

Post Abdominal Structures, A New Facet in Tephritid Taxonomic Research: A Case Study of The Genus *Dacus* Fabricius (Diptera: Tephritidae: Dacinae: Dacini)

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ABSTRACT

Post abdominal structures of seven species of *Dacus* Fabricius were examined, illustrated and described. Phylogenetic analysis revealed genus *Dacus* to be a monophyletic clade though the subgeneric branching was not in concordance with the present sub-generic classification.

WITH more than 4500 described species, Tephritidae represent one of the most diverse acalyptrate dipterans of superfamily Tephritoidea (Freidberg, 2006). Tribe Dacini, predominantly frugivorous, belongs to subfamily Dacinae with three genera *Bactrocera* Macquart, *Dacus* Fabricius and *Monacrostichus* Bezzi. *Dacus* is primarily African, represented by 195 species from Africa (White, 2006; White & Goodger, 2009) and 75 species from Indo-Australasian region (Drew & Romig, 2013). Ten species of *Dacus* are known from India (Agarwal & Sueyoshi, 2005; David & Ramani, 2011). Most of the taxonomic studies on tribe Dacini and genus *Dacus* in particular were purely based on external morphology without much attention to genitalia characters. An attempt is made here to study seven species of *Dacus* viz., *D. (Callantra) longicornis* Wiedemann, *D. (Didacus) ciliatus* Loew, *D. (Leptoxyda) persicus* Hendel, *D. (Mellesis) crabroniformis* (Bezzi), *D. (M.) discophorus* (Hering), *D. (M.) insulosus* Drew & Hancock and *D. (M.) ramanii* Drew & Hancock based on post abdominal structures.

Specimens deposited in following museums were examined for the present study: ICAR-NBAIR-National Bureau of Agricultural Insect Resources, Bengaluru and Department of Agricultural Entomology, University of Agricultural Sciences, Bengaluru; images of genitalia were acquired using a Leica DFC 425 camera mounted on a Leica DMLB 1000S microscope; the images were stacked and combined to a single image using Combine ZP (Hadley, 2011). Measurements of male and female genitalia were taken using a calibrated ocular micrometer fixed on a Leica DM1000 microscope. The terminology adopted here follows White *et al.* (1999). Male post

abdominal structures (epandrium, lateral surstylus, medial surstylus, prenisetae, proctiger, aedeagus, glans) of six species and female genital characters (aculeus shape, shape of spicules of eversible membrane, number and shape of spermatheca) of four species were studied and illustrated. Phylogenetic analysis of all the ten species of *Dacus* along with four species of *Bactrocera* Macquart, two each from subgenus groups viz., *Bactrocera* group [*B. dorsalis* (Hendel)] and *B. correcta* (Bezzi)) and *Zeugodacus* group (*B. tau* (Walker) and *B. cucurbitae* (Coquillett)) were performed by selecting *Gastrozona fasciventris* Macquart (Tribe: Gastrozonini) as the outgroup taxon. Though specimens of *D. (M.) icariiformis* (Enderlein), *D. (M.) polistiformis* (Senior-White) and *D. (Neodacus) sphaeroidalis* (Bezzi) were not available for the present study, they were scored based on the original descriptions and examination of digital images of the types. Morphological matrix generated from 18 characters of 15 taxa were analysed using TNT software (Tree Analysis Using New Technology) (Goloboff *et al.*, 2008).

Post abdominal structures: Comparative analysis of the genitalia characters of six species for male (Table I) and four species for female (Table II) of *Dacus* studied is presented below:

Strict consensus tree for tribe Dacini with mapped synapomorphies and bootstrap values (Fig. 1).

Phylogenetic analysis: Analysis revealed fourteen most parsimonious trees of 28 steps. Consensus tree (Figure 11) generated, revealed *Dacus* to be a monophyletic clade (bootstrap value=99) with following synapomorphies viz., fused abdominal

TABLE I

Comparative analysis of male genitalia of Dacus Fabricius

Characters	<i>lonngicornis</i> (Figs 1a.b.c)	<i>ciliatus</i> (Figs 2a.b.c)	<i>persictus</i> (Figs 1a.b.c)	<i>discophorus</i> (Figs 4a.b.c)	<i>crabroniformis</i> (Figs 5a.b.c)	<i>ramanii</i> (Figs 6a.b.c)
Constriction between epandrium and surstylus (posterior view)	prominent	prominent	prominent	not prominent	prominent	prominent
Posterior lobe of lateral surstylus	Not longer than anterior lobe	2-3 times longer than anterior	2-3 times longer than anterior	4-5 times longer than anterior lobe	4-5 times longer than anterior	4-5 times longer than anterior lobe
Apex of posterior lobe of surslus	Broad, pointed	Hook shaped	Narrow, angular	Broad, angular	Broad, blunt	Broad, angular
Proctiger shape	quadrate	triangular	quadrate	quadrate	quadrate	quadrate
Acrophallus pattern	polygonal	polygonal	elongate	polygonal	polygonal	polygonal
Aedeagal length	2.3"2.5 mm	2 mm	4.8"5 mm	2.4 mm	1.6 mm	2.12 mm
Praeputium	absent	present	absent	present	present	present

TABLE II

Comparative analysis of female geminalla of Dacus Fabricius

Characters	<i>lonngicornis</i> (Figs 7a.b.c)	<i>ciliatus</i> (Figs 8a.b.c)	<i>persictus</i> (Figs 9a.b.c)	<i>discophorus</i> (Figs 10a.b.c)
Oviscape shape	Conical, dorsoventrally flattened	Conical, dorsoventrally flattened	Bottle shaped, not dorsoventrally flattened	Conical, dorsoventrally flattened
Oviscape length	1.7 mm	1.21 mm	2.3-2.7 mm	1.87 mm
Eversible membrane length	4.3 mm	2.1 mm	5 mm	2.11 mm
Spicules at distal end of eversible membrane	5-6 pointed projections, tapering laterally	4-5 projections of equal height	18-20 sharp projections basal ones	8-10 sharp projections, the medial one broad 5-6 times higher than
Aculeus length	2.4 mm	1.43 mm	3.6"3.8 mm	1.72 mm
Aculeus tip	Acute, needle shaped	Acute, needle shaped	Broad, rounded	Broad, angulate
Preapical setae	three	three	three	Three
Spermatheca	Convolutd, curved	Bunch shaped	`Club shaped, with transverse striations	Club shaped, mooth texture

tergites, weak frontal setae and aculeus with three pairs of preapical setae. *Bactrocera* (*Zeugodacus*) group and *Bactrocera* (*Bactrocera*) group branched separately as monophyletic clades with bootstrap values, 73 and 99, respectively.

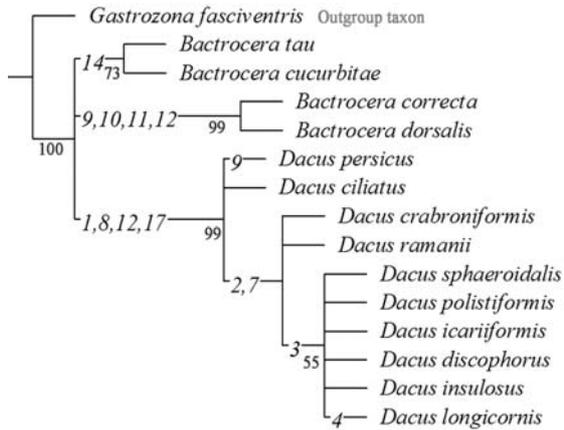


Fig. 11 : Strict consensus tree for tribe Dacini with mapped synapomorphies and bootstrap values

Studies revealed the presence of patterned acrophallus of glans, sphaeropedunculate epandrium in posterior view, broad lateral surstylus shorter than epandrium in posterior view and hyaline proctiger smaller than epandrium. Aculeus tip of females of four species examined were acute with three pairs of preapical setae, spicules of eversible membrane with spine like projections and two spermathecae. Branching of the cladogram was not in concordance with the present system of subgeneric classification of *Dacus* as the present one is exclusively based on the permutations and combinations of several homplasionous characters like shape of posterior margin of sternite 5 of males, shape of abdomen and scape length and presence or absence of postsutural supraalar seta. Inclusion of more number of species from other regions like the Australasian and African regions could have produced a more comprehensive tree.

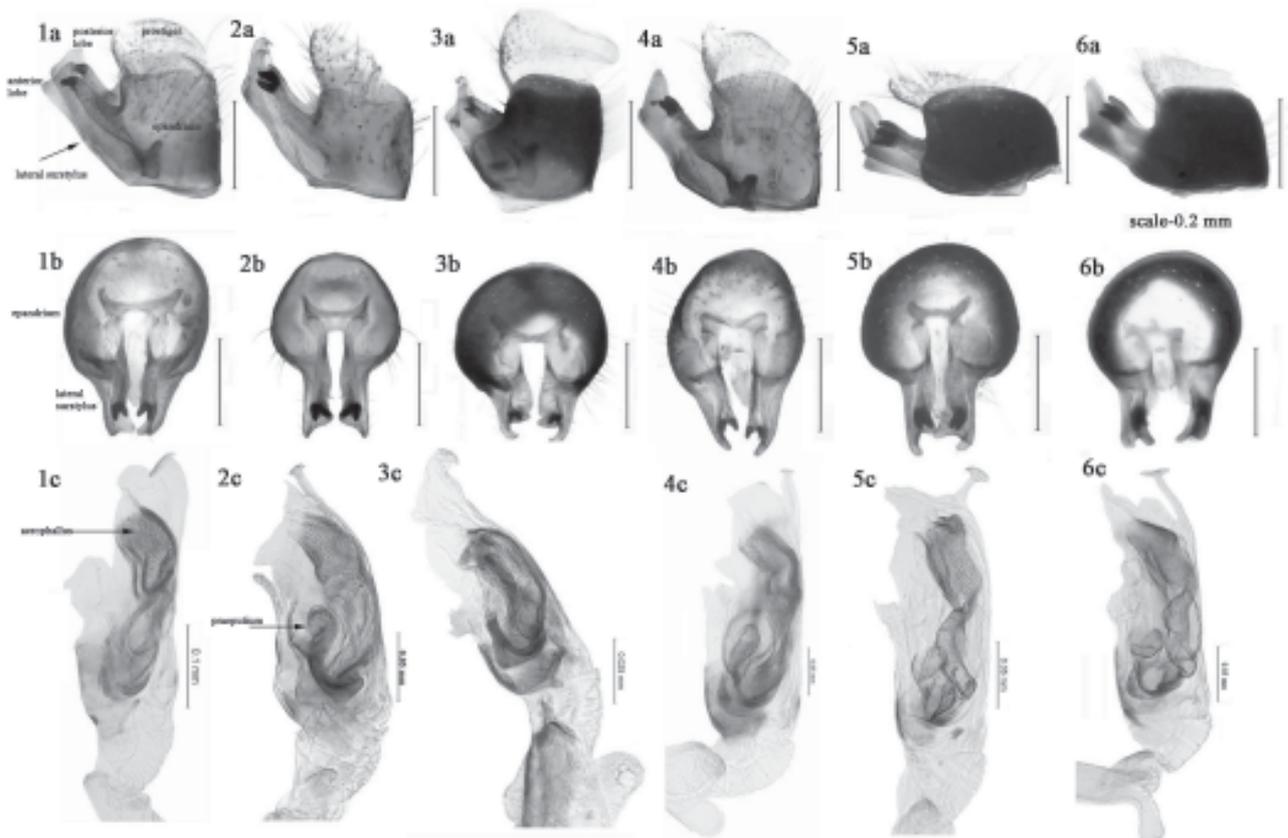


Figure 1-6 : Male genitalia of *Dacus* Fabricius ; a, epandrium, proctiger and surstyli (lateral view); b, epandrium and surstyli (posterior view); c, glans of phallus (lateral view); 1, *D. langicornis* (Wiedemann); 2, *D. ciliatus* (Loes); 3, *D. persicus* Hendel; 4, *D. discophorus* (Hering); 5, *D. crabroniformis* Bezzi; 6. *D. ramanii* Drew & Hancock

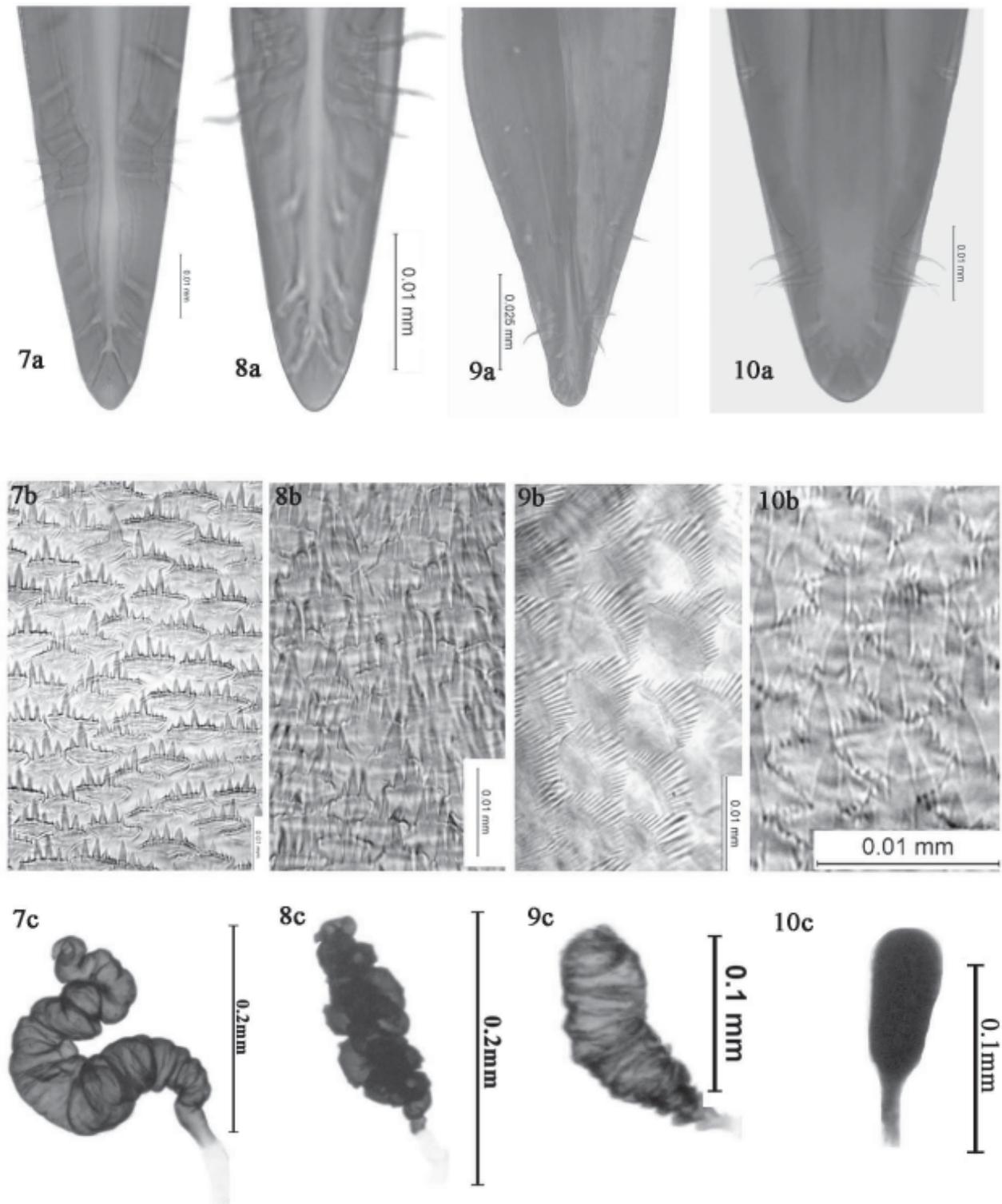


Figure 7-10 : Female genitalia of *Dacus* Fabricius ; a, aculeus tip; b, spicules at distal end of eversible membrane; c, spermatheca; 7, *D. longicornis* Wiedemann; 8, *D. ciliatus* (Loew); *D. persicus* Hendel; 10, *D. insulosus* Drew & Hancock 5, *D. crabroniformis* Bezzi; 10. *D. ramanii* Drew & Hancock

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