

HIBERNATION AND AESTIVATION IN GASTROPOD MOLLUSCS.

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INTRODUCTION.

By SUNDER LAL HORA.

The fascinating problems of hibernation and aestivation in gastropod molluscs, resorted to by these animals to tide over unfavourable climatic conditions, seem to have received very little attention at the hands of the earlier students of this group in India. A perusal of the literature on the subject has shown that with the exception of a few casual remarks no serious attempt has been made to study these phenomena in detail as regards the snails inhabiting this country. The exigencies of the service to which I belong necessitate extensive touring in various parts of India at different times of the year, and during such travels I have been able to look for snails and to devote some time to the study of their habits both under natural conditions and in the laboratory. That my work in this particular branch has met with success is shown by the results that I have already published¹ and by the two notes that are given below. Two aestivating species, *viz.*, *Succinea crassinuclea* Pfeiffer and *Macrochlamys glauca* Benson were found by me at Nurpore in the Kangra Valley : a few observations were made in the field about their peculiar habits and, as all the specimens of the latter species that I collected arrived in Calcutta in the same comatose condition as that in which they were found, they were entrusted to Dr. H. Srinivasa Rao for further study. I must express here my great indebtedness to Dr. Rao for his valuable help in this matter. The second note deals with the mode of hibernation of a species of *Glessula* from the Darjeeling District and a few observations on other land molluscs.

To study this problem in detail it is essential that field observations on the animals be made throughout the year and it thus becomes in the main a problem for investigation by local scientists, though other investigators, while on tour, should devote as much attention as is possible to the animals as soon as they are obtained.

Most places in India are subject to two periods of rainfall alternating with two periods of drought. From October to December there is a cold and dry season, towards the end of December and in January we usually get a few showers from the N. E. Monsoon, but from February begins the hot and dry season which lasts till June when we get the S. W. Monsoon : this continues with interruptions up to October. Twice during the year the animals have to tide over conditions that are un-

¹ Hora, *Rec. Ind. Mus.* XXVII, pp. 401-403 (1925) ; *Journ. Bombay Nat. Hist. Soc.* XXXI, pp. 447-449 (1926).

favourable, namely a condition either of dryness and cold or of heat and drought, and this they do by withdrawing themselves into their shells and by secreting an epiphragm, or by tightly closing the mouth with the operculum in the case of certain operculate molluscs.

The two phenomena of hibernation and aestivation are outwardly very similar in type but physiologically they must be quite different. Any species that has acquired the one or the other of these habits, in response to changing climatic conditions, must of necessity either be limited in its range of distribution as regards elevation in the hill regions, or must be so plastic as to be able to adapt itself to extremes of climate.

Major Sewell has gone through the manuscript and has made valuable suggestions : for all this my best thanks are due to him.

NOTE ON TWO SPECIES OF AESTIVATING GASTROPOD MOLLUSCS FROM THE KANGRA VALLEY.

By H. SRINIVASA RAO.

While touring in the Kangra valley, Western Himalayas, in the months of May and June 1926, Dr. Sunder Lal Hora observed instances of aestivation in two species of molluscs belonging to the families Succineidae and Zonitidae. He was able to study them in the field and record his observations. The present note is based on his observations and those of mine in the laboratory. I have here to thank him sincerely for giving me the opportunity of examining the molluscs and of making use of his field notes.

One of the species is represented by a young individual of *Succinea crassinuclea* Pfeiffer,¹ which is recorded from various places in N. India including the Simla Hills and the Punjab Salt Range. The species was hitherto known only from the shell. I have, in the specimen from Dr. Hora's collection, the soft parts also which are in a good state of preservation. I therefore take this opportunity of adding a brief note on the soft parts before proceeding to describe its habits.

In external features the species does not differ very strikingly from other species of *Succinea*. The jaw is quadratic in form with a saucer-shaped cutting-piece. Its anterior and posterior margins are concave, and the former has in its middle a mound-shaped projection. The arms of the cutting-piece are short and have their extremities broadly conical. The sides of the accessory basal plate are more or less straight, while its posterior margin is cup-shaped in the centre. The jaw is fairly well chitinised in the cutting-piece and on the sides of the basal plate. In the shape of the jaw the species stands distinct, though it is remarkable that the cutting-piece approaches in certain respects those of *Lithotis tumida*² and *Lithotis rupicola*,³ two rupicolous species known to live and hibernate in certain parts of the Western Ghats, Bombay Presidency.

¹ Rao, *Rec. Ind. Mus.* XXVI, p. 387 (1924).

² *Id. Ibid.* p. 393, fig. 6d.

³ Rao, *Rec. Ind. Mus.* XXVII, p. 390, fig. 3 (1925).