CHAPTER 10

HISTOCHEMICAL DEMONSTRATION OF INCREASED CORTICOID LEVEL IN THE ADRENAL OF THE MIGRATORY STARLING, STURNUS ROSEUS (LINNAEUS) TOWARDS THE MIGRATORY PHASE

It is known that adrenocorticotropic hormone (ACTH) accelerates the synthesis of corticosteroid hormones as well as the rate of their release from the adrenal (Brown, 1960; Ganong, and Forsham, 1960; Urist and Deutsch, 1960; Zarrow et al., 1962). Species differentiation in the corticoids of adrenal cortex in mammals has been noted (Bush, 1953; Hechter and Pincus, 1954; Dorfman, 1959). Later these differences were observed in different species of birds, e.g., the white king pigeon, the western gull and the white pekin duck (DeRoos, 1961) and in the domestic chicken (Phillips and Jones, 1957). However, Nagra et al., (1960) found no cortisol in the adrenal venous effluent plasma of three gallinaceous species.

Histochemical localization of corticoids, has been shown by indirect methods but a direct demonstration was obtained only recently by Khanolkar et al., (1958) in the rat adrenal. However, no such attempt has been made for the localization of corticoids in the adrenal of birds and the histochemical demonstration of seasonal changes in the adrenal corticoids of a migratory bird should be particularly useful. In the present study the localization of, as well as the seasonal changes in the corticoids of the adrenal of a migratory bird, Sturnus roseus, has been demonstrated. These birds arrive in Baroda (India) about the month of September and leave towards the end of April.

Materials and Methods

The birds were shot in the early morning during the months of March and April and the adrenals of both the ~~male~~ and female birds were excised and fixed in 10% cold neutral formalin for 12 to 18 hours. Later the tissues were perfectly washed in tap water, embedded in 15% gelatin at 37°C for 2 hours and blocks were prepared and preserved in cold 6% neutral formalin. Sections were cut at 15 µ on a freezing microtome and the rest of the procedure was as followed by Khanolkar et al., (1958). Sections were washed in distilled water and transferred into phenylhydrazine-acetic acid mixture (10 ml. of phenylhydrazine with 0.5 ml. of 1% acetic acid), for 5 to 10 minutes to block the plasmal reaction. The sections were then washed three to four times in water and transferred in 5% $FeCl_3$ maintained at 60°C for half an hour. The sections thus treated were washed in water, kept in Schiff's reagent for 30 to 40 minutes and then washed in SO_2 water to be finally mounted in glycerine jelly. Counterstaining with haematoxylin was not found necessary. Corticoids stained pink. To confirm the reaction the adrenal of rat was used as test material.

Results and Discussion

In the stained preparations of sectioned adrenals from both sexes in the last week of March and first week of April, the corticoids were revealed as moderately distributed pink granules confined to the cortical cells (Figs. 1 & 3). In the third week of April just a few days prior to actual migration the corticoids increased tremendously completely filling the cortex cells (Figs. 2&4).

Figs. 1 - 4. Photographs of the T.S. of the adrenal of the Rosy [illegible]or showing the distribution of corticoids.

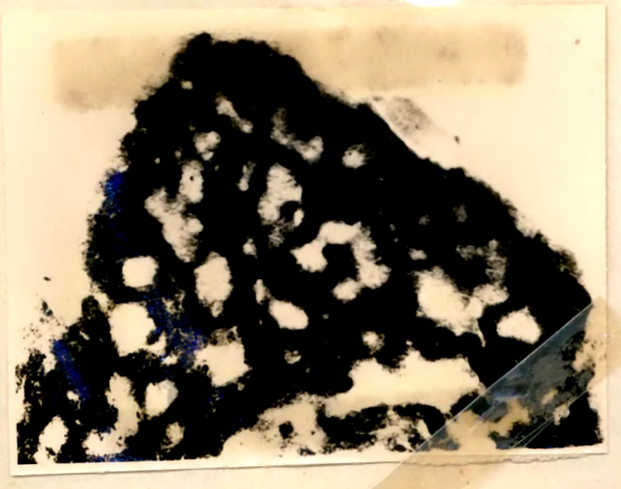

Fig. 1

300 μ

Fig. 2

Fig.1. In the month of March.

Fig. 2. In the month of April.

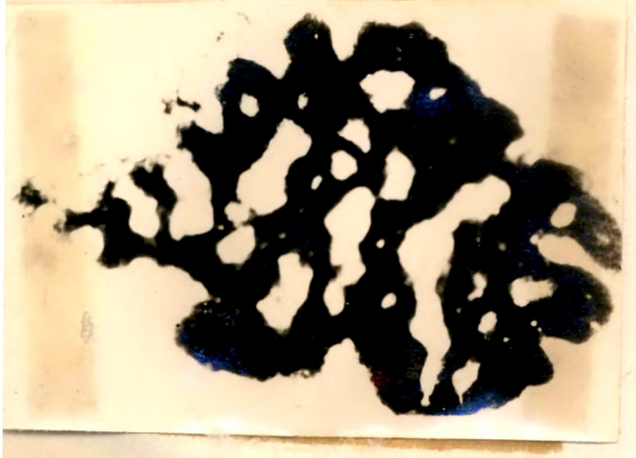

Fig. 3

100 μ

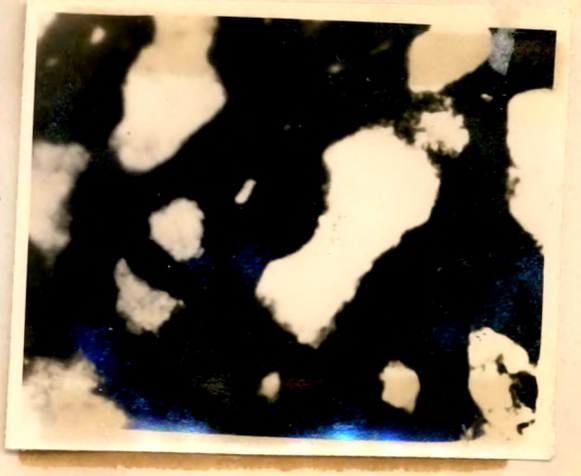

Fig. 4

Fig. 3. Part of the section in Fig. 1 magnified.

Fig. 4. A portion of fig. 2 magnified.

Ghosh (1962) observed in certain species of birds some cytochemical zonation in the adrenal cortex but not in others. In the case of the Rosy Pastor, however, there was no histological or cytochemical zonal differentiation. Similarly, in the histochemical localization of corticoids also, no zonal difference in the adrenal cortex was observed.

Robertson et al., (1961, 1962) found hyperadrenocorticism in spawning migratory and non-migratory rainbow trout as well as in the Pacific salmon. In the migratory trout (Steelhead), hyperplasia of the adrenocortical tissue, elevated concentrations of 17-hydroxy-corticoids (17-OHCS). In the Rosy Pastor in addition to the hypertrophy of the adrenal cortex a tremendous increase of corticoids prior to migration for breeding was noted. The increase in corticoids should therefore be revealed as a stress phenomenon.

Both in vitro and in vivo investigations have established that ACTH stimulates the production of corticoids (Brown, 1960; Nagra et al., 1960; Urist and Deutsch, 1960; DeRoos, 1961). Hayano et al., (1956) suggested that ACTH acts at some points in the conversion of cholesterol to corticoids. Haynes et al., (1957) and Haynes (1958) demonstrated that ACTH activates the adrenal phosphorylase and thereby increasing the production of corticosteroids.

Since it is clear that ACTH increases the production as well as the output of corticoids in the Rosy Pastor too, it is possible that at the time of migration the increased ACTH production induces increased corticoid synthesis in the adrenal cortex.

Summary

1. The localization and the increased production of corticoids in the adrenal cortex of the Rosy Pastor towards the migratory phase have been histochemically demonstrated.

2. It is suggested that the increase of corticoids are a result of the increase of ACTH prior to migration.