ORIGINAL RESEARCH PAPER

Anatomy

EFFECT OF AIR POLLUTION ON THE VEGETATIVE AND STOMATAL CHARACTERS OF EMILIA SONCHIFOLIA

KEY WORDS: Emilia, Sonchifolia, particulate matter,peroxy acetyl nitrate(PAN)

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ABSTRACT

Emilia sonchifolia is a branching, annual herb up to 40 cm (15.5 in) tall. Leaves are lyrate-pinnatilobed, up to 10 cm (4 in) long, sometimes becoming purplish as they get old. One plant can produce several pink or purplish flower heads. The study is focused on the effect of air pollution on the vegetative and stomatal characters. Emilia sonchifolia, were collected from the road sides of various polluted regions in Edayar and the non-polluted ones were collected from Valamboor. Different vegetative and stomatal were taken into consideration for comparing the plants in both Edayar and Valamboor.

INTRODUCTION

Going hand-in –hand with the increase in development and population is the increase in development and population is the increase in air pollution. While air pollution has natural causes such as volcano eruptions and wind, human activity is the primarily cause. (Arora, 1985).

According to the Worldwatch State if the World Report, air pollution costs upwards of $40 billion annually in the United States alone. Its impact on the environment is even greater. Air pollution effects are neither limited to the short term nor to the plant damaged or killed. Rather, air pollution can have long term effects that affect not only plants, but also the animals that depend upon them. It can cause irrepairable harm to water resources and eco systems. Rapid decline of ecosystem health can leave systems unlivable. For example, over 40 percent of U.S. rivers cannot sustain life according to the U.S. Environmental Protection Agency. The problem, however is not isolated. (Arumugham ,2001)

A report from the Environmental Agency in Great Britain states that over 18000 lakes in Sweden cannot support life due to acidic conditions caused by acid rain. Acid rain occurs as a chemical reaction fueled by the sun when contaminants in the atmosphere combine with moisture. The result is rain with an acidic pH. Depending up the pH level, effects can range from plant damage to plant death, depending on concentration and period of exposure to toxins. Entire ecosystems are in danger because of changes in soil chemistry. (Gheorghe ,2011)

MATERIALS AND METHODS

The material used for the study was Emilia Sonchifolia was collected from the road sides of various polluted regions in Edayar and the non-polluted one were collected from Valamboor.

1.Vegetative characters

The vegetative characters such as lenth of the plant, length of the internode, number of leaves, length of leaves was taken into consideration to check the effect of vegetative characters in Emilia Sonchifolia.

2.Stomatal type

An oblique cut was made on the leaf blade so that the lower epidermis strips of easily, these strips were then separated from the leaf and stained in very dilute safranin solution. The peel was later transferred into slide. In order to prevent the drying of the material, it was mounded in a drop of glycerin and covered carefully with a cover slip and observed under the microscope.

3.Stomatal Index

The same procedure which was used to find the stomatal type was employed to determine the stomatal index. Following this, the number of stomata and the epidermal cells were counted.

Stomatal index was calculated by the method as suggested by Salisbury (1927, 1932).

STOMATAL INDEX (S.I) =S/E + Sx100, Where S=number of stomata, E=number of epidermal cells in the same field

4.Estimation of chlorophyll using spectrophotometry

Weigh 500 mg of finely cut well mixed representative sample of leaves from Edayar and Vengalloor region. By using a mortar and pestle grind the tissue to a fine pulp with the addition of 20ml 80% acetone. Collect the sample in a centrifuge tube. The two samples should be prepared and preserved separately. Centrifuge the sample at 3000rpm for 3 minutes. Transfer the supernatant to a labelled test tube. Transfer 1ml of extract to another test tube and make up to 5ml with 80% acetone. Read the absorbance of the solution at 645nm and 662nm and 470nm against the solvent blank.

5. Interlaboratory study for Lead Cadmium Zinc Copper and Iron

Cleaning procedures - For glass and plasticware – Acid solution: 500 ml concentrated HNO3, C (b), + 4500 ml deionized water, C (a). Wash first with water and detergent. Rinse with tap water, followed by deionized water, then with acid solution. Finally rinse 4-5 times with deionized water. For Teflon digestion vessels – Rinse with acetone, wash with deionized water, keep vessels covered with 0.1M HNO3, C(c), for at least 30 min, rinse with deionized water, and let vessels dry.

Pretreatment – If product is to be analyzed fresh, proceed to C (d), homogenization. Otherwise, continue at C©, Drying.

Drying – Dry to constant weight in drying oven at 105°C, or freeze-dry. Freeze-drying is usually preferable because it renders the product is less compact and easier to homogenize. If final result is based on fresh weight, weigh test portion before and after drying to obtain water content.

Homogenization – Homogenize products using non contaminating equipment. Check for leached metals if the apparatus consists of metal parts.

Digestion – Weigh 0.2 – 0.5 g dry material into digestion vessel. If water- containing materials are used, maximum weight is restricted to 2g, but dry matter content must never exceed 0.5g. The program is valid only when 12 vessels are being digested simultaneously. If fewer are being digested, the remaining vessels must be filled with reagent blank. When a microwave oven other that the one given as an example is used, it may be necessary to use a slightly different time/power program. Remove digestion vessels from microwave oven and let cool thoroughly before opening them. Open vessel and rinse down lid and walls into container. Transfer solution to 25ml volumetric flask and dilute to mark with deionized water. Then, transfer solutions to plastic container. Treat blanks in the same way as tests. One blank should include in every set.

Dilution- If test solution needs to be further diluted (due to high metal concentrations), dilute with 3M HNO3, C (d), in order to maintain same acid concentration prior to metal determination, (g). High acid concentration is environmentally undesirable and may depress the analytical signal. Reduce acid strength by diluting the test solutions 1/2 with 0.1 M nitric acid and standard solutions1/2 with 3M nitric acid. The tests and standards are thereby brought to the same acid concentration. Matching of acid concentrations is important when a calibration curve is used.

Atomic absorption spectrophotometry- Use of flame or graphite furnace technique is determined by the concentration of the metal to be determined. Flame technique should be used as far as possible, since this technique is less sensitive to interference than the GFAAS. The most appropriate wavelength, gas mixture/temperature program, and other instrumental parameters for each metal are found in the manual provided with the instrument. Always use background correction. Measurements is must be within the linear range when the method of standard addition is used. A standard addition curve consists of at least 3 pints, of which at least 2 are standards. The concentration of the highest standard should be 3-5 times the concentration in the test solutions. The lower standard should have a concentration approximately half of the highest standard. A simplified version of the method of standard addition is to use a matric-matched standard curve, which is applicable is to products with the same matrix: The test and standard solutions are mixed and used to make a standard addiction curve. This curve is then parallel transferred to origin and is used as the standard curve for the tests that followed and that have been diluted in the same proportions. The matrix-matched standard curve and the test solutions will thus have the same matrix concentration. On most modern instruments, this function is included in the software.

1) Flame Technique

The technique of Zn, Cu and Fe are usually at levels suitable for determination by FAAS. When calibration curve is to be used, standards and test solutions must have the same acid concentration. Since Fe may be strongly affected by interferences from the matrix, use either the method of standard addition or matrix-matched standards. When experiencing severe interferences, an oxidizing nitrous oxide acetylene flame may be an alternative.

2) Graphic Furnace technique

This technique is generally required for determination of Pb and Cd in foods. Use pyrolytically coated tubes with platforms. Since the method results in a fairly large dilution of the analyte, it may frequently be needed also for the determination of e.g., Cu. The method of standard addition or matrix- matched standards should always be used unless shown to be unnecessary (i.e., no significant difference between the slopes of calibration curves of pure working standard and standard addition curves of the test product). Measurements must be made in the linear range when the method of addition is used.

RESULTS AND DISCUSSION

Chlorophyll estimation using spectrophotometry

There was a great variation in the amount of chlorophyll shown by plants thriving in Edayar and Valamboor regions. The amount of chlorophyll a and b in Edayar Emilia is 0.33 mg/gram and 0.317 mg/gram whereas in Valamboor region is 0.345 mg/gram and 0.325 mg/gram respectively

Interlaboratory test for lead, cadmium, zinc, copper, and iron

There was a great variation in the amount of Lead, Cadmium, Zinc, Copper, and Iron shown by plants thriving in Edayar and Valamboor regions. The amount of Lead, Cadmium, Zinc, Copper, and Iron in Edayar Emilia is 303mg/kg, 56.9mg/kg, 54.9mg/kg, 105.3mg/kg and 81.6mg/kg respectively whereas in Valamboor region it is 0.130mg/kg, 0.0124mg/kg, 0.050mg/kg, 0.121mg/kg and 0.041 mg/kg respectively.

STOMATAL INDEX

The number of stomata and epidermal cells more in Valamboor when compared to Edayar Emilia plant because of the increased leaf area. But the ratios were almost similar being 3.682 and 2.916 for Edayar and Valamboor respectively. The size of the guard cells and subsidiary cells were smaller in Edayar Emilia plant when compared to Valamboor plant.

Length of plant, internode and leaves

The maximum height of the Emilia plant seen in valamboor region was 46 cm, whereas the minimum recorded was 32. 3cm.But maximum height of Emilia plant in Edayar region was 18.4 cm and minimum height was 12.3 cm. The average value of height of Emilia plant in Valamboor and Edayar region were 38.92 cm and 14.88 cm respectively. Thus, the data about the height of Valamboor and Edayar plant shows a great deal of variation. The maximum length of internodes in Valamboor Emilia was 10.9 cm whereas in Edayar Emilia it was 4.1 cm. The minimum length of internodes in Valamboor Emilia and Edayar Emilia were 5 cm and 2.4 cm respectively. While the average value of length of internode in Valamboor Emilia plant was 7.68cm, the plants from Edayar region had the average value of length of internode was 2.28 cm. The maximum length of leaves in Valamboor Emilia plant was 7.6cm. But the same value for Edayar plant was 4.3cm. The average value of the length of leaves in Valamboor and Edayar plants were 7.16 cm and 3.62 cm respectively. There was a marked variation in the length of leaves along the diameter.

Number of leaves

There was a great variation in the number of leaves shown by plants thriving in Edayar and Valamboor regions. When the average number of leaves of this plant in Edayar area was found to be 8.2, the same in Valamboor area was 43.4. The maximum number of leaves seen in Valamboor plant was 55 but in Edayar plant the number was just 10. Thus, the number of leaves in Edayar and Valamboor plants of Emilia shows much variation.

CONCLUSION

Air pollution is a serious problem in many thickly populated and industrial area around the world. A vast majority is preferred to live in urban area as it gives a cleaner environment. Emilia Sonchifolia seen in both polluted and unpolluted area shows difference in the vegetative and stomatal characters. This is due to effect of air pollution in such plants. The results support that plants may can cope with the pollution up to a certain limit. (Dickinson et al. 1991).

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