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ECDYSIS OF THREE SPECIES OF KRAIT (*BUNGARUS*: ELAPIDAE: SQUAMATA) IN CAPTIVITY, BANGLADESH

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ABSTRACT: The ecdysis of three species of Kraits (*Bungarus caeruleus*, *B. niger* and *B. walli*) was studied in captivity from October 2006 to January 2012. Kraits molted in regular intervals. *B. walli* molted more frequently than *B. caeruleus* and *B. niger*. The ecdysis interval days was higher in winter but was more frequent in other times of the year and it was the highest in March. Body colors of all species become dull before 7-8 days of molting (n=5). *B. niger* was more active before and after molting whereas other two species were less active. Climatic factors showed weak positive correlations with shedding during this study (temperature: r = 0.22, rainfall: r = 0.13, and humidity: r = 0.17) but these physical factors did not significantly influence the shedding of the studied species ($p > 0.05$).

Key words: Ecdysis, Kraits; Climatic factors; Bangladesh.

INTRODUCTION

The complete shedding, molting or sloughing of outer layer of the skin of a snake is known as ecdysis but incomplete or improper shedding is termed as dysecdysis that occurs due to diseases (malnutrition, dermatitis, etc.) and problems of captivity (incorrect temperature, humidity and handling) (Goodman, 2007). Snakes molt for several reasons viz., replacement of old and worn skin, removal of parasites, renewal of skin and allowing growth (Tu *et al.*, 2002). Literature review reveals that the published papers and reports on ecdysis of snakes are limited but on kraits research information is not available. Some published works on ecdysis are on Iberian Cross Adder *Vipera seoanei* (Saint-Girons and Duguy, 1976); European Viper *Vipera berus* (Saint-Girons, 1980); Red Spitting Cobra *Naja pallida* (Chiszar *et al.*, 1992); Neotropical Rattle Snake *Crotalus durissus* (Panizzutti *et al.*, 2001); Anaconda *Eunectes murinus* (Lamonica *et al.*, 2007); King Cobra *Ophiophagus hannah* (Shankar and Whitaker, 2009); Indian Rock Python *Python molurus* (Ramesh and Bhupathy, 2013). In addition, the histological study of ecdysis in snakes has extensible

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been worked out (e.g., Bechtel, 1957; Forks, 1983; Maderson, 1964, 1965, 1986) and Mosmann (2001) discussed about the ecdysis of snakes in general. Kraits (*Bungarus*: Elapidae: Squamata) are venomous elapid snakes and five species of this genus occur in Bangladesh (Ahsan and Rahman, 2017). They are also timid and docile group of snakes and ecdysis study of this group of snakes is much tough in nature. For this reason, an attempt was taken to do so for three species of kraits (Common Krait *Bungarus caeruleus*; Greater Black Krait *B. niger* and Wall's Krait *B. walli*) in captivity.

MATERIAL AND METHODS

The ecdysis of three individuals (2 males and 1 female) of Common Krait (*Bungarus caeruleus* [Schneider, 1801]), one female Greater Black Krait (*B. niger* Wall, 1908) and one male Wall's Krait (*B. walli* Wall, 1907) were recorded. The snakes were kept in the University of Chittagong, Chittagong (now Chattogram), Bangladesh, housed singly in 80 x 40 x 40 cm box, in room temperature and natural photo period from October 2006 to January 2012. Common Kraits were observed one after another in consecutive years. During the same period the behavior of the snakes were monitored. The date of skin shedding, pre- and post-shedding activities were recorded throughout the period. The rate of ecdysis was calculated dividing by the number of ecdysis per year. Meteorological data, included temperature, rainfall, and relative humidity, were collected from the Meteorological Station in Ambagan, Chattogram. Multiple correlation analysis was done using SPSS 16.00 to examine the relationship between the monthly number of molts and the average temperature, rainfall, and humidity aiming to identify any link between shedding and climatic factors.

RESULTS AND DISCUSSION

B. caeruleus molted 25 times during the study period (October 2006-January 2012). The mean molting interval was 53 ± 6 days (range 15-125 days) (Figs. 1 & 2). The molting rate was 6.25 times per year per snake. The species behaved gently and/or remained less active, intended less feeding and less discharging excreta before and after molting. In case of *B. niger*, molting occurred 5 times from November 2006 to July 2007 and the mean interval was 61.75 ± 9 days (range 39-80 days) (Figs. 1 & 2). The molting rate was 6.32 times per year per snake. It was active and no inclination to feed in before and after molting. On the other hand, *B. walli* molted 8 times during November 2006 to August 2007 and the mean interval period of shedding was 42.57 ± 8 days (range 27-83 days) (Figs. 1 & 2). The molting rate was 8 times per year per

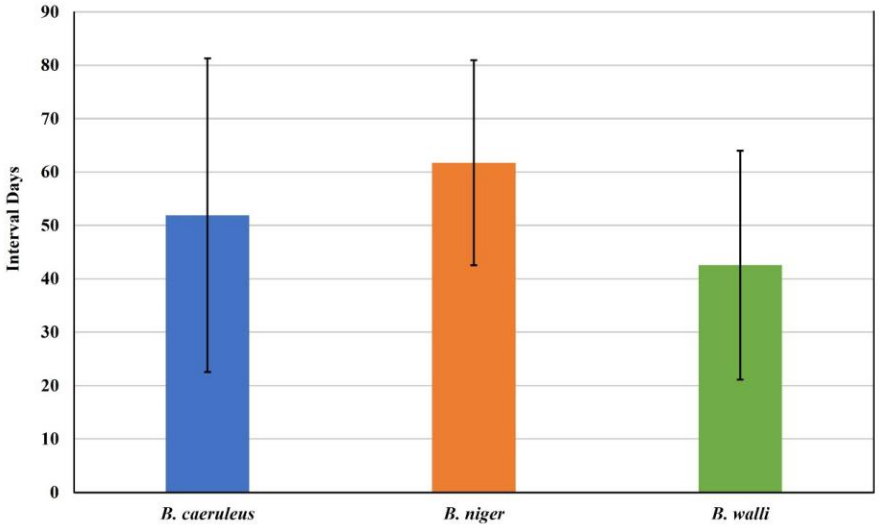

Fig. 1. Mean interval days of molting of three species of kraits in Bangladesh.

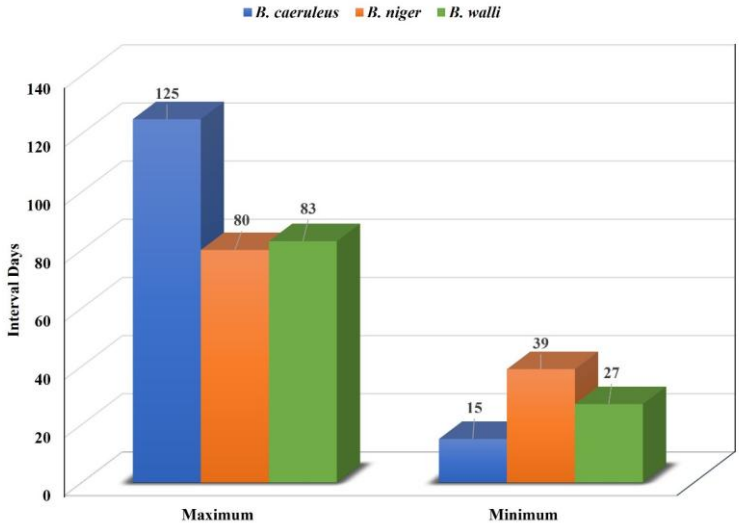

Fig. 2. Maximum and minimum interval days of molting of three species of kraits in Bangladesh.

snake. The species was less active, less intended to feed and ejection of excreta before and after shedding. In all three studied species, the body color became faded before 7-8 days of molting and all molting were complete ecdysis. Multiple correlation analysis was conducted to determine the relationship between molting frequency and temperature, rainfall and humidity; and showed weak

positive correlations with shedding during this study (temperature: r = 0.22, rainfall: r = 0.13, and humidity: r = 0.17) but these physical factors did not significantly influence the shedding of the studied species ($p > 0.05$).

DISCUSSION

Kraits molted in regular intervals. No specific difference with other snake molts was found and species can be identified by scales counting of the molts. The mean molting interval days were higher (61.75 days) in Greater Black Krait than other two species. The highest molting rate was recorded for *B. walli* (8 times/year/snake) and the lowest for *B. caeruleus* (6.25 times/year/snake). Saint-Girons and Duguy (1976) and Saint-Girons (1980) observed that Iberian Cross Adder and European Viper respectively have regular shedding cycles with on an average of twice a year. Mosmann (2001) presented the frequency of ecdysis, for snakes in general, as two to four times a year. Panizzutti *et al.* (2001) reported that the shedding rate of Neotropical Rattle Snake was up to 21.6 times per year per snake, which is much higher than that of the present study on kraits (maximum 8/year/snake). On the other hand, Lamonica *et al.* (2007) showed Anaconda (*Eunectes murinus*) shedding rate was 8.28 per year per snake, which is also bit higher than that of the present study. Shankar and Whitaker (2009) mentioned King Cobra (*Ophiophagus hannah*) molt rate 6.0 times (in male) and 5.2 times (in female).

The maximum (125 days) and minimum (15 days) interval days between two molting were recorded for *B. caeruleus*. The interval days between two ecdysis was longer in winter (November to January, while no molting occurs in February) but was more frequent in other times of the year. This is due to inactivity and slow metabolism rate of snakes during winter. Body color becomes dull before 7-8 days of molting. The vision of snakes is impaired during the opaque stage (Reinert, 1993) resulting in reduced activity but *B. niger* remained more active before and after molting instead of less active like other two species. Comparatively, higher number of molts was found in March, June and October whereas the highest molt was found in March (6-moult) during the study period (Fig. 3). The highest molting occurred in March may be the absence of molting in February and increasing temperature. The highest peak of molting in March reveals that skin sheds in this time may be significantly thinner than skins shed in other times. Relatively higher temperature is important for the physiological processes involved in epidermal cell growth (Gibson *et al.*, 1989). Some snake species shed more frequently during the summer, at higher temperature or after increasing in temperature (Cliburn, 1976; Semlitsch, 1979; Maderson, 1984). In this study, we found that higher molts were found during higher temperature,

which may be reflection of the lowest molts and low temperature in December (Fig. 3). Same reflection may be happened in April after the highest molts in March. After increasing temperature in March up to October the temperature varied little bit so the number of molts also remain almost similar (Fig. 3). This study suggests that the favorable temperature for ecdysis of these species is 26-27˚C and humidity is 70-83%. Hildebrand and Goslow (2001) reported that shedding is influenced by humidity. Shedding is also synchronized with the seasonal cycle according to the availability of energy resources and time to complete the essential functions (Ling, 1972). The climatic conditions especially temperature influenced the shedding but rainfall and humidity did not appear to influence the shedding of the studied species during the study period.

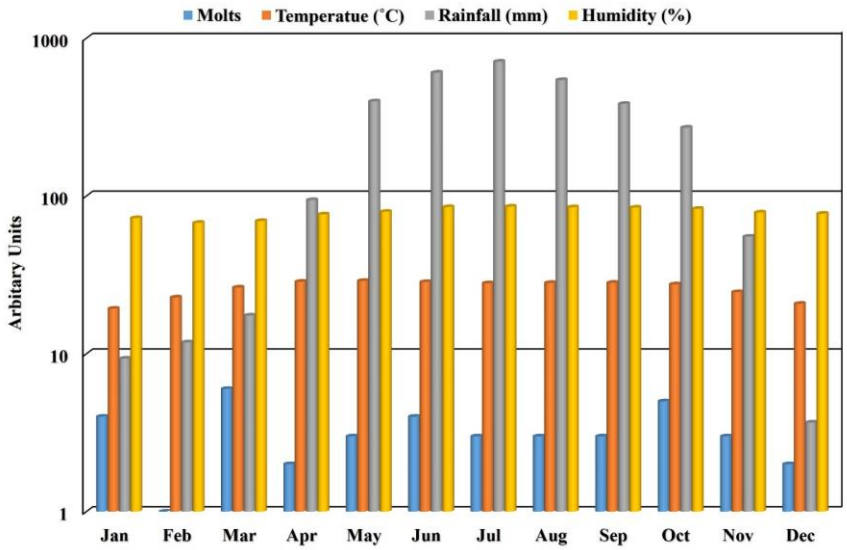

Fig. 3. Average temperature, rainfall, humidity and monthly molting frequency of three species of kraits.

CONCLUSION

This study may be used as the basement of further ecological investigation of life history patterns of krait species. Large scale and long-term study with large sample size, and onsite meteorological data may lead more precise output about the molting pattern of krait species in Bangladesh.

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LITERATURE CITED

AHSAN, M.F. and RAHMAN, M.M. 2017. Status, distribution and threats of kraits (Squamata: Elapidae: *Bungarus*) in Bangladesh. *J. Threatened Taxa*. **9**(3): 9903-9910.

BECHTEL, H.B. 1957. Some microscopic aspects of ecdysis in snakes. *Herpetologica.* **13**: 177-181.

CHISZAR, D., SMITH, H.M., RADCLIFFE, C.W. and BEHLER, J.L. 1992. Cover-seeking behaviour and ecdysis in red-spitting cobras (*Naja pallida*). *Bull. Psychon. Soc.,* **30**(3): 215-216.

CLIBURN, J.W. 1976. Observations of ecdysis in the black pine snakes, *Pituophis melanoleucus lodingi* (Reptilia, Serpentes, Colubridae). *J. Herpetol.,* **10**: 299 - 301.

FORKS, T.P. 1983. The histology of ecdysis in snakes. *Bull. Chic. Herpetol. Soc.* **18**: 1-6.

GIBSON, R.A., SMUCNY, D.A. and KOLLAR, J. 1989. The effects of feeding and ecdysis of temperature selection by young garter snakes in a simple thermal mosaic. *Can. J. Zool.,* **67**: 19-23.

GOODMAN, G. 2007. Common dermatoses in reptiles. *In Practice*. **29**: 288-293.

HILDEBRAND, M. and GOSLOW, G. 2001. *Analysis of Vertebrate Structure*, *5th Edition*. John Wiley and Sons, New York.

LAMONICA, R.C., ABRAHAO-CHARLES, H., LOGUERCIO, M.F.C. and ROCHA-BARBOSA, O. 2007. Growth, shedding and food intake in captive *Eunectes murinus* (Linnaeus, 1758) (Serpentes: Boidae). *Int. J. Morphol.* **25**(1): 103-108.

LING, J.K. 1972. Adaptive functions of vertebrate molting cycles. *Am. Zool.* **12**: 77-93.

MADERSON, P.F.A. 1964. The skin of lizards and snakes. *Brit. J. Herpetol.,* **3**: 151-154.

MADERSON, P.F.A. 1965. Histological changes in the epidermis of snakes during the sloughing cycle. *J. Zool.,* **146:** 98 - 113.

MADERSON, P.F.A. 1984. The squamate epidermis: new light has been shed. *Symp. Zool. Soc. Lond.* **52**: 111-126.

MADERSON, P.F.A. 1986. The tetrapod epidermis: a system proto-adapted as a semiochemical source. pp. 13-25. In: Duvall, D. Müller-Schwarze, D. and Silverstein, R.M. (eds), Chemical signals in vertebrates, 4, Ecology, Evolution and Comparative Biology. Plenum Press, New York.

MOSMANN, M.N. 2001. Guia das Principais Serpentes do Mundo. Vol. 1. Universidade Luterana do Brasil, Canoas.

PANIZZUTTI, M.H.M., OLIVEIRA, M.M., BARBOSA, J.L., CAVALCANTI, P.L.X. and ROCHA-BARBOSA, O. 2001. Evaluation of a balanced fresh past diet for maintenance of captive Neotropical rattle snakes used for venom production. *J. Am. Vet. Med. Assoc.* **218**(6): 912-914.

RAMESH, C. and BHUPATHY, S. 2013. Ecdysis in free-ranging Indian rock pythons: a case study. *Hamadryad.* **36**(2): 130-136.

REINERT, H.K. 1993. Habitat selection in snakes. pp. 201-240. In: Seigel, R.A. and Collins, J.T. (eds). Snakes, Ecology and Behavior. McGraw Hill, New York.

SAINT-GIRONS, H. 1980. Le cycle des mues chez les vipers européennes. *Bull. Soc. Zool. Fr.,* **105**: 551-559.

SAINT-GIRONS, H. and DUGUY, R. 1976. Écologie et position systématique de *Vipera seoanei* Lataste, 1879. *Bull. Soc. Zool. Fr.* **101**: 325-339.

SEMLITSCH, R.D. 1979. The influence of temperature on ecdysis in snakes (genus *Natrix*) (Reptilia, Serpentes, Colubridae). *J. Herpetol.* **13**: 212-214.

SHANKAR, P.G. and WHITAKER, N. 2009. Ecdysis in the king cobra (*Ophiophagus hannah*). *Russ. J. Herpetol.* **16**(1): 1-5.

TU, M.C., LILLYWHITE, H.B., MENON, J.G. and MENON, G.K. 2002. Postnatal ecdysis establishes the permeability barrier in snake skin: New insights into barrier lipid structures. *J. Exp. Biol.* **205**(19): 3019–3030.

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