reported the double cocoon-forming phenomenon in *A. assama* considering a limited number of cocoons. The present investigation was to study the frequency of occurrence of double cocoons and their sex association in muga silkworm.

Muga cocoons (24000 in number) were collected from four different places of Assam. From these, 114 double cocoons were obtained and the frequency of occurrence was calculated. Depending upon the sex association, double cocoons were again grouped into (i) female and female, (ii) male and female, and (iii) male and male.

Our results reveal that the frequency of occurrence of double cocoon in muga silkworm is very low with an average of 0.47% occurrence. The frequency of F–F association is higher than either M–F or M–M combination and the ratio being F–F : M–F : M–M = 57.38 : 32.09 : 10.53. Next to F–F association, M–F association is more frequent than M–M combination. The overall female occurrence in double cocoons of muga silkworm was 72.37% whereas male occurrence was 27.63%, which is of significant difference ($P < 0.01$).

Talukder who made similar observations in *A. assama* reported that of 14 double cocoons he studied, 50% were of F–F association, 28.57% of M–F and 7.14% of M–M association.

Unlike higher M–F associations in *B. mori* and *A. mylitta*, in *A. assama*, F–F associations is more frequent. The assumption[4] that the percentage of M–F association in double cocoon is higher due to some attractant released either by the male or by the female, cannot be established in the case of muga silkworm. Further, the view that 'to ensure successful mating' as a probable cause of double cocoon formation in general and M–F association in particular can also be clearly refuted from this study, since F–F association is more frequent in this insect than of M–F association. Unlike *B. mori* the emergence from double cocoon is not zero in *A. assama*. Almost 70% emergence is recorded from double cocoons of muga silkworm.

The involvement of any physiological, eco-climatological or genetical implication behind the phenomenon of double cocoon formation still remains undetermined. However, the present authors feel that some physical effect may be responsible for the double cocoon formation in *A. assama*. Thus, it has been noted that overcrowding in the cocoonage leads to an increase in the occurrence of double cocoon formation. However, the association of F–F cannot be attributed to chance or the effect of ecological condition in the form of over-crowding during cocooning.

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DAMAGE TO THE MIDGUT EPITHELIUM CAUSED BY FOOD IN THE ABSENCE OF PERITROPHIC MEMBRANE

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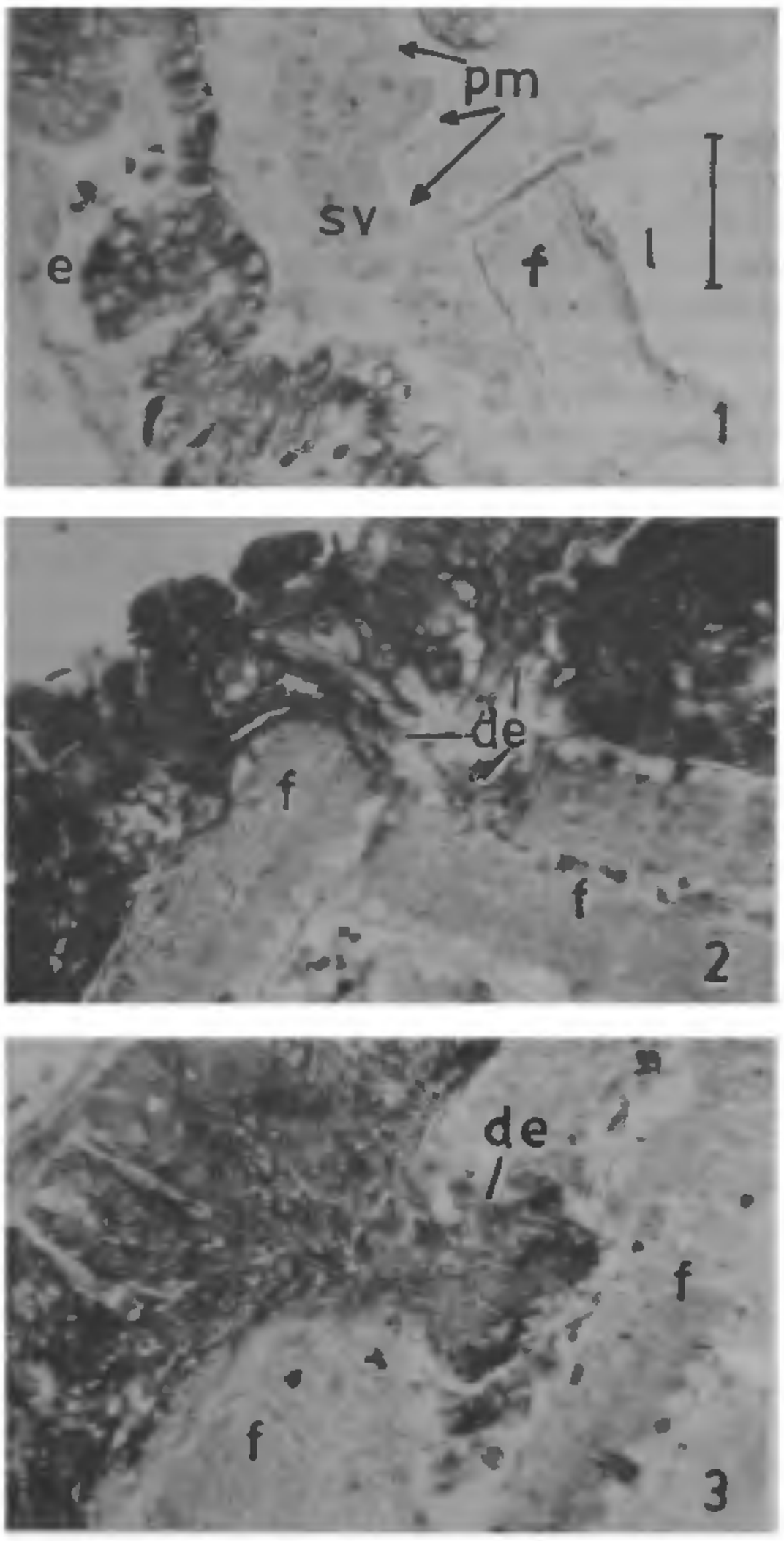
THE peritrophic membrane is a tubular sheath that lines the epithelium of the midgut of insects. It is generally reported to be present in all insects except in fluid-feeders such as adult Lepidoptera[1,2]. It is reported to protect the midgut cell from abrasion by hard fragments of food and act as a barrier to microflora that produce infection[3]. The peritrophic membrane is usually $< 5\,\mu m$ in thickness[4] and is composed of chitin and probably also protein[2]. During a study on the midgut of the fifth instar larvae of *Bombyx mori*, the present authors came across a silkworm which had no peritrophic membrane; the structure of the midgut epithelium and the absence of the membrane are reported.

Normally, the midgut of the silkworm has a distinct peritrophic membrane which lies a little away from the surface of the epithelial cells. The epithelium is composed of a single layer of columnar cells, goblet cells and regenerative cells. Numerous spherical vesicles, pinched off from the apices of the columnar cells, are present in the gap between the epithelium and the peritrophic membrane; these merocrine secretory vesicles contain digestive enzymes. The peritrophic membrane encloses the food

comprised by angular fragments of mulberry leaves; there is no direct contact between the food particles and the epithelium; digestive secretions and the digested food pass through the peritrophic membrane; the epithelial layer is continuous and smooth (figure 1).



Figures 1–3. Transverse sections of midgut. **1.** From normal larva; note the peritrophic membrane which separates the food from the epithelium; the gap is about 20–30 μm in width. The epithelial layer is continuous and composed of one layer of cells which is folded in some regions; **2, 3.** From the larva lacking a peritrophic membrane. Note the direct contact between the epithelium and fragments of leaves which have pared off the epithelial cells; the extensive damage and the debris of cells can be seen; the epithelial layer is unusually thick in this larva. e–epithelium; d.e.–damaged epithelium; f–food; l–lumen; p.m.–peritrophic membrane; s.v.–secretory vesicle. The scale line represents 20 μm.

In the freak larva, there was no peritrophic membrane. The passage of closely packed fragments of leaves aided by the peristalsis of the gut had abraded the epithelium; as a result the cells were found pared and damaged. The cells thus damaged and dislodged collected as irregular heaps within the lumen of the midgut. The integrity of the epithelium was lost and the food particles were jutting against the damaged cells (figures 2 and 3).

It is not clear how the larva survived the repeated abrasion and reached the fifth-instar stage. Probably, the regenerative cells in the epithelium were remarkably active in this larva in repairing the tissues and in coping with the enormous rate of destruction of the epithelial cells as evident from the unusually thick layer of the epithelium.

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NEUROENDOCRINE CONTROL OF PROTEIN AND AMINOACID LEVELS IN THE BLOOD OF FRESHWATER CRAB, *BARYTELPHUSA GUERINI* (H. MILNE EDWARDS) (DECAPODA, POTAMIDEA)

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STUDIES on *Hemigrapsus nudus* showed that the eyestalk principle diverts metabolism towards general growth and its loss through sinus gland removal led to a decrease in the whole animal protein content suggesting the acceleration of cata-