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Genitalia study on the genus *Glyphodes* (Crambidae: Spilomelinae) in Tamil Nadu, India

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ABSTRACT: Survey carried out to collect species belonging to the genus *Glyphodes* in different places of Tamil Nadu, *viz.*, Coimbatore, Anaikatti, Ooty, Yercaud, Kodaikanal and Periyakulam recorded a total of six species of the genus *Glyphodes viz., G. bivitralis, G. caesalis, G. canthusalis, G. onychinalis, G. pulverulentalis and G. stolalis.* Male and female genitalia of the collected species are described. © 2017 Association for Advancement of Entomology

KEYWORDS: Distribution, *Glyphodes*, Spilomelinae, genitalia, Tamil Nadu

INTRODUCTION

Spilomelinae is the largest subfamily in the Crambidae, with about 3,767 species worldwide (Regier *et al*., 2012) and are of economic importance as many species cause serious damage to agricultural and horticultural crops, forests trees and ornamental plants (Mathew and Menon, 1984). Under Spilomelinae the genus *Glyphodes* Guenée consists of 120 species and is widespread in tropical regions, with some species penetrating into subtropical and warm temperate areas (Common, 1990; Robinson *et al.,* 1994). Twenty five species have been recorded in the Southeast Asia and 17 species in Australia (Robinson *et al.,* 1994; Shaffer *et al.,* 1996). In Tamil Nadu,three species were recorded by Fletcher (1914) and Nair (1970) are *Glyphodes bivitralis*, *G. caesalis*, *G. canthusalis*. Before this background, the present study aims to identify the *Glyphodes* species encountered in different regions of Tamil Nadu by studying morphological characters of the genitalia, and to record the distribution of those species.

MATERIALS AND METHODS

The study was conducted in Coimbatore, Anaikatti, Ooty, Yercaud, Kodaikanal and Periyakulam areas of Tamil Nadu, India during 2014-15. Moths were attracted using a white cloth (1.5 x 5.5 m) and a mercury lamp (400 Watts) from 6.00pm to 6.00am.The moths were killed with ethyl acetate and transferred into butter paper covers. The insects were curated and labeled as per Johnson and Triplehorn (2005). The moths were identified as per Hampson (1896, 1898) and with the reference collection of the Insect Biosystematics Laboratory, TNAU, Coimbatore. The generic and species nomenclature followed as per Beccaloni *et al*. (2003) and Nuss *et al*. (2003-2015).Taxonomically informative characters *viz*., antennae, labial palpi, forewing (FW), hindwing (HW), legs, tympanum, male and female genitalia were studied. The standard technique given by Robinson (1976) was followed for genitalia studies, while wing venation was studied using the Comstock – Needham system (1898). Genitalia images were taken in a

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Leica MZ16 stereozoom microscope. Illustrations were drawn by using mirror type camera lucida Leica M80.

RESULTS AND DISCUSSION

During the study, six species of the genus *Glyphodes* were collected from light trap: *Glyphodes bivitralis* (Yercaud, Coimbatore), *G. caesalis* (Anaikatti, Yercaud), *G. canthusalis* (Coimbatore), *G. onychinalis* (Coimbatore, Yercaud, Kodaikanal),*G. stolalis* (Coimbatore, Yercaud, Kodaikanal), *G. pulverulentalis* (Coimbatore, Killikulam, Kodaikanal, Periyakulam); the later was also recorded from its host plant (mulberry).

Common characters of the six investigated species: Filiform antennae; labial palpi upturned; maxillary palpi and basally scaled proboscis present. In the forewing, vein R_3 stalked with R_4; R_5 free; 1A+2A complete with a basal fork and 3A short, forming a loop. In hind wing, $Sc+R_1$ thickened, basally anastomosed, with Rs after its origin from upper angle of cell and ends at costa near apex. The male and female genitalia of six species are described below.

Glyphodes bivitralis Guenée, 1854

Male genitalia: Uncus long, anteriorly enlarged with constricted tip; uncus tip with five short spines, ventrally fringed with long hairs. Gnathos absent; subscaphium long, strap-like.Tegumen long, sclerotized, dome-shaped and arched; vinculum short; saccus broadly U-shaped.Valva long, membranous; apex broadly fringed with hairs; costa inconspicuous; medially sclerotized line with distinct thickening; sacculus broad at base, ridge-like, dorsally bent inward; harpe long, claw-like basally supported with medial sclerotized line; hair pencil with bunch of short hairs. Transtilla composed of triangular anterior projections meeting at mid line; juxta narrow, flap-like. Phallus long, sclerotized thread-like (Fig.1a).

Female genitalia: Anal papillae densely setose. Anterior apophyses long, basally with angular projection; posterior apophyses short when compared to anterior apophyses.Ostium oval, membranous; antrum short, moderately sclerotized; ductus seminalis originate at posterior end of ductus bursae above antrum. Ductus bursae very long, narrow and membranous; corpus bursae oval, membranous; signum composed of two denticulate, sclerotized signa (Fig. 2a)

Glyphodes caesalis Walker, 1859

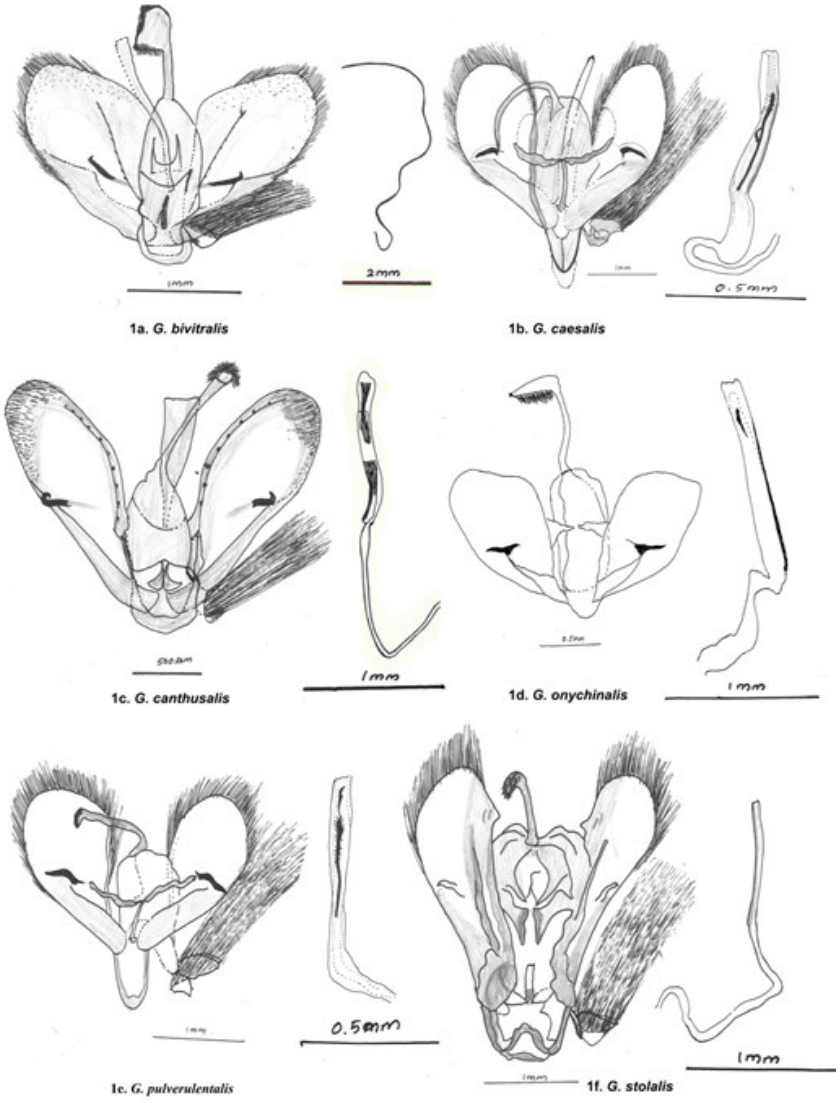
Male genitalia: Uncus long and narrow, apex enlarged and pointed, tip fringed with hairs. Gnathos absent; subscaphium long, strap-like.Tegumen longer than wide, sclerotized and arched; vinculum long, sclerotized and saccus long, U shaped. Valva long, membranous, apex narrow and rounded; costa inconspicuous, dorsally fringed with long hairs; sacculus broad, weakly sclerotized; ridge like dorsal edge with fine setae; harpe long, spine-like, sclerotized. Transtilla long, sclerotized band-like meeting at mid line; juxta narrow, sclerotized, arrow-like. Phallus almost straight, vesica with long sclerotized bar with lateral spine-like projection; medially long, curved sclerotized hook-like cornuti (Fig.1b).

Female genitalia: Anal papillae fringed with both long and short setae. Anterior apophyses long, basally with angular projection; posterior apophyses short.Ostium oval, membranous. Antrum short, sclerotized; ductus seminalis originate at posterior end of ductus bursae below antrum. Ductus bursae long and wide, membranous; caudally constricted; corpus bursae oval, membranous; sclerotized dots forming two strip-like signa (Fig.2b).

Glyphodes canthusalis Walker, 1859

Male genitalia: Uncus long, narrow, anterior tip enlarged and round, dorsally fringed with long setae. Gnathos absent, subscaphium long, strap-like, uniformly sclerotized.Tegumen long, membranous; vinculum long, curved and saccus broadly U shaped. Valva long, medially widened and apex narrow fringed with hairs; costa sclerotized, prominent with series of spots; sacculus broad at base, narrowed anteriorly and prominent; harpe long, sclerotized,

Plate 1. Male genitalia of the genus *Glyphodes*

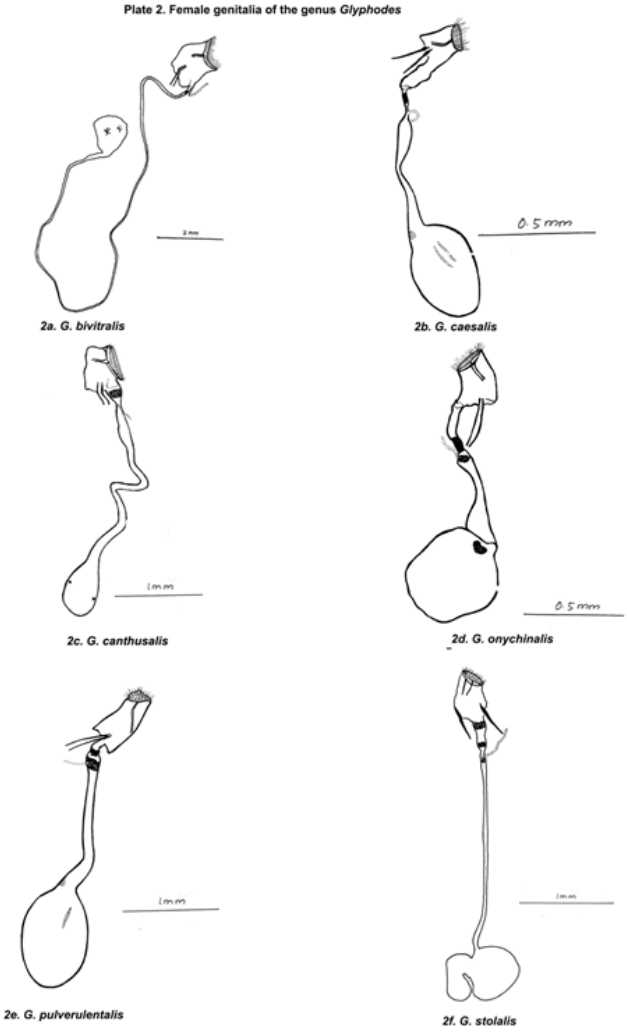


claw-like; upturned apically. Transtilla membranous; juxta broad with anterior weakly sclerotized projection. Phallus long, vesica with intermittent patch-like sclerotization (Fig. 1c).

Female genitalia: Anal papillae densely fringed with setae. Anterior apophyses longer than posterior apophyses with medial angular projection. Ostium funnel shaped, membranous; ductus seminalis originate at posterior end of ductus bursae. Ductus bursae long, membranous; corpus bursae elongate, membranous; two small patches of sclerotized spines forming signa (Fig. 2c).

***Glyphodes onychinalis* (Guenée, 1854)**

Male genitalia: Uncus long, anterior half strongly curved, enlarged and beak shaped, ventrally fringed with long hairs; anterior tip with four short spines. Gnathos absent; subscaphium long, strap-like.Tegumen longer than wide, arched; vinculum almost long, weakly sclerotized and saccus broadly U shaped. Valva long, apex narrow; outer margin covered with black hairs; costa inconspicuous; sacculus narrow, ridge-like, weakly sclerotized; harpe long, spine-like; directed distally and supported basally by the apical tip of the



sacculus. Transtilla composed of lateral projections meeting mid line; juxta narrow, flap-like and weakly sclerotized. Phallus almost straight, strongly sclerotized on ventral side and vesica with sclerotized patch-like cornutus (Fig.1d).

Female genitalia: Anal papillae densely setose. Anterior apophyses long, basally with angular projection; posterior apophyses short.Ostium oval, membranous.Antrum broadly sclerotized; ductus seminalis originate at antrum. Ductus bursae long, wide at anterior and membranous; corpus bursae round, membranous with heart shaped signum (Fig. 2d).

Glyphodes pulverulentalis Hampson, 1896

Male genitalia: Uncus long and narrow, anterior tip enlarged and pointed, beak-shaped dorsally with short setae. Gnathos absent; subscaphium long, strap-like.Tegumen longer than wide, sclerotized and arched; vinculum long, sclerotized and saccus long, U shaped. Valva long, membranous, apex broadly rounded; costa weakly sclerotized, dorsally fringed with long hairs; sacculus broad, weakly sclerotized; ridge-like, dorsal edge with fine setae; harpe long, spine-like; sclerotized, directed distally. Transtilla long, sclerotized band-like meeting at mid line; juxta narrow, sclerotized, arrow-like. Hair pencil with long bunch of hairs; phallus almost straight, vesica with long sclerotized bar with lateral spine-like projection; apically with long, curved sclerotized hook-like cornutus (Fig.1e).

Female genitalia: Anal papillae oval, fringed with both long and short setae. Anterior apophyses long, basally with angular projection; posterior apophyses short. Ostium membranous; antrum broadly sclerotized; ductus seminalis originate from antrum. Ductus bursae long, membranous; corpus bursae oval, membranous; signum as two strip-like sclerotized dots (Fig. 2e).

Glyphodes stolalis Guenée, 1854

Male genitalia: Uncus long and narrow, anterior tip enlarged and spoon shaped, fringed with setae. Gnathos absent; tegumen longer than wide, arched and teguminal ridges strongly sclerotized; vinculum almost long, sclerotized and saccus broadly W shaped. Valva long, narrow at base with broad apex, outer margin fringed with long hairs; costa inconspicuous, sclerotized, distally with triangular dorsal projection; sacculus narrow, ridge-like; harpe long, sclerotized and spine-like. Transtilla sclerotized flap-like extending downward; juxta short, membranous.Hair pencil with short bunch of hairs. Phallus straight, long; phallus apodeme strongly sclerotized on ventral side; cornuti absent (Fig. 1f).

Female genitalia: Anal papillae oval, fringed with short and long setae. Anterior apophyses long,

Plate 3. Identified species of the genus *Glyphodes*

3a. ***G. bivitralis***

3b. ***G. caesalis***

3c. ***G. canthusalis***

3d. ***G. onychinalis***

3e. ***G. pulverulentalis***

3f. ***G. stolalis***

basally broad; posterior apophyses short. Ostium oval, weakly sclerotized; antrum weakly sclerotized; ductus seminalis originate at posterior end of ductus bursae below antrum. Ductus bursae long, narrow; corpus bursae rounded, membranous; accessory bursae present, dropper shaped with minute denticulation; signum absent (Fig. 2f).

Identification key to investigated species of *Glyphodes*

1. FW and HW with spots and striations; ♀ genitalia with signum, appendix bursae absent …….. 2

1a. FW and HW with striations; ♀ genitalia without signum, appendix bursae present ……. ***Glyphodes stolalis***

2. ♀ genitalia with denticulate or stripe-like signum ……..... 3

2a. Heart shaped signum..... ***Glyphodes onychinalis***

3. Uncus long and narrow; tip enlarged ……. 4

3a. Uncus beak shaped; tip with five short spines ……..... ***Glyphodes bivitralis***

4. Costa with series of dots; cornuti absent …… ***Glyphodes canthusalis***

4a. Costa without dots; cornuti present

5. Ductus bursae uniform tube-like; ductus seminalis originates at antrum ....***Glyphodes pulverulentalis***

5a. Ductus bursae constricted and enlarged; ductus seminalis originate below antrum …… ..... ***Glyphodes caesalis***

Hampson (1896) described 48 species in the genus *Glyphodes* in the Fauna of India. Many species originally described in *Glyphodes* are currently referable under several genera such as *Palpita* Hübner, 1808, *Parotis* Hübner, 1831, *Stemorrhages* Lederer, 1863, *Arthroschista* Hampson, 1893 (Mathew, 2006). Sutrisno (2002, 2003) studied the phylogenetic relationship among the Australian *Glyphodes* group and 17 genera which are morphologically similar. According to Sutrisno, the genus *Glyphodes* is not a monophyletic group and the genitalia characters of *G. bivitralis* and *G. stolalis* are also confirmed with his study. *Glyphodes pulverulentalis* is a serious pest of mulberry in Karnataka, Andra Pradesh and Tamil Nadu (Geetha Bai *et al.,* 1997; Samuthiravelu *et al*., 2010; Rahmathulla *et al*., 2011). The pest is also reported in different locations of India *viz*., Nagaland (Gupta, 1994), Jammu (Sharma and Tara, 1985), Kashmir (Dar,1993) and Punjab (Mavi *et al*., 1996). Fletcher (1914) reported *G. caesalis* as a pest of jackfruit in Karnataka and Maharashtra. It is also recorded from Assam, Sikkim, Bihar, Uttar Pradesh, Andhra Pradesh and Tamil Nadu of India (Chowdhury and Majid, 1954; Prarthna *et al*., 2014). Soumya *et al*. (2015) reported *G. caesalis* for the first time from Kerala. In India, Kirti and Sodhi (2001) recorded five species (*G. bicolor*, *G. caesalis*, *G. canthusalis*, *G. pulverulentalis*, *G. stolalis* and *G. zelleri*) from North-Eastern India, Rose (2001) recorded seven species (*G. actorionalis*, *G.caesalis*, *G. multilinealis*, *G. canthusalis*, *G. pulverulentalis*, *G. stolalis* and *G. zelleri*) from Assam.

Tamil Nadu is endowed with rich flora and fauna that contribute to the biodiversity. Despite *Glyphodes* being a species rich tropical genus. Only six species were recorded during the present study. The diversity of Crambidae may vary in different locations with different climatic conditions. Therefore proper collection, identification and documentation of these species provide the most reliable data for conservation and management practices.

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