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Parthenogenesis in an Ornate Nile Monitor, *Varanus ornatus*

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Abstract: Parthenogenesis is documented in *Varanus ornatus* for the first time. A ten year old captive female *V. ornatus* laid a clutch of 21 eggs in July 2008 without ever coming into contact with a male. Two of the 21 eggs contained embryos. Information on the history and husbandry of the adult female is given as well as details of the reproductive event.

Introduction

Parthenogenesis was recently described in two varanid lizards, *Varanus panoptes horni* (Lenk *et al*., 2005) and *V*. *komodoensis* (Watts *et al*., 2006). Here, parthenogenesis is described for the first time in a *V. ornatus*, maintained in captivity at the Reptile Village Zoo in Kilkenny, Ireland.

Acquisition and Husbandry

A female *V. ornatus* (Figs. 1 & 2) was obtained from a dealer in 1998 as an unsexed, wild-caught juvenile (11 cm snout to vent length [SVL]). The exact country of origin is unknown.

Since January 2006, the female *V. ornatus* in question has been housed in a glass-fronted enclosure of timber construction measuring 150 x 120 x 140 cm (l x w x h). The female was housed alone her entire life except for three instances when attempts were made to house her with another adult female *V. ornatus* in the collection. All attempts at cohabitation were unsuccessful, with fighting occurring within seconds of introduction. The enclosure is furnished with an artificial rock background with several basking ledges and large climbing branches. A 5 cm deep layer of bark mulch of is used for substrate and a large water tub allows for bathing. A large cork bark tube is provided for refuge. A 300 watt UVB basking lamp

Fig. 1. Female *Varanus ornatus* which reproduced by parthenogenesis.


Fig. 2. Profile of female *V. ornatus*.

fixed to the ceiling of the enclosure provides basking temperatures of up to 45 °C. An ambient temperature of 25 °C (in winter) to 32 °C (in summer) is maintained by a panel heater controlled by a thermostat. As an adult, the female has been fed weekly on a diet of weaned rats, fish, chicks and eggs.

Both *V. ornatus* were proven to be females, evidenced by egg production. The female in question laid 15 eggs on 12 March 2007; the second female laid 12 eggs on 20 April 2007 and 15 eggs on 11 June 2008. Aside from the brief, unsuccessful introductions to each other, both females never came into contact with any other individual. As a result, when eggs were laid by either *V. ornatus*, they were assumed to be non-viable and were immediately discarded.

Oviposition

On 4 June 2008, the *V. ornatus* was given a routine general health assessment, was weighed, and measured. At this time, the female measured 52 cm SVL and 131 cm in total length (TL), and weighed 4.48 kg.

On 16 July 2008, the female deposited 21 eggs in the corner of the enclosure, with oviposition lasting ca. 30 minutes. Eggs were retrieved once the female had finished covering them with substrate. Defensive nest guarding behavior was observed, however the female appeared noticeably fatigued from oviposition.

Up until a few days prior to oviposition, the female's behavior did not change, exhibiting normal basking behavior and activity levels. Gravidity was not suspected until test digging was first observed on 9 July, eight days prior to oviposition. Test digging occurred in the rear of the enclosure, away from the public-viewing side of the enclosure. During gravidity, the female's feeding patterns did not change, and she consumed two large fish three days prior to oviposition.

Incubation and Parthenogenetic Embryos

Previous *V. ornatus* clutches at the zoo were discarded once retrieved. However, due to the recent reports by Lenk *et al.* (2005) and Watts *et al.* (2006) documenting parthenogenesis in *Varanus*, and the on-site availability of a large incubator, it was decided to artificially incubate the eggs on this occasion. The clutch was split up and placed in three plastic containers each measuring 25 x 18 x 8 cm filled with dampened vermiculite at a water:vermiculite ratio of 1:2 by weight. The containers were then placed inside an incubator converted from a refrigerator, heated by infrared lamps on the bottom connected to a digital thermostat. A small fan circulated air inside the incubator. The eggs were incubated at 27 °C and were inspected every other day by opening each container and visually inspecting each egg. Within a week, some of the eggs had begun to deteriorate. Eggs which collapsed and had begun to grow mold were removed and discarded. On 6 November 2008, after 113 days of incubation, seven eggs remained, of which four appeared healthy. Assuming that all eggs were non-viable after losing the majority of the clutch, it was decided to discard all remaining eggs.

Beginning with the three deteriorating eggs, each was dissected to check its contents. The three deteriorating eggs contained solidified yellow material and showed no signs of vascularization. Upon dissection of the first healthy-looking egg, a partially-developed embryo was discovered (Fig. 3). Coloration and patterning had

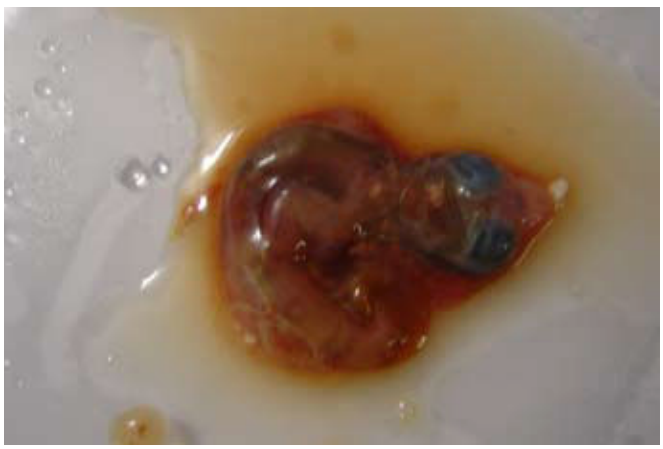
Fig. 3. Parthenogenetic embryo, removed from egg.

Fig. 4. Parthenogenetic embryo, dorsal view.

Fig. 5. Parthenogenetic embryo, ventral view.

begun to develop, and distinct banded markings on the tail were visible (Figs. 4 & 5). All limbs and digits, including the claws were formed. The embryo had a SVL of ca. 5.3 cm and a TL of ca. 13.0 cm. Given this discovery, the remaining three eggs were returned to the incubator, where they were checked on a daily basis for an additional 88 days. During this time another egg began to deteriorate and was removed. Dissection confirmed it was infertile.

On 2 February 2009, after 201 days of incubation, the remaining two eggs started to deteriorate. One of the eggs showed mold growth and was found to be infertile upon dissection. The remaining egg, while slightly beginning to smell of decomposition, appeared full and turgid. Upon dissection, a dead, fully-developed embryo was discovered (Figs. 6, 7 & 8). It had noticeably been dead for some time and decomposition had begun to set in. The yolk sac was fully absorbed and the embryo appeared fully formed, apart from developing only three digits on the front left foot. The embryo measured 9.3 cm SVL and 22.7 cm TL.

The same female laid another clutch on 2 August 2009. Eleven eggs were retrieved for incubation, though at least three were eaten by the female before they could be collected. All eggs began to decompose within the first week of incubation.

Fig. 6. Full-term parthenogenetic *V. ornatus* embryo. Note the expended yolk sack.

Fig. 7. Parthenogenetic embryo, dorsal view

Fig. 7. Parthenogenetic embryo, ventral view

Outlook

Since *V. ornatus* is now the third documented species of *Varanus* to undergo parthenogenesis, with previous reports documenting surviving parthenogenetic offspring (Lenk *et al*., 2005; Watts *et al*., 2006), it seems as though this reproductive mode may be more common in captive varanids than realized. Further research is needed to determine how widespread parthenogenesis is in captive varanids, and whether or not it occurs in wild populations. The two parthenogen have been preserved and are currently held at the Reptile Village Zoo awaiting future DNA analysis.

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