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A PRELIMINARY REPORT OF EGG CHORION FEATURES IN DRAGONFLIES (ANISOPTERA)

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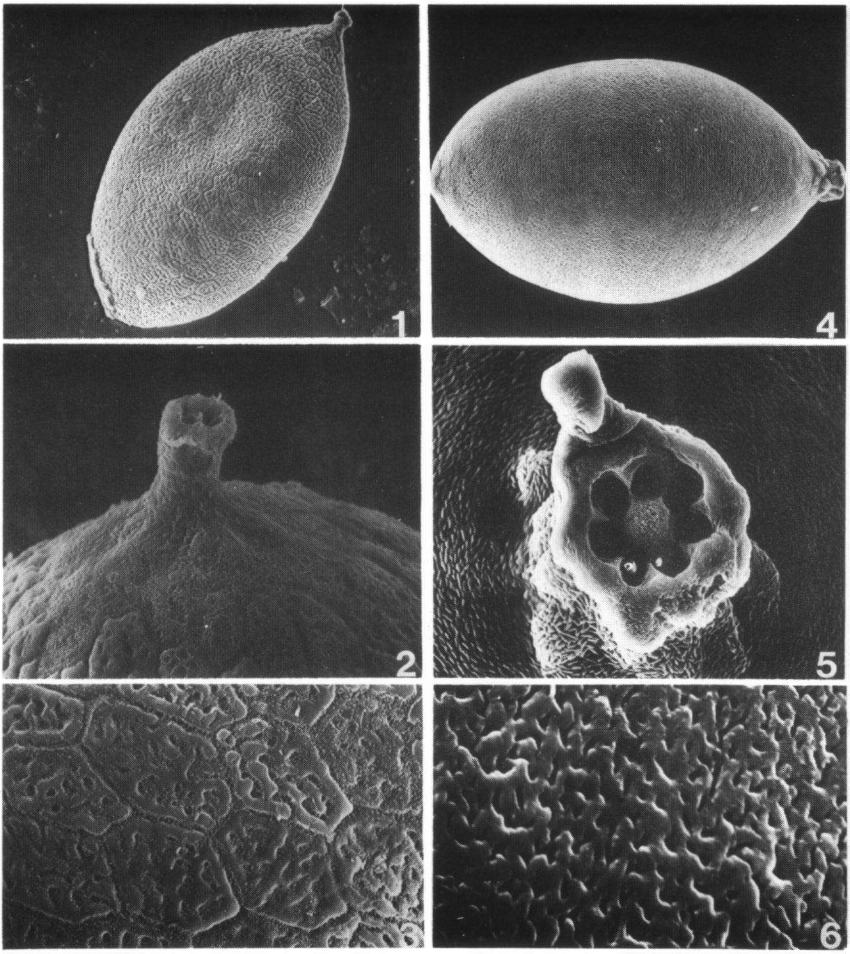
Scanning electron microscopy was used to examine surface chorionic features in selected odon. spp. *Aphylla williamsoni* (Gloyd) and *Gomphus exilis* Sel. (Gomphidae) have thick-shelled, elaborately sculptured eggs which exhibit multiple micropyles on a micropylar stalk. Several libellulid spp. display simply sculptured, thin-shelled eggs which have an apical disc surmounted by an extrachorionic nipple-like structure. *Anax junius* (Dru.) (Aeshnidae) eggs are elongate, smooth, and have an apical whorl of 6 micropyles surrounding a short stalk.

INTRODUCTION

Scanning electron microscopy (SEM) is widely used in ootaxonomic studies of various insect orders (e.g. DOWNEY & ALLYN, 1980; SCALI & MAZZINI, 1982; STARK & SZCZYTKO, 1982; CANTERBURY & NEFF, 1980; KONDRATIEFF & VOSHELL, 1984), but few odonatologists have used the technique to examine chorionic variation in dragonflies (e.g. MILLER, 1987). Light microscopy studies, however (GARDNER, 1951, 1955; GAMBLES & GARDNER, 1960; NEEDHAM & WESTFALL, 1955), indicate that significant variation exists in eggs of odonate taxa, but the accompanying illustrations generally lack sufficient detail to be useful in phylogenetic analysis. This study was undertaken to more fully explore the potential of SEM in ootaxonomic studies of dragonflies.

METHODS

Ovipositing or copulating females were captured in Hinds Co., Mississippi, and eggs were usually obtained by repeatedly dipping the abdominal apex in vials of pond water, but *Aphylla* and *Anax* eggs were dissected from freshly killed females. Eggs were removed from the surrounding jelly-like matrix using fine tipped forceps, and dehydrated through a series of ethanol solutions (50, 70, 90, 100%), before brief agitation in an ultrasonic cleaner. Eggs were transferred to acetone and critical point dried prior to mounting on specimen stubs with double-stick tape. Specimens were gold



Figs 1-6. Gomphid eggs: (Figs 1-3) *Aphylla williamsoni* (Gloyd): (1) Entire egg, 280 X, — (2) Micropylar stalk, 1000 X, — (3) Chorionic surface showing follicle cell impressions, 1000 X; — (Figs 4-6) *Gomphus exilis* Selys: (4) Entire egg, 260 X, — (5) Micropylar stalk, 1300 X, — (6) Chorionic surface, 2490 X.

coated using a Hummer II sputter coater and examined with an AMR 1000 scanning electron microscope. Several eggs were broken in order to examine the internal appearance of the chorion. Eggs were usually measured using a Wild M5 dissecting microscope and ocular micrometer; $\bar{X}$ lengths and widths reported are based on a sample size of 10 eggs, but *Aphylla* measurements were taken from electron micrographs of 3 eggs.

DISCRIPTIONS OF EGGS

AESHNIDAE

Anax junius (Drury). — X length 1.4 mm, X width 0.34 mm. Outline elongate oval, with a small, anterior micropylar stalk circumscribed by six micropyles (Figs 15-16). Surface smooth.

GOMPHIDAE

Aphylla williamsoni (Gloyd). — $\bar{X}$ length 0.43 mm, $\bar{X}$ width 0.24 mm. Outline oval, with a delicate micropylar stalk containing 5-6 orifices (Figs 1, 2). Surface covered throughout with prominent hexagonal follicle cell impressions (FCIs) except for narrow zone around base of micropylar stalk. FCI walls are narrow furrows surrounding a flat, elevated floor; floor with irregular vermiculate ridges (Fig. 3).

Gomphus exilis Selys. — $\bar{X}$ length 0.55 mm, $\bar{X}$ width 0.34 mm, shell thickness ca 0.008 mm. Outline oval with a robust micropylar stalk containing 7-8 orifices (Figs 4, 5). Surface covered throughout with irregular, fine vermiculate ridges (Figs 4, 6); FCIs faintly manifested around base of micropylar stalk.

LIBELLULIDAE

Perithemis tenera (Say). — $\bar{X}$ length 0.41 mm, $\bar{X}$ width 0.23 mm, shell thickness ca 0.001 mm. Outline oval with an apical disc circumscribed by a low ridge in the "micropylar position"; disc diameter ca 0.02 mm. Chorionic surface granular (Figs 7, 8).

Plathemis lydia (Drury). — $\bar{X}$ length 0.53 mm, $\bar{X}$ width 0.27 mm, disc diameter ca 0.04 mm. Surface features similar to *P. tenera* (Figs 9, 10).

Erythemis simplicicollis (Say). — $\bar{X}$ length 0.47 mm, $\bar{X}$ width 0.26 mm, disc diameter ca 0.02 mm. Surface features similar to *P. tenera* (Fig. 11).

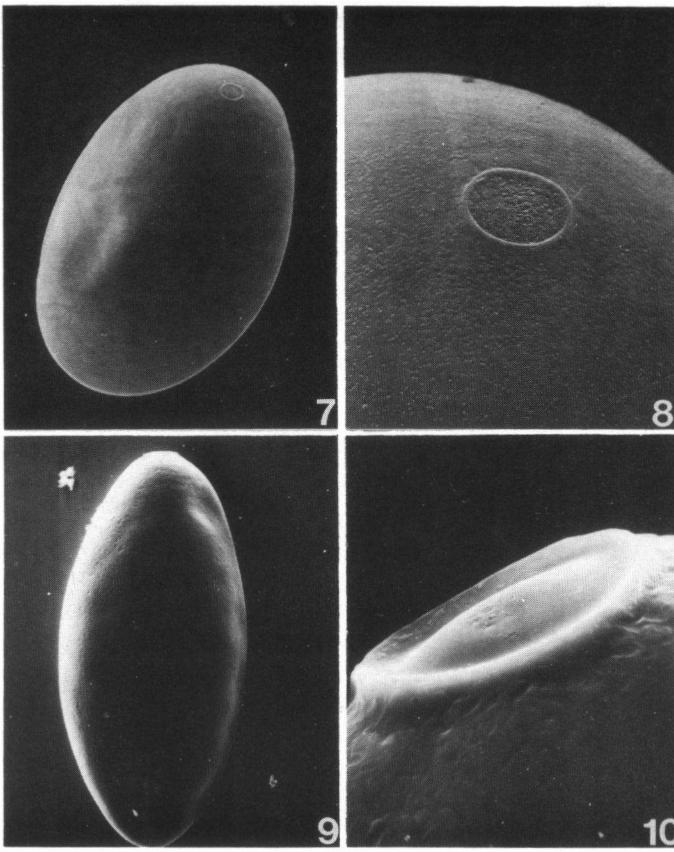
Ladona deplanta (Rambur). — $\bar{X}$ length 0.40 mm, $\bar{X}$ width 0.27 mm, disc diameter ca 0.01 mm. Chorionic surface covered by irregular large, flattened plates (Fig. 12).

Erythrodiplax minuscula (Rambur). — $\bar{X}$ length 0.39 mm, $\bar{X}$ width 0.26 mm, disc diameter ca 0.03 mm. Surface features similar to *P. tenera* (Fig. 13).

Celithemis fasciata Kirby. — $\bar{X}$ length 0.36 mm, $\bar{X}$ width 0.25 mm, disc diameter ca 0.02 mm. Surface features similar to *P. tenera* (Fig. 14).

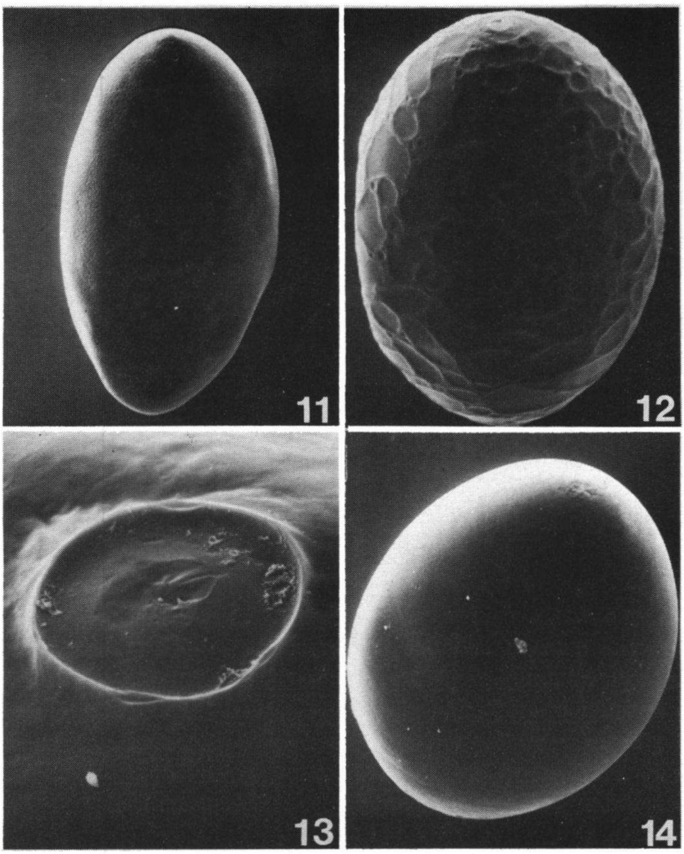
DISCUSSION

Libellulid eggs examined were comparatively thin-shelled and showed little variation in chorionic features. The small nipple-like, apical structure attributed to exophytic libellulids by GARDNER (1951) and NEEDHAM & WESTFALL (1955), is apparently associated with the extrachorionic matrix which we removed. We left this substance intact on some specimens but it could not be satisfactorily examined in our preparations beyond noting that it appeared to be a simple unadorned sac in *Plathemis*, but was intricately sculptured in *Erythemis* and appeared somewhat similar to the surface "spumaline" coat of *Tholymis*



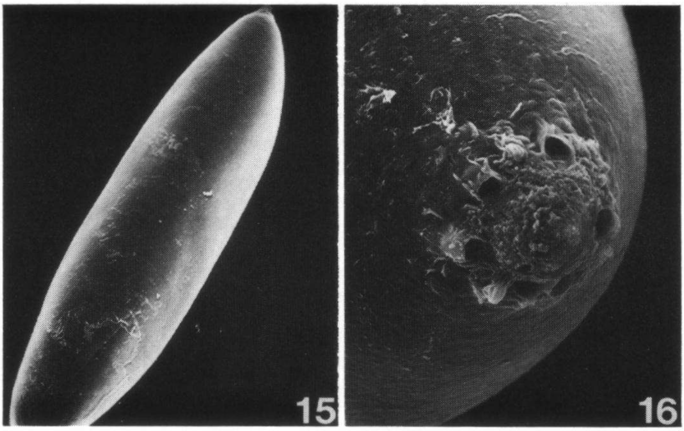
Figs 7-10. Libellulid eggs: (Figs 7-8) *Perithemis tenera* (Say): (7) Entire egg, 280 X, — (8) Apical disc, 1400 X; — (Figs 9-10) *Plathemis lydia* (Drury): (9) Entire egg, 264 X, — (10) Apical disc, 2100 X.

tillarga (Fabricius) (MILLER & MILLER, 1985). The apical disc is the surface chorionic manifestation of the nipple-like membrane structure which we presume to be a micropylar stalk, however, the absence of obvious micropylar canals in the disc suggests this structure is rudimentary among libellulids. Aeropyles and a complex pillared endochorion, similar to that reported by MILLER (1987) for *Brachythemis lacustris* (Kirby), were not observed among nearctic libellulids.



Figs 11-14. Libellulid eggs: (11) *Erythemis simplicicollis* (Say), entire egg, 336 X; — (12) *Ladona deplanata* (Rambur), entire egg, 374 X; — (13) *Erythrodiplax minuscula* (Rambur), apical disc, 2100 X; — (14) *Celithemis fasciata* Kirby, entire egg, 437 X.

Gomphid eggs had comparatively thicker and more ornate chorions than libellulids, and our preliminary data suggest this character suite might be useful in making phylogenetic inferences within Gomphidae. Apical micropylar stalks with open, multiple orifices were present in both species examined but we did not



Figs 15-16. Egg of *Anax junius* (Drury), Aeshnidae: (15) Entire egg, 120 X, — (16) Anterior end showing micropyles, 500 X.

section this stalk to determine if the canals actually penetrate the chorion. *Anax junius*, an endophytic aeshnid species, has a similar anterior micropylar apparatus, but the chorion is smooth (Figs 15-16).

These preliminary observations indicate ootaxonomic characters may have utility in delineating higher odonate taxa and may also be useful at the generic and species level in Gomphidae. Comparisons of congeners, of species in other families, and of species which oviposit endophytically, or in running water, are needed in order to assess more fully the value of chorionic data to odonate systematics.

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