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Jember, Indonesia, July 31-August 2, 2019

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Foreword from Dean of Agricultural Faculty

Assalamualaikum wr wb.

Praise goes to the most merciful God Allah SWT for the blessings of life and knowledge for us to gather in this meaningful occasion. To start with, I would like to warmly welcome the heads of both Indonesian and foreign universities to the Faculty of Agriculture, University of Jember, Indonesia. It is a great pleasure to have you with us today. This event is a reflection of our faculty's commitment to always improve education quality and accommodate more and more opportunities in academic collaborations.

The building of food sovereignty through sustainable agriculture has been a major focus in developing countries. Such acts can involve multiple areas including development of human capital, critical infrastructure, regional competitiveness, health, safety, and other initiatives.

Therefore I believe this international conference will be able to present an interesting discussion on the aforementioned topic, with prominent speakers from Indonesia, Germany, Japan, Korea, Malaysia, Thailand, giving a contribution to the development of science, and hopefully encouraging more research on this area.

I would also like to congratulate the Faculty of Agriculture, University of Jember as the main host of this international conference. Theme of The International Conference is "Sustainability of Industrial Agriculture and Food Sovereignty in the Era of Industrial Revolution 4.0". This International Conference is a collaboration between International Seminar and Workshop on Plant Industry (ISWPI) Organizer and International Seminar for Food Sovereignty and Sustainable Agriculture (FoSSA). May it support efforts to become world-class universities in the near future. I also wish to thank all the sponsors who have provided financial support for this event.

Finally, I would like to convey a warmest welcome to all the distinguished guests and participants of this international conference. May we have a fruitful discussion and may we all gain new and valuable knowledge.

Wassalamualaikum wr wb.

Jember, July 31st 2019.
Dean,

Sigit Soeparjono, Ph.D

Foreword from the Program Chairs

Dear Participants,

We welcome you to the International Conference on Agriculture and Life Sciences (ICALS) held July 31st – August 2nd, 2019 in Jember, East Java, Indonesia. This conference is a joint effort of the 3rd International Seminar and Workshop of Plant Industry (ISWPI) with the 2nd International Seminar on Food Sovereignty and Sustainable Agriculture (FoSSA). We are pleased to present the conference focusing on Sustainability of Industrial Agriculture and Food Sovereignty in the Era of Industrial Revolution 4.0.

The book of abstract of the ICALS 2019 contains the agendas, schedule, and abstracts for all speakers. Briefly, this conference is divided into three programs: theInternational seminar, the international symposium on biotechnology, and workshop on rice development. The International Seminar presents 3 keynotes speakers from the University of Jember, the Ministry of National Development Planning, Republic of Indonesia, and from Country Gateway Office of Islamic Development Bank. Also, 5 guest speakers from South Korea, Malaysia, Germany, and Indonesia supposed to give a comprehensive talk related to approaching industrial revolution 4.0.

On the second day, the symposium present 7 speakers from Thailand, South Korea, and Indonesia to give a talk about Genetic engineering, Molecular approach, Biodiversity, and Geneticmanipulationon the plant, especially Rice. Finally, on the last day, a workshop intensively discusses and focus on the subject of plant breeding to produce desired characteristics and about plant variety rights (PVR). This workshop presents 1 guest lecture and 2 experts.

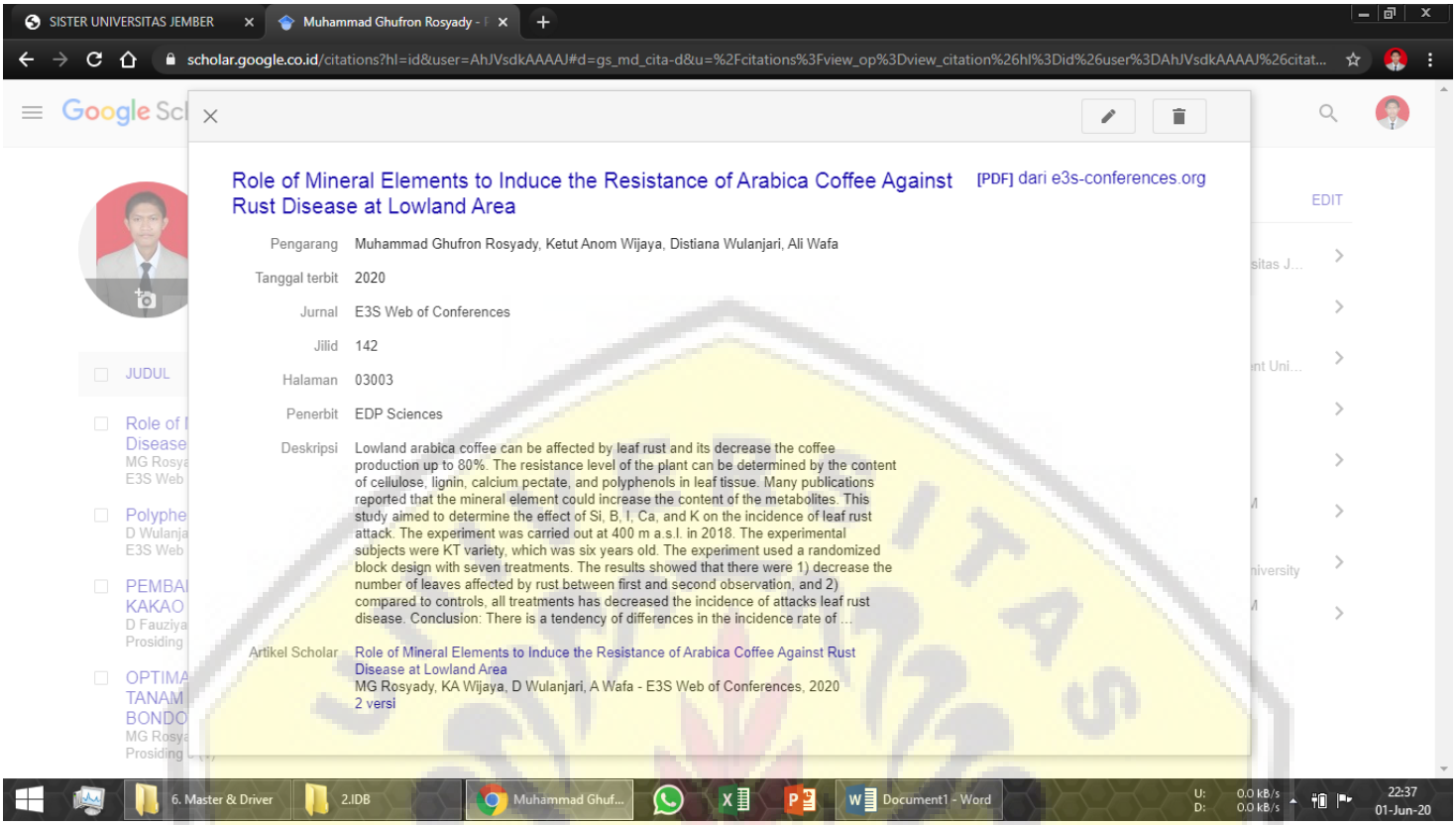
As information, the ICALS accommodate about 650 persons including academicians, researchers, students, public, and governments from 5 countries, 9 provinces in Indonesia (West Java, Central Java, East Java, South Sulawesi, Bali, Jakarta, Yogyakarta, Banten, and East Kalimantan. About 126 scientific papers are disseminated during this seminar both 100 oraland 26 posters presentation.

Finally, for their institutional and financial support to ICALS 2019 thank the University of Jember, IsDB Project, Pusat Unggulan Tanaman Industri (PU-BioTIn), Pascasarjana of University of Jember, and 2 sponsors (BASF and Nemadic).

We wish you all an exciting conference and an unforgettable stay in the city of Jember. We hope to meet you again next year for the same agenda.

Hardian Susilo Addy, Ph.D.

The ICALS 2019 Chair



Role of Mineral Elements to Induce the Resistance of Arabica Coffee Against Rust Disease at Lowland Area

Muhammad Ghufron Rosyady[1], *Ketut* Anom Wijaya[1], *Distiana* Wulanjari[1] and, *Ali* Wafa[2*]

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Abstract. Lowland arabica coffee can be affected by leaf rust and its decrease the coffee production up to 80%. The resistance level of the plant can be determined by the content of cellulose, lignin, calcium pectate, and polyphenols in leaf tissue. Many publications reported that the mineral element could increase the content of the metabolites. This study aimed to determine the effect of Si, B, I, Ca, and K on the incidence of leaf rust attack. The experiment was carried out at 400 m a.s.l. in 2018. The experimental subjects were KT variety, which was six years old. The experiment used a randomized block design with seven treatments. The results showed that there were 1) decrease the number of leaves affected by rust between first and second observation, and 2) compared to controls, all treatments has decreased the incidence of attacks leaf rust disease. Conclusion: There is a tendency of differences in the incidence rate of attack of leaf rust disease in each treatment. Control plants showed the highest incidence rate of 1.25%, while the lowest incidence was affected by Silica, iodine, and potassium, which were 0.63%. The treatment of silica and iodine was able to reduce the highest number of colonies Leaf Rust.

1 INTRODUCTION

Coffee is the most important agricultural commodity. Two main cultivated coffee species are *C. canephora* (Robusta coffee) and *C. arabica*. The main of the limiting factor of Arabica coffee (*Coffea arabica*) production worldwide is Coffee leaf rust [1].

Coffee leaf rust caused by *Hemileia vastatrix*. Its biotrophic fungi and the most important fungal disease. Its affecting coffee production. Although the use of fungicides can control the disease efficiently, the economically most favorable alternative is the use of resistant cultivars because it reduces the cost of production and has no negative impact on the environment [2]. The disease is currently managed through the use of protectant and systemic fungicides, including copper, triazoles, and strobilurins [3].

However, the susceptibility of arabica coffee is an important issue due to coffee leaf rust disease. Some treatment has done to tackle that problem like varieties building [4], by microbial inducer [5] and ecosystem management [6]. The plant nutrition management can use as an alternative method of reducing coffee rust and other fungal pathogens [7].

This research aimed to know the effect of several mineral éléments like Si, B, I, Ca, and K to plant resistance to the rust disease.

2 MATERIAL AND METHODS

2.1 Sample plant criteria

The criteria of coffee plant samples are productive Arabica Coffee with "Kartika 1 (KT)" Variety, within a minimum of three years old. Plant in low land area, 400 m above sea level and has been attacked by the fungal pathogen of coffee leaf rust.

2.2 Environmental sampling for preliminary research

The soil sample at the bottom of the coffee plant was taken at first for analysis of total N, P, K content. Furthermore, the plant treated by several mineral elements: calcium (Ca), silica (Si), iodine (I), potassium (K), boron (B), and a combination of all elements

2.3 Mineral treatment

The randomized block design with seven treatments used in this research. The treatments used in sequence are 1) control (sprayed with aqua dest), 2) Ca (3000 ppm), 3) Si (150 ppm), 4) I (300 ppm), 5) K (20,000 ppm), 6) B (300 ppm), and 7) Si + B + I + Ca + K and 4 repetitions. Mineral application techniques used are the foliar application. It applied with mist sprayer to the backside of the coffee leaf. 0.5 ml of surfactant Solution added during mineral applications. The foliar application of the mineral repeated by five times with seven days interval on each repetition.

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2.4. Disease Incidence Observation

The rust disease incidence observed by count the attacked branches of the coffee plant in each treatment and the disease severity conduct by measure the rust colony diameter and number of rust colonies in each leaf sample. The observation was conduct before mineral application and seven days after the last application. Leaf Sample taken by chose four leaves in each coffee branch.

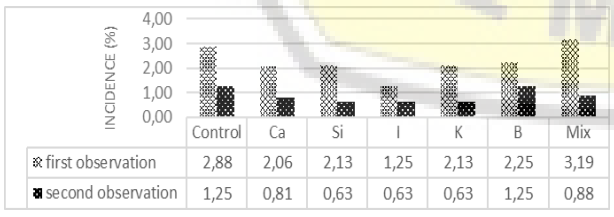
2.5 Lignin and Cellulose Content Test

The test of lignin and cellulose content in the tested coffee leaf conducted by followed Chesson methods [8]. The leaf samples were rooted and deseeded and the entire stem then sectioned into 12 cm lengths using a guillotine. Small sample sheaves (20 g) were prepared in triplicate from the sectioned material, dried overnight at 70°C, and reweighed. Sample were immersed in 0.25% (w/v) RP in O.lM acetate buffer pH 4.5 containing 0.002% (w/v) NaN3 as a bacteriostat and incubated at 400e overnight. After incubation, sheaves were dried at 700e and the fiber then manually extracted (scutched) from the retted straw. The total weight of dry fiber obtained was expressed as a percentage of the dry weight of the sample sheaf (%TF). The %TF values quoted are a mean of the values obtained from the three replicates.

3 RESULT AND DISCUSSION

Pathogenicity of biotrophic fungi influenced by host plant severity level. It affects the inoculation process of the fungal pathogen. The inoculation process of biotrophic fungi has a very complex mechanism, it starts by host recognition until host colonization.

The ingress process on the colonization process has a significant process for biotrophic fungi. Without succeeding in that process, the fungal pathogen became dying and failed to grow. The successfully of the ingress process can be affected by host plant physiological and biochemical. Related with the ingress process and according to the result, has been observed the treatment of mineral element can predispose the disease incidence of coffee leaf rust (Figure 1)



	Control	Ca	Si	I	K	B	Mix
first observation	2,88	2,06	2,13	1,25	2,13	2,25	3,19
second observation	1,25	0,81	0,63	0,63	0,63	1,25	0,88

Figure 1. Leaf Rust Incidence on each Treatment

The difference in leaf rust incidence indicating how much the *H. vastratrix* can colonizing the leaf of the host plant on each treatment. Each treatment did not affect the colony growth of *H. vastratrix* directly, yet affects the biochemical of host leaf.

As biotrophic fungi, haustorium could be a significant part to support their life. It formation process influenced by the part of plant cell. The haustorium will be difficult to form on the high lignin content. Based on the result, the leaf rust incidence became lower on the higher lignin content. The significant process resulted on the iodium treatment. On that treatment indicate lowest disease incidence nor with highest lignin content (figure 2). That related with Schurt *et al* [13] The lignification process has the important rôle of defense mechanisme of coffee plant during the *H. vastratrix* infection. It become first barrier to tackle the inoculation hypae to penetrate the cell host.

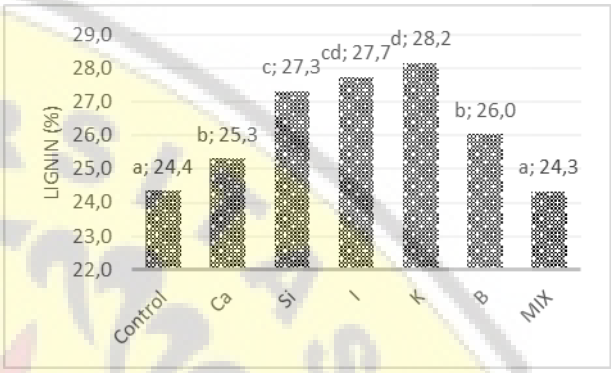


Figure 2. The lignin content on each treatment

Besides the lignin, cellulose also has a role for the resistance of coffee plants due to coffee leaf rust disease. Different from the lignin content result, the lowest incidence of coffee rust did not found in the highest cellulose content (figure 3). Based on the Hamid and wong [10], the primary effector of plant defense located on the activity of the plant bioactive signal during the pathogenicity process. However, the cellulose on the plant cell can be affected by several minerals to change their integrity and elasticity.

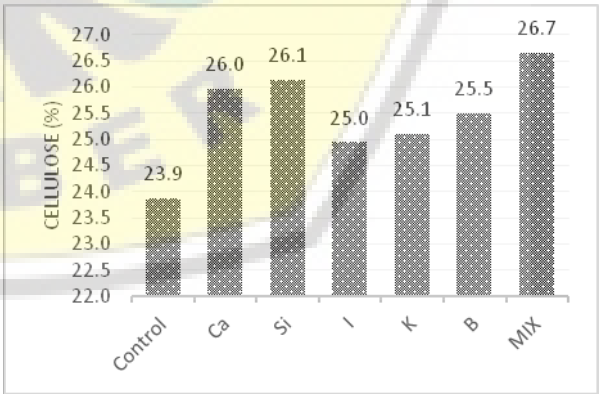


Figure 3. The cellulose content on each treatment

Based on Wang *et al* [11] the element enhanced to the plant resistance. It can increase the activity of defense-related enzymes, such as polyphenol oxidase, glucanase, peroxidase, and phenylalanine ammonia-lyase. That increasing the activity became as resulting on silicon enhancing. While undescribed well on the other component. However, the enhancing mineral element

like Iodium, Silicon and other to the arabica coffee plant can develop to the mechanical control treatment to tackle the leaf rust disease.

4 CONCLUSION

The mineral element enhances the arabica coffee plant resistance due to biotrophic fungal attack. The mineral elements like I, Si and K can reduce the leaf rust incidence on the arabica coffee. Each component could act as an alternative way to tackle leaf rust disease on arabica coffee.

5. ACKNOWLEDGMENT

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