



Redescription of *Achaea janata* (Linnaeus, 1758) with additional sexual dimorphic and structural characters

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ABSTRACT: *Achaea janata* was examined thoroughly for morphological characters. Legs of adults and abdominal segments of larvae and pupae can be used for differentiating male and females of *A. janata*. Spines on distal end of fore femur in male is reported. Characters like endoskeletal structures of thorax in adults, post genitalial segments of larva, genitalial segment of pupa and abdominal appendages of adults are discussed. © 2016 Association for Advancement of Entomology

Keywords: Sexual dimorphism, legs, morphological characters, *Achaea janata*

INTRODUCTION

Achaea janata (Linnaeus, 1758) is a major pest of many agriculturally important crops including castor and tomato. The genus is diverse in the old world tropics, with segregation into African and Indo-Australian to pacific subgroups (Holloway, 2005). Four species of Indo-Australian subgroup have been reported from southern India (Sivasankaran *et al.*, 2012). Of all, *A. janata* is most commonly occurring pest throughout India due to its wide distribution and host range. The genus *Achaea* Hubner, 1823 belong to tribe Poaphilini of subfamily Erebinae (Zahiri *et al.*, 2012). Understanding of Noctuoidea at higher level (subfamily and tribe) require type characters (Wing pattern or shape, antennal structure and eye size etc.) and other structural characters (Fibiger and Lafontaine, 2005). Sexual dimorphism in *A. janata* is indistinct due to similarities and uniform forewing faciation compared to other genera in the *Achaea/ Parallelia complex* (Edwards, 1978; Holloway,

2005). Although strenuous efforts on managing the pest were carried out widely, works on morphological observation of non type characters are limited. The present study emphasize the detailed morphological characters of *A. janata* collected from different locations of Tamil Nadu and Andhra Pradesh, which include both structural characters of adults and sexual dimorphic characters on all the life stages of this hazardous pest.

MATERIALS AND METHODS

Insect materials observed: 11 ♂ & 7 ♀ 2.ii.2016 Hokenakkal, Tamil Nadu; 13 ♂ & 9 ♀ 18.i.2016 Pollachi, Tamil Nadu; 6 ♂ & 13 ♀ 15.ix.2015 Yercaud, Tamil Nadu; 1 ♂ & 2 ♀ 22.xii.2015 Periyakulam, Tamil Nadu; 8 ♂ & 3 ♀ 14.xii.2015 Ooty, Tamil Nadu; 18 ♂ & 11 ♀ 30.x.2014 Anaikatti, Tamil Nadu; 24 ♂ & 17 ♀ 21.x.2014 Coimbatore. Tamil Nadu; 12 ♂ & 8 ♀ Tirupathy, Andhra Pradesh; 9 ♂ & 11 ♀ Bapatla, Andhra Pradesh.

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Examination of morphological characters of *Achaea janata* were carried out at Biosystematics laboratory, Department of Agricultural entomology, TNAU, Coimbatore. Adults were collected by use of 125V mercury vapour lamps and lab reared specimens were used for examination of both structural and sexual dimorphic characters. Twenty numbers each of field collected and laboratory reared larvae and pupae were also examined for sexual dimorphic characters. Larvae at 4th and 5th instars were used for examination. Adult moths were subjected to whole body slide mounting with slight modifications in proposed procedure of Sangmi Lee and Richard L. Brown (2006) to fit larger moths for observation of structural characters. Morphological characters were examined with Leica MZ16 Stereomicroscope and Photographs were taken through Leica MZ16 Stereomicroscope equipped with DFC 295 digital camera (LAS 3.8. version 2011). A total of 93 males and 70 females of adults were sexed using the characters of forelegs, Middle legs, wing coupling apparatus and abdominal characters. Species confirmation was done using the keys of Edwards (1978). Terminology proposed by Klots(1970) for genital morphology and Kitching and Rawlins(1999) for endoskeletal structures and noctuid tympanum has been used in the present study for nomenclature purpose.

RESULTS AND DISCUSSION

Adults are uniformly distributed throughout all the regions of India.

Diagnosis: Forewing faciation uniform throughout the genus Wing span 50-56mm. Forewing pale brown to dark brown in colour (Fig.1a). Male and female are similar in coloration. Basal, antemedial and post medial lines wavy. An indistinct subterminal line. Underneath forewing pattern unique. A broad white patch running across from Sc to anal margin with discontinuation at 1A+2A (Fig.1b). Hind wing rounded, black with one white band running diagonally and three separate patches at apical margin. Underneath hind wing brown in colour with distinct dark brown patch surrounded by white marking at tornus.

Genitalia morphology: Male genitalia with symmetrical valves. Uncus curved, prominent pseuduncus and distinct socii; tegumen unmodified; juxta X shaped; valva smooth, sclerotised towards margins with single coremata, separate costal and saccular process; Rod shaped slender saccular process from base of sacculus; Costal process trifid, symmetrical (Fig.1d). Aedeagus broad at base, with two triangular cornuti (Fig.1e). Female genitalia with ductus bursae wider than long; Carpus bursae divided into two distinct portions; Distal portion globular; Proximal portion dorsoventrally flattened; Signum present; Ductus seminalis opening in proximal portion of carpus bursae. Genital plate present (Fig.1f).

Morphological characters: Filiform antenna; ciliated antennifers; clypeofrons bare; well proboscis developed with spined tip; Ocelli present; chetostemma absent; scaled upwardly curved labial palpi; foreleg with tibial epiphysis; spined midtibia and unspined hind tibia; Tibial spur formula 0-2-4; (Fig .2).

Structural characters: Prothorax simple; Propleuron unmodified; dorsoventrally flattened rod shaped spina reaching pronotum; (Fig.3a); No distinct cervical sclerites; prothoracic sternal furca separate; Mesothorax elongated; Y-shaped Mesosternal furca (Fig.3b); Mesoscutellum elongated extending beyond metathoracic phragma. Metascutum and metascutellum at similar level; Metathoracic tympanum; Tympanal sclerite broad and flat; Tympanum with four tympanal pockets (I, II, III, IV); Metathoracic phragma overlay tympanal pocket II. Equal sized tympanal Pockets I and II; Pocket IV appearing double (Fig.3c and d); Y shaped metathoracic furca. Alula triangular.

Sexual dimorphic characters:

Wings: Male and female wing pattern similar; Male with single frenulum and bar shaped retinaculum (Fig.4a); Female with two frenulum and a bunch of hair-like retinaculum (Fig.4d).

Legs: Males: Pair of curved spines and hair brushes on outer marginal apex of fore femur (Fig 4b and

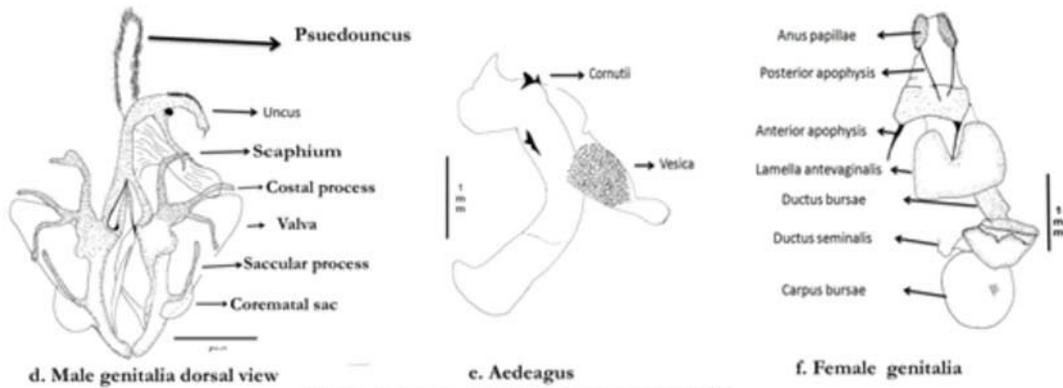
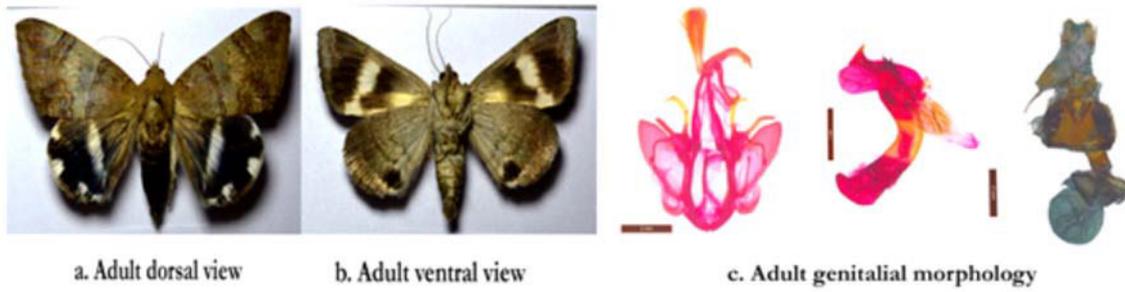


Fig.1 *Achaea janata* (Linnaeus,1758)

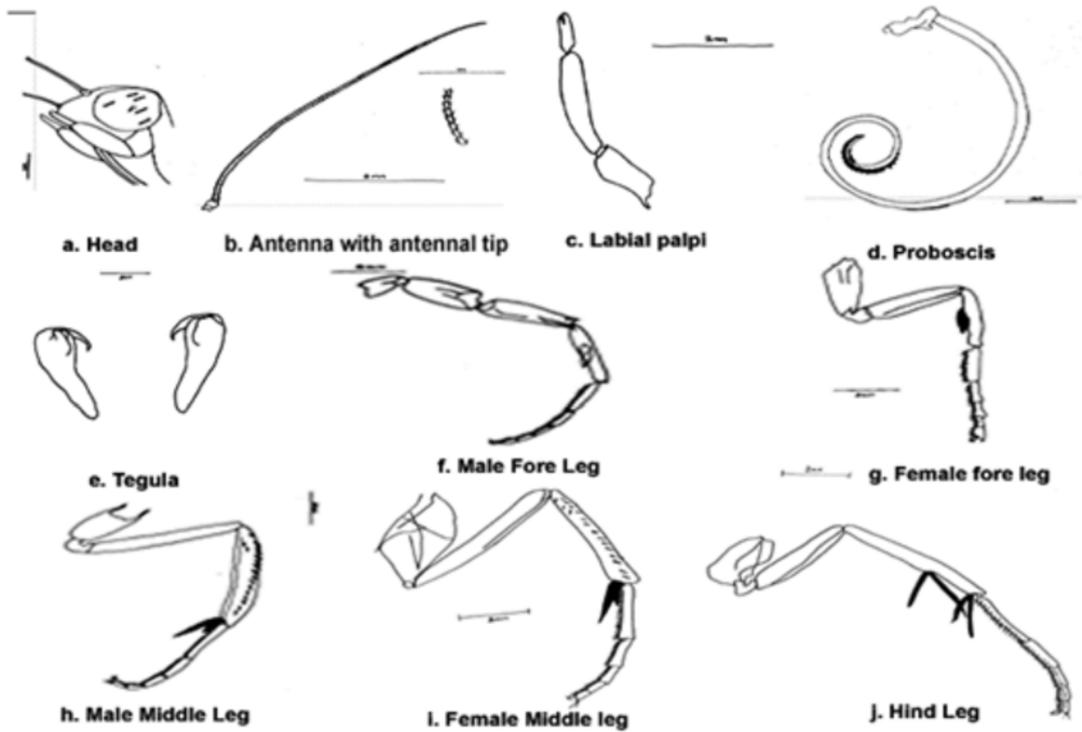


Fig.2 Morphological characters of *Achaea janata*

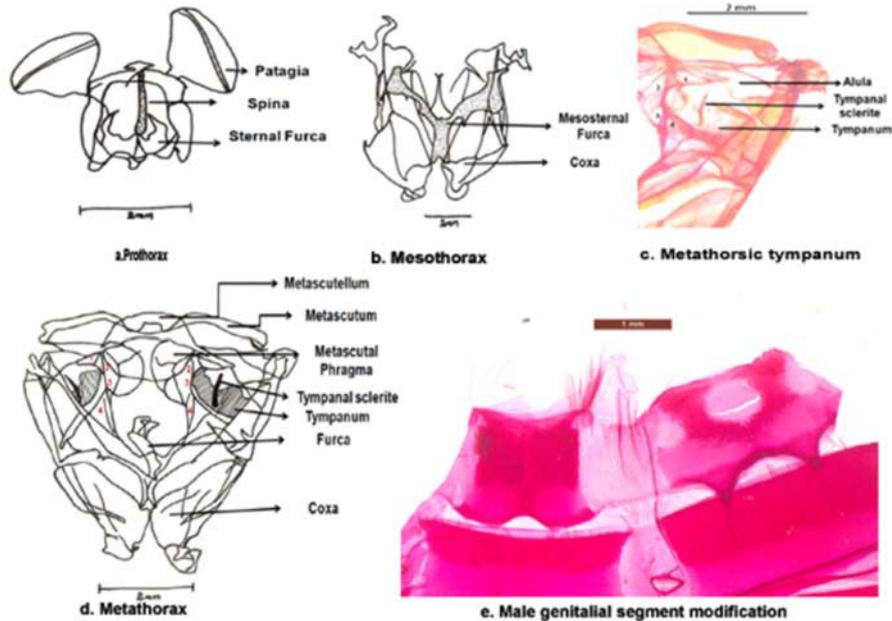


Fig.3 Internal view of thoracic and abdominal segments

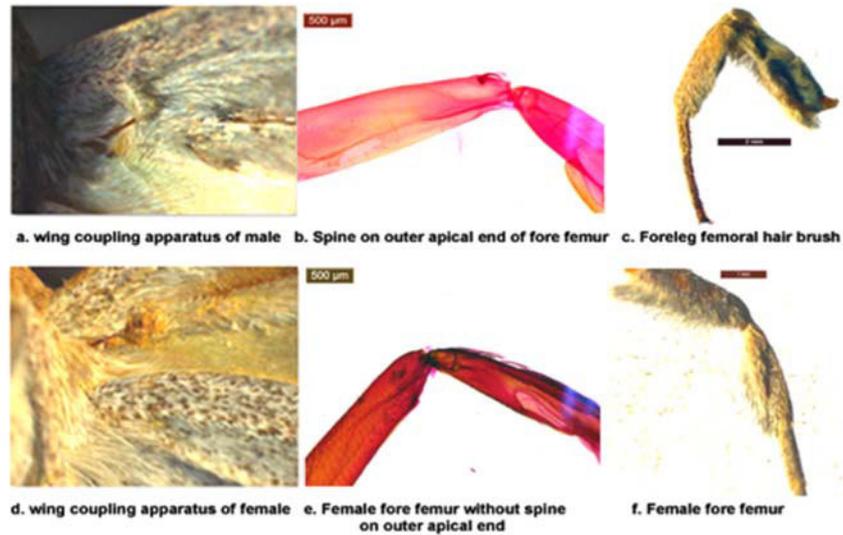


Fig.4 Sexual dimorphic characters in wings and fore legs of adult

c); Outer upper margin of mid tibia grooved with hair pencils (Fig 5a); Females lack hair brushes, spines on fore femur outer marginal and mid tibial groove.

Abdominal segments: Males: sternum of 8th abdominal segment modified with outwardly protruding Posterior lobes (Fig.3e); Hairpencils on

9th abdominal segment of males (Fig. 5c); Females: medially clefted rectangular lodix on 7th abdominal sternum covering the ostium (Fig. 5f).

Immature stages: Pupa: anal slit on 10th abdominal segment; Genital opening on 9th abdominal sternum in male; Genital opening on 8th abdominal sternum in females (fig.6b& c); Larva: Females of late

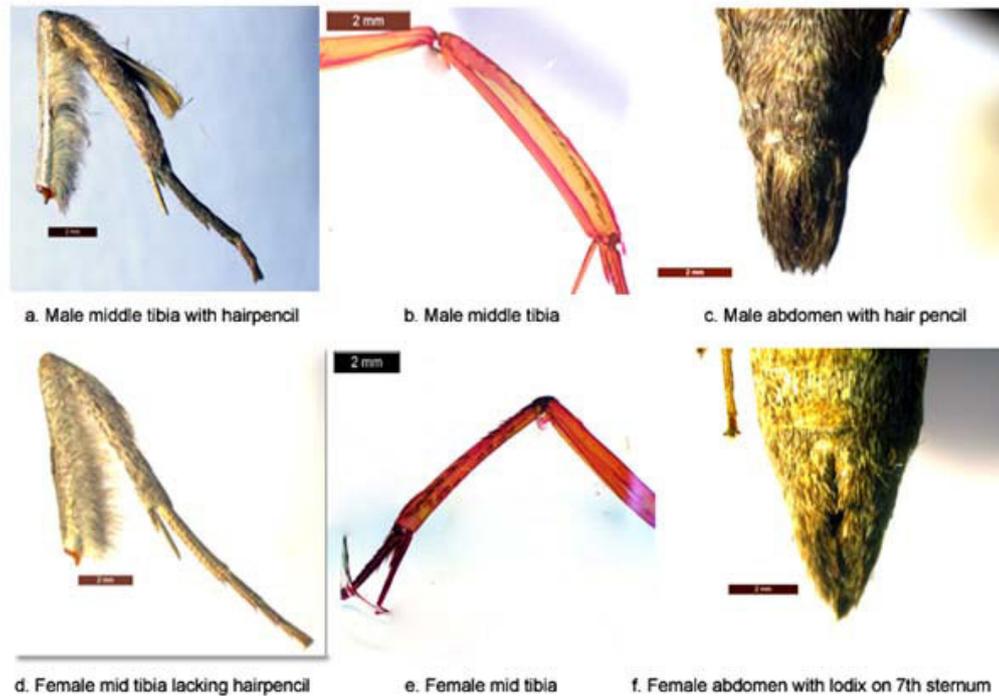


Fig.5 Sexual dimorphic characters in middle leg and abdominal segments of adult

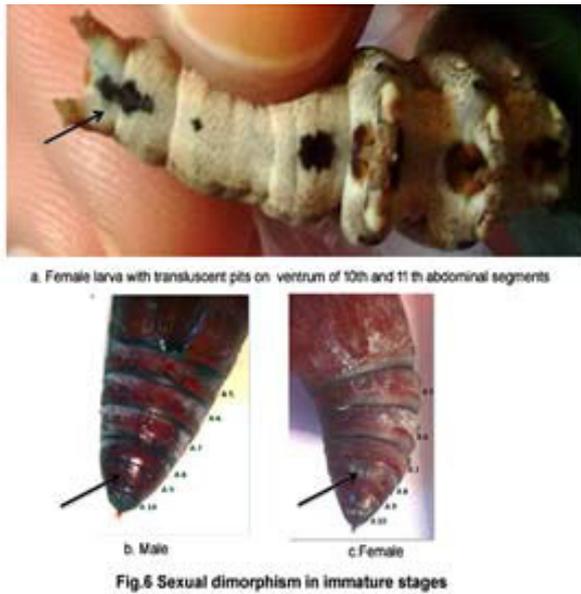
instar(IV and V) larvae with two pairs of translucent pits(Fig.6a) on postgenital segments (i.e., 10 and 11 abdominal ventrum).

Structural characters like noctuid tympanum with special emphasis on Notodontidae and arctiid/ noctuid families was summarised by Kitching and Rawlins (1999). However tympanal Pocket IV was of phylogenetic importance and is V- shaped in quadrafid noctuoids (Fibiger and Lafontaine, 2005). Small size of tympanal pocket IV in relation to other pockets, double pocket of IV and flat tympanal sclerite observed in *A. janata* confirm its placement in quadrafine noctuoids as these are reported as shared characters of tribe poaphilini and ophiusini of Erebinæ (Dombroskie, 2011).

Wing venation, general morphology and genital morphology of *A. janata* along with three other species of same genus were described earlier (Edwards, 1978). Taxonomic importance of adult sexual dimorphic characters like mid-tibial groove, modification of eighth abdominal segments and frenulum form were already reported by several

authors (Fibiger and Lafontaine, 2005; Edwards, 1978; Holloway, 2005). Spines at distal end of fore femur were observed as additional sex specific character in the present study. This can be compared to forefemur brush of genus *Zale* Hubner belonging to same tribe poaphilini. However forefemur hair brush of genus *Zale* Hubner is similar to mid tibial hair brush of tribe ophiusini. The current character studied (forefemur hairbrush) support the close relationship of tribe ophiusini and poaphilini (Fibiger and Lafontaine, 2005; Zahiri *et al.*, 2012). Fore femur spine distinguishes *A. janata* from other closely related moths of other tribes *viz.*, ophiusini, panopodini and catocalini. Functional adaptation for presence of fore femur spines and brushes needs further investigation in other tribes and genera.

Larval sexual dimorphism with the help of sex specific translucent pits was studied by several authors throughout the order Lepidoptera (Hinks, C.F and J. R. Byers, 1973; Linda, 1982). Live larvae can be sexed easily at later stages where as earlier stages can be sexed only after staining and preparation (Underwood, 1994). Genital segments



in pupa and adult abdomen were commonly used for sexing. (Muraleedharan and Muraleedharan, 1989).

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