Studies on Neotropical Fauna and Environment
Vol. 30 (1995), No. 2, pp. 101-106

0165-0521/95/3002-0101$6.00

Activity Pattern of *Crotalus durissus* (Viperidae, Crotalinae): Feeding, Reproduction and Snakebite

Maria da GRAÇA SALOMÃO, Selma Maria Almeida SANTOS and Guiseppe PUORTO

SALOMÃO, M. da GRAÇA, S.M.A. SANTOS and G. PUORTO (1995): **Activity pattern of *Crotalus durissus* (Viperidae, Crotalinae): Feeding, Reproduction and Snakebite.**
Studies on Neotropical Fauna and Environment 30, pp. 101-106.

One hundred and seventy-three adults and twenty-six juveniles of *Crotalus durissus* were examined by removing the stomach contents and faecal material. Rattlesnakes were most active between April and May (autumn) (unimodal type), but most intensive feeding occurred during summer and autumn (February to May). Juveniles were observed to feed from late autumn (May) through the winter. Prey consisted of rodents (*Cavia aperea, Rattus norvegicus* and *Mus* sp.) and no ontogenetic change was observed in the diet. Feeding peaks precede vitellogenesis (autumn - winter). Mated females continue feeding until ovulation (spring). It was observed that the biggest number of accidents were caused by snakes with stomach contents, especially males.

Maria da Graça Salomão, Selma Maria Almeida Santos, Giuseppe Puorto: Laboratório de Herpetologia, Instituto Butantan, Av. Vital Brazil, 1500 Butantã, 05503-900 São Paulo, Brazil.

Introduction

The diet of rattlesnakes is known, but not with a great amount of detail (Gloyd, 1933), as well as some aspects of their pattern of activity (Wallace and Diller, 1990).

This paper reports the feeding activity of *Crotalus durissus* and discusses its relationship with reproduction and the problems of snakebite in Brazil.

Material and methods

One hundred and seventy-three adults and twenty-six juveniles of *Crotalus durissus* from the State of São Paulo, Brazil, were dissected and their stomach or intestine contents were examined. In addition, the number of rattlesnakes which arrived in the Institute from 1990 to 1992, as well as the number of accidents from 1975 until 1992 were recorded. In addition, all the specimens which had caused accidents and had been preserved in the collection of the Instituto Butantan had their stomach or intestine contents examined. All females had their genital tract examined.

Results

Rattlesnakes were more active in April and May (autumn), while juveniles were more active between April and June (late autumn and early winter) showing a unimodal pattern of activity (Fig. 1).

The peak of feeding in adults was observed to occur during summer and autumn (February to May) (Fig. 2). Females feed mainly in summer and autumn and mated females continue foraging until ovulation (spring) (X^2 : $p < 0.004$). Juveniles were observed to feed from late autumn (May) through the winter. A larger percentage of vitellogenic (n = 61) females was observed to have stomach or intestine contents when compared to non-vitellofenic ones (n = 45) (Fig. 3).

Only rodents were found to be part of the diet and *Cavia aperea, Rattus norvegicus* and *Mus* sp. were identified. No ontogenetic change was observed regarding the diet. Adults ingest prey between 20 - 29 % (n = 9) of their snoutvent length (SVL) in size, whereas juveniles ingest between 30 - 40 % (n = 3) of their SVL in size (ANOVA : $P < 0.004$). From 57 fed snakes observed, only one ingested the prey tail first.

From the 111 accidents caused by *C. durissus* recorded between 1975 and 1992, 77 (69.4 %) were caused by males, whereas 34 (30.6 %) by females (Fig. 4) (X^2 : $P < 0.0001$). From a sample of 65 snakes which caused accidents and were examined, 68 % had stomach contents. From these fed specimens 54 %

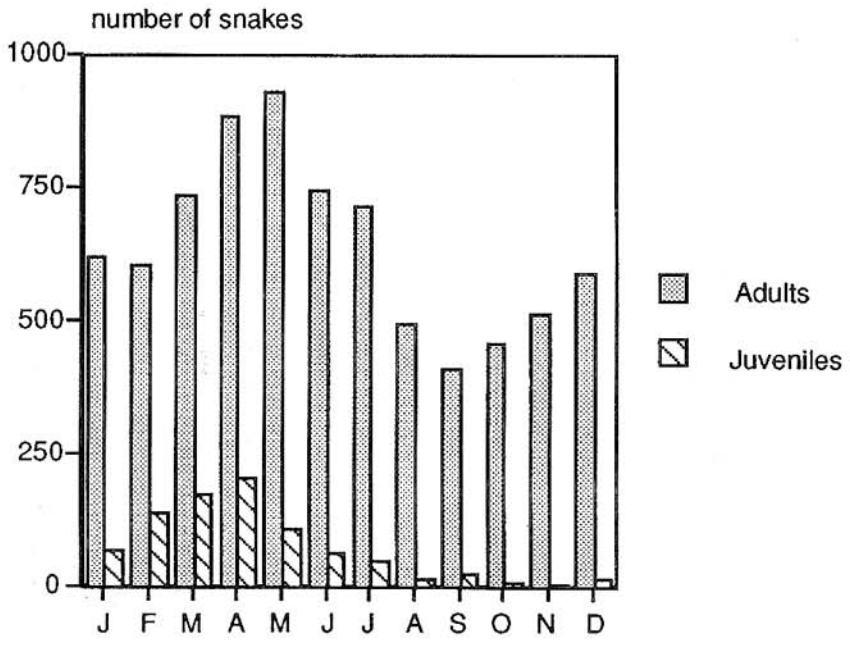

Fig. 1. Adults and juveniles of *C. durissus* which arrived in I.B. from 1990 to 1992.

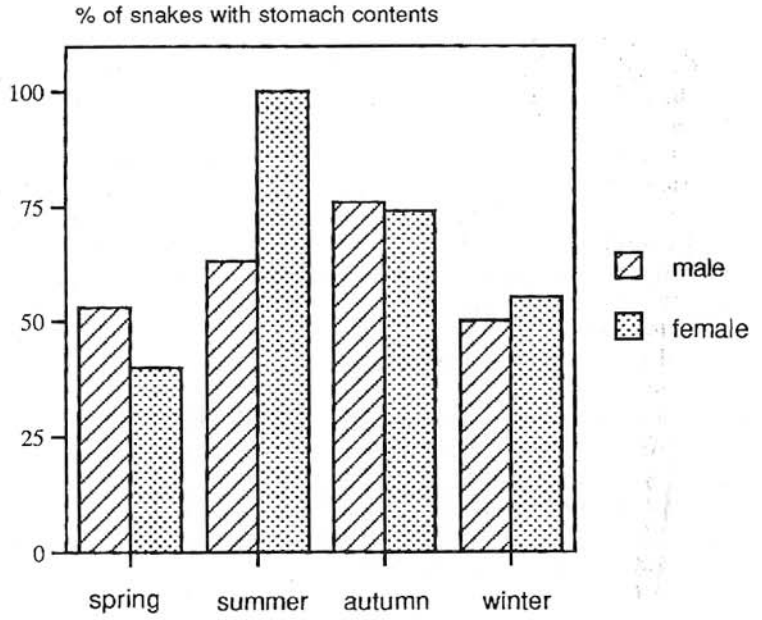

Fig. 2. Percentage of male and female *C. durissus* with stomach contents in each season of the year.

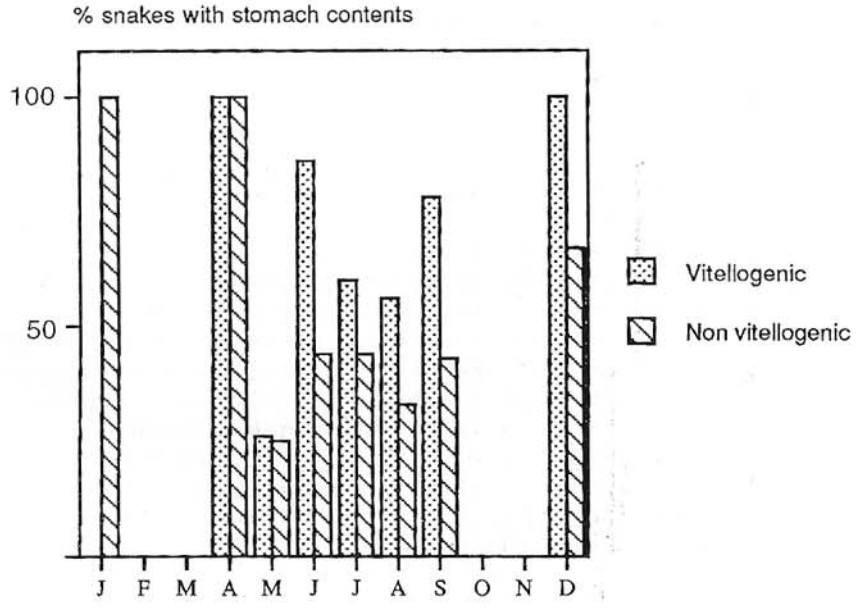

Fig. 3. Monthly variation (%) of vitellogenic and non-vitellogenic females with stomach contents in *C. durissus*.

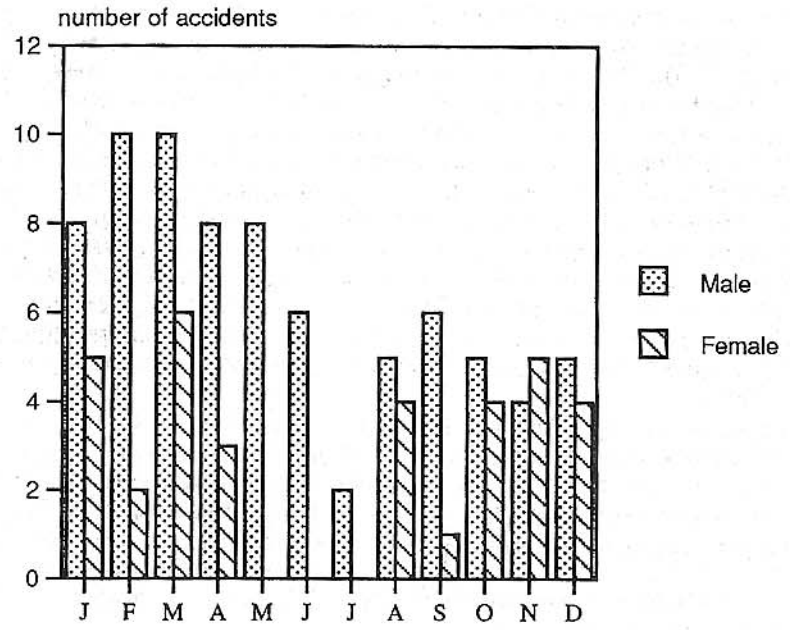

Fig. 4. Number of monthly accidents recorded between 1975 and 1992 caused by male and female *C. durissus*.

were males. The snakebites were observed to happen most often at about 9 - 10 h a.m. (n = 10), 14 - 15 h p.m. (n = 14) and 17 - 21 h p.m. (n = 19).

Discussion

The unimodal peak of activity in *Crotalus durissus* was observed in April and May (autumn) when combat ritual and mating happen (Santos et al., 1990), Langlada et al., 1993). Despite also showing a unimodal peak of activity, *B. jararaca* (Viperidae) was found to be more active in the summer (Sazima, 1988) in contrast to *C. durissus*. It was observed that there is a difference in the pattern of both male and female in the feeding activity. Females feed more in the summer, whereas males feed more during autumn. This can be explained by females needing energy to maximize secondary vitellogenesis during the winter. They practically stop eating in late winter and spring when the follicles are large and embrionary development starts (S.M.A. Santos, pers. observation) and therefore are less active, which agrees with the data of Keenlyne (1972), who claims that males are more active not only in looking for food but also for a female in the mating season. This data is supported by the number of accidents recorded between 1975 and 1992, since 69.4 % of the rattlesnake bites were caused by males, while 30.6 % were caused by females. This correlation between the number

of accidents and the pattern of activity was also recorded in *B. jararaca* (Sazima, 1988). In addition, in autumn and winter no snakebite by female *C. durissus* was recorded (Fig. 3). This could be a consequence of an increase in weight of the females (whether fed or carrying a clutch) and therefore, a reduction in locomotion to escape from predators, as well as to decrease energy intake (Seigel et al., 1987). These differences in their activity pattern were also observed by King and Duvall (1990) in *C. viridis viridis*. It was also noticed that most of the snakebites were caused by specimens with stomach contents, especially males. This can be explained by males being more active than females (see Fig. 4). In addition, they could be foraging, mainly in the evenings and basking in the morning and afternoon (hotter times of the day when the main peaks of accidents were observed), since higher temperatures were observed to be useful in thermoregulation (Gibbons & Semlitsch, 1987) and to accelerate digestion in *C. d. terrificus* (Francini et al., 1993).

Despite not having found any bird in the examined material, adults of *C. d. cascavella* from northeast of Brazil have been observed to strike and feed on pigeons (D.V. Veloso pers. communication), which agrees with what is mentioned by Vanzolini et al. (1983). The data presented here also shows that juveniles ingest bigger prey when compared with adult as it was observed in *Liophis* (Colubridae), *Oxyrhopus* (Colubridae) and *Helicops* (Colubridae) by Sazima & Martins (1990). *C. durissus* was also recorded to ingest prey head first and tail first as observed in *B. jararaca*.

When considering juveniles, their peak of activity (April to June - late autumn to winter) shows probably the birth season or soon after it, when they would be looking for food. This peak coincides with their heaviest feeding activity shown here to occur in the winter. It is interesting to note that juvenile *B. jararaca* (Viperidae, Crotalinae) show a peak in their pattern of activity in the summer (Sazima, 1988), different from *C. durissus* (autumn - winter). This can be explained by the fact that *B. jararaca* shows ontogenetic change in its diet, feeding when juvenile on amphibians and lizards, whose activity decreases during the winter, and on rodents when adults (Sazima, 1992). *C. durissus* did not present ontogenetic variation in its diet and it might mean that the availability of rodents all through the year does not work as a limiting factor on its pattern of feeding and activity. Thus, it seems to be totally different from what was observed in juvenile *C. durissus* from North America, which must hibernate during the winter, soon after birth and therefore, can not feed at this time (Klauber, 1972; Reinert and Zappalorti, 1988).

The fact that no ontogenetic change was observed in the diet may agree with the information that there is no age-dependent variation in their venom (M.F.D. Furtado, pers. communication), as has been reported in *Bothrops* (Furtado, M.F.D., 1987, PhD thesis, São Paulo).

Acknowledgements

We thank Valdir José Germano for preparing the rodent skulls for identification and for the help examining the specimens. We also thank Ian R. Fowler by revising and commenting on the manuscript.

References

FRANCINI, F., C.S. GRISOLIA, N.O. STANCHI & F.O. PELUSO (1993): Influência de la temperatura sobre la digestión en *Crotalus durissus terrificus* (Serpentes: Viperidae: Crotalinae). *Mem. Int. Butantan 55* (1): 11-17.

GIBBONS, J.W. & R.D. SEMLITSCH (1987): Activity patterns. In: Seigel, R.A., Collins, J.T. & Novak, S.S. (1987): Snakes: ecology and evolutionary biology. Macmillan Publishing Co. N. York, Toronto, London. 528 pp.

GLOYD, H.K. (1933): An unusual feeding record for the prairie rattlesnake. *Copeia,* 1933 (2): 98.

LANGLADA, F.G., S.M.A. SANTOS & I.L. LAPORTA-FERRAIRE (1993): Techniques of artificial insemination in *Crotalus durissus terrificus* (Viperidae, Crotalinae). Brazilian Journal of Veterinary Research and Animal Science 31 (1):

KEENLYNE, K. D. (1972): Sexual differences in feeding habits of *Crotalus horridus horridus.* J. Herpetol. 6: 234-237.

KING, M. B. & D. DUVALL (1990): Prairie rattlesnake seasonal migrations: episodes of movement, vernal foraging and sex differences. Anim. Behav. 39: 924-935.

KLAUBER, L. M. (1972): Rattlesnakes. Second edition. Univ. California Press. Berkeley, Los Angeles. 2 v.

REINERT, H.K. & R.T. ZAPPALORTI (1988): Field observation of the association of adult and neonatal timber rattlesnakes, *Crotalus horridus* with possible evidence for conspecific trailing. Copeia 1988 (4): 1057-1059.

SANTOS, S.M.A., I.L. LAPORTA-FERREIRA & G. PUORTO (1990): Ritual de combate em *C. durissus.* An. Acad. Bras. Ciências 62 (4): 418.

SAZIMA, I. (1988): Um estudo de biologia comportamental de jararaca, *B. jararaca,* com uso de marcas naturais. Mem. Inst. Butantan (S. Paulo) 50: 83-99.

SAZIMA, I. (1992): Natural history of the jararaca pitviper, *B. jararaca* in southeastern Brazil. In: Campbell, J.A. & Brodie E. D. Jr. Biology of the pitvipers. Selva Publ., Tyler, Texas, U.S.A.

SAZIMA, I. & M. MARTINS (1990): Presas grandes e serpentes jovens: quando os olhos são maiores que a boca. Mem. Inst. Butantan 52 (3): 73-79.

SEIGEL, R. A., M.M. HUGGINS & N.B. FORD (1987): Reduction in locomotor ability as a cost of reproduction in gravid snakes. Oecologia 73: 481-485.

VANZOLINI, P.E., A.M.M. RAMOS-COSTA & L.J. VITT (1980): Répteis das caatingas Acad. Bras. de Ciências, Rio de Janeiro, 152 pp.

WALLACE, R.L. & L.V. DILLER (1990): Feeding ecology of the rattlesnake, *Crotalus viridis oreganus,* in Northern Idaho. J. Herpetol. 24 (3): 246-254.