Jun-Jul	115	**FR**
Hydrangea macrophylla, Ser.	Hydrangeaceae	AS	Jun-Jul	226	**FR**
Jasminum nudiflorum, Lindl.	Oleaceae	AS	Mar-Apr	029	**FR**
Kerria japonica, DC.	Rosaceae	AS	Apr	215	Ara et al. (1995)
Paeonia suffruticosa, Andr.	Paeoniaceae	AS	Apr-May	160	Ara et al. (1995)
Philadelphus coronarius, L.	Philadelphaceae	EU	May-Jun	213	**FR**
Abutilon x hybridum, Voss.	Malvaceae	GO	May-Jun	133	**FR**
Philadelphus incanus, Koehne.	Philadelphaceae	NAM	May-Jun	136	Ara et al. (1995)
Azalea hybrids	Ericaceae	GO	May	260	**FR**
Amorpha fruticosa, L.	Papilionaceae	NAM	May-Jun	028	Ara et al. (1995)
Rosa x damascena; Mill.	Rosaceae	GO	May	224	Ara et al. (1995)
Berberis thunbergii, DC.	Berberidaceae	AS	Apr	258	**FR**
Rosa cultivars	Rosaceae	GO	May	061	**FR**
Buddleja davidii,Franch.	Buddlejaceae	AS	Jun-Aug	056	Ara et al. (1995)
Sambucus nigra,L.	Caprifoliaceae	EU;AS	May-Jun	235	Ara et al. (1995)
Chaenomeles lagenaria, Koidz.	Rosaceae	AS	Mar-Apr	039	Ara et al. (1995)
Solanum capsicastrum,Link.	Solanaceae	SAM	May	125	**FR**
Spartium junceum,L.	Papilionaceae	EU;AF	May-Jun	040	Ara et al. (1995)
Forsythia x intermedia, Zabel	Oleaceae	GO	Mar-Apr	075	**FR**
Fuschia hybrida, Voss.	Onagraceae	GO	Apr-Jun	264	**FR**
Spiraea japonica,L.	Rosaceae	AS	Jun	178	**FR**
Hibiscus syriacus, L.	Malvaceae	AS	Jun-Aug	201	Ara et al. (1995)
Spiraea prunifolia, Sieb. &	Rosaceae	AS	Apr-May	230	Ara et al. (1995)

Zucc.					(1995)
Spiraea x *Vanhouttei*,Zabel.	Rosaceae	GO	Apr-May	057	**FR**
Syringa x *laciniata*,Mill.	Oleaceae	GO	Apr	088	Ara et al. (1995)
Syringa persica,L.	Oleaceae	GO	Apr	249	Ara et al. (1995)
Syringa vulgaris,L.	Oleaceae	EU	Apr	174	Ara et al. (1995)
Viburnum opulus,L. var. Roseum	Caprifoliaceae	EU;AS; AF	Apr-May	212	Ara et al. (1995)
Weigela florida,DC.	Caprifoliaceae	AS	Apr-May	030	Ara et al. (1995)

Table 4. **Evergreen Shrubs**

Species	**Family**	**Origin**	**Flowering period**	**Voucher specimen number (by Shabana & Dar)**	**Primary Published source**
Abelia x *grandiflora*, Rehd.	Caprifoliaceae	GO	Jun	247	**FR**
Aucuba japonica var Variegata	Cornaceae	AS	May	185	**FR**
Araucaria heterophylla, (Salisb.) Franco.	Araucariaceae	SAM;AUS	-	262	**FR**
Buxus sempervirens, Hook.	Buxaceae	EU;AS;AF	Mar-Apr	099	Ara et al. (1995)
Camelia japonica,L.	Theaceae	AS	Mar-Apr	202	**FR**
Chamaerops humilis,L.	Arecaceae	EU	-	103	**FR**
Citrus sinenesis,Osbeck	Rutaceae	AS	May-Jun	272	Stewart **(**1972**)**
Cycas revoluta,Thunb.	Cycadaceae	AS	-	261	**FR**
Euonymous japonicus, Thunb.	Celastraceae	AS	Jun-Jul	035	Ara et al. (1995)
Fatsia japonica,Decne.	Araliaceae	AS	Oct-Nov	117	Ara et al. (1995)
Ligustrum japonicum, Thunb.	Oleaceae	AS	Jun-Jul	054	**FR**
Ligustrum lucidum,Ait.	Oleaceae	AS	Jun-Jul	037	Ara et al.(1995)
Ligustrum ovalifolium, Hassk.	Oleaceae	AS	Jun	179	Ara et al. (1995)
Ligustrum vulgare,L.	Oleaceae	EU;AS; AF	Jun	060	Ara et al. (1995)
Mahonia aquifolium,Nutt.	Berberidaceae	NAM	Mar-Apr	227	**FR**
Myrtus communis,L.	Myrtaceae	EU	Jul-Sept	012	**FR**
Nerium indicum,Mill.	Apocynaceae	EU	Jun-Jul	153	Ara et al. (1995)
Schefflera actinophylla,	Araliaceae	AUS		214	**FR**
Yucca aliofolia, L.	Agavaceae	NAM	Jun-Jul	071	Ara et al. (1995)
Yucca gloriosa,L.	Agavaceae	NAM	May-Sept	036	**FR**

Table 5. **Deciduous Woody Vines**

Species	Family	Origin	Flowering period	Voucher specimen number (by Shabana & Dar)	Primary Published source
Campsis grandiflora,Loisel.	Bignoniaceae	AS	Jun-Aug	116	Ara et al. (1995)
Campsis radicans,Seem.	Bignoniaceae	NAM	Jun-Aug	045	Ara et al. (1995)
Celastrus paniculatus, Willd.	Celastraceae	AUS;NAM	May	180	**FR**
Parthenocissus quinquefolia, Planch.	Vitaceae	NAM	May-Jun	062	Ara et al. (1995)
Parthenocissus tricuspidata, Planch.	Vitaceae	AS	Jun-Jul	204	Ara et al. (1995)
Rosa banksiae, R.Br	Rosaceae	AS	May	087	Ara et al. (1995)
Rosa multiflora,Thunb.	Rosaceae	AS	May	110	
Vitis vinifera,L.	Vitaceae	EU;AS	May	159	Stewart (1972)
Wisteria sinensis,Sims.	Papilionaceae	AS	Apr-May	218	Ara et al. (1995)
Wisteria sinensis,Sims. var Alba, Bailey	Papilionaceae	AS	Apr-May	038	Ara et al. (1995)

Table 6. **Evergreen Woody Vines**

Species	Family	Origin	Flowering period	Voucher specimen number (by Shabana & Dar)	Primary Published source
Hedera canariensis,Willd.	Araliaceae	EU	Sept-Oct	104	**FR**
Hedera helix,L.	Araliaceae	EU	Sept-Oct	098	Stewart (1972)
Hedera helix,L. var 'hibernica',Jaeg.	Araliaceae	EU	Sept-Oct	149	**FR**
Lonicera japonica,Thunb.	Caprifoliaceae	AS	May-Jun	044	Ara et al. (1995)
Lonicera nitida,Wils.	Caprifoliaceae	AS	Apr	126	**FR**
Passiflora caerulea,L.	Passifloraceae	SAM	Jun-Jul	058	**FR**

Table 7. Ground Covers (Deciduous Shrubs)

Species	Family	Origin	Flowering period	Voucher specimen number (by Shabana & Dar)	Primary Published source
*Rosa rugosa,*Thunb.	Rosaceae	EU;AS	May-Jul	119	**FR**
Rosa foetida,Herm.	Rosaceae	AS	May-Jul	092	Ara et al. (1995)

Table 8. Ground covers (Evergreen Shrubs)

Species	Family	Origin	Flowering period	Voucher specimen number (by Shabana & Dar)	Primary Published source
Agave americana,L.	Agavaceae	NAM		047	**FR**
Lavandula angustifolia	Lamiaceae	EU	Jun-Jul	072	**FR**
Phormium tenax,Forst.	Phormiaceae	AUS		065	**FR**
Rosmarinus officinalis,L.	Lamiaceae	EU	Mar-Apr	109	Khuroo et al. (2007)
Ruscus aculeatus,L.	Ruscaceae	EU;AF	Mar-Apr	085	**FR**
Ruscus hypoglossum,L.	Ruscaceae	EU	Mar-Apr	086	**FR**
Santolina chamaecyparissus,L.	Asteraceae	EU	Jun-Jul	127	**FR**
Vinca major,L.	Apocynaceae	EU	Apr-Jun	046	Reshi (1984)
Vinca major,L. var 'variegata', Loud	Apocynaceae	EU	Apr-Jun	273	**FR**

Table 9. **Bulbous Perennials**

Species	Family	Origin	Flowering period	Voucher specimen number (by Shabana & Dar)	Primary Published source
Alstroemeria ligtu, L	Alstroemeriaceae	NAM	Apr-Oct	246	**FR**
Amaryllis belladonna,L.	Amaryllidaceae	AF	Aug-Sept	097	**FR**
Anemone coronaria,L.	Ranunculaceae	EU	Mar-Apr	136	**FR**
Asparagus officinalis,L.	Liliaceae	EU;AS; AF	May	187	Kaul (1963)
Canna indica,L. and cultivars	Cannaceae	NAM	Jul-Sept	051	**FR**
Crinum x *powellii*, Hort. ex Baker	Amaryllidaceae	GO	May-Jun	158	**FR**
Crocus sativus,L.	Iridaceae	AS	Oct-Nov	181	Dar et al. (2002)
Cyclamen persicum, Mill.	Primulaceae	EU;AF	Aug-Nov	120	**FR**
Dahlia sp.	Asteraceae	NAM	Jul-Aug	216	-
Gladiolus cultivars	Iridaceae	GO	Jul-Sept	155	-
Helleborus hybridus,	Ranunculaceae	EU	Feb-Mar	173	**FR**

Hemerocallis fulva,L.	Liliaceae	EU	Jun-Jul	210	Stewart (1972)
Hippeastrum sp.	Amaryllidaceae	NAM	Jul-Sept	228	**FR**
Hosta plantaginea,Asch.	Liliaceae	AS	Jul-Sept	091	**FR**
Hosta ventricosa,Stearn.	Liliaceae	AS	Jul-Sept	223	**FR**
Hyacinthus orientalis,L.	Hyacinthaceae	EU;AS	Mar-Apr	203	Stewart (1972)
Iris ensata,Thunb.	Iridaceae	AS	Apr-May	084	Reshi (1984)
Iris germanica,L.	Iridaceae	EU	Apr-May	215	Kaul (1986)
Iris reticulata, M.Beib.	Iridaceae	EU	Mar	105	Stewart (1972)
Kniphofia uvaria,Hook.	Liliaceae	AF	Jun-Oct	154	**FR**
Lilium regale,Wils.	Liliaceae	AS	Jun-Jul	143	**FR**
Lilium auratum, Lindl.	Liliaceae	AS	Jun-Jul	270	**FR**
Muscari botryoides,Mill.	Hyacinthaceae	EU	Mar-Apr	209	**FR**
Narcissus poeticus,L	Amaryllidaceae	EU	Mar-Apr	066	**FR**
Narcissus pseudonarcissus,L.	Amaryllidaceae	EU	Mar-May	243	Stewart (1972)
Narcissus tazetta,L.	Amaryllidaceae	EU	Feb-Mar	135	Stewart (1972)
Narcissus cultivars	Amaryllidaceae	GO	Feb-May	229	-
Nerine x bowdenii,Wats.	Amaryllidaceae	AF	Sept	108	**FR**
Ornithogallum umbellatum,L.	Liliaceae	EU;AS; AF	Mar-Apr	222	**FR**
Paeonia lactiflora, Pall.	Paeoniaceae	AS	May	271	**FR**
Ranunculus asiaticus,L.	Ranunculaceae	EU;AS; AF	Apr-May	157	Khuroo et al.(2007)
Sternbergia lutea, Roem. & Schult.	Amaryllidaceae	EU;AS	Feb-Mar	059	**FR**
Tulipa cultivars	Liliaceae	EU;AS	Apr-May	182	-
Tradescantia pallida,Hunt. 'Purpurea'	Commelinaceae	NAM	May	148	**FR**
Tradescantia virginiana, L.	Commelinaceae	NAM	May	205	**FR**
Tradescantia sillamontana, Matuda	Commelinaceae	NAM	May	095	**FR**
Zantedeschia aethiopia, Spreng.	Araceae	AF	Apr-Jun	197	Stewart (1972)

Table 10. **Non bulbous Perennials**

Species	**Family**	**Origin**	**Flowering period**	**Voucher specimen number (by Shabana & Dar)**	**Primary Published source**
Alcea officinalis,L.	Malvaceae	AS	Jun-Aug	076	Naqshi et al. (1988)
Alcea rosea, Cav.	Malvaceae	AS	Jun-Aug	144	Naqshi et al. (1988)
Anchusa azurea, Mill.	Boraginaceae	EU;AS; AF	Mar-May	172	**FR**
Aquilegia alpina,L.	Ranunculaceae	EU	May-Jun	137	**FR**
Aquilegia caerulea, James.	Ranunculaceae	NAM	May-Jun	096	**FR**
Aquilegia vulgaris,L.	Ranunculaceae	EU	May-Jun	188	**FR**

Arundo donex,L.	Poaceae	EU	Aug-Sept	265	Stewart (1972)
Begonia semperflorens, Link & Otto.	Begoniaceae	SAM	Jun-Oct	081	**FR**
Bellis perennis,L.	Asteraceae	EU;AS	Apr-Jul	134	Kaul (1986)
Campanula medium,L.	Campanulaceae	EU	May-Jun	255	**FR**
Chrysanthemum coccineum, Willd.	Asteraceae	EU	May-Sept	093	**FR**
Coreopsis grandiflora, Hogg.	Asteraceae	NAM	May-Jul	183	**FR**
Coreopsis verticillata,L.	Asteraceae	NAM	May-Jul	155	**FR**
Dianthus caryophyllus,L.	Caryophyllaceae	EU	Jun-Aug	053	Stewart (1972)
Cheiranthus cheiri,L.	Brassicaceae	EU	Mar-May	080	Stewart (1972)
Euphorbia schillingii, *Radcl.*	Euphorbiaceae	AS	Apr	253	
Gaillardia aristata,Pursh.	Asteraceae	NAM	May-Jul	166	Stewart (1972)
Gaillardia pulchella,Foug.	Asteraceae	NAM	Jun-Oct	240	**FR**
Gazania hybrida,	Asteraceae	AF	May-Jun	131	**FR**
Geranium rotundifolium,L.	Geraniaceae	EU;AS	May	219	Kaul (1986)
Gerbera jamesonii, Bolus.	Asteraceae	AF	May-Oct	171	**FR**
Humulus lupulus,L.	Cannabaceae	EU;AS	Aug-Sept	167	Dar et.al. (2002)
Kalanchoe blossfeldiana, Poellnitz.	Crassulaceae	EU	Jun	266	**FR**
Lunaria annua, L.	Brassicaceae	EU	May-Jun	206	**FR**
Lupinus hartwegii,Lindl.	Papilionaceae	NAM	May-Jun	142	**FR**
Lychnis coronaria, Desr.	Caryophyllaceae	EU	May-Jun	267	Reshi **(**1984**)**
Matthiola incana,R. Br.	Brassicaceae	EU	Apr-May	254	Stewart (1972)
Pelargonium x hortorum, Bailey.	Geraniaceae	AF	May-Oct	245	**FR**
Pelargonium x fragrans, Willd.	Geraniaceae	AF	May-Oct	090	**FR**
Pelargonium peltatum, Ait.	Geraniaceae	AF	May-Oct	232	**FR**
Pelargonium x zonale,Ait	Geraniaceae	AF	May-Oct	184	Stewart (1972)
Phlox paniculata,L.	Polemoniaceae	NAM	Jun-Aug	268	**FR**
Physalis alkekengi,L.	Solanaceae	EU;AS	May	198	**FR**
Primula (Polyantha cultivars)	Primulaceae	EU	Mar-Apr	170	**FR**
Primula (Primrose cultivars)	Primulaceae	EU;AS	Mar-Apr	193	**FR**
Rudbeckia hirta,L.	Asteraceae	NAM	Jun-Aug	129	**FR**
Sedum clavatum,Clausen.	Crassulaceae	NAM	Jul-Sept	269	**FR**
Senecio bicolour,Viv.	Asteraceae	EU	Jul-Sept	257	**FR**
Solidago canadensis,L.	Asteraceae	NAM	Jul-Aug	048	**FR**

Table 11. **Annuals/ Seasonals**

Species	**Family**	**Origin**	**Flowering**	**Voucher**	**Primary**

			period	specimen number (by Shabana & Dar)	Published source
Aegeratum haustonianum, Mill.	Asteraceae	NAM;SAM	Jul-Sept	145	**FR**
Alyssum maritimum,Lam.	Brassicaceae	EU	Apr-May	050	**FR**
Amaranthus caudatus,L.	Amaranthaceae	NAM	Jul-Oct	233	Reshi (1984)
Amaranthus creuntus,L.	Amaranthaceae	NAM;SAM	Jul-Oct	128	Stewart (1972)
Amaranthus hypochondriacus, Rob.	Amaranthaceae	NAM	Jul-Oct	237	**FR**
Amaranthus tricolour, L.	Amaranthaceae	AS	Jul-Oct	077	Stewart (1972)
Antirrhinum majus,L.	Scrophulariaceae	EU	May-Jul	169	Stewart (1972)
Calendula officinalis,L.	Asteraceae	EU	Apr-Jun	194	Stewart (1972)
Callistephus chinensis,Cass.	Asteraceae	AS	Aug-Oct	061	**FR**
Capsicum annum,L. var Conoides, Bailey.	Solanaceae	NAM;SAM	Aug-Oct	079	**FR**
Celosia argentea-cristata, Kuntze.	Amaranthaceae	AS	Jul-Oct	241	**FR**
Celosia argentea-plumosa, Hort.	Amaranthaceae	AS	Jul-Oct	217	**FR**
Chrysanthemum carinatum ,L.	Asteraceae	AS	May-Sept	190	**FR**
Centaurea cyanus,L.	Asteraceae	EU	May	132	**FR**
Centaurea moschata,L.	Asteraceae	EU	May	234	**FR**
Clarkia pulchella,Pursh.	Onagraceae	NAM;SAM	May-Jun	107	**FR**
Cleome spinosa,L.	Capparidaceae	NAM	Aug-Sept	083	**FR**
Coleus blumei,Benth.	Lamiaceae	AS;AF; AUS	Jun-Jul	251	**FR**
Coreopsis tinctoria,Nutt.	Asteraceae	NAM	May-Jun	199	**FR**
Cosmos bipinnatus,Cav.	Asteraceae	NAM	Jul-Oct	078	**FR**
Delphinium ajacis,L.	Ranunculaceae	EU	May-Jun	238	Stewart (1972)
Dianthus barbatus,L.	Caryophyllaceae	EU;AS	May-Jun	141	Stewart (1972)
Dianthus chinensis,L.	Caryophyllaceae	EU;AS	May-Jun	069	**FR**
Dianthus deltoides,L.	Caryophyllaceae	EU;AS	May-Jun	106	**FR**
Dianthus plumaris,L.	Caryophyllaceae	EU	Jun-Aug	236	**FR**
Eschscholtzia californica, Cham	Papaveraceae	NAM	Mar-May	049	Stewart (1972)
Godetia amonea,Den.	Onagraceae	NAM	May-Jun	208	Khuroo et al. (2007)
Gomphrena globosa,L.	Amaranthaceae	SAM	Jul-Oct	139	Stewart (1972)
Gypsophila elegans,Bieb.	Caryophyllaceae	EU;AS	May-Jun	256	**FR**
Helianthus annuus,L.	Asteraceae	NAM	Jul-Sept	147	Stewart (1972)
Helianthus multiflorus,L.	Asteraceae	GO	Jul-Sept	231	**FR**
Helichrysum bracteatum,Andr.	Asteraceae	AUS	May-Oct	192	**FR**
Iberis amara,L.	Brassicaceae	EU	Mar-May	165	Stewart (1972)
Iberis umbellata,L.	Brassicaceae	EU	Mar-May	220	**FR**
Impatiens balsamina,L.	Balsaminaceae	AS	Jul-Sept	163	Stewart (1972)
Ipomoea purpurea,Lam	Convolvulaceae	NAM	Jun-Jul	263	Reshi (1984)
Linaria bipartita,Willd.	Scrophulariaceae	AF	Apr-May	250	**FR**
Linaria macroccana,Hook.	Scrophulariaceae	AF	Apr-May	138	**FR**
Myosotis sylvatica,Hoffm.	Boraginaceae	EU	Mar-Apr	156	**FR**
Nemophila	Hydrophyllaceae	NAM	Jun-Aug	089	**FR**

maculata,Benth.					
Papaver nudicaule,L.	Papaveraceae	EU	May	239	**FR**
Papaver rhoeas,L.	Papaveraceae	EU;AF	May	164	Kaul (1986)
Petunia hybrida,Vilm.	Solanaceae	SAM	Jun-Nov	195	Khuroo et al. (2007)
Phlox drummondii,Hook.	Polemoniaceae	NAM	May-Jul	244	Stewart (1972)
Portulaca grandiflora,Hook.	Portulaceae	SAM	Jul-Sept	094	**FR**
Salvia horminum,L.	Lamiaceae	EU	May	221	**FR**
Salvia splendens,Sello.	Lamiaceae	SAM	Jul-Oct	146	**FR**
Saponeria ocymoides,L.	Caryophyllaceae	EU	Apr-Jun	196	**FR**
Silene schafta,Gmel.	Caryophyllaceae	EU	May	067	Stewart (1972)
Tagetes erecta,L.	Asteraceae	NAM	Jul-Nov	133	Stewart (1972)
Tagetes patula,L.	Asteraceae	NAM	Jul-Nov	207	Stewart (1972)
Tagetes tenuifolia,Cav.	Asteraceae	NAM	Jul-Oct	082	**FR**
Tropaeolum majus,L.	Tropaeolaceae	NAM	Jun-Oct	242	**FR**
Verbena x *hybrida*,Voss.	Verbenaceae	SAM	Jul-Nov	191	**FR**
Viola tricolour,L.var 'hortensis' DC.	Violaceae	EU;AS	Mar-May	068	**FR**
Viola x *wittrockiana* Gams.	Violaceae	EU	Mar-May	189	**FR**
Zinnia angustifolia, HBK.	Asteraceae	NAM	Jul-Oct	140	**FR**
Zinnia elegans,Jacq.	Asteraceae	NAM	Jul-Oct	168	Stewart (1972)
Zinnia a. haagaena, Regel.	Asteraceae	NAM	Jul-Oct	052	**FR**

Abbreviations

AS	Asia	**AF**	Africa
AUS	Australia	**EU**	Europe
NAM	North America	**SAM**	South America
GO	Garden Origin	**FR**	First Report

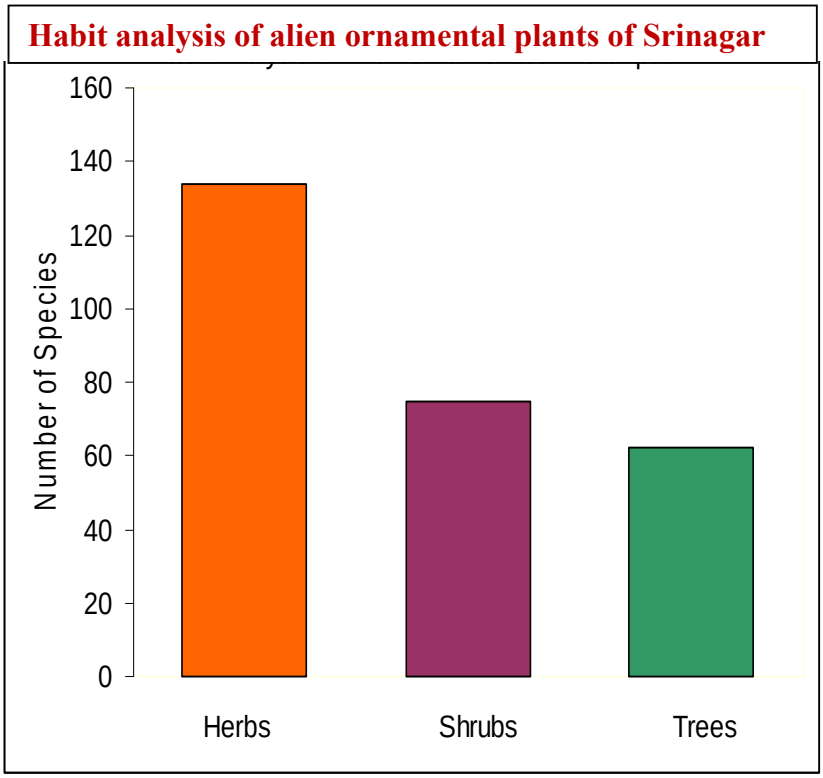

Figure 1

Figure 2

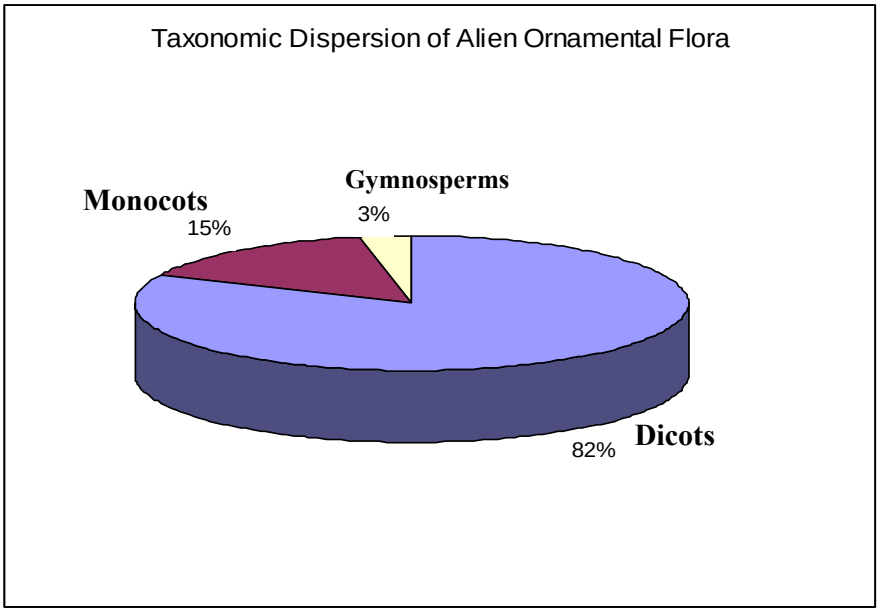

Figure 3

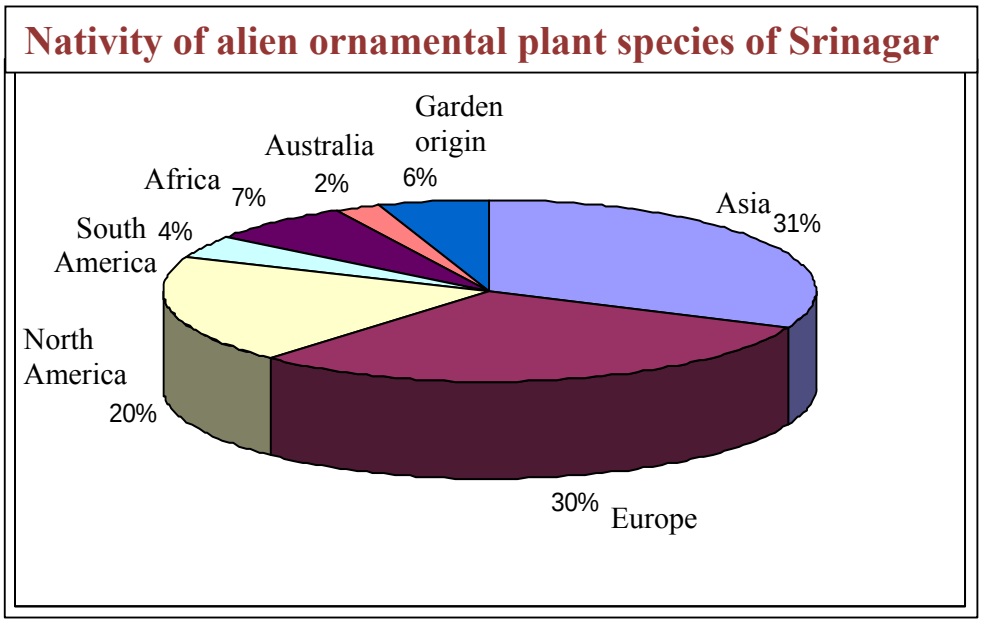

Table 12. Distribution of alien ornamental plant species into various life forms

1. Deciduous trees	53
2. Evergreen trees	09
3. Deciduous shrubs	29
4. Evergreen shrubs	20
5. Deciduous woody vines	10
6. Evergreen woody vines	06
7. Ground covers (deciduous shrubs)	02
8. Ground covers (evergreen shrubs)	08
9. Bulbous perennials	35
10. Non-bulbous perennials	39
11. Annuals/ seasonals	60

Table 13. Top ten families of alien ornamental species

S.No	Family	Number of species	Percentage of species
1	Asteraceae	30	11.07
2	Rosaceae	25	9.59
3	Oleaceae	12	4.42
4	Papilionaceae	10	3.69
5	Salicaceae	10	3.69
6	Amaryllidaceae	09	3.32
7	Caryophyllaceae	09	3.32
8	Liliaceae	09	3.32
9	Amaranthaceae	07	2.58
10	Brassicaceae	06	2.21

Top 10 families contribute 127 species with percentage of 46.86% by proportion. 42 families are represented by one genus with one species each. out of these, 30 families belong to dicots, six to monocots, and six to gymnosperms.These families include Alstroemeriaceae, Araceae, Araucariaceae, Arecaceae, Balsaminaceae, Begoniaceae, Buddlejaceae, Buxaceae, Caesalpeniaceae Campanulaceae, Cannabaceae, Cannaceae, Capparidaceae, Convolvulaceae, Cornaceae, Cycadaceae, Ericaceae, Euphorbiaceae, Ginkgoaceae, Hydrophyllaceae, Juglandaceae, Lythraceae, Meliaceae, Mimosaceae, Myrtaceae, Passifloraceae, Phormiaceae, Pinaceae, Platanaceae, Poaceae, Portulaceae, Punicaceae, Rutaceae, Sapindaceae, Simaroubaceae, Tamaricaceae, Taxaceae, Taxodiaceae, Theaceae, Tropaeolaceae, Ulmaceae, Verbenaceae. The largest genera are *Prunus* with 8 species, *Salix* and *Rosa* with 6 species each, *Dianthus* with 5 species, and *Amaranthus*, *Ligustrum*, *Magnolia*, *Pelargonium*, and *Populus* with 4 species each.

4. Discussion

The exotic species are continuously introduced into the valley for varied purposes (Ara *et al.* 1995, Dar *et al*. 1995, Khuroo *et al*. 2007) with the region hosting almost 704 alien plant species. The ornamental exotic plants are deliberately introduced for landscaping gardens, houses, parks, hospitals, public places, Hospitals and other institutions besides floriculture industry. The present assessment of ornamental plant diversity unravels ornamental horticulture as the major pathway of alien species introduction into the region. The rate of exotic species establishment and naturalization is much higher in Kashmir than depicted by Williamson's 10% rule (Williamson 1996). Our time series analysis revealed that almost 80% of exotic ornamental plant species introduced in the valley established nicely with almost 50% naturalizing in quick succession. The proportion of invasive and potential invasive species is alarmingly high and significantly deviating from Williamson's 10% law. This high proportion of alien invasive species is attributed to the high degree of disturbance, less diversity, availability of barren wastelands in the region and above all niche conservatism based human selection and introduction of alien species. The exotic species with simulating niches or niche conservatism find it easy to establish and naturalise thus enhancing values of establishment and invasion. The establishment of few individuals of an exotic species encourage the private and government agencies related to floriculture to traffic more propagules into the region, thus enhancing the propagule pressure to the maximum limits. The high rate of exotic species establishment in the valley confirms the fact that temperate biomes and ecosystems are prone to biological invasions than tropical ecosystems as proposed by Elton (1958). The tropical ecosystems harbour highest diversity which lends stability to these ecosystems. The high stability ecosystems resist invasion than less stable ones that are less diverse like temperate ecosystems (Kennedy et al 2002, Milbau and Nijs 2004). The high rate of establishment and naturalisation in this temperate pocket can also be attributed to possible richness of vacant niches. Our study does not conform to Williamsons tens law and suggests that human assistance of selection, introduction and establishment of exotic species change the contour of tens law to multiple folds ahead. The exotic flora of the valley is changing the composition, and altering structure and function of this valuable ecosystem. The invasive species are eroding the genetic diversity of the region and are posing threat to the biodiversity. The alien invasive species are penetrating deep into the forests of this region thus threatening their survival and sustenance. Cronon (1983) and Oak (1998) held the same concern for the forests of North America, which have been exposed to peak introductions of invasive organisms. The alien species driven forest damage can manifest in climate change which can drive major changes in socio-economic and other life attributes in the region, as predicted by Ehrlich and Mooney (1983) for invaders which alter the host ecosystem goods and services. The state is having an agriculture based economy which is under a considerable threat of invasive species as globally invasive species are known to have staggering economic and environmental costs (Pimentel et al 2000). Tracing the origin of these alien ornamental species, the introduction pathways radiate from almost all continents and converge into Kashmir which is housing about 704 species of alien plants. Most of the alien ornamental species in the region owe their origin to Asia (31%) followed by Europe (30%), America (24%) and Africa (7%). This depicts that ornamental horticulture is truly a major pathway of alien species introduction into Kashmir Himalayas. Smith and Silva (2004) and Wu et al (2004, a, b) also view ornamental horticulture as a major pathway of exotic species introduction. Among the 271 species of alien ornamental species explored and documented from the region, 133 are reported for the first time from the region (Table1-9). The present study will surely serve as a data base of alien ornamental flora of the region with wide economic and ecological implications. It also brings fore the potential of anthropogenic interferences to enhance rate of alien species establishment, naturalization and magnitude of invasiveness beyond the set rules and laws deduced so far form invasion biology.

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2/1/2010

Influence of dietary commercial Beaker's yeast, *Saccharomyces cerevisae* on growth performance, survival and immunostimulation of *Oreochromis niloticus* challenged with *Aeromonas hydrophila*.

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Abstract:
Eight weeks feeding trials were conducted to examine the effect of dietary commercial brewer's yeast, (Beaker's yeast), *Saccharomyces cerevisiae* on growth performance, survival and immunostimulation of Nile tilapia, *Oreochromis niloticus*. Brewer's yeast supplemented at 0, 1, 2, 3 and 6 gm/kg diet A, B, C, D and E respectively. Each diet was fed to triplicate group of *O. niloticus* with initial body weight at 77.39 ± 5.33 g at 8 weeks feeding period. Control group fed non supplemented diet at total period of experiment. Final weight, weight gain, specific growth rate (SGR), condition factor (CF) were recorded, and the optimum growth performance were obtained with 3.0 g yeast/kg diet. Physiological and biochemical parameters (RBCs count, Hb concentration, HCT value, glucose and lipids of fish), cellular immune parameters (total leucocytic count, phagocytic activity) and hormonal immune parameters (Total protein, albumin, globulin and lysozyme concentration) were significantly elevated than the control group(fed on A diet) and improved in *O. niloticus* fed brewer's yeast up to 3.0 g/kg diet. After experimental period (8 weeks) fish from each group were challenged by pathogenic *Aeromonas hydrophila* IP, kept under observation for 7 days, total fish mortality, clinical signs were recorded, and mortality percent decreased with the increase of yeast level in fish diets. [Nature and Science 2010;8(3):96-103]. (ISSN: 1545-0740).

Keywords: *Oreochromis niloticus* ; brewer's yeast ; growth performance ; immuno-stimulation ; condition factor ; immune promoters ; *Aeromonas hydrophila*.

1. Introduction

With the worldwide fish production and intensive cultivation system, fish are subjected to a wide spectrum of diseases which lead to great losses and decrease in fish production. The lack of effective disease control has the potential of being the chief limiting factor of realization of highly stable fish production (Phillip *et al*., 2000). Improving fish performance and disease resistance of cultured organisms are major challenges facing fish culturists, moreover bacterial diseases are one of the limiting factors for fish culture including Nile tilapia in particular, *Aeromonas hydrophila*, cause mass mortalities in several species and is the etiological agent of several diseases (Rahman *et al.,* 2001; Li *et al.,* 2006 and Abdel-Tawwab *et al*., 2008). Most of chemicals and antibiotics are ineffective in cleaning an infective cultivation system also their uses are major expenses that significantly reduce the profitability for fish production so, prevention is better than cure (Clark *et al*., 2000 and Phillip *et al*., 2000). Therefore, several alternative strategies to use of antimicrobials have been proposed such as immunotherapy like probiotics and another immunostimulants such alginic acid, mannon oligosaccharides B- glucan and live yeast *Saccharomyces cerevisae* which that may serve as dietary supplements to improve fish growth and immune responses (Irianto and Austin, 2002). Brewer's yeast, *Saccharomyces cerevisae* contains various immunostimulating compounds such as B-glucans, nucleic acids as well as mannon oligosaccharides which has the capability to enhance immune responses (Ortuno *et al*., 2002 and Abdel-Tawwab *et al*., 2008) as well as growth performance (Olivo-Teles and Goncalves, 2001; Lara-Flores *et al*., 2003; Li and Gatlin 2003, 2004, 2005 and Abdel-Tawwab *et al*., 2008) of various fish species, however, the administration of yeast has been recognized to have important effect as immunostimulants agent (Sakai, 1999). Recent investigations have showed that live brewer's yeast, *Saccharomyces cerevisae* and B (1, 3) glucans long chain polysaccharides containing repetitive glucopyronosyl which extracted from the yeast cell wall have the ability to stimulate non-specific defense mechanisms in vivo and vitro (Nayar, *et al.,* 1998). Therefore, the aim of present study was a trial to evaluate the efficacy of brewer's yeast, *Saccharomyces cerevisae* on growth performance, survival, immunostimulation for *O. niloticus* challenged with *A. hydrophila*

2. Materials and Methods

2.1 Experimental diets:

The formulation of the diet to give 45% crude protein, 19.9% lipid, 13.2% ash and 1.89% fiber and 8.7% moisture.

Five diets were prepared, A, B, C, D, and E, each supplemented with 0, 1, 2, 3 and 6 g/kg diet respectively dry brewer's yeast was added to diet. The diets were prepared by thoroughly mixing the dry ingredients with oil then adding cold water until stiff dough resulted. The dough was placed into a grinder for through mixing and extruded through 2.0 mm diameter strand. Diet was stored at 4 °C until used, control diet (0) brewer's yeast; diet (A) was prepared in the same way without the addition of brewer's yeast.

2.2 Experimental design:

100 *O. niloticus* fish with mean body weight of 70 ± 5 g obtained from Kafr El- Sheikh Governorate (private fish farm). They were randomly distributed in 4 aquaria at a density of 20 fish per each. The experimental diet was fed at feeding rate of 3% fish weight per day. Feeding rate was adjusted to actual fish biomass in each treatment.

The fish were fed two times per day, 7 days per week for 8 weeks. The water of the experimental aquaria replaced every 24 hr to prevent accumulation of ammonia and other toxic metabolites and uneaten diet were removed from the bottom. Continuous aeration was also provided to maintain dissolved oxygen level near saturation.

2.3 Water quality analysis:

Water samples were collected weekly at 20 cm depth from each aquarium, dissolved oxygen; temperature and unionized ammonia were measured in all treatments.

2.4 Growth performance:

Growth performance was determined and feed utilization was calculated as following:

-Weight gain= final weight(g)–initial weight (g).

$$\text{-Condition factor (CF)} = \frac{\text{Weight (gm)}}{\text{Length (cm)}} \times 100$$

-Specific growth rate (SGR) =

(Ln Wt– Ln Wo) X 100 / n

Lin: is the natural logarithm

-Total gain (g/ fish) = Wt – Wo

Wt: is the final fish weight (gm) at the end of the experiment.

Wo: is the initial fish weight (gm) at the start of the experiment.

n: is the duration period of the experiment in days.

-Feed conversion ratio (FCR) = Feed intake (g) / weight gain (g).

-Survival = N_t X 100 / N_o.

Where N_t and N_o are the final and initial numbers of fish in each replicate.

2.5 Analysis and measurement:

At the initiation of the experiment, the fish were fasted for 24 hr and weight after being anesthetized with eugenol 1:10,000. Fish were not fed for 24 hr prior to blood sampling; fish blood was collected with disposable syringe from the caudal vein. The collected blood was divided into two sets of eppendorf tubes. One set contained 500µ sodium heparinate/ ml, used as an anticoagulant for hematology (hemoglobin, hematocrite and red blood cells counting). The second set was left to clot at 4 °C and centrifuged at 5000 rpm for 5 min. at room temperature; the collected serum was stored at -20 °C for further assays.

Red Blood Cells (RBCs) were counted under light microscope using Neubauer haemocytometer after dilution with phosphate- buffered saline, Hemoglobin (Hb) level was determined colorimetrically by measuring the formation of cyanomthaemoglobin using a commercial kit. Total protein content of serum was determined colorimetrically according to Henry (1964**)**. Albumin and globulin were determined colorimetrically according to Wotten and Freeman (1982**)**. The determination of lysozyme level in serum was determined as described by Ellis (1990**)**. Results are expressed in units of lysozyme / ml serum. One unit is defined as amount of sample causing a decrease in absorbance of 0.001 min^{-1} at 530 nm compared to the control (*Micrococcus lysodeiktics* solution without serum). Phagocytosis was determined according to Kawahara *et al*., (1991**).**

Breifly fifty µ g *Candida albicans* culture were added to 1 ml of whole blood collected from treated and control fish then shacked in water bath at 23-25 °C for 3-5 hr, air dried blood smears were then stained with Giemsa stain.

Phagocytic cells which contain intracellular yeast cells in random count of 100 phagocytic cells and expressed as percentage of phagocytic activity (PA).

Phagocytic activity (PA) = Percentage of Phagocytic cells containing yeast cells.

Challenge test:

At the end of the study fish in each group were divided into two subgroups.

The first subgroup was challenged with pathogenic *Aeromonas hydrophila* at 0.2 ml dose of 24 hr. Saline from virulent bacterial broth of *Aeromonas hydrophila* 1 X 10^7 cells / ml was injected interperitoneal (IP) according to Schaperclaus *et al*., (1992).

The second subgroup was IP injected with 0.2 ml of saline solution as control. All groups were kept under observation for 7 days to record clinical signs and daily mortality rates.

3. Results and Discussion:

3.1 Clinical picture and postmortem findings:

Clinical picture and postmortem findings of experimentally inoculated fish of all treatments and control were nearly similar but varied in severity of developed lesions; they include poor appetite, loss of equilibrium with erratic movement of some fish, swimming with head down due to abdominal distension and loss of all reflexes and death. These beside presence of congestion and hemorrhage of the body and all fins, dorsal and caudal peduncle, Fig.1 (A), protruded anal opening Fig.1 (C), internally, congestion of all internal organs, Fig.1 (B) with serous yellowish fluid in abdominal cavity, the liver enlarged with hemorrhagic patches, distended gall bladder, enlarged spleen, while gills varied from pale anemic in some cases to congested in other cases Fig.1 (D).

Fish mortality after IP injection of *A. hydrophila* increased in the 1st day after injection till the 3rd day then decreased, table (1) and, moreover, total fish mortality 7 days after IP injection with *A. hydrophila* decreased with the increase of yeast supplementation.

3.2 Growth performance and survival:

Final fish weight, weight gain and specific growth rate increased significantly ($P<0.05$) with increase in dietary yeast level (table 2).

The optimum growth was obtained at 1.0 – 3.0 g yeast / kg diet while the control diet produced the lowest growth.

There were significant change in survival among the different treatment where there was significant survival rate was start from 2.0 to 6.0 g / kg diet. This means that the brewer's yeast affects survival of fish also.

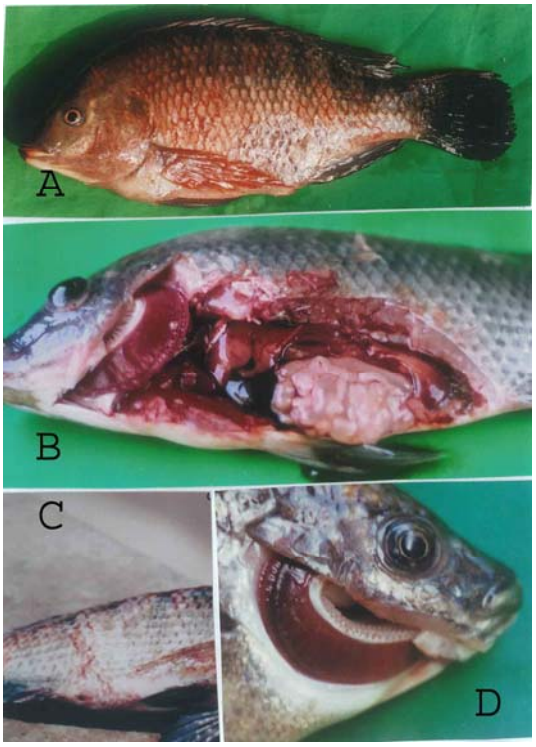

Fig. 1 *Oreochromis niloticus* Showing, A. congestion and hemorrhage of the body and all fins, B. congestion of all internal organs, C. protruded anal opening, D. Congested Gills.

3.3 Hematological and immune parameters:

Fish fed diets containing 1.0 – 3.0 g brewer's yeast / kg diet exhibited higher RBCs, Hb, HCt, total protein, albumin, globulin, lysozyme concentration, phagocytic activity and phagocytic index. Values up to 3.0 g/ kg diet after which those parameters decreased but not reached to those of control group, table (3).

Brewer's yeast, *Saccharomyces cerevisiae* have been used in aquaculture as a probiotic due to their fast growth, low cost, high stability and fact that they are not common constituents of feed (Irianto and Austin, 2002).

In spite of all these advantages, there is little information on the use of whole yeast in fish diets concerning the hypothesis that in vivo administration of whole yeast could enhance the fish immune system (Ortuno *et al.,* 2002).

Brewer's yeast, *S. cerevisae* have been recognized to have potential as a substitute for live food in the production of certain fish (Nayar *et al.,* 1998) or as a potential replacement for fish meal (Olivo - Teles and Goncalves, 2001).

In the present study, the supplementation of commercial live yeast, *S. cerevisae* improved growth and fed utilization. These results agree with that obtained with Catla carp (Mohanty *et al.,* 1996), mrigal Carp (Swain *et al.,* 1996), hybrid striped bass (Li and Galtin, 2003, 2004 and 2005) and Japanese flounder (Toaka *et al.,* 2006a). Similar results were obtained when *S. cerevisae* was added to fish diet of Nile tilapia (Lara – flores *et al.,* 2003 and Abdel-Tawwab *et al*., 2008). The effect of yeast incorporation in diet of digestive enzymes activity of sea bass D. labrax and reported that it lead to great improvement of the survival and growth rates.

Tovar *et al.,* (2002**)** in addition Irianto and Austin, (2002**)** reported that yeast was capable of adherence to the gut when supplied with diet led to enhance amylase secretion and stimulation of brush border membrane enzyme. The improved fish growth and feed utilization may possibly be due to improved nutrient digestibility. Tovar *et al.* (2002), Lara – Flores *et al*. (2003), Wache *et al*. (2006) and Abdel – Tawwab *et al.* (2008) found that the addition of live yeast improved diet and protein digestibility which may explain the better growth and feed efficiency with yeast supplements.

Brewer's yeast supplementation significantly affect the whole fish body composition. These results suggest that yeast supplementation plays a role in enhancing feed intake with subsequent enhancement of fish body performance.

The better feed intake in yeast supplemented diets in this study was recorded from 1.0 up to 3.0 g / kg diet; this may have been due to increased fish appetite resulting in a higher feed intake and therefore improved growth performance, physiological and biochemical analysis often provide vital information for health status about cultured fish (Cnaani *et al*., 2004; Rehulka *et al.,* 2004 and Abdel – Tawwab *et al*., 2008).

In the present study fish fed diets containing 1.0 g yeast to diets containing 3.0 g yeast / kg diet revealed higher RBCs, Hb and HCt values, also, protein, albumin and globulin values were increased up to 3.0 g yeast / kg diet after those the parameters were decreased. These results suggest an improvement of fish health when fed yeast supplement, measurement of albumin, globulin and total protein in serum is of considerable diagnostic value in Nile tilapia because it relates to general nutritional status as well as the integrity of vascular system and liver function (Abdel – Tawwab *et al*., 2008). These results nearly agree with the result obtained by Oliva – Teles and Goncalves (2001); Li et al., (2003) & (2005) and Abdel – Tawwab *et al.,* (2006) & (2008**).**

In regard to the immunological parameters, TLC, lysozyme concentration, phagocytic activity and phagocytic index that there is significant increase than that of the control group (A diet) from up to diet

contain 3.0 g / kg diet then decreased to the level not reached to the control group. These results nearly similar to that obtained by Ortuno et al., (2002) who reported that lyophilized whole yeast *S. cerevisae* in the diet of sea bream activates phagocytic activity and phagocytic index also Nevien (2005) reported that *O. niloticus* fed on *S. cerevisae* supplemented diet showed increased TLC, neutrophil count, phagocytic activity (P.A) and phagocytic index (P.I). Similar results were obtained by **(**Siwicki *et al.,* 1994) who observed an increase of the same cellular activities in rainbow trout after feeding *S. cerevisae*. This enhanced cellular activity could be attributed to many factors, first the presence of glucon receptors on the cell surface of blood monocytes, macrophages and neutrophils (Esteban *et al.,* 2001).

Nucleic acids especially yeast – RNA could act as immune activators and essential immune activity in mammals not only growth and reproduction (Rudolph *et al*., 1990 and Cerra *et al*., 1991). The administration of yeast B- glucans by injection strongly activates serum lysozyme activities in fish (Engstad *et al*., 1992; Santarem *et al*., 1997 and Paulsen *et al*., 2001).

Concerning resistance against diseases, mortality rate of *O. niloticus* fed on yeast supplemented diet for 8 weeks after I/ P injection of *A. hydrophila* was 50, 30, 0 and 10% respectively comparing to control +ve , 90% and control –ve, 0%. The mortality rate was decreased with increase of the yeast supplementation; this may be due to increased phagocytic activity, phagocytic index and serum lysozyme concentration. These results agree with Abdel – Tawwab *et al.,* (2008) who suggest that the yeast supplementation could increase the non-specific immune system of Nile tilapia resulting in resistance to *A. hydrophila*. Also, Toaka *et al.,* (2006b) investigated the effect of live and dead probiotic cells on the non – specific immune system of Nile tilapia such as lysozyme activity, migration of neutrophils and plasma bactericidal activity resulting in improved resistance to *Edwardsiella tarda* infection. Also, Abdel – Tawwab *et al*., (2008) proved that the cumulative mortality of Nile tilapia, ten days after I/P injection of *A. hydrophila* decreased significantly with the increased dose of yeast supplementation. Brewer's yeast is a source of nucleic acids and B 1,3- glucans which have been recognized to effectively enhance immune functions of African catfish (Yoshida et al., 1995), Atlantic salmon (Engstad *et al*., 1992), rainbow trout (Jorgensen *et al.,* 1993 and Siwicki *et al.,* 1994) and shrimp, *Penaeus nonadon* (Thanardkit *et al*.,2002). Moreover, Sakai *et al*., (2001) mentioned that the nucleotides from brewer's yeast RNA were capable of enhancing the phagocytic oxidative activities of kidney phagocytic cells, serum lysozyme in common carp as well as resistance to *A. hydrophila*.

In conclusion, brewer's yeast is promising as an alternative method to antibiotics for disease prevention in tilapia aquaculture and enhanced growth performance and the optimum level of dietary live brewer's yeast is about 3.0 g / kg diet for *O. niloticus*.

Table (1): The effect of dietary Brewer's yeast supplementation for 7 days in *O. niloticus*.

Item / Gp.(*)	No. of fish	Type Of inocu-lation	Days after challenge							No. of dead fish	No. of survi-ved fish	Mort-ality %	Surv-ival %
			1	2	3	4	5	6	7				
Contr-ol -ve	10	PBS*	0	0	0	0	0	0	0	0	10	0	100
Contr-ol +ve	10	A. hyd.**	4	1	1	1	2	1	0	9	1	90	10
Dose 1g/kg	10	A. hyd.	2	2	1	0	0	0	0	5	5	50	50
Dose 2g/kg	10	A. hyd.	2	1	0	0	0	0	0	3	7	30	70
Dose 3g/kg	10	A. hyd.	0	0	0	0	0	0	0	0	10	0	100
Dose 6g/kg	10	A. hyd.	0	1	0	0	0	0	0	1	9	10	90

(*)Gp.: group. ***PBS:** Phosphate buffer saline. ****A.hyd.:** *Aeromonas hydrophila*.

Table (2): The growth performance, condition factor and survival of *O. niloticus* fed on brewer's yeast for 7 days.

Items	Yeast levels, g / kg diet				
	A, control (0)	B (1.0)	C (2.0)	D (3.0)	E (6.0)
Initial weight (g)	77.39±15.46	76.93±15.38	77.20±15.44	77.10±15.42	77.30±15.46
Final weight	82.79±4.14	86.23±4.31	86.58±4.33	87.78±4.39	86.80±4.34
Weight gain (g)	5.4±0.27A	8.1±0.40aB	9.3±0.47abC	10.68±0.53abc	9.5±0.48ab
SGR %	0.17±0.017A	0.29±0.015a	0.26±0.013a	0.29±0.015a	0.26±0.013a
C.F	3.90±0.20A	4.70±0.24aB	5.00±0.50a	5.74±0.29ab	5.41±0.27a
Survival rate (%)	96.7±4.83	95.0±4.75	100±5.0	98.2±4.91	99.1±4.95

Small letters (a), (b),(c) and(d) represent a significant change to capital letters, A, B,C and D respectively (by LSD using ANOVA at $p \leq 0.05$).

Table (3): Showing (RBCs, Hb and HCt) and immunological parameters of *O. niloticus* fed on Brewer's yeast for 8 weeks.

Items	Yeast levels, g / kg diet				
	A, control (0)	B (1.0)	C (2.0)	D (3.0)	E (6.0)
RBCs	1.43±0.15A	1.89±0.09Ba	1.85±0.11aC	2.39±0.15ab	2.00±0.14a
Hb	4.30±0.15A	5.43±0.15Ba	5.43±0.15a	6.95±0.26ab	6.51±0.24ab
HCt	12.45±0.75A	17.51±0.90Ba	21.62±0.90abC	23.23±0.93ab	21.45±1.03ab
Total protein	3.62±0.13A	4.02±0.10Ba	4.68±0.14abC	5.14±0.13ab	4.54±0.12ab
Albumin	1.94±0.12A	2.30±0.10B	2.85±0.20abC	2.30±0.16c	2.56±0.13a
Globulin	1.68±0.08A	1.72±0.09B	1.83±0.09C	2.84±0.14abc	1.98±0.01a
Lysozyme	360.93±14.16A	401.43±14.66B	426.40±13.36a	466.75±15.52ab	408.51±13.35
Phagocytic activity	21.65±1.06A	26.40±1.56Ba	28.53±1.23aC	37.11±1.21abc	30.68±1.25a
Phagocytic index	3.09±0.19A	4.23±0.20Ba	6.25±0.25abC	9.50±0.40abc	8.64±0.31abc

Small letters (a), (b),(c) and(d) represent a significant change to capital letters A, B,C and D respectively (by LSD using ANOVA at $p \leq 0.05$).

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Quadratic Model for Predicting the Concentration of Dissolved Iron Relative to the Initial and Final Solution pH during Oxalic Acid Leaching of Iron Oxide Ore

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Abstract: Model for predicting the concentration of dissolved iron (relative to the initial and final solution pH) during leaching of iron oxide ore in oxalic acid solution has been derived. The model;

$$\gamma^2 - \beta\gamma - \left(\frac{0.001N}{\%Fe}\right) = 0$$

was found to calculate the concentration of dissolved iron being dependent on the values of the initial and final leaching solution pH measured during the leaching process. It was found that the validity of the model is rooted on the expressions D = 1000%Fe where both sides of each expression are correspondingly approximately almost equal. The maximum deviation of the model-predicted values of %Fe (dissolved) from the corresponding experimental values was found to be less than 28% which is quite within the acceptable range of deviation limit of experimental results. The value of the assumed coefficient of the dilution (N) was calculated to be 197.527. [Nature and Science 2010;8(3):104-109]. (ISSN: 1545-0740).

1. Introduction

Studies (Taxiarchour et al., 1997a and 1997b) have shown that at a temperature as low as 25°C, the presence of Fe^{2+} significantly enhances the leaching of iron extraction from silica sand. Ferrous oxalate is quickly oxidized by air during dissolution, giving room for an induction period of a few hours unless a strong acidic environment (<pH 1) or an inert atmosphere is maintained. It has been found (Lee et al., 2006) that maintaining the high level of ferrous oxalate in the leach liquor using an inert gas enhance the reaction kinetics. It is believed that during this process, removal of phosphorus from the iron compound and subsequent dissolution of the phosphorus oxide formed were effected.

Panias et al. (1996) reported that the optimum pH for dissolving iron oxide is pH 2.5 – 3.0. The solution pH governs the distribution of various oxalate ions in the leach system. Below pH 1.5, oxalic acid exists mainly as $H_2C_2O_4$, whereas HC_2O_4 is the most predominant species at pH 2.5 – 3.0.

Models for computational analysis of the concentration of dissolved haematite and heat absorbed by oxalic acid solution during leaching of iron oxide ore have been derived (Nwoye, 2008a). These models are:

$$\%Fe_2O_3 = K(\gamma/\mu) \qquad (1)$$

$$Q = K_C\,\mu \qquad (2)$$

Where

$\%Fe_2O_3$ = Concentration of dissolved haematite in oxalic acid solution.
γ = Final pH of the leaching solution at time t at which $\%Fe_2O_3$ was obtained.
μ = Weight of iron oxide added into the oxalic acid leaching solution (g)
K = Constant of proportionality associated with haematite dissolution
K_C = Constant of proportionality associated with heat absorption

Nwoye (2008a) found that optimization of the weight input of iron oxide ore could be achieved using the model; ($\%Fe_2O_3 = K(\gamma/\mu)$) by comparing the concentrations of dissolved haematite at different weights input of the iron oxide ore, with the view to identifying the optimum weight input of iron oxide ore that gives the maximum dissolution of Fe_2O_3. The model also indicates that the concentration of haematite dissolved during the leaching process is directly proportional to the final pH of the leaching solution and inversely proportional to the weight input of the iron oxide ore.

It was also found (Nwoye, 2008a) that values of Q obtained from both the experiment and model ($Q = K_C\,\mu$) agree to the fact that leaching of iron oxide ore using oxalic acid solution is an endothermic process, hence the absorbed positive heat energy by the leaching solution. The quantity of heat energy absorbed by the oxalic acid solution during the leaching process (as calculated from the model; $Q = K_C\,\mu$) was found to be directly proportional to the

weight input of the iron oxide ore. These results were obtained at initial pH 6.9, average grain size of 150µm and leaching temperature of 30^0C. The constants of proportionality K and K_C associated with the respective derived models were evaluated to be 0.0683 and 66.88 respectively.

Nwoye (2008b) derived a model for predicting the time for dissolution of pre-quantified concentration of phosphorus during leaching of iron oxide ore in oxalic acid solution as:

$$\tau = \left(\frac{\text{Log}\left[\frac{P^{1/4}}{1.8}\right]}{\text{LogT}} \right) \qquad (3)$$

Where

T = Leaching temperature (^{0}C) in the experiment (Nwoye,2006), taken as specified leaching temperature (^{0}C) aiding the expected dissolution of phosphorus .

N= 1.8 (Dissolution coefficient of phosphorus in oxalic acid solution during leaching of iron oxide ore) determined in the experiment (Nwoye, 2006).

P= Concentration of dissolved phosphorus (mg/Kg) in the experiment (Nwoye, 2006) taken as pre-quantified concentration of phosphorus expected to dissolve after a leaching time t (mg/Kg) in the model.

τ = Leaching time (sec.) in the experiment (Nwoye, 2006) taken as time for dissolution of the pre-quantified concentration of phosphorus (hrs) in the model.

The model was found to depend on a range of specified leaching temperatures (45-70^0C) for its validity. It was found (Nwoye, 2006) that the time for dissolution of any given concentration of phosphorus decreases with increase in the leaching temperature (up to 70^0C), at initial pH 5.5 and average grain size of 150µm.

Nwoye et al. (2008) also formulated a model for predicting the concentration of phosphorus removed during leaching of iron oxide ore in oxalic acid solution. It was found to predict the removed phosphorus concentration, with utmost dependence on the final pH of the leaching solution and weight input of the iron oxide ore. The model indicates that the concentration of phosphorus removed is inversely proportional to the product of the weight input of the iron oxide ore and the final pH of the leaching solution. Process conditions considered during the formulation of the model (Nwoye et al. 2008) include: leaching temperature of 25^0C, initial solution pH 5.5 and average ore grain size; 150µm).

Nwoye (2008c) derived a model for evaluating the final pH of the leaching solution during leaching of iron oxide ore in oxalic acid solution. The model evaluates the pH value as the sum of two parts, involving the % concentrations of Fe and Fe_2O_3 dissolved. The model can be expressed as;

$$\gamma = 0.5 \left(\frac{K_1}{\%Fe} + \frac{K_2}{\%\ Fe_2O_3} \right) \qquad \textbf{(4)}$$

Where

K_1 and K_2 = dissolution constants of Fe and Fe_2O_3 respectively

γ = final pH of leaching solution (after time t).

It was also found that the model (Nwoye, 2008c) could predict the concentration of Fe or Fe_2O_3 dissolved in the oxalic acid solution at a particular final solution pH by taking Fe or Fe_2O_3 as the subject formular. The prevailing process conditions under which the model works include: leaching time of 30mins., constant leaching temperature of 30^oC, average ore grain size; 150µm and 0.1M oxalic acid.

Nwoye (2008d) has reported that the heat absorbed by oxalic acid solution during leaching of iron oxide ore can be predicted using the model he derived which works under the process condition; initial pH 6.9, average ore grain size; 150µm and leaching temperature; 30^0C. The model [14] can be stated as

$$Q = K_N \left(\frac{\gamma}{\%Fe_2O_3} \right) \qquad (5)$$

Where

Q = Quantity of heat absorbed by oxalic acid solution during the leaching process. (J)

γ = Final pH of the leaching solution (at time t).

$\%Fe_2O_3$= Concentration of haematite dissolved in oxalic acid solution during the leaching process.

K_N = 4.57(Haematite dissolution constant in oxalic acid solution) determined in the experiment (Nwoye, 2008d).

Nwoye (2008d) carried out further work on the model using the same process conditions and observed that on re-arranging the model as;

$$\%Fe_2O_3 = K_N \left(\frac{\gamma}{Q} \right) \qquad (6)$$

the concentrations of haematite predicted deviated very insignificantly from the corresponding experimental values. In this case, the value of Q was calculated by considering the specific heat capacity of oxalic acid. Values of heat absorbed by the oxalic acid solution during the leaching of iron oxide ore as predicted by the model (Nwoye, 2008d) agree with the experimental values that the leaching process is endothermic. This is because all the predicted values of the heat absorbed

by the oxalic acid solution were positive. The model shows that the quantity of heat absorbed by oxalic acid solution during the leaching process is directly proportional to the final pH of the solution and

inversely proportional to the concentration of haematite dissolved.

Model for evaluation of the concentration of dissolved phosphorus (relative to the final pH of the leaching solution) during leaching of iron oxide ore in oxalic acid solution has been derived (Nwoye, 2009). It was observed that the validity of the model is rooted in the relationship $\ln P = N/\alpha$ where both sides of the expression are approximately equal to 4. The model; $P = e^{(12.25/\alpha)}$ is dependent on the value of the final pH of the leaching solution which varies with leaching time. In all, the positive or negative deviation of the model-predicted phosphorus concentration from its corresponding value obtained from the experiment was found to be less than 22%.

The aim of this work is to derive a quadratic model for predicting the concentration of dissolved iron relative to the initial and final solution pH during oxalic acid leaching of iron oxide ore.

2. Model

The solid phase (ore) is assumed to be stationary, contains the un-leached iron remaining in the ore. Hydrogen ions from the oxalic acid attack the ore within the liquid phase in the presence of oxygen.

2.1 Model Formulation

Experimental data obtained from research work (Nwoye, 2007) carried out at SynchroWell Research Laboratory, Enugu were used for this work.

Results of the experiment as presented in report (Nwoye, 2007) and used for the model formulation are as shown in Table 1.

Computational analysis of the experimental data shown in Table 1, gave rise to Table 2 which indicate that;

$$\gamma \ \alpha \ \left(\frac{1}{D}\right) \qquad (7)$$

$$D = 1000\%Fe \qquad (8)$$

Introducing a constant of proportionality into equation (7)

$$\gamma = \left(\frac{N}{D}\right) \qquad (9)$$

Substituting equation (7) into equation (8) gives

$$\gamma = \left(\frac{N}{1000\%Fe}\right) \qquad (10)$$

Where

γ = Initial pH of the leaching solution at time t = 0

N=Constant of proportionality assumed as the coefficient of dilution for oxalic acid solution

D= Dilution factor

%Fe = Concentration of dissolved iron in oxalic acid during leaching.

To introduce the effect of the final pH (on the leaching process) the differential pH (between initial and final pH) is considered.

ie ;

$$D_{pH} = \text{Initial pH } (\gamma) - \text{Final pH } (\beta) \qquad (11)$$

Based on the foregoing,

$$D_{pH} = \gamma - \beta \qquad (12)$$

From Table 1, $\gamma > \beta$; therefore $\gamma - \beta$ is positive. It is assumed that very little iron dissolved within the little time elapse just before the initial pH was taken timer set as well as just after the final pH was taken prior to chemical analysis of the filtrate containing the dissolved iron. Therefore to confine the dissolution of the iron to the time elapse at which the initial and final pH were taken, the value of %Fe in equation (10) was multiplied by the differential pH (correction factor) to get the real value of %Fe.

Based on the foregoing,

$$\gamma = \left(\frac{N}{1000\%Fe\ (\gamma - \beta)}\right) \qquad (13)$$

To evaluate the percentage concentration of dissolved iron, equation (13) becomes;

$$\%Fe = \left(\frac{N}{1000\gamma(\gamma - \beta)}\right) \qquad (14)$$

Forming a quadratic expression from equation (14)

$$\gamma^2 - \beta\gamma = \left(\frac{N}{1000\%Fe}\right) \qquad (15)$$

$$\gamma^2 - \beta\gamma = \left(\frac{0.001N}{\%Fe}\right) \qquad (16)$$

$$\gamma^2 - \beta\gamma - \left(\frac{0.001N}{\%Fe}\right) = 0 \qquad (17)$$

Equation (17) could be re-written as

$$\gamma^2 - \beta\gamma - \theta = 0 \qquad (18)$$

Where

$$\theta = \left(\frac{0.001N}{\%Fe}\right)$$

is a constant and dimensionless.

Equation (17) or (18) is the derived quadratic model. The concentration of dissolved iron could be calculated directly (for prediction) using equation (17) and indirectly using equation (18). The values of N were calculated from equation (10) and Table 1 for each of the samples (A-F) and average value taken since all samples were subjected to the same experimental process conditions (except initial solution pH).This was done by substituting the values of γ and %Fe obtained (after a leaching time of 180mins.) for samples A-F into equation (10).

Table 1: Variation of concentration of dissolved iron with initial and final solution pH. (Nwoye, 2007)

Sample Code	%Fe	D	γ	β
A	0.031	31.166	5.88	4.65
B	0.032	31.633	5.71	4.40
C	0.034	34.012	6.00	4.66
D	0.029	28.500	6.32	5.38
E	0.039	38.591	5.74	4.68
F	0.035	35.168	6.13	5.16

3. Boundary and Initial Condition

Consider iron ore in cylindrical flask 30cm high containing leaching solution of oxalic acid. The leaching solution is stationary i.e (non-flowing). The flask is assumed to be initially free of attached bacteria. Initially, atmospheric levels of oxygen are assumed. Constant weight 10g of iron oxide ore was used. The range of initial pH of leaching solution used; 5.71-6.32 and leaching time; 180 minutes were used. A constant leaching temperature of 25^{o}C was used. Average ore grain size; 150μm, and oxalic acid concentration; 0.1mol/litre was used. These and other process conditions are as stated in the experimental technique (Nwoye, 2007).

The boundary conditions are: atmospheric levels of oxygen (since the cylinder was open at the top) at the top and bottom of the ore particles in the liquid and gas phases respectively. At the bottom of the particles, a zero gradient for the liquid scalar are assumed and also for the gas phase at the top of the particles. The leaching solution is stationary. The sides of the particles are taken to be symmetries.

4. Model Validation

The formulated model was validated by direct analysis and comparison of %Fe values predicted by model and the corresponding experimental %Fe values for equality or near equality.

Analysis and comparison between these %Fe values reveal deviations of model-predicted %Fe values from the corresponding experimental values. This is believed to be due to the fact that the surface properties of the ore and the physiochemical interactions between the ore and leaching solution which were found to have played vital roles during the leaching process (Nwoye, 2007) were not considered during the model formulation. This necessitated the introduction of correction factor to bring the model-predicted %Fe values to those obtained from the experiment (Table 3).

Deviation (Dv) (%) of model-predicted %Fe values from the corresponding experimental %Fe values is given by

$$Dv = \left(\frac{Mv - Ev}{Ev}\right) \times 100 \qquad (19)$$

Where Mv = Predicted %Fe values from model
Ev = %Fe values obtained from experimental data

Correction factor (Cf) is the negative of the deviation i.e

$$Cf = -Dv \qquad (20)$$

Therefore

$$Cf = -100\left(\frac{Mv - Ev}{Ev}\right) \qquad (21)$$

Introduction of the corresponding values of Cf from equation (21) into the model gives exactly the corresponding experimental %Fe value (Nwoye, 2007).

5. Results and Discussion

The derived model is equation (17) or (18). Computational analysis of the experimental data (Nwoye, 2007) shown in Table 1, gave rise to Table 2

Table 2: Values of assumed coefficient of dilution for oxalic acid solution

Sample Code	N
A	183.26
B	180.62
C	204.07
D	180.12
E	221.51
F	215.58

Effect of initial and final pH of leaching solution on the concentration of dissolved iron

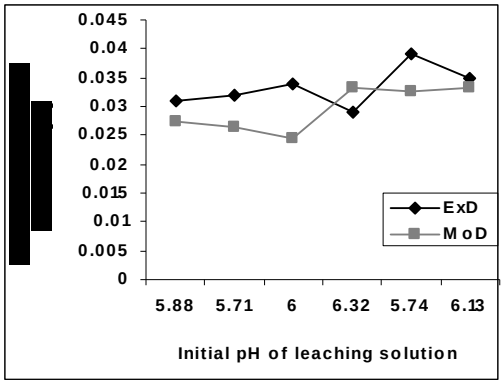

Figure 1-Comparison of the concentrations of Fe dissolved in relation to initial solution pH as obtained from experiment (Nwoye, 2007) and derived model.

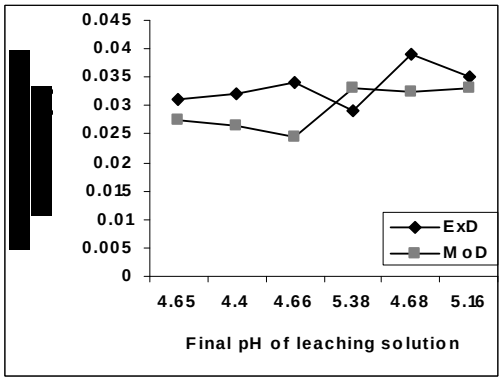

Figure 2-Comparison of the concentrations of Fe dissolved in relation to final solution pH as obtained from experiment (Nwoye, 2007) and derived model.

Comparison of Figures 1 and 2 show that both values of dissolved iron concentration obtained from the experiment (Nwoye, 2007) (Line ExD) and the derived model (Line MoD) in relation to both the initial ore and final solution pH are generally quite close, hence depicting proximate agreement and validity of the model.

It was found that the validity of the model is rooted on the expressions D = 1000%Fe where both sides of each expression are correspondingly approximately almost equal. Table 1 also agree with equation (8), following the value 1000%Fe evaluated from Table 1 as a result of the corresponding computational analysis. The value of the assumed coefficient of dilution (N) for oxalic acid solution was evaluated to be 197. 527.

$\%Fe_M$	Dv (%)	Cf (%)
0.0273	-11.94	+11.94
0.0264	-17.50	+17.50
0.0246	-27.65	+27.65
0.0332	+14.48	-14.48
0.0325	-16.67	+16.67
0.0332	-5.14	+5.14

Variation of deviation and associated correction factor with the concentration of dissolved iron

A comparison of the values of %Fe from the experiment and those from the model shows maximum deviation less than 28% which is quite within the acceptable range of deviation of experimental results. (Table 3)

Table 3 Variation of model-predicted concentrations of dissolved iron with associated deviations and correction factors.

$\%Fe_M$ = %Fe predicted by model.

Table 3 indicate that the highest and least deviations; -27.65 and -5.14% in relation to both the initial and final leaching solution pH corresponds to the model-predicted Fe dissolved concentrations 0.0246 and 0.0332% respectively. Table 1 shows that these percent deviations also correspond to initial and final solution pH: 6.0 & 6.13 and 4.66 & 5.16 respectively.

6. Conclusion

The model predicts the concentration of dissolved iron relative to the initial and final solution pH during oxalic acid leaching of Itakpe (Nigeria) iron oxide ore. The respective deviations of the model-predicted %Fe values from the corresponding experimental %Fe values were less than 28% which is quite within the acceptable range of deviation limit of experimental results.

Further works should incorporate more process parameters into the model with the aim of reducing the deviations of the model-predicted %Fe values from those of the experiment.

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Model for the Calculation of the Concentration of Sulphur Removed during Oxidation of Iron Oxide Ore by Powdered Potassium Chlorate

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Abstract: Model for the calculation of the concentration of sulphur removed (during oxidation of iron oxide ore by powdered potassium chlorate) has been derived. The model;

$$\%S = \left(\frac{0.0717}{\text{Log}\alpha} \right)$$

was found to predict the concentration of sulphur removed, very close to the corresponding %S values obtained from the actual experimental process. It was found that the model is dependent on the values of the weight input of the oxidant ($KClO_3$) during the desulphurization process. The validity of the model is believed to be rooted in the expression $[(\alpha)^{\beta\%S}] = T/\gamma k_n$ where both sides of the expression are approximately equal to 2. The positive or negative deviation of each of the model-predicted values of %S from those of the corresponding experimental values was found to be less than 30% which is quite within the range of acceptable deviation limit of experimental results. [Nature and Science 2010;8(3):110-114]. (ISSN: 1545-0740).

Keywords: Model, Sulphur Removed, Iron Oxide Ore, Oxidation, Potassium Chlorate.

1. Introduction

Past report (Uwadiele,1984) revealed that Agbaja iron ore deposit is the largest known Nigerian iron ore deposit estimated at 1250 metric tonnes of ore reserve. It consists of oolitic and pisolitic structures rich in iron oxides, in a matrix that is predominantly clay.The principal constituent mineral is goethite, with minor hematite, maghemite, siderite, quartz, kaolinite pyrite and an average of 0.09%S.

Uwadiele (1990) carried out an intensive and selective oil agglomeration of Agbaja iron ore. The researcher, starting from the crude ore Fe content (45.6%), concentrated the ore by oil agglomeration technique to 90% Fe recovery and 65% Fe assay. He stated that the ore require grinding to minus 5µm to effect adequate liberation. These results were obtained at optimum pH 9. Similar studies by Uwadiele and Whewell (1988) included the effect of temperature on magnetizing reduction of Agbaja iron ore. The results of the investigation showed that the fine-grained oolitic Agbaja iron ore, which is not responsive to conventional processing techniques, can be upgraded by the magnetizing reduction method with an Fe recovery of 87.3% and Fe assay of 60% at 600^0C.

Kulkarni and Somasundaran (1980), attempted to enhance concentrate Fe recovery The researchers stated that concentrate Fe recovery decreases progressively below pH 8. In this pH region, oleate used is present as dispersion of oleic acid, and its adsorption on the surface of the iron oxides is similar to the process of hetero-coagulation involving positively charged iron oxide particles and negatively charged oleic acid droplet.

Nwoye (2008) reported that Agbaja oolitic iron ore, which has not been responsive to so many upgrading processes, has been upgraded to 73.4% Fe assay (starting from as-received concentrate assaying 56.2%Fe) by a process referred to as pyrometallurgical-oxidation method. The researcher investigated mainly the effects of treatment temperature and oxidant ($KClO_3$) on the upgrading process. It was established that 800^0C is the optimum temperature for the upgrading step considering the range of temperature used (500-800^0C). It was observed from results of the investigation that both oxidant and temperature increase (up to 12g per 50g of iron ore and maximum of 800^0C respectively) during the process are vital conditions for improving on the grade of the ore concentrate.

A model for computational analysis of the concentration of iron upgraded during dry beneficiation of iron oxide ore has been derived by Nwoye et al., (2009). The model;

$$\%Fe = 2.25[(\ln (T/\mu))^{2.58}] \quad (1)$$

shows that the concentration of upgraded iron is dependent on the treatment temperature T, used when the mass of iron oxide ore μ, added is constant.

Desulphurization of Agbaja iron oxide ore concentrate by Nwoye (2008) using solid potassium trioxochlorate (V) ($KClO_3$) as oxidant and a treatment temperature range: 500 – 800^{0}C. revealed that simultaneous increase in both the percentage of the oxidant added (up to 15g per 50g of ore) and treatment temperature (maximum 800^{0}C) used give the ideal conditions for increased desulphurization efficiency. This translates into high desulphurization efficiency when both oxidant concentration (up to 15g per 50g of ore) and treatment temperature (maximum 800^{0}C) are high.

Nwoye (2009) investigated the mechanism and process analysis of desulphurization of Agbaja iron ore concentrate using powdered potassium trioxochlorate (v) ($KClO_3$) as oxidant. Concentrates were treated at a temperature range 500 – 800^{0}C. Results of the process analysis indicate that oxygen required for the desulphurization process was produced following decomposition of $KClO_3$ within a temperature range 375-502^{o}C. It was observed that this temperature range is the Gas Evolution Temperature Range (GETR) for sulphur present in Agbaja iron ore. Sulphur vapour and oxygen gas produced at this temperature range were believed to have reacted to form and liberate SO_2. The process analysis suggests that the mechanism of the desulphurization process involves gaseous state interaction between oxygen and sulphur through molecular combination. The results for the extent of desulphurization reveal that simultaneous increase in both the percentage of the oxidant added and treatment temperature used (up to 15g $KClO_3$ per 50g of ore and maximum of 800^{0}C respectively) are the ideal conditions for the best desulphurization efficiency.

Investigations made by Bardenheuer and Geller (1934) indicated that the sulphur transfer from metal to slag or slag to gas during desulphurization involves oxygen transfer in the opposite direction. They posited that the mechanism of such desulphurization involves oxidation of sulphur resident in the metal or slag by oxygen from the slag through ionic exchange between the oxygen and sulphur, since the whole system is made up of liquid/molten condition during this process.They maintained that oxygen in the slag comes from CaO, which is one of the products of decomposition of $CaCO_3$ deposited into the slag as a slag forming agent.

Studies (St Pierre and Chipman ,1956) on gas-slag system during iron making shows that at oxygen partial pressure below about 10^{-5} atm., sulphur dissolves in the melt as sulphide ions; at oxygen partial pressure higher than 10^{-3} atm., sulphur enters the melt as sulphate ions. In both cases, they stated that both the sulphide and sulphate ions leave the furnace through the slag. They therefore concluded that the mechanism of such desulphurization process is oxidation of sulphur by oxygen from the slag through ionic exchange between the two participating elements.

Turkdogan and Darken (1961) established that at a temperature well below about 1600^{0}C, the pyrosulphate reaction also occurs. They found that this reaction was an enhancement to the desulphurization process actually taking place in the furnace. Also oxygen for this process was found to come from the slag, engaging sulphur in ionic exchange; being the mechanism of such process.

It was discovered that one of the most important factors influencing the desulphurization process during iron making is the state of oxidation of the bath (Pehlke et.al 1975) .

A model has been derived (Nwoye et al., 2009) for the predictive analysis of the concentration of sulphur removed as result of the molecular-oxygen-induced desulphurization of iron oxide ore (potassium chlorate being the oxidant). The model;

$$\%S = \left(\frac{0.0415}{\log \gamma}\right) \quad (2)$$

was found to predict the concentration of sulphur removed, very close to the corresponding %S values obtained from the actual experimental process. It was found that the model is dependent on the values of the weight-input of the oxidant γ, ($KClO_3$) during the desulphurization process. The validity of the model is believed to be rooted in the expression $k_n[(\gamma)^{\mu\%S}] = T/\alpha$ where both sides of the expression are correspondingly almost equal. The positive or negative deviation of each of the model-predicted values of %S from those of the corresponding experimental values was found to be less than 33% which is quite within the range of acceptable deviation limit of experimental results.

Nwoye et al (2009) derived a model for computational analysis of the concentration of sulphur removed during oxidation of iron oxide ore by powdered potassium chlorate. The model;

$$\%S = \left(\frac{0.0357}{\log \alpha}\right) \quad (3)$$

indicates that the predicted %S is dependent on the weight-input of $KClO_3$ α, added during the

desulphurization process. The maximum deviation of the model-predicted values of %S from those of the corresponding experimental values was found to be less than 37%

Model for predicting the concentration of sulphur removed during gaseous desulphurization of iron oxide ore has been derived by Nwoye et al. (2009). The model;

$$\%S = \left(\frac{0.0745}{\text{LogT}}\right) \quad (4)$$

shows that the predicted %S is dependent on the treatment temperature T, used during the desulphurization process.

The aim of this work is to derive a model for predicting the concentration of sulphur removed during temperature enhanced oxidation of Agbaja (Nigerian) iron oxide ore

2. Model

The solid phase (ore) is assumed to be stationary, contains some unreduced iron remaining in the ore. It was found (Nwoye, 2008) that oxygen gas from the decomposition of $KClO_3$ attacked the ore in a gas-solid reaction, hence removing (through oxidation) the sulphur present in the ore in the form of SO_2 .Equations (5) and (6) show this.

$$2KClO_{3\,(s)} \longrightarrow 2KCl_{\,(s)} + 3O_{2\,(g)} \quad (5)$$

$$S_{(s)} \xrightarrow{\text{Heat}} S_{(g)} + O_{2\,(g)} \longrightarrow SO_{2\,(g)} \quad (6)$$

2.1 Model Formulation

Experimental data obtained from research work (Nwoye,2007) carried out at SynchroWell Research Laboratory, Enugu were used for this work. Results of the experiment as presented in report (Nwoye, 2007) and used for the model formulation are as shown in Table 1.

Computational analysis of the experimental data shown in Table 1, gave rise to Table 2 which indicate that;

$$[(\alpha)^{\beta\%S}] = T/\gamma \quad \text{(approximately)} \quad (7)$$

$$k_n[(\alpha)^{\beta\%S}] = T/\gamma \quad (8)$$

Taking logarithm of both sides

$$\text{Log}\,(k_n[(\alpha)^{\beta\%S}]) = \text{Log}\,(T/\gamma) \quad (9)$$

$$\text{Log}k_n + \text{Log}[(\alpha)^{\beta\%S}] = \text{LogT} - \text{Log}\,\gamma \quad (10)$$

$$\text{Log}k_n + \beta\%S\text{Log}\alpha = \text{LogT} - \text{Log}\,\gamma \quad (11)$$

$$\beta\%S\text{Log}\alpha = \text{LogT} - \text{Log}\,\gamma - \text{Log}k_n \quad (12)$$

$$\%S = \frac{\text{LogT} - \text{Log}\,\gamma - \text{Log}k_n}{\beta\,\text{Log}\,\alpha} \quad (13)$$

Introducing the values of β, T, k_n and γ into equation (13) (since they are constants) and evaluating further, reduces it to;

$$\%S = \frac{0.0717}{\text{Log}\alpha} \quad (14)$$

$$\%S = \frac{D_e}{\text{Log}\alpha} \quad (15)$$

Where

%S = Concentration of sulphur removed during the pyrometallurgical-oxidation process.

k_n= 9.75 (Decomposition coefficient of $KClO_3$ at the treatment temperature (800^0C)) determined in the experiment (Nwoye,2007).

(β) = 3.0 (Oxidation coefficient of $KClO_3$ relative to the treatment temperature (800^0C)) determined in the experiment (Nwoye,2007)

(γ) = Weight of iron oxide ore added (g)

T = Treatment temperature used for the process (^{0}C)

(α) = Weight of $KClO_3$ added (g)

D_e = 0.0717 (Assumed Desulphurization Enhancement Factor)

Table 1: Variation of concentration of sulphur removed with weight input of $KClO_3$ (Nwoye,2007)

(α)	M	%S
8	50	0.069
9	50	0.072
10	50	0.080
12	50	0.083
15	50	0.087

Table 2: Variation of $T/\gamma k_n$ with $[(\alpha)^{\beta\%S}]$

$T/\gamma k_n$	$[(\alpha)^{\beta\%S}]$
1.6410	1.5379
1.6410	1.6074
1.6410	1.7378
1.6410	1.8566
1.6410	2.0275

3. Boundary and Initial Condition

Consider iron ore (in a furnace) mixed with potassium chlorate (oxidant). The furnace atmosphere is not contaminated i.e (free of unwanted gases and dusts). Initially, atmospheric levels of oxygen are assumed just before the decomposition of $KClO_3$ (due to air in the furnace).Weight, M of iron oxide ore used; (50g), and treatment time; 360secs.

were used. Treatment temperature; 800^{o}C, ore grain size; 150µm, and range of weight of $KClO_3$ (oxidant) used; 8-15g were also used. These and other process conditions are as stated in the experimental technique (Nwoye, 2007).

The boundary conditions are: furnace oxygen atmosphere due to decomposition of $KClO_3$ (since the furnace was air-tight closed) at the top and bottom of the ore particles interacting with the gas phase. At the bottom of the particles, a zero gradient for the gas scalar are assumed and also for the gas phase at the top of the particles. The reduced iron is stationary. The sides of the particles are taken to be symmetries.

4. Model Validation

The formulated model was validated by direct analysis and comparison of %S values predicted by the model and those obtained from the experiment for equality or near equality.

Analysis and comparison between these %S values reveal deviations of model-predicted %S values from those of the experiment. This is attributed to the fact that the surface properties of the ore and the physiochemical interactions between the ore and the oxidant (under the influence of the treatment temperature) which were found to have played vital roles during the oxidation process (Nwoye, 2007) were not considered during the model formulation. This necessitated the introduction of correction factor, to bring the model-predicted %S values to those of the experimental %S values (Table 3).

Deviation (Dv) (%) of model-predicted %S values from experimental %S values is given by

$$Dv = \left(\frac{Sp - Se}{Se} \right) x\ 100 \qquad (16)$$

Where

Sp = Predicted %S values from model

Se = Experimental %S values

Correction factor (Cf) is the negative of the deviation i.e

$$Cf = -Dv \qquad (17)$$

Therefore

$$Cf = -\left(\frac{Sp - Se}{Se} \right) x\ 100 \qquad (18)$$

Introduction of the corresponding values of Cf from equation (18) into the model gives exactly the corresponding experimental %S values (Nwoye, 2007).

5. Results and Discussion

The derived model is equation (14) or (15). A comparison of the values of %S from the experiment and those from the model shows maximum deviations less than 30% which is quite within the acceptable deviation limit of experimental results hence depicting the reliability and validity of the model. This is shown in Table 3.

The validity of the model is believed to be rooted in equation (7) where both sides of the equation are correspondingly almost equal.

Table 2 also agrees with equation (7) following the values $T/\gamma k_n$ and $[(\alpha)^{\beta\%S}]$ evaluated from Table 1 as a result of corresponding computational analysis. The value 0.0717 has a direct relationship with the value of %S as shown in equation (14). This indicates that the constant contributes directly (as a multiplying factor) to the predicted concentration of sulphur removed from the ore. Based on the foregoing, the constant is denoted as desulphurization enhancement factor D_f

$\%S_e$	$\%S_M$	Dv (%)	Cf (%)
0.069	0.0794	+15.07	-15.07
0.072	0.0751	+4.31	-4.31
0.080	0.0717	-10.38	+10.38
0.083	0.0664	-20.00	+20.00
0.087	0.0610	-29.89	+29.89

Table 3: Comparison between %S removed as predicted by model and as obtained from experiment (Nwoye ,2007).

Where

$\%S_e$= %S values from experiment (Nwoye,2007)

$\%S_p$ = %S values predicted by model

6. Conclusion

The model calculates the concentration of sulphur removed during desulphurization of the iron oxide ore (using powdered potassium chlorate as oxidant). The validity of the model is rooted in The model calculates the concentration of sulphur removed during desulphurization of the iron oxide ore (using powdered potassium chlorate as oxidant). The validity of the model is rooted in the expression $[(\alpha)^{\beta\%S}] = T/\gamma$ where both sides of the equation are approximately equal to 2. The maximum deviation of the model-predicted %S values from those of the experiment is less than 30% which is quite within the acceptable deviation limit of experimental results.

Further works should incorporate more process parameters into the model with the aim of reducing the deviations of the model-predicted %S values from those of the experiment

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Electrogastrograhy As A Diagnostic Tool For Overlapping Dyspepsia In Irritable Bowel Syndrome Patients

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Abstract: Introduction: Distinguishing between irritable bowel syndrome (IBS) and functional dyspepsia can be challenging because of the variations in symptom patterns, which commonly overlap. Although the principles of electrogastrography (EGG) have been known for years, it is contrvesial whether alteration of gastric electrical activity (GEA) could be of clinical relevance in functional gastrointestinal disorders.
Aim of the work was to assess the role of electrogastrography and gastric emptying in diagnosis of overlapping dyspepsia in patients with irritable bowel syndrome (IBS).
Subjects and methods: 120 patients with IBS were compared with 60 healthy controls. EGG was performed before and after a standard meal. Furthermore, gastric emptying (GE) and symptom scores were assessed.
Results: Of 120 IBS patients, 52 (43.3%) had dyspeptic symptoms as well as delayed gastric emptying. IBS patients with overlapping dyspepsia showed significantly more bradygastria (26.9%) than controls (5.9%) ($P < 0.01$) , also they had statistically significant lower PR compared to non dyspeptic patients(2.1±1.3 vs. 2.9±1.6 respectively $P<0.05$), moreover gastric emptying time was delayed in IBS patients with overlapping dyspepsia (14.7±1.8) compared to those without dyspeptic complaints and controls (10 ±1.27 & 10.6±2.1 respectively) ($P<0.01$).
Conclusion and recommendation: IBS patients with overlapping dyspepsia frequently reveal impaired gastric emptying and increased bradygastria, lack of a postprandial increase in the EGG amplitude, which may have pathophysiological significance in these patients .Using both EGG and gastric emptying test can aid in the detection of functional disorders associating IBS and therefore achieve greater patient satisfaction with their treatment. [Nature and Science 2010;8(3):115-120]. (ISSN: 1545-0740).

Keywords: Electrogastrography, functional dyspepsia, gastric emptying, irritable bowel syndrome.

Introduction: Irritable bowel syndrome (IBS) is part of a spectrum of functional gastrointestinal disorders that include a component of disordered bowel motility. Dyspepsia may be another part of that spectrum. [1] A high prevalence of overlap between functional dyspepsia and irritable bowel syndrome has been consistently and universally reported. The recognition of IBS in dyspeptic patients has potentially profound therapeutic importance. It could help to reduce the risk of unnecessary cholecystectomy in IBS patients.[2] Previous studies demonstrating shared common pathophysiological disturbances including delayed gastric emptying and visceral hypersensitivity involving more than one region, suggest that these patients have a generalized rather than regional disorder of the gut.[3] Delayed gastric emptying has been reported in IBS patients, whether overlapping dyspepsia correlates with gastric emptying abnormalities in IBS patients or not has not been clarified.[4] Transcutaneous electrogastrography (EGG) is the only non-invasive method of gastric myoelectric activity assessment which allows to evaluate slow wave activity and peak potentials of gastric contractions.[5] Although the principles of (EGG) have been known for years, it is controversial whether alteration of gastric electrical activity could be of clinical relevance in functional gastrointestinal disorders.[6]

This study aimed to assess the role of electrogastrography and gastric emptying in diagnosis of overlapping dyspepsia in patients with irritable bowel syndrome (IBS).

Subjects and Methods: 120 patients fulfilled Rome III criteria for IBS recruited from gastroenterology outpatient clinic of Ain Shams University hospital and 60 healthy controls who had no history of GIT disorders were enrolled in this study. (Subjects receiving any medication over an eight week period before the study (that is, antibiotics, antacids, prokinetics, proton pump inhibitors, H_2 receptor antagonists, or non-steroidal anti-inflammatory drugs), those with a history of abdominal surgery, gastrointestinal cancer, DM, renal failure, liver cell failure, neurological diseases, peptic ulcer disease and pregnant females were excluded from the study). Patients and volunteers gave informed consent prior to the investigations.

For all subjects the following was done:

1: ***Full history taking*** with special emphasis on ***IBS symptoms*** ex. abdominal pain and influence of defecation on pain, change in stool frequency or form, sensation of incomplete evacuation after defecation, passage of mucus and flatulence and ***dyspeptic symptoms*** ex. early satiety (fullness), nausea, vomiting and heart burn. A score for dyspeptic symptom was

assigned using a scale from 0 to 3 (0 = absence of symptoms, 1= mild, symptoms noticed when paid attention, 2 = moderate, symptoms clearly noticed without interfering with normal daily activities, 3 = severe, symptoms interfering with normal daily activities.[7]

2: *Clinical examination* with special emphasis on local abdominal examination.

3: Standardized workup included laboratory testing (CBC, ESR, blood glucose, renal and liver profile, stool analysis).

4: ***Abdominal sonography***.

5: ***Upper gastrointestinal endoscope*** (to exclude organic causes of dyspepsia) in patients with dyspeptic symptoms.

6: ***Colonoscopy*** was also performed in all subjects with red flag symptoms.

7: Liquid gastric emptying was evaluated sonographically after overnight fasting in order to calculate the fasting antral area (A fast**).** Then, after giving 200 ml water, the largest cross-sectional area of the antrum was calculated (A full) and the postprandial variation of the antral area was assessed every 5 minutes till reaching its original size.[7] Gastric half emptying time (the time taken for the antrum to reach half its full area (GET ($t_{1/2}$, min)) was the index of gastric emptying.[8]

8: Electrogastrography (EGG*)* was recorded from five disposable silver chloride surface electrodes placed on the upper abdomen for one hour in a fasting state and post prandial recording for one hour after ingestion of pastry and 250 ml milk (350 kcal).Variables assessed were: Dominant frequency (DF), the power of the dominant frequency (DP), power ratio (PR), percentage of bradygastria, normal and tachygastria.[5, 9]

Dominant frequency (DF): The frequency of gastric peak was determined by the absolute peak value ranged from 1 to 9 cycle per minute (CPM), and the mean frequency was computed by averaging the individual spectra, reflects the frequency of the gastric slow waves.[10]

Power ratio (PR): The ratio of dominant postprandial power to pre-prandial power. It is indicative of the post-prandial increase in gastric motor activity.[10]

A rhythmic electrical activity ranging from 2.6-3.7 CPM was defined as normal gastric electrical activity. Dysrhythmia was defined as follows:

Tachygastria: Was considered to be present when the running spectrum had a dominant peak at a frequency >3.7 and <10.8 CPM, that at the same time the normal gastric signal was absent in all four EGG signals.

Bradygastria: When the dominant peak was at a frequency less than 2.6 and more than 0.5 CPM in the absence of a normal 3 CPM component in all four EGG leads.[11]

Statistical analysis: All collected data were expressed as mean± SD for quantitative measures and both number and percentage for categorized data and analyzed by using SPSS version 13 using the following tests: Student t test, Chi-square test, Correlation co-efficient test (r-test), $P > 0.05$ was considered non significant, $P < 0.05$ was considered significant and $P < 0.01$ was considered highly significant.

Results: 120 **patients** fulfilling ROME III criteria of IBS were enrolled in this study, they were 52 males (43.35%) and 68 females (56.75%), their age ranged from 22-52 with a mean of 34.8±9.50 years. Of 120 IBS patients, 52 (43.3%) had dyspeptic symptoms as well as delayed gastric emptying and 22 (18.3%) had abnormal EGGs. 17 of these 22 patients (77.3%) with abnormal EGGs had delayed GE.

This study included also **sixty ages and sex matched healthy volunteers** as controls they were 30 males (50%) and 30 females (50%), their age ranged from 24-43 with a mean of 35±4.5 years. None of them neither had GIT symptomatology nor delayed gastric emptying, however abnormal EGG was found in 4 (6.7%) of the controls. Comparison between cases and controls as regard EGG and gastric emptying parameters is shown in table (1).

Table (1): Comparison between cases and controls as regard EGG and gastric emptying parameters.

Parameters	IBS(120)	Controls(60)	P
GET $t_{1/2}$ (min)	12.45±2.8	10.6±2.1	<0.05
DF(CPM)	3.1±0.8	3±0.68	>0.05
PR	1.77±1.1	2.5±2.16	<0.05
Normal EGG	98(81.7%)	56(93.3%)	<0.05
Bradygastria	18(15%)	3(5%)	<0.05
Tachygasria	4(3.3)	1(1.7%)	>0.05

IBS patients were subdivided according to bowel symptoms in to:
Group 1 (IBS-D): Sixty diarrhea predominant IBS patients. They were 28 males (46.7%) and 32 females (53.3%). Their age ranged from 23-45 with a mean of 33.13±8.18 years.
Group 2 (IBS-C): Sixty constipation predominant IBS patients. They were 24 males (40%) and 36 females (60%). Their age ranged from 22-52 with a mean of 36.53±9.82 years.
Gastric half emptying time was longer in IBS-C patients (13.7±2.9) compared to IBS-D and controls (11.2±2.8 & 10.6±2.1 respectively) (P < 0.01). IBS-C patients had lower PR (1.4±0.7) than did IBS-D and controls (2.14±1.5 & 2.5±2.16 respectively) (P < 0.01) as shown in table (2).

Table (2): Comparison between IBS-C, IBS-D and controls as regard EGG and gastric emptying parameters.

	Group 1	Group 2	Controls(3)	1 vs2	1vs3	2 vs.3
GET	**11.2±2.8**	**13.7±2.9**	**10.6±2.1**	**<0.01**	**>0.05**	**<0.01**
DF	**3.3±0.9**	**2.9±0.7**	**3±0.68**	**<0.01**	**<0.05**	**>0.05**
PR	**2.14±1.5**	**1.4±0.7**	**2.5±2.16**	**<0.01**	**>0.05**	**<0.01**

Fasting IBS-C patients showed more bradygastria and tachygastria than controls (29+/-14 and 9±6 vs. 16±11 and 7±5 respectively), feeding increased bradygastria to (40±15 vs. 13±9%) (P<0.01) as shown in table (3).

Table (3): Comparison between IBS-C, IBS-D and controls as regard dominant frequency distribution.

		IBS-D(1)	IBS-C(2)	Controls(3)	1vs.2	1vs .3	2vs.3
Normogastria	**Rest**	**78±18**	**61±17**	**77±15**	**<0.01**	**>0.05**	**<0.05**
	Meal	**78±19**	**52±18**	**86±14**	**<0.01**	**<0.01**	**<0.01**
Brady gastria	**Rest**	**13±11**	**29±23**	**16±11**	**<0.01**	**>0.05**	**<0.01**
	Meal	**13±7**	**40±15**	**13±9**	**<0.01**	**>0.05**	**<0.01**
Tachy gastria	**Rest**	**8±6**	**9±6**	**7±5**	**>0.05**	**>0.05**	**<0.05**
	Meal	**6±4**	**8±5**	**4±2**	**<0.05**	**<0.01**	**<0.01**

The IBS patients were further classified according to the presence or absence of overlapping dyspepsia into 52 patients with overlapping dyspepsia and 68 patients without dyspepsia.
Overlapping dyspepsia was more frequent in IBS-C as 44 patients were IBS-C vs. 8 were IBS-D (P<0.01). The electrogastrogram was normal in 93.3% of asymptomatic controls and 92.6% of patients with irritable bowel syndrome who did not complain of dyspepsia (p>0.05). The electrogastrogram was abnormal in 32.7% with IBS patients with overlapping dyspepsia. These patients showed significantly more bradygastria (26.9%) than controls (5.9%)(P < 0.01) , also they had statistically significant lower PR compared to non dyspeptic patients(2.1±1.3 vs. 2.9±1.6 respectively P<0.05), moreover gastric emptying time was delayed in IBS patients with overlapping dyspepsia (14.7±1.8) compared to those without dyspeptic complaints and controls (10 ±1.27 & 10.6±2.1 respectively) (P<0.01), however there was no statistically significant difference between non dyspeptic patients and controls as regard gastric emptying time(P=0.05) as shown in table (4).

Table (4): Comparison between IBS patients with overlapping dyspepsia and those without as well as controls as regard EGG and gastric emptying parameters.

	Dyspeptic (1)	Non Dyspeptic(2)	Controls (3)	1vs.2	1vs.3	2vs.3
GET	**14.7±1.8**	**10 ±1.27**	**10.6±2.1**	**<0.01**	**<0.01**	**0.05**
DF	**2.65±1.24**	**2.96±0.4**	**3±0.68**	**>0.05**	**>0.05**	**>0.05**
PR	**2.1±1.3**	**2.9±1.6**	**2.5±2.16**	**<0.05**	**>0.05**	**>0.05**
Normal	**35(67.3%)**	**63(92.6%)**	**56(93.3%)**	**<0.01**	**<0.01**	**>0.05**
Brady	**14(26.9%)**	**4(5.9%)**	**3(5%)**	**<0.01**	**<0.01**	**>0.05**
Tachy	**3(5.8%)**	**1(1.5%)**	**1(1.7%)**	**>0.05**	**>0.05**	**>0.05**

Gastric half emptying time was longer in patients with early satiety (fullness) compared to patients presented with other dyspeptic symptoms (P<0.01), and it had a negative correlation with severity of symptoms (r = -0.63, P < 0.01).The dyspeptic symptomatology did not correlate with EGG parameters. However, dominant frequency was negatively correlated with the symptom score (r = -0.26, P <0.05).Gastric half emptying time had significant negative correlation with power ratio (r= -0.73 &P<0.05).

Discussion: Overlapping dyspepsia was diagnosed in 52/120 (43.3%) IBS patients, which was more frequent in IBS-C (44 in IBS-C and 8 in IBS-D (p<0.01)). High prevalence of overlap between functional dyspepsia (FD) and irritable bowel syndrome (IBS) was reported in the previous studies as Wang and associates[12] found that in questionnaires were returned by 3014 patients FD-IBS overlap was observed in 5% of the patients, while 15.2% and 10.9% of the patients were classified as FD alone and IBS alone, respectively while Corsetti et al.,[13] reported that in 309 consecutive FD patients, questionnaires revealed that fifty-four percent of the patients had FD alone, whereas 46% had FD + IBS, moreover De Vries et al.,[14] stated that among GERD patients 25% had FD 35% had IBS and 5% had both FD and IBS. Only 35% had neither FD nor IBS. Clinical overlap of FD and IBS-C were more common than IBS-D.[12, 15]

The electrogastrogram was normal in 93.3% of the controls and 92.6% of patients with irritable bowel syndrome who did not complain of dyspepsia (p>0.05). 32.7% of patients with overlapping IBS and dyspepsia had abnormal electrogastrogram in the form of bradygastria (26.9%) and tachygastria (5.8%). These patients showed significantly more bradygastria (26.9%) than controls (5.9%) (P < 0.01). Gastric emptying was delayed in IBS patients with overlapping dyspepsia (14.7±1.8) compared to those without dyspeptic complaints (10 ±1.27) (P<0.01). However there was no statistically significant difference between non dyspeptic patients and controls as regard gastric emptying time (P=0.05).

These results were supported by ***Martinez et al.,[16]*** who stated that normogastria is the predominant rhythm in healthy people, although brief dysrrhythmia can be recorded that do not have any pathological meaning. Also **Leahy et al., [17]**who found that the electrogastrogram was normal in 92% of patients with irritable bowel syndrome who did not complain of dyspepsia. The electrogastrogram was abnormal in 25% with irritable bowel syndrome who complained of concurrent dyspepsia and concluded that the electrogastrogram is usually abnormal only if concurrent dyspepsia is present. However ***Oba-Kuniyoshi et al., [18]*** stated that gastric dysrhythmias, such as tachy- or bradygastria, have been reported in patients with functional dyspepsia (FD). Moreover Lin **et al., [19]** found that 60% of patients with functional dyspepsia had abnormal recording of GEA. Patients with FD frequently reveal impaired gastric emptying and increased tachygastria, which may have pathophysiological significance in these patients **Pfaffenbach et al.,[20]** this was confirmed by **Stanghellini et al.,[1]** who found that gastric emptying was delayed in IBS patients with overlapping dyspepsia as IBS patients without overlapping dyspepsia had normal gastric emptying of solids. These data were consistent with the concept that alterations in gastric myoelectrical activity leading delayed gastric emptying play a role in the dyspeptic manifestation in IBS patients**.[21]**

In this study fasting IBS-C patients showed more bradygastria and tachygastria than controls (29+/-14 and 9±6 vs. 16±11 and 7±5 respectively), feeding increased bradygastria to (40±15 vs. 13±9%) (P<0.01). However **Mazur et al.,[22]** who studied 23IBS patients matching Manning criteria and 30 healthy volunteers found that fasting IBS pts showed gastric dysrrhythmia (29+/-14% vs. 11+/-7%), feeding (300 kcal) improved dysrrhythmia to 20+/-13% vs. 8+/-5%.

We found that IBS patients with overlapping dyspepsia had lower PR compared to those without dyspeptic complaints (2.1±1.3 vs. 2.9±1.6 respectively P<0.05).

Increased sympathetic drive in IBS patients is responsible for gastric dysrrhythmias and low PR resulting in gastric emptying delay and dyspeptic symptoms **Mazur et al.,[22]** Thus overlapping dyspeptic symptoms in IBS patients should be not be attributed to their high prevalence but to a possible common disease process in a subset of patients.[23]

Gastric half emptying time was longer in patients with early satiety (fullness) compared to patients presented with other dyspeptic symptoms (P<0.01), it had significant negative correlation with severity of symptoms and power ratio (r = -0.63, r= -0.73 respectively & P<0.01). Dominant frequency was negatively correlated with the symptom score (r = -0.26, P <0.05).

Previous studies reported conflicting results concerning the association between symptomatology, gastric myoelectrical activity and gastric emptying.

Parkman et al.,[25], Cuomo et al., [25],Schaar et al.,[26] , Stanghellini et al.,[1], Giovanni et al., [27], Sarnelli et al., [28] , Hou et al., [29], Loreno et al., [7] **and Devanarayana et al.,[21]** agreed with our results as they found an association between bloating and delayed gastric emptying as well as indirect correlation between symptoms severity and gastric emptying rate, moreover **Van der Voort et al.,[4]** concluded that EGG could be useful as a diagnostic tool in patients with FD and IBS as they reported that eight of 40 patients (20%; three FD, three IBS, two FD and IBS) had delayed gastric

emptying. Disturbed gastric emptying and lack of a postprandial increase in the EGG amplitude were significantly correlated (r = 0.8; P < 0.01). **Chen et al.,** [30] stated that electrogastrography was abnormal in 26 (44.1%) patients with functional dyspepsia, also symptoms predicted abnormal electrogastrography in dyspeptic patients with nausea (OR=3.1; P<0.05). So electrogastrography is helpful in differentiating subgroups of patients with nausea or satiety.

Other studies failed to correlate dyspeptic symptoms with delayed gastric emptying ***(Holtmann et al.,*** [31]***, Talley et al.,*** [32]***and Boeckxstaens et al.,*** [33] Moreover, ***Pfaffenbach et al.,***[34] found that there was no association between clinical subtypes of dyspepsia and abnormalities in EGG. There was no association between normalization of gastric emptying and improvement in symptoms, thus while on the one hand it might be argued that abnormalities of gastric emptying can be directly associated with symptoms, it may be that disturbances in gastric emptying are simply a marker for other underlying abnormalities but are not directly relevant for manifestation of symptoms.

Conclusion and recommendation: IBS patients with overlapping dyspepsia frequently reveal impaired gastric emptying and increased bradygastria, lack of a postprandial increase in the EGG amplitude, which may have pathophysiological significance in some of these patients. Using both EGG and gastric emptying test can aid in the detection of functional disorders associating IBS and therefore achieve greater patient satisfaction with their treatment.

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Medicinal and Aromatic Plants Diversity of Asteraceae in Uttarakhand

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Abstract: Geographically Uttarakhand represents six eco-climatic regions from 300 m asl to 7817 m asl, and abode to a variety of medicinal and aromatic plants, and their products are being used by local communities from time immemorial. Asteraceae is the largest family of medicinal and aromatic plants in Uttarakhand. The species of the family are growing from low altitude of Tarai Bhabar to the alpine. There are annual, biennial or perennial herbs, under shrubs, shrubs. This paper includes the database on various aspects of medicinal plants of the family Asteraceae in the state. The database on various aspects includes species richness, genera richness, medicinal use and altitude for the different species of the family Asteraceae. "Nature and Science. 2010;8(3):121-128]. (ISSN: 1545-0740)".

Key Words: asteraceae, diversity, medicinal and aromatic plants

Introduction

Uttarakhand lies between $28^0$53'24" and $31^0$27'50" N latitudes and $77^0$34'27" and $81^0$02'22" E longitude and covers an area of 53,483 Km^2. The state is divisible into four major geological formations: Siwalik (outer) Himalaya, Lesser (lower) Himalaya, Greater (main) Himalaya and Trans Himalaya with six eco-climatic regions: Sub-tropical (<1500 m), warm temperate (1500-2500 m), cool temperate (2500-3000 m), sub-alpine (3000-3500 m), alpine (3500-5500 m) and nival (>5500 m). Due to its rich forest cover, the state has great potential to serve as a model for conservation and development of herbal plants. Medicinal and aromatic plant species are widely distributed due to a variety of climatic factors and altitudinal variations coupled with varied ecological habitats. These plant species are basic ingredient of the ethno-botanical and traditional health care system.

Asteraceae or Compositae family is also known as daisy family, sunflower family or thistle family. This is the largest family of the flowering plants with more than 24000 - 30000 species and 1600 - 1700 genera (Funk et. al, 2005) worldwide and inhabit almost every environment and continent except Antarctica. In India the family is represented by 900 species under 167 genera. Asteraceae taxa can assume almost every life-form viz. annual, biennial or perennial herbs, undershrubs, shrubs, a few trees, some scramblers and aquatics. Some are succulent, whereas others are spiny and some have milky sap. Many perennial species are adapted to survive the cold, dry winter season by underground storage organs and producing annual stems in spring. The name Asteraceae is derived from the term Aster means *composite* and refers to the characteristic inflorescence – have flower heads composed of many small flowers, called florets, and are surrounded by bracts (Moreira & Munoz, 2007). The largest genera are *Senecio* (1,500 species), *Vernonia* (1,000 species), *Cousinia* (600 species) and *Centaurea* (600 species). The circumscription of the genera is often problematic and some of these have been frequently divided into minor subgroups. Asteraceae are cosmopolitan, but most common in the temperate regions and tropical mountains. Some of the plants in Asteraceae are medically important and are also commonly featured in medical and phytochemical journals. Many members of the family are grown as ornamental plants for their flowers.

Uttarakhand represents the reservoir of 85 species of the family Asteraceae, which are being used by the local people from time immemorial in traditional health care system. They have very vast and important knowledge about many plants and their uses in traditional system of medicine. However, the information about this valuable resource is scattered and even some of these resources are at the verge of extinction. Therefore, the present work is an effort towards the compilation and documentation of medicinal plants resources of Uttarakhand.

Material and Method

Present study was carried out in the Uttarakhand state and based on extensive and intensive literature surveys, carried out in different universities, institutions and organizations, different Ph.D. thesis, Research papers, short communications, articles and flora providing information on medicinal and aromatic plants were studied thoroughly and available information was recorded. Attempts were made to collect all the possible data of the region, therefore, some recently introduced plants have also been included. The data present in the current paper is based on the compilation of collections made by other authors. Description of the species stated with correct name, author citation, synonym, habit, vernacular name (local dialect), Hindi, Sanskrit, English names, uses, altitudinal range, flowering and fruiting time and subsequent author citations. Although, inclusion of vernacular, Hindi names does not look proper but has a immense value to different users. The use of plants varies from place to place. Many plants which have no specific use is known are yet regarded as medicinal herb by different authors.

It is now well understood that appropriate knowledge about plants of a given region is essential for the proper and effective utilization of these resources. The main objective of the study was to create the database on various

aspects of medicinal and aromatic plants of Asteraceae family from Uttarakhand, so that it could provide necessary information about the present status of medicinal and aromatic plants of the family in the state.

Results

In the present study a total of 85 species of medicinal and aromatic plants with 54 genera of Asteraceae from Uttarakhand were recorded. Among them *Anaphalis, Artimissia, Chrysanthmum* and *Saussurea* (5 spp.) are the largest genera. Whereas others dominating genera are *Aster, Scenecio* and *Sonchus* (3 species), *Echinops* (2 species). Most of the plant species (76 spp.) are herbs, some are shrubs (5 spp.) and few (4 spp.) are under shrubs. These plant species are useful in traditional and ethnomedico-botany to treat different ailments such as asthma, diarrhoea, dysentery, cough, cold, inflammation, arthritis, rheumatism etc. by local inhabitant of the state.

Conclusion

Proper identification of the medicinal and aromatic plant has a vital role in the utilization of this natural wealth and conservation of biodiversity in the state. The future of this resource in Uttarakhand is at risk as they are often picked up from the wild, leaving little scope for their regeneration. Recently Rawat *et al.* (2001) listed 45 species (excluding Red Data Book) those need special attention for conservation. Undoubtedly, the resource needs to be harnessed for economic development, but simultaneously we have to conserve this resource for use on a sustainable basis.

In this context, it is of paramount importance that the herbal resource of Uttarakhand is scientifically identified, inventorised, documented and an exhaustive data base be prepared.

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***Acanthespermum hispidium* DC.**

Ht: Herb, *V:* Gokhuru, *E:* Star-bur, *U:* Antimicrobial, Arthritis, Rheumatism, *A:* up to 1500 m, *Fl. & Fr.*: Jan. – Jun.
1836 – DC., *Prodr.* **5:** 522. 1977 – Babu, *Herb. Fl. D. Dun* 237. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 553.

***Achillea millefolium* (L.)**

Ht: Herb, *V:* Milfoli, Gandrain, *H:* Gandan, *E:* Common Yarrow, Bloodwort, Sneezewort, Solider's Friend, *U:* Inflammation, headache, Influenza, excretory, *A:* 2000-3600 m, *Fl. & Fr.*: May – Oct.
1753 – Linnaeus, *Sp. Pl*. 899. 1881 – Hook. f., *Fl. Brit. India* **3:** 312. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1376. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 554.

***Adenostemma lavenia* (L.) Kuntze**

Syn: Verbesina lavenia L., *Ht:* Herb, *V:* Soh – byrthit, *H:* Jangli Jeera, *E:*Clubwort, *U:* Extract of leaves applied on injuries, *A:* up to 1300 m, *Fl.*: Apr.- May; *Fr.*: May - Sept.
1753 – Linnaeus, *Sp. Pl.* 902. 1881– Hook. f., *Fl. Brit. India* **3:** 242. 1977 – Babu, *Herb. Fl. D. Dun* 237. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 554.

***Ageratum conyzoides* L.**

Ht: Herb, *V:* Jangli Pudina, Gundrya, *H:* Jangli Pudina, *E:* Goat Weed, *U:* Pneumonia, Wounds and burns, *A:* up to 1500 m, *Fl. & Fr.*: Jan. – Dec.
1753 – Linnaeus, *Sp. Pl*. 839. 1881 – Hook. f., *Fl. Brit. India* **3:** 243. 1977 – Babu, *Herb. Fl. D. Dun* 238. 1984 – Naithani, *Fl. Chamoli* **1:** 304. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1330. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 554.

***Ageratum houstonianum* Miller**

Syn:Ageratum caeruleum Hort., *Ageratum mexicanum* Sims., *Ht:* Herbs, *U:* Cuts and Wounds, *A:* up to 1200 m, *Fl. & Fr.*: Jan. – Dec.
1768 – Miller, *Gard. Dict. ed*. **8:** n. 2. 1977 – Babu, *Herb. Fl. D. Dun* 239. 1984 – Naithani, *Fl. Chamoli* **1:** 304. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 555.

Ainsliaea apetera DC.

Syn: Liatris latifolia D. Don, *A. pteropoda* DC., *Ht:* Herb (Perennial), *V:* Khad-Jari, Kauru, *H:* Karvi Booti, *U:* Colic, Intermittent fiver, *A:* up to 1800 m, *Fl.* Mar. –May; *Fr.*: Sept. – Oct.
1838 – DC., *Prodr*. **7:** 14. 1881– Hook. f., *Fl. Brit. India* **3:** 388. 1884 – Naithani, *Fl. Chamoli* **1:** 304.
1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 555. 2001 – Joshi *et al.* Diversity, Distribution & Indigenous Uses of Plant Species in Pindari Area of Nanda Devi Biosphere Reserve II. in *Ind. J. For.* **24(4):** 514-536. 2001 – Samant *et al.* from Valley of Flowers National Park in *Himal. Biosp. Reser.* **3(1&2):** 5.

A*insliaea latifolia* (D.Don) Schults- Bipontinus

Syn: A. pteropoda DC. & *Liatris latifolia* D. Don., *Ht:* Herb, *V:* Kauru, *U:* Colic, *Fl.* : Apr. – Jun.; *Fr.*: Jul. – Oct.
1825 – D.Don, *Prodr. Fl. Nep*. 169. 1881– Hook. f., *Fl. Brit. India* **3:** 388. 1984 – Naithani, *Fl. Chamoli* **1:** 305. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 555. 2001 – Samant *et al.* from Valley of flowers National Park in *Himal. Biosp. Reser.* **3(1&2):** 5.

***Anaphalis adnata* Wall. ex DC.**

Syn: Gnaphalium adnata Wall., *Ht:* Herb, *V:* Bugla, *U:* Cuts, Wounds, Boils, *Fl. & Fr.*: Aug. – Feb.
1831 – Wall., *Cat.* 101 n. 2948. 1881– Hook. f., *Fl. Brit. India* **3:** 282. 1984 – Naithani, *Fl. Chamoli* **1:** 306. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 556.

An*aphalis busua* (Buch.- Ham. ex D. Don) DC.

Syn: A. araneosa DC. & *Gnaphalium busuum* Buch- Ham. ex D. Don, *Ht:* Herb, *V:* Bugla, Buglya, *U:* Bruises, Wounds, Cuts, *Fl. & Fr.*: Jan. – Dec.
1825 – Buch – Ham. ex D. Don, *Prodr. Fl. Nep*. 173. 1881 – Hook. f., *Fl. Brit. India* **2:** 283. 1977 – Babu, *Herb. Fl. D.Dun* 239. 1984 – Naithani, *Fl. Chamoli* **2:** 306. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 556.

***Anaphalis contorta* (D. Don) Hook. f. Kuntze**

Syn: Antennaria controta D. Don, *A. tenella* DC., *Ht:* Herb, *V:* Bhglya, *U:* Diarrhoea, *A:* up to 1800 m, *Fl. & Fr.*: Jul. – Mar.

1821 – D. Don, *Bot. Reg.* **7:** t. 605. 1881 – Hook. f., *Fl. Brit. India* **3:** 284. 1984 – Naithani, *Fl. Chamoli* **1:** 306. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 556. 2001 – Joshi *et al.* Diversity, Distribution & Indigenous Uses of Plant Species in Pindari Area of Nanda Devi Biosphere Reserve II. in *Ind. J. For.* **24(4):** 514-536.

***Anaphalis margaritacea* (L.) Benth**

Syn: A. cinnamone C.B. Clarke, *Gnaphalium margaritaceum* L., *Ht:* Herb, *V:* Buglya, *E:* Cottonweed, *U:* Astringent, Sedative, Antiseptic, *A:* up to 1800 m, *Fl. & Fr.*: Aug. – Dec.
1753 – Linnaeus, *Sp. Pl*. 850. 1876 – C.B. Clarke in *Comp. Indicae* 104. 1881– Hook. f., *Fl. Brit. India* **3:** 279. 1984 – Naithani, *Fl. Chamoli* **1:** 307. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 556.

***Anaphalis triplinervis* (Sims) C. B. Clarke**

Syn: Antennaria triplinervis Sims, *Ht:* Herb, *V:* Buglya, *U:* Diuretic, Tonsilittis, Edema, *A:* 1800 – 3200 m, *Fl. & Fr.*: Aug. – Oct.

1823 – Sims in *Bot. Mag*. **51:** t. 2468. 1876 – C.B. Clarke in *Comp. Indicae* 105. 1881 – Hook. f., *Fl. Brit. India* **3:** 281. 1984 – Naithani, *Fl. Chamoli* **1:** 307. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 556. 2001 – Samant *et al*. from Valley of flowers National Park in *Himal. Biosp.Reser. 3***(1&2):** 5. 2001 – Joshi *et al.* Diversity, Distribution & Indigenous Uses of Plant Species in Pindari Area of Nanda Devi Biosphere Reserve II. in *Ind. J. For.* **24(4):** 514-536.

***Artemisia absinthium* L.**

Ht: Shrub, *V:* Dumaar, Vilayati Afsanthin, *S:* Afsanteen, *E:* Absinthe, *U:* Heart burn, Appetite, *Fl. & Fr.*: Jun. – Oct.
1753 – Linnaeus, *Sp. Pl*. 850. 1977 – Babu, *Herb. Fl. D. Dun* 241. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1394. 2001 – Samant *et al.* from Valley of Flowers National Park in *Himal. Biosp. Reser*. **3(1&2):** 6.

***Artemisia cappillaris* Thunb.**

Syn: A. scoparia Waldstein & Kitaibel, *Ht:* Herb, *V:* Marwa, Jhirun, *E:* Wormwood, *U:* Dietary, Colic, *A:* 200-2000 m, *Fl. & Fr.*: Jul. – Nov.
1784 – Thunb., *Fl. Jap*. 309. 1881 – Hook. f., *Fl. Brit. India* **3:** 323. 1977– Babu, *Herb. Fl. D. Dun* 24. 1984 – Naithani, *Fl. Chamoli* **1:** 309. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1393. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 557.

***Artemisia japonica* Thunb.**
Syn: A. parviflora Roxb. ex D. Don, *Ht:* Herb, *V:* Pati, Pamasi, *U:* Antimalerial, *A:* 300-1500 m, *Fl. & Fr.*: Jul. – Nov.
1784 – Thunb., *Fl. Jap*. 310. 1881 – Hook. f., *Fl. Brit. India* **3:** 322. 1977 – Babu, *Herb. Fl. D. Dun* 241. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 558.

***Artemisia roxburghiana* Wall. ex Besser**
Ht: Under Shrub, *V:* Kunjaa, Chamur, *E:* Indian Wormwood, *U:* Antipyretic, Tonic, Skin allergy, *Fl. & Fr.*: Sept. – Nov.
1836 – Wall. ex Besser in *Bull. Soc. Imp. Nat. Mosc*. **9:** 57. 1881 – Hook. f., *Fl. Brit. India* **3:** 326. 1984 – Naithani, *Fl. Chamoli* **1:** 310. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 558. 2001 – Samant *et al.* from Valley of flowers National Park in *Himal. Biosp. Reser*. **3(1&2):** 6.

***Artemisia vulgaris* L.**
Syn: A. nilagirica var. septentrionalis (C.B.Clarke) Pampanini, *Ht:* Shrub, *V:* Kunjaa, *H:* Dona, *S:* Damnak, *E:* Mugwort, *U:* Ulcer, Ear trouble, *A:* up to 1500 m, *Fl. & Fr.*: Jul. – Dec.
1881 – Hook. f., *Fl. Brit. India* **3:** 325. 1876– C. B. Clarke, *Comp. Indicae* 162. 1977 – Babu, *Herb. Fl. D. Dun*. 241. 1984 – Naithani, *Fl. Chamoli* **1:** 310. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1394. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 558.

***Aster ericoides* L.**
Ht: Herb (Annual), *E:* Aster, *U:* Cough, pulmonary affection, Antimalerial, *Fl. & Fr.*: Aug. – Oct.
1753 – Linneaus, *Sp. Pl.* 875. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Aster peduncularis* Wall. ex Nees**
Syn: Amphirhaphis peduncularis DC., *Ht:* Herb, *V:* Phulyan, *U:* Stomachic, *A:* up to 1800 m
1826 – DC., *Prodr*. **5:** 344. 1881 – Hook. f., *Fl. Brit. India* **3:** 252. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 559. 2001 – Samant *et al.* from Valley of Flowers National Park in *Himal. Biosp. Reserv.* **3(1&2):** 6.

***Aster thomsonii* C. B. Clarke**
Syn: Callimeris flexuosus Royle ex DC., *Ht:* Herb, *V:* Phulari, *E:* Thomson Aster, *U:* Indigestion, *Fl. & Fr.*: Aug. – Oct.
1876 – C. B. Clarke in *Comp. Indicae* 48. 1881 – Hook. f., *Fl. Brit. India* **3:** 252. 1984 – Naithani, *Fl. Chamoli* **1:** 312. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 559. 2001 – Samant *et al.* from Vallley of Flowers National Park in *Himal. Biosp. Reser.* **3(1&2):** 6.

***Bidens biternata* (Lour.) Merill & Sherff**.
Syn: Coreopsis biternata Lour., *Ht:* Herb, *V:* Mangrinya, *H:* Chirchitta, *E:* Blackjack, *U:* Ear and Eye disorder, *Fl. & Fr.*: Mar. – Oct.
1790 – Lour., *Fl. Cochinch*. 508. 1881 – Hook. f., *Fl. Brit. India* **3:** 309. 1977 – Babu, *Herb. Fl. D. Dun* 242. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 560.

***Bidens pilosa* L.**
Syn: B. chinensis acut. non Willd., *Ht:* Herb, *V:* Kuree, *H:* Kumar, Kumra, Kurei, *E:* Bur – Marigold, U: Acute and Chronic Hepatitis, Eczima, Itching, Ulcers, *A:* up to 1500 m, *Fl. & Fr.*: Mar. – Aug.
1753 – Linnaeus, *Sp. Pl*. 832. 1881 – Hook. f., *Fl. Brit. India* **3:** 309. 1984 – Naithani, *Fl. Chamoli* **1:** 313. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1373. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 560. 1999 – Joshi *et al*. Diversity, Distribution and Indigenous use of Medicinal and Edible Plants of Nanda Devi Biosphere Reserve **I** in *Himal. Biosp. Reser*. **1(1&2):** 49-65.

***Blumea lacera* (Burm.f.) DC.**
Syn: Conyza lacera Burm. f., *Ht:*Herb, *V:* Kakranda, Kukurdara, *H:* Jangli Mulli, *S:* Kukuradru, *U:* Cough, Bronchitis, Rhinitis, Dysentry, *Fl. & Fr.*: Jan. – Dec.
1768 – Burm. f., *Fl. Indica* 180.t.59. 1881 – Hook. f., *Fl. Brit. India* **3:** 263. 1977 – Babu, *Herb. Fl. D. Dun* 245. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1341. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 562.

***Blumea lanceolaria* (Roxb.) Druce**
Syn: Conyza lanceolaria Roxb., *Ht:* Shrub, *U:* Wounds, Cuts, *Fl. & Fr.*: Feb. - May
1832 – Roxb., *Fl. Indica* **2.3:** 432. 1881 – Hook. f., *Fl. Brit. India* **3:** 269. 1977 – Babu, *Herb. Fl. D. Dun*. 246. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 562.

***Calendula officinalis* L.**
Ht: Herb (Annual), *E:* Pot marigold, Scotch marigold, *U:* Anti-viral, Anti-septic, Astringent, Anti-Inflamatory, *A:* 300-2200 m, *Fl. & Fr.*:
1753 – Linnaeus, *Sp. Pl.* 921. 1881 – Hook. f. in *Fl. Brit. India* **3:**357. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Carpesium abrotanoides* L.**
Syn: C. racemosum Wall., *Ht:* Herb, *V:* Kuleo, *U:* Antiplasmodial, Laxative, Diuretic, Anthelmintic, *A:* up to 2100 m, *Fl. & Fr.*: Aug. – Nov.
1753 – Linnaeus, *Sp. Pl*. 860. 1881 – Hook. f., *Fl. Brit. India* **3:** 301. 1984 – Naithani, *Fl. Chamoli* **1:** 317. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 565.

***Carthamus tinctorius* L.**
Ht: Herb (Annual), *V:* Kusumb, *H:* Kusum, *S:* Kusumba, *E:* Saf flower, *U:* Chronic disorder, Blood Purifier, Laxative, Diaphoretic, *A:* 300-1500 m,
1753 – Linnaeus, *Sp. Pl.* 830. 1881 – 1753 – Linnaeus, *Sp. Pl.* 830. 1881 - Hook. f. in *Fl. Brit. India* **3:**386. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Centaurea cyanus* L.**
Syn: C. lanata Roxb., *Ht:* Herb (Annual), *E:* Corn flower, Blue bottle, *U:* Conjuctivities,
1753 – Linnaeus, *Sp. Pl.* 875. 1832 – Roxb., *Fl. Indica* **2.3:** 644. 1999
1753 – Linnaeus, *Sp. Pl.* 875. – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Centipeda minima* (L.) A. Braun & Ascherson**
Syn: Astimisia minima L., *Ht:* Herb, *V:* Nakh-Chhikni, *S:* Chikkika, *E:* Sneeze Weed, *U:* Dipurative, Diuretic, *A:* up to 800 m, *Fl. & Fr.*: Jan. – Dec.
1723 – Linnaeus, *Sp. Pl.* 849. 1881 – Hook. f., *Fl. Brit. India* **3:** 317. 1977 – Babu, *Herb. Fl. D. Dun* 251. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 565.

***Centratherum anthelminticum* (Willd) Kuntze**
Syn: Vernonia anthelmintica (L.) Willd., *Ht:* Herb, *V:* Kalijeeri, Dhorajeeri, Ghrajiri, *H:* Somraji, *S:* Agnibija, Kshudrapatra, *E:* Purple Fleabane, *U:* Analgesic, Antipyretic, *Fl. & Fr.*: Aug. – Nov.
1763 – Linnaeus, *Sp. Pl. ed*. **2:** 1207. 1881 – Hook. f., *Fl. Brit. India* **3:** 236. 1977 – Babu, *Herb. Fl. D. Dun* 251. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1325. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 594.

***Chrysanthemum cinerariaefolium* Vis.**
Ht: Herb, *V:* Pyrethrum, *H:* Guldawali, *E:* Daisy, *U:* Insecticide, *A:* 350-2500 m,

1847- Vis., *Fi. Dalmat.* **11:**88. 1974 – Brewer, *Euphytica* 19: 121-124. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Chrysanthmum carinatum* Schousbe.**

Ht: Herb (Annual), *E:* Tricolour Daisy, *U:* Anti-viral, Anti-septic, Anti-Inflamatory, *A:* 300-600 m,
1801 – Schousbe., *Vextr. Maroklo.* 198. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Chrysanthmum cononarium* L.**

Ht: Herb (Perennial), *H:* Akurkurra, *S:* Chanramallika, *E:* Crown Daisy, *U:* Gonorrhoea, Conjunction,
1753 – Linneaus, *Sp. Pl.* 1254. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Chrysanthmum indicum* L.**

Ht: Herb (Perennial), *H:* Guldauli, *S:* Bahupatrika, Bringhesta, *E:* Pyrethrum, *U:* Diuretic, Carminative, Blood purifier, Stomachic,
1753 – Linneaus, *Sp. Pl.* 889. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1380. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Chrysanthmum leucanthemum* L.**

Syn: Leucanthemum vulgare, Ht: Herb (Perennial), *E:* Oxeye Daisy, *U:* Bronchitis, Diuretic, Astringent, Stomach Ulcer, *A:* 1500-2400 m,
1753 – Linneaus, *Sp. Pl.* 888. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Cichorium endivia* L.**

Ht: Herb (Annual), *H:* Kashini, *E:* Garden Endive, *U:* Febrifuge, Fever, Tonic, Demulcent, *A:* 300-1500 m,
1753 – Linneaus, *Sp. Pl.* 813. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1435. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Circium verutum* (D. Don) Spreng.**

Syn: Cnicus verutus D. Don, *Ht:*Herb, *V:* Kandaru, Kardra, *E:* Indian Thistle, *U:* Fever, Constipation, *Fl. & Fr.*: Aug. – Dec.
1825 – D. Don, *Prodr. Fl. Nep*. 167. 1881 – Hook. f., *Fl. Brit. India* **3:** 362. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 567.

***Cirsium Wallichi* DC.**

Syn: Cnicus Wall.ii (DC.) C. B. Clarke, *Ht:* Herb, *V:* Burunse, Kendeiya, *H:* Kandra, *E:* Indian Thistle, *U:* Dysentry, *A:* 1300-3000 m, *Fl. & Fr.*: Jul. – Nov.
1838 – DC., *Prodr.* **6:** 643. 1881 – Hook. f., *Fl. Brit. India* **3:** 236. 1977 – Babu, *Herb. Fl. D. Dun* 254. 1984 – Naithani, *Fl. Chamoli* **1:** 319. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 567. 2001 – Samant *et al.* from Valley of Flowers National Park in *Himal. Biosp. Reser.* **3(1&2):** 6.

***Cosmos bipinnata* Cav.**

Ht: Herb (Annual), *E:* Spanish needle, *U:* Anti-viral, Anti-septic, Blood Tonic, Jaundice, *A:* 300-1800 m, *Fl. & Fr.*: May – Sept.
1791 – Cav., Icon. **1:**10. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Dahlia imperialis* Roezl ex Ortigies**

Syn: D. rosea Cav., *Ht:* Herb, *E:* Imparialis Dahlia, *U:* Urinary disorder, Epilepsy, *A:* 300-1800 m, *Fl. & Fr.*: Aug. – Oct.
1863 – Roezl ex Ortigies in *Gart. Fl.* 243. 1794 – Cav., *Icon*. **3:** 37. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Echinops cornigerus* DC.**

Ht: Herb, *V:* Kantela, Kandara, *H:* Utakanta, *S:* Kantalu, Utati, Kantaphala, *E:* Globe- Thistle, *U:* Fever, Urinary Trouble, *A:* 1000-2000 m, *Fl. & Fr.*: Jul. – Oct.

1838 – DC., *Prodr.* **6:** 525. 1881 – Hook. f., *Fl. Brit. India* **3:** 358. 1977 – Babu, *Herb. Fl. D. Dun* 260. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 571.

***Echinops echinatus* Roxb.**

Ht: Herb, *V:*Kantela, Kandara, *H:* Gokhru, *S:* Kantalu, Kantphala, *E:* Globe – Thistle, *U:* Malarial fever, Kidney pain, *A:* 1200-2000 m, *Fl. & Fr.*: Feb. – Aug.
1832 – Roxb., *Fl. Indica*. **2.3:** 447. 1881 – Hook. f., *Fl. Brit. India* **3:** 358. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1414. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 572.

***Eclipta alba* (L.) Hassk.**

Syn:Eclipta prostrata (L.) L., *Ht:* Herb, *V:* Bhangru, *H:* Bhangru, Bhangri, *S:* Bhringraj, Kesharaj, Suparna, *E:* False Daisy, *U:* Liver Tonic, Rejuvenative, Dermatitis, *A:* up to 2000 m, *Fl. & Fr.*: Jan. – Dec.
1753 – Linnaeus, *Sp. Pl.* 902. 1881 – Hook. f., *Fl. Brit. India* **3:** 304. 1977 – Babu, *Herb. Fl. D. Dun* 260. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 572.

***Elephantopus scaber* L.**

Ht: Herb, *V:* Mayurjati, Adhomukha, *H:* Mayurjata, Gobhi, *S:* Anadujivha, Darvika, *E:* Prickly-leaved Elephant's Foot, U: Anaemia, Hepatitis, Cough and Cold, *Fl. & Fr.*: Aug. – Dec.
1753 – Linnaeus, *Sp. Pl.* 814. 1881 – Hook. f., *Fl. Brit. India* **3:** 242. 1977 – Babu, *Herb. Fl. D. Dun* 261. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:** 1328. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 572.

***Emilia sonchifolia* (L.) DC.**

Syn: Cacalia sonchifolia L., *Ht:* Herb, *V:* Hirankuri, Dudhi, *H:* Kirankari, *S:* Dravanti, *U:* Conjuctivities, Ulcer, Worm Infection, *A:* up to 2000 m, *Fl. & Fr.*: Feb. – Jun.
1753 – Linnaeus, *Sp. Pl.* 835.
1881 – Hook. f., *Fl. Brit. India* **3:** 336. 1984 – Naithani, *Fl. Chamoli* **1:** 224. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 573.

***Eupatorium adenophorum* Spreng.**

Syn: Ageratina adenophora (Spreng.) King & Robinson, *Ht:* Shrub, *V:* Kharna, Bakura, *E:* Hemp Agrimony, *U:* Dyspnea, Wound, Cough, *Fl. & Fr.*: Oct. – Mar.
1826 – Sprengel, *Syst. Veg.* **3:** 420. 1977 – Babu, *Herb. Fl. D. Dun* 264. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 574.

***Galinsoga parviflora* Cav.**

Ht: Herb (Annual), *V:* Marchya, Banmara, *E:* Gallant Soldier, U: Diarrhoea, Vomitting, *A:* up to 2000 m, *Fl. & Fr.*: Apr. – Oct.
1795 – Cav., *Icon. Descr. Pl.* **3:** 41.t.281. 1881 – Hook. f., *Fl. Brit. India* **3:** 311. 1977 – Babu, *Herb. Fl. D. Dun* 267. 1984 – Naithani, *Fl. Chamoli* **1:** 326. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 575. 2001– Joshi *et al.* Diversity, Distribution & Indigenous Uses of Plant Species in Pindari Area of Nanda Devi Biosphere Reserve II. in *Ind. J. For.* **24(4):** 514-536.

***Gerbera gossypina* (Royle) G. Beauv.**

Syn: Chaptalia gossypina Royle, *Ht:*Herb, *V:* Kapasee, Kapsalu, *U:* Manstrual disorder, Blood Pressure, Gastric, *A:* up to 2800 m, *Fl. & Fr.*: Mar. – Aug.
1835 – Royle, *Illus. Bot. Himal.* 251.t.59.f.2. 1881 – Hook. f., *Fl. Brit. India* **3:** 390. 1977 – Babu, *Herb. Fl. D. Dun* 267. 1984 – Naithani, *Fl. Chamoli* **1:** 326. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 576. 2001 – Joshi *et al.* Diversity, Distribution & Indigenous Uses of Plant Species in Pindari Area of Nanda Devi Biosphere Reserve II. in *Ind. J. For.* **24(4):** 514-536.

***Gnaphalium hypoleucum* DC.**

Ht: Herb, *V:*Buglya, Buglu, *E:* Cud weed, *U:* Cough, Backache, *A:* 1500-2400 m, *Fl. & Fr.*: Mar. – Oct.

1834 – DC. in Wight, *Contrib. Bot. India* 21. 1881 – Hook. f., *Fl. Brit. India* **3:** 288. 1984 – Naithani, *Fl. Chamoli* **1:** 327. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 577.

***Helianthus annuus* L.**

Ht: Herb, *V:* Suraj mukhi, *H:* Suraj Mukhi, *S:* Suryavarta, *E:* Sun Flower, *U:* Kidney and Pulmonary troubles, Spider medicine, *Fl. & Fr.*: Apr. – Oct.
1753 – Linnaeus, *Sp. Pl.* 904. 1977 – Babu, *Herb. Fl. D. Dun* 270. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1370. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 578.

***Helianthus tuberosus* L.**

Ht: Herb, *E:* Jerusalem Artichoke, *U:* Diabetes, Cough, Cold, *A:* 300-7500 m, *Fl. & Fr.*: Aug. – Nov.
1753 – Linneaus, *Sp. Pl.* 905. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 596.

***Helichrysum bracteatum* (Ventenat) Andrews**

Ht: Herb (Annual), *E:* Paper Daisy, Everlasting Daisy, *U:* Diuretic, Cough, Cold, Aphrodisiac, *Fl. & Fr.*: May – Sept.
1805 - (Ventenat) Andrews, Bot. Repos. Sub. t. 428. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 597.

***Inula cappa* (Buch. – Ham. ex D.Don) DC.**

Syn: Conyza cappa Buch.- Ham. ex D. Don, *Ht:* Undershrub, *V:* Athhu, Tamagari, Anodyne, Carminative, Depurative, *E:* Sheep's Ear *U: A:* 1000-2400 m, *Fl. & Fr.*:
1825 – Buch.- Ham. ex D. Don, *Prodr. Fl. Nep.* 176. 1881 – Hook. f., *Fl. Brit. India* **3:** 295. 1977 – Babu, *Herb. Fl. D. Dun* 271. 1984 – Naithani, *Fl. Chamoli* **1:** 329. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 579.

***Inula cuspidata* (DC.) C. B. Clarke**

Syn: Amphiraphis cuspidata DC., *Ht:* Shrub, *V:* Jhuri, Pushkar, *U:* Dyspepsia, Colic, *A:* up to 2000 m, *Fl. & Fr.*: Sept. – Dec.

1836 – DC., *Prodr.* **5:** 343. 1881 – Hook. f., *Fl. Brit. India* **3:** 296. 1977 – Babu, *Herb. Fl. D. Dun* 271. 1984 – Naithani, *Fl. Chamoli* **1:** 329. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 579.

***Jurinea macrocephala* Benth**

Ht: Herb, *V:* Gugal, Jari-Dhhp, *U:* Antimalerial, Eruption, Decoction, Colic, *A:* 3000-4000 m, *Fl. & Fr.*: Jul. – Sep.
1873 – Benth, Benth and Hook. Gen. Pl. II, 474.1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 595.

***Lactuca sativa* L.**

Syn: L. scariola var. sativa Boiss., *Ht:* Herb (Annual), *V:* Salad, *H:* Kahu, *E:* Lettuce, *U:* Demulcent, Sedative, Diuretic, Leucoderma,
1753 – Linneaus, *Sp. Pl.* 795. 1875 – Boissier, *Fl. Or.* **3:**809. 1881 – Hook. f. in *Fl. Brit. India* **3:**404. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 597.

***Laggera alata* (D.Don) Schultz-Bipon. ex Oliver**

Syn: Bluma alata (D. Don) DC., *Ht:* Herb, *V:* Lumra, *U:* Anti-inflammatory, Psychomedicine
Fl. & Fr.: Aug. – Nov.
1825 – D. Don, *Prodr. Fl. Nep.* 171. 1881 – Hook. f., *Fl. Brit. India* **3:** 271. 1984 – Naithani, *Fl. Chamoli* **1:**332. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 581.

***Launaea aspleniifolia* (Willd.) Hook. f.**

Syn: Prenanthes aspleniifolia Willd., *Ht:* Herb, *V:* Dudhliya, *H:* Musakani, *U:* diarrhoea, *A:* up to 1000 m, *Fl. & Fr.*: mar. – Oct.

1803 – Willd., *Sp. Pl.* **3:** 1540. 1881 – Hook. f., *Fl. Brit. India* **3:** 415. 1977 – Babu, *Herb. Fl. D. Dun* 274. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1370. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 578.

***Metricaria chamomilla* L.**

Syn: Chamomilla chamomilla (L.) Rydb., *Ht:* Herb, *H:* Chamomile, *E:* German Chamomile, *U:* Copugh, Cold, Cosmatic, *A:* 350-2500 m, *Fl. & Fr.*: Jun. – Sept.
1753 – Linnaeus, *Sp. Pl.* 862.

***Prenanthes violaefolia* Decne.**

Syn: Cicerbita violaefolia (Decne.) G. Beauv., *Ht:* Perennial Herb, *V:* Pitlya, *U:* Dismenorrhoea, *Fl. & Fr.*: Aug. – Oct.
1844 – Decne., *Jacquem. Voy.* **4(Bot.):** 100.t.108. 1881 – Hook. f., *Fl. Brit. India* **3:** 412. 1984 – Naithani, *Fl. Chamoli* **1:** 337. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 585.

***Saussurea albescens* (DC.) Schultz-Bipon.**

Syn: Aplotaxis albescens DC., *Ht:* Herb (Perennial), *V:* Pirya, *U:* Bronchitis, *Fl. & Fr.*: Sept. – Nov.
1838 – DC., *Prodr.* **6:** 540. 1881 – Hook. f., *Fl. Brit. India* **3:** 374. 1977 – Babu, *Herb. Fl. D.Dun* 277. 1984 – Naithani, *Fl. Chamoli* **1:** 339. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 586.

***Saussurea candicans* (DC.) Schultz-Bipon.**

Syn: S. heteromalla (D.Don) Hand. –Mazz., *Ht:* Herb (Annual), *V:* Murang, *U:* Carminative, Antibacterial, *Fl. & Fr.*: Aug. – Oct.

1838 – DC., *Prodr.* **6:** 540. 1881 – Hook. f., *Fl. Brit. India* **3:** 373. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1419. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 586.

***Saussurea gossypiphora* D. Don.**

Ht: Herb, *V:* Bherhgandha, *H:* Kasturi Kamal, *S:* Phenkamal, *U:* Cuts and Wounds, Check bleeding, *A:* 4300-5600 m, *Fl. & Fr.*:
2001 – Samant *et al.* Valley of Flower National Park *Himal Biosp.Reser.* **3(1&2):** 6.

***Saussurea costus* (Falc.) Lepsch.**

Syn: Saussurea lappa Clarke, *Ht:* Herb (Perennial), *V:* Kuth, *H:* Kuth, *S:* Kusth, *E:* Costus, *U:* Antiseptic, Anthelmintic, Cholera, *A:* 2200-3500 m, *Fl. & Fr.*: May. – Oct.
Clarke, *Comp. Ind.*233. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1420.

***Saussurea hypoleuca* Spreng. ex DC.**

Syn: S. auriculata (Spreng. ex DC.) Schultz- Bipon., *Ht:* Herb (Perennial), *V:* Thimra, Nurya, *S:* Kustha, *U:* Antiseptic, Anthelmintic, Cholera, *A:* 2200-3500 m, *Fl. & Fr.*: Jul. – Aug.

1838 – Spreng. ex DC., *Prodr.* **6:** 541. 1881 – Hook. f., *Fl. Brit. India* **3:** 374. 1984 – Naithani, *Fl. Chamoli* **1:** 340. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1420. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 586.

***Saussurea obvallata* (DC.) Edgew.**

Ht: Herb (Perennial), *V:* Kounl, Brahmkamal, *H:* Brahmakamal, *S:* Sthalpadam, *U:* Paralysis of limbs, *A:* Around 4000 m, *Fl. & Fr.*:
1999 – Joshi *et al*. from Nanda Devi Biosphere Reserve in *Himal. Biosp. Reser.* **1(1&2):** 49-65. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1419. 2001 – Samant *et al.* from Valley of Flower National Park in *Himal Biosp.Reser.* **3(1&2):** 6.

***Senecio graciliflorus* D C.**

Ht: Herb (Perennial), *V:* Luchee, Kikret, *E:* Groundsel, *U:* Insect bite, Ringworm diseases, *A:* 3000-4000 m, *Fl. & Fr.*: May – Oct.
1838 – DC., *Prodr.* **6:** 365. 1881 – Hook f., *Fl. Brit. India* **3:** 338. 1984 – Naithani, *Fl. Chamoli* **1:** 345. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 587. 2001 – Samant *et al.* from Valley of Flower National Park in *Himal. Biosp. Reser.* **3(1&2):** 7.

***Senecio laetus* Edgew**.

Syn: S. chrysanthemoides DC., *Ht:* Herb, *V:* Kalya di Jar, *U:* Asthma, Respiratory problems

Fl. & Fr.: Jun. – Nov.
1846 – Edgew in *Trans. Linnaeus Soc. Bot.* **20:** 74. 1881 – Hook. f., *Fl. Brit. India* **3:** 339. 1984 – Naithani, *Fl. Chamoli* **1:** 345. 1995 – Mathur in Hajra *et al.*, *Fl. India* **13:** 263. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 587. 2001 – Samant *et al.* from Valley of Flower National Park in *Himal. Biosp. Reser.* **3(1&2):** 7.

***Senecio nudicaulis* Wall. ex DC.**
Ht: Herb (Perennial), *V:* Galpatiya, Kakrata, *H:* Neelkanthi, *U:* Fever, Colic, *A:* up to 1500 m
Fl. & Fr.: Mar. – Oct.
1825 – Buch.- Ham. ex D. Don, *Prodr. Fl. Nep.* 178. 1881 – Hook. f., *Fl. Brit. India* **3:** 340. 1977 – Babu, *Herb. Fl. D. Dun* 278. 1984 – Naithani, *Fl. Chamoli* **1:** 346. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 587. 2001 – Samant *et al.* from Valley of Flower National Park in *Himal. Biosp.Reser.* **3(1&2):** 7.

***Siegesbeckia orientalis* L.**
Ht: Herb (Annual), *V:* Liskura, Gobariya, *U:* Anodyne, Blood Tonic, *A:* up to 2000 m
Fl. & Fr.: Jul. – Nov.
1753 – Linnaeus, *Sp. Pl.* 900. 1881 – Hook. f., *Fl. Brit. India* **3:** 304. 1977 – Babu, *Herb. Fl. D. Dun* 279. 1984 – Naithani, *Fl. Chamoli* **1:** 347. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1358. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 588.

***Silybum marianum* (L.) Gaertn.**
Syn: Cardoos marinus L., *Ht:* Herb, *V:* Silybum, *H:* Silybum, *E:* Milk Thistle, *U:* Liver tonic, Diuretic, Astringent, *A:* 350-1000 m, *Fl. & Fr.*: Jul. – Oct.
1791 - Gaertn., *Fruct. Sem. Pl.* 2:378.

***Solidago virgaurea* L.**
Ht: Herb, *V:*Pinja-phool, Sonali, *H: S: E:* Common Golden Rod, Aaron's-rod, U: Kidney tonic, Inflammation, Irritation, Digestion, *A:* up to 3000 m, *Fl. & Fr.*: Jul. – Oct.
1753 – Linnaeus, *Sp. Pl.* 880. 1881 – Hook. f., *Fl. Brit. India* **3:** 245. 1977 – Babu, *Herb. Fl. D. Dun* 280. 1984 – Naithani, *Fl. Chamoli* **1:** 337. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1335. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 589. 2001 – Samant *et al.* from Valley of Flower National Park in *Himal. Biosp. Reser.* **3(1&2):** 7.

***Sonchus asper* (L.) Hill.**
Syn: S. oleraceus var. asper L., *Ht*: Herb (Annual), *V:* Choupali, Pili dudhi, *E:* Rough Sow Thistle, Milk Thistle, *U:* Tonic, Diuretic, Jaundice, *A:* up to 3000 m, *Fl. & Fr.*: Mar.- Sept.
1753 – Linnaeus, *Sp. Pl.* 794. 1881 – Hook. f., *Fl. Brit. India* **3:** 414. 1977 – Babu, *Herb. Fl. D. Dun* 181. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1442. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 589.

***Sonchus brachyotus* DC.**
Syn: S. arvensis L., *Ht:* Herb (Perennial), *V:* Karatu, *H:* Sahadevi, *E:* Corn Sow Thistle, *U:* Dermatitis, Ulcer, Stomach problem, *A:* up to 2500 m, *Fl. & Fr.*: Apr.- Oct.
1753 – Linnaeus *Sp. Pl.* 793. 1838 – DC., *Prodr.* **7:** 186. 1881 – Hook. f., *Fl. Brit. India* **3:** 414. 1977 – Babu, *Herb. Fl. D. Dun* 282. 1984 – Naithani, *Fl. Chamoli* **1:** 348. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 590.

***Sonchus oleraceus* L.**
Ht: Herb, *V:* Dudiya, Dudhkani, *H:* Dudhi, *E:* Milk Thistle, U: Anticancerous, Febrifuge, Fever, Stimulate menstrual flow, Liver tonic, *A:* up to 2200 m, *Fl. & Fr.*: Mar. – Nov.
1753 – Linnaeus, *Sp. Pl.* 794. 1881 – Hook. f., *Fl. Brit. India* **3:** 414. 1977 – Babu, *Herb fl. D. Dun* 282. 1984 – Naithani, *Fl. Chamoli* **1:** 249. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1442. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 589. 2001 – Joshi *et al.* Diversity, Distribution & Indigenous Uses of Plant Species in Pindari Area of Nanda Devi Biosphere Reserve II. in *Ind. J. For.* **4(4):** 514-536.

***Sphaeranthus indicus* L.**
Syn: S. senegalensis DC., *Ht:* Herb, *V:* Gorkhmundi, *H:* Gorakh – Mundi, Mundi, *S:* Mundi, Bhikshugparivraji, Aruna, *E:* East Indian Globe Thistle, *A:* up to 1000 m, *Fl. & Fr.*: Mar.- Jun.
1753 – Linnaeus, *Sp. Pl* 794. 1881 – Hook. f., *Fl. Brit. India* **3:** 275. 1977 – Babu, *Herb Fl. D. Dun* 283. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1347. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 590.

***Stevia rebaudiana* (Bertoni) Hemsl.**
Ht: Herb, *V:* Madhukari, *H:* Madhukari, *E:* Stevia, *U:* Contraceptives, cholesterol
suppressing, antitumour activity, Calorie free sweetener, *A:* 300-1600 m, *Fl. & Fr.*: Aug. –Nov.
Author Citation:.

***Synotis alatus* (Wall. ex DC.) C. Jeff. &Y.L.Chen**
Syn: Senecio alatus Wall ex. DC., *Ht:* Herb (Perennial), *V:* Galpatiya, *U:* Fever, *Fl. & Fr.*: Aug. – Oct.
1838 – Wall. ex DC., *Prodr.* **6:** 368. 1881 – Hook. f., *Fl. Brit. India* **3:** 353. 1984 – Naithani, *Fl. Chamoli* **1:** 344. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 591.

***Tagetes erecta* L.**
Ht: Herb, *V:* Genda, *H:* Genda, *S:* Jhandu, *E:* Merigold, U: Wounds, Otalgia, *A:* up to 1800 m
Fl. & Fr.: Jan. – Dec.
1753 – Linnaeus, *Sp. Pl.* 807. 1977 –Babu, *Herb, Fl. D. Dun* 284. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1385. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 592.

***Tanacetum longifolium* Wall.**
Syn: T. dolichophyllum (Kitamura) Kitamura, *Ht:* Herb (Perennial), *V:*Guggal, Dhoop, *E:* Long leaved Tansy, U: Headache, Body ache, *A:* up to 3500 m, *Fl. & Fr.*: Aug. – Nov.
1838 – Wall. ex DC., *Prodr.* **6:** 130. 1881 – Hook. f., *Fl. Brit. India* **3:** 320. 1984 – Naithani, *Fl. Chamoli* **1:** 349. 1985 – Bisht *et al.*, Folk Medicines of Arakot Valley in Distt. Uttarkashi in : *Ind. Med. Pl.*(ed. P. Kaushik) 157-165. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 592. 2001 – Samant *et al.* from Valley of Flower National Park in *Himal. Biosp. Reser.* **3(1&2):** 7.

***Taraxacum officinale* Weber.**
Syn: Ht: Herb (Perennial), *V:* Dudhi, Karata, Kanphuliya, *H:* Barau, Dugdhfeni, *S:* Dugdhfeni, *E:* Common Dandleon, Bitterwort, *U:* Migrains, Hepatitis, Headache, *Fl. & Fr.*: Feb. – Oct.
1780 – Weber in Wiggers, *Prim. Fl. Holsat.* 56. 1881 – Hook. f., *Fl. Brit. India* **3:** 401. 1977 – Babu, *Herb, Fl. D. Dun* 285. 1984 – Naithani, *Fl. Chamoli* **1:** 350. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1436. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 593. 1999 – Joshi *et al*. from Nanda Devi Biosphere Reserve in *Himal. Biosp. Reser.* **1(1&2):** 49-65. 2001 – Samant *et al.* from Valley of Flower National Park in *Himal. Biosp. Reser.* **3(1&2):**7.

***Tragopogon gracilis* D. Don**.
Ht: Herb (Perennial), *V:* Gualsi, Induli, *U:* Wounds, *A:* up to 1800 m, *Fl. & Fr.*: Mar. – Sept.
1821 – D. Don in *Mem. Werm. Nat. Hist. Soc.* **3:** 414.
1881 – Hook. f., *Fl. Brit. India* **3:** 417. 1984 – Naithani, *Fl. Chamoli* **1:** 350. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 593. 2001 – Samant *et al.* from Valley of Flower National Park in *Himal. Biosp.Reser.* **3(1&2):** 7.

***Tridax procumbens* L.**
Ht: Herb, *V:* Akalkohrhi, Kumra, Kanphuli, *E:* Maxican daisy, wild daisy, Coat button, U: Wounds, *A:* up to 1000 m, *U:* Anti-diabetic, Immuno-modulation, *Fl. & Fr.*: Jan. – Dec.

1753 – Linnaeus, *Sp. Pl.* 900. 1881 – Hook. f., *Fl. Brit. India* **3:** 311. 1977 – Babu, *Herb. Fl. D. Dun* 286. 1984 – Naithani, *Fl. Chamoli* **1:** 351. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 594.

***Vernonia cinerea* (L.) Lessing**

Syn: Conyza cinerea L., *Ht:* Herb, *V:* Kalgira, Kaljiri, *H:* Sahadevi, *S:* Sadodi, *U:*Dysentry, Cough, Cold, *A:* up to 1500 m, *Fl. & Fr.*: Jan. – Dec.
1753 – Linnaeus, *Sp. Pl.* 862. 1881 – Hook. f., *Fl. Brit. India* **3:** 233. 1977 – Babu, *Herb Fl. D. Dun* 287. 1984 – Naithani, *Fl. Chamoli* **1:** 351. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 594.

***Xanthium indicum* Koenig**

Syn: X. strumarium L., *Ht:* Herb (Annual), *V:* Kuroo., Bhangra, Gokhuriya, *H:* Gokhru, Burchita, *S:* Arishta, *E:* Cocklebur, *A:* up to 1800 m, *Fl. & Fr.*: Jul. – Dec.
1832 – Koenig in Roxb., *Fl. Indica* **2.3:** 601. 1881 – Hook. f., *Fl. Brit. India* **3:** 303. 1977 – Babu, *Herb. Fl. D. Dun* 290. 1984 – Naithani, *Fl. Chamoli* **1:** 353. 1995 – Chowdhery in Hajra *et al.*, *Fl. India* **12:** 427. 1994 – Kirtikar & Basu, *Ind. Med. Plant* (second ed.) **2:**1356. 1999 – Gaur, *Fl. Distt. Garh. N. W. Himal. (with ethnobotanical notes)* 595.

Common Abbreviation:

asl- Above sea level, Ht - Height, H - Hindi name, Syn - Synonym, V - Vernacular name, S - Sanskrit name, U – Uses, A – Altitude, Fl – Flowering, Fr – Fruiting.

1/12/2010

An issue of improvement in Annual land use planning

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Abstract: The part where the mathematic modeling and GIS modeling are being established and formulated is the major system of decision supporting system, and taking into account the criterions of making the GIS modeling, \in this thesis\ it will be easily established using all types of relevant information. Models that base on relevant information and criterions are most likely to effectively serve the decision makers and the users of the modeling. In order to follow the world standard and freely transfer geographic information in an international environment, the process of reforming meta data standard of GIS in Mongolia is basing on researches of international meta data standard of GIS (ISO 19115). Therefore the meta data standard have been processed adapting into certain conditions of Mongolia. The territory of Ulaanbaatar city is selected as the research object and including the total territory, researches on today's pressing issues of land administration, land legislation, land cadastre, and land planning have been made thoroughly and the objectives of this thesis have been put forward in resolving issues in urban land use planning. When processing the land use planning of the capital in 2009, taking into account the results from the 3.3.1 and using the GIS analyzing and GAP assessment tools, it is now possible to extend the serving area. Two types of construction standards those are observed in Mongolia used in order to set\establish serving area of commerce in Ulaanbaatar city. [Nature and Science 2010;8(3):129-138]. (ISSN: 1545-0740).

Keywords: Annual land use planning, Geographic information system, assessment, land administration, meta data

1. Introduction

In recent years, Ulaanbaatar population have increased steeply that from 1998 to 2008 average growth reached 5.3% and this leads to an issue of social, economic and infrastructure service areas not being able to grow at the same rate as the population growth. Master plan of developing Ulaanbaatar city until 2020 was officially approved and being implemented since 2002, however population growth management and monitoring of land use are now the issues that need to be revised.

Land Law of Mongolia was approved in 1995, Land Privatization Law of Mongolia was approved in 2002, and as a result land privatizing, land possessing and land use right have been registered until now, however formulating methodology of annual land use planning for implementing the Master Plan have not been approved yet.

For this reason, corresponding to new approach to land administration in International level, when formulating the annual land use planning method legal legislations relating to land privatization, land possession, land use right need to be taken account. Using highly accurate and relative information that base on GIS, improving the future Ulaanbaatar land use planning by bringing it to other developed county standards and creating system that use high technologies and providing quality training to specialized workforce are crucial.

One of the objectives of the thesis is to uncover the ways of improving the operations of Capital land use planning. Within this objective, following issues are put forward for resolution. These are:

- Looking out for ways of improving the future Capital land use planning by evaluating current Capital land use planning.
- Formulating land use plan basing on GIS and investigate whether the plan is feasible.

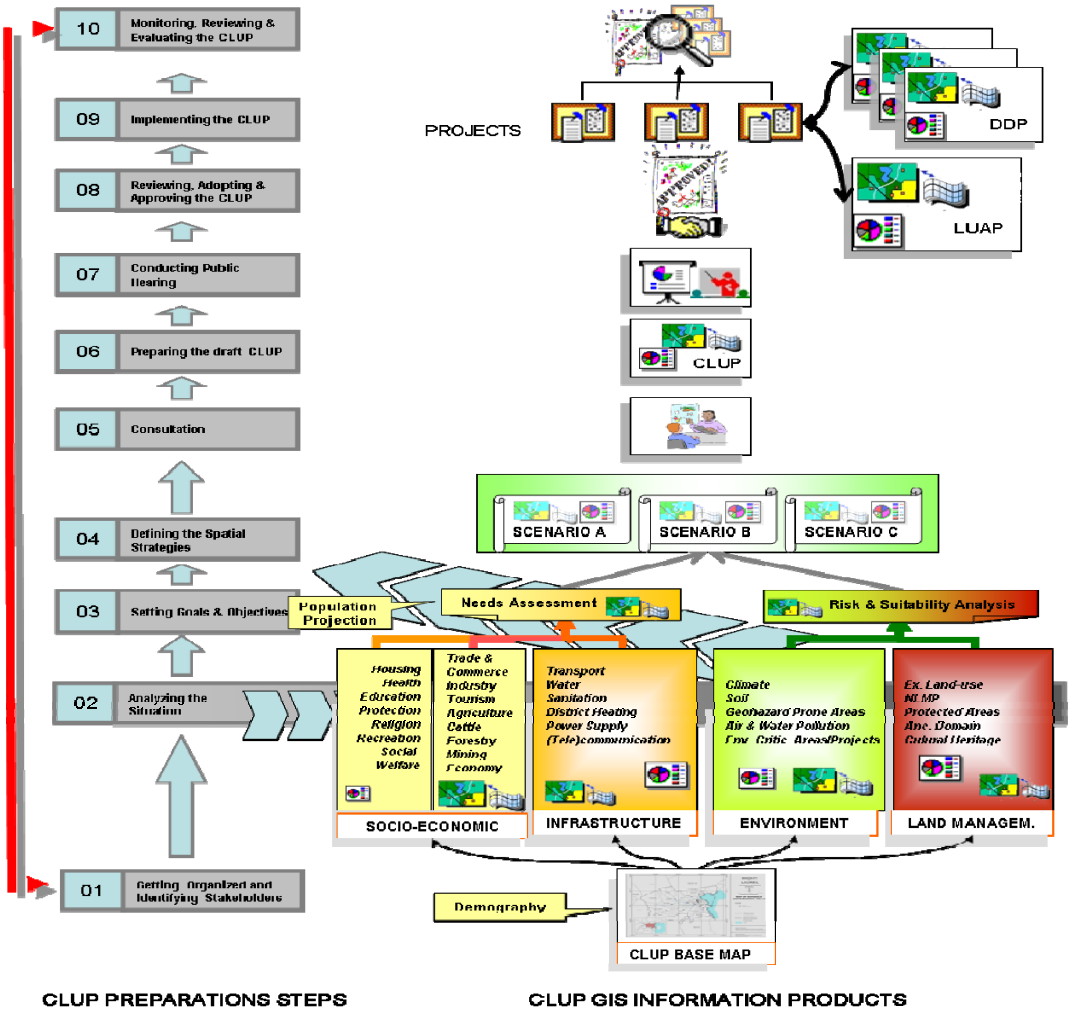
Information are sourced from Department of Land Affairs, Geodesy and Cartography, Land Administration Department of Capital, SIDA, and Swedesurvey.

Acronyms:

CLUP	Comprehensive Land use planning
LUP	Land use planning
GIS	Geographic information system
LA	Land administration

2. Methodologies of this case study /New modeling for improvement of land use planning/

Applying the information with high level of accuracy that base on GIS, plan to implement the major policy of improving land use planning in Ulaanbaatar, future land use and land administration have been made and divided to be implemented within following steps. (Figure 1).



\ISO 1.05 Relationship of the GIS Cookbook to CLUP Guidebook\.

Figure 1. Structure of the methodology

The main appearance form of methodology consists from 10 steps, 2 types of analyzes and 4 types of information.

Step 1. Getting organized stakeholders
Step 2. 2 types of analyzes on main 4 information.
Step 3. Setting goals and objectives
Step 4. Establishing and evaluating options
Step 5. Consultation
Step 6. Preparing the draft
Step 7. Conducting public hearing
Step 8. Approval
Step 9. Implementation
Step 10. Monitoring

From this methodology /thesis/, two kinds of analyze will be thoroughly explained. (Figure 2).

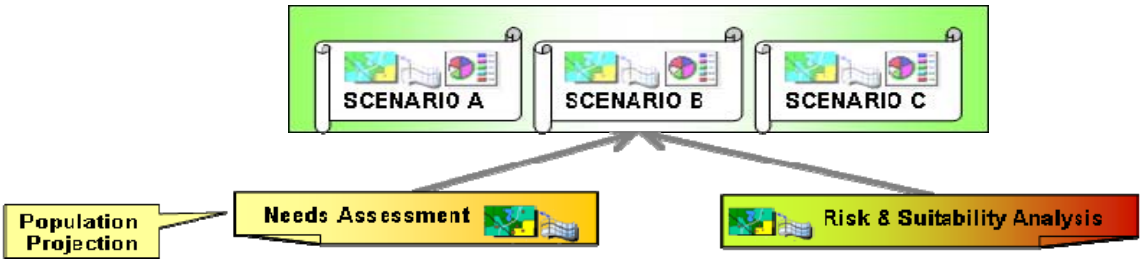


Figure 2. Types of analyzes

(Analyze 1) Needs assessment

Needs assessment is mainly useful analyze for ArcGIS program, it describes commerce serving area of needs for regional territory. It will be appeared below as an example. (Figure 3).

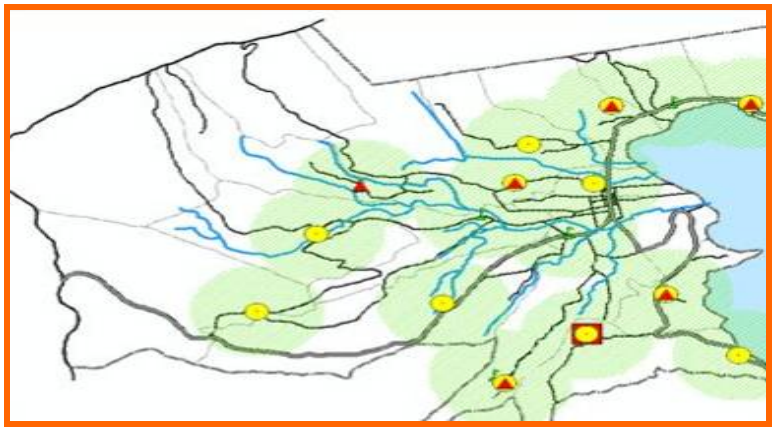


Figure 3. School positioning that has to be repaired.

Triangular red color on this map is the school positioning that has to be repaired and green contour line is the commerce serving area.

(Analyze 2) Risk and Suitability analysis

This analyze describes average value of suitable and unsuitable positions, creates follow the meaning point from many kinds of thematic maps. The modeling of suitability analyses will be appeared below. (Figure 4).

Figure 4. The modeling of suitability analyses.

There are 10 needed steps in order to implement this framework /case study/ and step numbers of 2, 4, 5, 7 are the predominate levels. (Table 1).

Table 1. Steps for implementing framework

Step1 Analyzing on dominate information, approval of the draft	**Step2** Standardized and realized information \Metadata of the ESRI and ISO standard\	**Step3** Setting criterions in accordance with needs and characteristics of the activity	**Step4** Conducting public hearing, evaluation and control of the criterions \experts and specialists\	**Step5** Formulation GIS Modeling, establishing other models
Step 10 Monitoring, evaluating on implementing process Monitoring, Reviewing & Evaluating the CLUP	Step9 Setting results into the materials and other source of information \database,WEB page, printing\	Step8 Classifying, zoning and setting limitation the researches	Step7 \Analyzing the model's\	Step6 Setting goals and objectives

By implementing this program with 10 steps, as a result, GIS storage will be created for decision supporting system that based on geographic information system. From this program with 10 steps, step numbers of 1,2,5 will be thoroughly explained below.

A) Analyzing the dominate information, approval of draft /final version/

This step is going to describe the ways of activities and information transferring in order to conduct the activities how to implement this program. In order to implement the planned activities, public hearing with specialists and experts should be conducted. (Figure 5).

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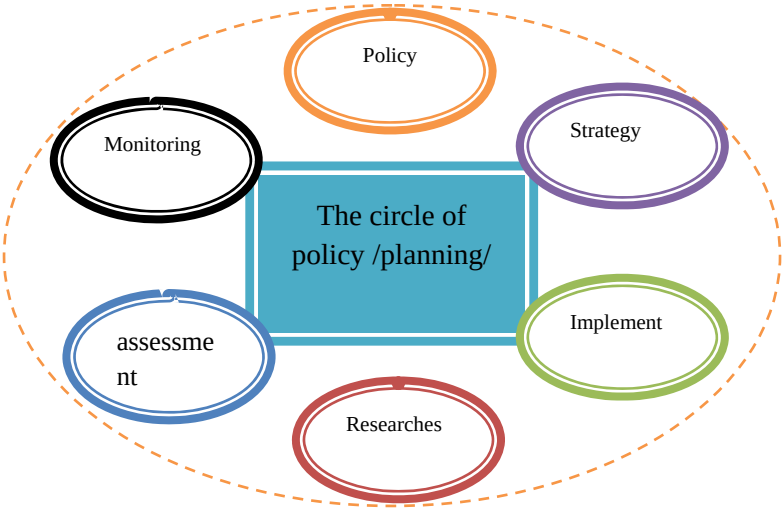

Figure 5. The form of Program

Transferring information and general modeling consists from 4 basic information. These are:

1. Socio and economic information
2. Infrastructure
3. Environment
4. Using land

B) To create the criterions what is compatible for specific features of activity and needs

In this part of activity, what criterions has to be implemented, using these information? What results will be set from implementing the criterions on these information? These are the most important activities.

C) Creating "GIS Modeling" and formulate other modeling.

The part where the mathematic modeling and GIS modeling are being established and formulated is the major system of decision supporting system, and taking into account the criterions of making the GIS modeling, \in this thesis\ it will be easily established using all types of relevant information. Models that base on relevant information and criterions are most likely to effectively serve the decision makers and the users of the modeling. (Figures 6, 7, 8).

Figure 6. Formulating criterions and the methodology for creating modeling

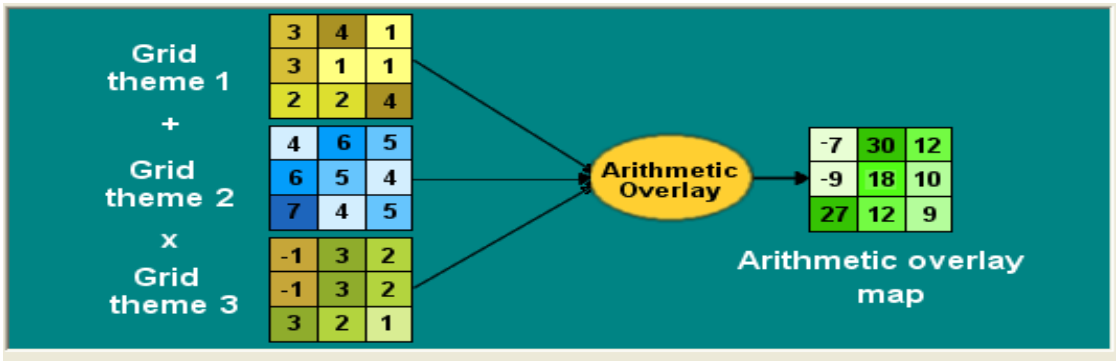

Figure 7. The methodology to unifying criterions

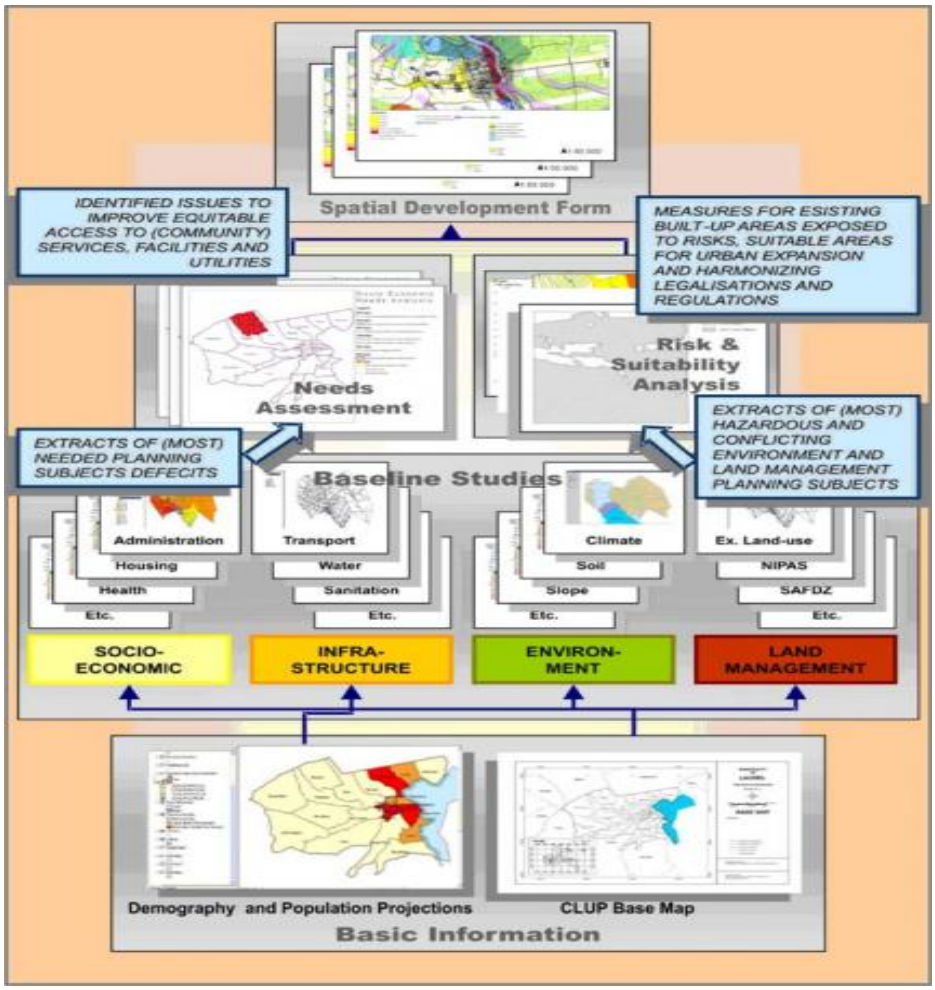

Figure 8. Decision supporting system.

2.1. Results

1. Monitoring system based on Geographic information database will be established.
2. Mathematic models based on Geographic information database will be consisted of.
3. Professional bases on high technology to support for decision makers will be established.

2.2 Inserting basic information that will be used for Decision Supporting System into International meta data standard

Today many organizations in Mongolia, depending on their capacity and ability, are using various geographic information and data in different levels. Constituting geographic information is a process that requires reasonable time and money.

Therefore, cooperating and sharing geographic information have various advantageous traits such as saving the expenses, remove unnecessary job vacant, making the information transparent, improving the quality of the data, maintaining appropriate technical conditions for transferring and sharing information and etc. In order to create favorable information gaining environment for users, organizations that handle geographic information and certain professionals need to discuss the issue first of all. Afterwards, National Standard for meta data needs to be processed and following this standard information fund shall be established through constituting geographic meta data.

In order to follow the world standard and freely transfer geographic information in an international environment, the process of reforming meta data standard of GIS in Mongolia is basing on researches of international meta data standard of GIS (ISO 19115). Therefore the meta data standard have been processed adapting into certain conditions of Mongolia.

2.3. A Need To Shift Into United Structure of Geographical Co-ordinates

From 1990s GPS measuring and mapping technology was introduced to Geodesy and Topography sector of Mongolia and further ordinary users all over the world started using this technology. Air and auto transportation, sea shipment, tourism, sport competition, environment, telecom, energy sector, agriculture, and mining sector all started using GPS technology and within this reason a need to coincide the previous topographic mappings with GPS measuring was urged. Furthermore, satellite pictures being used in making topographic mapping technology has helped Geodesy, Topographic Mapping sector to develop enormously. Nowadays, normal Internet users are able to access satellite pictures from Google, Landsat, Spot and etc.

All the pictures taken by the satellites are same co-ordinates as GPS co-ordinates and this influenced in common usage of GPS technology and now information fund and mappings have been created in the coordinating structure and being used worldwide. Different structures of coordinating – satellite pictures, satellite technology and GIS systems have been used in making cadastre mapping, however this limits transferring information between organizations and leads to confusion demands the topographic mapping to shift into united structure of geographical coordinating.

2.4. Used projection

Geographic Coordinate System: GCS_ITRF_1988
Angular Unit: Degree (0,017453292519943299)
Prime Meridian: Greenwich (0,000000000000000000)
Datum: D_ITRF_1988
Spheroid: GRS_1980
Semimajor Axis: 6378137,000000000000000000
Semiminor Axis: 6356752,314140356100000000
Inverse Flattening: 298,257222101000020000

2**.5. Meta data**

In order to use the information fully, it is crucial to draft requirements and limits of data and forces that constitute the data well. Meta data makes it less complicated for data producers to draft complete package of that data, and thoroughly explain the data. Further it gives certain limits and things to be cautious while using the data to users and provide them with the opportunity to use the metadata within their necessary purposes and assess it.

Geographical metadata is used not only by its producers but various other users, in other words, metadata can be produced by certain person or organization but other non authorized persons are able to use the information. There is a need to draft the metadata in a way that certain users who do not have basic knowledge of topography understand it and use it effectively. For geographical metadata producers and users the more the data size and range the better chance of drafting the data in an advanced way, giving more precise information about the data, further producing, saving, renewing ,and reusing the data. And overall it improves the management of these operations.

The purpose of this standard is to create content and structure of elements that is used in drafting and explaining geographical numeric data. This standard will help system investigator, developer of GIS and other users to understand and effectively use general requirements and main principles in using the standard. This standard will determine the metadata elements, graphically show the relations of set of data, and define professional terms that are used and adjust them. By following the standard, data producers will benefit:

1. Data producers will know how to draft data with precision by using necessary geographical data indicators.
2. Possibility of organizing and improving the data management of geographical data.
3. For users, it gives the opportunity to easily obtain and use the information by knowing the general information and necessary specifications.
4. It will be possible to discover, and repeatedly use the data. Users will have wide opportunities to locate, obtain, assess, buy, and use the geographical information.
5. Users will also be able to determine whether the necessary information exists and if it does where to obtain it.

International standard will be used toward common objective of information gaining and it determines the meta data thoroughly. Metadata that is related to geographical data and geographical data

serving area are clearly written in the ISO 19100 international standard.

2.6. Realized and standardized information

Geographic information will be unified into international standard and Meta data from. These are:

1. Quick Look, Table Index and Table Coding
2. Metadata for Basic Information
3. Metadata for Socio-economic
4. Metadata for Infrastructures
5. Metadata for Environment
6. Metadata Land Management

Metadata for Basic Information

1. Boundary \Urban boundary information\
2. Relief
3. RS data\ Remote Sensing\

Metadata for Socio-economic

1. Housing
2. Health
3. Education
4. Protection
5. Religion
6. Recreation
7. Social Welfare
8. Commerce
9. Industry
10. Tourism
11. Agriculture
12. Forestry

Metadata for Infrastructures

1. Transport
2. Water
3. Sanitation
4. Power Supply
5. Communication
6. Mining

Metadata for Environment

1. Slope
2. Landslide
3. Soil Type
4. Flood
5. Water
6. Ground Water

Metadata Land Management

1. Existing General Land and Water Use
2. Proposed General Land and Water
3. Zoning
4. Land Classification
5. Strategic Agriculture and Fisheries Development Zones (SAFDZ)
6. Building Permit from (the date the CLUP was Approved) onwards
7. National Integrated Protected Areas System (NIPAS)
8. Non-National Integrated Protected Areas System (Non-NIPAS),
9. Cultural Heritage

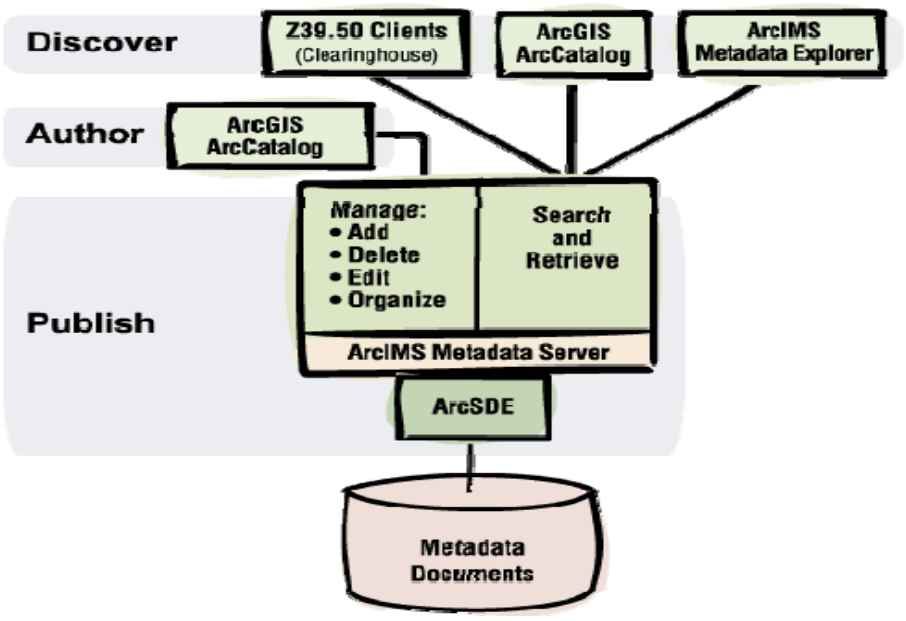

Figure 9. Scheme of information standard

In order to unify above all information, Arccatalog and metadata explorer systems have to be used.

3. Urban land use planning, land use form

3.1. Condition of urbanization.

Ulaanbaatar city occupies 16151 hectare, out of this urban land also occupies 4.95 percent.

Comparing Commercial zoning and field structure below. /percentage/

1.Commercial zoning-33,2
2.Social infrastructure zoning- 5,2
3. Industrial infrastructure zoning-10
4. Production and office zoning-13,7
5. Protected area-2,7
6. Non operational and damaged area 28,8
7. Other 4,2

3.2. Evaluating the situation of urbanization

Master plan of Ulaanbaatar city, case study for construction of Ulaanbaatar city.

3.3. Land use planning of 2009

This chapter includes model draft of 2009 land use planning of Ulaanbaatar City. By using this model it is possible for Land Administration Office to solely make the land use planning of 2010 and 2011 without computer programmers' help.

By using this new drafting model, following results have been made. Regions to be newly developed are colored in blue, brown background shows the areas that are in use now. Brown is deducted from the newly developing region and these regions that are near the necessary infrastructure have been located using the ArcGIS program and it is monitored by architect and land planning officials. Out of the results planning of businesses, service, and public organizations are shown below /Figure 10, 11/.

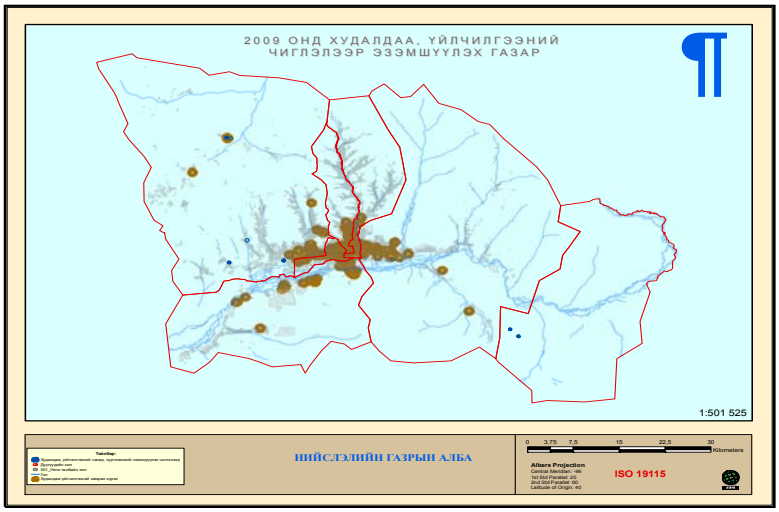

Figure 10. Land position to possess for just commerce

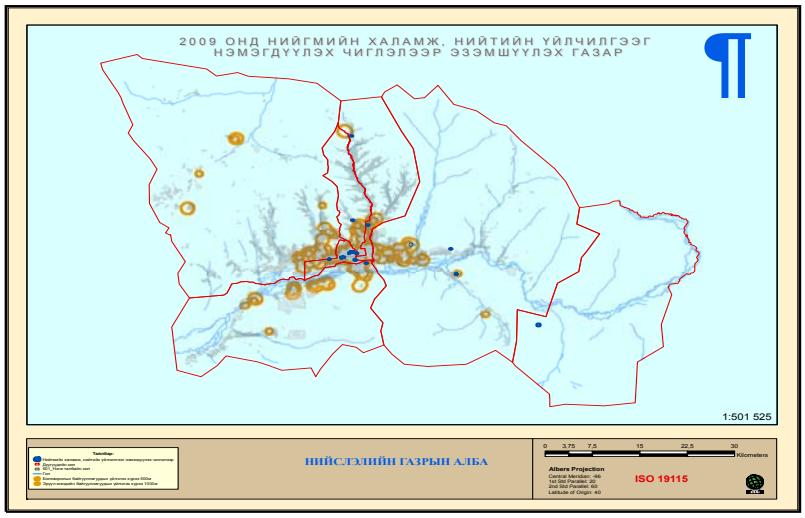

Figure 11. Land position to possess for just public service

4. Conclusions

Regarding the social and economic conditions, summing up today's condition of the capital and capital development process and land use planning process are following:

1. Looking at the analyses and assessments that were made on public supply, infrastructure, businesses and services, education and other sectors, suburb areas and some of the regions in the central capital are not used in any purpose. In terms of danger level, central parts of the city buildings are locating in the areas where petrol station dangerous area locates. Health service stands in relatively high standard comparing to other services. It is well possible to develop those suburban areas and register the locations to include in the capital land use planning.
2. In today's highly developed information and technology society, basing on the satellite information that constitute GIS, will help decision makers determine the land use planning and it is mentioned in summaries of 2009 land use planning of the capital. Therefore, it is considered that when processing Master plan of land use, and capital building plans, it is important to assess the social and economic condition of the area and apply it to the planning process.

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