SCANNING ELECTRON MICROSCOPY OF THE EGGS OF *HAEMAGOGUS CELESTE* AND *HAEMAGOGUS EQUINUS* (DIPTERA: CULICIDAE) FROM TRINIDAD, WEST INDIES

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ABSTRACT. The eggs of *Haemagogus celeste* Dyar and Nunez Tovar and *Haemagogus equinus* Theobald are described and illustrated. The eggs were studied with the light and scanning electron microscopes.

INTRODUCTION

Mattingly (1971) reviewed some features of the egg physiology and oviposition behavior of *Haemagogus* mosquitoes and noted that the eggs themselves were never described. However, in a subsequent study, Mattingly (1973) described and illustrated the eggs of two species belonging to the genus *Haemagogus*, *Hg. speqazzinii* Brethes and *Hg. lucifer* (Howard, Dyar & Knab).

In Trinidad, the genus *Haemagogus* is represented by four species, of which *Hg. equinus* Theobald is the most recent addition (Chadee and Tikasingh 1985), while *Hg. janthinomys* Dyar, *Hg. celeste* Dyar and Nunez Tovar and *Hg. leucocelaenus* (Dyar and Shannon) have been reported previously (Arnell 1973, Heinemann et al. 1980, Chadee 1983).

During 1988 the eggs of *Hg. celeste* and *Hg. equinus* were collected from conventional ovitraps (Fay and Eliason 1966) used for monitoring the *Aedes aegypti* (L.) populations in Trinidad and Tobago, W.I. The collection of these eggs afforded us the opportunity of examining and describing the morphology of these *Haemagogus* eggs using the scanning electron microscope. In this paper we describe and compare the morphological structures of the eggs of *Hg. celeste* and *Hg. equinus.*

MATERIALS AND METHODS

Eggs of *Hg. equinus* and *Hg. celeste* were collected from ovitrap paddles. The paddles were dried and eggs removed using a fine-pointed needle, placed directly onto stubs (Bakelite Structure Probe, Westchester, PA) and gold coated. The scanning electron microscope used has been described previously (Chadee & Bennett 1988). One hundred eggs of each species were collected from paddles and measured using a light microscope. The terminology used follows that suggested by Harbach and Knight (1980).

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RESULTS

Description of eggs. The eggs of *Hg. celeste* and *Hg. equinus* are dark brown in color, subfusiform in shape and circular in cross-section. However, the eggs of *Hg. celeste* are smaller than those of *Hg. equinus* (Fig. 1 a, b). The mean measurements of the length and width of the eggs of both species are given in Table 1.

The surface of the eggs of both species are covered, except on the anterior polar specialized area, with small outer chorionic tubercles. In both, the array of tubercles are relatively uniform over the entire surface (Fig. 1 c, d), except around the micropyle. The tubercles are organized into individual cells as described by Harbach and Knight (1980). The size of the individual tubercles are smaller in *Hg. celeste* than in *Hg. equinus* (Table 1), but the cell walls of *Hg. equinus* appear thicker and slightly upraised forming "wells" compared to the *Hg. celeste* eggs. These wells with their thick cellular walls give the *Hg. equinus* eggs a rough or coarse appearance (Fig. 1 a, b).

The posterior ends of the *Hg. equinus* and *Hg. celeste* eggs are pointed while the anterior ends bearing the micropyle are arched in *Hg. celeste* and blunt in *Hg. equinus* (Table 2). At the anterior polar specialized area, the micropyle of the *Hg. equinus* egg is blocked (may be an artefact) while the *Hg. celeste* egg is open (Fig. 1 e, f). The pattern of dehiscence in the eggs of both species is apical and incomplete.

DISCUSSION

The similarities and differences in shape of the *Hg. equinus* and *Hg. celeste* eggs are compared in Table 1. Although the two eggs can be separated on the basis of actual measurements, it is uncertain whether morphological differences are readily apparent under the light microscope.

In Trinidad the problem of *Haemagogus* egg identification is compounded by the presence of four species which are not only collected in the same localities but also are readily found in similar habitats. For example, in the Chagaramas forest, Chadee and Tikasingh (1985) col-

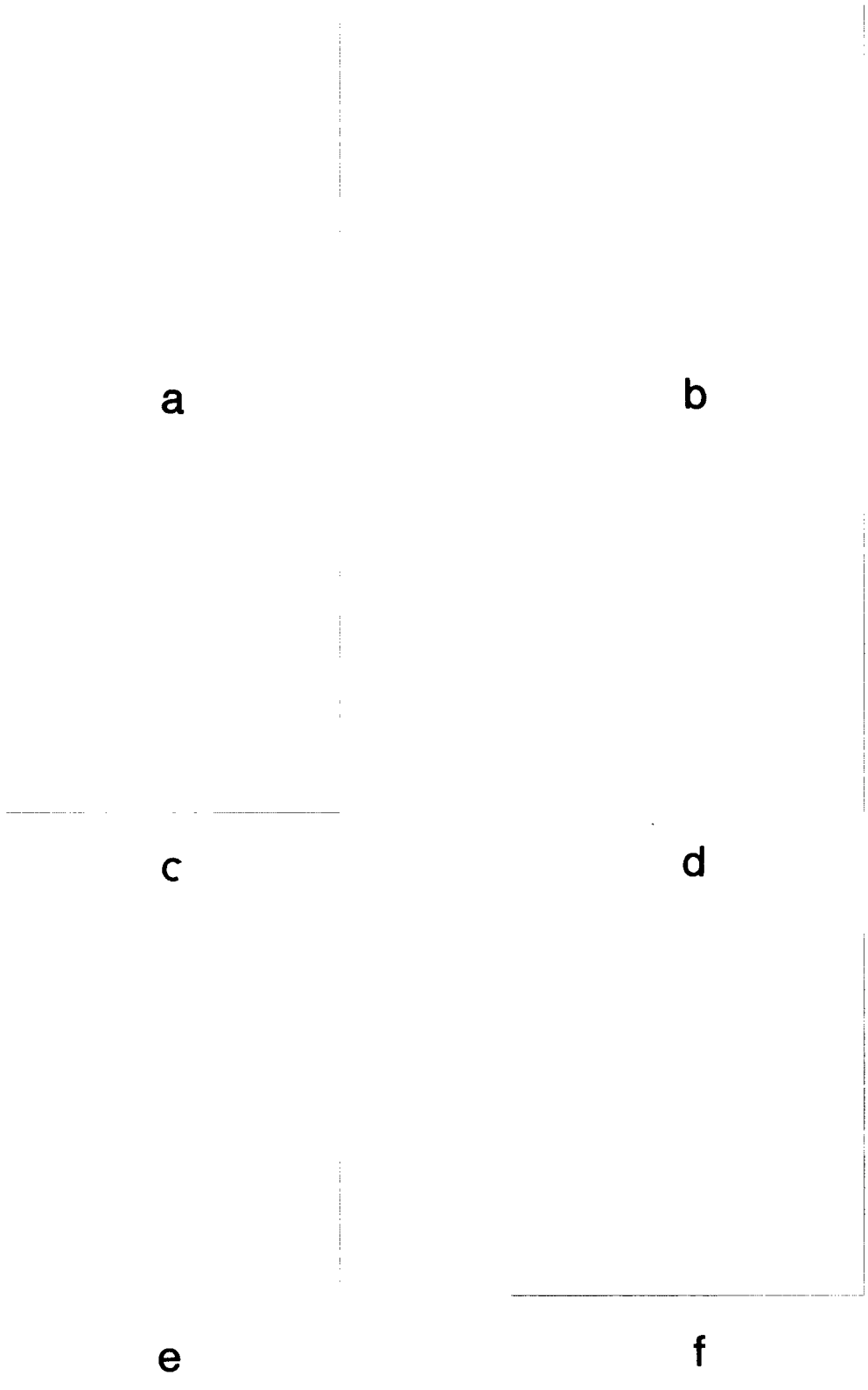

Fig. 1. Egg morphology of *Haemagogus celeste* and *Haemagogus equinus*. a. Egg of *Hg. equinus*. b. Egg of *Hg. celeste*. c. Chorionic tubercles of egg of *Hg. equinus*. d. Chorionic tubercles of egg of *Hg. celeste*. e. Micropylar apparatus, with micropyle blocked, of egg of *Hg. equinus*. f. Micropylar apparatus, with micropyle open, of egg of *Hg. celeste*.

Table 1. Dimensions of eggs of two species of *Haemagogus* from Trinidad, W.I.

Measurements (μm)	Eggs of	
	Haemagogus celeste	*Haemagogus equinus*
	Mean ± SD	Mean ± SD
Length	579.05 ± 16.29	628.20 ± 62.15
Width	156.26 ± 13.36	174.89 ± 13.28
Micropylar apparatus (diameter)	25.09 ± 6.32	39.22 ± 4.95
Individual chorionic tubercles	9.97 ± 3.01	13.78 ± 2.79

Table 2. Comparison of some surface features of *Haemagogus* eggs.

Feature	Eggs of	
	Haemagogus celeste	*Haemagogus equinus*
Shape	subfusiform and arched at posterior end	subfusiform and blunt at posterior end
Color	dark brown	dark brown
Appearance (under light microscope)	fine grain	coarse
Chorionic pattern (SEM)	individual tubercles with thin walls	individual tubercles with thick walls
Pattern of dehiscence	apical and incomplete	apical and incomplete
Micropyle	opened	blocked (may be an artefact)

lected the eggs of the four species using both conventional and modified ovipots (Chadee and Tikasingh 1985, 1989). The presence of eggs of two or more *Haemagogus* species on ovitrap paddles is not uncommon.

It is noteworthy that most *Hg. equinus* eggs hatch when first flooded and since the length of larval development is relatively short, the populations of *Hg. equinus* reach a peak shortly after the beginning of the rainy season. In contrast, the eggs of *Hg. celeste* and other *Haemagogus* mosquitoes hatch only after being conditioned for 15 days (Arnell 1973). This delay in identification may be critical, especially since transovarial transmission of Yellow Fever has been demonstrated among *Hg. equinus* (Dutary and Le Duc 1981).

The identification of the two species described in the present study may be further complicated by the presence of *Hg. janthinomys* and *Hg. leucocelaenus* eggs (Table 2). It is therefore important to have the two other mosquito species described and illustrated.

ACKNOWLEDGMENTS

We thank Messrs. J. James, Department of Biological Sciences, The University, Dundee, Scotland, R.C. Persad

and R. Ganesh, Insect Vector Control Division, Ministry of Health, Trinidad for assistance in the laboratory.

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