DNA Barcoding for mangrove identification

R. Taufan Harisam\textsuperscript{1,2}\textsuperscript{*}, Asrul Sahri Siregar\textsuperscript{1}, Norman Arie Prayogo\textsuperscript{1}, Purnama Sukardi\textsuperscript{1}, Nguyen The Hung\textsuperscript{3}

\textsuperscript{1}Fishery and Marine Faculty, Universitas Jenderal Soedirman, Jenderal Soedirman University, Purwokerto 53122, Indonesia
\textsuperscript{2}Research and Community Service, Jenderal Soedirman University, Indonesia
\textsuperscript{3}Thai Nguyen University of Agriculture and Forestry, Viet Nam

\textsuperscript{*}Corresponding author: taufan.ltd@gmail.com

Abstract. Mangroves are distributed in the transition zone between sea and land, mostly in tropical and subtropical areas. They provide important ecosystem services and are therefore economically valuable. Mangrove species identification using traditional taxonomical methods is often burdened with taxonomic controversies. DNA barcoding provides a useful tool for species identification and phylogenetic reconstruction. \textit{rbcl} and \textit{matK} are short and unique DNA sequences, and also provide good identification for magrove. This critical review highlights the development of the use of molecular applications that is DNA Barcoding. We focus on observing the development of the use of DNA barcoding in the world, especially on mangroves. Our observations are limited to the use of \textit{rbcl} and \textit{matK} markers in some mangrove species in the world. In conjugation with newer and faster techniques such as high-throughput sequencing, \textit{rbcl} and \textit{matK} marker can serve as an effective modern tool in mangrove identification.

Keywords: \textit{rbcl}, \textit{matK}, DNA barcoding, mangrove

1. Introduction

Mangrove forests, in a broad sense, are a community of woody plants that grow in intertidal zones in the tropics and subtropics, which play an important role in maintaining the balance of coastal ecosystem zones (Dan et al, 2016). Mangrove forests are highly productive ecosystems with the same primary production level as tropical forests [1; 25].

Species identification method living things have evolved from morphological identification to on molecular identification based on short pieces of DNA called “DNA barcode” [11]. DNA Barcoding is a very short standardized DNA sequence that can be used for identification to species level [8]. The concept of DNA barcoding has become one of the most important and significant scientific visions in the past decade. As an effective tool for species level identification, the concept of DNA barcoding has developed rapidly and gained popularity throughout the world. In 2009, Professor Paul Hebert and collaborators on duty at the University of Guelph, Canada, initially the use of DNA Barcoding. Around 2005, The concept of DNA barcoding was introduced into botanical research [3; 5]. Further research is required to compare DNA barcode fragments to test their efficacy for species identification [14; 11].

Identification of mangroves based on morphological characteristics, such as leaf shape, flower shape, branching stems and root shape is very susceptible to errors [21; 19]. There are many mangrove species morphologically that look almost the same, and the distribution area is in almost the
same location. It is difficult to identify at the level of mangrove species that have similar morphological forms using external morphological forms of plants, such as Sonneratia alba, Sonneratia caseolaris (L.), Sonneratia Hainanesis, Sonneratia paracaseolaris or Bruguiera sexangula (Lour.) Poir and Bruguiera sexangula (Lour.), and fact it is difficult to understand the evolutionary relationship between mangrove species and traditional classification methods. The development of the world of biotechnology, especially in the molecular field is very rapid, one of which is DNA Barcoding which provides species-level identification results with a high level of accuracy at a relatively affordable price [27].

Technically, the use of DNA barcoding for mangrove identification is a comparison of short DNA sequences compared to sequences that already exist at Gene Bank. Some Gene which is commonly used to identify mangroves are Gene rbcl and matK. In this article, we highlight the development of DNA barcoding, especially the rbcl and matK markers for mangrove identification in the world.

2. The rbcl and matk markers: A marker for mangrove identification

Mangroves are unique plants and grow at tidal locations. There are 84 species of 24 genera and 16 families of mangrove plants in the world, including 70 species of 16 genera and 11 families of true plants and 14 species of 8 genera and 5 families of semi-mangrove plants [16]. Conventional mangrove identification often causes errors due to damage to plant parts and differences in perspective. One of the effective molecular markers is DNA barcode. In the last decade, DNA barcoding method has become very important, especially for mangrove identification. Many researchers have begun using DNA barcodes to explore mangroves in several countries. The Used of DNA Barcode markers for reasons of high efficiency and accuracy.

DNA Barcoding is designed to provide accurate identification at the species level through molecular markers based on short standard gene regions [7;18]. In 2009, the CBOL (Consortium for the Barcode of Life) Plant Working Group initially identified and recommended the use of the chloroplast-derived DNA barcode fragments rbcl and matK. The core barcode matK locates at the intron region in chloroplast lysine tRNA (trnK) gene, and is ~1,550 bp in length, encoding a mature enzyme that involves in type II intron splicing during RNA transcripts [18]. matK is a single-copy and one of the fastest evolving genes in protein encoding regions of the chloroplast genome [10]. Rbcl has supported it as a barcode fragment because of its universality, easy amplification and comparability [12]. However, the use of rbcl rarely finds variations at the species level, only at the species level above [13; 20;7;17]. The use of DNA barcoding in mangrove research has been carried out to determine the genetic characteristics of mangroves [18;9]. Further studies on the DNA barcoding especially on rbcl and matK marker for the mangrove have mainly focused on DNA barcoding analysis and phylogenetic relation of several mangroves in China [8]. Loss of evolutionary unique species in the mangrove ecosystem has been reported and DNA barcoding provided phylogenetic information for developing unified mangrove management plan worldwide [5]. According to Suman [24], in their study rbcl and matK markers provided initial assessment data that would be useful for broader applications of DNA Barcoding in the ecological studies of Mangrove Plants.

| Serial number | Topics                             | References |
|---------------|------------------------------------|------------|
| 1.            | Mangroves in Guangdong Province, China | [8]        |
| 2.            | Mangrove plant species of Visakhapatnam Coast, Andhra, India | [24]       |
| 3.            | Genetic mutation in mangrove Acanthus ilifolicius Coastal Cilacap, Central Java, Indonesia. | [25]       |
| 4.            | Mangroves from Goa, West Coast, India | [18]       |
| 5.            | Phylogenetic, Sequence Analysis and Structural Studies of Maturase K Proteins from Mangroves | [26]       |
| 6.            | Phylogenetic relationships of the Rhizophoraceae in China | [22]       |
3. Closing and future DNA barcoding research trends

DNA Barcode research for the mangrove field will continue. Molecular mangrove conservation is a challenge in the world of biological conservation. The influence of anthropogenic activity on mangrove ecosystems is increasing every year. There are can be effect for the extent of mangroves to narrow in the future. Rapid and precise identification of mangroves will continue because researchers need them for other fields such as forestry, coastal management, and exploration of wetland areas. Molecular research on mangrove associations still needs to be done. Important discoveries regarding DNA barcoding in sub-tropical and tropical countries are very important to be developed. The challenge of managing mangroves is not easy, especially molecular-based mangrove management to ensure its sustainability.

4. Conclution

Research publications on DNA barcoding in the mangrove field are still limited. rbcL and matK are effective markers for mangrove identification, but have not been proven to look for genetic variations at the species level. rbcL and matK markers provide preliminary assessment data that will be useful for broader applications of DNA barcodes in the ecological studies of Mangrove Plants.

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