J. Entomol. Res. Soc., 16(1): 21-26, 2014 *ISSN:1302-0250*

Taxonomic Significance of Male Supra-anal Plate, Cerci and Subgenital Plate in the Classification of Indian Pyrgomorphidae (Orthoptera: Pyrgomorphoidea)

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ABSTRACT

Male supra-anal plate, cerci and subgenital plate are considered as external parts of male genitalia. Taxonomic significance of internal genitalia such as epiphallus and aedeagus was already known for identification and classification of Indian Pyrgomorphidae. In the study, a comparative investigation of male supra-anal plate, cerci and subgenital plate was undertaken in twelve species of grasshoppers representing six genera under four tribes belonging to the family Pyrgomorphidae. The present study revealed that shape and size of male supra-anal plate, cerci and subgenital plate have the significant importance in separating the various genera and species of family Pyrgomorphidae.

Key words: Significance, Pyrgomorphidae, Classification, supra-anal plate, cerci, subgenital plate.

INTRODUCTION

Supra-anal plate of male is eleventh tergite known as epiproct. It is triangular in its simplest form. Paraprocts are present under the epiproct in half-concealed form. Paraprocts represents the eleventh sternite. Cerci are tubular appendages arising from the membrane between the joints of epiproct and paraproct. There are two main structural parts in the cerci i.e. the main body and a small lobe usually concealed under the epiproct. Cerci are sensory in nature. Supra-anal plate and cerci together are used to hold the female abdomen during the course of copulation. The subgenital plate of male is ninth sternite. It is usually longer than wide. It envelops the phallic complex and generally conical in apical part.

Supra-anal plate is triangular normally, cerci are tubular and subgenital plate is conical but all of them are greatly variable in one species to another species. Dirsh (1965) briefly described the male supra-anal plate and cerci in African genera of Acridoidea. Uvarov (1966) illustrated supra-anal plate and cerci in some species of Acridoidea. Usmani and Ajailli (1994) showed taxonomic significance of male supra-anal plate and cerci in some Libyan grasshoppers.

Keeping in view the taxonomic importance of supra-anal plate, cerci and subgenital plate, the present study was carried out in twelve Indian species of Pyrgomorphidae.

The characters such as triangular or angular shape of supra-anal plate, shape and size of subgenital plate and shape and size of cerci and their comparative length in respect to length of epiproct are considered as useful characters of generic and specific significance.

MATERIAL AND METHODS

The present authors collected new material of adult grasshoppers of both sexes from various localities. For a detailed study of the external genitalia, the apical part of male body was cut off and boiled in 10% potassium hydroxide for a variable period till the material became transparent (usually about 10 minutes) to remove unsclerotized and non-chitinous tissues. They were then thoroughly washed in tap water for complete removal of KOH and examined in 70 percent ethyl alcohol on a cavity slide. Later, every specimen was dissected under a binocular microscope with the help of fine needles to separate various components viz., supra-anal plate, cerci and subgenital plate of male. The normal process of dehydration was adopted and clearing was done in clove oil. A 22 mm square cover-glass over the cavity of the slide was normally used when examining the supra-anal plate and subgenital plate. This was made to prevent them from curling upwards and inwards at the edges. The slides were kept in a slide drier at a temperature of approximately 40°C for about one week to get them completely dry.

The permanent slides were examined under the microscope in order to make a detailed study of the genital structures. Drawings were initially made with the help of a camera lucida. Details were filled in by conventional microscope examination.

RESULTS

The following observations on the supra-anal plate, cerci and subgenital plate of male were made in detail on different genera and species which are arranged in their respective families and subfamilies.

Tribe: Chrotogonini I. Bolivar, 1884

Genus: *Chrotogonus* Serville, 1838

***Chrotogonus oxypterus* (Blanchard, 1836)**

Supra-anal plate broad, wider than long, apex obtusely conical; Cerci slightly longer than the epiproct, obtusely conical at apex; Paraproct broad and slightly longer than epiproct; Subgenital plate triangular and obtusely conical at the tip (Figs. 1a., 2a.)

***Chrotogonus armatus* Steinmann, 1965**

Supra-anal plate broadly triangular, longer than wide, apex rounded; Cerci shorter than the epiproct, broad at base and obtusely rounded at apex; Paraproct is also broader and longer than the epiproct; Subgenital plate angularly rounded and slightly obtusely conical at the apex (Figs. 1b., 2b.).

***Chrotogonus trachypterus trachypterus* (Blanchard, 1836)**

Supra-anal plate broad, wider than long, apex slightly conical; Cerci small, slightly shorter than the epiproct, conical at apex; Paraproct is also broader and smaller than the epiproct; Subgenital plate triangular and slightly longer, obtusely conical at apex. (Figs. 1c., 2c.)

Genus: *Tenuitarsus* Bolivar, 1904

***Tenuitarsus orientalis* Kevan, 1959**

Supra-anal plate broad, as wide as long, apex conical; Cerci longer than the epiproct and conical at apex; Paraproct is also broader and smaller than the epiproct; Subgenital plate angularly rounded at the apex (Figs. 1d., 2d.).

Tribe: Poekilocerini Burmeister, 1840

Genus: *Poekilocerus* (Serville, 1831)

***Poekilocerus pictus* (Fabricius, 1775)**

Supra-anal plate broad, wider than long, apex rounded; Cerci longer than the epiproct and conical at apex; Paraproct is less wider and longer than the epiproct; Subgenital plate triangular and much wider at the base with obtusely rounded at the apex. (Figs. 1e., 2e.)

Tribe: Pyrgomorphini Brunner, 1882

Genus: *Pyrgomorpha* (Serville, 1838)

***Pyrgomorpha conica* (Olivier, 1791)**

Supra-anal plate triangular, longer than wide, apex obtusely conical; Cerci longer than the epiproct, obtusely conical at apex; Paraproct shorter than epiproct; Subgenital plate angularly rounded at the apex (Figs. 1f., 2f.).

Genus: *Zarytes* (Bolivar, 1904)

***Zarytes squalinus brachycerus* (Kirby, 1914)**

Supra-anal plate triangular, slightly wider at base, longer than wide, apex conical; Cerci longer than the epiproct and conical at apex; Paraproct much smaller than epiproct; Subgenital plate triangular with truncated apex (Figs. 1g., 2g.)

Tribe: Atractomorphini Bolivar, 1905

Genus: *Atractomorpha* Saussure, 1862

***Atractomorpha burri* Bolivar, 1905**

Supra-anal plate elongate angular, much longer than wide, apex conical; Cerci shorter than the epiproct, and conical at apex; Paraproct much smaller than epiproct; Subgenital plate triangular in shape with flat apex (Figs. 1h, 2h).

***Atractomorpha psittacina psittacina* (Haan, 1842)**

Supra-anal plate elongate angular, much longer than wide, apex conical; Cerci much shorter than the epiproct, and conical at apex; Paraproct much smaller than epiproct; Subgenital plate angularly rounded at apex (Figs. 1i., 2i)

***Atractomorpha crenulata* (Fabricius, 1793)**

Supra-anal plate elongate angular, much longer than wide, apex conical; Cerci shorter than epiproct, and conical at apex; Paraproct much smaller than epiproct; Subgenital plate oval at apex. (Figs. 1j., 2j.)

***Atractomorpha angusta* Karsch, 1888**

Supra-anal plate elongate angular, much longer than wide, apex conical; Cerci shorter than the epiproct, and conical at apex; Paraproct smaller than epiproct; Subgenital much wider than longer and rounded at the apex. (Figs. 1k., 2k.)

***Atractomorpha sinensis sinensis* Bolívar, I., 1905**

Supra-anal plate elongate angular, much longer than wide, apex conical; Cerci shorter than the epiproct, and conical at apex; Paraproct slightly smaller than the epiproct; Subgenital plate much wider than longer and oval at the apex. (Fig. 1l., 2l.)

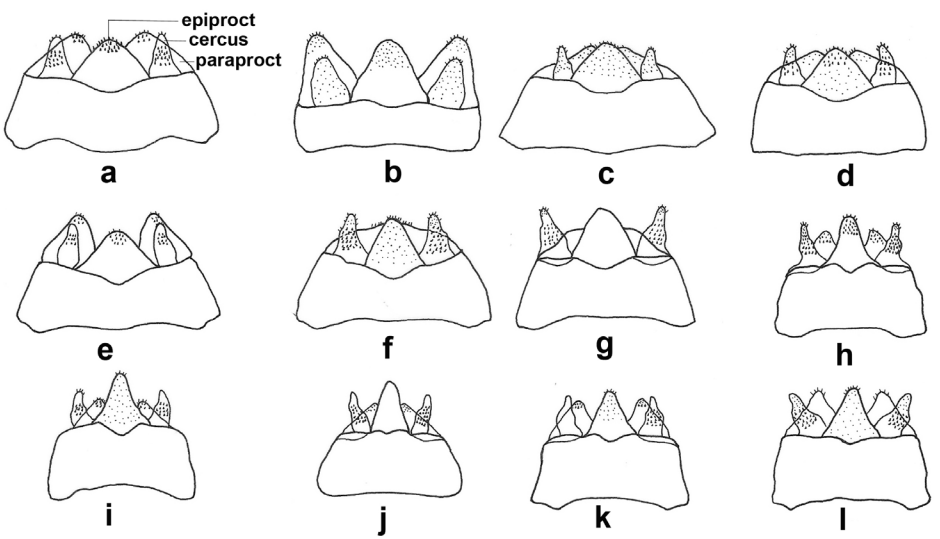

Fig. 1. Male Supra-anal plate and cerci a) *Chrotogonus oxypterus,* b) *C. trachypterus,* c) *Chrotogonus armatus,* d) *Tenuitarsus orientalis,* e) *Poekilocerus pictus,* f) *Pyrgomorpha conica,* g) *Zarytes squalinus brachycerus,* h) *Atractomorpha angusta, i) Atractomorpha burri*, j) *Atractomorpha crenulata*, k) *A. psittacina*, l) *A. sinensis.*

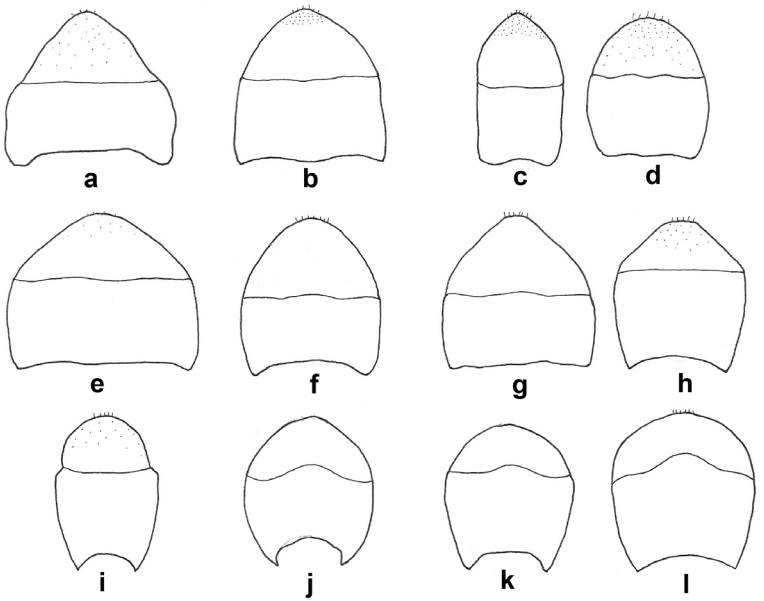

Fig. 2: Subgenital plate, a) *Chrotogonus oxypterus*, b). *Chrotogonus trachypterus*, c) *C. armatus*, d) *Tenuitarsus orientalis*, e) *Poekilocerus pictus*, f) *Pyrgomorpha conica*, G. *Zarytes squalinus brachycerus*, h) *Atractomorpha angusta*, i) *A. burri*, j) *A. crenulata*, k). *A. psittacina*, l) *A. sinensis*.

CONCLUSION AND DISCUSSION

Earlier workers classified the Pyrgomorphid insects on the basis of externally visible morphological characters such as shape, size, colour, texture, antennal segments etc. But all these characters are variable and in the same species they can change in the influence of environmental conditions. So the proper identification may be interrupted. For avoiding this type of confusion, it is necessary to incorporate such type of characters which can not be affected by environmental stresses. The genitalic structures provide such type of key characters which are stable for environmental stresses. So keeping all the ideas, the present comparative study on the supra anal plate, cerci and subgenital plate was carried out in twelve species of Pyrgomorphidae under four tribes and six genera.

The present study reveals that the shape of supra-anal plate is used as a key character for separating various tribes. Supra-anal plate is elongate-angular in tribe Atractomorphini while in Chrotogonini, Poekilocerini and Pyrgomorphini it is triangular. In Poekilocerini, apex of supra-anal plate rounded and in Pyrgomorphinae, apex of supra-anal plate conical while in Chrotogoninae, apex of supra-anal plate obtusely conical.

Shape and size of subgenital plate is regarded as stable character for separating different genera. In the tribe Chrotogonini, the subgenital plate in the genus *Chrotogonus* is obtusely conical at the apex while in the genus *Tenuitarsus* it is rounded

at the apex. In the tribe Pyrgomorphini, the subgenital plate in the genus *Pyrgomorpha* is angularly rounded at the apex while in the genus *Zarytes* it is truncated at the apex.

The length of cecri in comparision to length of epiproct, shape of apex of cerci and comparative length of paraproct in relation to epiproct are stable character for identifying different species belonging to same genus. In the genus *Chrotogonus*, the cerci in *Chrotogonus oxypterus* are longer and obtusely conical at apex, paraproct also longer than epiproct while in *Chrotogonus armatus* cerci are much shorter and angularly rounded, paraproct is much longer. In *Chrotogonus trachypterus trachypterus* cerci shorter and conical, paraproct slightly shorter. In *Tenuitarsus orientalis* cerci longer and conical, paraproct slightly shorter and in *Poekilocerus pictus* cerci longer conical, paraproct much longer. In *Pyrgomorpha conica* cerci longer and obtusely conical, paraproct slightly shorter while in *Zarytes squalinus brachycerus* cerci longer and conical, paraproct much smaller. In the genus *Atractomorpha*, the cerci in *Atractomorpha burri* are slightly shorter and conical, paraproct smaller; in *Atractomorpha psittacina psittacina* cerci much shorter and conical, paraproct much smaller; in *Atractomorpha crenulata* cerci shorter and conical, paraproct much smaller and in *Atractomorpha angusta* cerci slightly shorter and conical, paraproct slightly smaller while in *Atractomorpha sinensis sinensis* cerci slightly shorter and conical, paraproct slightly smaller. Such type of comparative study on genitalia along with conventional morphological characters have made the identification of genera and species more perfect and convenient.

ACKNOWLEDGEMENTS

We wish to extend our gratitude to Department of Science and Technology, New Delhi for providing financial assistance during the tenure of a major research project (Ref. No. SR/SO/AS 32/2008) being carried out on Biosystematics and Biodiversity of Acridoidea (Orthoptera) in North India. Thanks are also due to Prof. Irfan Ahmad, Chairman, Department of Zoology, Aligarh Muslim University, Aligarh for providing necessary facilities.

REFERENCES

David R. R., *Grasshoppers and Locusts*. Cambridge, 481 pp..

Dirsh, V. M., 1965, *The African genera of Acridoidea*. Cambridge, xiii + 579 pp.

Usmani, M. K., Ajaili, A. A., 1994, Taxonomic significance of male supra anal plate and cerci in some Libyan grasshoppers (Orthptera: Acrididae). *Annals of Agricultural Science*, 39(1): 407-416.

Received: August 15, 2012 *Accepted: January 20, 2014*