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Short Communication

Stomach content analyses of lizard species from Mindanao Island, Philippines

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Palavras-chave: Dieta, *Gonocephalus semperi, Gonocephalus sophiae,* Hábitos alimentares, *Tropidophorus misaminius*.

The Philippines is home to 209 lizard species (Uetz *et al.* 2021), of which 74% are endemic (Brown *et al*. 2013a). Knowledge of lizard species in the country has been focused mainly on species accounts in various localities from Luzon (Diesmos *et al.* 2004, Devan-Song and Brown 2012, Siler *et al.* 2012, Brown *et al.* 2013b, Binaday *et al.* 2017, Cruz *et al.* 2018); Visayas (Denzer *et al.* 1994, Ferner *et al.* 2000, Bucol *et al.* 2011, Supsup *et al.* 2016, Obeña *et al.* 2021); and Mindanao (Delima *et al.* 2007, Nuñeza *et al.* 2010, Beukema 2011, Supsup *et al.* 2017, Venturina *et al.* 2020, Pitogo *et al.* 2021, Solania *et al.* 2021). Data on the diet of lizards from the country remain limited (Villadolid 1934, Reyes 1957, Auffenberg and Auffenberg 1988, Struck *et al.* 2002, Bucol *et al.* 2011, Law *et al.* 2018, Tabug *et al.* 2018).

Information on diets from earlier reports used field observations (Bucol *et al.* 2011, Bennett 2014), claw material subjected to isotope analysis (Struck *et al.* 2002), individual tracing, and fecal sample examination (Law *et al.* 2018), in addition to inspection of stomach contents from captured wild specimens prior to preservation (Tabug *et al.* 2018) and stomach content analysis of preserved specimens (Villadolid 1934, Auffenberg and Auffenberg 1988).

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The diet of *Lamprolepis smaragdina* (Lesson, 1829) has been examined from Visayas (Reyes 1957, Bucol *et al.* 2011) and Luzon (Auffenberg and Auffenberg 1988). Information about the diet of *Gonocephalus* in the field from Panay Island and from captive individuals is also available (see Gaulke and Demegillo 2005, Gaulke 2011). No information is available on the diet of *Tropidophorus misaminius* Stejneger, 1908.

This study provides data on stomach content analyses of three endemic lizards: *Gonocephalus semperi* (Peters, 1867), *Gonocephalus sophiae* (Gray, 1845), and *Tropidophorus misaminius*. Frequency of occurrence, food item condition, and degree of food preference were investigated. Additional information augments knowledge of the diet of *Gonocephalus* species. In contrast, information on the diet of *T. misaminius* is possibly the first published account of the preferred food items of this species. We also present information on the stomach contents of *L. smaragdina* that confirms previous accounts of a diet of hymenopterans in this species.

Samples used for this study are voucher specimens collected from three biodiversity areas in Mindanao: Mount Sinaka, Mount Hamiguitan, and Lake Sebu (Figure 1). Specimens used were part of previous collections housed at the College of Science and Mathematics of the University of the Philippines-Mindanao. Snout–vent length (SVL) of all specimens was measured before removal of the stomachs. Verification of specimen identification followed the field guide for amphibians and reptiles of the Philippines (Alcala 1986), coupled with a review of recently published accounts of reptile species.

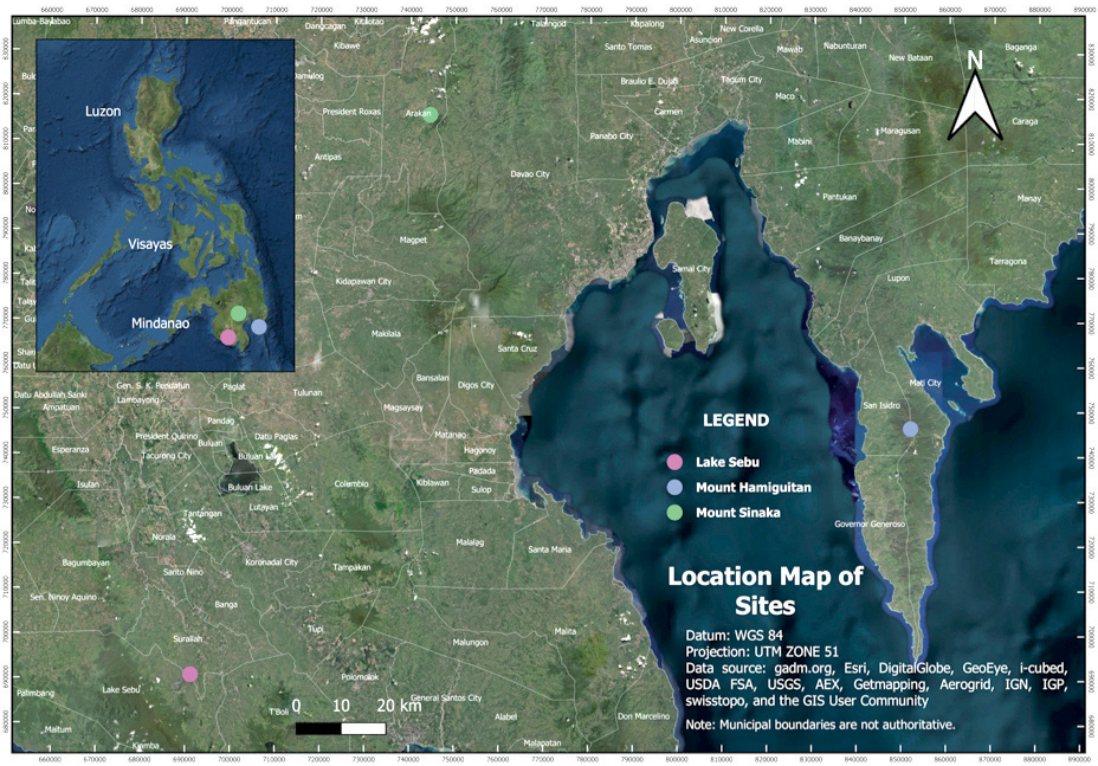

Figure 1. Map showing location of biodiversity areas in Mindanao Island, Philippines where specimens were previously collected.

Stomachs from voucher specimens were cut at least 2 cm above and below the cardiac and pyloric ends. The stomach content analysis included frequency of occurrence, condition of prey items, and degree of food preference following the method of Santos *et al*. (2004).

Thirty-one voucher specimens were inspected for stomach contents. All samples were adults representing three endemic lizards (SVL, mean ± SD): *Gonocephalus semperi* (95.12 ± 13.54 mm, *N* = 7), *G. sophiae* (88.01 ± 9.22 mm, *N* = 5), and *Tropidophorus misaminius* (68.02 ± 23.02 mm, *N* = 12), and the widely occurring species *Lamprolepis smaragdina* (77.42 ± 11.47 mm, *N* = 7). Of the 31 stomach samples, 25 contained food items. A total of six food items were identified: three from the Class Insecta (Orders Coleoptera, Hymenoptera, and Orthoptera), one from the Class Arachnida (Order Araneae), and one from the Class Clitellata (Order Haplotaxida), in addition to plant material. The ingestion of plant material could be accidental, conforming with the observation of Auffenberg and Auffenberg (1988). Although food item composition varied among the species, samples of the order Hymenoptera were present in all stomachs (Table 1).

Table 1. Frequency of occurrence (%), condition, and degree of preference of food items found in the stomachs of lizards collected from the different areas of Mindanao. Frequency (*F*): c - constant > 50%, s - secondary 25–50%, a - accidental < 50%. Condition of food item (CFI): 1 - fresh whole organisms relatively intact, 2 - intermediate body parts and most flesh intact with other body parts digested, 3 - immeasurable body parts but higher taxon or species group still identifiable, 4 - fully digested amorphous substance. Degree of Preference (DP): hp - highly preferential 3 < DFP < 4, p - preferential 2 < DFP < 3, s - secondary 1 < DFP < 2, o - occasional 0 < DFP < 1. *N:* number of stomachs with contents.

Food items		***Gonocephalus semperi*** (*N* = 7)	***Gonocephalus sophiae*** (*N* = 5)	***Lamprolepis smaragdina*** (*N* = 3)	***Tropidophorus misaminius*** (*N* = 10)
Araneae	*F*(%)				20^{a}
	CFI				1
	DP				0.8^{o}
Coleoptera	*F*(%)	57.14^{c}	60^{c}		20^{a}
	CFI	2,3	1,3		3
	DP	2^{p}	2.2^{p}		0.8^{o}
Haplotaxida	*F*(%)				20^{a}
	CFI				3
	DP				0.8^{o}
Hymenoptera	*F*(%)	$42.86^{s(2,3)}$	$40^{s(3,3)}$	$100^{c(1)}$	20^{a}
	CFI	2,3	3,3	1	1
	DP	1.57^{s}	1.2^{s}	4^{hp}	0.8^{o}
Orthoptera	*F*(%)	$28.57^{s(3)}$			10^{a}
	CFI	3			3
	DP	0.86^{o}			0.4^{o}
Plant material	*F*(%)	$28.57^{s(3)}$	$20^{a(3)}$		10^{a}
	CFI	3	3		3
	DP	0.43^{o}	0.8^{o}		0.4^{o}

The inclusion of Hymenoptera as a food source in *L. smaragdina* is not as novel as previously reported (see Reyes 1957, Bucol *et al.* 2011). Current data did not include termites in the list of food items although field observations by Bucol *et al.* (2011) reported *L. smaragdina* foraging near colonies of ants and termites while Auffenberg and Auffenberg (1988) noted that ants and termites are preferred by *L. smaragdina* during the dry season. Another food item not represented in the present study is Lepidoptera, which was reported by Reyes (1957) as a major food source for *L. smaragdina* in Dumaguete, Visayas area.

This study provides novel information on the preferred food items of *T. misaminius,* for which no previous studies exist. Moreover, the data provided here on the diet of *G. semperi* and *G. sophiae* augments knowledge based on previous accounts (Gaulke and Demegillo 2005, Gaulke 2011) because specimens used in this study are from Mindanao Island. The presence of Coleoptera from the gut of *T. misaminius* may be expected because Villadolid (1934) reported its presence from the stomach of *Tropidophorus grayi* Günther, 1861, a close congener of *T. misaminius*.

Information presented here on the frequency of occurrence, food item condition, and degree of food preference is the first account for these Philippine species. Hymenoptera (present in all four species) and Coleoptera (present in three species, with the exception of *L. smaragdina*) occurred frequently in the stomachs of the samples examined. Data also show higher degrees of preference of the lizards for Hymenoptera and Coleoptera. These prey items (Hymenoptera and Coleoptera) are also more intact compared to the rest of the invertebrate food items. The condition of prey items may be affected by the time individual frogs were alive prior to preservation, as well as the period the voucher specimens were stored before stomach analysis.

The findings of the current study present the first published information on the diet of the endemic lizard *T. misaminius* from Mindanao, Philippines, in addition to providing additional knowledge on the diets of *G. semperi* and *G. sophiae*. Data can be utilized to broaden understanding of the life history traits of these endemic reptile species. Diet analyses of more samples from other localities are necessary for an enhanced understanding of the food ecology of these species. The utility of voucher specimens needs to be regulated to reduce wildlife collections yet to provide essential information for diet studies.

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