Assessment of phytoremediation potential of *Dianthus* sp. and *Ocimum basilicum*

Nouf Ali Asiri 1, Waseem Mushtaq 2, Hassan Saeed Al-Zahrani 1, Hesham F. Alharby 1.3 and Khalid Rehman Hakeem 1.3 *

1Department of Biological Sciences, Faculty of Science, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia
2Allelopathy Laboratory, Botany Department, Aligarh Muslim University, Aligarh, India
3Princess DrNajlaBint Saud Al- Saud Center for Excellence Research in Biotechnology, King Abdulaziz University, Jeddah, Saudi Arabia

IJASR 2022
VOLUME 5
ISSUE 2 MARCH – APRIL **ISSN: 2581-7876**

Abstract: Soil pollution is the most common type of pollution while heavy metals` contamination of soil is one of the most serious problems in the world. Heavy metal pollution is not affecting the plants only; rather it is negatively influencing human and animal health. The quest to solve this problem by traditional methods is not effective and/or very expensive. The best way to look forward is to use green plants to clean up heavy metal-contaminated soil. Phytoremediation is an eco-friendly and economical way to decontaminate the soil from heavy metals. In the current study, *Dianthus alpinus* L. and *Ocimum basilicum* L. are assessed for phytoremediation of mercury (Hg) and arsenic (As). This study showed that plant growth, biomass and photosynthetic pigments decreased with increasing concentrations of Hg (10 ml/g soil) and As (1.5 ml/g soil) as compared to control by 94% in Dianthus sp. and 69 % in O. basilicum with a significant difference among various treatments by 36 %. Different concentrations of Hg and As had high accumulation in selected plants especially in photosynthetic pigments. The present study investigates the effect of soil phytoremediation on changes in growth, morphology, physiology and biochemistry to determine the efficiency of Hg and As uptake by selected plants. The indicated plant species can be used in phytoremediation of soil contaminated by heavy metals as they showed a high accumulation of Hg and As.

Keywords: Phytoremediation, Mercury, Arsenic, Ornamental plants, Heavy metals.

1.INTRODUCTION

Soil contamination is one of the most common types of environmental pollution, which is caused by several routes and the most prevalent is human activities (Mishra et.al., 2018). Soil pollution caused by heavy metal contamination is the most widespread type of soil pollution, with numerous origins such as waste from smelters, mines, atmospheric deposition, drainage and inorganic fertilizers. Heavy metals are usually found in contaminated soil (Tangahu et.al., 2011, Stefanowicz et.al., 2020). Mercury (Hg) covers many areas around the world and it is considered among the most toxic heavy metals. Hg can be found in different forms: organic (e.g. methylmercury, which humans may consume unknowingly along with their food) and inorganic (possible exposure to humans due to their profession). Hg shows its harmful effects on the lungs, kidneys, skin and eyes (Higueras et al., 2015 and Pamphlett et al., 2021). Arsenic (As) is a naturally occurring element in the earth's crust that is extensively spread in the air, water, and land. In its inorganic form, it is extremely poisonous. Drinking contaminated water or using it in food preparation and irrigation of food crops, industrial activities, eating contaminated food, and smoking tobacco expose people to high quantities of inorganic As (Abdul KS et al., 2015 and Bhagwat, 2019). Chronic As poisoning can be caused by prolonged exposure to inorganic As, which is primarily acquired from drinking water and food. The most common side effects include skin blemishes and skin cancer. A lot of research has been done to find solutions to treat heavy metals` contaminated soils. This problem has been overcome by the use of thermal absorption, soil modifications, electrical treatment, soil washing and bioremediation (Ferreiro et al., 2018 and Awa and Hadibarata, 2020). However, cleaning up the contaminated soil should be low-cost and eco-friendly. Many methods have been investigated and tried to remediate the contaminated soil viz., cover system, soil washing, stabilization, thermal treatment and disposal landfill (Saber et al., 2015; Sarwar et al., 2017 and Zhang et al., 2021). Nevertheless, phytoremediation (using green plants as remediation candidates) is an effective, eco-friendly, low cost

and easier technique (Nedjimi, 2021). Phytoremediation depends on the natural processes of plants such as absorption of nutrients and water, processes of accumulation, transition, exchange of gases, transpiration, secretion, photosynthesis and secretions, resulting in different types of plant treatments that contain soil pollutants. Many different plant species are known to be the candidates of phytoremediation depending on their phytoextraction capacity, biomass and life cycle, nevertheless, using ornamental plants as phytoremediation candidates have not been fully explored (Capuana, 2020), even though they might be the source of economy in floriculture sector, besides helping decontaminate the soil from heavy metals and beautifying it as well (Nanda and Pradhan, 2019). Ornamental plants are a good choice for phytoremediation due to their ability to remove contaminants and improve site aesthetics (Shyamala et al., 2019 and Ramírez et al., 2020). Several species of ornamental plants have been evaluated for their phytoremediation capacity to clean contaminated soil due to their high biomass which means they can accumulate more heavy metal concentrations through their roots and tissues (Khan et al., 2021). Accumulation and uptake of contaminants by plants are regarded as efficient, cost-effective, and eco-friendly. methods in faster soil cleaning (Wiszine et al., 2016). Phytoremediation takes a long time to clean the soil; adding amendments improves fertility and plants perform phytoextraction heavy metals accumulation from contaminated soil faster. Many chemicals are used as assistances in phytoremediation some of them are organic such as industrial wastes, humic substances, biochar, chicken manure and grass landfilling (Ullah et al.,2015a; Zhou et al., 2015). Moreover, using inorganic materials with soils contaminated by heavy metals even with low concentrations causes a significant redistribution of heavy metals in contaminated soil, which could be employed in soil remediation (Janos et.al., 2016 and Oladoye et. al., 2021). The current study was carried out to understand the capacity of some ornamental plants; *Dianthus alpinus* L and *Ocimum basilicum* L. in cleaning up contaminated soil toward different concentrations of Hg and As. The emphasis was to study their physiological, biochemical parameters and their antioxidant defence mechanism against heavy metal contamination.

2. MATERIALS AND METHODS

The experimental plants for this study were five species of ornamental plants: D. alpinus, M. incana, C. unicum, G. elegans and O. basilicum. The seeds of our experimental plants were procured from SemillasFito Company (Barcelona, Spain). The soil used in this study was agriculture soil (pH: 6.4, EC:120 µS/cm) with soil texture of 83.12% sand, 15.66% silt and 1.22% clay, and water content (WC) 1.93%. 75 pots were used for each ornamental plant (3 replicates for each treatment) with 3 treatments for each heavy metal (Hg and As) in addition to the control sample for each of the selected ornamental plants. The pots were arranged in a completely randomized block design.

2.1. Germination

The ornamental plants were allowed to germinate in petri dishes lined inside with filter paper (Waltman) for 7 days (3 seeds in each dish- 3 replications). The seeds were first washed with 2% sodium hypochlorite solution (NaOCl) followed by rinsing with sterile water and then sprinkled with 3-4 ml water every day for 3 days. Germination percentage was calculated by the following formula: GP= seeds germinated/total seeds x 100 (Coolbear et al.,1984) After 3 days, the germinating seeds were transferred from petri dishes to the propylene pots, 16 cm height (3 seeds in each pot) with a field capacity of 230 ml water. The pots contained agricultural soil that was mixed with different concentrations of Hg and As. The pots were treated with Hoagland solution for 10 days and maintained in a greenhouse of Faculty of Science, University of Jeddah, Kingdom of Saudi Arabia at temperature 25–30 °C during the day, 15–20 °C at night and 65–75% relative humidity at 12-h photoperiod for further use. After 10 days, the plants were assessed for the following parameters.

2.2. Growth parameters studied

2.2.1. Plant height

Ornamental plants` height was taken by meter-scale from the top of the stem to the last nodes on the stem for three random plants in a pot.

2.2.2. Root penetration ratio

The root penetration ratio was taken at the end of the experiment and calculated by the following equation:
Root penetration ratio = (root length/soil deep) x 100 where, soil deep = height of pot (16 cm)

2.2.3. Leaf area

Leaf area was taken from three random leaves by the method of Larcher (1995) as follows: Leaf area, LA= RLB, where R= 0.75, L = length of leaf, B= width of leaf

2.2.4. Fresh and dry weights

Fresh and dry weights were taken for three indicators: Bio Concentration Factor (BCF) (metal concentration ratio of plant roots to soil), Translocation Factor (TF) (metal concentration ratio of plant shoots to roots) and Removal Efficiency (RE) based on total dry biomass (total concentrations of metal and dry biomass of plants to total loaded metal in growth media). BCF, TF and RE were calculated as follows:
BCF= metal concentration in root/ metal concentration in soil (mg kg−1)
TF= metal concentration in shoot (mg kg−1)/ Metal Concentration in root (mg kg−1)
RE (%)= metal concentration in shoot (mg kg−1) ×shoot biomass (kg) + metal concentration in shoot (mg kg−1)) × root biomass (kg) /total added metal per pot (mg)

2.3. Physiological parameters

2.3.1. Estimation of water content (WC) and relative water content (RWC)

WC was estimated in roots at different stages and in the shoot (with uppermost expanded leaves) (Weatherly, 1993) as follows: WC= [(fresh weight / dry weight)/ fresh weight] x 100 RWC was estimated from freshly taken leaves and roots which were kept in distilled water under the light in Petri dishes for 24 hours then following the method of Weatherly (1993). RWC= [(fresh weight – dry weight)/ (turgid weight -fresh weight)]x 100 The samples were taken freshly from three random plants in each species (fresh weights). Dry weights were taken for the same samples after 24 hours in the oven (75°c).

2.3.2. Determination of photosynthesis pigments

Chlorophyll A, chlorophyll b, and carotene were estimated by the method of Lichtenthaler (1987). The amount of dyes extracted using optical absorption (Spectrophotometer, Model Spectronic 20 Genesys) at the following wavelengths: Chlorophyll A = 664.5 nm Chlorophyll B = 647.4 nm Carotenoids = 452.5 nm The equations used to calculate the amount of chlorophyll A, chlorophyll B and carotene, expressed in mg / g wet weight are as follows
Chlorophyll A= (12.7 A664 - 2.79 A647)) × V/ W.1000
Chlorophyll B = (20.7 A647 - 4.62 A664) × V/ W.1000
Carotenoids = 4.2 A452 - (0.0264chl.a + 0.426 chl.b) × V/ W.1000
where, V = Volume of solvent, W = Weight of leaves used

2.3.3. Determination of pH and EC

Soil Extract was prepared by shaking a known weight of aerobic soil at a specific volume of water by 5: 1 for two hours in the electric shaker model (VRN-200, Taiwan) and then left for 24 hours. After filtration using the filter paper (Whatman 1) and store it in plastic bottles for the necessary analysis. pH was measured for the soil extract previously prepared using the pH meter, Mattler MC 235, Toledo. EC conductivity was measured using EC-meter (Mattler MC 226, Toledo).

2.4. Biochemical parameters

2.4.1. Determination of soluble protein

The total soluble protein content of leaves was evaluated using Bradford's technique (1976). Half gramme of fresh leaf was chopped into very tiny particles and combined with 5 mL of 0.1M phosphate buffer. The homogenate was then centrifuged for 10 minutes at 40C at maximum speed. 10 per cent TCA was added to one millilitre of the floating material, and it was centrifuged for another 10 minutes. The deposited substance was rinsed with acetone and dissolved in 1 mL of 0.1N NaOH. 5 mL Bradford's reagent was added to its 1 mL and properly mixed; the mixture was then left for 10 minutes to generate the ideal colour. The absorbance was then measured using a UV-Vis spectrophotometer at 595 nm. The soluble protein content was determined using a standard curve made from a Bovine Albumin Serum standard (BSA). The amount of protein is expressed in mg (g fw)-1.

2.4.2. Determination of soluble proline

The soluble amino acid content was determined by the method of (Lee and Takahashi,1966).
Reagent preparation: 5 M (pH 5.6) citrate buffer was prepared as follows:
Solution A: Dissolve 10.50 g of citric acid in DDW and make the final volume to 100 mL. Solution B: Dissolve 14.71 g of trisodium citrate in DDW and make the final volume again to 100 mL.
The two components of the buffer were mixed in an appropriate amount to maintain the pH of the buffer to 5.6. *55% glycerol was prepared by mixing 55 mL of glycerol and 45 mL of DDW. *1% ninhydrin solution was prepared by dissolving 1.0 g of ninhydrin in citrate buffer and the final volume was made up to 100 mL. Extraction 0.5 g leaf material was dipped overnight in 5 mL ethanol, then ground using mortar and pestle and centrifuged at 5500 rpm for 10 min at 40C. The test tubes holding the supernatant were incubated at 100 C0 for 1h in a water bath to evaporate the alcohol. The collected pellet was dissolved in 10 mL of 0.5 M citrate buffer (pH 5.6). Estimation 1.2 mL of 55 per cent glycerol and 0.5 mL of 1.0 per cent ninhydrin solution were added to a 0.5 mL aliquot and the mixture so obtained was boiled in a water-bath for 20 minutes. The volume was made to 6 mL following the development of the blue colour. On a UV-Vis spectrophotometer, the absorbance was measured at 570 nm (BIO 20 Perkin Elmer, Germany). The quantity of amino acid was expressed as µmol g-1 FW concerning a standard curve developed from glycine of various concentrations.

2.4.3. Determination of soluble sugar

The method of Dubois et al. (1956) was used to quantify soluble sugars. 0.5 g fresh weight of roots and shoots were homogenised in deionized water. The extract was filtered and treated with 5% phenol and 98 % sulfuric acid for 1 hour, after which the absorbance at 485 nm was measured using a spectrophotometer (Biochrom S 2100). Soluble sugar concentrations were measured in mg g−1 FW.

2.4.4. Antioxidant defence enzymes

The activity of superoxide dismutase, SOD (EC 1.15.1.1) was measured using the Beyer and Fridovich method (1987). Using a mortar and pestle, grind 0.1 g of the fresh leaf with 1 mL of extraction buffer. The procedure was carried out in a cold environment, with the mortar and pestle kept on ice during the homogenization process. After that, the homogenate was centrifuged at 10,000 rpm for 20 minutes at 4° C. The SOD activity in inhibiting the photoreduction of NBT to generate blue formazan was tested using superoxide radicals. The test mixture comprises of One mL of reaction buffer, 1 M sodium bicarbonate, 200 mM methionine, 3 mM EDTA, 60 µM riboflavin, and 100 µl of enzyme 35 extracts placed in a test tube and incubated for 10 minutes at 25/28° C. Blank "B," which had the aforesaid ingredients (test mixture) as well as the samples kept in the light, whereas blank "A," which contained the enzyme extract and the buffer, was kept in the dark. After the light was turned off, the tubes were covered with a black cloth, and the reaction came to a halt. In the reaction mixture including the enzyme extract, the bluish tinge emerged. At 560 nm, the absorbance of the samples and the blank "B" was compared to the blank "A." The contrast in % reduction in colour between blank "B" and the sample was then calculated. One unit of SOD was determined by the volume of enzyme necessary to initiate 50% photoinhibition of NBT, and thus one unit of enzyme activity was characterized as a 50% reduction in colour. The activity is measured in enzyme units (EU) per mg of protein per hour. SOD = (percentage difference in colour between the blank and the sample × dilution factor) /Incubation time × protein *Address correspondence to this author at the Department of xxxy, Faculty of xxx, xxx University, P.O. Box: 0000-000, City, Country; Tel/Fax: ++0-000-000-0000, +0-000-000-0000 It is important for the Method Section should be sufficiently detailed in respect of the data presented, and the results

produced from it. This section should include all the information and protocol gathered for the study at the time when it was being written. If the study is funded or financially supported by an organization to conduct the research, then it should be mentioned in the Method Section. Methods must be result-oriented. The statement regarding the approval by an independent local, regional or national review committee (e.g. name of ethic committee and institutional review board) should be part of the Methods Section.

3. STATISTICAL ANALYSES

All data are median values for three random replicates to evaluate the heavy metals in plant tissues. Data analyses using Student's t-test, correlation & regression and one-way ANOVA were carried out using Microsoft Excel. Comparisons of average values between treatments using Student's t-test are presented as and means an error of the mean (+SE), with statistical significance shown at a confidence level of Significant differences in P <0.05 were considered by using Statistical Package for Social Since Program, SPSS.

4. RESULTS

Table 1 shows a summary of the toxic effects of low and high concentrations of Hg and As contaminated soil on the height of Dianthus sp. and O. basilicum. Generally, As exhibited considerable effect on the experimented plants' heights than Hg. At low concentrations, As show non-significant (P>0.05) variation for the inorganic (EDTA) assisted; while As influenced *O. basilicum* at high concentration in the same assisted. On the other hand, while O. basilicum revealed metal tolerance, non-significant (P>0.05) at low Hg concentration with EDTA, significant (*P≤0.05) variation among the other experimented ornamental plants were resulted as shown in Figure 3.

Plant growth did not benefit from Hg and As with organic aided (FYM) and biotic (Actinomycetes); nonetheless, detrimentaleffects were observed at low doses of these metals in the growth media. Plants growing in soil contaminated with 1 mg Hg/kg show a considerable reduction in height. Moreover, tiller and panicle development was similarly reduced. In Table 3 a significant effect (*P≤0.05) of contamination on the plants' root length was observed for all plantsexceptfor*Dainthus*sp. at high concentration of Hg with the inorganic assisted (EDTA), and *O. basilicum* at high and low concentrations of Hg and As with all enhancements. In general, As exhibited more effect on the experimented plants' root penetration length than Hg with EDTA compared to FYM and Actinomycetes. The effect of contamination in Dunthus sp. root length with EDTA was an increase of 87.5% compared to the control sample (Figure 4).

The effect of different concentrations of Hg and As contaminated soil on the leaf area is shown in Table 4. Significant (*P≤0.05) variation on leaf area had been revealed for most of theexperimented ornamental plants except Dainthus sp., which indicated non-significant (P>0.05) variation at the low and high concentrations of both Hg and As contaminated soils with EDTA. The results obtained in Figure 5 indicated that O. basilicum as a phytoremediation plant could potentially be used for the phytoremediation of Hg and As contaminated soils. In Table 5, the results show statistically significant (*P≤0.05) reduction in leaves number for Dainthus sp.. but in O. basilicum the was a tolerant non-significant (P>0.05) effect at the low concentration of Hg with EDTA. A reduction in the total number and size of leaves (Figure 6 and 7) will ultimately reduce the surface area available for water loss exhibiting heavy metals tolerance adaptation mechanism for the experimented ornamental plants. The size of the leaves and the thickness had decreased in all plants with EDTA and FYM in all testaments (Hg and As), affecting the density of stomata and decreasing their aperture.

Table 6 indicated a statistically significant (*P≤0.05) reduction in shoots' water content for all the experimented ornamental (Figure 4.28). *Dainthus* sp. exhibited non-significant (P>0.05) low root water content (WC) at the low Hg concentration with FYM and Actinomycetes compared to the control sample (Table 7). However, increasing Hg concentration with enhancements caused significant variation in the RWC of *O.basilicum*. the plants show significant (*P≤0.05) variation at the low and high concentrations of Hg and As contaminated soils. Tables 4.27 and 4.28 indicated the effect of different concentrations of Hg and As contaminated soil on the shoot relative water content of the experimented ornamental plants. The results indicated non-significant (P>0.05) variations of shoots' RWC among *O. basilicum* and *Dainthus*sp. groups at the all concentration of Hg contaminated soils with EDTA and FYM. On the other hand, the plants' tolerance at all concentrations of As contaminated soil reveals its phytoremediation

potentials with all enhancements (Figures 4.30 and 4.31). Table 17 and Figure 4.39 show the significant (*P≤0.05) variations in soluble protein content in all examined ornamental plants in all different treatments. In Table 18 and Figure 4.40 the plants show significant (*P≤0.05) accumulation of soluble proline at low and high concentration of Hg and As contaminated soils with all treatments. In Tables 4.29 and 4.30 the effect of different concentrations with all enhancements on chlorophyll A and B of plants with significant (*P≤0.05) reduction in chlorophyll A and B contents among the tested plants at the different concentrations of Hg and As contaminated soils' samples.

In Table 12 and Figure 4.34 the effect of different concentrations with all enhancements of Hg and As contaminated soils on carotenoids of the experimented ornamental plants. The results show a significant (*P≤0.05) reduction in carotenoid contents among Dianthus sp. and (P>0.05) in O. basilicum.

Dainthus sp. indicated non-significant (P>0.05) variation in soluble sugar content at the low concentrations of As contaminated soil (Table 19). *O. basilicum* show significant (*P≤0.05) increased soluble sugar content at low and high concentration of Hg and Ar contaminated soils.

5. DISCUSSION

This research focused on ornamental plants (*Dianthus* sp. and *Ocimum basilicum* L.), which are commonly used in phytoremediation (Nakbanpote et al., 2016, Purushothaman et al., 2018) and have heavy metal absorption capabilities (Capuana et al., 2020). At lower concentrations of heavy metals (5ml /g soil of Hg and 0.5 ml /g soil of Ar), all ornamental plants were found to withstand the influence of heavy metal concentrations (Liu et al., 2017, Vamerali et al., 2010, Ali et al., 2013, Motuzova et al., 2014). However, at high quantities of Hg (10ml/g soil) and Ar (1.5 ml/g soil), the plants were shown to be ineffectual, as previously reported by Shrestha et al. (2019) and Capuana et al (2020). During the soil investigation, we observed that soil with a high electrical conductivity had physicochemical features that were conducive to heavy metal uptake by plants. Due to the limited bioavailability of heavy metals and their reduced leaching, *Dianthus* sp. and *Ocimum basilicum*L. were able to uptake a high level of heavy metals, Hg (10ml/g soil) and Ar (1.5 ml/g soil) from contaminated soils (Webber and Singh, 1995). Changes in soil pH influence the chemical forms of heavy metals. The current study discovered that under stress, pH increased by 32% with the mean percentage of the selected soil's pH being 6.41, which was below neutral, resulting in increased metal solubility in *Dianthus* sp. and *Ocimum basilicum* by 44% compared to the control, which agrees with Yan et al (2020).

A rise in pH (basic range) induces higher adsorption of heavy metals on soil particles and decreases heavy metal uptake by plants. Soil pH effects not only metal bioavailability but also the process of metal uptake through root penetration ratio, which is reduced by 56% at high levels of Hg (10 ml/ g soil) and As (1.5 ml/ g soil) compared to the control in *O. basilicum* and *Dainthus* sp.. Morphological and growth indicators, such as shoot height and plant dry weight, are the most commonly used to describe plant tolerance, and root, stem, and leaf morphologies are significant in the phytoremediation process. Our findings accord with the study of El-Shabasy (2021). Root length, density, and surface area are significant features that can have a direct impact on the uptake or degradation of soil contaminants. These markers have been reduced significantly in all our experimental plants due to heavy metal toxicity at high levels, As (1.5 ml/ g soil) was more toxic than Hg (10 ml/g soil). Because the effect of heavy metal toxicity on plant growth varies depending on the individual heavy metal involved in the process, the root, stem, and leaf morphologies played a significant role in the phytoremediation process (Nurzhanova et al., 2019).

The responses of the experimented ornamental plants' root penetration ratio reduction due to higher concentrations of As and Hg was consistent with the plants under higher Hg and Ar concentrations similar to Yue et al. (2019) in accumulation of Zn in Sunflower. The majority of the diminution in growth parameters of plants growing in polluted soils can be attributed to reduced photosynthetic activities, plant mineral nutrition (Iftikhar et al., 2019), and reduced activity of some enzymes and water delivery to the shoot due to transpiration inhibition, as they reduce the size of the leaves and the thickness of the lamina, reduce intercellular spaces, affect the density of stomata, and decrease their aperture (Chauhan and Mathur., 2020). Heavy metals usually reduce plants` physiology and their metabolism (Ashfaque et al., 2016). In our study, Chlorophyll A, B and carotenoids decreased in all selected plants under the stress of high levels of As (1.5 ml/ g soil) more than Hg (10 ml/ g soil), the cause is that

most generalized consequence of heavy metals in plants is their attack to the photosynthetic machinery (Pinto et al., 2014, Sheoran et al., 2016).

The leaf area index has an impact on biomass due to its influence on photosynthesis (Sun et al., 2010; El-Shabasy, 2021 and Sun et al., 2011). The phosphate (P) transport mechanisms take up arsenate (Wang et al., 2002). Meharg and Jardine (2003) used excised rice roots to show that Hg could inhibit the uptake of both As and Hg by 43 per cent in high levels when compared to the control, possibly due to general cellular stress induced by Hg2+, such as enzyme activities and photosynthesis. Protein precipitation can occur when Hg levels are high (Patra and Sharma, 2000), limiting the action of several enzymes, notably P transporters. The amount of Hg accumulated by the plants may influence the reduction of plant biomass (Israr et al., 2006). Another consequence of Hg may be the suppression of aquaporins (Hernández and Magnitskiy, 2009; Minkina et al., 2021).

Proteins had been decreased in high concentrations of Hg (10 ml/ g soil) and As (1.5 ml/g soil) in all candidate plants by 53% compared to the control, proteins are crucial cell elements that are easily damaged by environmental stress. As a result, any change in these molecules can beconsidered as a key signal of oxidative stress in plants, which explains why the data in our study show a decline in protein determination (Prasad, 1996, Haq et al., 2020). The amount of chlorophyll pigments reduced at the higher concentrations of As and Hg, these results are close to Paunov et al. (2018) with wheat under higher concentrations of Zn and Cd, to describe the responses of the ornamental plants` photosynthesis In the present study, a higher significant reduction was observed in sugar content among the experimented plants O. basilicum and Dainthus sp. at high concentrations of Hg (10 ml/g soil) and As (1.5 ml/g soil). The decrease in sugar content in plants exposed to heavy metals is most likely linked to the accelerated degradation of photosynthetic pigments, resulting in photosynthetic and monosaccharide production suppression.

Bernardi et al. (2020) came up with a similar finding. The hydroperoxyl radical (radical •OH, H2O2) is produced when free radicals are increased, and it transforms fatty acids to hazardous lipid peroxides. This would raise MDA levels, which are a measure of lipid peroxidation in stressful situations (Rosa et al., 2009). Plants' potential to boost antioxidative protection to resist the harmful effects of heavy metal stress appears to be limited, since several studies have shown that exposure to high levels of redox reactive metals results in reduced rather than enhanced antioxidative enzyme activity (Bhaduri and Fulekar, 2012). Heavy metals generate free radicals in higher plants by producing superoxide radicals such as hydrogen peroxide (H2O2) and hydroxyl radicals (HO•), and singlet oxygen [O], collectively termed ROS (Devi and Prasad, 1998). ROS can rapidly degrade biomolecules such as nucleic acids, proteins, lipids, and amino acids (De Vos and Schat, 1991; Mehta et al., 1992; Luna et al., 1994), resulting in permanent metabolic dysfunction and cell death (De Vos and Schat, 1991, Mehta et al., 1992, Luna et al., 1994). As a result, activating antioxidant enzymes such as SOD, CAT, and POD is an important defensive strategy in polluted environments for reducing oxidative damage. SOD is a ubiquitous enzyme in organisms that plays an important role in cellular ROS defence mechanisms.

Carotenoids work as non-enzymatic antioxidants that protect plants from the devastation caused by oxidative stress in the context of lowering ROS. Heavy metals increase the number of ROS while also increases oxidative stress in plants (Mc Elroy and Kopsell, 2009, Azevedo and Azevedo, 2006). Paunov et al. (2018) show similar results in wheat under Cd and Zn stress. Therefore, increased soil As concentrations with improvements is projected to boost nitrogen content in rice plants, increasing chlorophyll content. Because the net photosynthetic rate of rice is strongly influenced by leaf nitrogen content and specific leaf weight, this lowers the photosynthesis rate (Peng, 2000).

6. CONCLUSION

Heavy metal uptake by ornamental plants using phytoremediation technology appears to be a potential method for cleaning up a heavy metal-contaminated environment. It has some advantages over other commonly used traditional technologies. The most important factor to consider for getting a high-performance remediation result is an appropriate plant species that can be used to consume the contaminants. Although phytoremediation appears to be one of the greatest solutions, it did have certain downsides. More research is required to reduce these limitations so that this technology can be used effectively. Heavy metals used in the present study show significant variation in

the leaf area of the tested plants except for G. elegans. Likewise, arsenic show a decrease in seed germination; reduction in height of seedlings and reduced leaf area at plant height. This behaviour may be due to the direct exposure of the roots to the mercury in the substrate, with a large amount of mercury sticking to it in the cell walls, thus avoiding toxic effects in the upper parts of the plant, especially the development of necrosis and chlorosis in the leaves. In this study, it was found that water content and relative water content decreased at higher concentrations of Hg and As in all plants.. Plants' relative water content (RWC) is an indicator that is used to evaluate plant water status described how photosynthetic rates and stomatal conductance. The current study's findings show that increased soil arsenic concentrations reduce chlorophyll content. Our study emphasises that soil As concentrations are projected to lower nitrogen content in plants as well, resulting in a drop in chlorophyll content. Therefore, the amount of chlorophyll-a in the plant is proportional to the amount of carbohydrates produced. As a result, the substantial negative link between leaf chlorophyll concentration and carbohydrates production could be the outcome of decreasing leaf chlorophyll content. In general, the quantity of total available sugars increased in several experimental plants that had been exposed to heavy metals. Environmental stressors that affect the delivery of carbohydrates from source organs to sink have a high sensitivity to soluble sugars. The up-regulation of growth-related genes and the down-regulation of stress-related genes are examples of how sucrose and hexoses both play dual roles in gene regulation.

Acknowledgements

References

1. Abdul, K. S. M., Jayasinghe, S. S., Chandana, E. P., Jayasumana, C., & De Silva, P. M. C. (2015). Arsenic and human health effects: A review. Environmental toxicology and pharmacology, 40(3), 828-846.
2. Alhogbi B.G and Alsolame A.F. (2017), Soil Pollution: A Case Study on the Determination of Toxic Elements in Soil in Jeddah City, Saudi Arabia. International Journal of Chemistry, vol. 9, No. 2. Page 39.
3. Alhogbi, B. G., &Alsolame, A. F. (2017). Soil Pollution: A Case Study on the Determination of Toxic Elements in Soil in Jeddah City, Saudi Arabia. International Journal of Chemistry, 9(2).
4. Ashfaque, F., Inam, A., Sahay, S., &Iqbal, S. (2016). Influence of heavy metal toxicity on plant growth, metabolism and its alleviation by phytoremediation-a promising technology. Journal of Agriculture and Ecology Research International, 1-19.
5. Awa, S.H. and Hadibarata, T., 2020. Removal of heavy metals in contaminated soil by phytoremediation mechanism: a review. Water, Air, & Soil Pollution, 231(2), pp.1-15.
6. Babich, R., & Van Beneden, R. J. (2019). Effect of arsenic exposure on early eye development in zebrafish (Danio rerio). Journal of Applied Toxicology, 39(6), 824-831.
7. Bhagwat, V.R., 2019. Safety of water used in food production. In Food Safety and Human Health (pp. 219-247). Academic Press.
8. Capuana, M., 2020. A review of the performance of woody and herbaceous ornamental plants for phytoremediation in urban areas. iForest-Biogeosciences and Forestry, 13(2), p.139.
9. Chauhan, P. and Mathur, J., 2020. Phytoremediation efficiency of Helianthus annuus L. for reclamation of heavy metals-contaminated industrial soil. Environmental Science and Pollution Research, 27, 29954-29966.
10. Chaves, L. H. G., Estrela, M. A., & de Souza, R. S. (2011). Effect on plant growth and heavy metal accumulation by sunflower. Journal of Phytology, 3(12).
11. Cristaldi, A., Conti, G. O., Cosentino, S. L., Mauromicale, G., Copat, C., Grasso, A., & Ferrante, M. (2020). Phytoremediation potential of Arundodonax (Giant Reed) in contaminated soil by heavy metals. Environmental research, 185, 109427.
12. Gul, I., Manzoor, M., Kallerhoff, J. and Arshad, M., 2020. Enhanced phytoremediation of lead by soil applied organic and inorganic amendments: Pbphytoavailability, accumulation and metal recovery. Chemosphere, 258, p.127405.
13. Hakeem, K., Sabir, M., Ozturk, M., &Mermut, A. R. (Eds.). (2014). Soil remediation and plants: prospects and challenges. Academic Press.
14. Henry, J. R. (2000). An overview of the phytoremediation of lead and mercury.Higueras, P., Fernández-Martínez, R., Esbrí, J. M., Rucandio, I., Loredo, J., Ordónez, A., & Alvarez, R. (2014). Mercury soil pollution in Spain: A review. Environment, Energy and Climate Change I, 135-158.

15. Khan, A.H.A., Kiyani, A., Mirza, C.R., Butt, T.A., Barros, R., Ali, B., Iqbal, M. and Yousaf, S., 2021. Ornamental plants for the phytoremediation of heavy metals: Present knowledge and future perspectives. Environmental Research, p.110780.
16. Lichtenthaler, H. K. (1987). [34] Chlorophylls and carotenoids: pigments of photosynthetic biomembranes. Methods in enzymology, 148, 350-382.
17. Manoj, S.R., Karthik, C., Kadirvelu, K., Arulselvi, P.I., Shanmugasundaram, T., Bruno, B. and Rajkumar, M., 2020. Understanding the molecular mechanisms for the enhanced phytoremediation of heavy metals through plant growth promoting rhizobacteria: A review. Journal of environmental management, 254, p.109779.
18. Mishra R.K , Mohammad N and N Roychoudhury N .(2018), Soil pollution: Causes, effects and control. Tropical Forest Research Institute, Jabalpur, MP, India, vol 3 No.1.
19. Nazir, M.I., Idrees, I., Idrees, P., Ahmad, S., Ali, Q. and Malik, A., 2020. Potential of water hyacinth (Eichhorniacrassipes L.) for phytoremediation of heavy metals from waste water. Biological and Clinical Sciences Research Journal, 2020(1).
20. Nedjimi, B., 2021. Phytoremediation: a sustainable environmental technology for heavy metals decontamination. SN Applied Sciences, 3(3), pp.1-19.
21. Oladoye, P.O., Olowe, O.M. and Asemoloye, M.D., 2021. Phytoremediation technology and food security impacts of heavy metal contaminated soils: A review of literatures. Chemosphere, p.132555.
22. Pamphlett, R., Jew, S.K., Doble, P.A. and Bishop, D.P., 2021. Mercury in the human adrenal medulla could contribute to increased plasma noradrenaline in aging. Scientific reports, 11(1), pp.1-14.
23. Paunov, M., Koleva, L., Vassilev, A., Vangronsveld, J., &Goltsev, V. (2018). Effects of different metals on photosynthesis: Cadmium and zinc affect chlorophyll fluorescence in durum wheat. International journal of molecular sciences, 19(3), 787.
24. Paz-Ferreiro, J., Gascó, G., Méndez, A., &Reichman, S. M. (2018). Soil pollution and remediation. International journal of environmental research and public health, 15(8), p.1657.
25. Purushothaman, B., PrasannaSrinivasan, R., Suganthi, P., Ranganathan, B., Gimbun, J., &Shanmugam, K. (2018). A comprehensive review on Ocimum basilicum. Journal of Natural Remedies, 18(3), 71-85.
26. Ramírez, A., García, G., Werner, O. and Ros, R.M., 2020. In vitro lead tolerance and accumulation in three Chrysanthemum cultivars for phytoremediation purposes with ornamental plants. International journal of phytoremediation, 22(11), pp.1110-1121.
27. Shyamala, S., Manikandan, N.A., Pakshirajan, K., Tang, V.T., Rene, E.R., Park, H.S. and Behera, S.K., 2019. Phytoremediation of nitrate contaminated water using ornamental plants. Journal of Water Supply: Research and Technology-Aqua, 68(8), pp.731-743.
28. Stefanowicz, A. M., Kapusta, P., Zubek, S., Stanek, M., &Woch, M. W. (2020). Soil organic matter prevails over heavy metal pollution and vegetation as a factor shaping soil microbial communities at historical Zn–Pb mining sites. Chemosphere, 240, 124922.
29. Stefanowicz, A. M., Kapusta, P., Zubek, S., Stanek, M., &Woch, M. W. (2020). Soil organic matter prevails over heavy metal pollution and vegetation as a factor shaping soil microbial communities at historical Zn–Pb mining sites. Chemosphere, 240, 124922.
30. Sumiahadi, A. and Acar, R., 2018, March. A review of phytoremediation technology: heavy metals uptake by plants. In IOP conference series: earth and environmental science (Vol. 142, No. 1, p. 012023). IOP Publishing.
31. Swayam Prakash Nanda and Abanti Pradhan (2019), ROLE OF ORNAMENTAL PLANTS IN PHYTOREMEDIATION OF ENVIRONMENTAL POLLUTANT AND ECONOMIC BENEFITS. Book
32. Tangahu, B. V., Sheikh Abdullah, S. R., Basri, H., Idris, M., Anuar, N., &Mukhlisin, M. (2011). A review on heavy metals (As, Pb, and Hg) uptake by plants through.phytoremediation. International Journal of Chemical Engineering, 2011.
33. Van der Lelie, D., Corbisier, P., Diels, L., Gilis, A., Lodewyckx, C., Mergeay, M., Taghavi, S., Spelmans, N. and Vangronsveld, J., 2020. The role of bacteria in the phytoremediation of heavy metals. In Phytoremediation of contaminated soil and water (pp. 265-281). CRC Press.
34. Wan, X., Lei, M., & Chen, T. (2016). Cost–benefit calculation of phytoremediation technology for heavy-metal-contaminated soil. Science of the total environment, 563, 796-802.
35. Woranan Nakbanpote , Orapan Meesungnoen and Prasad Majeti (2017), Potential of Ornamental Plants for Phytoremediation of Heavy Metals and Income Generation, In book: Bioremediation and Bioeconomy,

Chapter: Chapter-9 Potential of Ornamental Plants for Phytoremediation of Heavy Metals and Income Generation, Publisher: UK: Elsevier, Editors: M.N.V. Prasad, pp.177-217

36. Zeng, X., Xu, X., Qin, Q., Ye, K., Wu, W., &Huo, X. (2019). Heavy metal exposure has adverse effects on the growth and development of preschool children. Environmental geochemistry and health, 41(1), 309-321.Zhang, C., Zang, X., Dai, Z., Zhang, X. and Ma, Z., 2021. Remediation Techniques for Cadmium-Contaminated Dredged River Sediments after Land Disposal. Sustainability, 13(11), p.6093.
37. Zhou, L., Li, Z., Liu, W., Liu, S., Zhang, L., Zhong, L., Luo, X. and Liang, H., 2015. Restoration of rare earth mine areas: organic amendments and phytoremediation. Environmental Science and Pollution Research, 22(21), pp.17151-17160.
38. Zhou, L., Zhang, H., Li, Z., Wu, H., & Zheng, W. (2020). Study on Passivation of Wood Vinegar on Heavy Metals (Cu, Zn) During Cow Dung Compost Process. Journal of Biobased Materials and Bioenergy, 14(1), 114-119.

Table 1. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on plant height (cm) of *Dianthussp.* and *Ocimumbasilicum*

Plant height (cm)																				
Plants species	CO	Hg									As									
		L			M			H			L			M			H			
		O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	
Dianthus sp.	31.843 ± 1.657 ± 0.956	25.773 ± 1.257 ± 0.726 P= 0.007	27.530 ± 0.851 ± 0.491 P= 0.016	21.733 ± 0.788 ± 0.455 P= 0.001	11.680 ± 0.996 ± 0.575 P= 0.000	18.497 ± 1.001 ± 0.578 P= 0.000	12.693 ± 0.772 ± 0.446 P= 0.000	10.953 ± 0.988 ± 0.570 P= 0.000	13.223 ±1.816 ±1.048 P= 0.000	12.387 ± 1.982 ± 1.144 P= 0.000	21.810 ± 0.848 ± 0.490 P= 0.001	22.540 ± 0.930 ± 0.537 P= 0.001	18.150 ± 1.449 ± 0.836 P= 0.000	9.357 ± 1.128 ± 0.651 P= 0.000	15.510 ± 0.897 ± 0.518 P= 0.000	11.380 ± 0.924 ± 0.534 P= 0.000	9.753 ± 1.206 ± 0.696 P= 0.000	12.350 ± 0.680 ± 0.393 P= 0.000	10.477 ± 1.078 ± 0.622 P= 0.000	
Ocimumbasilicum	46.640 ± 0.580 ± 0.335	43.493 ± 0.905 ± 0.522 P= 0.007	44.470 ± 0.727 ± 0.420 P= 0.016	40.657 ± 0.870 ± 0.502 P= 0.001	34.383 ± 0.741 ± 0.428 P= 0.000	37.397 ± 1.316 ± 0.760 P= 0.000	32.830 ± 1.169 ± 0.675 P= 0.000	24.423 ± 1.260 ± 0.727 P= 0.000	26.290 ± 1.099 ± 0.635 P= 0.000	23.640 ± 1.067 ± 0.616 P= 0.000	42.170 ± 0.737 ± 0.425 P= 0.001	43.507 ± 0.709 ± 0.409 P= 0.004	41.427 ± 1.207 ± 0.697 P= 0.003	32.440 ± 1.163 ± 1.672 P= 0.000	35.477 ± 0.930 ± 0.537 P= 0.000	32.257 ± 1.131 ± 0.653 P= 0.000	23.540 ± 0.926 ± 0.535 P= 0.000	26.460 ± 0.950 ± 0.548 P= 0.000	20.267 ± 1.104 ± 0.637 P= 0.000	

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 2. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on root penetration ratio (%) of *Dianthussp.* and *Ocimumbasilicum*

Root penetration ratio (%)																		
Plants species	CO	Hg									As							
		L			M			H			L			M			H		
		O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	O	I	B
Dianthus sp.	83.000 ± 1.000 ± 0.577	76.000 ± 1.000 ± 0.577 P= 0.001	79.000 ± 1.000 ± 0.577 P= 0.008	73.000 ± 1.000 ± 0.577 P= 0.000	72.000 ± 1.000 ± 0.577 P= 0.000	74.000 ± 1.000 ± 0.577 P= 0.000	69.000 ± 1.000 ± 0.577 P= 0.000	61.000 ± 1.000 ± 0.577 P= 0.000	66.000 ± 1.000 ± 0.577 P= 0.000	63.000 ± 1.000 ± 0.577 P= 0.000	73.000 ± 1.000 ± 0.577 P= 0.000	75.000 ± 1.000 ± 0.577 P= 0.001	72.000 ± 1.000 ± 0.577 P= 0.000	63.000 ± 1.000 ± 0.577 P= 0.000	65.000 ± 1.000 ± 0.577 P= 0.000	62.000 ± 1.000 ± 0.577 P= 0.000	58.000 ± 1.000 ± 0.577 P= 0.000	65.000 ± 1.000 ± 0.577 P= 0.000	61.000 ± 1.000 ± 0.577 P= 0.000
Ocimumbasilicum	96.000 ± 1.000 ± 0.577	91.000 ± 1.000 ± 0.577 P= 0.004	94.000 ± 1.000 ± 0.577 P= 0.070	92.000 ± 1.000 ± 0.577 P= 0.008	88.000 ± 1.000 ± 0.577 P= 0.001	93.000 ± 1.000 ± 0.577 P= 0.021	90.000 ± 1.000 ± 0.577 P= 0.002	83.000 ± 1.000 ± 0.577 P= 0.000	91.000 ± 1.000 ± 0.577 P= 0.004	85.000 ± 1.000 ± 0.577 P= 0.000	81.000 ± 1.000 ± 0.577 P= 0.000	86.000 ± 1.000 ± 0.577 P= 0.000	84.000 ± 1.000 ± 0.577 P= 0.000	83.000 ± 1.000 ± 0.577 P= 0.000	90.000 ± 1.000 ± 0.577 P= 0.002	81.000 ± 1.000 ± 0.577 P= 0.000	79.000 ± 1.000 ± 0.577 P= 0.000	88.000 ± 1.000 ± 0.577 P= 0.001	74.000 ± 1.000 ± 0.577 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

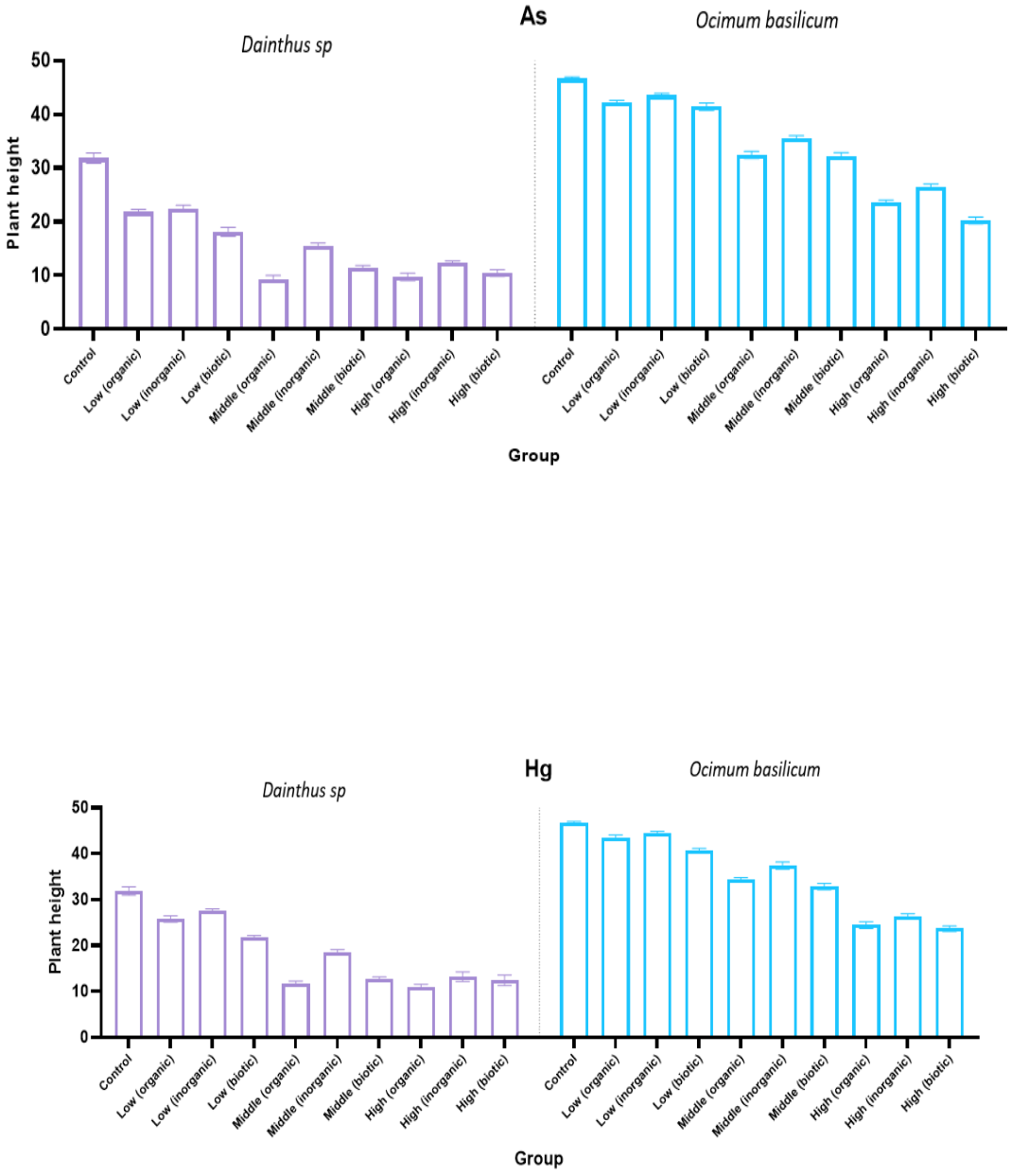


Figure 1.Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on plant height (cm) of *Dianthussp.* and *Ocimumbasilicum*

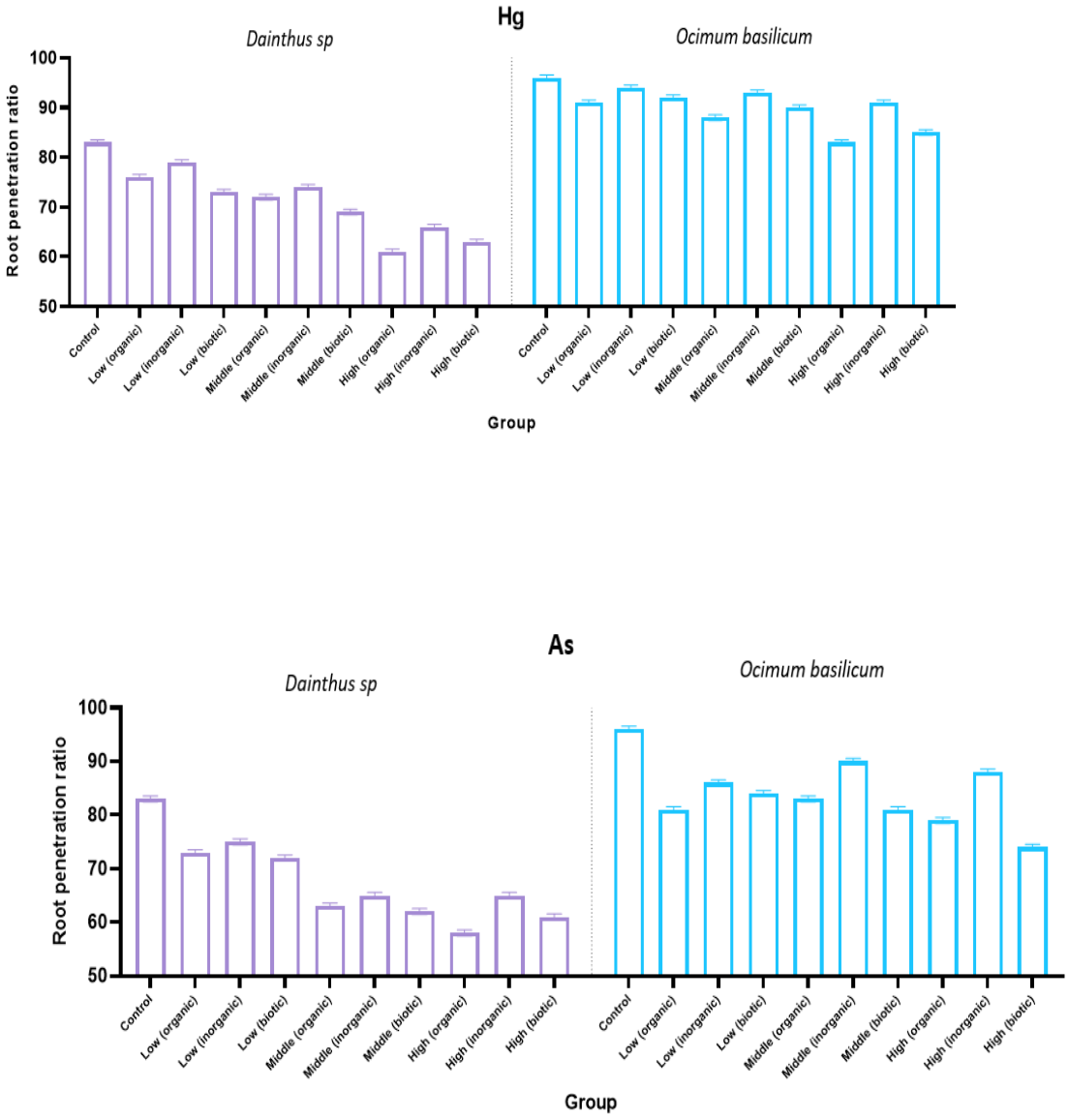


Figure 2.Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on root penetration ratio (%) of *Dianthussp.* and *Ocimumbasilicum*

Table 3. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on leaf area (cm²) of *Dianthussp.* and *Ocimumbasilicum*

Leaf area (cm²)																		
Plants species	CO	Hg									As							
		L			M			H			L			M			H		
		O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	O	I	B
Dianthus sp.	5.653 ± 0.958 ± 0.553	4.443 ± 0.705 ± 0.407 P= 0.153	4.620 ± 0.496 ± 0.286 P= 0.172	4.493 ± 1.306 ± 0.754 P= 0.283	2.923 ± 0.472 ± 0.272 P= 0.011	3.593 ± 0.586 ± 0.338 P= 0.034	2.643 ± 0.573 ± 0.331 P= 0.010	1.643 ± 0.520 ± 0.300 P= 0.003	3.097 ± 0.307 ± 0.177 P= 0.012	2.720 ± 0.898 ± 0.519 P= 0.018	3.200 ± 0.546 ± 0.315 P= 0.018	3.753 ± 0.565 ± 0.326 P= 0.042	2.713 ± 0.728 ± 0.420 P= 0.013	1.943 ± 0.534 ± 0.308 P= 0.004	2.857 ± 0.762 ± 0.440 P= 0.017	1.800 ± 0.421 ± 0.243 P= 0.003	1.800 ± 0.941 ± 0.543 P= 0.008	2.287 ± 0.342 ± 0.198 P= 0.005	1.380 ± 0.212 ± 0.122 P= 0.013
Ocimumbasilicum	9.370 ± 0.735 ± 0.425	7.597 ± 0.144 ± 0.083 P= 0.015	8.220 ± 0.208 ± 0.120 P= 0.046	7.093 ± 0.588 ± 0.339 P= 0.014	6.927 ± 0.867 ± 0.501 P= 0.020	7.797 ± 0.444 ± 0.257 P= 0.034	5.960 ± 0.910 ± 0.526 P= 0.007	5.630 ± 0.927 ± 0.535 P= 0.005	6.463 ± 0.501 ± 0.289 P= 0.005	3.890 ± 0.743 ± 0.429 P= 0.001	8.187 ± 0.641 ± 0.370 P= 0.104	7.867 ± 0.266 ± 0.153 P= 0.029	6.090 ± 0.904 ± 0.522 P= 0.008	4.967 ± 0.895 ± 0.517 P= 0.003	5.780 ± 0.927 ± 0.535 P= 0.006	4.180 ± 0.805 ± 0.465 P= 0.001	3.687 ± 0.405 ± 0.234 P= 0.000	4.170 ± 0.645 ± 0.372 P= 0.001	3.127 ± 0.586 ± 0.338 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 4 Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on leaves Number of *Dianthussp.* and *Ocimumbasilicum*

Leaves Number																		
Plants species	**CO**	**Hg**									**As**							
		L			**M**			**H**			**L**			**M**			**H**		
		O	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**
Dianthussp.	**49.000 ± 1.000 ± 0.577**	43.000 ± 1.000 ± 0.577 P= 0.002	45.000 ± 1.000 ± 0.577 P= 0.008	40.000 ± 1.000 ± 0.577 P= 0.000	37.000 ± 1.000 ± 0.577 P= 0.000	42.000 ± 1.000 ± 0.577 P= 0.001	40.000 ± 1.000 ± 0.577 P= 0.000	29.000 ± 1.000 ± 0.577 P= 0.000	31.000 ± 1.000 ± 0.577 P= 0.000	23.000 ± 1.000 ± 0.577 P= 0.000	41.000 ± 1.000 ± 0.577 P= 0.001	43.000 ± 1.000 ± 0.577 P= 0.002	38.000 ± 1.000 ± 0.577 P= 0.000	33.000 ± 1.000 ± 0.577 P= 0.000	38.000 ± 1.000 ± 0.577 P= 0.000	31.000 ± 1.000 ± 0.577 P= 0.000	25.000 ± 1.000 ± 0.577 P= 0.000	29.000 ± 1.000 ± 0.577 P= 0.000	18.000 ± 1.000 ± 0.577 P= 0.000

Ocimumbasilicum	**57.000 ± 1.000 ± 0.577**	50.000 ± 1.000 ± 0.577 P= 0.001	55.000 ± 1.000 ± 0.577 P= 0.070	47.000 ± 1.000 ± 0.577 P= 0.000	41.000 ± 1.000 ± 0.577 P= 0.000	51.667 ± 1.000 ± 0.577 P= 0.007	39.000 ± 1.000 ± 0.577 P= 0.000	32.000 ± 1.000 ± 0.577 P= 0.000	38.000 ± 1.000 ± 0.577 P= 0.000	30.000 ± 1.000 ± 0.577 P= 0.000	51.000 ± 1.000 ± 0.577 P= 0.002	52.000 ± 1.000 ± 0.577 P= 0.004	45.000 ± 1.000 ± 0.577 P= 0.000	38.000 ± 1.000 ± 0.577 P= 0.000	42.000 ± 1.000 ± 0.577 P= 0.000	32.000 ± 1.000 ± 0.577 P= 0.000	27.000 ± 1.000 ± 0.577 P= 0.000	34.000 ± 1.000 ± 0.577 P= 0.000	21.000 ± 1.000 ± 0.577 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 5. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on water content (shoot) %of *Dianthussp.* and *Ocimumbasilicum*

WC (Shoot) %																			
Plants species	**CO**	**Hg**									**As**								
		L			**M**			**H**			**L**			**M**			**H**		
		O	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**
Dianthus sp.	82.247 ± 0.942 ± 0.544	74.647 ± 1.067 ± 0.616 P= 0.001	79.433 ± 0.836 ± 0.483 P= 0.018	72.443 ± 0.693 ± 0.400 P= 0.000	73.493 ± 0.967 ± 0.558 P= 0.000	76.930 ± 1.457 ± 0.841 P= 0.006	73.247 ± 1.778 ± 1.027 P= 0.001	61.480 ± 0.898 ± 0.519 P= 0.000	66.513 ± 1.219 ± 0.704 P= 0.000	62.513 ± 1.027 ± 0.593 P= 0.000	73.473 ± 1.375 ± 0.794 P= 0.001	78.183 ± 1.769 ± 1.021 P= 0.025	69.477 ± 0.940 ± 0.543 P= 0.000	68.257 ± 1.061 ± 0.612 P= 0.000	73.453 ± 1.375 ± 0.794 P= 0.001	63.463 ± 0.964 ± 0.557 P= 0.000	53.353 ± 1.114 ± 0.643 P= 0.000	59.520 ± 0.864 ± 0.499 P= 0.000	51.563 ± 0.734 ± 0.424 P= 0.000

Ocimumbasilicum	88.523 ± 0.769 ± 0.444	83.593 ± 0.737 ± 0.425 P= 0.001	86.330 ± 0.888 ± 0.513 P= 0.032	81.613 ± 1.018 ± 0.588 P= 0.001	80.457 ± 0.976 ± 0.564 P= 0.000	83.593 ± 0.594 ± 0.343 P= 0.001	78.323 ± 0.932 ± 0.538 P= 0.000	76.407 ± 1.030 ± 0.595 P= 0.000	81.317 ± 0.975 ± 0.563 P= 0.001	73.540 ± 0.979 ± 0.565 P= 0.000	81.493 ± 1.058 ± 0.611 P= 0.001	84.420 ± 0.812 ± 0.469 P= 0.003	78.503 ± 1.086 ± 0.627 P= 0.000	72.670 ± 0.920 ± 0.531 P= 0.000	78.353 ± 1.170 ± 0.676 P= 0.000	73.760 ± 0.881 ± 0.509 P= 0.000	66.363 ± 0.868 ± 0.501 P= 0.000	73.430 ± 1.182 ± 0.683 P= 0.000	67.333 ± 1.004 ± 0.580 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 6. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on water content (root) %of *Dianthussp.* and *Ocimumbasilicum*

WC (Root) %																			
Plants species	**CO**	**Hg**									**As**								
		L			**M**			**H**			**L**			**M**			**H**		
		O	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**
Dianthus sp.	52.247 ± 0.942 ± 0.544	44.647 ± 1.067 ± 0.616 P= 0.001	46.100 ± 5.016 ± 2.896 P= 0.164	42.443 ± 0.693 ± 0.400 P= 0.000	43.493 ± 0.967 ± 0.558 P= 0.000	46.930 ± 1.457 ± 0.841 P= 0.006	43.247 ± 1.778 ± 1.027 P= 0.001	31.480 ± 0.898 ± 0.519 P= 0.000	36.513 ± 1.219 ± 0.704 P= 0.000	32.513 ± 1.027 ± 0.593 P= 0.000	43.473 ± 1.375 ± 0.794 P= 0.001	48.183 ± 1.769 ± 1.021 P= 0.025	39.477 ± 0.940 ± 0.543 P= 0.000	38.257 ± 1.061 ± 0.612 P= 0.000	43.453 ± 1.375 ± 0.794 P= 0.001	33.463 ± 0.964 ± 0.557 P= 0.000	23.353 ± 1.114 ± 0.643 P= 0.000	29.520 ± 0.864 ± 0.499 P= 0.000	21.563 ± 0.734 ± 0.424 P= 0.000
Ocimumbasilicum	58.523 ± 0.769 ± 0.444	53.593 ± 0.737 ± 0.425 P=	56.330 ± 0.888 ± 0.513 P=	51.613 ± 1.018 ± 0.588 P=	50.457 ± 0.976 ± 0.564 P=	48.593 ± 0.594 ± 0.343 P=	41.990 ± 1.475 ± 0.852 P=	35.407 ± 1.030 ± 0.595 P=	31.317 ± 0.975 ± 0.563 P=	35.540 ± 1.157 ± 0.668 P=	41.493 ± 1.058 ± 0.611 P=	44.420 ± 0.812 ± 0.469 P=	38.503 ± 1.086 ± 0.627 P=	32.670 ± 0.920 ± 0.531 P=	38.353 ± 1.170 ± 0.676 P=	33.760 ± 0.881 ± 0.509 P=	26.363 ± 0.868 ± 0.501 P=	33.430 ± 1.182 ± 0.683 P=	27.333 ± 1.004 ± 0.580 P=

		0.001	0.032	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 7. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on relative water content (shoot) %of *Dianthussp.* and *Ocimumbasilicum.*

RWC (Shoot) %																			
Plants species	CO	Hg									As								
		L			M			H			L			M			H		
		O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	O	I	B
Dianthus sp.	77.383 ± 1.174 ± 0.678	72.360 ± 0.920 ± 0.531 P= 0.004	75.413 ± 0.971 ± 0.561 P= 0.089	71.373 ± 0.986 ± 0.569 P= 0.002	68.477 ± 0.780 ± 0.451 P= 0.000	72.677 ± 1.391 ± 0.803 P= 0.011	65.593 ± 1.124 ± 0.649 P= 0.000	63.427 ± 0.983 ± 0.568 P= 0.000	69.143 ± 0.929 ± 0.537 P= 0.001	62.513 ± 1.099 ± 0.634 P= 0.000	65.423 ± 0.671 ± 0.387 P= 0.000	73.580 ± 0.980 ± 0.566 P= 0.013	68.350 ± 0.981 ± 0.566 P= 0.001	63.577 ± 1.381 ± 0.797 P= 0.000	69.503 ± 1.245 ± 0.719 P= 0.001	64.590 ± 0.956 ± 0.552 P= 0.000	61.170 ± 0.962 ± 0.555 P= 0.000	63.500 ± 0.733 ± 0.423 P= 0.000	56.423 ± 1.046 ± 0.604 P= 0.000
Ocimumbasilicum	92.570 ± 1.235 ± 0.713	86.230 ± 1.068 ± 0.616 P= 0.003	88.223 ± 1.105 ± 0.638 P= 0.010	84.273 ± 0.945 ± 0.546 P= 0.001	83.530 ± 0.798 ± 0.460 P= 0.000	88.407 ± 0.789 ± 0.455 P= 0.008	83.360 ± 0.947 ± 0.546 P= 0.001	77.407 ± 1.124 ± 0.649 P= 0.000	81.420 ± 1.205 ± 0.696 P= 0.000	74.223 ± 0.812 ± 0.469 P= 0.000	84.417 ± 1.104 ± 0.637 P= 0.001	87.320 ± 0.930 ± 0.537 P= 0.004	82.590 ± 1.219 ± 0.704 P= 0.001	80.593 ± 0.817 ± 0.472 P= 0.000	82.473 ± 0.910 ± 0.525 P= 0.000	73.623 ± 0.680 ± 0.393 P= 0.000	70.430 ± 0.628 ± 0.363 P= 0.000	74.590 ± 1.257 ± 0.725 P= 0.000	64.480 ± 1.188 ± 0.686 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 8. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on relative water content (root) %of *Dianthussp.* and *Ocimumbasilicum.*

RWC (Root) %																			
Plants species	CO	Hg									As								
		L			M			H			L			M			H		
		O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	O	I	B
Dianthus sp.	47.383 ± 1.174 ± 0.678	42.360 ± 0.920 ± 0.531 P= 0.004	45.413 ± 0.971 ± 0.561 P= 0.089	41.373 ± 0.986 ± 0.569 P= 0.002	38.477 ± 0.780 ± 0.451 P= 0.000	42.677 ± 1.391 ± 0.803 P= 0.011	35.593 ± 1.124 ± 0.649 P= 0.000	33.427 ± 0.983 ± 0.568 P= 0.000	39.143 ± 0.929 ± 0.537 P= 0.001	32.513 ± 1.099 ± 0.634 P= 0.000	35.423 ± 0.671 ± 0.387 P= 0.000	43.580 ± 0.980 ± 0.566 P= 0.013	38.350 ± 0.981 ± 0.566 P= 0.001	33.577 ± 1.381 ± 0.797 P= 0.000	39.503 ± 1.245 ± 0.719 P= 0.001	34.590 ± 0.956 ± 0.552 P= 0.000	31.170 ± 0.962 ± 0.555 P= 0.000	33.500 ± 0.733 ± 0.423 P= 0.000	26.423 ± 1.046 ± 0.604 P= 0.000
Ocimumbasilicum	52.570 ± 1.235 ± 0.713	46.230 ± 1.068 ± 0.616 P= 0.003	48.223 ± 1.105 ± 0.638 P= 0.010	44.273 ± 0.945 ± 0.546 P= 0.001	43.530 ± 0.798 ± 0.460 P= 0.000	48.407 ± 0.789 ± 0.455 P= 0.008	43.360 ± 0.947 ± 0.546 P= 0.001	37.407 ± 1.124 ± 0.649 P= 0.000	41.420 ± 1.205 ± 0.696 P= 0.000	34.223 ± 0.812 ± 0.469 P= 0.000	44.417 ± 1.104 ± 0.637 P= 0.001	47.320 ± 0.930 ± 0.537 P= 0.004	42.590 ± 1.219 ± 0.704 P= 0.001	40.593 ± 0.817 ± 0.472 P= 0.000	42.473 ± 0.910 ± 0.525 P= 0.000	33.623 ± 0.680 ± 0.393 P= 0.000	23.763 ± 5.275 ± 3.046 P= 0.008	34.590 ± 1.257 ± 0.725 P= 0.000	24.480 ± 1.188 ± 0.686 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Chlorophyll A (mg (gfw)-1)																		
Plants species	**CO**	**Hg**									**As**							
		L			**M**			**H**			**L**			**M**			**H**		
		O	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**
Dianthus sp.	0.820 ± 0.010 ± 0.006	0.750 ± 0.010 ± 0.006 P= 0.001	0.780 ± 0.010 ± 0.006 P= 0.008	0.730 ± 0.010 ± 0.006 P= 0.000	0.733 ± 0.006 ± 0.003 P= 0.046	0.763 ± 0.015 ± 0.009 P= 0.006	0.710 ± 0.010 ± 0.006 P= 0.000	0.660 ± 0.010 ± 0.006 P= 0.000	0.690 ± 0.010 ± 0.006 P= 0.000	0.630 ± 0.010 ± 0.006 P= 0.000	0.720 ± 0.010 ± 0.006 P= 0.000	0.760 ± 0.010 ± 0.006 P= 0.002	0.700 ± 0.010 ± 0.006 P= 0.000	0.680 ± 0.010 ± 0.006 P= 0.000	0.740 ± 0.010 ± 0.006 P= 0.001	0.650 ± 0.010 ± 0.006 P= 0.000	0.620 ± 0.010 ± 0.006 P= 0.000	0.690 ± 0.010 ± 0.006 P= 0.000	0.570 ± 0.010 ± 0.006 P= 0.000
Ocimumbasilicum	0.940 ± 0.010 ± 0.006	0.887 ± 0.015 ± 0.009 P= 0.007	0.920 ± 0.010 ± 0.006 P= 0.070	0.840 ± 0.010 ± 0.006 P= 0.000	0.820 ± 0.010 ± 0.006 P= 0.000	0.873 ± 0.015 ± 0.009 P= 0.003	0.790 ± 0.010 ± 0.006 P= 0.000	0.730 ± 0.010 ± 0.006 P= 0.000	0.750 ± 0.010 ± 0.006 P= 0.000	0.710 ± 0.010 ± 0.006 P= 0.000	0.880 ± 0.010 ± 0.006 P= 0.002	0.910 ± 0.010 ± 0.006 P= 0.021	0.820 ± 0.010 ± 0.006 P= 0.000	0.810 ± 0.010 ± 0.006 P= 0.000	0.840 ± 0.010 ± 0.006 P= 0.000	0.790 ± 0.010 ± 0.006 P= 0.000	0.710 ± 0.010 ± 0.006 P= 0.000	0.730 ± 0.010 ± 0.006 P= 0.000	0.670 ± 0.010 ± 0.006 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 10. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on chlorophyll B (mg (gfw)-1) of *Dianthussp.* and *Ocimumbasilicum.*

Chlorophyll. B (mg/g fresh weight)																		
Plants species	**CO**	**Hg**									**As**							
		L			**M**			**H**			**L**			**M**			**H**		
		O	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**
Dianthus sp.	0.320 ± 0.010 ± 0.006	0.250 ± 0.010 ± 0.006 P= 0.001	0.280 ± 0.010 ± 0.006 P= 0.008	0.230 ± 0.010 ± 0.006 P= 0.000	0.233 ± 0.006 ± 0.003 P= 0.046	0.263 ± 0.015 ± 0.009 P= 0.006	0.210 ± 0.010 ± 0.006 P= 0.000	0.160 ± 0.010 ± 0.006 P= 0.000	0.190 ± 0.010 ± 0.006 P= 0.000	0.130 ± 0.010 ± 0.006 P= 0.000	0.220 ± 0.010 ± 0.006 P= 0.000	0.260 ± 0.010 ± 0.006 P= 0.002	0.200 ± 0.010 ± 0.006 P= 0.000	0.180 ± 0.010 ± 0.006 P= 0.000	0.240 ± 0.010 ± 0.006 P= 0.001	0.150 ± 0.010 ± 0.006 P= 0.000	0.120 ± 0.010 ± 0.006 P= 0.000	0.190 ± 0.010 ± 0.006 P= 0.000	0.070 ± 0.010 ± 0.006 P= 0.000
Ocimumbasilicum	0.440 ± 0.010 ± 0.006	0.390 ± 0.010 ± 0.006 P= 0.004	0.420 ± 0.010 ± 0.006 P= 0.070	0.340 ± 0.010 ± 0.006 P= 0.000	0.420 ± 0.010 ± 0.006 P= 0.070	0.473 ± 0.015 ± 0.009 P= 0.034	0.390 ± 0.010 ± 0.006 P= 0.004	0.330 ± 0.010 ± 0.006 P= 0.000	0.350 ± 0.010 ± 0.006 P= 0.000	0.310 ± 0.010 ± 0.006 P= 0.000	0.380 ± 0.010 ± 0.006 P= 0.002	0.410 ± 0.010 ± 0.006 P= 0.021	0.320 ± 0.010 ± 0.006 P= 0.000	0.310 ± 0.010 ± 0.006 P= 0.000	0.340 ± 0.010 ± 0.006 P= 0.000	0.290 ± 0.010 ± 0.006 P= 0.000	0.210 ± 0.010 ± 0.006 P= 0.000	0.330 ± 0.010 ± 0.006 P= 0.000	0.270 ± 0.010 ± 0.006 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 11. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on carotenoids (mg (gfw)-1) of *Dianthussp.* and *Ocimumbasilicum.*

Carotenoids (mg/g fresh weight)																		
Plants species	CO	Hg									As								
		L			M			H			L			M			H		
		O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	O	I	B
Dianthus sp.	0.180 ± 0.010 ± 0.006	0.120 ± 0.010 ± 0.006 P= 0.002	0.150 ± 0.010 ± 0.006 P= 0.021	0.130 ± 0.010 ± 0.006 P= 0.004	0.140 ± 0.010 ± 0.006 P= 0.008	0.163 ± 0.015 ± 0.009 P= 0.189	0.110 ± 0.010 ± 0.006 P= 0.001	0.160 ± 0.010 ± 0.006 P= 0.070	0.190 ± 0.010 ± 0.006 P= 0.288	0.130 ± 0.010 ± 0.006 P= 0.004	0.110 ± 0.010 ± 0.006 P= 0.001	0.140 ± 0.010 ± 0.006 P= 0.008	0.090 ± 0.010 ± 0.006 P= 0.000	0.110 ± 0.010 ± 0.006 P= 0.001	0.140 ± 0.010 ± 0.006 P= 0.008	0.103 ± 0.015 ± 0.009 P= 0.002	0.080 ± 0.010 ± 0.006 P= 0.000	0.100 ± 0.010 ± 0.006 P= 0.001	0.060 ± 0.010 ± 0.006 P= 0.000
Ocimum basilicum	0.240 ± 0.010 ± 0.006	0.190 ± 0.010 ± 0.006 P= 0.004	0.220 ± 0.010 ± 0.006 P= 0.070	0.140 ± 0.010 ± 0.006 P= 0.000	0.220 ± 0.010 ± 0.006 P= 0.070	0.273 ± 0.015 ± 0.009 P= 0.034	0.190 ± 0.010 ± 0.006 P= 0.004	0.130 ± 0.010 ± 0.006 P= 0.000	0.150 ± 0.010 ± 0.006 P= 0.000	0.110 ± 0.010 ± 0.006 P= 0.000	0.280 ± 0.010 ± 0.006 P= 0.008	0.210 ± 0.010 ± 0.006 P= 0.021	0.120 ± 0.010 ± 0.006 P= 0.000	0.110 ± 0.010 ± 0.006 P= 0.000	0.140 ± 0.010 ± 0.006 P= 0.000	0.190 ± 0.010 ± 0.006 P= 0.004	0.110 ± 0.010 ± 0.006 P= 0.000	0.130 ± 0.010 ± 0.006 P= 0.000	0.170 ± 0.010 ± 0.006 P= 0.001

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 12. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on pH (shoot) of *Dianthussp.* and *Ocimumbasilicum.*

pH (Shoot)																		
Plants species	CO	Hg									As							
		L			M			H			L			M			H		
		O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	O	I	B
Dianthus sp.	13.000 ± 1.000 ± 0.577	12.000 ± 1.000 ± 0.577 P= 0.288	12.000 ± 1.000 ± 0.577 P= 0.288	11.000 ± 1.000 ± 0.577 P= 0.070	11.000 ± 1.000 ± 0.577 P= 0.070	12.000 ± 1.000 ± 0.577 P= 0.288	11.000 ± 1.000 ± 0.577 P= 0.070	7.000 ± 1.000 ± 0.577 P= 0.002	9.000 ± 1.000 ± 0.577 P= 0.008	6.000 ± 1.000 ± 0.577 P= 0.001	11.000 ± 1.000 ± 0.577 P= 0.070	11.333 ± 1.528 ± 0.882 P= 0.189	8.000 ± 1.000 ± 0.577 P= 0.004	10.000 ± 1.000 ± 0.577 P= 0.021	10.000 ± 1.000 ± 0.577 P= 0.021	8.000 ± 1.000 ± 0.577 P= 0.004	7.000 ± 1.000 ± 0.577 P= 0.002	9.000 ± 1.000 ± 0.577 P= 0.008	5.000 ± 1.000 ± 0.577 P= 0.001
Ocimumbasilicum	13.000 ± 1.000 ± 0.577	11.000 ± 1.000 ± 0.577 P= 0.070	12.000 ± 1.000 ± 0.577 P= 0.288	10.000 ± 1.000 ± 0.577 P= 0.021	9.667 ± 1.528 ± 0.882 P= 0.034	11.000 ± 1.000 ± 0.577 P= 0.070	9.000 ± 1.000 ± 0.577 P= 0.008	8.000 ± 1.000 ± 0.577 P= 0.004	6.000 ± 1.000 ± 0.577 P= 0.001	9.000 ± 1.000 ± 0.577 P= 0.001	10.000 ± 1.000 ± 0.577 P= 0.021	11.000 ± 1.000 ± 0.577 P= 0.070	9.000 ± 1.000 ± 0.577 P= 0.008	10.000 ± 1.000 ± 0.577 P= 0.021	10.000 ± 1.000 ± 0.577 P= 0.021	7.000 ± 1.000 ± 0.577 P= 0.002	8.000 ± 1.000 ± 0.577 P= 0.004	9.000 ± 1.000 ± 0.577 P= 0.008	7.000 ± 1.000 ± 0.577 P= 0.002

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 13. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on pH (root) of *Dianthussp.* and *Ocimumbasilicum.*

pH (Root)																		
Plants species	**CO**	**Hg**									**As**							
		L			**M**			**H**			**L**			**M**			**H**	
		O	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**
Dianthus sp.	13.000 ± 1.000 ± 0.577	10.000 ± 1.000 ± 0.577 P= 0.021	11.000 ± 1.000 ± 0.577 P= 0.070	9.000 ± 1.000 ± 0.577 P= 0.008	9.000 ± 1.000 ± 0.577 P= 0.008	11.000 ± 1.000 ± 0.577 P= 0.070	8.000 ± 1.000 ± 0.577 P= 0.004	9.000 ± 1.000 ± 0.577 P= 0.008	10.000 ± 1.000 ± 0.577 P= 0.021	6.000 ± 1.000 ± 0.577 P= 0.001	9.000 ± 1.000 ± 0.577 P= 0.008	10.000 ± 1.000 ± 0.577 P= 0.021	8.000 ± 1.000 ± 0.577 P= 0.004	8.000 ± 1.000 ± 0.577 P= 0.004	10.000 ± 1.000 ± 0.577 P= 0.021	7.000 ± 1.000 ± 0.577 P= 0.002	8.000 ± 1.000 ± 0.577 P= 0.004	9.000 ± 1.000 ± 0.577 P= 0.008	7.000 ± 1.000 ± 0.577 P= 0.002
Ocimumbasilicum	12.000 ± 1.000 ± 0.577	10.000 ± 1.000 ± 0.577 P= 0.070	11.000 ± 1.000 ± 0.577 P= 0.288	9.000 ± 1.000 ± 0.577 P=	8.000 ± 1.000 ± 0.577 P=	10.000 ± 1.000 ± 0.577 P= 0.070	9.000 ± 1.000 ± 0.577 P=	8.000 ± 1.000 ± 0.577 P=	9.000 ± 1.000 ± 0.577 P= 0.021	8.000 ± 1.000 ± 0.577 P=	9.000 ± 1.000 ± 0.577 P=	10.000 ± 1.000 ± 0.577 P= 0.070	8.000 ± 1.000 ± 0.577 P=	9.000 ± 1.000 ± 0.577 P=	8.000 ± 1.000 ± 0.577 P= 0.008	6.000 ± 1.000 ± 0.577 P=	7.000 ± 1.000 ± 0.577 P=	9.000 ± 1.000 ± 0.577 P=	6.000 ± 1.000 ± 0.577 P=

				0.021	0.008		0.021	0.008		0.008	0.021		0.008	0.021		0.002	0.004	0.021	0.002

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 14. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on EC (shoot) (µS/cm)of *Dianthussp.* and *Ocimumbasilicum*

EC (Shoot) (µS/cm)																			
Plants species	CO	Hg									As								
		L			M			H			L			M			H		
		O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	O	I	B
Dianthus sp.	946.00 ± 1.00± 0.57	831.00± 1.00 ± 0.57 P= 0.00	893.00 ± 1.00 ± 0.57 P= 0.00	812.00 ± 1.00 ± 0.57 P= 0.00	723.00 ± 1.00± 0.57 P= 0.00	788.00 ± 1.00 ± 0.57 P= 0.00	710.00 ± 1.00 ± 0.577 P= 0.00	642.00 ± 1.00 ± 0.57 P= 0.00	679.00 ± 18.19 ± 10.50 P= 0.00	611.00 ± 1.00 ± 0.57 P= 0.00	824.66 ± 3.78 ± 2.18 P= 0.00	894.00 ± 1.00 ± 0.57 P= 0.00	855.00 ± 1.00 ± 0.57 P= 0.00	703.00 ± 1.00 ± 0.57 P= 0.00	757.00 ± 1.00 ± 0.57 P= 0.00	698.00 ± 1.00 ± 0.57 P= 0.00	636.00 ± 1.00 ± 0.57 P= 0.00	652.00 ± 1.00 ± 0.57 P= 0.00	588.00 ± 1.00 ± 0.57 P= 0.00

Ocimum basilicum	1005.00 ± 1.00 ± 0.57	972.00 ± 1.00 ± 0.57 P= 0.00	987.00 ± 1.00 ± 0.57 P= 0.00	911.000 ± 1.000 ± 0.577 P= 0.00	833.000 ± 1.000 ± 0.577 P= 0.00	866.00 ± 1.00 ± 0.57 P= 0.00	812.00 ± 1.00 ± 0.57 P= 0.00	747.00 ± 1.00 ± 0.57 P= 0.00	783.00 ± 1.00 ± 0.57 P= 0.00	725.00 ± 1.00 ± 0.57 P= 0.00	923.00 ± 1.00 ± 0.57 P= 0.00	966.00 ± 1.00 ± 0.57 P= 0.00	905.00 ± 1.00 ± 0.57 P= 0.00	833.00 ± 1.00 ± 0.57 P= 0.00	888.00 ± 1.00 ± 0.57 P= 0.00	767.00 ± 1.00 ± 0.57 P= 0.00	637.00 ± 1.00 ± 0.57 P= 0.00	697.00 ± 1.00 ± 0.57 P= 0.00	620.00 ± 1.00 ± 0.57 P= 0.00

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 15 Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on EC (root) (µS/cm)of ***Dianthussp.*** **and** ***Ocimummbasilicum***

EC(Root) (µS/cm)																		
Plants species	**CO**	**Hg**									**As**							
		L			**M**			**H**			**L**			**M**			**H**		
		O	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**

Dianthus sp.	847.000 ± 1.000 ± 0.577	731.000 ± 1.000 ± 0.577 P= 0.000	797.000 ± 1.000 ± 0.577 P= 0.000	704.000 ± 1.000 ± 0.577 P= 0.000	641.000 ± 1.000 ± 0.577 P= 0.000	686.000 ± 1.000 ± 0.577 P= 0.000	511.000 ± 1.000 ± 0.577 P= 0.000	538.000 ± 1.000 ± 0.577 P= 0.000	582.000 ± 1.000 ± 0.577 P= 0.000	523.000 ± 1.000 ± 0.577 P= 0.000	727.000 ± 1.000 ± 0.577 P= 0.000	791.000 ± 1.000 ± 0.577 P= 0.000	702.000 ± 1.000 ± 0.577 P= 0.000	618.000 ± 1.000 ± 0.577 P= 0.000	667.000 ± 1.000 ± 0.577 P= 0.000	607.000 ± 1.000 ± 0.577 P= 0.000	522.000 ± 1.000 ± 0.577 P= 0.000	564.000 ± 1.000 ± 0.577 P= 0.000	498.000 ± 1.000 ± 0.577 P= 0.000
Ocimum mbasilicum	926.000 ± 1.000 ± 0.577	886.000 ± 1.000 ± 0.577 P= 0.000	904.000 ± 1.000 ± 0.577 P= 0.000	847.000 ± 1.000 ± 0.577 P= 0.00	812.000 ± 1.000 ± 0.577 P= 0.000	793.000 ± 1.000 ± 0.577 P= 0.00	793.000 ± 1.000 ± 0.577 P= 0.000	721.000 ± 1.000 ± 0.577 P= 0.000	786.000 ± 1.000 ± 0.577 P= 0.00	714.000 ± 1.000 ± 0.577 P= 0.00	843.333 ± 1.528 ± 0.882 P= 0.00	877.000 ± 1.000 ± 0.577 P= 0.00	832.000 ± 1.000 ± 0.577 P= 0.00	750.000 ± 1.000 ± 0.577 P= 0.00	788.000 ± 1.000 ± 0.577 P= 0.00	712.000 ± 1.000 ± 0.577 P= 0.00	653.000 ± 1.000 ± 0.577 P= 0	733.000 ± 1.000 ± 0.577 P= 0.00	613.000 ± 1.000 ± 0.577 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 16 Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on soluble protein(mg (gfw)-1)of *Dianthussp.* and *Ocimumbasilicum*

Soluble Protein (mg/g fresh weight)																		
Plants species	CO	Hg									As							
		L			M			H			L			M			H		
		O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	O	I	B
Dianthus sp.	2.130 ± 0.010 ± 0.006	1.930 ± 0.010 ± 0.006 P= 0.000	2.110 ± 0.010 ± 0.006 P= 0.070	1.870 ± 0.010 ± 0.006 P= 0.000	1.660 ± 0.010 ± 0.006 P= 0.000	1.730 ± 0.010 ± 0.006 P= 0.000	1.430 ± 0.010 ± 0.006 P= 0.000	1.370 ± 0.010 ± 0.006 P= 0.000	1.520 ± 0.010 ± 0.006 P= 0.000	1.120 ± 0.010 ± 0.006 P= 0.000	1.860 ± 0.010 ± 0.006 P= 0.000	2.070 ± 0.010 ± 0.006 P= 0.002	1.640 ± 0.010 ± 0.006 P= 0.000	1.480 ± 0.010 ± 0.006 P= 0.000	1.670 ± 0.010 ± 0.006 P= 0.000	1.250 ± 0.010 ± 0.006 P= 0.000	1.130 ± 0.010 ± 0.006 P= 0.000	1.470 ± 0.010 ± 0.006 P= 0.000	0.900 ± 0.010 ± 0.006 P= 0.000
Ocimumbasilicum	2.340 ± 0.010 ± 0.006	2.080 ± 0.010 ± 0.006 P= 0.000	2.210 ± 0.010 ± 0.006 P= 0.000	1.940 ± 0.010 ± 0.006 P= 0.000	1.830 ± 0.010 ± 0.006 P= 0.000	1.980 ± 0.010 ± 0.006 P= 0.000	1.650 ± 0.010 ± 0.006 P= 0.000	1.450 ± 0.010 ± 0.006 P= 0.000	1.660 ± 0.010 ± 0.006 P= 0.000	1.130 ± 0.010 ± 0.006 P= 0.000	2.030 ± 0.010 ± 0.006 P= 0.000	2.110 ± 0.010 ± 0.006 P= 0.000	1.840 ± 0.010 ± 0.006 P= 0.000	1.740 ± 0.010 ± 0.006 P= 0.000	1.930 ± 0.010 ± 0.006 P= 0.000	1.550 ± 0.010 ± 0.006 P= 0.000	1.110 ± 0.010 ± 0.006 P= 0.000	1.280 ± 0.010 ± 0.006 P= 0.000	1.040 ± 0.010 ± 0.006 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 17 Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on soluble proline (nmol (gfw)-1) of *Dianthussp.* and *Ocimumbasilicum*

Soluble Proline (mg/g fresh weight)																		
Plants species	**CO**	**Hg**									**As**							
		L			**M**			**H**			**L**			**M**			**H**		
		O	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**
Dianthus sp.	0.480 ± 0.010 ± 0.006	0.540 ± 0.010 ± 0.006 P= 0.002	0.520 ± 0.010 ± 0.006 P= 0.008	0.560 ± 0.010 ± 0.006 P= 0.001	0.590 ± 0.010 ± 0.006 P= 0.000	0.530 ± 0.010 ± 0.006 P= 0.004	0.600 ± 0.010 ± 0.006 P= 0.000	0.640 ± 0.010 ± 0.006 P= 0.000	0.570 ± 0.010 ± 0.006 P= 0.000	0.680 ± 0.010 ± 0.006 P= 0.000	0.580 ± 0.010 ± 0.006 P= 0.000	0.560 ± 0.010 ± 0.006 P= 0.001	0.630 ± 0.010 ± 0.006 P= 0.000	0.590 ± 0.010 ± 0.006 P= 0.000	0.540 ± 0.010 ± 0.006 P= 0.002	0.600 ± 0.010 ± 0.006 P= 0.000	0.640 ± 0.010 ± 0.006 P= 0.000	0.590 ± 0.010 ± 0.006 P= 0.000	0.680 ± 0.010 ± 0.006 P= 0.000
Ocimumbasilicum	0.230 ± 0.010 ± 0.006	0.260 ± 0.010 ± 0.006 P= 0.021	0.210 ± 0.010 ± 0.006 P= 0.070	0.300 ± 0.010 ± 0.006 P= 0.001	0.280 ± 0.010 ± 0.006 P= 0.004	0.250 ± 0.010 ± 0.006 P= 0.070	0.330 ± 0.010 ± 0.006 P= 0.000	0.350 ± 0.010 ± 0.006 P= 0.000	0.310 ± 0.010 ± 0.006 P= 0.001	0.390 ± 0.010 ± 0.006 P= 0.000	0.300 ± 0.010 ± 0.006 P= 0.001	0.240 ± 0.010 ± 0.006 P= 0.288	0.330 ± 0.010 ± 0.006 P= 0.000	0.320 ± 0.010 ± 0.006 P= 0.000	0.290 ± 0.010 ± 0.006 P= 0.002	0.360 ± 0.010 ± 0.006 P= 0.000	0.387 ± 0.015 ± 0.009 P= 0.000	0.350 ± 0.010 ± 0.006 P= 0.000	0.440 ± 0.010 ± 0.006 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Soluble Sugar (mg/g fresh weight)																			
Plants species	**CO**	**Hg**									**As**								
		L			**M**			**H**			**L**			**M**			**H**		
		O	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**	**O**	**I**	**B**
Dianthus sp.	13.787 ± 1.001 ± 0.578	16.450 ± 1.384 ± 0.799 P= 0.054	14.467 ± 0.792 ± 0.457 P= 0.408	18.327 ± 0.921 ± 0.532 P= 0.004	19.207 ± 1.023 ± 0.591 P= 0.003	17.600 ± 1.045 ± 0.603 P= 0.010	21.307 ± 1.070 ± 0.618 P= 0.001	23.623 ± 0.660 ± 0.381 P= 0.000	20.300 ± 1.022 ± 0.590 P= 0.001	26.473 ± 0.616 ± 0.356 P= 0.000	18.293 ± 0.981 ± 0.566 P= 0.005	13.380 ± 1.165 ± 0.673 P= 0.670	22.407 ± 1.121 ± 0.647 P= 0.001	20.673 ± 1.086 ± 0.627 P= 0.001	16.440 ± 1.325 ± 0.765 P= 0.050	23.590 ± 1.111 ± 0.642 P= 0.000	26.657 ± 1.101 ± 0.636 P= 0.000	22.667 ± 0.996 ± 0.575 P= 0.000	31.307 ± 1.112 ± 0.642 P= 0.000
Ocimumbasilicum	18.457 ± 1.248 ± 0.721	21.583 ± 1.129 ± 0.652 P= 0.032	18.520 ± 1.132 ± 0.654 P= 0.951	24.600 ± 1.236 ± 0.713 P= 0.004	24.503 ± 1.059 ± 0.611 P= 0.003	21.593 ± 1.306 ± 0.754 P= 0.040	28.403 ± 1.166 ± 0.673 P= 0.001	30.223 ± 0.856 ± 0.494 P= 0.000	17.600 ± 1.113 ± 0.642 P= 0.425	32.723 ± 0.888 ± 0.513 P= 0.000	25.607 ± 1.080 ± 0.623 P= 0.002	21.557 ± 1.215 ± 0.702 P= 0.037	30.373 ± 1.227 ± 0.708 P= 0.000	26.383 ± 0.899 ± 0.519 P= 0.001	23.613 ± 1.226 ± 0.708 P= 0.007	32.210 ± 1.171 ± 0.676 P= 0.000	35.503 ± 1.252 ± 0.723 P= 0.000	30.150 ± 0.987 ± 0.570 P= 0.000	38.283 ± 1.077 ± 0.622 P= 0.000

Table 18 Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on soluble sugar (mg/g fw)of *Dianthussp.* and *Ocimumbasilicum*

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

Table 19. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on antioxidant defense enzymes (lipids) (nmol (gfw)-1) of *Dianthussp.* and *Ocimumbasilicum*

Antioxidant defense enzymes (Lipids)																		
Plants species	CO	Hg									As							
		L			M			H			L			M			H		
		O	I	B	O	I	B	O	I	B	O	I	B	O	I	B	O	I	B
Dianthus sp.	15.260 ± 1.117 ± 0.645	18.400 ± 1.276 ± 0.737 P= 0.033	16.480 ± 1.295 ± 0.747 P= 0.284	20.477 ± 0.768 ± 0.444 P= 0.003	21.560 ± 0.610 ± 0.352 P= 0.001	19.790 ± 0.859 ± 0.496 P= 0.005	23.357 ± 0.735 ± 0.424 P= 0.000	26.503 ± 1.040 ± 0.600 P= 0.000	22.623 ± 1.196 ± 0.691 P= 0.001	28.510 ± 0.660 ± 0.381 P= 0.000	20.303 ± 0.966 ± 0.557 P= 0.004	17.433 ± 1.171 ± 0.676 P= 0.081	24.507 ± 0.716 ± 0.413 P= 0.000	23.383 ± 0.888 ± 0.513 P= 0.001	19.247 ± 0.948 ± 0.548 P= 0.009	26.527 ± 0.949 ± 0.548 P= 0.000	29.417 ± 0.909 ± 0.525 P= 0.000	22.360 ± 1.117 ± 0.645 P= 0.001	34.393 ± 1.143 ± 0.660 P= 0.000
Ocimumbasilicum	18.617 ± 1.255 ± 0.725	25.503 ± 0.754 ± 0.435 P= 0.001	20.470 ± 0.596 ± 0.344 P= 0.082	26.613 ± 1.055 ± 0.609 P= 0.001	27.587 ± 1.079 ± 0.623 P= 0.001	24.610 ± 1.045 ± 0.603 P= 0.003	30.487 ± 1.301 ± 0.751 P= 0.000	33.600 ± 1.144 ± 0.661 P= 0.000	19.353 ± 1.029 ± 0.594 P= 0.476	35.453 ± 0.726 ± 0.419 P= 0.000	27.377 ± 0.883 ± 0.510 P= 0.001	24.393 ± 1.162 ± 0.671 P= 0.004	32.467 ± 1.063 ± 0.614 P= 0.000	28.430 ± 0.910 ± 0.525 P= 0.000	25.490 ± 1.012 ± 0.584 P= 0.002	34.340 ± 1.042 ± 0.601 P= 0.000	38.407 ± 1.007 ± 0.582 P= 0.000	32.397 ± 1.012 ± 0.584 P= 0.000	42.343 ± 1.247 ± 0.720 P= 0.000

P ≤ 0.05* Significant
P >0.05 not significant
Mean ±Std. Deviation ± Std. Error of Mean

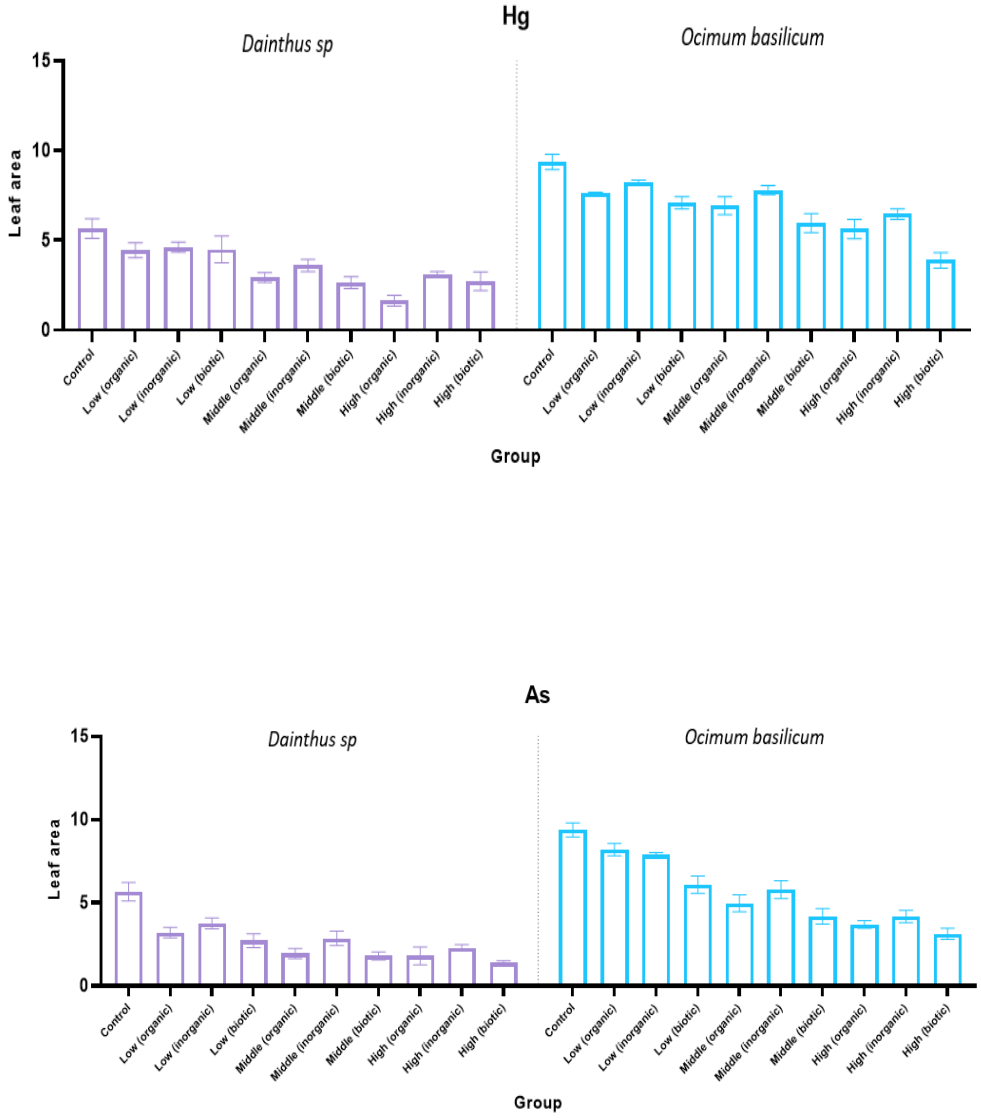
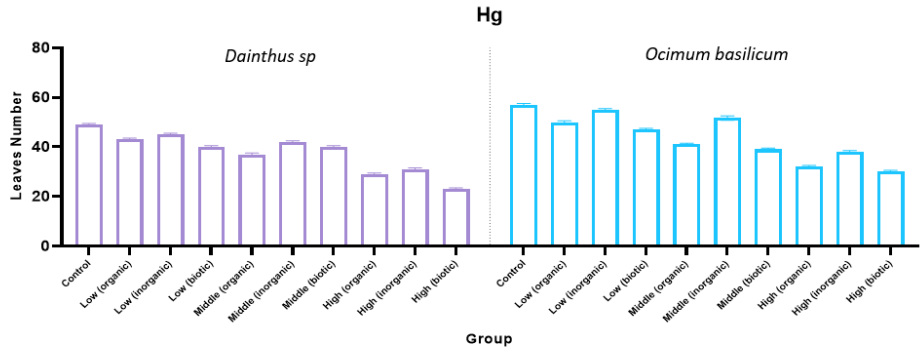


Figure 3.Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on leaf area (cm²) of *Dianthussp.* and *Ocimumbasilicum*



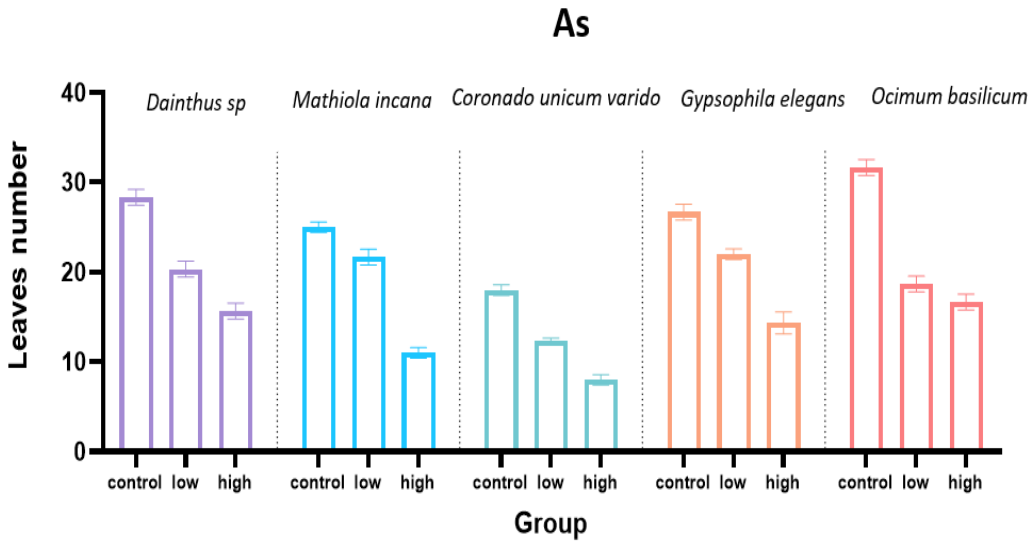


Figure 4.Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on leaves Number of *Dianthussp.* and *Ocimumbasilicum*

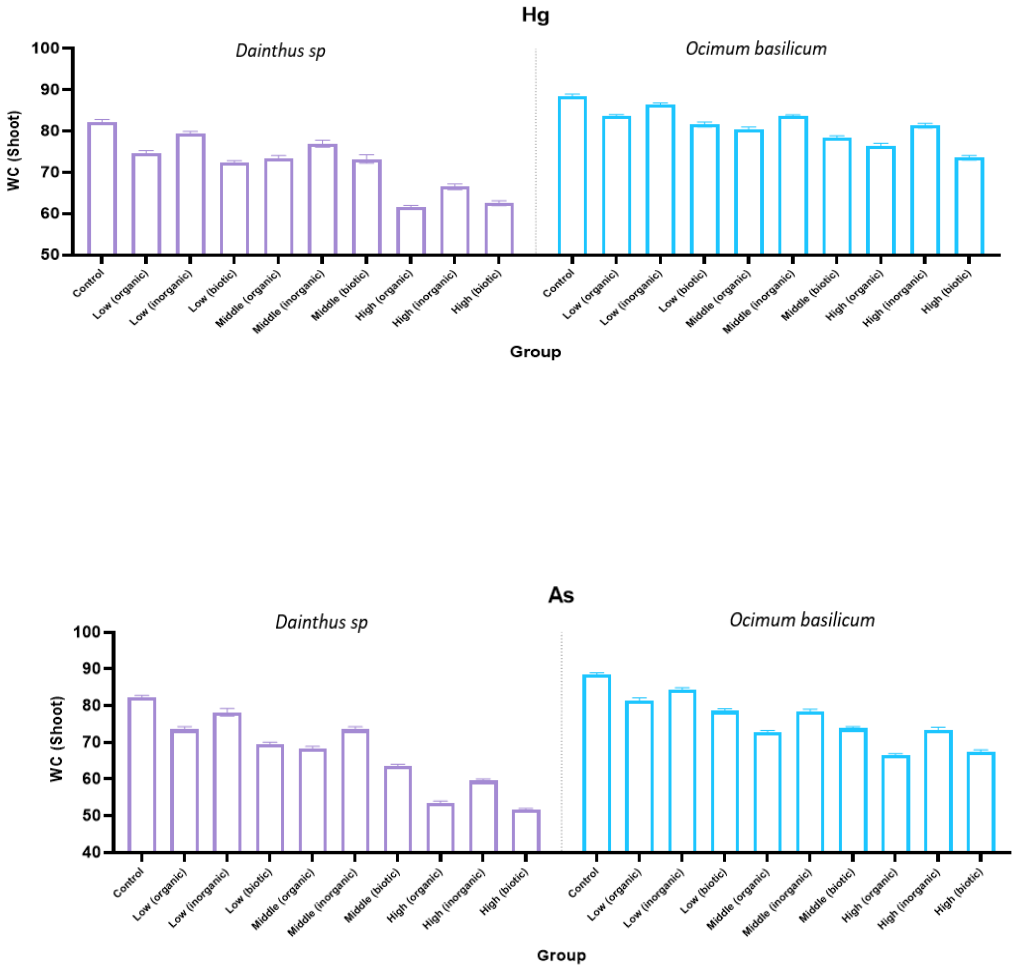
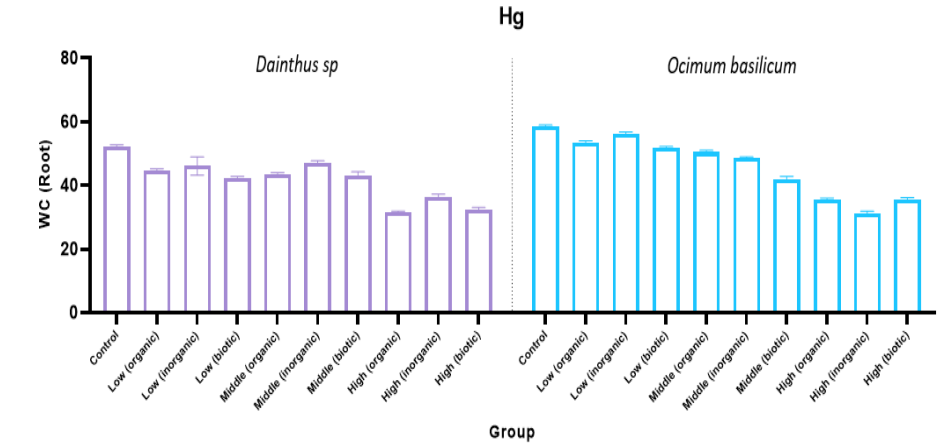


Figure 5Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on water content (shoot) %of *Dianthussp.* and *Ocimumbasilicum*



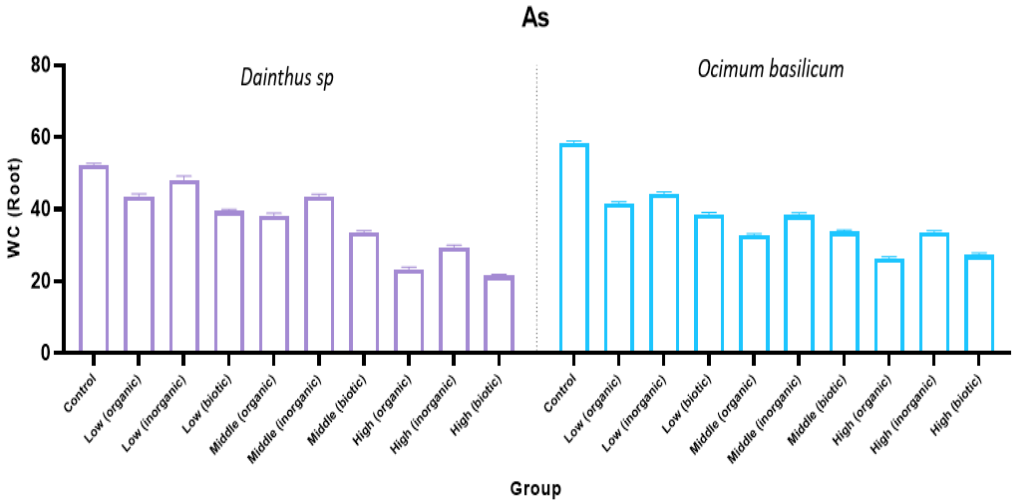
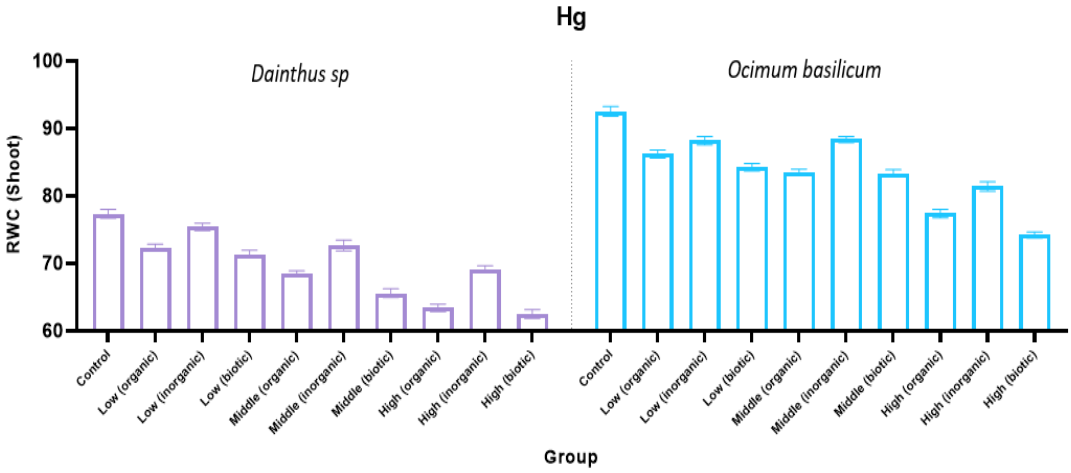


Figure6. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on water content (root) %of *Dianthussp.* and *Ocimummbasilicum*



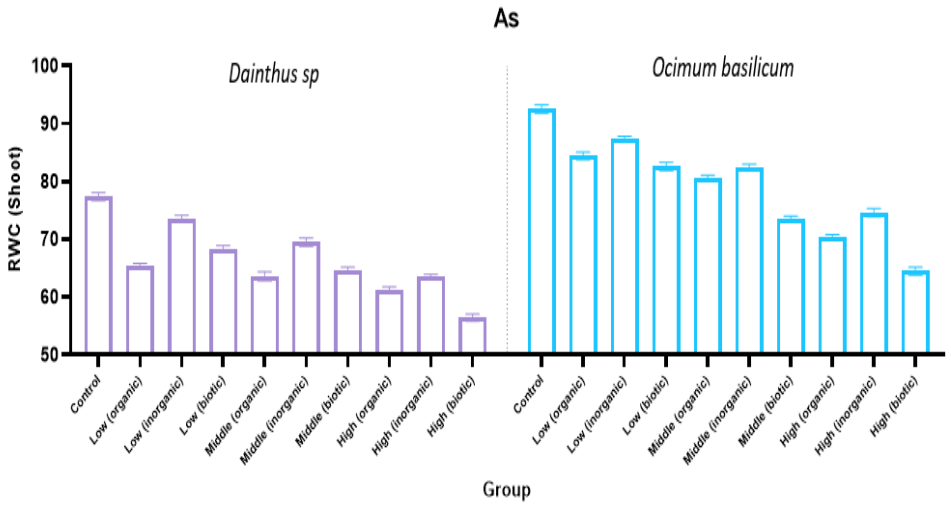


Figure7. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on relative water content (shoot) %of *Dianthussp.* and *Ocimumbasilicum.*

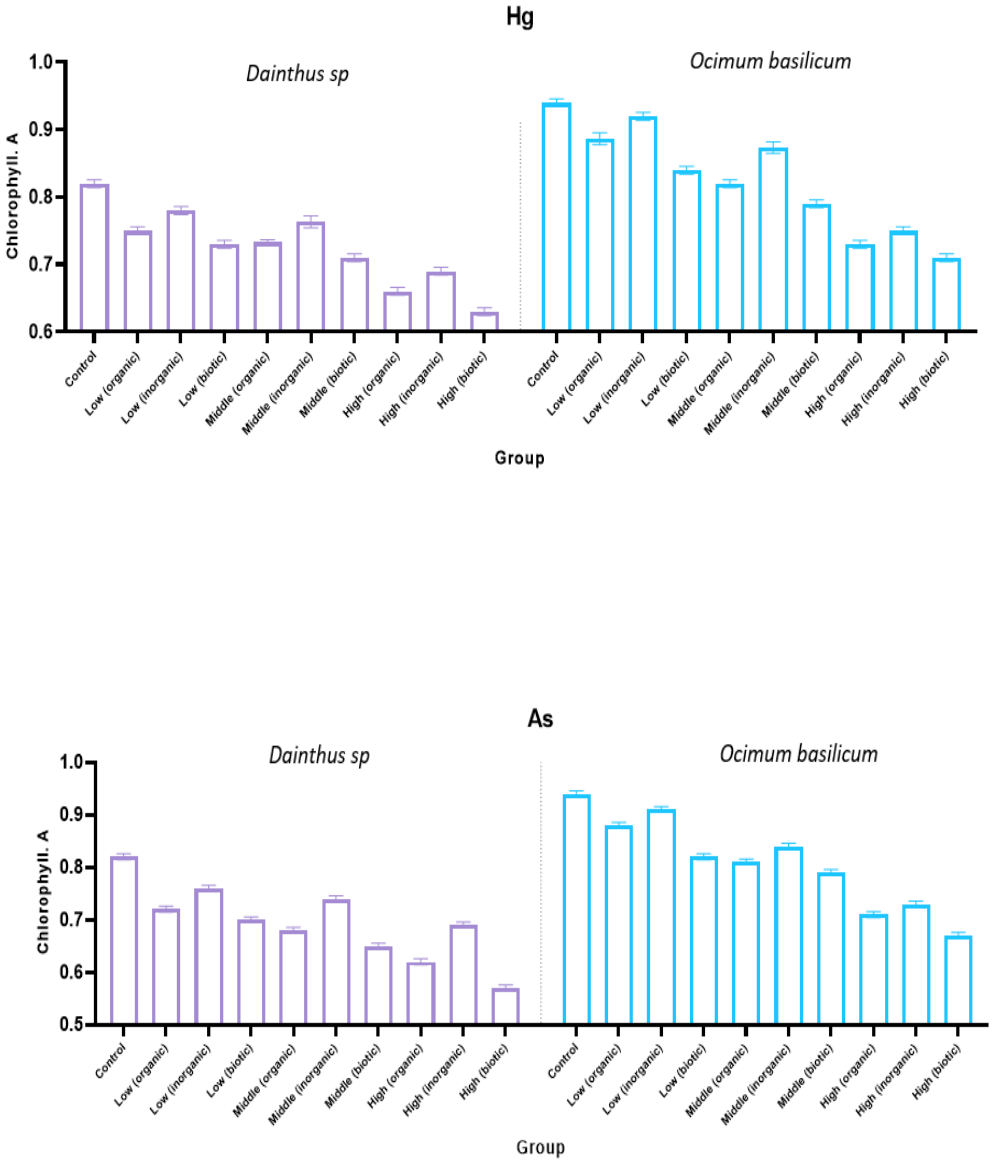


Figure8. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on relative water content (root) %of *Dianthussp.* and *Ocimummbasilicum.*

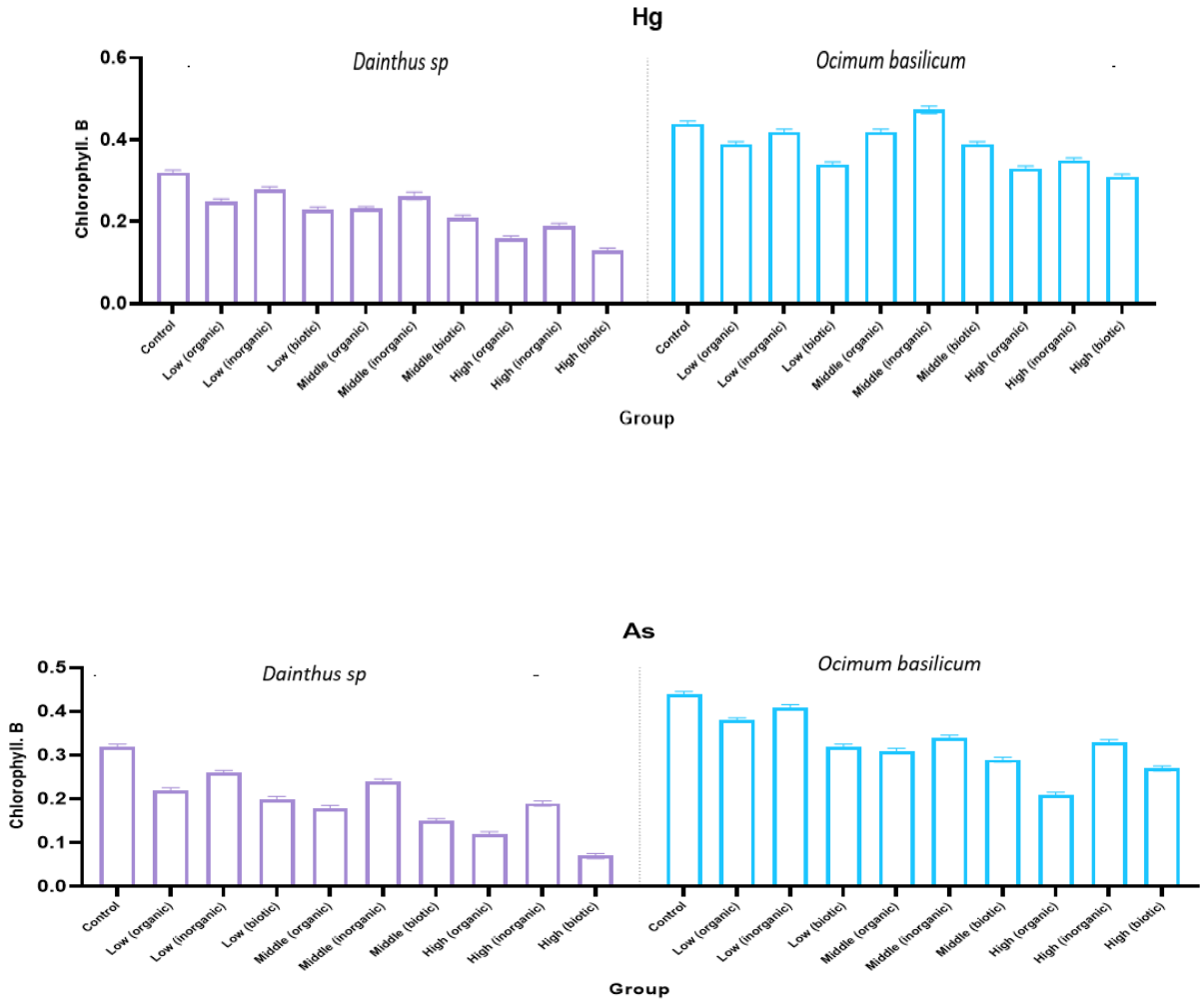


Figure9. Effect of different concentrations of Mercury (Hg) (5ml/g soil, 7ml/g soil, 10 ml/g soil) and Arsenic (As) (0.5 ml/g soil, 1 ml/g soil 1.5 ml/g soil) contaminated soil on chlorophyll A (mg (gfw)-1) of *Dianthussp.* and *Ocimummbasilicum*Figure