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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.

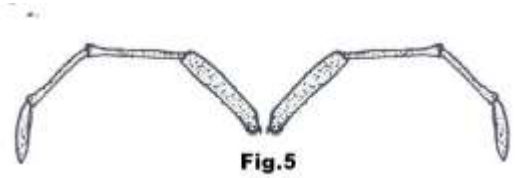
Key words: Hemiptera, Coreidae, *Cletomorpha*, Indo-Pakistan, Cladistic analysis.

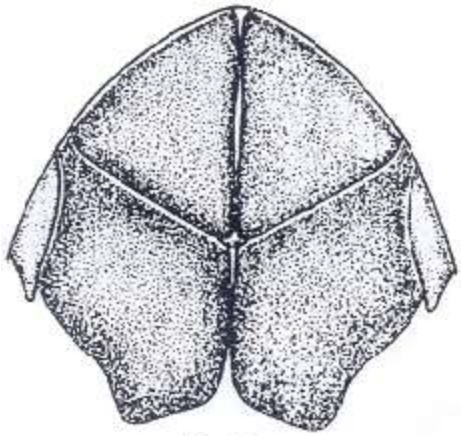
INTRODUCTION

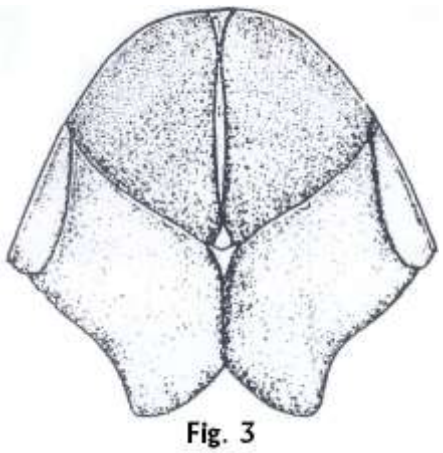
Species of the gonocerine squash bug genus *Cletomorpha* Mayer have significant economic importance as pest of some vegetables like *Portulaca oleracea* L., *Amaranthus viridis* L. and are potential pests of rice *Oryza sativa* L. and of other grasses. The genus *Cletomorpha* was established by Mayer (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 Culcutta 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 Sikhim. 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, Muzzafarabad 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 Sikhim, 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.







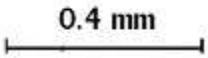


Fig. 1-9 *Cletomorpha* spp. Mayer Figures 1-9; *Cletomorpha* spp. ; 1. Head Dorsal view; 4. Spermethecal bulb; *C. hastata*; 2. Pronotum dorsal view; 3. Eight paratergite ventral view; *C. punjabensis* ; 7. Head Dorsal view; 8. Pronotum Dorsal view; 9. Eight paratergite ventral view *C. raja;* 5. Antennal segments; *C. kirbyi;* 6. Antennal segments.

RESULTS

Characters and chracterstates

Ancestral characters deduced from outgroup i.e. (A_o, B_o, C_o, D_o, E_o) are not particularly mentioned here

Body Colour

Body dull ochraceous in *Cletomorpha raja, C.punjabensis* and *C.hastata* shows their synapomorphic condition (A_1). Body dark brown in *C. kirbyi, C. insignis* and *C. walkeri* (A_2) shows their synapomorphy. Body pale luteous (A_3) in *C. insignis* shows autapomorphic condition.

Body size

In *Cletomorpha walkeri* body slightly shorter in length shows its autapomorphic state (B_1). In *C. kirbyi* body of medium size in length shows its derived autapomorphic condition (B_2). Body slightly longer in *C. punjabensis* and *C. hastata* shows their more derived synapomorphic condition (B_3).

Head

Head slightly produced infront of antenniferous tubercles in the species of *Cletus* and *Cletomorpha* (Fig.1) shows their synapomorphic condition (C_1). 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 (D_1). In *C. raja* 3rd antennal segment shorter than either 1st or 2nd separately (Fig.5) shows its autapomoprphic condition (D_2). Third antennal segment distinctly shorter than 1st and 2nd separately in *C. walkeri and C. kirbyi* (Fig.6) shows their derived synapomorphic condition (D_3).

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 (E_1). 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 (E_2).

Abdomen

In the species of *Cletus* and *Cletomorpha* connexiva appear atleast slightly exposed which show their synapomorphy (F_1). In the species of *Cletus* the connexiva appear only slightly exposed which show their derived autapomorphy (F_2). In *Cletomorpha* however the connexiva appear much more exposed than that in *Cletus* which show their more derived autapomorphy (F_3). Abdomen broad and robust in the species of *Cletomorpha* and connexival angles acutely produced show their derived synapomorphic condition (F_4).

Eighth paratergites

Lateroposterior margin of 8th paratergites round in *Cletomorpha punjabensis* (Fig.9) shows its autapomorphic condition (G_1). In *C. hastata* lateroposterior margin of 8th paratergites (Fig.3) appear acutely produced which shows its derived autapomorphic state (G_2).

Spermethecal bulb

Spermethecal bulb (Fig.4) produced into finger like projections in all the species of *Cletomorpha* shows their synapomorphic condition (H_1).

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 antenneferous tubercles (C_1) while *Cletomorpha* is neatly separated from *Cletus* in having autapomorphies of connexiva remarkably exposed (F_3) and abdomen broad and robust (F_1) with connexival angles acutely produced (F_4) and spermethecal bulb produced into finger like projections (H_1). Among the six species of *Cletomorpha* three species i.e. *raja, punjabensis* and *hastata* play sister group and out group relationships with *walkeri, kirbyi* and *insignis* while *pujabensis* and *hastata* play sister group relationship with each other in having synapomorphies of 3rd antennal segment subequal to 1st and much shorter than 2nd (D_1) 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 3rd antennal segment shorter than either 1st or 2nd 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 3rd antennal segment distinctly shorter than 1st and 2nd(D_3), while *insignis* plays outgroup relationship with *C. walkeri* and *C. kirbyi* in having body pale luteous(A_3).

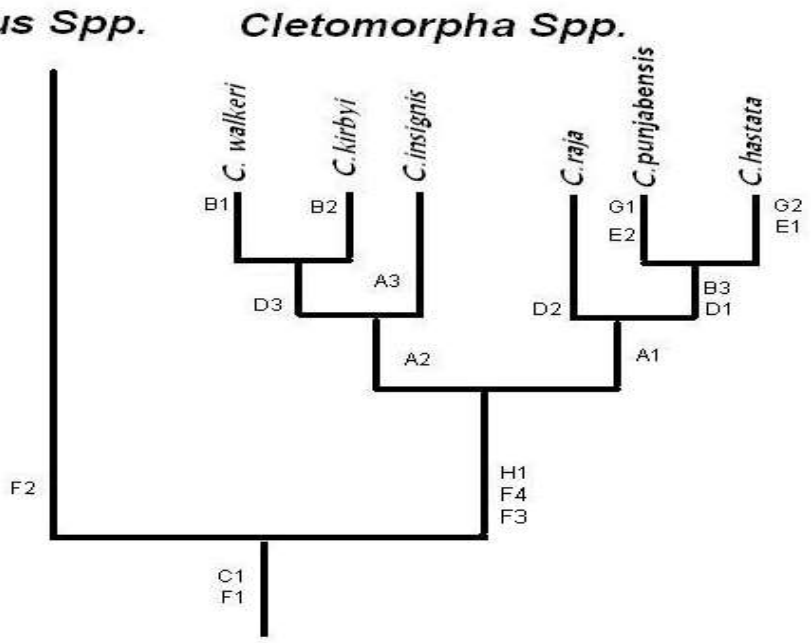


Fig.2. A Cladogram between two spercies.

REFERENCES

Ahmad, I. (1979). A revision of the superfamilies Coreoidea and Pentatomoidea (Hemiptera : Pentatomomorpha) from Pakistan, Azad Kashmir and Bangladesh. Part I. Additions and corrections of Coreid and Pentatomid fauna with phylogenetic considerations. *Entomol. Soc. Kar. Suppl.* 4(1): 1-113.

Ahmad, I. (1980). Insect fauna of Pakistan and Azad Kashmir : Some groups within the order Hemiptera. *Proc. 1st Pakistan Congr. Zool.* A: 115-155.

Ahmad, I., M.U. Shadab and A.A. Khan (1977). Generic and supergeneric keys with reference to a check-list of coreid fauna of Pakistan (Heteroptera: Coreoidea) with notes on their distribution and food plants. *Kar. ent. Soc. Suppl.* 2: 1-49.

Ahmad, I., N. Rab and S. Kamaluddin (2000). A new species of *Cletomorpha* Mayr (Hemiptera: Coreidae) on vegetables from Punjab, Pakistan with a key to the known species of *Cletomorpha* from Indo-Pakistan subcontinent. *Proc. Pakistan Congr. Zool. Jamshoro 20:* 71:-76.

Ahmad, I. and N. Rab (2006). New records and redescription of a gonocerine squash bug *Cletomorpha hastata* (F.) (Hemiptera: Coreidae) from Indo-Pakistan subcontient and its cladistic relationships. *Pakistan J. Zool*., 38(2): 115 – 523.

Distant, W. L. (1901). Revision of the Rhynchota belonging to the family Pentatomidae in the Hope collection at Oxford. *Proceedings of the Zoological Society of London*, 1900(4):807-824, pls. 52-53.

Distant, W.L. (1902). *The Fauna of British India including Ceylon and Burma*. Rhynchota (Heteroptera), Vol. 1. Taylor and Francis, 1-438, London.

Distant, W.L. (1918). *The Fauna of British India including Ceylon and Burma. Rhynchota*, Vol. 7, pp. 1-210.

Fabricius, J. C. (1787). *Mantissa insectorum sistens eorum species nuper detectas adjectis characteribus genericis, differentiis specificis, emendationibus, observationibus*. Christ. Gottl. Proft, Taylor and Francis, London. Vol. 2: 382 pp.

Kirby, W. F. (1891). Catalogue of the described Hemiptera Heteroptera and Homoptera of Ceylon, based on the collection formed (chiefly at Pundaloya) by Mr. E. Ernest Green. *J. Linnean Society of Zoology*, 24:72-176, pls. 4-6.

Mayr, G. L. (1866). *Hemiptera. In: Reise der Österreichischen Freggate Novara um die Erde in den Jahren* 1857, 1858, 1859. Zoologischer Teil, II, Abt. 1. Wien. 204 pp

Stal (1868). Hemiptera Fabriciana. Fabricianska Hemipterarter, efter de i Köpenhavn och Kiel Förvarade typexemplaren granskade och beskrifne. *Kongliga Svenska Vetenskaps-Akademiens Handlingar* 7(2): (1868); Part 2 *op. cit.* 8 No. 1 (1869). Stockholme.

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