REPTILES & AMPHIBIANS

Deciphering the Reproductive Enigma: The Ornate Flying Snake, *Chrysopelea ornata* (Shaw 1802), in The Dangs District, Gujarat, India

Dikansh S. Parmar

Herpetology Section, Museum Koenig, Leibniz Institute for the Analysis of Biodiversity Change, Adenauerallee 127, 53113 Bonn, Germany
(ophiophagus_hannah10@yahoo.com; https://orcid.org/0000-0002-1687-6352)

The Ornate Flying Snake, *Chrysopelea ornata* (Fig. 1), is a rear-fanged, mildly venomous but harmless colubroid snake (Daniels 2002; Whitaker and Captain 2004, 2008). This oviparous, diurnally active species is distributed in southern and southeastern Asia (Uetz et al. 2024). In India, it ranges from the Western Ghats north to The Dangs District in Gujarat and Katernia Ghat in Uttar Pradesh through Madhya Pradesh, Odisha, North Bihar, and northern West Bengal eastward to Arunachal Pradesh (Daniels 2002; Uetz et al. 2024). In Gujarat, *C. ornata* is restricted to The Dangs District (Whitaker and Captain 2004; Desai 2011, 2017).

Most studies of squamate reproductive organs focus solely on hemipenes, but small paired hemiclitores occur in at least some females (Valdecantos and Lobo 2015). These structures appear to be vestigial and their exact role is unknown. Herein, I report novel observations on reproductive organs resembling hemiclitores, ovipositioning, and feeding behavior in *C. ornata*. Additionally, I discuss the role of hemiclitores in female snakes.

One adult female (SVL 673.1 mm, TLL 292.1 mm) was confiscated from a snake charmer on 19 December 2010 in Surat District, Gujarat, India (21.17801, 72.81189). While employing the popping method for sex determination (Gregory 1983), we noticed small paired bud-like structures initially identified as hemipenes. However, upon closer examination, their diminutive size and distinct structural features indicated that they were hemiclitores (Fig. 2).

A second adult female (SVL 701 mm, TLL 301 mm) was obtained by answering a snake rescue call on 15 March 2022 in The Dangs District, Gujarat, India (20.75880, 73.68861). During transportation from the rescue site to the release site the female laid 11 eggs (Fig. 3). Midbody girth of the gravid female (138.3 mm) decreased to 108.2 mm at parity. Five of the 11 eggs were attached and the rest were separate. Lengths, widths, and weights are listed in Table 1.

Both females were ready feeders when offered geckos, taking one, sometimes two at a time (eight geckos were offered to each individual) and both actively preyed on geckos in captivity (Fig. 4), ingesting their prey alive.

Reproductive organs.—This is the first evidence of everted structures resembling hemiclitores in any Indian snake without dissection. Folwell et al. (2022) documented the first evidence of hemiclitores in female snakes by dissecting individuals and using diffusible iodine contrast-enhanced micro-CT and histology. They reported that unlike lizard hemiclitores those in snakes are non-eversible. However, I was able to document the presence of everted organs resembling hemi-

Figure 1. A female Ornate Flying Snake (*Chrysopelea ornata*) confiscated from a snake-charmer in Surat, Gujarat, India. Photograph by Dikansh S. Parmar.

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Figure 2. The first record of hemiclitores in a female Ornate Flying Snake (*Chrysopelea ornata*). Note the shape and size of the hemiclitores (smooth and small when compared to hemipenes). Photograph by Dikansh S. Parmar and Vasudev Limbachiya.

Figure 3. A gravid female Ornate Flying Snake (*Chrysopelea ornata*) laid eggs during transportation from the rescue site to the release site. After examining the eggs, the snake was released. Photograph by Dikansh S. Parmar.

Table 1. Measurements of eggs laid by an Ornate Flying Snake (*Chrysopelea ornata*) (lengths and widths in mm and weights in g).

Egg	Length	Width	Weight
A	31.0	12.0	2.75
B	30.0	12.0	2.55
C	26.5	13.0	2.39
D	26.0	13.0	2.39
E	27.0	13.0	2.38
F	27.0	12.0	2.42
G	29.0	14.0	2.94
H	28.0	12.0	2.50
I	26.0	14.0	2.98
J	28.0	14.5	3.12
K	28.5	14.5	3.20

clitores. Valdecantos and Lobo (2015) suggested that hemiclitores occur in certain female squamates as vestigial organs, with unknown functions. However, the histological study of Folwell et al. (2022) suggested that hemiclitores of snakes have a significant role in mating and that they are not underdeveloped hemipenes or scent glands. I suggest that hemiclitores serve as a potential barrier that discourages simultaneous polygamy. Parmar and Limbachiya (2020) documented two male Buff-striped Keelbacks (*Amphiesma stolatum*) attempting to mate with one female. The presence of robust paired structures like hemiclitores could impede simultaneous mating by two males, thus acting as a natural deterrent against polygamy.

Reproduction.—Daniels (2002) documented gravid females acquired in May and June producing clutch sizes of 6–12 eggs. Whitaker and Captain (2008) noted a similar range of 6–12 eggs in June–July. Desai (2011, 2017) reported clutch sizes of 6–10 elongated eggs without mentioning any specific breeding seasons. Herein I report a gravid female that laid 11 eggs in March, which suggests that *C. ornata* likely breeds between December and January, with egg-laying beginning in March. Incubation of the eggs was not successful because of contamination and infertile eggs laid under stress during transportation.

Diet and Feeding Behavior.—*Chrysopelea ornata* is known to feed on a wide range of animals, including fish, frogs, lizards, small birds, eggs of reptiles and birds, and bats (Grossmann 1999; Whitaker and Captain 2008; Das 2010; Desai 2011, 2017; Hasan et al. 2014; Dutta 2015; Melvinselvan and Nibedita 2016; Babu et al. 2018; Ahmed et al. 2020). Jena et al. (2021) reported *C. ornata* preying on an Indian Bark Gecko (*Hemidactylus leschenaultia*) by swallowing the tail first and the time of complete ingestion reported was 40 minutes in the wild. In captivity, we observed *C. ornata* feeding on Spotted House Geckos (*Hemidactylus brookii*) and ingesting prey both tail- and headfirst with complete ingestion in 3–6 minutes. Although *C. ornata* is mildly venomous, geckos were eaten without subduing them, similar to observations of Parmar (2018) in Green Keelbacks (*Rhabdophis plumbicolor*). This type of feeding behavior suggests that *C. ornata* is able to discern whether or not it needs to subdue its prey. If the prey is small and cannot defend itself, the snake foregoes injecting venom.

Figure 4. A female Ornate Flying Snake (*Chrysopelea ornata*) preying on a Spotted House Gecko (*Hemidactylus brookii*), which was biting the snake in an effort to escape. Photograph by Dikansh S. Parmar.

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