P: ISSN No. 0976-8602 RNI No.UPENG/2012/42622 VOL.-V, ISSUE-III, July-2016
E: ISSN No. 2349-9443 Asian Resonance

Karyology of Five Indian Pierid Butterflies

Meenu Sadhotra
Assistant Professor,
Deptt.of Zoology,
Govt.College for Women,
Parade, Jammu,
J & K

Abstract

Lepidoptera is one of the largest orders of the class Insecta which includes butterflies and moths and is economically, biologically and aesthetically an important order. Chromosomal structure and size are of great significance in karyological studies and have relevance to evolution, speciation and Chromosomal organization.Karyotypic studies in Lepidoptera has been a difficult task due to small dot- like chromosomes of similar sizes. The chromosome cytology of Indian Lepidoptera is very much limited. The present paper reports chromosome garniture of five Pierid butterflies from Jammu, India. The modal haploid chromosome number shows deviation in five Pierid butterfly species.

Keywords: Pierid, Butterflies, Haploid Chromosome Number, Deviation.

Introduction

Cytological investigations in Indian Lepidoptera have made a little headway although some attention has been paid to this branch in recent years (Rishi, 1973, 1975; Nayak, 1975; Rao and Murthy, 1976). Saura *et al.,* (2013) studied chromosome evolution in Neotropical butterflies and they listed chromosome number for 65 species of Neotropical Hesperiidae and 104 species of Pieridae having modal n=28 and n=31 respectively. They observed that many Neotropical groups are characterized by karyotype instability with several derived modal numbers or none at all, while almost all taxa of Lepidoptera studied from other parts of the world have one of n=29-31 as modal numbers.The present work pertains to mitotic and meiotic chromosomes of five species of butterflies belonging to family Pieridae.

Aim of the Study

The aim of the present study was to know new methods of insect pest management which will contribute to sustainable agriculture, protection of the environment and the maintenance of biodiversity. The strength of lepidopteran genomics lies in the diversity of the group as a whole.

Review of Literature

Henking (1890) observed 2n =28 in *Pieris brassicae* and recorded two types of primary spermatocytes with 14 and 15 chromosomes respectively. Doncaster (1912) observed 2n=30 and 2n=50 in *Pieris brassicae* and *Abraxas grossulariata* while working on spermatogenesis and oogenesis of *P. brassicae* and of *A. grossulariata*. de Lesse and Condamin (1962) showed n=31 in all species of *Pieris*. Rishi and Rishi (1977) successfully obtained elongated chromosomes in *Pieris brassicae* by *in vivo* colchicine treatment. Elongated chromosomes showed 15 bivalents with clear chiasmata during metaphase-I.

Material and Methods

Larvae of five species of Pierid butterflies were collected from their respective host plants and were reared in cages. The fifth instar larvae and early pupae were found suitable for chromosomal investigation. Brain ganglia from male and female and testes from male were dissected out and fixed in Carnoy's fixative. Slides were prepared following the technique of Rishi *et al*., 1997 and stained in Giemsa stain. Slides were examined under binocular research microscope, good stages were photographed.

Results

***Pieris canidia indica* Sparr.**

2n=50. Mitotic metaphase from male and female brain ganglia showed 50 elongated, homomorphic chromosomes (Figs. 1&2). Male meiotic prophase chromosomes in zygotene and pachytene are elongated and thread like paired bodies. Their exact number, however was not countable in these stages. Chromosomes showed gradual condensation from pachytene to diakinesis. Metaphase I showed 25 bivalents which were at maximum state of condensation and were oval in shape (Figs. 3, 4 & 5)

***Pieris brassicae nepalensis* Linn**

2n=30. Mitotic metaphase from male and female brain ganglia showed 30 elongated, homomorphic chromosomes (Figs. 6&7). Male meiotic prophase chromosomes in zygotene and pachytene are elongated and thread like paired bodies. Their exact number, however was not countable in these stages. Chromosomes showed gradual condensation from pachytene to diakinesis. Metaphase I showed 15 bivalents which were at maximum state of condensation and were oval in shape(Figs. 8,9&10).

***Ixias pyrene* Linn**

2n=56. Somatic metaphases showed 56 dot like chromosomes (Figs.11&12). Further, their number was confirmed from the meiotic stages. Metaphase I showed 28 bivalents, one of which was deeply stained (Figs.13, 14 &15).

***Ixias marriane* Cramer**

2n=56. Somatic metaphases showed 56 dot like chromosomes (Figs. 16&17). Further, their number was confirmed from the meiotic stages (Figs.18&19).

***Pontia daplidice* Linn**

2n=52.Good number of somatic metaphases were scored for this species (Fig. 20&21). Modal number was found to be 52 but it deviated from 52 to 50 in some of the cells. However, the meiotic stages, confirmed the diploid number of the species. Anaphase I was normal (Figs.22,23&24).

Discussion

This family of butterflies ranks second in the list of cytologically exploited families. As many as 205 species of this family have been cytologically investigated by a number of authors. The number of Indian Pierids investigated so far is eleven including the five presently investigated species.This chromosomal polymorphism may be due to geographical variation. A G-banded karyotype was described by Rishi and Rishi (1990) for *P. brassicae* consisting of 7 pairs of acrocentrics, 6 pairs of sub-metacentrics and 2 pairs of metacentrics. The smallest pair, being heteromorphic, suggested female heterogamety of ZW type.

Analysis of sex chromosomes in Lepidoptera has been greatly impeded due to homomorphic nature of metaphase chromosomes which make the sex chromosomes and autosomes undifferentiable. In Lepidoptera, female is heterogametic sex with ZW sex chromosome mechanism and male is of ZZ type. In other insect orders, male are usually heterogametic. No definite information is available as to how the switchover from male to female heterogamety occurred in Lepidoptera during their evolution from their presumed mecopteroid ancestor. The large bivalent occurring in the chromosome garniture of some species of Lepidoptera has often been considered as sex bivalent (White, 1973; Ennis, 1976).

Conclusion

The present observationand the earlier chromosomal data of order Lepidoptera shows that the different number found in the various species are the exact multipulesof the lowest number.They are in no way indicative of a polyploidy evolution.

Acknowledgment

The author is thankful to Deptt. of Zoology, University of Jammu, Jammu-180006 (J&K) for providing the necessary facilities.

References

1. Doncaster, L. 1912. The chromosomal in oogenesis and spermatogenesis of *Pieris brassicae* and oogenesis of *Abraxas grossulariata*. *J. Genet*. 2 : 189 -200.
2. Ennis, T.Z. (1976). Sex chromatin and chromosome numbers in Lepidoptera. *Canadian J. of Cytology* 18, 119-130.
3. Henking, H. 1890. Untersunchung uber die erster Entwick lungsvorgauge in den Eien der Insekten. I. Das Ei von *Pieris brassicae* L. nebst. Bemarkunger uben Samen and Samenbildung. *Z. Wiss. Zool*., 49: 503 – 564.
4. Lesse de, H. and Condamin, M. 1962. Formulas chromosomiques de quelques Lepidopteres Rhopaloceres du Senegal. *Bull. Inst. Frac. Afr. Noire, A.,* 24: 464-473.
5. Nayak, B. (1975). Studies on the male germinal chromosomes of thirty one species of moths and butterflies (Lepidoptera). *Prakruti-Utkal University Journal Science* 12 (1&2), 141-150.
6. Rao, N. N. and Murthy, A. S. (1976). Chromosome numbers in two species of Ergolis (Lepidoptera: Nymphalidae). *J. Res. Lepid.* 19(1), 23-26.
7. Rishi,S. (1973). Chromosome numbers of thirty species of Indian Lepidoptera. *Genen Phalnen* 16(3), 119-122.
8. Rishi, S. (1975). Chromosome studies in Indian Lepidoptera. *Nucleus* 18 (1&2), 65-70.
9. Rishi, S.and Rishi, K.K. 1977. Elongated chromosomes in *Pieris brassicae* L. (Lepidoptera Pieridae) after treatment with colchicine. *Experientia*, 33: 609-610.
10. Rishi, S. and Rishi, K.K. (1990). A chromosomal study of *Pieris brassicae* L. (Lepidoptera: Pieridae). *Cytobios* 64, 203-207.
11. Rishi, S., Sahni, G. and Rishi, K.K. (1997). Female heterogamety and localized centromeres in *Papilio demoleus* Lin.(Lepidoptera : Papilionidae). *Chromosome Sci.* 1, 109-113.
12. Saura, A., Schoultz, B.V., Saura, A.O. and Brown, K.S. (2013). Chromosome evolution in Neotropical butterflies.*Hereditas*,150 (2-3), 26-37.
13. White, M.J.D. (1973). Animal Cytology and Evolution, (3rd Ed.), Cambridge University Press

Captions for Figures

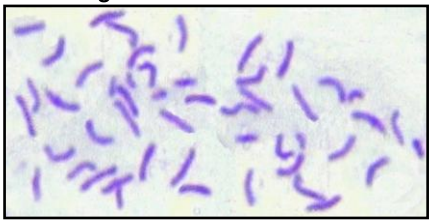

Fig.1: Somatic metaphase (*Pieris canidia indica* Sparr.- male)

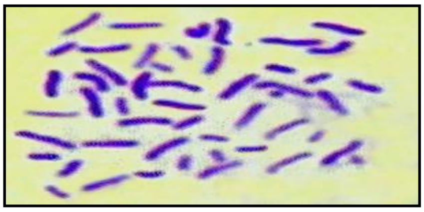

Fig.2 : Somatic metaphase (*Pieris canidia indica* Sparr.- female)

Fig.3:Zygotene

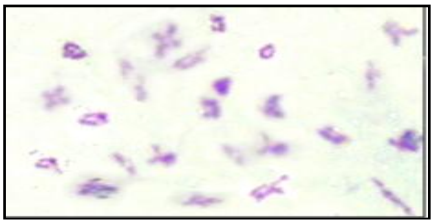

Fig.4 : Diakinesis

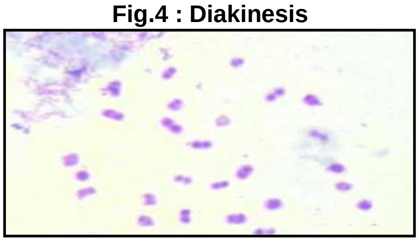

Fig.5:Metaphase-I

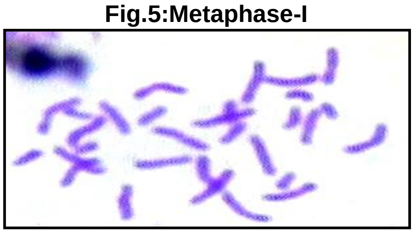

Fig.6: Somatic metaphase (*Pieris brassicae nepalensis* Linn.- male)

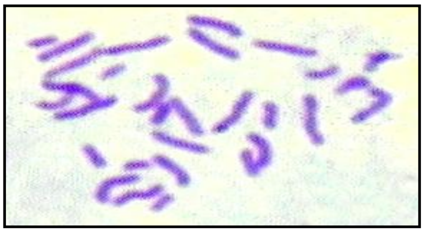

Fig.7 Somatic metaphase (*Pieris brassicae nepalensis* Linn.- female)

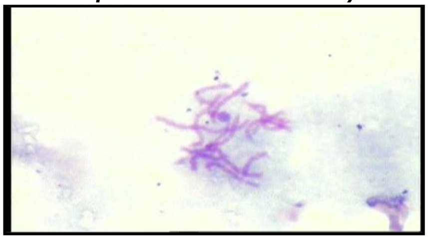

Fig.8 : Leptotene

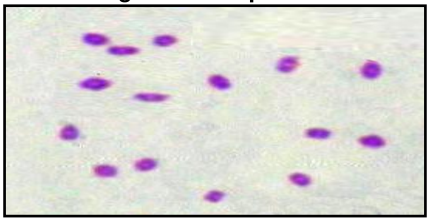

Fig.9 : Diakinesis

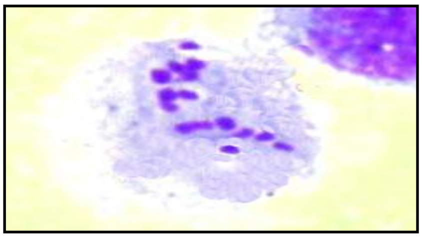

Fig.10 : Metaphase-I

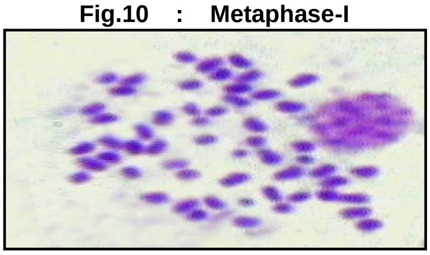

Fig.11 : Somatic metaphase (*Ixias pyrene* Linn.-male)

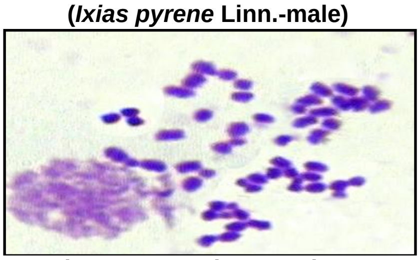

Fig.12 : Somatic metaphase (*Ixias pyrene* Linn.-female)

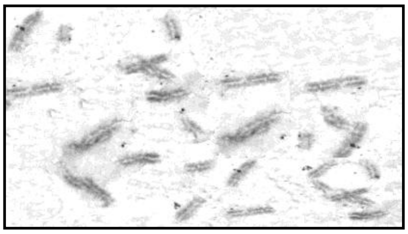

Fig.13 : Pachytene

Fig.14 : Late Diakinesis

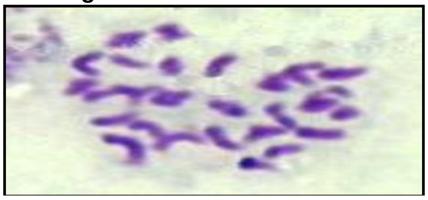

Fig.15 : Metaphase-I

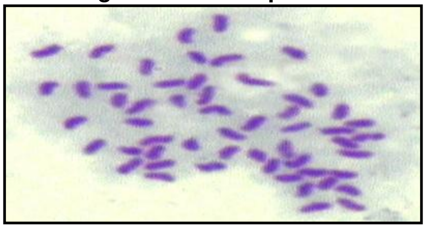

Fig.16 : Somatic metaphase (*Ixias marriane* Cramer-male)

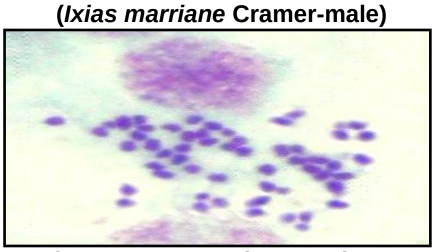

Fig.17 : Somatic metaphase (*Ixias marriane* Cramer-female)

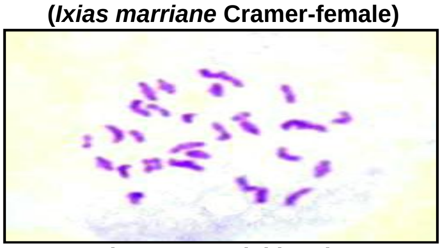

Fig.18 : Diakinesis

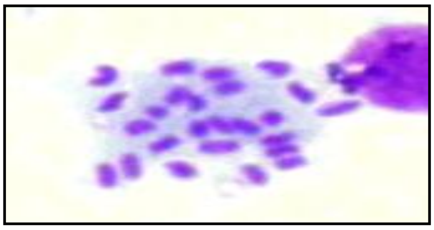

Fig.19 : Metaphase-I

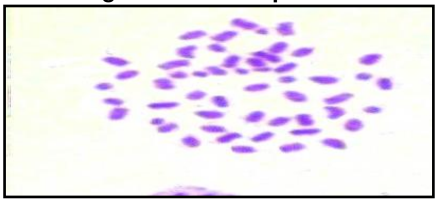

Fig.20 : Somatic metaphase (*Pontia daplidice* Linn.-male)

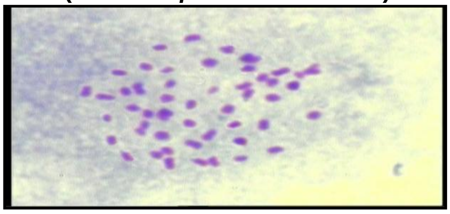

Fig.21 : Somatic metaphase (*Pontia daplidice* Linn.-female)

Fig.22 : Diplotene

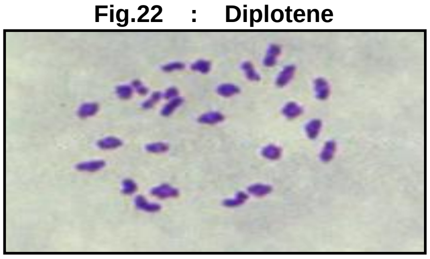

Fig.23 : Diakinesis

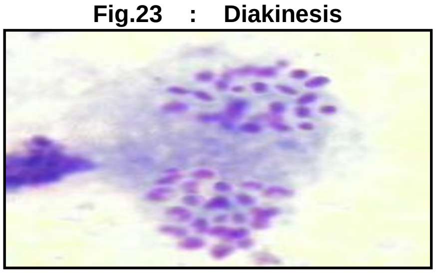

Fig.24 : Anaphase