

BRIEF ARTICLE

**Sexual dimorphism and reproduction of the pitviper *Porthidium ophryomegas* (Serpentes: Viperidae) in Guatemala**

Dwight Lawson

Department of Biology, The University of Texas at Arlington, Arlington, TX 76019 USA.

(Rec. 7-X-1994. Rev. 24-X-1996. Accep. 30-IV-1996)

**Key words:** *Porthidium ophryomegas*, sexual dimorphism, Río Motagua Valley, Guatemala, Costa Rica.

*Porthidium ophryomegas* is a slender, relatively small (to 770 mm) terrestrial pitviper inhabiting seasonally dry forests of the Pacific versant from south-central Guatemala to north-west Costa Rica with questionable records from eastern Panama (Campbell & Lamar 1989). This species also occurs in several rainshadow valleys of the Atlantic drainage in Guatemala and Honduras. *Porthidium ophryomegas* is allied with a group of six Neotropical species commonly referred to as the hognosed pitvipers. Recent revisions of the genus *Porthidium* (Campbell & Lamar 1992, Werman 1992) have clarified a once diverse and polyphyletic arrangement and restricted the generic name to the six hognosed pitvipers and the enigmatic *P. melanurum* and *P. hyoprorum*. The latter two species will eventually be allocated to genera other than *Porthidium*. Wilson and Meyer (1985) reviewed and clarified the confused taxonomic history of *P. ophryomegas*. *Porthidium ophryomegas* is predominantly nocturnal and is most frequently encountered on roads at night after rains (Campbell & Lamar 1989; personal obs.). Little is known of the ecology and behavior of this species in the wild or in captivity. Reproductive information is reported herein based on captive propagation of two specimens from the Río Motagua Valley of Guatemala at the northernmost extreme of the species' range.

A comparison of the sexual dimorphism exhibited by Río Motagua material and specimens from the southern extreme of the range in Costa Rica (Solórzano et al. 1988) is also presented.

During a collecting trip to Guatemala in December 1990, a juvenile male and female *Porthidium ophryomegas* were obtained from the Río Motagua Valley, Aldea El Rosario, Cabañas, Departamento de Zacapa. Habitat in the Middle Motagua Valley is characterized as very dry tropical forest (Holdridge 1959). Both individuals were similar in size (ca. 20 cm total length) at the time of acquisition and presumed to be not more than one year old. The animals were maintained separately in aquaria under a 12L/12D photoperiod at approximately 22° C with a heat tape under half of each enclosure to provide a basking site. Both snakes were fed an exclusive diet of appropriately sized laboratory mice. By the Fall of 1992, the snakes appeared to have reached mature sizes (i.e., ca. 40 - 50 cm total length) and were intermittently introduced and housed together for periods of several days to several weeks. Approximately two months prior to parturition it had become apparent from the female's distended appearance that she was either gravid or amassing considerable yolk reserves. The only mating behavior observed consisted of a brief episode of caudocephalic head thrusts by the male initi-

ated immediately after an introduction one to two months prior to parturition at which time the female was obviously already gravid. Because they were obtained as juveniles, this represented the first reproductive effort for both animals.

During the night of 26 April 1993 the female gave birth to a litter of 19 live neonates (8 males, 11 females) and one apparently unfertilized ovum. On 27 April 1993, 15 neonates were euthanized, weighed, measured, preserved, and deposited in the UTA Collection of Vertebrates. The four remaining animals are being maintained in the UTA Live Collection. Morphometric data on the neonates are presented in Table 1. Total mass of the offspring and ovum (76.77 g) represents a reproductive output of 68% of the female's post-parturition mass of 113.5 g. However, these masses do not take into account the resources expended by the female on additional birth products (extraembryonic membranes, fluid, etc.) which could not be effectively quantified.

Parturition must have begun shortly after dark as offspring were noticed in the cage during a random check approximately 1.5 to two hours after the onset of the dark cycle.

An overall MANOVA for the eight combined variables of size and scalation indicated that there were significant differences between males and females (Wilks lambda = 0.0492,  $p = 0.002$ ). Subsequent univariate tests indicate female offspring were significantly heavier than males ( $\bar{x}_{\text{female}} = 4.094$  g,  $\bar{x}_{\text{male}} = 3.627$  g,  $F_{1,13} = 5.645$ ,  $p = 0.034$ ). Females have a significantly higher number of ventral scales ( $\bar{x}_{\text{female}} = 167.111$ ,  $\bar{x}_{\text{male}} = 160$ ,  $F_{1,13} = 26.624$ ,  $p = 0.0002$ ), and a correspondingly longer snout-vent length (SVL) ( $\bar{x}_{\text{female}} = 167.22$  mm,  $\bar{x}_{\text{male}} = 156.67$  mm,  $F_{1,13} = 17.216$ ,  $p = 0.001$ ). Females also possess significantly more midbody dorsal scale rows than males ( $\bar{x}_{\text{female}} = 26.444$ ,  $\bar{x}_{\text{male}} = 25.167$ ,  $F_{1,13} = 10.83$ ,  $p = 0.006$ ). Males possess a significantly higher number of subcaudals ( $\bar{x}_{\text{female}} = 34.33$ ,  $\bar{x}_{\text{male}} = 38.833$ ,  $F_{1,13} = 28.864$ ,  $p = 0.0001$ ) and correspondingly longer tails ( $\bar{x}_{\text{female}} = 22$  mm,  $\bar{x}_{\text{male}} = 23.5$  mm,  $F_{1,13} = 6.794$ ,  $p = 0.022$ ). These sexual differences in lepidosis agree with those reported by Solórzano *et al.* (1988) for *P. ophryomegas* in Costa Rica. However, mean ventral numbers for both sexes and subcaudal numbers in males of the Guatemalan litter

TABLE 1

*One day post-parturition measurements of 15 neonate Porthidium ophryomegas*

Specimen	SEX	WT	SVL	TL	HL	HW	VEN	SC	MDSR
UTA R-34720	M	3.15	150	24	12.2	7.9	161	39	25
UTA R-34721	M	4.14	157	24	12.5	7.9	162	39	25
UTA R-34722	F	4.31	168	22	13.4	9.5	164	35	27
UTA R-34723	F	3.33	160	21	13.2	8.0	167	34	27
UTA R-34724	F	3.89	167	22	13.6	8.0	169	34	27
UTA R-34725	M	3.40	153	23	12.7	8.6	156	38	26
UTA R-34726	F	4.22	164	20	12.9	8.5	167	32	26
UTA R-34727	F	4.01	165	22	12.6	8.1	167	37	27
UTA R-34728	F	4.43	171	22	11.6	7.6	168	36	25
UTA R-34729	M	3.94	165	25	12.8	8.7	162	42	25
UTA R-34730	M	3.34	155	22	12.3	8.2	155	37	25
UTA R-34731	F	4.45	174	23	14.0	8.6	168	33	25
UTA R-34732	M	3.79	160	23	12.1	7.7	164	38	25
UTA R-34733	F	3.85	164	22	12.6	7.7	165	34	27
UTA R-34734	F	4.36	172	24	13.5	9.2	169	34	27

WT = weight (g), SVL = snout -

vent length (mm), TL = tail length (mm), HL = head length from tip of snout to articulation of jaw (mm), HW = head width at widest point (mm), V = ventrals, SC = subcaudals, MDSR = midbody dorsal scale rows, UTA = University of Texas at Arlington Collection of Vertebrates. Weight and sex data of four additional specimens, UTA R-35950 and 39599-601, were included in the analysis, but are not presented here as the specimens are being maintained alive and the additional measurements are not available.

were consistently lower but within the range of those reported for the Costa Rican specimens (Table 2). Midbody dorsal scale rows were similar in both samples (Table 2). Size data for the Guatemalan snakes agree with the findings of Solórzano et al. (1988) that females are larger than males, although their conclusions were drawn apparently without knowledge of the relative ages of their specimens. It appears that

female *P. ophryomegas* throughout its distribution are larger as neonates and attain larger adult sizes than males. In the Guatemalan animals, no significant differences between the sexes were detected in head width or head length, although analysis of head length proved only marginally non-significant (one-way ANOVA,  $p = 0.069$ ) with females averaging slightly longer heads.

TABLE 2

Comparison of mean scale counts  $\pm$  1 S.D. for *Porthidium ophryomegas* from the Río Motagua Valley, Guatemala and Costa Rica. Data for Costa Rican specimens are from Solórzano et al. (1988). Parenthetical values denote the range of values. MDSR = midbody dorsal scale rows

	Males	
	Guatemala	Costa Rica
Ventrals	160 $\pm$ 3.63 (155-164)	165 $\pm$ 2.61 (159-169)
Subcaudals	38.83 $\pm$ 1.72 (37-42)	41 $\pm$ 1.08 (39-42)
MDSR	25.17 $\pm$ 0.41 (25-26)	25 $\pm$ 0.8 (23-26)
	Females	
	Guatemala	Costa Rica
Ventrals	167.1 $\pm$ 1.69 (164-169)	170 $\pm$ 4.05 (157-176)
Subcaudals	34.33 $\pm$ 1.5 (32-37)	34 $\pm$ 2.61 (23-37)
MDSR	26.44 $\pm$ 0.88 (25-27)	26 $\pm$ 2.61 (23-28)

Solórzano et al. (1988) also described a sexual dichromatism in *Porthidium ophryomegas* from Costa Rica. Observations on the Guatemala material agree with their findings and indicate that a sexual dichromatism is present from birth and likely occurs throughout the species' range. Male background color is gray and the overall appearance of the dorsal and lateral pattern is bolder than that of females. Female background color is typically tan to grayish brown. Males possess a prominent dorsal head pattern of paired blotches while that of females only faintly contrasts with the tan background or is lacking altogether. Males also have a darker, more prominent postorbital bar and bolder supra and infralabial markings than females. Previous descriptions of the color and pattern of *P. ophryomegas* (Cope 1861, Villa 1984, Wilson & Meyer 1985, Campbell & Lamar 1989) have inadvertently incorporated this sexual dichromatism into their accounts as individual variation. Exceptionally dark individuals with an obscured body pattern have been noted by Campbell and Lamar (1989). It is unclear whether this melanism represents an

ontogenetic condition in older larger snakes as Campbell and Lamar suggested, or whether it is the result of additional color variation.

Sexual dichromatism has been reported for only two other species of Neotropical pitvipers, *Bothrops asper* (Burger & Smith 1950) and *Atropoides picadoi* (Solórzano 1990). In a Veracruz, Mexico, population of *B. asper* examined by Burger and Smith, neonate males possessed a bright yellow tail tip while that of females was drab yellow or consistent with the more anterior dorsal pattern. However, the yellow tail tip of male *B. asper* disappears prior to sexual maturity. It is noteworthy that in the figure presented by Burger and Smith (1950) illustrating sexual differences in tail tip color there are also noticeable differences in dorsal pattern and apparently color between the two animals pictured. Whether the differences illustrated are the result of general variation in this species or whether they may be attributable to sex of the individual remains speculative. Neonate Costa Rican *A. picadoi* exhibit a marked sexual dichromatism in head pattern, but did not exhibit significant size differences (Solórzano 1990).

The manuscript was improved by the guidance and suggestions of J. A. Campbell and M. Keck. Export permits for Guatemala were kindly issued to J. A. Campbell by the Consejo Nacional de Areas Protegidas (CONAP).

### RESUMEN

Se describen el dimorfismo y dicromatismo sexual en neonatos de la serpiente *Porthidium ophryomegas* con base en reproducción en cautiverio de especímenes del Valle del Río Motagua, Guatemala. En comparación con los machos, las hembras son más pesadas y tienen más escamas ventrales y medio-dorsales. Las diferencias son similares a las registradas para Costa Rica.

### REFERENCES

- Burger, W. L. & P. W. Smith. 1950. The coloration of the tail tip of young Fer-de-Lances: sexual dimorphism rather than adaptive coloration. *Science* 112: 431-433.
- Campbell, J. A. & W. W. Lamar. 1989. The venomous reptiles of Latin America. Cornell University, Ithaca, New York, 425p.
- Campbell, J. A. & W. W. Lamar. 1992. Taxonomic status of miscellaneous neotropical viperids, with the description of a new genus. *Occ. Pap. Mus. Texas Tech.*, No. 153.
- Cope, E. D. 1861. Contributions to the ophiology of Lower California, Mexico and Central America. *Proc. Acad. Nat. Sci. Phil.* 1861: 292-306.
- Holdridge, L. R. 1959. Mapa ecológico de Guatemala, C. A. Instituto Interamericano de Ciencias Agrícolas de las Organización de Estados Americanos, Proyecto 39, Programa de Cooperación Técnica, San José, Costa Rica, in 2 sheets.
- Solórzano, A., J. M. Gutiérrez & L. Cerdas. 1988. *Bothrops ophryomegas* Bocourt (Serpentes: Viperidae) en Costa Rica: distribución, lepidosis, variación sexual y cariotipo. *Rev. Biol. Trop.* 36: 187-190.
- Solórzano, A. 1990. Reproduction in the pit viper *Porthidium picadoi* (Serpentes: Viperidae) in Costa Rica. *Copeia* 4: 1154-1157.
- Villa, J. 1984. The venomous snakes of Nicaragua: a synopsis. *Milwaukee Public Mus. Contrib. Biol Geol.* 59: 1-41.
- Werman, S. D. 1992. Phylogenetic relationships of Central and South American Pitvipers of the genus *Bothrops* (*sensu lato*): cladistic analyses of biochemical and anatomical characters, p. 21-40 *In* J. A. Campbell & E. D. Brodie, Jr. (eds.) *Biology of the pitvipers*. Selva, Tyler, Texas.
- Wilson, L. D. & J. R. Meyr. 1985. The snakes of Honduras. Milwaukee, Wis., Milwaukee Pub. Mus. 150 p.