A CLADISTIC ANALYSIS OF THE SPECIES OF THE GONOCERINE SQUASH BUG GENUS CLETOMORPHA MAYER (HEMIPTERA: COREIDAE) FROM INDO-PAKISTAN SUBCONTINENT

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ABSTRACT

Cladistic analysis of the species of the genus Cletomorpha Mayer from Indo-Pakistan subcontinent is carried out with Cletus as its out group. A cladogram is constructed on the principle of parsimony. No homoplasies had to be invoked.

Key words: Hemiptera, Coreidae, Cletomorpha, Indo-Pakistan, Cladistic analysis.

INTRODUCTION

Species of the gonocerine squash bug genus Cletomorpha Mayer have significant economic importance as pest of some vegetables like Portulaca oleracea L., Amaranthus viridis L. and are potential pests of rice Oryza sativa L. and of other grasses. The genus Cletomorpha was established by Mayer (1866) to accommodate bellula Stal from the Malayan Archipelago which became its type species. Fabricius (1787) described Cimex hastatus which was transferred to Cletomorpha by Stal (1868) and later Distant (1902) redescribed this species from Indo-Pakistan subcontinent and newly recorded it from Karachi in Pakistan and from Bombay and Calcutta in India. In addition, this author described four species of Cletomorpha i.e. C. walkeri Kirby (1891) endemic to Srilanka, C. insignis Distant from Burma and finally C. raja Distant (1901) known from Indian Assam, Burma and Sikkim. Ahmad et al. (1977) keyed, gave dorsal view diagram, and newly recorded C. hastata from Hyderabad and Tandojam in Sindh, Lahore, Changamanga and Rawalpindi in Punjab, Muzafarabad in Kashmir and Dacca, Jessore, Jantipur, Ishurdi and Sylhet in Bangladesh on vegetable Portulaca oleracea L. from January to November. Ahmad and Rab (2000) described a new species C. punjabensis from various localities of Punjab, recorded C. hastata from Pakistan, Sindh, Karachi, India, Bombay, Calcutta keyed it with the above new species and all known Indo-Pakistani species giving their relationships. Ahmad and Rab (2006) keyed, and redescribed C. hastata and discussed its phylogenetic relationships. Kirby (1891) described C. walkeri and C. benita from Indian region and Distant (1902) redescribing walkeri synonymised benita with it and recorded it from Srilanka. Distant (1901) newly named C. kirbyi for C. denticulata, a preoccupied name from Srilanka and described C. raja from Mungphu in Sikkim, Margherrita in Assam, India and Palon in Karennee Burma and again he (1902) redescribed them. The cladistic analysis of these taxa has never been attempted. To fill this gap the present work was undertaken.

MATERIALS AND METHODS

The species from the areas of Indo-Pakistan subcontinent were studied at different museums and collections lodged at different public sector universities and institutes in Pakistan, namely Natural History Museum, Department of Zoology-Entomology, University of Karachi, National Museum of Natural History, Pakistan Science Foundation, Islamabad, National Insect Musem earlier at Pakistan Agricultural Research Council, Malir Halt Karachi and now lodged at NARC, Chakshehzad Islamabad, collections at Pakistan Forest Institute, Peshawar and at Commonwealth Institute of Biological Control, Rawalpindi, by first and second authors. Species of Cletomorpha were also studied by the courtesy of Mr. Mick Webb incharge Hemiptera section, and other authorities of Natural History Museum, London (BMNH) and Hope collections at oxford Museum by the courtesy of Mr. I. Lansbury and other authorities of that museum by the first author. Different characters of species of Cletomorpha were scanned from literature of Distant (1901, 1902 and 1918), Ahmad et al. (1977), Ahmad (1979, 1980), Ahmad et al. (2000) and Ahmad and Rab (2006). For cladistic analysis Cletus was taken as out group for the ancestral characters. Characters were randomly taken and their polarities were recognized not unreasonably by comparing with those of outgroup. A cladogram was constructed using the principle of parsimony in such a manner that no homoplasies had to be invoked.
RESULTS

Characters and character states
Ancestral characters deduced from outgroup i.e. (A₀, B₀, C₀, D₀, E₀) are not particularly mentioned here

Body Colour

Body size
In Cletomorpha walker body slightly shorter in length shows its autapomorphic state (B₁). In C. kirbyi body of medium size in length shows its derived autapomorphic condition (B₂). Body slightly longer in C. punjabensis and C. hastata shows their more derived synapomorphic condition (B₃).

Head
Head slightly produced infront of antenniferous tubercles in the species of Cletus and Cletomorpha (Fig.1) shows their synapomorphic condition (C₁). This character shows that Cletus is an out group of Cletomorpha.

Proportion of 3rd antennal segment as compared to 1st and 2nd
Third antennal segment subequal to 1st in Cletomorpha punjabensis (Fig.7) and C. hastata shows their synapomorphic condition (D₁). In C. raja 3rd antennal segment shorter than either 1st or 2nd separately (Fig.5) shows its autapomorphpheric condition (D₂). Third antennal segment distinctly shorter than 1st and 2nd separately in C. walker and C. kirbyi (Fig.6) shows their derived synapomorphic condition (D₃).

Lateroposterior spines of pronotum
In Cletomorpha hastata lateroposterior spines of pronotum (Fig.2) appear continuous with humeral spine and former appear shorter which show its autapomorphic condition (E₁). Lateroposterior spines of pronotum continuing with humeral spine and former appearing only a little shorter in Cletomorpha punjabensis (Fig.8) show its derived autapomorphic condition (E₂).

Abdomen
In the species of Cletus and Cletomorpha connexiva appear atleast slightly exposed which show their synapomorphy (F₁). In the species of Cletus the connexiva appear only slightly exposed which show their derived autapomorphy (F₂). In Cletomorpha however the connexiva appear much more exposed than that in Cletus which show their more derived autapomorphy (F₃). Abdomen broad and robust in the species of Cletomorpha and connexival angles acutely produced show their derived synapomorphic condition (F₄).

Eighth paratergites
Lateroposterior margin of 8th paratergites round in Cletomorpha punjabensis (Fig.9) shows its autapomorphic condition (G₁). In C. hastata lateroposterior margin of 8th paratergites (Fig.3) appear acutely produced which shows its derived autapomorphic state (G₂).

Spermethecal bulb
Spermethecal bulb (Fig.4) produced into finger like projections in all the species of Cletomorpha shows their synapomorphic condition (H₁).

DISCUSSION

The species of two genera i.e. Cletus and Cletomorpha play sister group and outgroup relationships with each other in having head slightly produced infront of antenniferous tubercles (C₁) while Cletomorpha is neatly separated from Cletus in having autapomorphies of connexiva remarkably exposed (F₃) and abdomen broad and robust (F₁) with connexival angles acutely produced (F₄) and spermethecal bulb produced into finger like projections (H₁). Among the six species of Cletomorpha three species i.e. raja, punjabensis and hastata play sister group and out group relationships with walker, kirby and insignis while punjabensis and hastata play sister group relationship with each other in having synapomorphies of 3rd antennal segment subequal to 1st and much shorter than 2nd (D₁) and the
body of medium size less than 5.5 mm in length (B_3) and C. raja plays outgroup relationship with C. punjabensis and C. hastata in having 3\textsuperscript{rd} antennal segment shorter than either 1\textsuperscript{st} or 2\textsuperscript{nd} antennal segment separately (D_2). Among the rest of the three species of this subgroup i.e. C. kirbyi and C. walkeri play sister group relationship with each other in having the synapomorphies of 3\textsuperscript{rd} antennal segment distinctly shorter than 1\textsuperscript{st} and 2\textsuperscript{nd} (D_3), while insignis plays outgroup relationship with C. walkeri and C. kirbyi in having body pale luteous(A_3).

**REFERENCES**


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