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Herpetofauna Diversity at Eaglewood *Gyrinops vesteegii* Conservation Area in Pusuk Protected Forest, Lombok

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Abstract: Pusuk Protected Forest at Lembah Sari Village, Batu Layar District, western Lombok is *Gyrinops vesteegii* conservation area, the one of eaglewood trees in the Lesser Sunda Islands. Studying diversity and distribution of herpetofauna in conservation area to understanding how this fauna could be stabilized the community structure of organisms in the ecosystems with their act as secondary and tertiary consumers in food web organization. Herpetofauna in this area was captured by visual encounter surveys (VES) method. Eleven species of herpetofauna have been collected from eaglewood conservation area in protected forest of Pusuk, is comprised by four species of amphibians (*Duttaphrynus melanostictus, Ingerophrynus biporcatus, Limnonectes dammarmani* and *Limnonectes kadarsani*) and seven species of reptiles (*Ahaetulla prasina, Cyrtodactylus petani, Dendrelaphis pictus, Draco volans, Eutropis multifasciata, Gekko gecko, Sphenomorpus melanopogon* and *Sibynopis geminatus*). This animal group plays as a role in maintaining the stability of eaglewood ecosystems by controlling its pest populations such as moth larvae of *Heortia vitessodes* and white lice of *Dysmicoccus brevipes*. Based on this research, higher diversity of herpetofauna with varying types of their habitats could be control the varying types of forest tree pests.

Keywords: Conservation; Diversity; Herpetofauna.

Introduction

Herpetofauna is a group of poikilothermic vertebrates which comprised by amphibians and reptiles. The diversity information of this fauna especially in Lombok is still rare. This is caused by their ecological function less known than other vertebrae such as fishes, birds and mammals. According to Reptile Database in 2022 there are 11.940 species reptiles in the world, 799 species of them distributed in Indonesia. Whereas amphibians had been recorded approximately 6600 species in the word and 409 species had distributed in Indonesia. This makes Indonesian ranked 7th in amphibian diversity and 4th in reptile diversity (Iskandar, 1998).

Herpetofauna has an important role in maintaining ecosystem balances. These taxa groups could be control the tree pest in forest such as insect and other small invertebrates and also act as seeds dispersed (Valencia-Anguilar et al., 2013). Herpetofauna could be stabilized the faunal community structure in the ecosystems with their act as secondary and tertiary consumers in food web organization. Several species of herpetofauna had a sensitive in microclimate exchange such as thermal and humidity. Their existence influenced by environmental factors, it made herpetofauna could be used as a bioindicator of environmental changes (Yanuarefa et al. 2012).

Pusuk Protected Forest is one of the conservation areas which located in Lembah Sari Village, western Lombok. This area has been purposed to the conservation of *Gyrinops vesteegii*, the eaglewood species in Lesser Sunda islands. The conservation project has been conducted by *Dinas Kehutanan Provinsi NTB* (Forestry Office of West Nusa Tenggara) since 1996 with initiated the parental garden of *G. vesteegii* (Mulyaningsih et al., 2017). Distribution of this species covering each island in Lesser Sunda such as Lombok,

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Sumbawa, Flores, Sumba, Timor and Alor (Mulyaningsih et al., 2014).

The important to understanding the ecological function of herpetofauna made both species diversity and distributional data of these taxa as important information to measure the forest condition and as a basic data to manage the conservation area. In this study, we recorded the diversity of herpetofauna in *G. vesteegii* conservation areas at Pusuk Protected Forest, Lombok to evaluate the forest condition.

Method

Survey of herpetofauna diversity was carried out in the eaglewood *G. vesteegii* conservation area in Pusuk Protected Forest, Lembah Sari Village, western Lombok. Herpetofauna had been observed in two periods at the morning and night times. Diurnal herpetofauna was observed from 08.00 am to 02.00 pm in local times while for nocturnal animals were observed from 06.00 pm to 10.00 pm in local times. Herpetofauna was obtained through visual encounter surveys (VES) methods, where amphibians and reptiles are taken directly during an encounter on the observation track (Heyer et al., 1994). Observation track was followed the formed track in the forest.

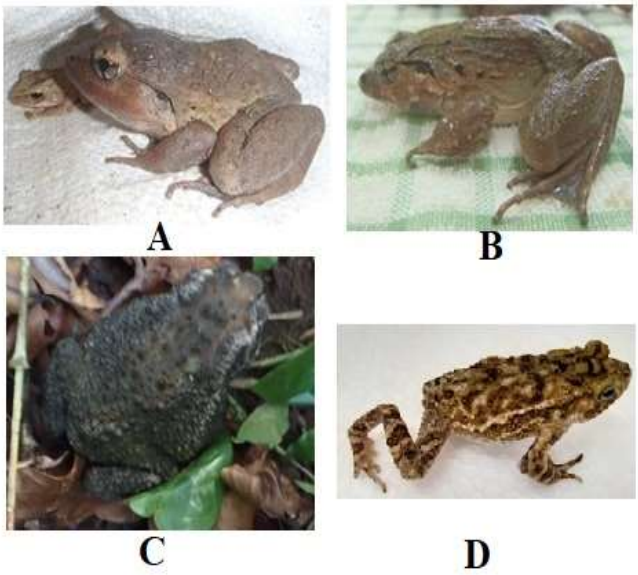
In this method, all types of herpetofauna habitats in the forest track such as trees, bushes, litter piles, wood piles, holes in the ground, pools or rivers around the eaglewood forest are observed. The harmless faunas such as frogs, toads, lizards, skinks, geckos, and agamid lizards (Agamidae) were captured by hand, nets or traps, whereas dangerous reptiles such as snakes were collected by hooks (Kusrini 2009; Yanuarefa et al 2012). Herpetofauna were identified using De Lang (2011), Iskandar (1998), Kurniati (2003), Somaweera (2017) and Yanuarefa et al. (2012).

Result and Discussion

Eleven species of herpetofauna were collected in the conservation areas of eaglewood *G. versteegii*, they comprised by four species of amphibians and seven species of reptiles. Four species of them (*Ingerophrynus biporcatus*, *Limnonectes dammermani, Limnonectes kadarsani*, and *Sphenomorphus melanopogon*) are endemic species and one species (*Cyrtodactylus petani*) is a new record for the Lesser Sunda Islands (Table 1; Figures 1 and 2). All of the herpetofauna in this study are common species found in the forest area of Lombok. The ecological function of these faunas is to maintaining the balance of the ecosystem in the eaglewood forest. Herpetofauna occupies the second and third levels in the food chain, so its existence can control the population of organisms in their below levels and maintain the stability of the food chain.

Table 1. Herpetofauna diversity in Protected Forest of Pusuk, Western Lombok

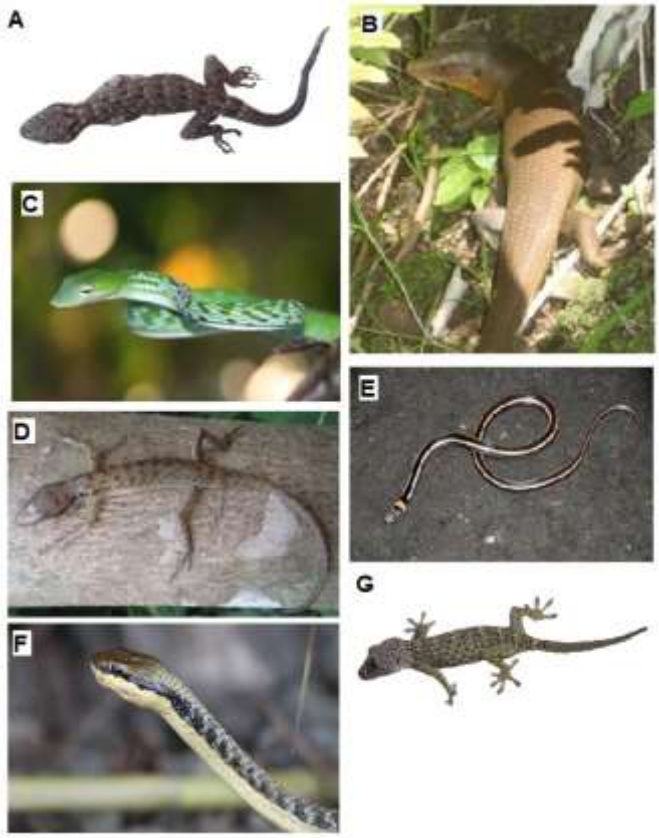
Families	Species	Habits and Habitats
Amphibians		
Bufonidae	*Duttaphrynus melanostictus*	Habitat in terrestrial. Nocturnal habit, but this species can be found until the morning at litter and grass surfaces near the eaglewood trees.
	Ingerophrynus biporcatus	Habitat in semiterrestrial. Nocturnal habit, but this species can be found until the morning at litter surface and rock near the river.
Dicroglossidae	*Limnonectes dammermani*	Habitat in the aquatic. Nocturnal habit, this species could be found at a rock or aquatic plants in the river.
	Limnonectes kadarsani	Habitat in the aquatic. Nocturnal habit, this species could be found at a rock or aquatic plants in the river.
Reptils		
Gekkonidae	*Gekko gecko*	Arboreal habitat, nocturnal habit, this species could be found in eaglewood stem.
	Cyrtodactylus petani	Arboreal habitat, nocturnal habit, this species could be found in a stem of eaglewood.
Scincidae	*Eutropis multifasciata*	Terrestrial habitat, diurnal habit, this species could be found sunbathing on the rock, foraging in the litter or underbrush near the eaglewood trees.
	Sphenomorphus melanopogon	Arboreal habitat, diurnal habit, this species could be found on the stem of eaglewood and sometimes foraging on the forest floor.
Agamidae	*Draco volans*	Arboreal habitat, diurnal habit, this species could be found in the stem of eaglewood
Colubridae	*Ahaetulla prasina*	Arboreal habitat, diurnal habit, this species could be found in the branch of eaglewood trees.
	Sibynophis geminatus	Terrestrial habitat, diurnal habit, this species could be found under of litter near the eaglewood trees.
	Dendrelaphis pictus	Habitat in terrestrial. Diurnal habit. This species could be found in the litter surface near eaglewood tree



Figures 1. Amphibian in Conservation Areas of Pusuk Protected Fores, Western Lombok. (A) *Limnonectes kadarsani*; (B) *Limnonectes dammarmani*; (C) *Duttaphrynus melanostictus*; (D) *Ingerophrynus biporcatus*.

Herpetofauna comprises a diverse array of species that cover a broad spectrum of dietary requirements. Amphibians and several small reptiles such as skinks and geckos commonly are insectivorous, whereas lizards and snakes could be classified as carnivorous. Insects as a prey of herpetofauna are dominant taxa in forest ecosystems and generally occupies as herbivores. Several of it act as a pest for the plants and could damage the growth and health of trees in the conservation areas. During this study, we found several eaglewood trees were dead caused by moth larvae of *Heortia vitessodes* and white lice of *Dysmicoccus brevipes* attach (Figures 3).

Both of these pests commonly threated the eaglewood plants from seedlings aged six months to mature trees that are five years old. The caterpillar of moth generally consuming green leaves the trees which it caused photosynthesis disrupted. Although this herbivory is not usually fatal, an eaglewood plant whose body parts have been eaten by pests must expend energy to replace the loss and it could inhibit eaglewood growth. In special cases when the population of moth larvae are blooming, it could the tree leafless and then the caterpillar will damage the tip of eaglewood plants which can cause the death of trees. In the other side, the white lice will tap into the phloem and sucking the stem fluid until the tree malnutrition. The attack of these two pests from year to the year continued to increase significantly in both of eaglewood natural forests and plantation in Indonesia (Turjaman et al., 2009).



Figures 2. Reptil in Conservation Areas of Pusuk Protected Forest, Western Lombok. (A) *Cyrtodactylus petani*; (B) *Eutropis multifasciata*; (C) *Ahaetulla prasina* (Courtesy of Taofi Kussani); (D) *Sphenomorphus melanopogon*; (E) *Sibynophus geminatus* (Courtesy of Monito Supratman); (F) *Dendrelaphis pictus* (Courtesy of L. Ahmad Tantilar); (G) *Gekko gecko* (Courtesy of Islamul Hadi).

Figures 3. Pets Insects in Conservation Areas of Pusuk Protected Fores, Western Lombok. (A) *Heortia vitessoides*; (B) *Dysmicoccus brevipes*.

In addition to these two types of pests, other pest insects that attack eaglewood include leaf beetle larvae (*Phaedonia inclusa*), grasshopper (*Valanga* spp.), plant ladybugs (*Anasa* spp.) and hemiptera (*Leptocorisa oratorius*). The highest damage of agarwood forest is caused by caterpillar of moth (Rahayu & Maharani 2012). Reproductive ability and survival level of pest insects will influence the damage level of host plants, while the existence of predators that will control the population of pest insects (Sumardi and Widyastuti 2004).

The small size of insects makes them difficult to preying by bigger fauna such as birds and mammals. In the other hand, the reptiles and amphibians which have varying types of habitats (aquatic, terrestrially, litter surface, burrowing, and arboreal) enables to exploit the small insects and making these herpetofauna as generalist predators (Santos et al 2004). Zamroni et al. (2021) checked the gastric content of amphibians from eaglewood conservation area of Pusuk Forest, western Lombok. The main anurans gastric content in this area are hymenoptera, coleoptera, orthoptera and chilopods. These four major taxa comprised more than 50% of gastric content. Pal et al. (2007), reported the diet composition of agamid lizards comprised majority by ants (Hymenoptera) and caterpillar (Lepidoptera) which these preys always found in the stomach of each lizard. It's meant the insects are the main components of herpetofauna preys (Vitt & Caldwell 1994). Many of herpetofauna have opportunistic characters which they can use resources in their habitat (Hofrichter, 2000; Rahman, 2013). Among the herpetofauna, snakes are the top predators that can prey insects, fish, amphibians, other reptiles, birds, and/or other small mammals (Mushinsky, 1987). Based on this research, higher diversity of herpetofauna with varying types of their habitats could be control the varying types of forest tree pests.

Conclusion

Eleven species of herpetofauna which was successfully collected in the eaglewood (*G. versteegii*) conservation area at Pusuk protected forest, western Lombok, consisted of four species of amphibians and seven species of reptiles. The hight diversity of this herpetofauna with varying types of their habitats could be control the varying types of pests in the forest.

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Author Contributions
YZ, AJ and BF conceptualized and designed the research. YZ, AM, and TM carried out fieldwork, data collection, and identified specimens. All authors wrote the manuscript.

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Conflicts of Interest
The authors declare that there is no conflict of interest regarding the publication of this paper

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