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GROWTH, BIOMASS AND PHYTOCHEMICAL COMPOUND OF SEAGRASS (CASE STUDY: MALANG REGENCY COASTAL)

PERTUMBUHAN DAN BIOMASSA LAMUN SERTA SENYAWA FITOKIMIA TERKANDUNG DI DALAMNYA (STUDI KASUS: PESISIR KABUPATEN MALANG)

Citra Satrya Utama Dewi[1,3*], Rarasrum Dyah Kasitowati[1,2], Syarifah Hikmah Julinda Sari[1,4], Ade Yamindago[1], Amellia Alya Rohenda[1], & Riska Fatmawati[5]
[1]Department of Marine Science, FPIK-University of Brawijaya, Malang, 65145, Indonesia
[2]Coastal Resilience and Climate Change Adaptation,
FPIK-University of Brawijaya, Malang, 65145, Indonesia
[3]Pusat Studi Pesisir dan Kelautan, LPPM-University of Brawijaya, Malang, 65145, Indonesia
[4]Marine Resources Exploration and Management,
FPIK-University of Brawijaya, Malang, 65145, Indonesia
[5]Department of Marine Fisheries Technology, FPIK-IPB University, Bogor, 16680, Indonesia
*E-mail: satryacitra@ub.ac.id

ABSTRACT

Seagrass known as Lamun in Bahasa is one of the species that are can live in submerged marine habitats. Seagrasses have an important role in the ecosystems, including as primary producers, living habitats of benthic organisms, stabilize bed sediments and carbon storage in shallow-water coastal. Monospecies community of seagrass was found in Malang, however, only limited number studies of seagrass have been done in the area. This study aimed to determine the growth rate and biomass of the seagrass, as well as the phytochemical compounds. Experiments were conducted during August-November in 2014 and 2015. Measurement of in situ growth and biomass leaf were made using marking techniques in one week also the data of leaf seagrass collected were using a random sampling method. Extracted materials were tested by methanol to get the phytochemical compound. Data were analyzed at the Fisheries and Marine Exploration Laboratory, FPIK-UB. The results of the present study showed that two species of seagrass, *Syringodium isoetifolium* at Kondang Merak and *Thalassia hemprichii* at Bale Kambang. The growth rate of the seagrass leaves of the former species had positive values with 0.45±0.19 cm/day, while the later species had 0.25±0.14 cm/day. Furthermore, the biomass value of the two types seagrass obtained that in the below-ground was higher than the above-ground. Phytochemical tests showed that both of type seagrass contained bioactive compounds such as flavonoids and saponins.

Keywords: biomass, growth, phytochemical, seagrass

ABSTRAK

Seagrass, yang umum disebut sebagai lamun dalam bahasa indonesia merupakan satu satunya tumbuhan tingkat tinggi yang dapat hidup terendam air laut. Padang lamun memiliki peran kunci dalam ekosistem, antara lain sebagai produsen primer, habitat hidup organisme bentik, menstabilkan sedimen, dan menyimpan karbon di laut dangkal. Komunitas lamun monospesies dapat ditemukan di Kabupaten Malang, namun penelitian terkait lamun di Kabupaten Malang juga masih terbatas, sehingga kajian ini dirasa penting untuk dilakukan. Tujuan dari kajian ini untuk mengetahui laju pertumbuhan daun dan biomassa lamun, serta mengetahui kandungan fitokimianya. Penelitian ini dilakukan pada bulan Agustus hingga November Tahun 2014 dan Tahun 2015. Pengukuran laju pertumbuhan daun dan biomassa lamun dilakukan secara in situ dengan metode penandaan selama satu minggu, serta pengambilan contoh daun lamun dilakukan secara acak di lokasi penelitian. Tahap selanjutnya bahan diekstraksi dengan methanol untuk mendapatkan kandungan senyawa fitokimia. Analisis data di Laboratorium Eksplorasi Sumberdaya Perikanan dan Kelautan, FPIK–UB. Hasil penelitian menunjukkan bahwa terdapat dua jenis lamun, yaitu Syringodium isoetifolium di Pantai Kondang Merak dan Thalassia hemprichii di Pantai Bale Kambang. Laju pertumbuhan daun kedua jenis lamun secara berurutan menunjukkan nilai positif yaitu 0,45±0,19 cm/hari dan 0,25±0,14 cm/hari. Nilai biomassa kedua jenis lamun menunjukkan bahwa biomassa pada bagian bawah substrat lebih tinggi dibandingkan bagian atas substrat. Uji fitokimia menunjukkan bahwa kedua jenis lamun ini mengandung senyawa bioaktif jenis flavonoid dan saponin.

Kata kunci*: biomassa, fitokimia, lamun, pertumbuhan*

I. INTRODUCTION

Seagrass are the flowering plant capable to live a submerged in sea water. This plant has roots, stems and leaves sheath, blooms, and bears fruit, therefore seagrass can multiply generatively through seeds, and vegetatively through rhizomes. Seagrass could form a community from a single species (monospecies), as well as from multispecies (Kordi, 2011; Asriyana & Yuliana, 2012; Sjafrie *et al.*, 2018).

Seagrasses is so widespread in Indonesia that has important ecological functions, including as primary productivity, living habitats of benthic organisms, stabilize bed sediments, and carbon storage in shallow-water coastal (Bujang *et al.*, 2006). Organisms that could be found associatively in seagrass meadow are molluscs, echinoderms, *crustaceans*, and *Polychaeta*, (Hutomo & Azkab, 1987; Kordi, 2011; Cappenberg & Wulandari, 2019). Also, seagrass could storage the carbon as a biomass in their body, roots, stems, and leaves (Rustam *et al*., 2014).

As with other plants, seagrass share most features on their secondary metabolism (Gustavina *et al*., 2018). Seagrass are an outstanding source of components such as flavonoid and saponin (Dewi *et al.*, 2012; Ganesan *et al.,* 2019). Flavonoid and saponin compounds are naturally produced as a form of plant defense against predators, and unfavorable environmental conditions (Papenbrock, 2012). During the earlier years, flavonoid and saponin can be used as a nutraceutical compound in various food and pharmaceutical industries (Qi *et al*., 2008; Tangke, 2010; Bharathi *et al.*, 2019).

Malang Regency has monospecies seagrass meadow in the coastal area. The vegetation condition have a unique characteristic, as the Malang coastal, East Java, Indonesia adjacent with the Indian Ocean, which has strong currents and high waves, besides seagrass growth is limited by substrate conditions of the water (Short *et al.*, 2016). However, only a limited number of studies about seagrass in the area, particularly regarding the role of growth, biomass and phytochemical compounds of seagrass. Therefore, understanding the seagrass growth and biomass is an important conservation objective in many coastal marine systems worldwide. The objectives of this study were to determine the growth rate, biomass, and phytochemical compounds of seagrass.

II. RESEARCH METHOD

The experiments was carried out in 2014 and 2015 in Kondang Merak and Bale Kambang sites, Malang (Figure 1). There are several steps in these experiment, the first step in the growth rate and biomass seagrass was collect from August to November 2015. Seagrass growth is measured by measuring leaf length in daily, whilst seagrass biomass is calculated using the method by Alie, 2010; Christon *et al*., 2012; Ganefiani *et al*., 2019. The second step, performed phytochemical compounds was collected from August to November 2014. Then the extraction processed of seagrass leaves by methanol, followed by a qualitative assay on phytochemical compounds (Dewi *et al*., 2012). The phytochemical analysis was performed in the Fisheries and Marine Exploration Laboratory, Faculty of Fisheries and Marine Science, University of Brawijaya.

III. RESULTS AND DISCUSSION

Results showed that in two study sites, 2 species of seagrasses were found, *S. isoetifolium* in Kondang Merak site and *T. hemprichii* in the Bale Kambang site (Figure 2). *S. isoetifolium* has a pointed leaf at the end, like a stick with an air space in the middle. Further, *T. hemprichii* has a leaf-like ribbon, which a rhizome that is clearly visible in the dark color of each segment. Two of these species were seagrasses that

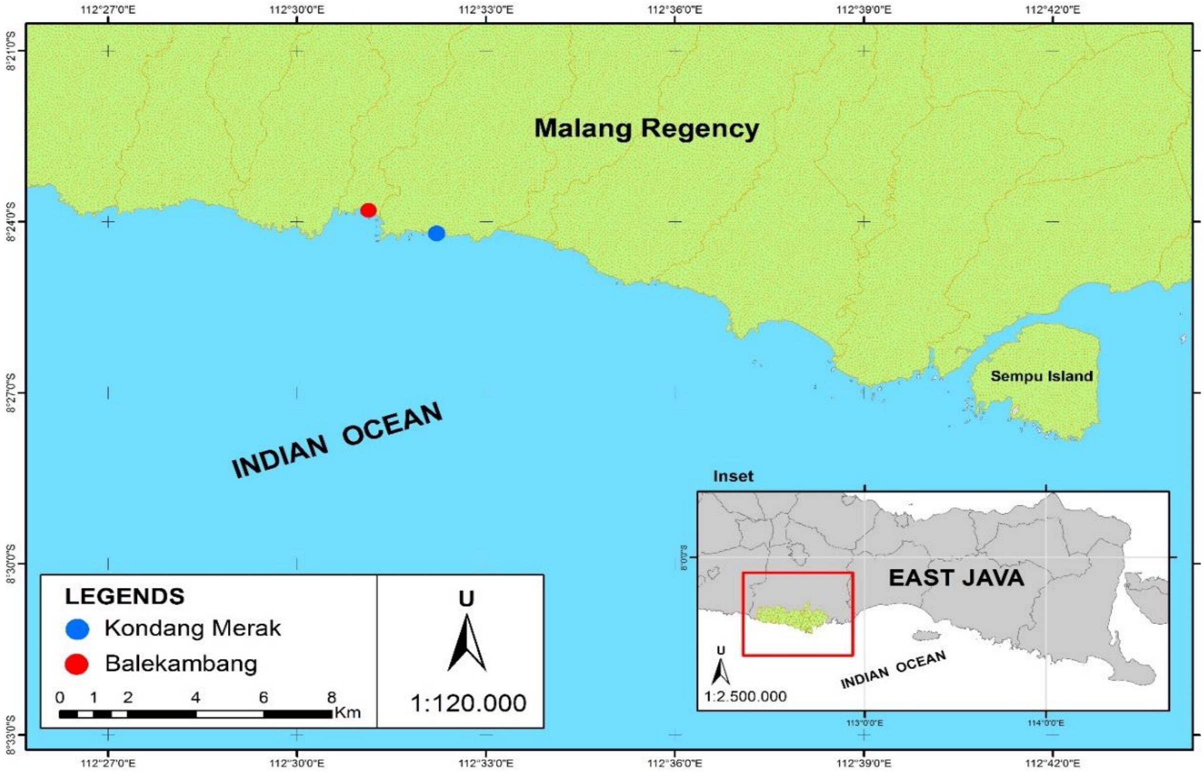

Figure 1. Map of the study sites.

(a) (b)

Figure 2. Variety of seagrass: (a) *S. isoetifolium* in the Kondang Merak site; and (b) *T. hemprichii* in the Bale Kambang site.

predominate in the Indo-Pacific region (Short *et al.*, 2007).

The growth rate of seagrass *S. isoetifolium* had 0.45±0.19 cm/day and *T. hemprichii* approximately 0.25±0.14 cm/day. This value was obtained from an analysis of the leaf growth of the two kind of seagrass in each period (weeks) (Figure 3). Based on the result the growth rate of *S. isoetifolium* leaves in Kondang Merak, Malang is relatively faster compared to Bunaken Waters at 0.25 cm/day (Wagey & Sake, 2013). On the other hands, the growth rate of *T. hemprichii* leaves on Bale Kambang is not significantly different compared to Bone Batang Island, Spermonde Islands, South Sulawesi (0.29 cm/day) (Alie, 2010).

As a result of the significant differences in above and below-ground

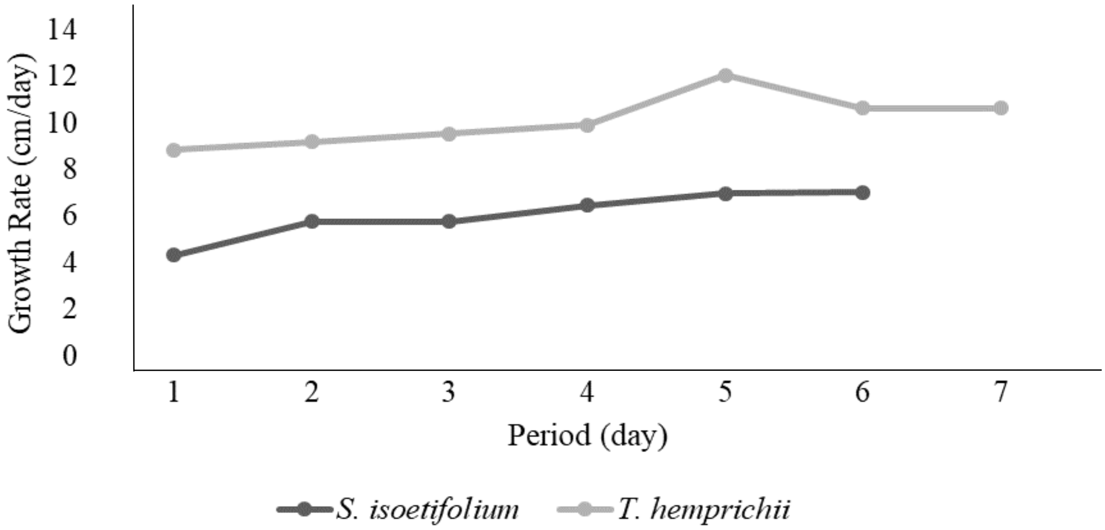

Figure 3. Growth rate of *S. isoetifolium* and *T. hemprichii*.

biomass among species. Total biomass of *S. isoetifolium* at above-ground is 2.2% lower than below-ground (3.1%). Total biomass of *T. hemprichii*, with higher values below-ground (89.36%) than the above-ground was 65.86%. The ratio of biomass *T. hemprichii* higher than *S. isoetifolium*, for both substrates (Figure 4). This study related to the statement by Dewi & Sukandar (2017), that seagrass biomass at the below-ground in the Talango Madura Island had a higher value than at the above-ground, also in the Pari Island, Jakarta (Rahmawati, 2011). This might be caused by seagrass obtain nutrient through the stem, rhizomes, and roots, further three parts contained under the substrate (Hartati *et al*., 2017). Biomass of seagrass species are expected to vary between locations, especially influenced by variations in depths (Lavery *et al.,* 2013). Depth may not be a factor affecting possible variability in the sampling sites in Malang. However, other factors like light availability, temperature and nutrient supply also be taken into consideration such as the effect of substrate on the variability of biomass (Kaldy & Dunton, 2000).

The extraction of bioactive compounds from seagrass leaves is carried out to obtain a crude extract in the form of a paste. 86.67 g of dried *S. isoetifolium* leaf produced 8.58 g of crude extract. On the contrary, 39.98 g of dried *T. hemprichii* leaf produced 3.34 g. These results reported that the yields from the extraction process by methanol is 9.88% for *S. isoetifolium* and *T. hemprichii* (8.35%) (Figure 5). This result showed that *S. isoetifolium* tends to be more polar. As well as with Priyanto (2012) that the yield extracted by methanol is probably influenced by the solvent characteristics that can dissolve almost all compounds of the active material.

There were six phytochemicals tested for raw extracts seagrass leaves using methanol (Table 1). As shown in Figure 4, *S. isoetifolium* had a positive response to the

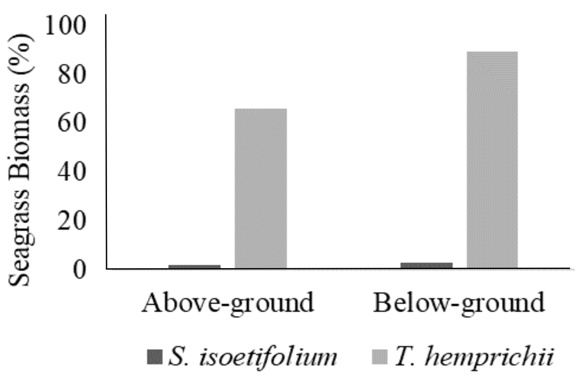

Figure 4. Biomass in above- and below-ground of *S. isoetifolium* and *T. hemprichii*.

Table 1. Result of seagrass phytochemical test.

No	Species	Sampling site	Alkaloid	Flavonoid	Biuret	Saponin	Molish	Benedict
1	*S. isoetifolium*	Kondang Merak, Malang	-	+	+	++	++	-
2	*T. hemprichii*	Bale Kambang, Malang	++	+	-	+	-	-

Information: - = a negative response, + = a positive response, ++ = a positive response with over concentration.

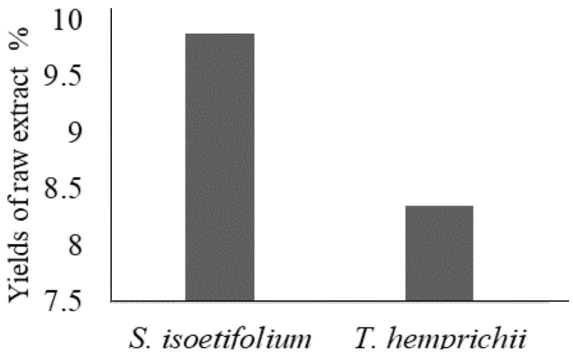

Figure 5. Yields of raw extract from *S. isoetifolium* and *T. hemprichii.*

flavonoid and biuret test, also had a positive response with over concentration to the saponin and molisch tests. Whilst *T. hemprichii* was positive with over concentration in the alkaloid, and showed a positive response to the flavonoid and saponin tests. Both types of seagrass are contained bioactive compounds included flavonoid and saponins. Based on the phytochemical compounds discovered in the analyses, seagrass has the potential to be used for biomedicinal applications, cytotoxic, antimicrobial, or antimacrofouling activity. As flavonoids and saponin are known to have antioxidant activities (Lachowicz *et al.,* 2018). These findings provide an opportunity for the development of natural products from seagrass. The study brings out the medicinal value of *S. isoetifolium* and *T. hemprichii* which can be used as a nutraceutical compound in various food and pharmaceutical industries. *S. isoetifolium* has pharmacological activities such as antioxidant, antihemolytic, antibacterial cytotoxicity, and antifungal activity (Kalaivani *et al.*, 2020).

IV. CONCLUSION

The conclusion of this research that the seagrass *S. isoetifolium* was found in Kondang Merak is, while *T. hemprichii* found in Bale Kambang. Both species of seagrass have 0.45±0.19 cm/day growth rate for *S. isoetifolium*, and *T. hemprichii* (0.29±0.14 cm/day), respectively. The value of the biomass obtained from both seagrass showed that the the below-ground biomass (3.1%) is higher than the above-ground (2.2%). Phytochemical tests by methanol on the two species of seagrass showed that both positively have a potential of bioactive compounds, particularly with flavonoids and saponins contents.

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