



First report on meiotic behavior of chromosomes in three species of subfamily Pentatominae (Pentatomidae: Heteroptera)

HARBHAJAN KAUR & KANU SHARMA

Department of Zoology and Environmental Sciences, Punjabi University, Patiala-147002, India.

E-mail: harbhajankaur@hotmail.com

Abstract

Regardless of rich biodiversity, cytogenetic reports on Pentatomidae refer to less than 400 species. This paper reports, for the first time, course of meiosis of three species of subfamily Pentatominae viz., *Tolumnia antennata* Distant, *Cahara jugatoria* (Lethierry) and *Cahara confusa* (Distant). Species-specific variations observed with respect to association pattern of X and Y during prophase, arrangement pattern of chromosomes at metaphase I and degree of association between X and Y in the pseudobivalent at metaphase II are explained in the present paper.

Tolumnia antennata and *Cahara jugatoria* possess $2n=14=12A+XY$ while *Cahara confusa* possesses $2n=12=10A+XY$. At least one ring bivalent is observed during diplotene in all the three species. X and Y dissociate to get well separated at diplotene in *Cahara confusa*, at diakinesis in *Tolumnia antennata* and at metaphase I in *Cahara jugatoria*. In *Cahara jugatoria*, at metaphase I, X and Y are peripheral forming a part of the ring. In *Cahara confusa*, at metaphase II, X is peripheral while Y lies in the centre and the two fail to associate to form a pseudobivalent, a phenomenon never recorded earlier in any pentatomid.

Key words: Heteroptera, Pentatomidae, Pentatominae, Meiosis, chromosomes

Introduction

The family Pentatomidae is one of the largest families of the sub-order Heteroptera, consisting of 4,722 species belonging to 896 genera (Rider, 2006–2014). It is divided into eight subfamilies: Asopinae, Cyrtocorinae, Discocephalinae, Edessinae, Pentatominae, Phyllocephalinae, Podopinae and Serbaninae. Majority of pentatomids are plant feeders and several of them are of great economic importance. Most of the economically important phytophagous species belong to the subfamilies Edessinae and Pentatominae, and include majority of crop pests (Schaefer & Panizzi 2000). Pentatominae is the largest subfamily comprising 3,336 species belonging to 621 genera (Rider 2006–2014).

Cytogenetically, Pentatomidae is characterized by the absence of microchromosomes and XY sex determining mechanism except in three species: *Macropygium reticulare* (Fabricius), *Rhytidolomia senilis* (Say) and *Thyanta calceata* (Say) (Rebagliati *et al.*, 2005). Regardless of rich biodiversity, cytogenetic reports on Pentatomidae refer to less than 400 species (Ueshima 1979; Manna & Deb-Mallick 1981; Nuamah 1982; Manna 1984; Satapathy & Patnaik 1988, 1989; Satapathy *et al.* 1990; Gozález-García *et al.* 1996; Rebagliati 2000; Rebagliati *et al.* 2001, 2002, 2003, 2005; Lanzone 2003; Kerzhner *et al.* 2004; Kaur & Semahagn 2010 a & b; Rebagliati & Mola 2010 a & b; Kerisew 2011). In the present paper, course of meiosis of three species viz. *Tolumnia antennata* Distant, *Cahara jugatoria* (Lethierry) and *Cahara confusa* (Distant) belonging to subfamily Pentatominae has been described for the first time.

Material and methods

Adult males of three species of subfamily Pentatominae, *Tolumnia antennata* Distant, *Cahara jugatoria* (Lethierry)

During the diffuse stage, a common meiotic feature of Heteroptera, condensed sex chromosomes usually fuse or associate closely. In the present three species of Pentatominae, too, X and Y chromosomes associate closely to form a single heteropycnotic body during the diffuse stage but variations in their association pattern have been observed in the subsequent stages. X and Y dissociate to get well separated at diplotene in *Cahara confusa*, at diakinesis in *Tolumnia antennata* and at metaphase I in *Cahara jugatoria*. Such variations have been reported earlier in other pentatomids also (Manna 1951; Satapathy & Patnaik 1988, 1991; Rebagliati *et al.* 2001; Kaur & Semahagn 2010 a & b; Kerisew 2011).

In Heteroptera, there is predominance of one chiasma per bivalent (Satapathy & Patnaik 1988; Gozalez-Garcia *et al.* 1996; Grozeva & Nokkala 1996; Bressa *et al.* 1999; Nokkala & Nokkala 1999; Lanzone & Souza 2006). However, in the presently studied three species of Pentatomidae, a good proportion of cells (100% in *Tolumnia antennata*, 67.64% in *Cahara jugatoria* and 68.48% in *Cahara confusa*) show at least one autosomal bivalent of the complement with two chiasmata as has been reported earlier in some pentatomids by Camacho *et al.* (1985), Mola & Papeschi (1993), Kaur & Semahagn (2010 a & b), Rebagliati & Mola (2010a & b) and Kerisew (2011). The present observations substantiate the viewpoint of Rebagliati & Mola (2010b) that the presence of ring bivalent is common rather than exceptional in Pentatomidae

In *Cahara confusa* and *Tolumnia antennata*, autosomal bivalents are arranged in a ring on the metaphase I plate in the centre of which lie X and Y as has been reported in most of the pentatomid species (Manna 1951; Satapathy & Patnaik 1988; Rebagliati *et al.* 2001; Lanzone & Souza 2006). However, in *Cahara jugatoria*, chromosome arrangement deviates from this typical pattern. Here, X and Y are peripheral forming a part of the ring (84.21% of 38 cells analyzed). This behavior is less common and has earlier been reported only in 7 species viz., *Eurydema pulchrum* (Kaur *et al.* 2006; Kaur & Semahagn 2010 a), *Mormidae paupercula* (Rebagliati & Mola 2010a), *Acletra kimbergii* (Rebagliati & Mola 2010b), *Eysarcoris rosaceus*, *Halys seregera*, *Plautia fimbriata* and *Priassus exemptus* (Kerisew 2011).

In *Cahara jugatoria* and *Tolumnia antennata*, at metaphase II, autosomes form a ring in the centre of which lies the XY pseudobivalent, a behavior commonly observed in Pentatomidae (Manna 1951; Parshad 1957; Satapathy & Patnaik 1988; Rebagliati *et al.* 2001; Kaur & Semahagn 2010 a & b; Kerisew 2011). Deviations with respect to degree of association between X and Y have earlier been reported in *Acletra kimbergii* in which sex chromosomes retain their typical close association or are slightly separated (Rebagliati & Mola 2010b) and in *Haylomorpha murrea* where the two lie nearby but remain well separated (Kerisew 2011). In both these species, sex chromosomes lie within the ring. In *Cahara confusa*, however, X is peripheral while Y lies in the centre and the two fail to associate at all to form a pseudobivalent in all the studied plates, a phenomenon never recorded earlier in any pentatomid species.

To conclude, behavior of the chromosomes during meiosis in *Tolumnia antennata* is typical of Pentatomidae. However, a few species-specific variations and exceptions with respect to arrangement of chromosomes and degree of association between X and Y during metaphase I and II are recorded in *Cahara jugatoria* and *Cahara confusa*.

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