

A CLADISTIC ANALYSIS OF SPECIES OF THE GENUS *PSALMOCHARIAS* KIRKALDY (HEMIPTERA:CICADIDAE) FROM PAKISTAN

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ABSTRACT

Five species of the genus *Psalmocharias* Kirkaldy belonging to the subfamily Cicadinae (Cicadidae) have been cladistically analyzed and a cladogram has been constructed and discussed in the light of apomorphies found in the included species of the genus *Psalmocharias* Kirkaldy.

Key words: Cladistic analysis, Hemiptera, Cicadidae, *Psalmocharias* species, Pakistan.

INTRODUCTION

The genus *Psalmocharias* Kirkaldy belongs to the subfamily Cicadinae and the tribe Cicadatrini has been regarded as monophyletic group in several publications dealing with description of new taxa and faunal checklist of Palaearctic region (Distant, 1889-1892, 1906; Dlabola 1957, 1964, 1970, 1971 and 1981; Kudryasheva 1979; Schedl 1993, 1999; Linnavouri, 1962; Zamanian *et al.*, 2008; Ahmed & Sanborn 2010; Mozaffarian & Sanborn 2010). Nast (1972) placed four species of *Psalmocharias* under the genus *Cicadatra*, *C. flava*, *C. plagifera*, *C. rugipennis* and *C. querula* in the faunal checklist of Iran and Pakistan. Mozaffarian & Sanborn (2010) and Ahmed & Sanborn (2010) reported three species, *C. flava*, *C. rugipennis* and *C. querula* under the genus *Cicadatra* while one species *C. plagifera* reported in the genus *Psalmocharias* as *P. plagifera* (Schedl, 1999). In Pakistan, only two species are reported, *P. querula* and *P. rugipennis* (Distant, 1906; China, 1926; Ghulamullah, 1941; Janjua and Samuel, 1941; Chaudhary *et al.*, 1970). Ahmed and Sanborn (2010) presented faunal checklist of cicadas of Pakistan with four new species of the genus *Psalmocharias*.

This paper presents the first cladistic analysis ever of the genus *Psalmocharias* from Pakistan.

Cladistic analysis of species of the genus *Psalmocharias* Kirkaldy

- a₁. Head with three spots at base of vertex (*P.querula*)
- a₂. Head with two spots at base of vertex (*P.balochii*, *P.chitralensis*, *P.gizarensis* and *P.japokensis*)

- b₁. Mesonotum with two lines dense at base and unite medially (*P.querula*)
- b₂. Mesonotum with two lines without dense at base (*P.balochii*, *P.chitralensis*, *P.gizarensis* and *P.japokensis*)

- c₁. Timbal with 8 long and 7 intercalary ribs (*P.balochii*, *P.chitralensis*)
- c₂. Timbal with more than 8 long ribs (*P.gizarensis* and *P.japokensis*)

- d₁. Head ochraceous (*P.balochii*)
- d₂. Head black (*P.chitralensis*)

- e₁. Transverse grooves mark ochraceous (*P.balochii*)
- e₂. Transverse grooves mark dull reddish at middle (*P.chitralensis*)

- f₁. Fore wings with bases of 1st, 2nd and 3rd apical cells infuscated (*P.balochii*)
- f₂. Fore wings with bases of 1st, 2nd, 3rd, 4th and 6th apical cells infuscated (*P.chitralensis*)

- g₁. Pronotum with fissures dull reddish (*P.balochii*)
- g₂. Pronotum with fissures black (*P.chitralensis*)

- h₁. Mesonotum with two lateral and two median sigilla (*P.balochii*)
- h₂. Mesonotum with two faint yellow lines only (*P.chitralensis*)

- i₁. Eyes ochraceous with black patches (*P.gizarensis*)
 i₂. Eyes tawny brown with chocolate brown patches (*P.japokensis*)
- j₁. Rostrum just passes intermediate coxae (*P.gizarensis*)
 j₂. Rostrum reaching in the middle of hind coxae (*P.japokensis*)
- k₁. Timbal with 9 long and 8 intercalary ribs (*P.gizarensis*)
 k₂. Timbal with 10 long and 9 intercalary ribs (*P.japokensis*).

Characters and Characterstates

Head with spots (a):

In *P. querula*, head with three spots at base of vertex shows its autapomorphic condition (a₁) while head with two spots at base of vertex in *P. balochii*, *P. chitralensis*, *P. gizarensis* and *P. japokensis* shows their synapomorphic condition (a₂).

Mesonotum with lines (b):

In *P. querula*, mesonotum with lines dense at base and unite medially show its autapomorphic condition (b₁) while mesonotum with two lines without dense at base in *P. balochii*, *P. chitralensis*, *P. gizarensis* and *P. japokensis* shows their synapomorphic condition (b₂).

Timbal with ribs (c):

In *P. balochii* and *P. chitralensis*, timbal with 8 long and 7 intercalary ribs shows their synapomorphic condition (c₁) while in *P. gizarensis* and *P. japokensis*, number of ribs exceed the above numbers shows their derived synapomorphic condition (c₂).

Colour of head (d):

In *P. balochii*, head ochraceous show its autapomorphic condition (d₁) while in *P. chitralensis*, head black show its derived autapomorphic condition (d₂).

Colouration of transverse grooves (e):

Transverse grooves mark ochraceous in *P. balochii* show its autapomorphic condition (e₁) while in *P. chitralensis*, transverse grooves mark dull reddish medially only show its derived autapomorphic condition (e₂).

Fore wings infuscation (f):

In *P. balochii*, fore wings with the bases of 1st, 2nd and 3rd apical cells darkly infuscated show its autapomorphic condition (f₁) while fore wings with the bases of 1st, 2nd, 3rd, 4th and 6th apical cells darkly infuscated in *P. chitralensis* show its derived autapomorphic condition (f₂).

Colouration of fissures (g):

In *P. balochii*, pronotum with fissures dull reddish show its autapomorphic condition (g₁) while pronotum with fissures black in *P. chitralensis* show its derived autapomorphic condition (g₂).

Mesonotum with or without sigilla (h):

Mesonotum with two lateral and two median sigilla in *P. balochii* show its autapomorphic condition (h₁) while in *P. chitralensis*, mesonotum with two faint yellow lines only show its derived autapomorphic condition (h₂).

Colouration of eyes (i):

In *P. gizarensis*, eyes ochraceous with black patches show its autapomorphic condition (i₁) while in *P. japokensis*, eyes tawny brown with chocolate brown patches show its derived autapomorphic condition (i₂).

Lengthening of rostrum (j):

Rostrum just passes intermediate coxae in *P. gizarensis* show its autapomorphic condition (j₁) while rostrum reaching in the middle of hind coxae in *P. japokensis* show its derived autapomorphic condition (j₂).

Timbal with number of ribs (k):

In *P. gizarensis*, timbal with 9 long and 8 intercalary ribs show its autapomorphic condition (k_1) while timbal with 10 long and 9 intercalary ribs in *P. japokensis* show its derived autapomorphic condition (k_2).

Discussion on cladogram of the species of the genus *Psalmocharias* Kirkaldy

The Palaearctic genus *Psalmocharias* Kirkaldy comprising four species *P. flava*, *P. rugipennis*, *P. plagifera* and *P. querula*, however, Zamanian *et al.*, (2008) discussed the *Cicadatra alhageos* as *Psalmocharias alhageos* from Iran and Pakistan but there were no presence in Pakistan and the species under the genus *Psalmocharias* (Mozaffarian & Sanborn, 2010). The present paper deals with five species including four new species described by Ahmed and Sanborn, 2010. The known species of *P. querula* is female.

These five species *P. balochii*, *P. chitralensis*, *P. gizarensis*, *P. japokensis* and *P. querula* falls into two groups. Group I include *P. querula* plays out group relationship from the remaining four species of the second group in having head with three spots at vase of vertex (a_1) and mesonotum with two lines dense at base and unite (b_2).

Group II leads to two subgroups. Subgroup I includes two species, *P. balochii* and *P. chitralensis* sharing the apomorphic character, timbal with 8 long and 7 intercalary ribs (c_1), while subgroup II consist of two species *P. gizarensis* and *P. japokensis* sharing the apomorphic character, timbale with exceed number of long ribs (c_2) than previous species.

Subgroup I appears in two lines of evolution. The first line leads to *P. balochii* with derived characters of head ochraceous (d_1), transverse grooves mark ochraceous (e_1), fore wings with bases of 1st, 2nd and 3rd apical cells infuscated (f_1), pronotum with fissures dull reddish (g_1), mesonotum with two lateral and two median sigilla (h_1), where as *P. chitralensis* shows the derived characters of head black (d_2), transverse grooves mark dull reddish at middle (e_2), fore wings with bases of 1st, 2nd, 3rd, 4th and 6th apical cells infuscated (f_2), pronotum with fissures black (g_2), mesonotum with two faint yellow lines only (h_2).

Subgroup II also appears in two lines of evolution. The first line leads to *P. gizarensis* with derived characters of eyes ochraceous with black patches (i_1), rostrum just passes intermediate coxae (j_1), timbal with 9 long and 8 intercalary ribs (k_1) where as *P. japokensis* shows the derived characters of eyes tawny brown with chocolate brown patches (i_2), rostrum reaching in the middle of hind coxae (j_2), timbal with 10 long and 9 intercalary ribs (k_2).

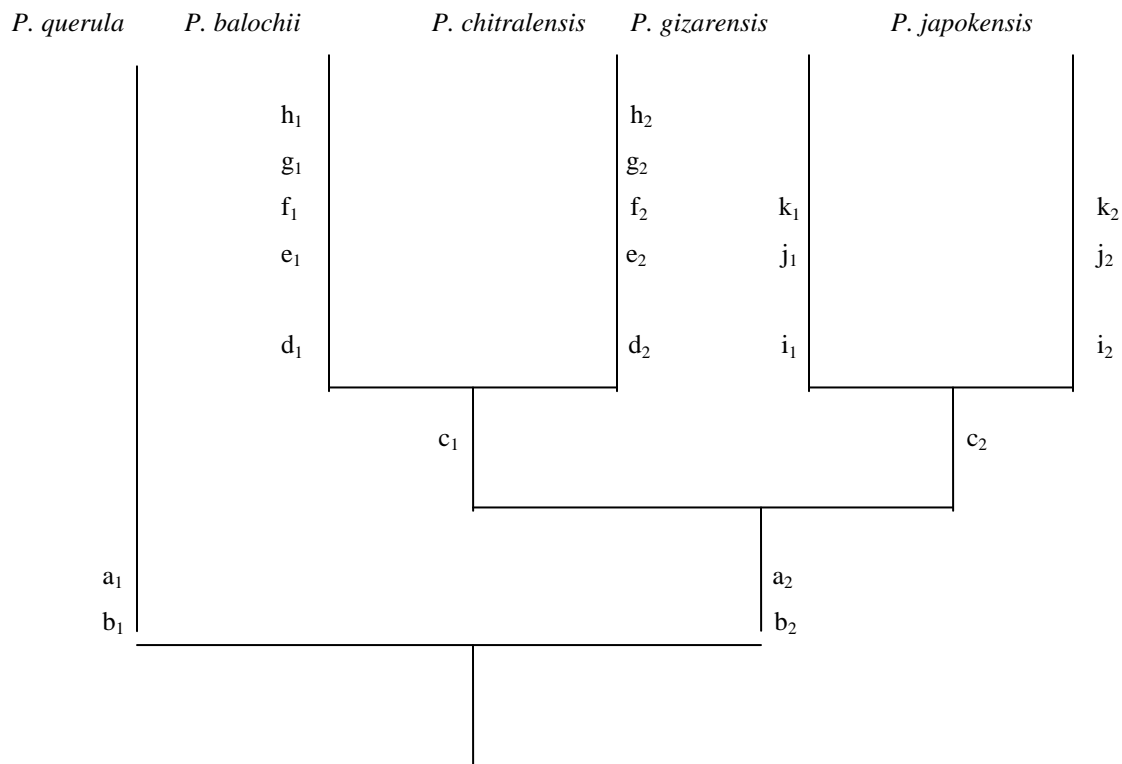


Fig.1. Cladogram of the species of the genus *Psalmocharias* Kirkaldy

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