ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

CYTOGENETIC STUDIES ON TWO SPECIES OF APHIDS FROM JAMMU AND KASHMIR (WESTERN HIMALAYAS), INDIA.

Sapana Jangral* and N.K.Tripathi.

Department of Zoology, University of Jammu, Jammu-180006.

Manuscript Info

Manuscript History:

Received: 14 December 2015
Final Accepted: 18 January 2016
Published Online: February 2016

Key words:
Acrythosiphon pisum ,
Rhopalosiphum padi, TCL%, RL%.

Corresponding Author

Sapana Jangral

Abstract

In the present investigation, the data regarding the diploid chromosomes number, karyotype and karyomorphometric analysis of two species of aphids i.e. *Acrythosiphon pisum* and *Rhopalosiphum padi*, were done from Jammu (J&K). The observed diploid chromosome number for both the species was 2n=8. The karyotype and histogram were prepared on the basis of chromosomal measurements. Thus their TCL% and RL% vary accordingly.

Introduction:-

Aphids are one of most variable insects having interesting and complicated life cycle. They are important from agriculture point of view because they serve as vectors for many crop diseases (Giannini et al., 2003). They always found in the colonies and suck the sap of new tender leaves, stems and buds. A great deal of work has been done on the diversity and identification of aphids, but as for as the cytogenetics of aphids are concerned there is a little work done because they possess holocentric chromosomes i.e. centromere is diffused throughout the whole axis of chromosomes and chromosomes are too small in size. Most of the studies are concerned with the mitotic studies of aphids as their sexuals are available for shorter period. The present study dealt with karyotypic study of two species of aphids i.e. Acrythosiphon pisum and Rhopaosiphum padi.

Material methods:-

Aphids were collected from their host plant i.e *Acrythosiphon pisum* from pea plant and *Rhopalosiphum padi* from wheat. The chromosome squash preparation were made from young embryos removed from live specimens. The embryonic tissue were given the Invitro hypotonic treatment of 0.8% sodium citrate for30- 35 minutes and then fixed in Carnoy's fixative for 10 – 15 minutes and further processed by staining procedure by 2% lactoaceto-orcein. Scanning and photomicrography of slides was done by using Nikon YS100 binocular research microscope and Samsung SDC-313 camera respectively. Well spread mitotic metaphase stages were photomicrographed at a magnification of 1000X. Histogram was prepared by taking chromosome pair number on X-axis and corresponding relative length percentage (RL %) on Y-axis.

Results:-

During the present study, chromosomes of two species of aphids infesting different plants have been studied.

***Acrythosiphon pisum*:-**

The aphids of this species were green in color and infested ventral and dorsal side of leaves, stems of pea plant. The diploid chromosome number of *A.pisum* was 2n=8 (Fig.1). About 50 metaphase stages were observed and in majority the diploid chromosome number was 8 confirming 2n=8. The photokaryotype (Fig. 2) was prepared from well spread somatic metaphase and karyo-morphometrical data showed that actual length of chromosome ranged

from 6.6 µm shortest chromosome to 15.0 µm in longest chromosome. The relative length percentage of chromosome ranged from 44.0% in shortest chromosome to 100% in longest chromosome. The total complement length percentage (TCL %) vary from 16.05% (smallest) to 36.49% (longest) (Table 1). Histogram (Fig. 3) was prepared on the basis of decreasing value of relative length percentage (RL %) from chromosome pair number one to four. The chromosome showed gradual decrease in length.

***Rhopalosiphum padi*:-**

The somatic metaphase plate (Fig. 4) of *R. padi* revealed the diploid chromosome number 2n=8.. All the elements appeared to be rod shaped, thick and condensed. The chromosomes were darkly stained and lack primary/secondary constriction. About 50 metaphase stages were observed and in majority the diploid chromosome number was 8 confirming 2n=8. The photokaryotype (Fig. 5) was prepared from somatic metaphase complement revealed 4 pairs of large to small-sized autosomes, showing gradation in size. Histogram (Fig. 6) was prepared on the basis of decreasing value of RL% from chromosome pair one to four. The karyo-morphometrical analysis (Table 2) of somatic metaphase complement showed the actual mean length of autosomes varies from 7.3µm to 16.1µm. The first autosomal pair was the largest in the complement with mean total length 16.1µm, TCL% of 36.02 and RL% of 100. The fourth autosomal pair is smallest in the complement with mean total length of 7.3µm, TCL% of 16.33 and RL% of 45.34 was observed.

Discussion:-

The chromosomal information on few species of the genus *Acrythosiphon* is available (Blackman, 1980; Sun and Robinson, 1966; Robinson and Chen, 1969). The species investigated in present studies, *Acrythosiphon pisum* was previously studied by Gautam and Dhatwalia (2003), Khuda-Bukhsh and Kar (1990), Kuznetsova and Shaposhnikov (1973), Blackman and Eastop (1984), reporting 2n=8. The present study of *A. pisum* with diploid count of 8 chromosomes is in conformity with earlier workers.

Altogether 9 species from the genus *Rhopalosiphum* have been studied in the past (Kuznetsova and Shaposhnikov, 1973; Gut, 1976; Behura and Bohidar, 1978; Kurl, 1978, 1985). The diploid numbers reported was 2n=8 for *R. cerasifoliae*, *R. maidis*, *R. nympheae*, *R. padi*, *R. prunifoliae*, *R. rufiabdominalis* and *R. rufulum*, 2n=10 for *R. ntchii*, 2n=16 for *R. nymphaeae* and 2n=6 for *R. pseudobrassicae*. Among these species chromosomal variation is reported in *R. maidis* (2n=8 and 7) by Blackman (1980) and in *R. nymphaeae* by Kurl (1985). During present investigation on *R. padi*, the diploid chromosome number was found to be eight. Same diploid chromosome number was reported by Kuznetsova and Shaposhnikov (1973), Kar et al. (1990), De Barro (1992).

Though the diploid chromosome number for both the species was 2n=8 but there is difference in their shape, morphology and as well as in their karyomorphometrical analysis. On this basis we can differentiate both the species from each other. But there is need for the banding and molecular technique to throw more light on genetics of aphids as well as for the meiotic studies.

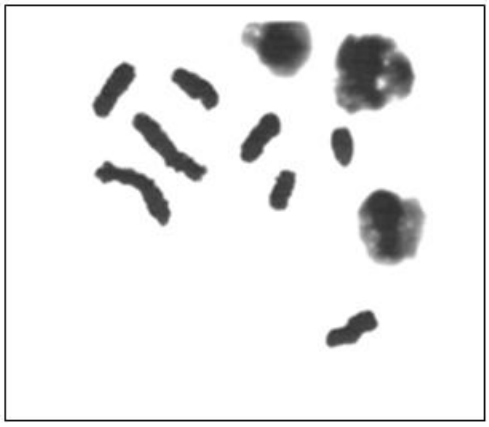

Fig. 1: Somatic metaphase complement of parthenogenetic female *Acrythosiphon pisum* showing 8 chromosomes.

Fig. 2: Karyotype of somatic metaphase complement of *A. pisum* (2n=8).

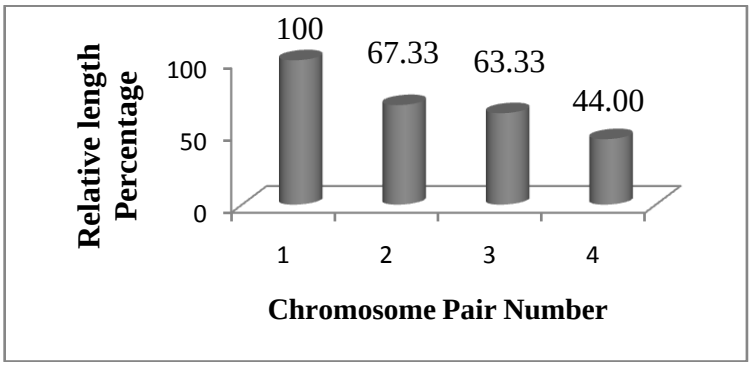

Fig. 3: Histogram of parthenogenetic female *Acrythosiphon pisum.*

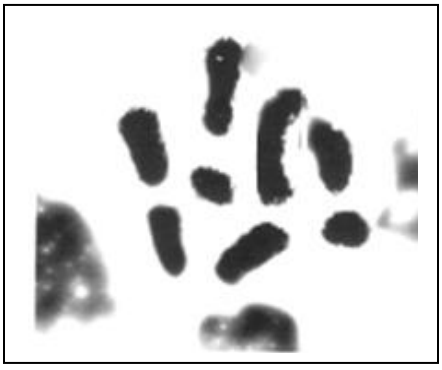

Fig. 4: Somatic metaphase of parthenogenetic female *Rhopalosiphum padi* showing 8 chromosomes.

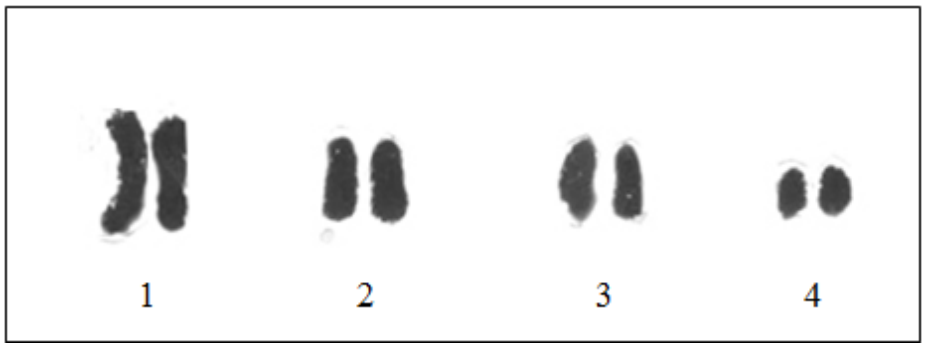

Fig. 5: Karyotype of somatic metaphase complement of *R. padi* (2n=8).

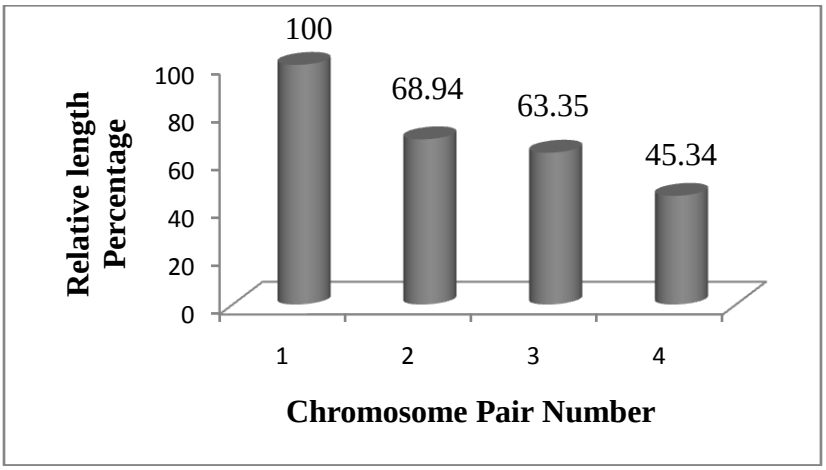

Fig. 6: Histogram of parthenogenetic female of *Rhopalosiphum padi.*

Table 1:- Morphometric data of karyotype of *Acrythosiphon pisum* (female-embryo) 2n=8.

Chromosome Pair Number	Mean Total Length (µm)	Total Complement Length Percentage (TCL %)	Relative Length Percentage (RL %)
1	15.0	36.49	100
2	10.1	24.57	67.33
3	9.5	23.11	63.33
4	6.6	16.05	44.00

Morphometric data of karyotype:-

Actual mean length of the largest chromosome (autosome) = 15.0µm
Actual mean length of the smallest chromosome (autosome) = 6.6µm
RL% of the largest chromosome = 100%
RL% of the smallest chromosome = 44.00%
Ratio of the largest chromosome to the smallest chromosome= 2.27
Total complement length of haploid set = 41.1µm

Table 2:- Morphometric data of karyotype of *Rhopalosiphum padi* (Parthenogenetic female- embryo) 2n=8.

Chromosome Pair Number	Mean Total Length (µm)	Total Complement Length Percentage (TCL %)	Relative Length Percentage (RL %)
1	16.1	36.02	100
2	11.1	24.83	68.94
3	10.2	22.82	63.35
4	7.3	16.33	45.34

Morphometric data of karyotype:-

Actual mean length of the largest chromosome (autosome) = 16.1µm
Actual mean length of the smallest chromosome (autosome) = 11.1µm
RL% of the largest chromosome = 100%
RL% of the smallest chromosome = 45.34%
Ratio of the largest chromosome to the smallest chromosome= 2.20
Total complement length of haploid set = 44.7µm

Acknowledgement:-
I am highly grateful to Prof. Roopma Gandotra, HOD Zoology, University of Jammu for providing the necessary lab facilities. Thanks are also due to Prof. D.C.Gautam, Himachal Pradesh University for their valuable suggestions. Finally, I would like to thank UGC-RGNF-JRF/SRF for providing the financial support.

References:-

1. Behura, B.K. and Bohidar, K. (1978): On the mitotic chromosomes of the lotus aphid, *Rhopalosiphum nymphaeae* (Linn.) (Homoptera: Aphididae). Proc. 65 Indian Sci. Congr., 3: 240.
2. Blackman, R.L. (1980): Insect Cytogenetics. Sym. Roy. Entomol. Soc., London, No. 10. (Eds. R. L. Blackman, G. M. Hewitt and D. Ashburner). pp. 133-148.
3. De Barro, P.J. (1992): Karyotypes of cereal aphids in South Australia with special reference to *Rhopalosiphum maidis* (fitch) (Hemiptera : Aphididae). J. Aust. Ento. Soc., 31**:** 333-334.
4. Gautam, D.C. and Dhatwalia, N. (2003): Karyotypes of twenty one species of aphids from Northwestern Himalayas. J Cytol Genet., 4:1–9.
5. Gut, J. (1976): Chromosome numbers of parthenogenetic females of fifty five species of Aphididae (Homoptera) new to cytology. Genetics, 46: 279-286.
6. Kar, I., Basu, G. and Khuda-Bukhsh, A. R. (1990): A check-list of chromosomes in aphids (Homoptera: Aphididae) worked out in India along with the names and families of their host plants. Environ. And Ecol., 8: 414-428.
7. Khuda-Buksh, A.R. and Kar, I. (1990): Karyotypic studies in twenty-seven species of aphids (Homoptera : Aphididae) from India. Caryologia , 55 : 231-241.
8. Kurl, S.P. (1978): Chromosome numbers of ten species of Indian aphids. Chrom. Inf. Serv., 5: 251-255.
9. Kurl, S.P. (1985): Variation in chromosome numbers and structural heterozygosity in 10 species of aphids (Homoptera: Aphididae) from Meghalaya. II National Symp. on RTAS Modinagar, 62: 42-43.
10. Kuznetsova, V.G. and Shaposhnikov, G.Kh. (1973): The chromosome numbers of the aphids (Homoptera: Aphidinea) of the world fauna. Entomol. Rev., 52: 78-96.
11. Sun, R. Y. and Robinson, A. G. (1966): Chromosome studies on fifty species of aphids. Can. J. Zool., 44: 649-658.
12. Robinson, A.G. and Chen, Y.H. (1969): Cytotaxonomy of Aphididae. Canadian Journal of Zoology. 47: 511-516.
13. Blackman, R.L. and Eastop, V.F. (1984): Aphids on the World's crops: an identification and information guide.chichester: Wiley.
14. Giannini, S., Bizzaro, D., Mandrioli, M. And Manicardi, G.C. (2003): Cytogenetic analysis on the holocentric chromosomes of the cabbage aphid *Brevicoryne brassicae*.Caryologia, 56(2): 143-147.