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External egg morphology of *Melanogryllus desertus* (Pallas, 1771) (Orthoptera: Gryllidae)

Özlem ÇAKICI* and Gürsel ERGEN

Ege University, Science Faculty, Biology Department, Zoology Section 35100 Bornova-Izmir, Turkey.
*Corresponding author, Ö. Çakıcı, E-mail: ozlem.cakici@ege.edu.tr

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Abstract. External egg morphology of *Melanogryllus desertus* was studied with both light and scanning electron microscopy. Culture of this species was made at 26 ±2°C and 45±5% relative humidity in laboratory conditions. Mature female crickets laid eggs singly on cotton and they are carefully separated from each other. Eggs of *M. desertus* are yellow and thin-long shaped. While anterior end has sharp tip, posterior end is rounded. There was a micropylar opening in the anterior end. The surface of the egg is smooth, but posterior end bears small chorionic protrusions.

Key words: *Melanogryllus desertus*, Gryllidae, egg, chorion, morphology.

Introduction

The egg shells are composed of vitelline envelope and chorion (Rosciszewska 1996a,b, Simiczyjew 1999, Poprawa & Rost 2004, Kubrakiewicz et al. 2005, Gaino et al. 2008). The orthopteroid egg shell, like that of many pterygote insects, commonly consists of three layers: the vitellin envelope, the endochorion, and the exochorion. These layers are secreted by the follicle cells by means of successive secretory cycles (Kimber 1980, Mazzini et al. 1984). The studies related to the external surface of the egg by scanning electron microscopy have naturally given rise to the development of ootaxonomy (Mazzini 1987). Egg shells have species-specific characteristics. They may reflect important evolutionary adaptations when comparatively considering their morphology and features of egg shells may be satisfactorily used for phylogenetic concept (Howard & Kistner 1978, Dominguez & Cuezzo, 2002).

Scanning electron microscope (SEM) is an important tool to determine external morphology of biological materials. Several studies were conducted to investigate the surface morphology of insect eggs (Greenberg & Singh 1995, Sahlen 1996, Thomas et al. 1999, Suludere et al. 2000, Choochote et al. 2001, Pascal & Puig 2007, Al-Dosary 2010, Kucerova & Stejskal 2010, Candan et al. 2008, 2011, Dias et al. 2011, Sandoval et al. 2011, Villalobos et al. 2012).

Melanogryllus desertus also known as black cricket damages the plants by eating their shoots. This species is distributed in South Europe, North Africa, southern parts of Siberia and middle Asia, middle and west Anatolian region in Turkey (Lodos 1975). In this study, we aimed to examine external egg morphology of *M. desertus* using light and scanning electron microscope for the first time. We hope that the results obtained from the external morphology of egg of *M. desertus* will be useful for ootaxonomic studies.

Material and Methods

Mating pairs of *Melanogryllus desertus* were maintained at 26±2°C and 45±5% relative humidity in laboratory conditions. Scanning electron microscope studies were applied according to the Nation (1983). Eggs are transferred to 1 % glutaraldehyde in 0.1M cacodylate buffer at pH.7.0 for 5 minutes. The eggs were dehydrated in ethanol and immersed in hexamethyldisilazane (HMDS) for 5 minutes, coated with gold and examined under a Jeol JSM-5200 scanning electron microscope (SEM). Some eggs are examined and photographed using a stereo-microscope (Olympus SZ61) attached with a digital camera (Camedia C-5060).

Results

Eggs of *Melanogryllus desertus* are yellow and thin-long in shape. It measures around 2 mm long and 0.5 mm wide. In light microscopic examinations, it is clearly seen that the surface of the egg is smooth in general. While anterior end has sharp tip, shape of posterior end is rounded (Fig. 1). Posterior end bears small chorionic protrusions (Fig. 2a) but micropyle is located in the anterior end of the egg (Fig. 2b). In scanning electron microscopic investigations, more detailed views of eggs were obtained. Thin-long shaped eggs were easily seen in Fig. 3. Similarly, chorionic protrusions were easily distinguised in view of lateral side of the egg in Fig. 4a and in the top view of the egg in Fig. 4b. In addition, detailed appearance of chorionic protrusions was shown in Fig. 4c. Micropylar opening in the anterior end of the egg were discernible (Fig. 5).

Discussion

In this work, we determined that *Melanogryllus desertus* eggs which is thin-long in shape bears micropyle in the anterior end, and chorionic protrusions in the posterior end. Nevertheless, there are limited studies about the egg morphology of Orthopteran species.

Moscana (1950) reported that eggs of *Basillus libanicus* (Orthoptera: Phasmiidae) were opaque black or dark-sepia colour and beared many elongated and branched light-or dark grey protuberances. In addition, these eggs have slightly curved elipsoid form and approximately 2 mm in length like in *Melanogryllus desertus*. On the other hand micropyl is located in the anterior end of *M. desertus*, whereas it is located on the convex surface of eggs of *B. libanicus*. However, Viscuso et al. (1990) reported that close to the posterior pole, the chorion formed a ringlike constriction, the micropylar region, where the sculptures become indistinct and the micropylar openings appeared. On average there were 40 micropyles in this region, regularly arranged in a ring-like

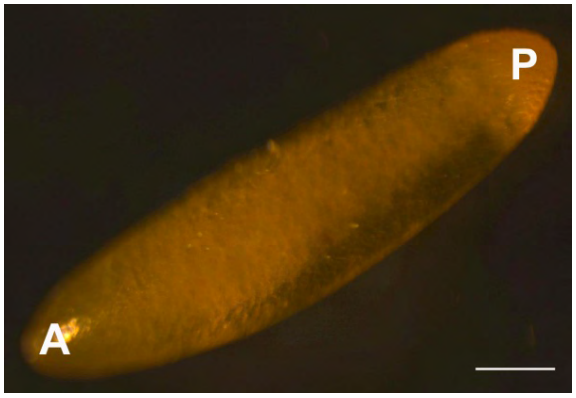

Figure 1. Yellow and thin-long shaped egg of *Melanogryllus desertus*. (A): Anterior end; Note that rounded posterior end (P) has chorionic protrusions. Bar: 250 µm

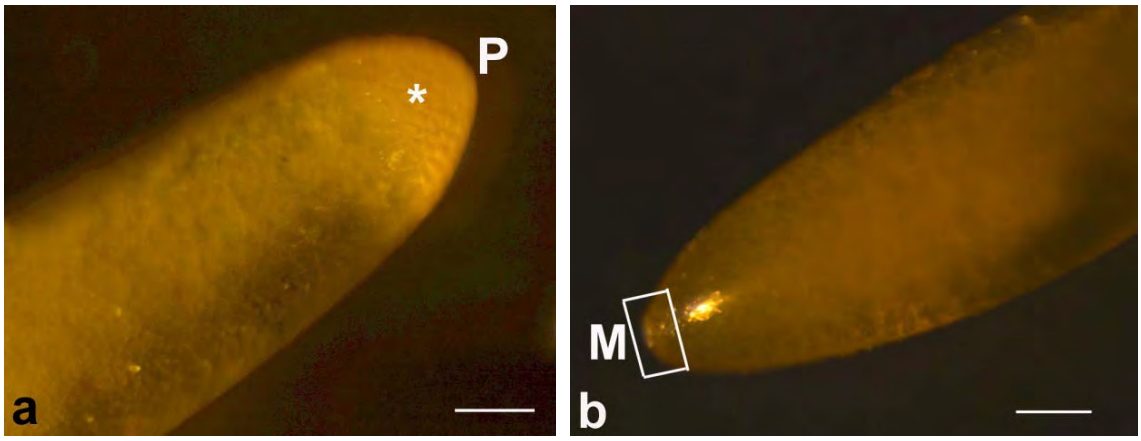

Figure 2. (a.) Detailed view of posterior end (P) of an egg. Chorionic protrusions (asterisk). Bar: 125 µm; **(b.)** Detailed view of anterior end of an egg. M (micropylar region: rectangulated). Bar: 125 µm.

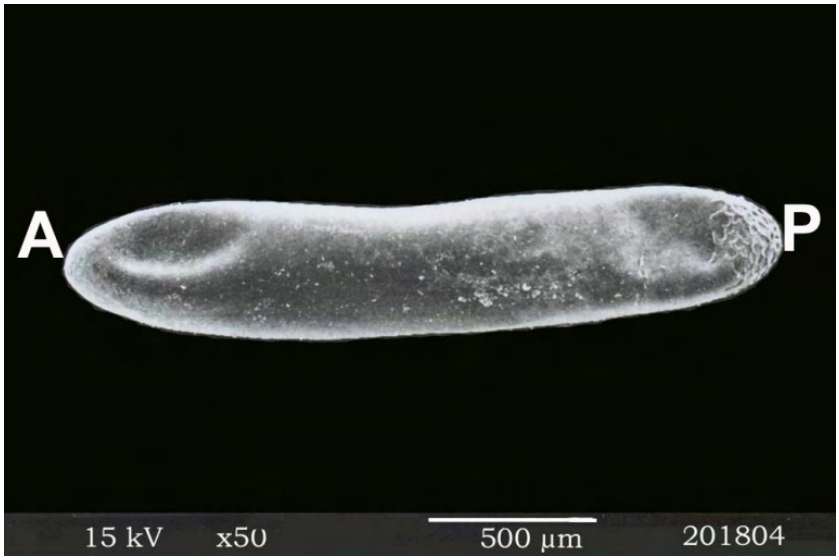

Figure 3. SEM photograph of *M. desertus* egg, Anterior (A), Posterior (P).

manner in *Eyprepocnemis plorans* (Orthoptera: Acrididae).

The egg of *Gryllus bimaculatus* (Orthoptera: Grylliade) is light yellow in color and 2.5-3.0 mm long and 0.5-0.7 mm in diameter. A scanning electron microscopic image of the anterior region of an unfertilized egg showed that no micropyler structure is found. It is located in the mid-ventral region of the egg, number varied between two and four (Sarashina et al. 2005). Interestingly, Sato & Tanaka-Sato (2002) reported that micropyles are situated in the anterior region of the egg of the twospotted cricket *G. bimaculatus*. Similarly, these two contrary views have also been proposed on micropyles of the egg of the house cricket *Acheta domestica*: McFarlane & McFarlane (1988) noted that micropyles situated in the anterior region, whereas Sauer (1966) reported the mid-ventral region. On the other hand, micropyle is located in anterior region of the egg of *Melanogryllus desertus*

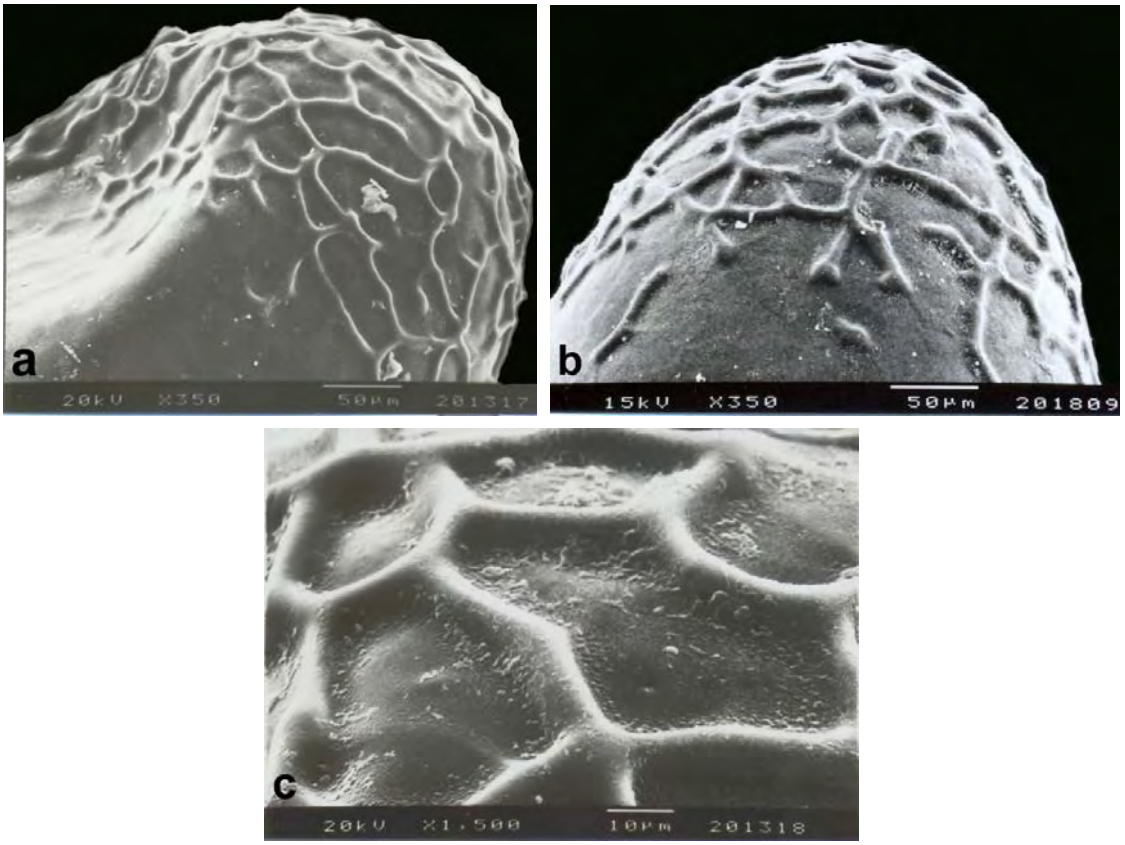

Figure 4. (a.) Chorionic protrusions of posterior end; **(b.)** Top view of chorionic protrusions; **(c.)** Detailed view of chorionic protrusions.

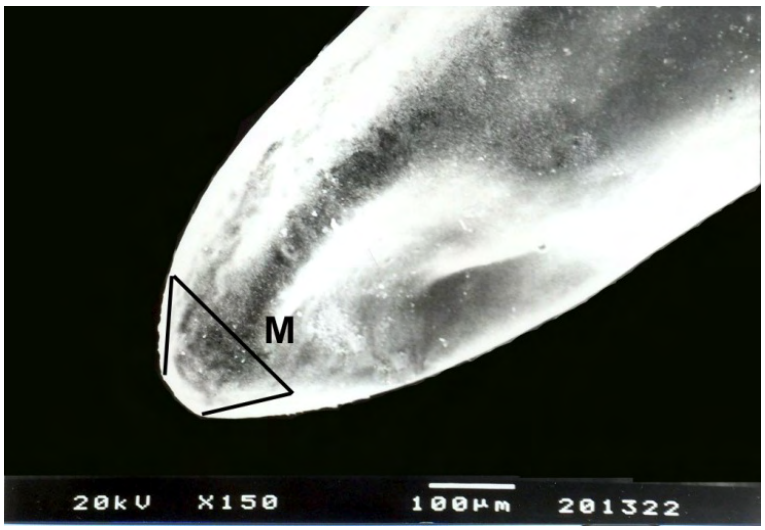

Figure 5. Micropylar region (M) of egg.

belonging to same family, Gryllidae.

The cylindrical eggs of *Gryllomorpha dalmatina* (Gryllidae) are unique in that eggs have micropyles approximately equidistant from the poles of the eggs and in chorionic pattern morphology (Mazzini 1987). The diameter of the eggs of *Galloisiana nipponesis* (Grylloblattidae) are approximately 1.6x0.75mm and there are disc-shaped projections on the external surface of the chorion. The micropylar area is located in the middle of the anterior end of the egg (Matsuzaki et al. 1979).

Both the chorionic and micropylar structures are useful in systematic scheme (Mazzini 1976, 1980). This was particularly true in families containing many species (Phaneropteridae, Meconemidae, Conocephalidae, Tettigoniidae, Sagidae, Ephippigeridae, Gryllidae, Catantopidae and Acrididae) (Mazzini 1984). From this point of view, we belive that this research will contribute to the other works related to the egg morphology of the Orthopteran species.

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