Physiological and biochemical responses of two cultivars of wheat to elevated levels of CO$_2$ and SO$_2$, singly and in combination. *Environ Polln*, 121(2)(2003), 189-197 [36 Ref].

Study was aimed at investigating the long-term influence of elevated concentrations of CO$_2$ and SO$_2$, singly and in combination on the physiological and biochemical characteristics of two cultivars of wheat (*Triticum aestivum* L. cv Malviya 234 and HP 1209). Stimulation of photosynthesis rate and reduction in stomatal conductance and transpiration rate were observed under CO$_2$ treatment. Concentrations of total soluble sugars, starch and total phenolics increased in response to CO$_2$ and CO$_2$+SO$_2$ treatments.


The crop of sugarcane (*Saccharum officinarum*) was grown at the agricultural farm of the Mathura Oil Refinery in a simple randomized block design. The plants gave better response to the treated wastewater (TW) than the groundwater. The soil receiving wastewater did not show any significant change in its physico-chemical characteristics. The soil accumulated all the heavy metals but the plant samples receiving TW only exhibited the present of Ni, Pb and Zn whose values are far below the premissible limits.


The accumulation of pollutants on the plant surface is a contributing factor to the forest decline. Phosphatase is thought to be directly related to the level of organic phosphorous in the soil. Phosphatases are also produced by ectomycorrhizal fungi. Root surface phosphatase activity has its relationship with mycorrhizal association and p-uptake. Investigation was carried out to study the toxicity of heavy metals on phosphatase activity of mycorhizospheric pine seedlings.

The abnormal growth of trees and failure of growing crops in the vicinity of thermal power house Kasimpur is indicative of the genotoxic effect of air pollution on plants. Mitotic studies were carried out on *Cestrum diurnum* Linn. brought from the Kasimpur power station area. Chromosomal abnormalities like stickiness, bridges, laggards, precocious separation and cytoplasmic bridges were observed in considerable frequency.


Mungbean (*Vigna radiata* L. Witczek) cv. Pusa Baisakhi seedlings were raised in individual (0, 1, 10, 100 and 1000 ppm) and combined solutions (1: 1, 10 : 1, 1 : 10 ppm Hg : Mn) of mercury and manganese for 6 days. Phenol and proline were found to accumulate in leaves in response to treatment with heavy metals. The magnitude of accumulation correlated with concentration of metals. However, a reverse trend was noticed in stem for phenol. Accumulation of phenol in response to heavy metal treatment was organ specific and occurred at higher rate in plant part, which faced the stress mostly.


Mercury, a non essential element renders inhibitory effect on many physiological activities of plants even at a low concentration. Plants absorb Hg from soil through root system. Manganese, an essential element has been found to counter the inhibitory effect of mercury mostly by preventing its uptake from soil. Mung bean grown in individual solution of Hg and Mn showed varied uptake of these heavy metals. However, in combined solutions mercury uptake was mostly prevented in presence of 10 ppm Mn, indicating its ameliorating effect.


Effect of mixed industrial effluents on growth, dry matter accumulation and mineral nutrient in *Eucalyptus camaldulensis* seedlings were studied. Paper evaluates the
adaptability of *E. camaldulensis* to effluent, tolerance to excess/deficiency of mineral elements and ultimately to determine suitable combinations of industrial/municipal effluent for their use in biomass production in dry areas. Mixing of effluents is useful in tree irrigation to increase biomass productivity and reduction of toxic concentration of metal ions in effluents may be helpful for a long-term field application.


The nature and quality of soil impaired by dairy effluents was assessed to ascertain the feasibility of use of the effluents for establishment and growth of trees and forage crops suited to the desert region. The impact of the effluents on soils was studied by examining the physico-chemical characteristics of soil (treated and virgin soil) in comparison to due standards use for irrigation of soils.


Root meristem cells of *Allium cepa* have been used as a test model to evaluate the genotoxicity of leachates of tannery solid waste through aqueous and soil medium. Root tips, sampled after 48 h revealed higher frequency of aberrations in aqueous medium in comparison of leachate-contaminated soil. Both the methods displayed similar type of mitotic and chromosomal aberrations and inhibited MI significantly.


Reproductive biology of *Cassia siamea* plants growing at eight different sites on various important roads of Agra city was studied. The plants of this species growing at various sites showed significant variations in their floral morphology and reproductive biology which were found to be closely associated with the extent of air pollution caused by increasing number of automobiles.

0301-278. Dhankhar R, Khatri S, Dahiya JS, Sushma (Dept Biosci, MD Univ, Rohtak 124001). **Inhibition of nitrate reductase activity in some crop plants raised with sewage wastewater.** *J Ecophysio Occupl Hlth*, 2(3&4) (2002), 235-242 [16 Ref].

Investigation was done on the inhibition of nitrate reductase activity in pot culture experiments of different crop plant species under different concentration of sewage wastewater collected from Rohtak city of Haryana. It has been revealed that all the
crop plant species inhibited the nitrate reductase activity at both 50% and 100% sewage concentrations which could be due to high level of nitrogen or high salinity level in sewage wastewater. Nitrate reductase activity has been observed maximum in *Triticum aestivum* at 9% sewage concentration whereas minimum concentration in *Brassica campestris* at 100% sewage concentration.


Contamination of seeds with the heavy metals affect welfare of human beings and animals through their entry into the food chain. Recent investigations point to the effect of heavy metals of quantitative and qualitative male and female reproductive structures and sexual units, resulting in diminished crop yield.


Rhizobial strains isolated and characterized from extreme environments such as virgin soil, polluted soil and saline soil with garden soil as control were employed as bio-inoculants. The rhizobial strains were isolated through root nodule-trap method and applied through seed-pelleting method to *Vigna mungo* and *Vigna unguiculata*. After 50 days of growth, the CO$_2$ fixation and morphometric parameters were analysed. Application of saline soil and virgin soil rhizobia augment the morphometric parameters.


Study was conducted on physico-chemical properties and heavy metal content of wastewater (TW), groundwater (GW) and the field soil that was irrigated with TW or GW. Moreover, the impact of TW on crop productivity, heavy metal status in the seed/grains, at harvest was also studied. Results indicate that the level of nitrate, phosphate, potassium, calcium, magnesium and sulphate in wastewater is comparatively more than of the ground water. The seed yield in mustard and wheat, irrigated with TW, was more than that with GW.

Flower of *Cassia fistula*, *Delonix regia* and *Peltophorum inerme* collected from polluted areas (textile mills, industrial area and roadsides) and the reference area (Agriculture College Campus) were studied for fresh and dry weights and per cent pollen germination. Maximum reduction in flower weights (fresh and dry) was noted in textile mill area and minimum at roadsides. Flower of *P. inerme* appeared to be more sensitive to air pollution than others. Maximum reduction in per cent pollen germination was recorded in the industrial area in *D. regia* being the most sensitive.


A pot culture experiment was carried out to elucidate an appropriate dilution of dyeing factory effluent for irrigating agricultural crops such as cotton (MCU-5) and sorghum (Co-26) and to assess the changes in soil pH, electrical conductivity and organic carbon during dyeing factory irrigation. Results showed that the effluent could be safely used for irrigation at proper dilutions (25 and 50%) in combination with NPK.


Germination studies were conducted in the laboratory to investigate the effect of distillery effluent and leachate on the growth of *Cicer arietinum*. Seeds of *Cicer arietinum* exposed to the concentration of effluent (10 to 50%) and concentration of leachate of flash light factory sludge (5%) of 20% was found to be beneficial for the growth of root and shoot as compared to control. However, the concentration of effluent/leachate 100% was found to be inhibitory.


The primary objective of this investigation was to determine the lethal dose of experimental crude oil spills on *Oryza sativa* (paddy), *Phaseolus aureus* (greengram) and Arachis hypogea (groundnut) and to find out the associated changes in the physical properties of cultivable soil, oil mobility and growth of seedlings during germination period. The LC50 values at the 7th day of germination were determined as 0.039, 1.63 and 2.56 lit. m-2 for paddy, greengram and groundnut respectively. The oil mobility was found to be more in well drained soils of greengram and groundnut than in water submerged soil of paddy.

Study deals with effect of aluminium toxicity on growth of mungbean (Vigna radiata L. Wilczek) seedlings. Seed germination (in %) declined with increased content of Al$_2$(SO$_4$)$_3$, while promotive effect was observed at very low dosage. Different concentrations of Al$_2$(SO$_4$)$_3$ was observed through scanning electron microscope.


Studies were made to assess the impact of distillery effluent on seed germination, and seedling growth (root and plumule length), of bengal gram, Cicer arietinum Linn. at various concentrations for different days, respectively. There was increment in above parameters at lower concentrations (10%, 20% & 40%) while a decrement was observed at higher concentrations (60%, 80%, and 100%) after exposure. It is concluded that chlorophyll and protein content are very sensitive to pollutants and thus can be used as bio-indicators of water pollution.


Effects of heavy metals on biological systems have created interest following the increase in global use of these elements. Synergistic effects of these heavy toxic metals have been studied and concluded that a number of factors like species, strain, concentration and time period of exposure affect the interaction between metals. The possibility of complex formation of any two metals cannot be ignored.


Seedling of wheat (Triticum aestivum L. cv Sonalika) were treated with different concentrations of hexavalent chromium (K$_2$Cr$_2$O$_7$). The plants were subjected to different nitrogen nutritional conditions. Various parameters for chromium toxicity of wheat seedlings were noted. NO$_3$ and the combination of NO$_3$-NH$_4$+ was found to be protective in increasing the activities during early days of treatment. Lower concentration of chromium (0.001mM) increased the peroxidase activity of plants.
Plants grown without nitrogen but treated with chromium, showed highest nitrate reductase activity.


Three different concentrations of sulphur dioxide (320, 667 & 1334 ig m⁻³) were used to fumigate the two different varieties, each of *Raphanus sativus* and *Brassica rapa*. Both chlorophyll a and b content decreased with increasing concentration, maximum decrease being at the highest concentration i.e. 1334 ig m⁻³. Chlorophyll a showed more reduction than chlorophyll b.


Toxic effect of solid waste from chlor-alkali factory on the pigment and Net Primary Productivity, respiration rate (NPP, R.R) in the rice seedlings were tested. After exposure to the solid waste an initial rise followed by a decline in pigments and NPP, R.R. were observed. The variation of different parameters were attributed to the dichotomous behaviour of the heavy metal mercury which was present in solid waste and the control set remained physiologically healthy through out the experimental period.


The performance of *Vicia faba* L. in soil amended by different concentrations of fly ash has been studied. Results revealed that while fly-ash amendment to the soil improved the growth performance at initial stages with application of lower concentrations, it was inhibitory at higher exposure concentrations. Fly ash delayed the nodulation as lesser number of nodules was recorded at higher amendments.


Potentiality of pollen germinability in *Nerium odorum* was noted in F and F-24 series. Pollen of F series collected from unpolluted area of Colaba and polluted area of Sewri-Mumbai showed their first sign of germination after one hour of sowing. However, the pollen of F-24 series collected from either sites required two hours to
germinate. Industrial pollution inhibited the rate of pollen germination of successive flowers of *N. odorum*. It also inhibited the germination of pollen of either series.


Potentiality of pollen germinability in *Peltophorum ferrugineum* was noted in F series. Pollen of F series collected from unpolluted area of Colaba showed their first signs of germination after one hours of sowing. However, the pollen collected from the polluted side of Sewri-Mumbai required 6 hours to germinate. Industrial pollution inhibited the rate of pollen germination.


For healthy environment although more emphasis is now being given to check air pollution, certain plant species resistant to pollutants are being identified, so that such plant can be grown in polluted areas. To find out resistant species some morphological parameters of plants, growing in polluted and non-polluted areas are compared.


Assessment of agropotentiality of the effluent coming out from Century pulp and paper mill, Ghanshyamdam, Lalkua (Uttaranchal) has been made on wheat (*Triticum aestivum var* UP-2329) crop grown in two soils differing in texture with different effluent concentrations. Diluted effluent increased the chlorophyll content, plant height, shoot and root biomass, grain yield, protein, carbohydrate and lipid contents in wheat grains, while undiluted effluent caused inhibition in plant growth resulting in a sharp decline of yield.


A 120 day greenhouse experiment was conducted to study the effects of various fly ash concentrations (0%, 20%, 40%, 60%, 80% and 100% vol/vol) with normal field soil and *Helminthosporium oryzae* on the growth and yield of three cultivars of rice, *Oryza sativa* L. Application of 20% and 40% fly ash with soil caused a significant increase in plant growth and yield of all the three cultivars. Forty percent fly ash
caused a higher increase in growth and yield than did 20%. Sixty percent, 80% and 100% fly ash had an adverse effect on growth and yield of all the three cultivars, the maximum being with 100% fly ash.


A greenhouse experiment was conducted to study the effect of *Alternaria triticina* with and without foliar dusting of fly ash on the growth, yield, photosynthetic pigments, protein and lysine contents of three cultivars of wheat, *Triticum aesticum*. Dusting of 2.5 and 5.0 g fly ash caused a significant increase in growth, yield, photosynthetic pigments, protein and lysine contents of all the three cultivars. Dusting of 5.0 g fly ash caused a higher increase in the parameters than the 2.5 g dusting. However, dusting of 7.5 g fly ash had an adverse effect on growth, yield, photosynthetic pigments, protein and lysine contents.


Excess of cadmium (Cd) induced changes in oxidative scenario and water status of plants *Brassica juncea* grown in soil pot culture. Although lower and marginal levels of excess cadmium (100 and 250 ppm) improved growth but higher levels (500 ppm) caused significant suppression. Significant accumulation of proline, an indicator of water stress, occurred at higher level of Cd. The excess levels of Cd also decreased the concentrations of soluble protein and chlorophylls and increased the ratio of chlorophyll a/b.


Study deals to assess the suitability of fly ash application with agricultural soil for plant growth and development. Result indicates that best growth performance was obtained at 25% fly ash application. After harvesting of plants, soil analysis results indicate that the soil pH decreased which showed the fly ash pH was slightly acidic in nature. The data indicate that fly ash has a great potential to be utilized as a source of macro and micronutrients for plant growth.

0301-301. Sinha Suchita, Mukherji S, Dutta Jayanta (Crop Physio Lab, Inst Agricl, Visvavarathi, P.O. Santiniketan 731236). **Effect of manganese toxicity on pigment**

Effect of different concentrations, of manganese sulphate (MnSO₄, 7H₂O) on chlorophyll, carotenoid pigment content and photosynthesis of mungbean seedlings was examined. Progressive increase in manganese sulphate concentration upto 5x10⁻³ M brought about a progressive decrease in total chlorophyll and chl a content. Chl b changed very little by excess manganese treatment. Hill activity of chloroplasts isolated from leaves of mungbean seedling and rate of photosynthesis in terms of CO₂ uptake showed progressive reduction alongwith the increase in concentration of the manganese.


The seedlings of *Pisum sativum* L. tolerated simulated acid rain exposure down to pH 2.2. Below this the seedling growth was reduced and the seeds succumbed at pH level 1.2 and pH 0.5. A reduction of about 48.7% in root length and 67.3% in shoot length was observed between pH 6.8 (control) and pH 2.2. The shoot dry weight showed a reduction of 48.5% while root dry weight decreased about 56.4%.


The high resistant and sensitive plant species were identified in the vicinity of a cement factory in Ariyalur, through the determination of air pollution tolerance index (APTI) using four leaf parameters. The result indicated that out of fifteen woody plant species only eight were found to be resistant to cement kiln dust pollution.


Dilution of Tan Yard effluent at 75 times showed the highest germination percentage in all the crops tried, but 50 times diluted TYE showed the maximum shoot and root lengths. The inhibition and promotion in both germination and growth is due to high and low salt concentrations at lower and higher dilution respectively and the increased length of root and shoot might be due to the nutrients contained by the effluent. In this study, salinity dominated the toxic constituents like chromium in deciding the crop growth, because of this reason, TYE showed better performance.

Paper discusses the physico-chemical characteristic of distillery effluents and the effect of its various concentrations on the seed germination of *Helianthus annus* Cv Ec 68413 in Western Uttar Pradesh. High temperature, acidic pH, excessive quantities of inorganic salts, organic matter and total solids in the spent wash caused soil salinity and high osmotic pressure of the soil solution after irrigation and decreased the seed germination drastically.


Microflora usually comprises of unicellular and multicellular microscopic organisms, widely distributed in air, water, soil, dead matter and within the living organisms. Microbes have industrial applications which involve oxidation, reduction, isomerisation, hydrolysis and condensation. They play an important role in human welfare activities and environmental application such as in waste water treatment, sewage treatment, reduction of pollution load in water bodies and environmental biotechnology.


Tests were performed in pots with five legume cultivars viz. *Vigna unguiculata, Vigna mungo, Vigna radiata,Macrotyloma uniflorum* and *Lablab purpureaus* to study the effects of heavy metal toxicity on nodulation and growth. Heavy metals used were aluminium and mercury. Among these two heavy metals which were tested at the same molar concentration of 100mM, mercury was found to be more toxic than aluminium. Tests were also performed to study the reversal of the inhibitions and disorders caused by heavy metal toxicity. Calcium supplementation proved to show positive results in this process.


Ambient lead levels in air, soil and dust deposits on selected plant species at ten distinctly located sampling stations of Indore city are presented. The maximum lead level in air was recorded at Palasia, where the traffic density was found to be the highest. Out of the plant species studied, the maximum lead was recorded on
*Dalbergia sissoo* leaves. A possible relationship between leaf morphology and dust accumulation tendency is also discussed.