



## Biology, morphology and DNA barcodes of *Tessaratoma javanica* (Thunberg) (Hemiptera: Tessaratomidae)

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### Abstract

*Tessaratoma javanica* (Thunberg) (Hemiptera: Tessaratomidae) an important sucking pest of litchi is studied for supplementing information on its biology, morphometrics of life stages and mtCOI (DNA barcodes). More details generated on the study add to the description of stages namely egg, 1<sup>st</sup> to 5<sup>th</sup> nymphal instars and adults. The evaluation of morphometrics of the life stages reveal that the progression of growth is more during 2<sup>nd</sup> to 3<sup>rd</sup> nymphal stages, and these are critical as far as the growth and development is concerned. The life cycle takes about 141.7±4.25 days; eggs last for 12.81±1.4 days with 97.14±2.86% hatchability; and duration of 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> nymphal instars were 11.69±0.58, 7.23±0.2, 8.63±0.55, 13.04±0.55 and 26.31±0.97 days, respectively. In addition mtCOI analyses have been done employing standard 658 bp barcode fragments facilitating molecular diagnostics of the adults and other life stages and the phylogenetic tree with available sequence in the GenBank.

**Key words:** Litchi, Bionomics, Life stages, mtCOI, Barcoding, India

### Introduction

*Tessaratoma javanica* (Thunberg) (Hemiptera: Tessaratomidae) is an economically important sucking pest of *Litchi chinensis* Sonn. (Sapindaceae) from India (Kumar and Singh 2007; Choudhary *et al.* 2012). Like *T. javanica*, *T. papillosa* Drury causes damage to litchi in China (Kershaw 1907) and are commonly known as litchi bugs. Apart from litchi, it is causing damage to kusum (Glover 1933; Mehra and Kapur 1955) and also been reported feeding on *Sapindus* sp. (Distant 1902; Scafefer and Ahmad 1987), *Schleichera oleosa* (Mehra and Kapur 1955) and *Michelia champaca* (Kumar and Singh 2007). In view of economic importance, the biology of these bugs had been studied earlier by many workers (Liu 1965; Liu and Gu 2000; Mehra and Kapur 1955; Kumar and Singh 2007). The genus *Tessaratoma* has about 26 species of which only 6 species are known from India.

Litchi is a tropical and subtropical tree native to Southern China, Taiwan and South East Asia, and now cultivated in many parts of the world. India is the second largest producer of litchi in the world after China, with an area and production of 77,600 ha and 497,300 t, respectively, during 2010–11 (<http://nhb.gov.in>). There are many species of bugs that attack litchi, among them *T. javanica* is the most destructive. The damage is caused due to the sap sucking habit of its gregarious nymphs as well as adults on tender parts of the litchi tree, such as growing buds, leaf petioles, inflorescence, fruit stalks, and fruits. This results in drying of growing buds and tender shoots and further heavy fruit drop lead to total loss.

Recently, an outbreak of *T. javanica* was observed in the Chotanagpur plateau of Jharkhand with damage exceeding 80% (Choudhary *et al.* 2012). Despite its economic importance, *T. javanica* biology and life cycle stages are less understood and a taxonomy oriented morphological description especially of nymphal instars is lacking. Also, there is a need to develop mtCOI barcodes so that these life stages could be subjected to molecular diagnostics in a demanding situation, such as phytosanitation. The present study is thus an attempt in this direction,

females and males were found longer than the studies of Kumar Singh (2007). Similar trends were observed in case of incubation period as well as in all immature life stages. Total duration of development from egg to adult is 79.6 days which differs slightly from earlier findings i.e. 86.7 days by Mehra and Kapur (1955) and 66.6 days by Kumar and Singh (2007). In contrast to the five nymphal stages, Mehra and Kapur (1955) recorded six nymphal stages of *T. javanica*.

*Tessaratomya* species show a high degree of similarity in appearance, particularly in these immature stages and making species differentiation difficult. So far there are only few molecular studies like those of Lis *et al.* (2012) on the relationship between Tessaratomidae and Dinidoridae, and Song *et al.* (2013) who sequenced the complete mitochondrial genome of the tessaratomid *Eusthenes cupreus* (Westwood). The present study provides the mtCOI sequences as molecular identification tools for all life stages of *T. javanica* and incidentally adds to the molecular data of the Tessaratomidae. It was also observed that *T. javanica* shared 99% of mtCOI identity with *Tessaratomya* sp. from Maharashtra, India and 98% identity with *T. papillosa* from USA, respectively, the sequences available in the NCBI GenBank. Also the ML tree of two *Tessaratomya* species produced two separate clades for *T. javanica* and *T. papillosa*. It is the first study on *T. javanica* integrating biology, morphology, and the mtCOI variations in the Indian populations. This study also contributes to the DNA barcode library for Heteroptera, with all life stage data. The present results provide an approach towards linking of the DNA barcodes with biology and morphology of the litchi bug and these might be critical in its diagnostics under special situations like plant quarantine or phytosanitary applications. Moreover, this enables the quick and accurate identification of immature stages during the import or export of litchi.

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