

Antimicrobial Production by an Actinomycetes Isolated from the Termite Nest

Ni Putu Ratna Ayu Krishanti *, Deni Zulfiana, Bramantyo Wikantyoso

Faculty of Engineering, UPN "Veteran" Jawa Timur

*Corresponding author:

E-mail: ratna.a.krishanti@gmail.com

ABSTRACT

Actinomycetes are Gram positive bacteria that have been detected in diverse ecological niches. Their member species are known to be a main source of various bioactive compounds. The discovery of Actinomycetes from diverse and unexplored resources has also been linked to increased opportunities to obtain novel bioactive compounds. Insect nest material is being investigated as a new source of novel antimicrobial producing Actinomycetes, which could be harnessed for therapeutic potential. A total of 10 Actinomycetes isolates were collected from the nest of *Nasutitermes* sp. in Pananjung Pangandaran Nature Reserve. These isolates were evaluated for antimicrobial activity against the challenge bacteria (*Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, *Serratia marcescens*) and fungi (*Fomitopsis palustris*, *Fusarium oxysporum*, *Trichoderma viridae*) by dual culture method. The result revealed that several isolates were active against fungi and bacteria. Isolate Pn-TN2 showed the highest level of antibacterial inhibition and the highest antifungal inhibition with Inhibition Rate value more than 80%. By morphological and 16S rRNA gene sequence analysis strongly suggested that the isolate Pn-TN2 belonged to *Streptomyces prasinopilosus*. We suggested that termite nest is a potential source of bioactive strains of cultivable Actinomycetes for future biotechnological needs.

Keywords: *Actinomycetes*, *antimicrobial*, *Nasutitermes* sp., *Streptomyces prasinopilosus*, *termite nest*

Introduction

Indonesia excels in a period of 2045 prepared by the application from the map of the industrial revolution era 4.0. answering education as a solution to the impact of the industrial era 4.0. required entrepreneur education. The concept of entrepreneurial education will create creative and innovative children who able to overcome the obstacles in the future. Moravec states that industry 4.0 requires the education to build individual innovation practices and student empowerment teams to produce innovation (Sarikaya & Coskun, 2019). Schools are educational institutions designed for the development of human potentials. Also, the purpose of education is to improve the quality of human resources with the anticipation of producing superior and characterized human beings, raised through the affirmation of each activity that is integrated into entrepreneurship-based learning in school.

Ningrum's opinion (2017) reported entrepreneurship as a soul, attitude, ability to create something new, valuable and useful for personal consumption and others, while entrepreneurs are skilled personnel in the aspect of developing personal businesses and taking advantage of opportunities, to improve their lives. Moreover, Nurseto (2010) established that efforts needed to instill the required entrepreneurship for teachers ought not to be limited to master the concepts, but also have the ability to perform the related activities. These include the application of all existing conceptions.

The plans towards learning conducted at Mata Najwa Kindergarten which involved the application of entrepreneurship activities in early childhood, including several learning components, encompassing: 1) the objectives; 2) materials; 3) educators; 4) students; and 5) strategies (Sofino, 2017). This is followed by the inculcation of entrepreneurial values, performed in a series of activities

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that are initiated with planning, learning, implementing and evaluating. Sani and Yunus (2018) in Malaysia showed the need to relate the results of research on teaching design or planning to one another and not to a specific subject. Furthermore, the information required is centered on the objective learning content, approaches, methods used, the imparting techniques and assessment design of the teachers' teaching and learning outcomes. These are needed to play the role of an evaluation material, which ought to be performed and added on instances where there are deficiencies.

the cooking class is innovative programs in preschool children. These are usually conducted to promote healthy eating behaviors, attained by providing the knowledge on basic nutrition, food selection, menu planning, time-saving tips in the kitchen and food preparation skills to parents and caregivers (Condrasky, Graham & Kamp, 2006).

This is also significantly increased their willingness to explore fruits and vegetables, as reported by parents. Also, the effectiveness of cooking on children's food-related preferences, attitude and behaviors is promoted (Hersch et al., 2014). The results and discussions stipulated that the values of entrepreneurship need to be internalized in students include independent, creativity, the dare to take risks, action-oriented.

Material and Methods

Preparation of termite nest sample

Actinomycetes isolates growth

Sample of termite nest was collected in September 2016 from Pananjung Pangandaran Nature Reserve, West Java, Indonesia. Termite nest was obtained by cruise method. The type of collected nest termite was carton nest. Termite nest samples (200 g per sample) were placed in polyethylene bags and immediately transported to Microbiology Laboratory of Research Center for Biomaterials- LIPI. Termites sample (worker and soldier) inhabiting the nest were collected and preserved in 70% alcohol tube. The termites were identified based on key identification. Photographs were taken with digital microscope with 40 – 80 × magnification. Nest samples were ground into fine particles and air-dried at an ambient temperature for 7 days before the isolation of Actinomycetes.



Figure 1. Actinomycetes isolates growth in HV agar media

Results and Discussion

Isolation of Actinomycetes from termite's nest sample

In this research, we using HV agar media to isolate Actinomycetes from the termite's nest sample. Its classify into nutrient-poor media therefore not many other microorganisms are able to live and

utilize nutrients available in the media other than Actinomycetes bacterial group. In the process of Actinomycetes, we found contain in soil can be detected and avoided by termites with several disease resistance mechanism. A trend in termite evolution of nests was observed progressively reducing contact with soil. The high incidence of entomopathogens in soil were likely involved in the evolution of the more derived nesting habits in *Nasutitermes*. Environmental factors such as moisture, temperature, and light may be attributed to characteristic of termite nesting then may lead to influence the composition of microbial communities in termite nest [41].

Conclusion

The strain *S. prasinopilosus* Pn-TN2 which isolated from termite nest sample, showed a broad range of antimicrobial activity against bacterial and fungal test. Result showed that this isolate possessed inhibition rate antifungal activity by 80% against *F. oxysporum*, 61% against *F. palustris*, and 62% against *T. viridae*. Advised, this isolate also possessed high antibacterial activity against *B. subtilis*, *P. aeruginosa*, and *E. coli*. Sequence analysis of 16S rRNA gene indicated that isolate Pn-TN2 belongs to genus *Streptomyces*. It shares 99% similarity with *S. prasinopilosus*. We conclude that termite nest represent source of cultivable Actinomycetes that contribute diverse bio active compounds for further biotechnology application in the medical, pharmaceutical, and agricultural fields.

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