

ON THE SECRETORY ACTIVITY OF THE CELLS OF THE HEPATIC
CAECA IN THE INSTARS AND ADULTS OF SOME ACRIDIDS
(ORTHOPTERA : INSECTA)

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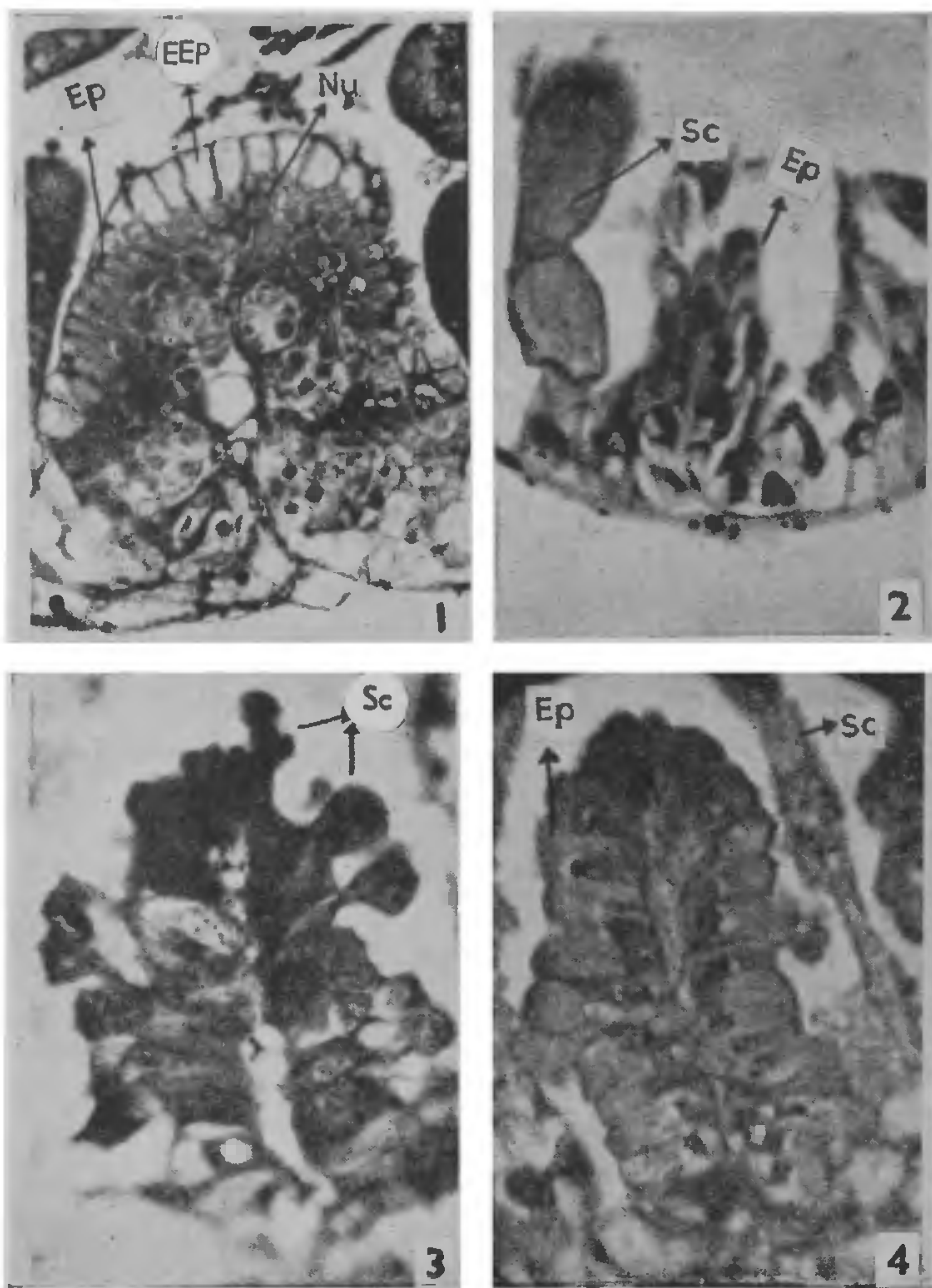
INFORMATION on the secretory activity of the cells of the hepatic caeca and the midgut epithelium in Acridids is restricted to the works of Hodge,¹ Khan,^{2,3} Shinoda⁴ and Woodruff.⁷ In general the secretions are regarded as merocrine, the secretory cells not breaking in the process and the nucleus remaining intact. Shinoda⁴ however observes that the secretions are normally merocrine, becoming holocrine when fed after a period of fasting. Observations of Srivastava⁵ in *Periplaneta americana* fed after a month's starvation, show the secretions to be of merocrine type. Srivastava⁶ working on *Liogryllus bimaculatus* Sauss. also reports that the midgut cell extrusions are caused by cell degeneration and do not represent the digestive secretions. Hodge¹ confirms the holocrine nature of secretion in *Melanoplus* at the time of intensive digestive activity and merocrine when not particularly active. Observations pertaining to the nature of the secretions in the nymphs and adults of *Eyprepocnemis alacris alacris* (Serv.) as well as in the adults of *Truxalis indicus* Bol. and *Pækilocerus pictus* Fabr. are presented here.

For staining purposes Haidenhain's hæmatoxylin and Haidenhain's Azan with 3% alum as mordent was used. Better results were obtained when 1½% alum was first used and subsequently 3% differentiator.

Observations on the adults of all the three species mentioned showed typically holocrine mode of secretion in normally active individuals of *E. alacris alacris* and apocrine in *Truxalis indicus* and *Pækilocerus pictus* (Fig. 1, 3 and 4). While the major portion of the secretory material in *E. alacris alacris* is extruded into the lumen of the lobe of the hepatic caeca and pouring out through the interspaces between different lobes, a limited amount appears to be directly extruded through the brush border of the cells. In the newly formed folds of the caeca, the cells are long and there is no lumen or cavity in the folds. During the secretory activity, the secretion is poured into the lumen, resulting in its enlargement. Sometimes the folds break at some points, thus releasing the secretion into the lumen of the caeca. In *Truxalis indicus* and *Pækilocerus pictus* the distinct bladders or vesicles project into the lumen of the hepatic

caeca and these could be explained in terms of foldings to form complex crypts, of cell outgrowth, discharging the secretory products. In *Truxalis indicus* the secretory vesicles are more numerous at the apex, while in *Pækilocerus pictus* they are more basally situated. When the insects (*E. alacris alacris*) were fed for 1½ days after moulting into the adult and starved for 3½ days, the epithelial cells appear distorted and the folds or the villi become completely disorganised, followed by nuclear clumping towards the muscular layer, without any secretory granules being present in the cytoplasm of the cells.

Examination of the structure of the hepatic caeca in the nymphal instars of *E. alacris alacris* (Fig. 2) reveals that the nature of the release of secretion was found to vary among the instars of the same species. In the first three instars the secretions are of merocrine type while in the IV and V instars both holocrine and merocrine were found to be present. In the IV instar more of merocrine nature was observed, while in the V instar it was *vice versa*. Even among the adults of the same species more of holocrine nature was observed. In the I nymphal instar, immediately after hatching the epithelial cells are single layered, with 6 caecal lobes and the secretion is of merocrine type. In the same instar, two days after hatching, the epithelial cells become columnar and broad. With the increase in the number of cells in the II instar, there is a reduction in the nuclear size upto IV instar and it enlarges once again in the V instar and in the adult condition. There is a tendency for the nuclei to move towards the anterior end from the base, during the secretory activity depending upon the activity of the cells. During the secretory activity, the secretory material appears to be extruded through the brush border in merocrine secretions, many vacuoles appearing in the process. When the cells are loaded with secretory material, no vacuoles seem to be present. Among the caecal folds, some are long while others are short, the long ones being loaded with secretory material and designated as major folds, while the neighbouring smaller folds, not containing much of the secretory material, as minor folds. Presumably, the major folds when full of secretion, break up, liberating the secretory products. During this period the minor folds



FIGS. 1-4. Fig. 1. Adult hepatic caecal lobe of *Eyprepocnemis alacris alacris*. Fig. 2. Showing the release of secretion in II instar of *Eyprepocnemis alacris alacris*. Fig. 3. Adult hepatic caecal lobe of *Truxalis indicus*. Fig. 4. Adult hepatic caecal lobe of *Pakilocerus pictus*. (Ep.—Epithelial cell; Nu.—Nucleus; EEP—Emptied epithelial cells; Sc.—Secretions.)

become active and may develop to form the major ones, and thus alternate with each other in relation to the secretory activity of the caecal lobes. The cells in the posterior region of the hepatic caeca do not take part in the secretory activity but they may help in storing the secretory products produced in the anterior lobe of the caeca.

1. Hodge, C., *J. Morph.*, 1937, 59, 423.
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4. Shinoda, O., *Zellforsch Mtky Anat.*, 1927, 5, 278.
5. Srivastava, R. P., *Curr. Sci.*, 1955, 24, 57.
6. —, *Experientia*, 1966, 22 (6), 372.
7. Woodruff, J. *Morph.*, 1933, 55, 53.