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Short Communication

The First Record of Snake Predation by an Invasive Species, *Calotes versicolor* (Daudin, 1802) in Indonesia: A Case Study on its Feeding Ecology

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ABSTRACT
Calotes versicolor (Daudin, 1802) is an agamid lizard originating from India, now widespread across Asia and invasive in certain regions, including parts of the Malay Archipelago. Here, we report its first recorded snake predation in Indonesia. A male *C. versicolor* was observed consuming an adult Painted Bronzeback Snake (*Dendrelaphis pictus*). The lizard began swallowing the snake headfirst and fled with it still wriggling in its mouth. This observation highlights the species' capacity to prey on larger vertebrates, underscoring its potential ecological impact in invaded habitats. Further studies are needed to clarify its feeding ecology and implications for native fauna.

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Calotes versicolor, commonly known as the Oriental-garden lizard or Common-garden lizard, belongs to the family Agamidae within the order Squamata. *Calotes versicolor* (Daudin, 1802) (Squamata: Agamidae) originated from India and is distributed across Asia (Daniel 2002; Gowande et al. 2016). It has also been introduced and become an invasive species in several other countries (Kraus 2009; Enge & Krysko 2019; Ginal et al. 2022; Uetz et al. 2024). It has been documented as an invasive species in multiple regions, including the Malay Archipelago, where its presence raises concerns about its ecological impact on native fauna (Daniel 2002; Gowande et al. 2016; Uetz et al. 2024). Within the Malay Archipelago region, it was first documented by De Rooij (1915) from the nearby Sundaic island of Sumatra, specifically in Olehleh (5.576667°, 95.293334°). The exact administrative at present day is Ulee Lheue, District Meuraxa, City of Banda Aceh, Aceh Province. Years after, Brongersma (1931) reported three additional specimens from about 60 km north of Medan in Sumatra Utara Province, Indonesia (Das et al. 2008). Far east of Sumatra across the Malacca Strait and the South China Sea, Das et al. (2008) reported the distribution of *C. versicolor* in Borneo. Vinson (1870) documented the species' introduction to Mauritius, noting that the founding population originated from Java (Das et al. 2008).

This lizard exhibits remarkable adaptability, occupying diverse habitats ranging from arid landscapes to dense forests. While primarily insectivorous, its opportunistic feeding habits have led to reports of predation on various vertebrate species, including birds, amphibians, and other reptiles. However, detailed studies on its feeding ecology remain limited, particularly concerning its interactions with snakes.

This study presents the first documented case of snake predation by *C. versicolor* in Indonesia, specifically involving an adult Painted Bronzeback Snake (*Dendrelaphis pictus*). Such an observation sheds light on the lizard's capacity to prey on relatively large vertebrates and raises questions about its role in local food webs.

Calotes versicolor, or Oriental-garden lizard, or Common-garden lizard, is described as an arboreal, diurnal lizard that favours habitats such as gardens, arid desert biotopes, dense forests, hedges, and scrublands (Daniel 2002). We consider the species as *C. versicolor* since it was morphologically identical to this group, as mentioned by Zug et al. (2006). We are unable to collect the lizard to check the deeper identity of the population in Java. Since it was mentioned by Uetz et al. (2024) that it is a widespread species and its range fits into the region, we use *C. versicolor* for the specimen recorded and discussed within this article.

Information regarding the diet and feeding habits of Indian lizards remains fragmented (Pal et al. 2007). The diet of *C. versicolor* is primarily composed of annelids, mollusks, insects, millipedes, centipedes, earthworms, arachnids, crustaceans, plant material, bird eggs, and various vertebrates, including small birds, frogs, its hatchlings (cannibalism), other lizards, and even iguana faeces, other reptiles, and mammals (Matyot 2004; Sudasinghe & Somaweera 2015; Khandakar et al. 2020).

The success of *C. versicolor* as an invasive species can be attributed to several ecological and behavioural factors: 1) High Reproductive Output – Females lay multiple clutches per year, each containing up to 16 eggs, facilitating rapid population growth (Khandakar et al. 2020); 2) Broad Dietary Range – While primarily insectivorous, its diet extends to annelids, mollusks, arachnids, crustaceans, amphibians, reptiles, birds, and small mammals (Matyot 2004; Sudasinghe & Somaweera 2015); 3) Habitat Plasticity – The species thrives in urban and rural environments, from home gardens to dense forests (Daniel 2002).

Understanding the dietary habits of invasive species is crucial for as-

sessing their ecological impact. Predation on native reptiles like snakes may indicate a shift in their feeding ecology or heightened competition with native predators.

OBSERVATION OF SNAKE PREDATION

We reported an opportunistic observation concerning the diet of the invasive species *C. versicolor* within a housing area in Karanganyar, Central Java, Indonesia (-7.558026°, 110.88269°). On 31 October 2024, at 09:52 hrs, an adult male *C. versicolor* was observed consuming a live adult Painted Bronzeback Snake, *Dendrelaphis pictus* (Gmelin 1789), on a Bilimbi (*Averrhoa bilimbi* L.) tree (Figure 1). The scene was in a tree in front of the house at a height of approximately 2,5 meters above the ground. The approximate Total length (TL) of the *Calotes versicolor* was 30 cm, while the snake's length was approximately 80 cm. The lizard was first observed while it was still killing the snake. It was known by the movement of the snake twisting around while the lizard secured the head (Figure 1). It was never released until the snake stopped moving and hanging in the lizard's mouth. The lizard commenced feeding on the snake from its head, followed by the swallowing process, and afterward swiftly fled with the wriggling snake in its mouth upon closer observation. We have not managed to record the entire process since it quickly vanished in the leafy area, as it responds after being disturbed. At that time, *C. versicolor* attacked *Dendrelaphis pictus* and managed to make it part of its diet. This could happen as a result of overlapping habitats used by both reptile species of the order Squamata.

This observation is significant for several reasons. Firstly, it was the first record in Indonesia, while *C. versicolor* has been documented consuming vertebrates; this is the first confirmed case of snake predation in Indonesia. Secondly, it also has implications for local fauna, which predation on a native snake species suggests potential disruptions in local ecological dynamics. Lastly, the size and handling of prey are also interesting due to the size of the snake being approximately three times the length of the lizard, demonstrating its capability to subdue relatively large prey.

COMPARATIVE ANALYSIS OF SNAKE PREDATION BY *CALOTES VERSICOLOR*

There is limited information regarding snake species consumed by *C. versicolor* in Indonesia. Sharma (1999) was the first to document *C. versicolor* preying on a juvenile Indian wolf snake, *Lycodon aulicus* (Linnaeus, 1758). Thite and Nelekar (2012) was the second report of snake predation by *C. versicolor* and the first record of *Xenochrophis piscator* as a prey species. Our observation is the first record of snake predatory by *Calotes versicolor* from Indonesia. Opportunistic observations such as this provide valuable insights into the dietary habits of *Calotes versicolor* on various species.

A comparative analysis of known cases reveals the following patterns: 1) Prey Size: Typically, prey items are smaller than or comparable to the lizard's body size. However, this case demonstrates the consumption of a prey item significantly larger than the predator; 2) Prey Handling: Predation events follow a similar pattern—headfirst ingestion to minimise defensive retaliation from the snake; 3) Habitat Overlap: Predator and prey were observed in overlapping microhabitats, suggesting opportunistic rather than specialised snake predation.

ECOLOGICAL IMPLICATIONS

The ability of *C. versicolor* to consume large vertebrates raises concerns regarding its ecological impact in invaded habitats. Several potential implications warrant further investigation:

1. Displacement of Native Predators – As an introduced species, *C. versicolor* may compete with native lizards, birds, and snakes for similar prey resources.
2. Impact on Native Snake Populations – Increased predation pressure on species like *D. pictus* may influence population dynamics.
3. Trophic Cascade Effects – If *C. versicolor* significantly alters prey availability, it could impact other trophic interactions within the ecosystem.

Future research should aim to:

1. Conduct a diet analysis through stomach content examination or faecal analysis to determine the frequency of snake consumption.
2. Assess competition between *C. versicolor* and native predatory species.
3. Investigate potential behavioural adaptations facilitating successful snake predation.

This study documented the first recorded case of snake predation by *C. versicolor* in Indonesia. The observation of a male *C. versicolor* preying on an adult *Dendrelaphis pictus* highlights its dietary flexibility and potential ecological impact. Given its invasive status, continued monitoring of its feeding habits is essential to understand its influence on native reptile populations and broader ecosystem dynamics.

The adaptability of *C. versicolor* underscores its resilience as an invasive species, raising concerns about its role in altering native food webs. Future studies should explore its predatory behaviour in greater detail to develop strategies for mitigating potential ecological disruptions in regions where it has become established. This observation highlighted the species' capacity to prey on larger vertebrates, underscoring its potential ecological impact in invaded habitats. Further studies are needed to clarify its feeding ecology and broader implications for native fauna.

Figure 1. *Calotes versicolor* feeding on *Dendrelaphis pictus:* killing (biting and securing) process (left) and swallowing process (right).

AUTHOR CONTRIBUTION

R.E. designed the writing, analysed the data, wrote the manuscript, authored or reviewed drafts, and approved the final draft; S.I. collected, analysed the data, and approved the final draft.

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CONFLICT OF INTEREST

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