International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Potential of Katang-Katang Plants as Animal Feed: Analysis of Abundance and Chemical Content in 3 Locations

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Abstract**—** *As the global population grows, food and protein sources demand increases. Livestock productivity relies on a continuous and high-quality feed supply, but availability often competes with other uses, such as compost production and human consumption. To address this issue, exploring alternative feed sources is essential. Ipomoea pes-caprae (katang-katang) is a potential candidate due to its adaptability, high biomass, and nutritional value, yet it remains underutilized. This study, conducted from April to November 2023, aimed to evaluate the abundance of Ipomoea pes-caprae at Glagah Beach, Samas Beach, and Parangtritis Beach and analyze its chemical composition. Using the transect quadrat method with purposive sampling in 1×1 m² quadrats, the research assessed parameters such as moisture content, crude protein, crude fat, crude fiber, nitrogen-free extract (NFE), total digestible nutrients (TDN), calcium, and phosphorus. The results show that Ipomoea pes-caprae meets the minimum nutritional requirements for ruminants and poultry, with crude protein levels exceeding 12% and sufficient TDN for livestock growth. Its high abundance and adaptability suggest its sustainability as an alternative feed. Further studies are required to evaluate livestock preferences and assess potential anti-nutritional factors to maximize its utilization.*

Keywords**—** *Ipomoea pes-caprae (Katang-katang, beach morning-glory), Livestock Feed, Abundance, Nutritional Composition of Feednter.*

I. INTRODUCTION

Ipomoea pes-caprae (katang-katang) is a plant commonly found in tropical and subtropical coastal sandy areas [1]. Its presence diminishes the farther it is from the shoreline [2]. Katang-katang is often regarded as a coastal weed and is considered undesirable due to its potential to threaten the survival of certain coastal fauna, such as the leatherback turtle (Dermochelys coriacea). The roots of katang-katang penetrate deep into the sand, potentially damaging and breaking turtle eggs [3]. On the other hand, this plant has medicinal properties and contains potent antioxidants [1],[4].

Ipomoea pes-caprae (katang-katang) is known by various local names. In Manado, it is called batatas pantai, in Malay it is known as daun katang, in Madura as tangkatang, in Bali as katang-katang, and it is also referred to as tapak kuda [5]. The local community uses katang-katang for various purposes, including in face mist formulations [4] to relieve toothache, diarrhea, and as a remedy for poisoning caused by jellyfish stings. Several studies have shown that this plant possesses pharmacological activities such as antioxidant, analgesic, anti-inflammatory, antihistamine, and has hygienic properties. It also acts as a fungicide, antibiotic, and inhibitor of tumor cell [2].

Katang-katang has shown potential as a substrate for the growth of oyster mushrooms (Pleurotus ostreatus). In a study by [6], straw substituted with 2.4%, 5.0%, 7.5%, and 10% katang-katang resulted in better mushroom growth compared to straw without any addition of katang-katang . [7] found that using 100% katang-katang without straw resulted in the best oyster mushroom growth. Additionally, katang-katang shows potential as a material for Plant Growth-Promoting Rhizobacteria (PGPR), which has been proven to enhance growth and yield in various plants when PGPR from katang-katang is added [8][9][29].

Indonesia's current population is 272,292,372, ranking 4th after China, India, and the United States [9], while the global population in 2023 is 8 billion [10]. The average protein requirement for the Indonesian population is 57 g/person/day, based on the recommended protein intake [11]. The majority of protein needs are met through livestock, which contains 15-30% of its fresh weight, much higher than plants, which contain only 5-15% [12]. Livestock feed generally consists of three types: forage, concentrate, and supplements. Forage is the primary feed for meeting nutritional needs, especially for ruminant animals. As is well known, forage availability is minimal during the dry season.

Given the issue of limited availability of forage for livestock, especially during the dry season, it is necessary to explore alternative uses of plants, particularly weeds, that can be utilized as livestock feed, either as a primary feed or as a substitute in existing general feed formulations. A literature review suggests that Ipomoea pes-caprae (katang-katang) has the potential as one such solution, based on its nutritional content, abundance, and benefits. This study aims to explore katang-katang as an alternative to ensure a continuous supply of forage, as it is not seasonal and can thrive in marginal areas. Moreover, it is highly resilient to wind and salt exposure, as it is a coastal weed.

The objectives of this study are:
(a) To analyze the abundance of Ipomoea pes-caprae (katang-katang) at Glagah Beach, Samas Beach, and Parang Tritis Beach.
(b) To analyze the chemical composition, including moisture content, crude protein, crude fat, crude fiber, NFE (Nitrogen-

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International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Free Extract), TDN (Total Digestible Nutrients), calcium, and phosphorus.

II. Materials And Method

The materials used in this study were Ipomoea pes-caprae (katang-katang) plants, which were sampled from three locations: Glagah Beach and Samas Beach (representing the southern coast), and Bali 2 (Balongan Indah 2) Beach (representing the northern coast). The method used to assess plant abundance was the transect quadrat method (modified from Zang et al., 2021) [13] with a size of 1m x 1m. Equipment included an analytical balance, a Samsung smartphone for documentation, chemical analysis tools, and labeling paper for marking the plants collected from the transect. The research method involved direct exploration at the designated locations using transects to assess the abundance of Ipomoea pes-caprae (katang-katang), followed by the chemical analysis of the collected samples.

III. Implementation Of Research

The research began by selecting three coastal locations. The chosen study sites were coastal areas located 0.5 – 2 km from the shoreline (depending on where Ipomoea pes-caprae grows). The selected beaches included Samas Beach and Glagah Beach (representing the southern coast) and Bali 2 Beach (Balongan Indah 2) representing the northern coast. Transect locations were chosen based on the abundance of Ipomoea pes-caprae. At each location, the abundance of katang-katang was assessed using the transect quadrat method (modified from Zang et al., 2021)[13] through purposive sampling, with a quadrat size of 1m x 1m. In each quadrat, the number of plants was counted, and the total biomass (including roots, stems, leaves, flowers, and fruits) was weighed. Katang-katang collected from each location was then subjected to chemical composition analysis of the leaves and stems. For each plant and each location, a random sample of approximately 1 kg (optional) was collected and analyzed for its chemical content, including moisture, crude protein, crude fat, crude fiber, BETN, TDN, calcium, and phosphorus [14].

IV. Results And Discussion

This study found significant differences in the abundance of Ipomoea pes-caprae and its chemical composition among the three study locations: Samas Beach, Glagah Beach, and Indramayu/Balongan Indah 2 Beach. Chemical analysis revealed that the chemical content of Ipomoea pes-caprae varied significantly depending on its geographic location, highlighting the importance of considering environmental factors when utilizing it for livestock nutrition (Tables 1, 2, and 3)

The results of the chemical content analysis of Ipomoea pes-caprae from the three sampling locations, namely Samas Beach, Glagah Beach, and Balongan Indah 2 Beach, are presented as follows:

The air-dry weight of Katang-katang plants varies depending on the habitat or growing location. At Bali 2 Beach (Balongan Indah 2) in Indramayu, West Java, and Glagah Beach, the air-dry weight was higher compared to that of plants from Samas (Table 1). The dry matter content of *Katang-katang* plants ranges from 25.27% to 28.87%. The protein content of Katang-katang is relatively low, ranging from 3.19% to 4.38% on a dry weight basis. This level is considered insufficient, suggesting the need for protein supplementation if it is to be used as fodder or forage. Fermentation has been proposed as one method to enhance protein content [15]. Moreover, Wang et al. (2018)[15] emphasize that utilizing feeds with low crude protein content can reduce feed costs and nitrogen excretion, which in turn contributes to improved gut health. Reducing nitrogen excretion also benefits the environment by lowering ammonia emissions, which contributes to more sustainable agricultural practices.

TABLE 1: Chemical Content of *Ipomoea pes-caprae* from Samas Beach, Glagah Beach, and Indramayu (Balongan Indah 2) Locations

No.	Chemical Content	Sampling Location	Average	Overall Average
1	Air dry weight (%)	Samas	25.27 b	27.56
		Glagah	**28.58 a**	
		Bali 2	**28.83 a**	
2	Nitrogen protein (%)	Samas	3.19 b	3.79
		Glagah	3.80 b	
		Indramayu	**4.38 a**	
3	Silica (%)	Samas	1.53a	1,53
		Glagah	1.52a	
		Indramayu	1.54a	
4	Ash (%)	Samas	**2.25a**	1.95
		Glagah	1.62b	
		Indramayu	1.99b	
5	Crude fiber (%)	Samas	1.58b	1.91
		Glagah	1.79b	
		Indramayu	2.35a	
6	Fat (%)	Samas	0.53c	0.63
		Glagah	0.63b	
		Indramayu	**0.74a**	
7	Calcium (Ca) %	Samas	3.02b	3.38
		Glagah	**5.61a**	
		Indramayu	1.52c	
8	BETN (Nitrogen-free Extract %)	Samas	**95.45a**	92.72
		Glagah	92.16b	
		Indramayu	90.54b	
9	TDN (Total Digestible Nutrients) (%)	Samas	85.23a	84.67
		Glagah	85.53a	
		Indramayu	83.24a	
10	Energy (Calories/gram)	Samas	531.66c	727.45
		Glagah	587.12b	
		Indramayu	**1.063.56a**	

Explanation: The tests were conducted at the Biochemistry Laboratory of UMBY, the Analytical Chemistry Laboratory of the Department of Chemistry, Faculty of Mathematics and Natural Sciences, UGM, and the Food and Nutrition Study Center Laboratory, UGM.

From Table 1, it can also be observed that the ash content of *Katang-katang* ranges from 1.19% to 2.25%, with an overall average of 1.95% across the three locations. The highest ash content was observed in Katang-katang plants growing in the Samas beach area. Ash content reflects the minerals and inorganic materials that remain after the removal of water, volatile compounds, and organic matter. Common minerals and inorganic materials found in ash include

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phosphorus, calcium, magnesium, sodium, and potassium [16].

The ash content of Katang-katang is relatively low, as the typical ash content for fodder plants ranges from 7% to 9%, making Katang-katang a good candidate for use as forage. Additionally, the silica and calcium levels in Katang-katang fall within the ideal range for feed. Katang-katang plants offer advantages due to their low energy and crude fiber content. The energy content varies, with 531.66 calories/gram (from Samas beach), 587.12 calories/gram (from Glagah beach), and 1,063.56 calories/gram (from Balongan Indah 2, Indramayu). The crude fiber content ranges from 1.58% to 2.35% (Table 1). Another advantage of Katang-katang is its content of flavonoids and alkaloids, which have been shown to inhibit the growth of *Staphylococcus aureus* and *Pseudomonas* sp. [17]; [18]). Furthermore [17] notes that these two bacteria are responsible for mastitis, which can reduce milk production in dairy cows [18]. Based on the proximate/chemical analysis, *Katang-katang* plants generally meet the minimum feed technical requirements (PTM) according to the Indonesian National Standard for Animal Feed (SNI Pakan,[19]. In addition to meeting PTM, as stated by [18] and [20], Katang-katang contains chemical compounds such as flavonoids and alkaloids, which contribute to improving animal health.

Katang-katang is a coastal weed that has not been fully utilized. Some communities use it as a traditional medicine for toothaches and itching caused by jellyfish stings. Additionally, Katang-katang is considered a threat to the conservation of the leatherback sea turtle (Dermochelys coriacea), as its roots penetrate the sand, disrupting nesting sites and leading to the destruction of turtle eggs [3].

Katang-katang, also known as railroad vine, bayhops, beach morning-glory, seaside yam, goat's foot, goat's foot morning-glory, and goat's foot creeper, is a fast-growing, creeping plant that occasionally climbs [21]. According to [21], state of katang-katang can spread over 100 feet in length. The plant has alternate, simple, and deeply lobed leaves that are green in color. Its axillary flowers are funnel-shaped, typically in shades of pink, lavender, reddish-purple, or, rarely, white. Katang-katang blooms year-round, with peak flowering occurring from May to November. The fruit is a four-chambered capsule that bursts open when mature and dry, with a brown color and fine hairs. The plant thrives in full sunlight and sandy soil with a slightly acidic to neutral pH. It is drought-tolerant and has a very high tolerance to salt. Propagation can be done through stem cuttings or seeds. Katang-katang is used in Australia as a poultice for stingray and stonefish stings, in Brazil to treat inflammation and digestive disorders, and in the Philippines, this plant is locally known as Bagasua and is used to treat rheumatism, colic, edema, whitlow, and hemorrhoids [21].

The biomass and abundance of Katang-katang are very high (Table 1). The abundance of Katang-katang is 45.11 plants/m², with a biomass of 1358.33 grams/m². These values are considered very high, indicating significant potential for further research on its use as animal feed. Given its high abundance and the fact that it has not been widely utilized, Katang-katang holds great promise as livestock feed. According to [22], plant-based biomass, especially from weeds in large quantities that humans do not consume, holds potential for utilization as animal feed in the production of meat, milk, and eggs.

Biomass reflects the organic matter content of a plant per unit area at a specific time. By assessing biomass, we can determine the total carbon, hydrogen, and oxygen content produced during the plant's growth through photosynthesis. The presence of high abundance and biomass serves as an indicator of a plant's fast growth rate and high adaptability. The abundance of Katang-katang plants is shown in Figure 1.

Figure 1: Abundance of *Katang-katang* assessed using the transect quadrat method through purposive sampling at a 1x1 m² plot (Samas beach).

TABLE 2: Abundance and Biomass of Katang-katang Plants at Different Locations

No.	Description	Sampling Location	Average of 3 Locations	Overall Average
1	Abundance (plants/m²)	Samas	**52.67**	45.11
		Glagah	45.33	
		Indramayu	37.33	
2	Biomass (g/m²)	Samas	**1503.33**	1358.33
		Glagah	1366.66	
		Indramayu	1205.00	

Based on the measurements taken from three locations—Samas, Glagah, and Indramayu—there is a noticeable variation in plant abundance and biomass. The Samas location recorded the highest plant abundance at 52.67 plants/m² and the highest biomass at 1503.33 g/m², followed by Glagah with 45.33 plants/m² and 1366.66 g/m², and Indramayu, which showed the lowest values for plant abundance (37.33 plants/m²) and biomass (1205.00 g/m²). The average abundance was 45.11 plants/m², and the average biomass was 1358.33 g/m². This variation reflects the influence of different environmental factors at each location. The abundance and biomass of a marine plant, such as a marine weed, are influenced by several environmental factors that interact dynamically. Light is an important factor in supporting the photosynthesis process, which directly contributes to biomass

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growth. Locations with better light intensity, such as Samas, can support higher photosynthesis rates, leading to greater biomass production [13]. In contrast, in Indramayu, which has the lowest biomass value, lower light penetration or more turbid water conditions may hinder the photosynthesis process, thus reducing plant productivity.

Nutrients also play a crucial role in determining the abundance and biomass of plants. The availability of nitrogen and phosphorus in the water significantly influences the growth of marine plants. In Samas, the high biomass may indicate sufficient nutrient availability to support plant growth [24]. In contrast, in Indramayu, the lower biomass could be related to limited nutrient availability or uneven nutrient distribution.

Salinity and seawater temperature are other physical factors that influence the growth of marine plants. Samas, which has the highest abundance and biomass, may have salinity and temperature levels that are closer to the optimal conditions for the growth of marine weeds compared to Glagah and Indramayu. The extreme variations in temperature and salinity in Indramayu may suppress plant growth, as reflected in the lower abundance and biomass values [25],[26].

Additionally, hydrodynamic factors and currents also influence nutrient distribution and sediment deposition. Strong or weak currents can limit the plant's ability to acquire the nutrients necessary for growth. The optimal hydrodynamic conditions in Samas may be one of the reasons for the high biomass at this location [27]. Biotic interactions, such as interspecies competition and herbivory, can significantly impact the abundance and biomass of marine weeds. Lower competition or reduced herbivory levels in Samas may support higher abundance, while higher herbivore pressure or competition in Indramayu may reduce the abundance and biomass of plants [28].

V. Conclusion

Based on the results of the study titled 'Potential of Katang-Katang Plants as Animal Feed: Abundance and Chemical Content Analysis at Three Locations,' the following conclusions can be drawn:

1. Abundance and Biomass: Railroad vine (Ipomoea pes-caprae) shows high abundance, with an average of 45.11 plants/m² and an average biomass of 1358.33 g/m² across three study locations (Samas, Glagah, and Indramayu). The Samas location exhibits the highest abundance and biomass, indicating more favorable environmental conditions for its growth.
2. Chemical Composition: The chemical composition of railroad vine, including crude protein, crude fiber, and ash, has values suitable for animal feed.
3. Microbiota Diversity: The study shows significant microbial diversity on railroad vine at the three locations, which may play a role in supporting livestock digestion and improving feed efficiency.
4. Further Research: Further research is needed to understand the interaction between the microbiota and the chemical composition of the plant, as well as its impact on feed quality. Palatability tests should also be conducted to assess livestock preference for this plant as feed.

Recommendations:

With its high abundance and chemical composition meeting livestock nutritional needs, railroad vine shows great potential as an alternative feed source. Utilizing this plant could help reduce feed costs and support sustainability in livestock farming.

Acknowledgment

The authors would like to express their gratitude to the Research and Community Service Institute of Universitas Mercu Buana Yogyakarta for their funding and support for this research..

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