

External morphology of eri (*Samia cynthia ricini* Boisduval) egg during embryonic development

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ABSTRACT

Reddy D.N.R. and K.C. Narayanaswamy. 2000. External morphology of eri (*Samia cynthia ricini* Boisduval) egg during embryonic development. *Ann. Trop. Res.* 22[1&2]:52-59.

This study was conducted to gain better understanding of the features of eri (*Samia cynthia ricini* Boisduval) egg during progressive embryonic development. The eri egg is oval, flat and broader at the anterior region. The follicular imprints are evenly distributed over the chorion. The creamy white egg colour changed to grayish/bluish on the eighth day. The length and width of egg changed on the eighth day after oviposition. The egg mean length was positively related with its width ($r=0.9938$). Except for an increase on the third day, there was a gradual reduction in egg weight through progressive embryonic development.

Keywords: egg morphology. embryonic development. eri silkworm.

INTRODUCTION

Eri silkworm (*Samia cynthia ricini* Boisduval) is one of the sericigenous insects exploited for its silk. Ericulture, once largely confined to the state of Assam, is rapidly spreading to other states of India, where it is an additional source of income to many farmers (Devaiah *et al.*, 1984). The egg is most important in commercial ericulture, as cocoon crop success depends on egg quality (Narasimhanna, 1985). Other than the works of Lefroy and Gosh (1912), Jolly and Sen (1974), Krishnappa (1989) and Nambiar *et al.* (1991),

no other published information is available on the morphology of eri eggs. The present study was made to improve our knowledge of the features of eri egg during progressive embryonic development.

MATERIALS AND METHODS

The eri silkworms required for egg production were raised on castor leaves, the primary food plant of the insect, following standard rearing technology (Basaiah, 1989) at $26.5 \pm 1^\circ\text{C}$ and $75 \pm 5\%$ relative humidity. Eggs laid within 24 h from mating of ten moths were used. Thirty eggs in three replications were maintained to record the visual observations for changes in color during incubation. Based on color, the eggs were grouped into Type-I and Type-II. To study the follicular imprints, ten eggs were fixed in Carnoy's fluid, washed thoroughly in alcohol and separated egg shells were stained with dilute aqueous Giemsa stain. Temporary wet mounts were prepared from the stained chorions and observed under a Steriozome Wild-M8 binocular microscope. Follicular imprint drawings of the general egg surface and the micropylar region were made with a Camera Lucida.

A batch of 30 eggs of known weight was maintained singly in tubes (1 x 5 cm), plugged with cotton and incubated at a constant temperature of $23.5 \pm 1^\circ\text{C}$ and $75 \pm 5\%$ relative humidity in a biological oxygen demand (BOD) incubator. Measurements of the eggs were made under a Wild-M8 microscope at 75x magnification, at an interval of 24 h from the day of oviposition until the eggs hatched. The eggs were aligned at horizontal and vertical positions in a paraffin plate and measured for width at the broader, smaller and middle parts. The eggs maintained singly in tubes were weighed at 24 h intervals in a sensitive Sartorius electronic balance, from the day of oviposition until hatching.

Means, standard deviations and correlation coefficients were computed, based on the methods suggested by Sundararaj *et al.* (1972).

RESULTS AND DISCUSSION

Color of egg

Two types of egg colors - creamy white and dull white or grayish white - were observed in *S. c. ricini* and were grouped into Type-I and Type-II.

Both egg color types remained unchanged until the seventh day. According to Lefroy and Gosh (1912), the eri egg is whitish and appears yellowish due to gum coat on the surface. This may correspond to Type-II eggs that appeared dull white or yellowish white. However, eggs derived from a single moth belonged to either Type-I or Type-II color. This may be due to the nutritive status of the worm or the environment. On the eighth day, the egg color turned grayish white in both types, which coincided with the appearance of head pigmentation in the developing embryo. From the ninth day onwards, the color remained gray until hatching (Table 1). The change in color to gray could be due to pigmentation of the head, setae and thoracic hood of the embryo.

Table 1. Changes in the color of eri eggs during embryogenesis.

Days of development	Color	
	Type I	Type II
0-7	Creamy white	Dull white
8	Bluish white	Bluish white
9	Bluish/Gray	Bluish/Gray
10	Gray	Gray

Follicular imprints

The follicular imprints were uniformly distributed on the egg surface (Fig. 1b). Main cells, intercellular bodies and intercellular spaces were found to be uniform throughout the egg stage. However, the type of follicular imprints varied within the egg and also with the species, as in the case of the study of Jolly and Sen (1969 and 1974). The structure of the micropyle on the broader end of the egg (Fig. 1c) was similar to the pattern described by Kawakami *et al.* (1980) and Hinton (1981) in *Anthereae* spp. The broader end of the egg which possesses the micropyle can be considered as the anterior end (Chapman, 1972). The existence of the micropyle at the broader end indicates that the exit of the embryo after its complete development occurs at the anterior end.

Size and shape of egg

The eri egg is oval, flat, broader at the anterior and narrower at the posterior end (Fig. 1).

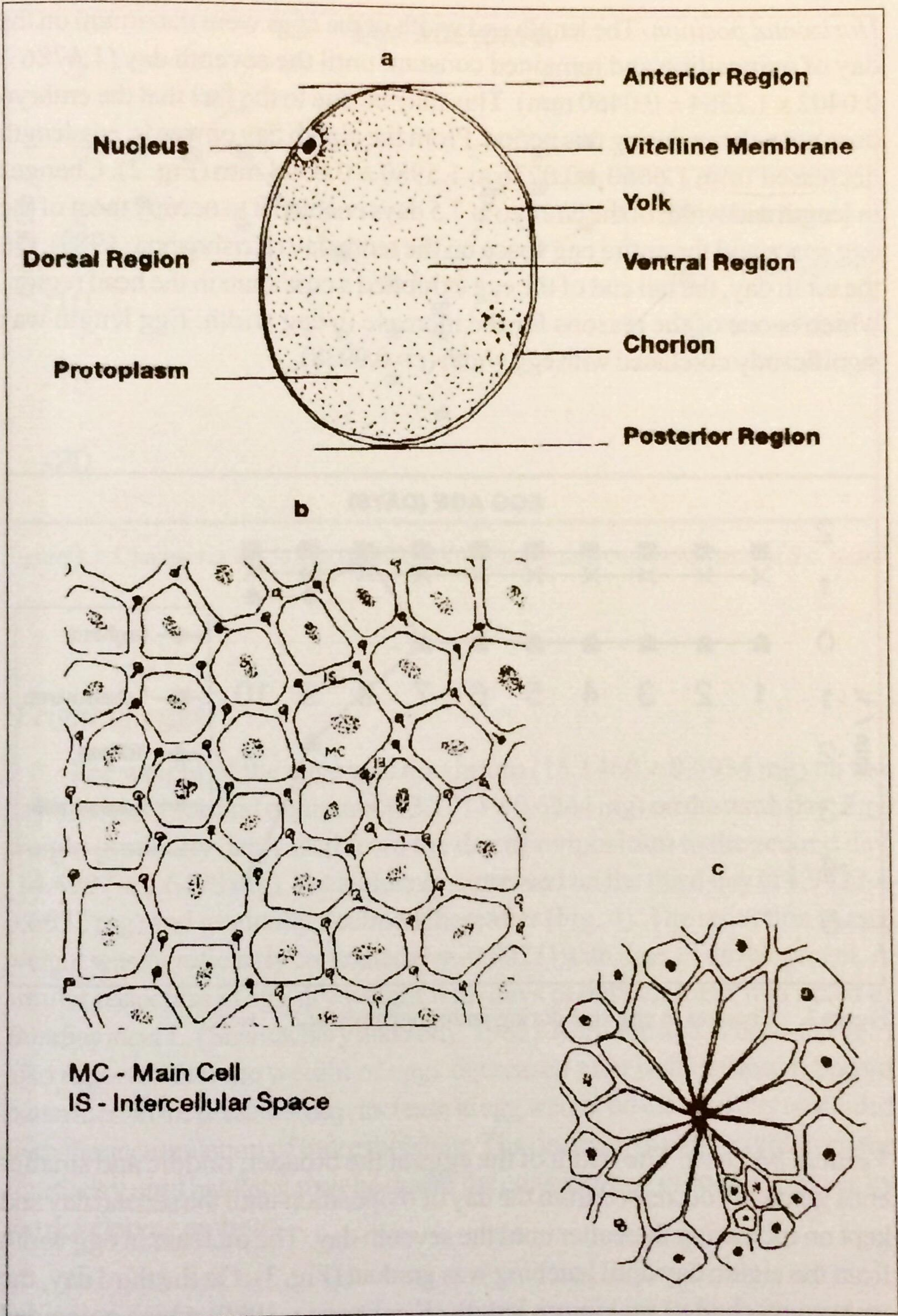


Figure 1. Surface structure of *S. c. ricini* egg (a. position of egg; b. follicular pattern of egg chorion; c. structure of micropyle on the broader end of the egg)

Horizontal position. The length and width of the eggs were maximum on the day of oviposition and remained constant until the seventh day ($1.6786 \pm 0.0402 \times 1.2364 \pm 0.0460$ mm). This may be due to the fact that the embryo does not enlarge during this period. From the eighth day onwards, egg length decreased from 1.6660 ± 0.0276 to 1.5980 ± 0.0394 mm (Fig. 2). Changes in length and width of the embryo at 7.5 days enabled it to occupy most of the egg space and the entire egg space on the tenth day (Krishnappa, 1989). On the ninth day, the tail end of the egg exhibited a curvature in the head region, which is one of the reasons for the increase in egg width. Egg length was significantly correlated with egg width ($r = 0.9938$).

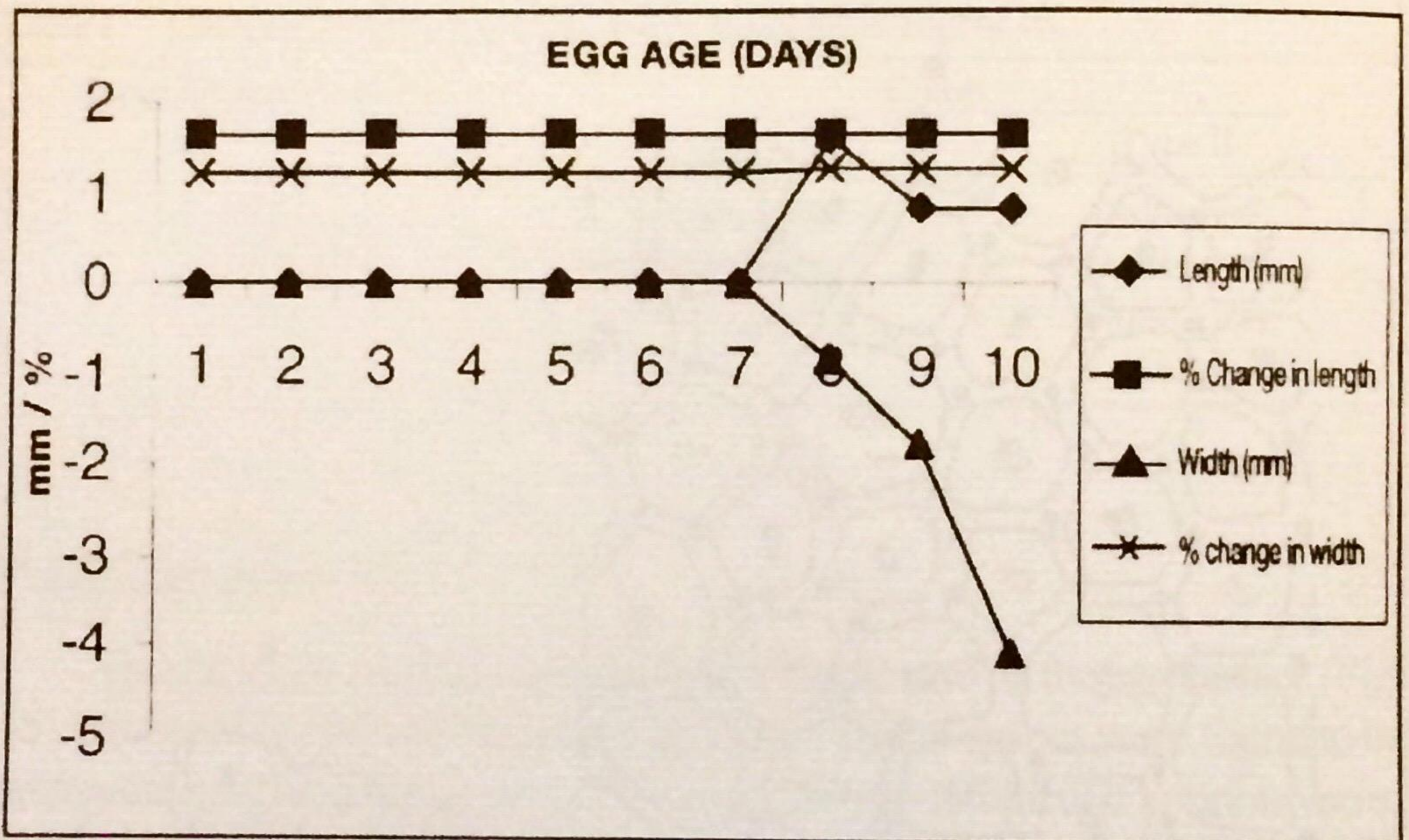


Figure 2. Changes in egg size during embryogenesis of *S.c. ricini*

Vertical position. The width of the eggs at the broader, middle and smaller ends gradually decreased from the day of oviposition until the second day and kept on increasing thereafter until the seventh day. The increase in egg width from the eighth day until hatching was gradual (Fig. 3). On the third day, the embryo reached its maximum length (Krishnappa, 1989) which coincided with the increase in egg width at the broader, middle and smaller ends.

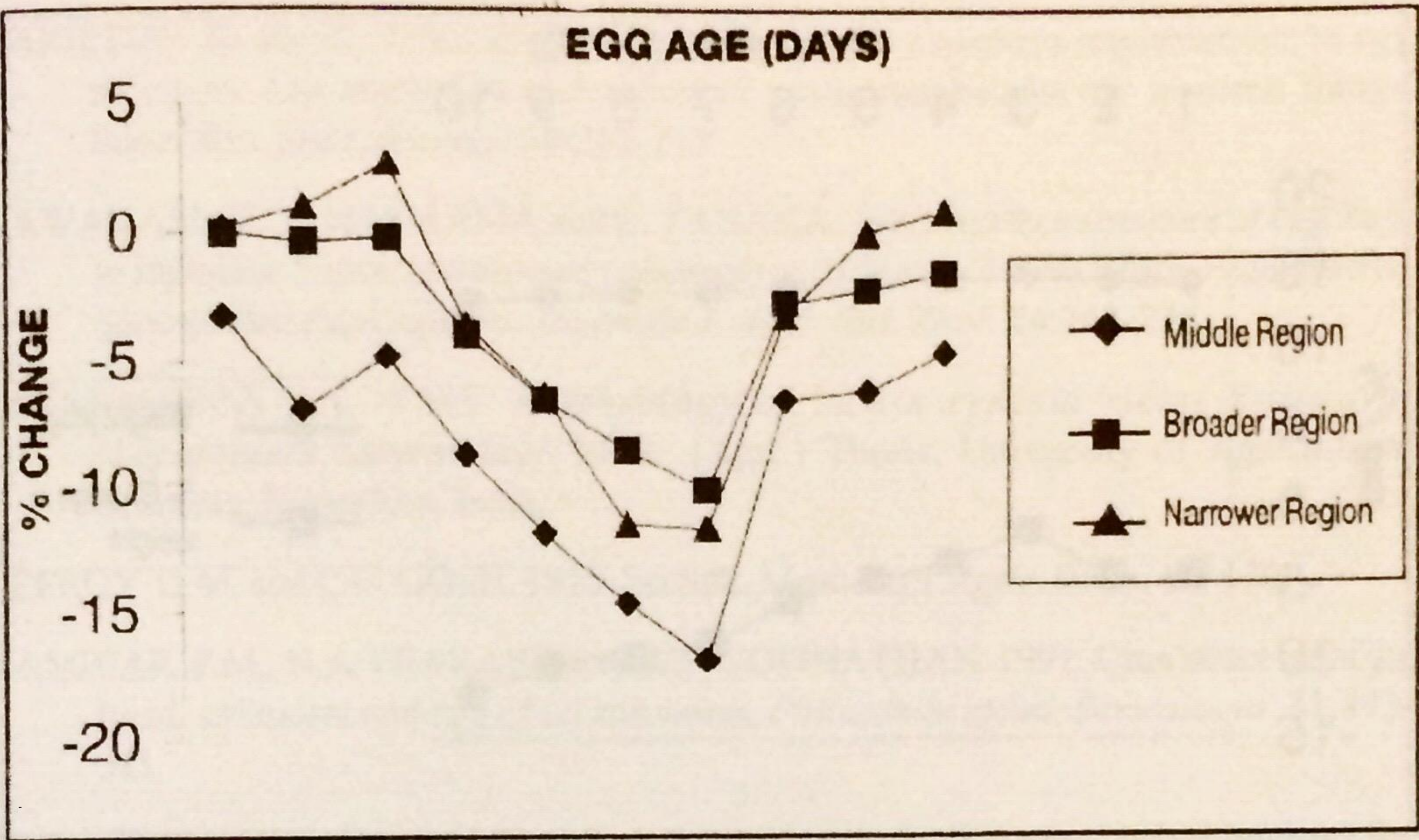


Figure 3. Changes in egg width in different regions during embryogenesis of *S.c. ricini*

Weight of eggs

The weight of the eggs was maximum (15.1460 ± 0.6934 mg) on the day of oviposition and minimum (13.1713 ± 0.6244 mg) on the tenth day. Egg weight gradually decreased from the day of oviposition to the second day (14.4997 ± 0.6499 mg), but suddenly increased on the third day (14.9427 ± 0.6632 mg) and gradually declined thereafter (Fig. 4). The reduction in egg weight was significantly correlated ($r = -0.9021$) with days of development. A similar reduction in egg dry weight with days of development was noted in *Bombyx mori* L. (Shamachary and Jolly, 1985). Karisson and Wiklund (1985) also reported that the weight of eggs decreased after oviposition in Satryd butterflies. In the present study, increase in egg weight on the third day coincided with the accumulation of more moisture. The decrease in egg weight from the fourth day until hatching may be due to the consumption of energy sources by the developing embryo.

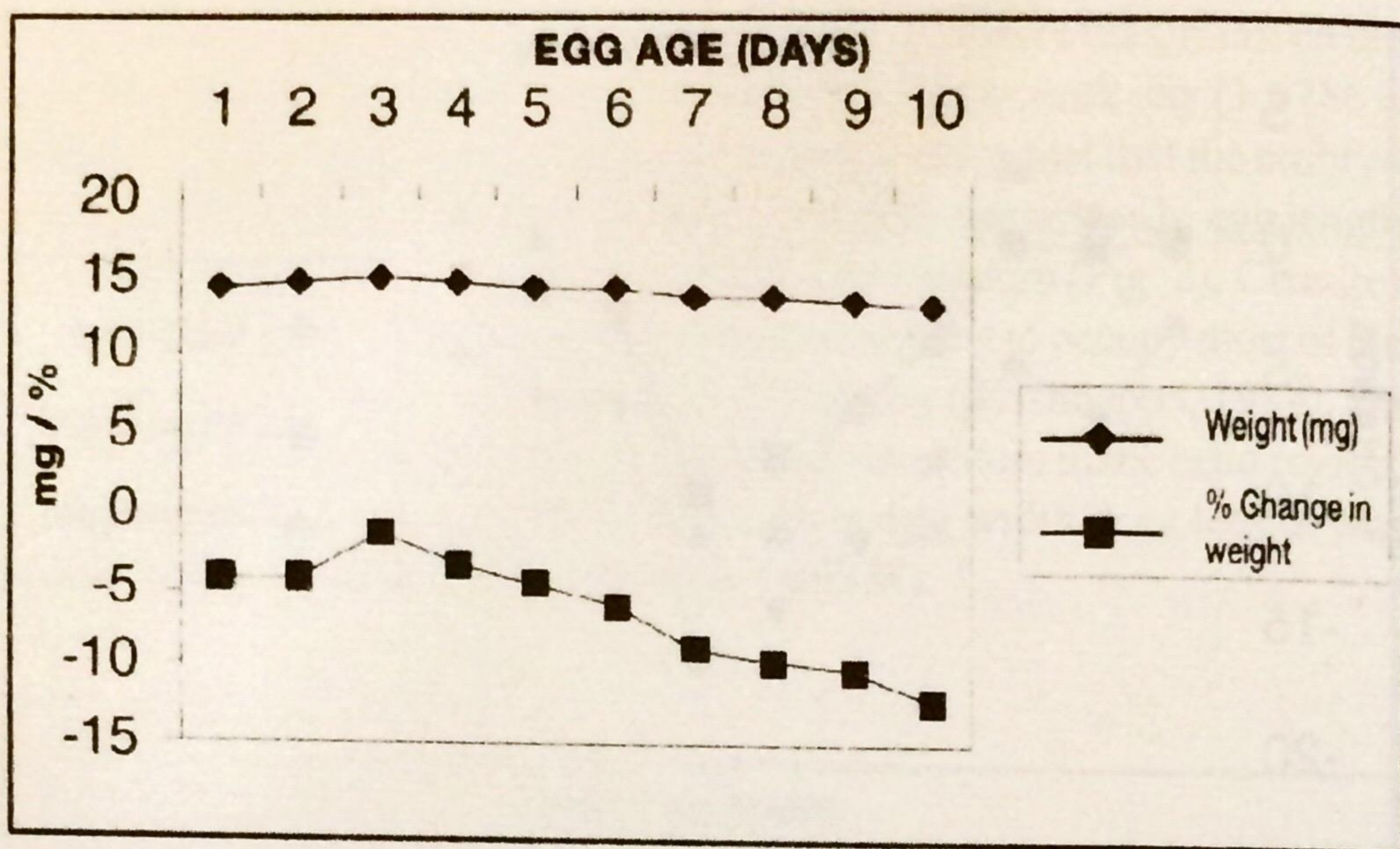


Figure 4. Changes in egg weight during embryogenesis of *S.c. ricini*

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