



Diet Composition of two species of swiftlets from caves of Northern Mindanao, Philippines

Crista Jane P. Nituda and Olga M. Nuñez*

Department of Biological Sciences, College of Science and Mathematics, Mindanao State University – Iligan Institute of Technology, Iligan City, Philippines.

*Corresponding author's email: olgamnuneza@yahoo.com

ABSTRACT

*Caves serve as sanctuaries for birds especially swiftlets, the most common cave-dwelling birds. This study was conducted to determine and compare the diet composition of the two species of swiftlets, *Collocalia esculenta* and *Aerodramus vanikorensis*. Examination of the gut contents showed that the two bird species are generally insectivorous and the prey items consisted of insects under Orders Coleoptera (beetles), Hymenoptera (wasps, ants, and bees), Diptera (flies), and Odonata (damselflies). There was no significant difference in the frequency of occurrence of the prey items between species since both species prefer the same prey items. However, percentage occurrence of the different prey items within the same species was significantly different ($p < 0.05$). Coleopterans were the abundant prey items. The wide diversity of the diet of cave swiftlets suggests that these birds are not particularly selective in their diet and are more probably dependent on the available prey. Results indicate that swiftlets are good insect control agents. Collection of swiftlet nests inside caves appears to be a major threat to cave swiftlets.*

Keywords: birds, cave-dwelling, insect, insectivorous, prey.

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INTRODUCTION

Cave is a fragile environment and one of the unique habitats of birds especially swiftlets [1]. Swiftlets live in colonies mostly on mountains or coastal caves and rarely in open areas and towns [1, 2]. Swiftlets have spatial variations in twist, flatter, and tail-wing-open foraging maneuvers [3]. Also, these birds have long wings and tail that enable them to forage much closer to vegetation [4]. These small aerial insectivores are distributed throughout southern Asia, Malay Peninsula, and the islands of south Pacific. Furthermore, swiftlets inhabit caves for nesting and breeding where some species navigate using a crude form of echolocation [5]. These birds are mainly diurnal foragers [6, 7] and gather their food entirely on the wing where they selectively sample the array of arthropods such as spiders and insects available [8]. During the day, they leave the cave to search for food and return to their roost at night. With an open mouth, swifts drink by flying near the surface of water. There are some nocturnal and diurnal species of swiftlets and most of them feed at dawn or dusk and roost during the hottest part of the day [1]. Thus, swiftlets substantially support the food chain and food web in many caves [9] and they control insect population [10, 11]. However, human disturbance unknowingly alters cave environments destroying unique and valuable organisms including swiftlets. The prevalent threats to swiftlet population are overexploitation, loss of foraging habitats, and nest harvesting which has become a tradition in many local communities, [12]. Swiftlets as insectivorous birds [10, 11] are important agents in pest control. One of the basic requirements for swiftlet habitat and productivity is the food source [13]. Hymenoptera (bees, wasps, and ants), Diptera (true flies), Hemiptera (true bugs) and Coleoptera (beetles) were noted in the diet of swiftlets [14]. The study of Langham [15] who examined the diet of swiftlets by analyzing the food balls regurgitated by mist netted adults revealed over 500 prey items which included Hymenoptera (48%), Ephemeroptera (26%), Homoptera (15%) and Diptera (7%). Moreover, a number of studies had been conducted in many countries [13, 14, 16, 17, 18] showing that the potential prey varies in its abundance, and thus availability, both geographically and temporally. Detailed knowledge of food and diet can benefit the conservation of rare species by providing critical information for evaluating life history, threats, and recovery actions [16]. However, data are very limited in Mindanao, the second largest island

in the Philippines especially for species residing in caves. Thus, this study was conducted to determine and compare the diet composition of two species of swiftlets, *Collocalia esculenta* and *Aerodramus vanikorensis* collected from seven caves in Northern Mindanao. The existing threats to the cave habitats of these swiftlets were also identified.

METHODOLOGY

Two species of swiftlets were captured from seven caves in Northern Mindanao for diet analysis. Only *Collocalia esculenta* was present in the caves in Barangay Matangad, Gitagum, Misamis Oriental and Barangay Minsalirac, Quezon while only *Aerodramus vanikorensis* (formerly known as *Collocalia vanikorensis*) was present in Barangay Poblacion, Kitaotao and Barangay Concepcion, Valencia. Among the seven caves, only Kabyao Cave in Bukidnon had both *Collocalia esculenta* and *Aerodramus vanikorensis*. Less number of bird individuals were captured in this area.

The swiftlets were captured using the mist netting method. Morphometrics were obtained using the vernier caliper while weights were taken using a Pesola spring balance. Identification was based on Guide to the Birds of the Philippines [2]. Removal of stomach contents was carried out in the field to minimize digestion and decomposition. The contents were placed in a vial and preserved in 70% ethyl alcohol. Stomach contents were brought to the laboratory for further analysis using the stereomicroscope. Fragments of bodies inside the gut like wings, legs, head capsules, mouthparts, or antennae were sorted, grouped, and identified using Philippine Insects as reference [19]. The percentage occurrence was calculated using the modified formula [20] as shown below:

$$\text{percentage occurrence of prey items} = \frac{\text{Number of individuals with prey items}}{\text{Total number of individuals dissected}} \times 100$$

Analysis of variance was used to test the significant difference of the prey items according to cave site and the two species of swiftlets.

RESULTS AND DISCUSSION

Beetles (Order Coleoptera), ants, bees and wasps (Order Hymenoptera), flies (Order Diptera), damselflies (Order Odonata), and amorphous materials were found in the gut of swiftlets. Figure 1 shows the percentage occurrence of the different prey items in *C. esculenta* and *A. vanikorensis*. Of the two cave birds, *A. vanikorensis* had the highest percentage (64%) of prey intake (Order Coleoptera) while *C. esculenta* had 57.82% (Order Coleoptera). This result concurs with the findings of Louire and Tompkins [14] that the Glossy Swiftlet, *C. esculenta* takes a higher prey intake of Coleoptera.

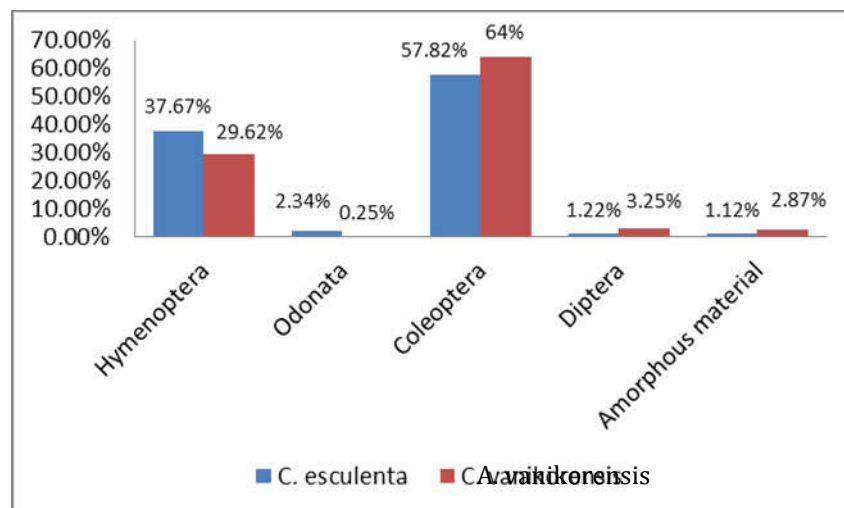


Figure 1. Comparison of the percentage frequency occurrence of each dietary item observed from all sampled individuals of *C. esculenta* and *A. vanikorensis* in all cave sites.

Coleoptera was the most common prey item in the guts of the two swiftlet species and these prey items were in the form of beetle heads, pronotum, elytra, and abdomen. Majority of the sampling sites are near cultivated areas where Coleopterans are expected to be abundant and could be the easily available food items for birds. According to Asokan *et al.* [18], Coleopterans form the principal food items for birds that forage in agricultural lands due to their greater availability. In addition, Coleoptera is found in nearly all

natural habitats, that is, vegetative foliage, from trees and their bark to flowers, leaves, and underground near roots, even inside plants like galls, tissue, including dead or decaying ones [21, 22] which could also be the reason for being the most common dietary item since Coleoptera is found in all major habitats, except marine and the Polar region [21]. Table 1 shows the comparison of the percentage frequency occurrence of each dietary item occurring in all individuals of a species of swiftlet sampled from all cave sites.

Table 1. Percentage frequency occurrence of the different prey items of the two swiftlet species.

Species	Cave Site	Percentage occurrence of the Dietary item				
		Hymenoptera	Odonata	Coleoptera	Diptera	Amorphous material
<i>Collocalia esculenta</i>	1	35.38%	0.99%	62.02%	-	1.68%
	2	42.69%	4.49%	49.44%	2.93%	0.45%
	3	27.73%	-	71.42%	-	0.85%
<i>Aerodramus vanikorensis</i>	3	37.5%	-	50%	-	12.5%
	4	24.63%	-	64.54%	2.46%	8.37%
	5	41.44%	-	54.28%	2.85%	1.43%
	6	21.4%	-	75.22%	3.47%	-
	7	36.57%	0.77%	58.36%	4.3%	-

1=Gitagum Cave, 2=Cave 1, Quezon; 3=Kabyao Cave; 4=Cave 1, Kitaotao; 5=Cave 2, Kitaotao; 6=Cave 3, Kitaotao; 7=Salawao Cave.

Majority of the sampling sites are situated near cultivated *Spondias purpurea* trees (Spanish plum), coconut farms, rice fields, corn and few bananas, cogon (*Imperata cylindrica*), bamboo and herbaceous plants where beetles prefer to inhabit [19]. The study on the diet of *Aerodramus bartschi* (Mariana swiftlet) in Mariana Islands within Micronesia showed that Coleoptera and Hymenoptera were the dominant prey items of Mariana Swiftlets [16], a finding supporting the present study. It appears that *C. esculenta* and *A. vanikorensis* also have the same dominant prey items with *A. bartschi*. A study further implies that insectivorous birds predominantly prefer coleopterans [18]. But this was not true to studies conducted in other areas although similar representation of dietary items was found in the diet of certain swiftlet species examined. In Malaysia, Hymenoptera and Diptera were the most abundant prey in all diets of four species of swiftlets including the glossy swiftlet documented from different habitats [14]. Another study showed a variety of food items of the Alpine swift which included several arthropods, mainly insects but also spiders; Homoptera, Diptera, and Hymenoptera being the most often consumed [8]. The study on the diet of Common Swift and Pallid Swift showed that Coleoptera and Hymenoptera are the most consumed prey [23]. A study conducted on food boluses of the white-nest swiftlet from palm oil plantations in Johor by Kamarudin and Anum [24] also showed that the majority of insects found were from the orders Diptera and Hymenoptera. The arthropod orders noted in the diet of the swiftlets in the present study were also documented by some related studies in the past. In two caves in Fiji, the food items of white-rumped swiftlet (*Aerodramus spodiopygius*) were examined where Diptera (flies), Homoptera (planthoppers), Hymenoptera (social insects, Isoptera (termites), and Coleoptera (beetles) were the most numerous prey items found [17]. The Malaysian Edible Bird's Nest swiftlets feed on Hymenoptera (winged ants, fig wasps and bees), Coleoptera (small beetles), Homoptera (leafhoppers), and Ephemeroptera (mayflies). Insects under Order Odonata had the least number of occurrence [13]. In the present study, the rest of the prey items other than Coleoptera and Hymenoptera were represented by head of a fly (Diptera), head of a damselfly (Odonata), and amorphous materials which had low occurrence in both bird species with the latter being absent in the diet of *A. vanikorensis* in two caves. Odonata was present only (0.77% occurrence) in the diet of *A. vanikorensis* from cave 7 (Salawao Cave). Salawao is a big cave with a body of water flowing out of the cave. This can be correlated with the presence of Odonata because Odonata utilizes a very wide range of freshwater habitat, from permanent running waters [25] and lakes to small temporary rain pools [26]. Odonata (females) lays eggs in or around the water, either lentic or lotic waters [27]. This also implies the reason why Odonata was absent in other caves in this study. The findings of the present study are more or less similar to previous studies but seem to differ on which arthropod orders were mostly consumed by certain species in certain locale which could imply a potential diet preference. The low occurrence of some food items could indicate the low or non availability of these prey items in certain cave sites, such as in the case of the presence of Odonata in the diet of *A. vanikorensis* in Cave 7, or it could be that both bird species have really low preference for these prey items. In general, both species prefer the same prey items. There is no

significant difference in the frequency of occurrence of the prey items between species. However, frequency of occurrence of the different prey items within species is significantly different ($p < 0.05$). The presence of different prey items suggests that these two swiftlet species are not particularly selective in their diet. Their diet was probably dependent on the available prey present in the vegetation and their foraging behavior. This result concurs with the findings of Hao *et al.* [28] that that swiftlets are not particularly selective in their diet composition, but react to food availability. The study of Lourie and Tompkins [14] which compared the diet composition of the Glossy swiftlet in forest, rural, and urban habitats showed that the dietary composition of these insectivorous birds mainly differ quantitatively and not due to the diversity of their prey. Therefore, it is unlikely that a variation in any one prey component would significantly influence the overall growth and development of these birds [28]. It is clear from the composition of insects in the diet of *C. esculenta* (98.88%) and *A. vanikorensis* (97.13%) that these two species are generally insectivorous.

In this study, threats to the swiftlets were also noted. Human disturbances such as treasure hunting, vandalism, and cooking inside caves were observed in the sampling sites which are considered as threats to cave-dwelling birds [16]. According to Soldatini *et al.* [29] human disturbance in a cave could negatively affect cave fauna because disturbed and threatened animals could leave cave environment and may find no suitable substitute habitat. There were also evidences of nest collection, *kaingin* or slash-and-burn farming in the immediate vicinity of the caves and improper garbage disposal in the surrounding areas. Nest collection and treasure hunting were very rampant in the sampling site in Barangay Minsalirac, Quezon. Because of the remote location of caves, nest collection is difficult to control. It is suspected to account for a substantial proportion of the swiftlet-nest trade. Exploitation and the loss of foraging habitats could lead to the increasing pressure on the swiftlet population especially the cave-dwelling species.

CONCLUSION

The prey items of the two species, *Collocalia esculenta* and *Aerodramus vanikorensis* were predominantly insects under Orders Coleoptera (beetles), Hymenoptera (wasps, bees, and ants), Diptera (flies), and Odonata (damselflies). Beetles were the most abundant diet item. There is no significant difference in the frequency of occurrence of the prey items because both species prefer the same prey items. However, frequency of occurrence of the different prey items within species is significantly different. The different prey items suggest that these birds are not particularly selective in their diet and are probably dependent on the available prey present in the vegetation and the foraging behavior of these species.

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