

Successful colonization of inoculated endophytic fungus, *Hendersonia toruloidea* GanoEF1 within the immature oil palm root after three-time application of GanoEF biofertilizer

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Abstract

The roots of oil palm (*Elaeis guineensis* Jacq.) previously treated with three-times application of GanoEF biofertilizer product at 0 months after planting (MAP) (500g at the planting hole), 12 MAP and 36 MAP (the latter two applications were 2kg of GanoEF at trunk base by subsoil in four point), were sampled from oil palm plantation at PASFA's Bukit Kerisek (Pahang, Peninsular Malaysia). These root samples were identified for the colonization of inoculated endophytic fungus, *Hendersonia toruloidea* GanoEF1 within the oil palm roots. Results showed that *Hendersonia* GanoEF1 colonization in both primary and feeder roots were 40%, at 40 MAP in the treated palms. Therefore, the use of three-time application GanoEF biofertilizer was further proved to be more successfully colonized in both primary and feeder roots of oil palm. This clearly showed the infection of *Ganoderma* disease, the causal pathogen of basal stem rot disease, can be controlled in oil palm plantation.

Keywords: Oil Palm; *Hendersonia*; Basal Stem Rot.

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I. Introduction

The development of GanoEF biofertilizer containing endophytic fungus, *Hendersonia toruloidea* GanoEF1 incorporated into inorganic and organic fertilizers was successfully produced in collaboration between Malaysian Palm Oil Board (MPOB) and All Cosmos Industries Sdn. Bhd., Pasir Gudang, Johor (Idris et al., 2012). The endophytic fungus, *H. toruloidea* GanoEF1 has been found to be strongly antagonistic against *Ganoderma boninense*, which is the causal pathogen of basal stem rot disease in the oil palm (*Elaeis guineensis* Jacq.), under many laboratory and nursery studies (Ramli et al., 2011, 2018; Idris et al., 2010; Azman et al., 2012). According to Idris et al. (2012), the benefits of GanoEF biofertilizer are inclusive of the effectiveness of *Ganoderma* disease control, environmental-friendly, easy storage, and easy application in the nursery and field conditions.

Previously, Tony Peng et al. (2020) reported the successful significant colonization of *H. toruloidea* GanoEF1 within the oil palm root after one application (8 months after the application of the GanoEF biofertilizer product). They recommended application of GanoEF biofertilizer (2kg/palm) for another three subsequent years to enhance more colonization of *Hendersonia* sp.. Therefore, the objective of the present study was to identify the colonization of inoculated *H. toruloidea* GanoEF1 within the immature oil palm root after three-time application of GanoEF biofertilizer, sampled from oil palm plantation at The Pahang Farmers' Organisation (PASFA) Bukit Kerisek, Pahang, Peninsular Malaysia.

II. Materials and Methods

Root sample from a treated palm was sampled from oil palm plantation at PASFA's Bukit Kerisek, Pahang, Peninsular Malaysia, on the 28th March 2018. The oil palm chosen in the present study was previously treated with GanoEF biofertilizer product. The application of the GanoEF biofertilizer was conducted by digging four holes around the circle of the oil palm. The GanoEF biofertilizer was applied into every hole and later the

hole was covered with soils. The applications of the GanoEF biofertilizer were done three times when the oil palm at the ages of 0, 12 and 36 months after planting (MAP) (Table 1) at the Block E15 in PASFA's Bukit Kerisek oil palm plantation. The root samples were collected at 40 MAP.

Table 1: Application of GanoEF biofertilizer at oil palm plantation at PASFA's Bukit Kerisek, Pahang.

Month after planting	0th	12th	36th
Application and quantity applied	500g of GanoEF at the planting hole	2kg of GanoEF at trunk base by subsoil (4point)	2kg of GanoEF at trunk base by subsoil (4point)

The entire root system was washed with tap water to remove the adhering soil and divided into two parts (Sample 1, Sample 2). The roots were subsequently surface sterilized with chlorox (20% v/v) and ethanol (70% v/v) before washing with sterile water. The surface sterilized roots were then divided into primary and feeder root sections. A total of 60 primary root sections and 40 feeder root sections from both palms were placed on selective agar media (Rose Bengal Chloramphenicol Agar) and incubated at 28°C for 1 – 2 weeks for *H. toruloideaGanoEF1* determination. The percentage colonization of *H. toruloideaGanoEF1* was calculated by using the following equation (adapted from Campbell and Madden, 1990):

$$\text{Root colonization percentage per sample} = \frac{\text{no.of root sections with target fungus}}{\text{Total no.of root sections}} \times 100\%$$

III. Results And Discussion

After 40 MAP, the root samples showed 40% of *H. toruloidea* colonized in both the primary roots and feeder roots of the treated palms. Presence of *H. toruloidea* in both primary roots and feeder root has proved that the respective fungus was successfully inoculated. Colonization will be increased proportionately with time (subject to favourable condition) and positively will control the infection of *Ganoderma* disease in oil palm plantation. At 40 MAP, it showed that there was no sign of BSR infected palms counted after the three-time application of GanoEF1. This is an important management strategy to reduce and protect the oil palm from being infected by BSR disease (Tony Peng et al., 2020).

Based on one-time application basis of GanoEF1, Tony Peng et al. (2020) reported that *H. toruloidea* colonization in primary and feeder roots of immature oil palm were 19.3-21.6%, and 37.5-42.5%, respectively, while Munthe and Dahang (2018) reported 24-28% of root colonization of *H. toruloideaGanoEF1*, based on the roots of oil palm collected from two locations in Riau Province, Indonesia. The one-time application of GanoEF1 was made by putting 750 g per plant of *Hendersonia GanoEF1* before establishing. The root samples were taken at 12 MAP.

The use of *H. toruloideaGanoEF1* for the reduction of *Ganoderma* infection in the oil palm plantations have been proven effective by Idris et al. (2012, 2019), Ramli et al. (2018) and Kamarudin et al. (2017). Hence, *HendersoniaGanoEF1* is a biotechnological fertilizer product that can promote soil fertility and prevent *Ganoderma* incidence in oil palm plantation (Idris et al., 2012). The present finding of using *HendersoniaGanoEF1* within the immature oil palm root after three-time application of GanoEF biofertilizer is recommended.

IV. Conclusions

In conclusion, the present study exhibited that *H. toruloidea* colonization in primary and feeder roots of immature oil palm were both 40% after three-time application of GanoEF biofertilizer. Therefore, the use of GanoEF biofertilizer product has been proven effectively since *H. toruloidea* was successfully colonized in both primary and feeder roots of oil palm. This shows that the infection of BSR disease can be controlled in oil palm plantation with the recommendation of three-time application of GanoEF biofertilizer.

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