Poll Res. 39 (4) : 966-970 (2020)

ISSN 0257–8050

THE CORRELATION OF LEAD (PB) CONTENT ON LEAVES OF PURING (*CODIAEUM VARIEGATUM*) CULTIVAR CROTON TO STOMATA'S NUMBER IN SURABAYA, INDONESIA

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(Received 30 May, 2020; Accepted 2 July, 2020)

ABSTRACT

This study aims to determine the correlation between lead (Pb) content in Puring (*Codiaeum variegatum*) cultivar Croton leaves to the number of stomata and determine the difference number of stomata at the Bundaran Dolog Surabaya, Jl. Gading Ketabang Surabaya, and Kebun Bibit 2 Surabaya. Sampling was carried out in three different places, at Bundaran Dolog Surabaya, Jl. Gading Ketabang Surabaya, and Kebun Bibit 2 Surabaya. For each locations were taken four plants and four leaves were taken for each plant. Testing of lead (Pb) content was carried out by the AAS method. To determine the correlation were carried out using Pearson correlation on SPSS. The result of the calculation show that the correlation value between lead (Pb) content in croton leaves and the number of stomata at Bundaran Dolog Surabaya 0,51, Jl. Gading Ketabang Surabaya 0,50, and Kebun Bibit 2 Surabaya 0,54. Correlation is negative, so the number of stomata will be lower if the lead (Pb) content is higher.

KEY WORDS: Croton's Leave, Lead, Number of stomata

INTRODUCTION

Surabaya is the second largest city in Indonesia after Jakarta, so that Surabaya is the center of business, commerce, industry, and education. No wonder, if various kinds of problems arise. Air pollution occured from emissions of vehicles. One of them is lead. Lead is a heavy metal a contaminant for living things because it is carcinogenic (Mallongi *et al*., 2017; Hasmi and Anwar Mallongi, 2016). It also causes mutation and decomposes in a long time (Nadia *et al*., 2016; Rujito *et al*., 2015). Lead can pollute air, air, soil, plants, animals and humans (Brass and Strauss, 1981; Ruaeny *et al.*, 2015).

The rate of lead accumulation in vegetation and in the soil will increase proportional with traffic density and decreases with increasing distance from the edge of the highway (Rangkuti, 2003; Hasairin and Siregar, 2018).

Croton (*Codiaeum variegatum*) is an ornamental plant and can function as a bioremediation agent. Croton has an elliptical leaf shape that is yellow, brown, to red. Lead enters the leaf tissue through the roots and stomata. Lead that is absorbed in plants will accumulate in plant tissue and can cause damage to the leaves. Sulistiana and Setijorini (2016) stated that the leaves of croton plant (*Codiaeum variegatum*) are able to absorb lead about 2.05 mg/L in the air.

The leaves are an important part of the plant. The leaves are thin, broad, and contain chlorophyll. The leaves have several functions including as a place for processing food substances (assimilation), evaporation (transpiration), and respiration (respiration). Leaf stomata are the main means of gas exchange in plants. Stomata are small pores, usually on the underside of leaves, which are opened or closed under the control of a pair of banana-shaped cells called guard cells.

Leaf stomata are the main parts of gas exchange in plants. Salisbury and Ross (1995) states the number and composition of stomata is determined

by plant ethnicity. In addition, it is also influenced by several environmental factors including light intensity, CO_2 concentration, and other compounds that are toxic to plants.

METHODS

Research Place and Time

Croton (*Codiaeum variegtaum*) leaf sampling was taken from three different locations, namely in the Bundaran Dolog Surabaya, Jl. Gading Ketabang Surabaya, and Kebun Bibit 2 Surabaya. Lead content analysis was carried out at the Industrial Research and Consultation Agency (BPKI). Observation of the number of stomata was carried out at the Biosystematics Laboratory of Biology, Faculty of Science and Technology, Airlangga University, Surabaya. This research was conducted in February to May 2019.

Leaf Sampling

For each location we take four plants. Each plant is taken four leaves. The total number of leaves taken for each location was 16 strands so that from the three locations 48 leaves were taken. Leaves taken are the 5th, 6th, 7th and 8th leaves, or the 6th, 7th, 8th and 9th order. In each leaf four sub-surrounding leaves of a bone with a size of 1 x 1 cm are taken to observe the number of stomata. The remaining leaves that have been taken in the middle will be measured by the lead content (Pb) by the AAS method.

Atomic Absorption Spectrophotometry (AAS) Test

Preparation/destruction of croton leaves

Croton leaves that are still wet are chopped with a size of 1-2 mm and then dried at 105 °C so that all the water is separated. The dried leaves are crushed to flour and filtered with mess size 40 - 60 then weighed as much as 10 g. Then the leaf flour is put into a porcelain cup and burned to ash. The resulting ash has been burned at a temperature of 500-600 °C until it is white (formed ashes). White colored ash is added with 25 mL of HCl so that the dissolved ash is then added with 5 mL of concentrated HNO_3. The volume is regulated by measuring flask with the addition of distilled water to 100 mL then filtered with filter paper so as to obtain 50 mL clear filtrate.

Readings of Atomic Absorption Spectrophotometry (AAS)

The filtrate was transferred to a 50 mL *glass beaker* with capillary tubes flowing to the AAS combustion device. The unit from AAS is activated then takes measurements of the absorbance blank with 3 times the measurement. Then measure the absorbance for a variety of standard solutions. After the resulting values match, then proceed with measuring the absorbance of the sample solution. After burning completely, then the absorbance value (intensity of the fuel color) is measured so that the absorbance value is obtained using a lead calibration curve (Pb). The data obtained is then stored according to the sample name.

Observation of the number of stomata

Croton leaves that have been taken are cleaned of dirt using a tissue, then cut to size 1 x 1 cm. The leaves that have been cut are smeared with clear nail polish on the leaf surface and wait for it to dry. After drying, the tape is placed on the leaf which has been coated with polish and then the tape is carefully removed using tweezers. Duct tape that has been removed from the leaf is then affixed to the glass object. Preparations that have been placed on glass objects are observed using a light microscope. Observations were made with a magnification of 400 x. The number of stomata is randomly calculated 100% randomly without requirements in one field of view.

Data Analysis

To determine the correlation between the content of lead (Pb) in the leaves of croton (*Codiaeum variegatum*) cultivars Croton by the number of stomata in the Bundaran Dolog Surabaya, Jl. Gading Ketabang Surabaya and Kebun Bibit 2 Surabaya were carried out using Pearson correlation on SPSS.

RESULTS AND DISCUSSION

The correlation value between lead content (Pb) on croton leaves and the number of stomata in Surabaya Dolog roundabout was 0.51, Jl. Gading Ketabang Surabaya 0.50, and Kebun Bibit 2 Surabaya 0.54.

Based on data from the Surabaya City Traffic Police Office in 2015 posted on the Central Statistics Agency website, the number of motor vehicles continues to increase from year to year. The number of vehicles operating in the city of Surabaya, namely, in 2009 the number of vehicle ownership was 1,483,271 units, in 2010 the number of vehicle ownership was 1,584,453 units, in 2011 the number

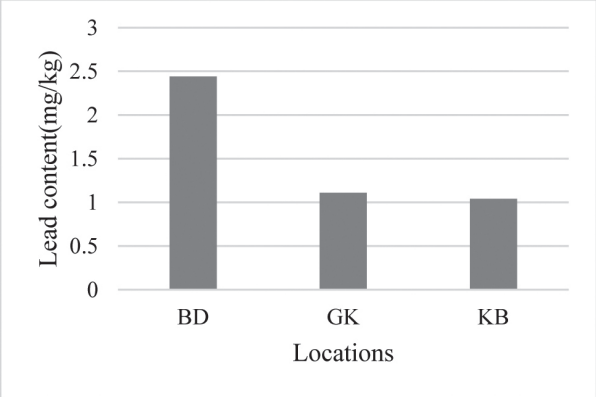

Fig. 1. Lead (Pb) Content of Three Sampling Locations

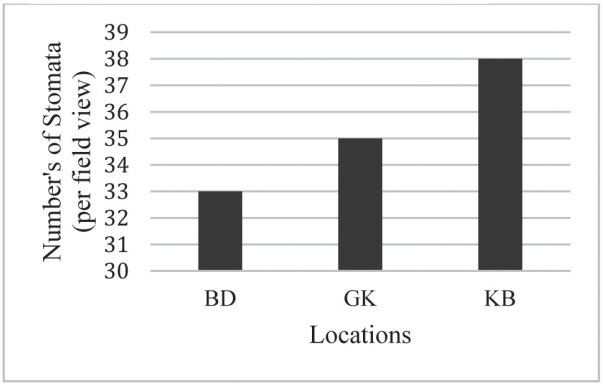

Fig. 2. Number of Stomata from Three Sampling Locations

of vehicle ownership was 1,645,212 units, in 2012 the number of ownership vehicles totaling 1,800,415 units, in 2013 the number of vehicle ownership was 1,903,039 units, in 2014 the number of vehicle ownership was 2,011,512 units and in 2015 the number of vehicle ownership was 2,126,168 units. Based on these data it can be seen that the number of vehicle ownership continues to increase every year. The most dominant vehicle is a motorcycle.

Croton leaf sampling was conducted at three different locations based on traffic density. The Dolog Circle is the place that has the highest traffic density. This is because the Dolog Roundabout is part of Jl. Ahmad Yani which is the primary arterial road. This road connects between national activity centers or regional activity centers or it can be said that the Bundran Dologis part of the national transportation route. Almost all vehicles that want to enter the Surabaya area must pass through this lane. Jl. Gading Ketabang has a moderate traffic density. Jl. Gading Ketabang is a secondary collector road. This road connects between Jl. The Attorney General Suprapto headed for the Cheng Ho Mosque in Surabaya and the surrounding housing complex, so that the volume of vehicles that passed was not too much. Kebun Bibit 2 is located on Jalan Kendalsari Wonorejo Rungkut. Kebun Bibit 2 is a conservation area, so it can be ascertained that there are no public motorized vehicles entering the park area except vehicles from the management.

The lead content (Pb) absorbed by croton leaves from the three locations has differences. The highest average is 2.44 mg / kg found in the Surabaya Dolog Roundabout, the middle average is 1.11 mg / kg found on Jl. Gading Ketabang Surabaya, and the lowest mean is 1.03 mg / kg found in Kebun Bibit 2 Surabaya. These results are consistent with Palar's (2012) theory; emissions of heavy metal lead (Pb) which enters the air in the form of gas, mainly derived from motor vehicle exhaust gases. Vehicle fumes are the biggest contributor to heavy metal height.

The level of traffic density (the number of motorized vehicles) will describe the level of lead pollution (Pb) in the air, because the higher the traffic density in an area, the greater the Pb emissions released into the air in the area. The main source of lead pollutants (Pb) in the air comes from smoke emitted by motorized vehicles (Inayah, 2010). In addition to the level of traffic density or motor vehicles which are the main factors of the high lead content (Pb) of the leaves, there are also other factors that influence the light intensity, wind direction and speed, and high rainfall. Pasaribu (2017) states that when water flows on the leaf surface, the spray power can cause lead (Pb) to be released from sorption on the leaf surface.

The results of this study relate to the opinion of Azmat (2009), that the level of lead accumulation (Pb) on the leaves of each type of plant varies depending on the location used as a place of sampling, the level of motor vehicle density, type of motorized vehicle, high rainfall, direction and speed wind, and leaf morphological and anatomic forms. Each type of plant will have a lead content (Pb) in the leaves varies for each type of plant. The difference in the ability of leaves to absorb lead (Pb) is affected by leaf structure. Leaves that have hair, uneven surfaces, and rough surfaces are usually able to absorb lead (Pb) more than leaves with smooth surfaces.

Lead (Pb) can accumulate on the surface of plant organs or be absorbed into tissues. High lead concentration (Pb) in plant tissue is caused by the process of lead (Pb) entering the tissue through

several ways, including absorption through roots and leaves. Absorption through roots can occur if lead (Pb) is in the form of dissolved compounds (Rangkuti, 2003).

Croton leaf stomata are found on the underside of the leaf. Campbell *et al.* (2000) states that in most plants, stomata are more in the lower surface of the leaf than in the upper surface. This adaptation minimizes the loss of water that occurs more quickly through stomata on the top of leaves exposed to sunlight.

Stomata of croton cultivar is kidney-shaped and has a parasitic type. The location of the stomata in epidermal cells is that they are surrounded by 2 neighboring cells aligned on each side of the right and left which are special epidermal cells called guard cells. According to Nugroho *et al.* (2017) that the parasitic type is a closing cell accompanied by a neighboring cell or more with a long axis of neighboring cells parallel to the axis of the closing cell and a gap. Stomata of this type are usually found in most dicotyledonous plants.

The croton leaf epidermis cell shape is irregular with wavy cell walls and some are flat. Although there are differences in the shape of epidermal cells, epidermal cells are uniform tissue. The composition of epidermal cells is irregular and not in the same direction.

The correlation values of the four tests are in the range of 0.50 to 0.54. According to Jonathan (2009), if the correlation value is in the range 0.50 - 0.75, it means that the correlation is strong. Strong correlations were found in the three sampling locations.

In addition to strong correlations, the correlation of lead content to stomata is a negative correlation. This shows the existence of an inverse relationship. The higher the lead content in leaves, the lower the number of stomata.

Correlation value not 1 indicates an influence other than lead (Pb), such as from air pollution from other gases. Observations from air pollution conditions displayed on the website of the Ministry of Environment and Forestry of East Java Province show that from 7 monitoring stations in Surabaya only 3 stations are still functioning, namely Wonorejo Station, the Office of the Governor of Prestasi Park, and Kebonsari. At Wonorejo station ISPU value 41 and the Office of the Governor of the Achievement Park the value of the Air Pollution Standards Index (ISPU) 16 shows the criteria for air quality in the good category while in Kebonsari the ISPU score of 58 air quality is in the medium category.

Based on the Minister of Environment Decree Number: Kep-45 / MenLH/ 10/1997 the air displayed on the website of the Ministry of Environment and Forestry of East Java Province explains that the good category indicates the level of air quality which has no effect on human or animal health and has no effect on plants, building or aesthetic value, while the medium category shows the level of air quality does not have an effect on human or animal health, but affects sensitive plants and aesthetic value.

The lower the number of stomata that if the bladder ~~an~~ lead (Pb) due to high lead (Pb) is not an essential element for plants and unknown benefits. So that if too much lead (Pb) is in the plant it will become toxic and interfere with plant growth (Widowati, 2008).

Based on the calculation of the number of stomata using a *hand counter*, it shows that the highest number of stomata at the third location (Kebun Bibit 2 Surabaya) is 38 per field of view, while the average number of stomata is lowest at the first location (Surabaya Dolog Roundabout) which is 33 per field. This number is included in many categories. The amount of stomata will affect the photosynthesis process. This is in accordance with what was stated by Tabaika (2013), stomata have a function as the entrance of CO_2 in the process of photosynthesis. The more stomata, it will increase the CO_2 absorbed for photosynthesis.

Suhaimi's research results (2017) states that the number of stomata on the leaves of *Polyalthia longifolia* Sonn in areas that have high vehicle density has a low number of stomata and areas that have low vehicle densities have a high number of stomata.

CONCLUSION

Based on the research that has been done, it can be concluded that there is a correlation between lead content (Pb) in croton leaves (*Codiaeum variegatum*) on the number of stomata in location Surabaya Dolog Round about 0.51, Jl. Gading Ketabang Surabaya 0.50, and Kebun Bibit 2 Surabaya 0.54 from all three correlations show a negative correlation.

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