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Original Research Article

Karyotypic Studies on Four Aphid Species of Some Common Plant from Kangra, Himachal Pradesh

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ABSTRACT:
The present study reveals the chromosome of 4 aphids species found on four common plants with medicinal properties. These aphids species are, *Macrosiphum euphorbiae* (Thomas) with diploid chromosome numbers 2n = 10 infesting on *Malva parviflora*, *Myzus ornatus* Liang having diploid chromosome numbers 2n = 12 infesting *Ajuga bracteosa, M. ascalonicus* Doncaster with chromosome numbers 2n = 12, on host plant *Dahlia pinnata* and *Toxoptera odinae* (van der Goot) with diploid chromosome numbers 2n = 8 infesting *Duranta erecta.* The actual lengths, relative lengths as well as Total complement length of the chromosome were measured at metaphase. Karyotypes were prepared and Idiograms were constructed based on relative lengths data.

Keywords: Chromosomes, Aphids, Total complement lengths, Karyotypes, Idiograms.

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INTRODUCTION

Aphids constitute an important group of insects belonging to the order Hemiptera. These insect pests cause great damage to various agricultural and horticultural crops by sucking the plant sap and by transmitting various plant virus diseases (Kennedy et al., 1962). This group contains approximately 5000 species described worldwide in about 510 genera infesting about 300 plant families (Blackman & Eastop, 2000; Favret, 2015; Gavrilov-Zimin et al., 2015). Aphidoidea that includes Aphididae, Phylloxeridae and

Adelgidae mainly occur in the temperate regions of the Northern Hemisphere (Blackman & Eastop, 2000; Favret, 2015).

Aphids have several peculiar phenomena in their life cycles such as polymorphism, viviparity, telescoping of generation, host alternation and holocentric chromosomes. Due to the holocentric nature of chromosomes, karyotypic variations occur frequently in aphids as a result of fusion (Steffan, 1968) or fragmentation (Kuznetsova, 1968).

Kangra is the second largest district area wise after Lahaul Spiti, weather of this district is quite favourable for the growth of diverse type of vegetation. A large number of aphid pests have been infesting twigs, leaves and inflorescence of different host plants and deteriorating their medicinal value. Very little information available on aphids and their chromosomes from this area. The present study will help in understanding the host-aphid association to each other. Keeping this in view, it is desirable to investigate the chromosome number in these species.

MATERIAL AND METHODS

Apterous, parthenogenetic, viviparous female aphids were collected from different localities, as shown in Table1. For the identification of aphids key developed by Blackman and Eastop (1984) was used. For chromosome study, somatic embryonic tissues of parthenogenetic females were used. They were dissected by puncturing the posterior end of the abdomen and pretreated with 0.7% tri sodium citrate solution for 25–30 min. These embryos were fixed in 1:3 acetic-ethanol solutions for 15–20 min. Chromosome slides and cover slips were stained in 2% Giemsa for 20–30 min. Slides were made permanent by dipping in xylene and mounting in DPX.

Table 1: Species of aphid along with their host plant, Collecting site and no. of chromosomes.

Sr. No.	Aphid species	Host Plants	Collecting Site	No. of Chromosomes (2n)
1.	*Macrosiphum euphorbiae*	*Malva parviflora*	Matour, Kangra	2n=10
2.	*Myzus ornatus*	*Ajuga bracteosa*	Ansoli, Kangra	2n=12
3.	*Myzus ascalonicus*	*Dahlia pinnata*	Ansoli, Kangra	2n=12
4.	*Toxoptera odinae*	*Duranta erecta*	Ichhi, Kangra	2n=8

The slides were observed under a binocular microscope and photomicrographs were taken. The actual lengths, total complement lengths and relative lengths of chromosomes were calculated. The idiograms for each species were constructed based on relative lengths data.

RESULTS

In the present investigation chromosome of four species of *Aphis* have been studied namely *Macrosiphum euphorbiae* (Thomas), *Myzus ascalonicus Doncaster, Myzus ornatus Laing,* and *Toxoptera odinae (van der Goot).*

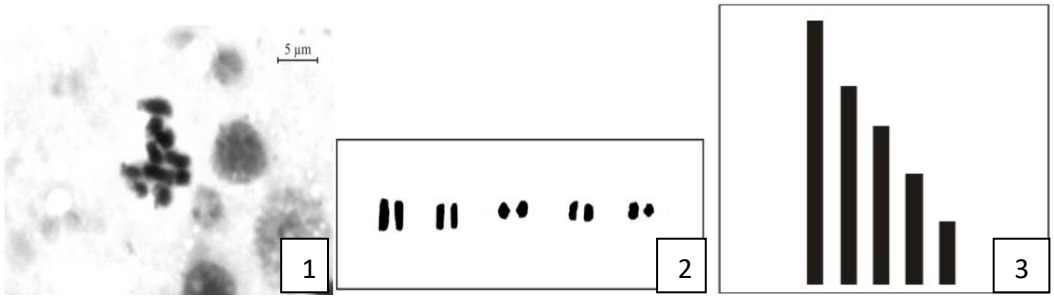
Table 2: Actual and relative lengths of somatic metaphase plates of different aphid species

S. N.	Name of the Aphid species along with host plants	Chromosome numbers													Total complement length
1	*Macrosiphum euphorbiae* (Host plant) *Malva parviflora*	A.L. (µm) ± S.E.	3.79 ± 0.29	3.79 ± 0.29	2.86 ± 0.21	2.86 ± 0.21	2.27 ± 0.14	2.27 ± 0.14	1.63 ± 0.20	1.63 ± 0.20	0.94 ± 0.14	0.94 ± 0.14			23.05 ± 0.82
		R.L. ± S.E.	16.57 ± 0.52	16.57 ± 0.52	12.86 ± 0.21	12.86 ± 0.21	9.96 ± 0.25	9.96 ± 0.25	6.98 ± 0.55	6.98 ± 0.55	3.97 ± 0.36	3.97 ± 0.36			

2	*Myzus ascalonicus* (Host plant) *Dahlia pinata*	A.L. (µm) ± S.E.	3.46 ± 0.08	3.46 ± 0.08	3.22 ± 0.04	3.22 ± 0.04	2.62 ± 0.12	2.62 ± 0.12	2.28 ± 0.08	2.28 ± 0.08	1.71 ± 0.08	1.71 ± 0.08	1.47 ± 0.07	1.47 ± 0.07	29.54 ± 0.66
		R.L. ± S.E.	11.76 ± 0.14	11.76 ± 0.14	10.94 ± 0.10	10.94 ± 0.10	8.87 ± 0.23	8.87 ± 0.23	7.73 ± 0.25	7.73 ± 0.25	5.79 ± 0.17	5.79 ± 0.17	4.88 ± 0.21	4.88 ± 0.21	
3	*Myzus ornatus* (Host plant) *Malva parviflora*	A.L. (µm) ± S.E.	3.89 ± 0.04	3.89 ± 0.04	3.36 ± 0.08	3.36 ± 0.08	2.97 ± 0.09	2.97 ± 0.09	2.40 ± 0.13	2.40 ± 0.13	1.65 ± 0.04	1.65 ± 0.04	1.57 ± 0.06	1.57 ± 0.06	32.18 ± 0.70
		R.L. ± S.E.	12.14 ± 0.24	12.14 ± 0.24	10.47 ± 0.17	10.47 ± 0.17	9.27 ± 0.22	9.27 ± 0.22	7.43 ± 0.27	7.43 ± 0.27	5.76 ± 0.08	5.76 ± 0.08	4.89 ± 0.09	4.89 ± 0.09	
4	*Toxoptera odinae* Vander Goot (Host plant) *Duranta erecta*	A.L. (µm) ± S.E.	2.87 ± 0.08	2.87 ± 0.08	2.62 ± 0.07	2.62 ± 0.07	2.13 ± 0.06	2.13 ± 0.06	1.82 ± 0.04	1.82 ± 0.04					18.90 ± 0.30
		R.L. ± S.E.	15.16 ± 0.25	15.16 ± 0.25	13.87 ± 0.25	13.87 ± 0.25	11.30 ± 0.28	11.30 ± 0.28	9.64 ± 0.24	9.64 ± 0.24					

Macrosiphum euphorbiae (Thomas)

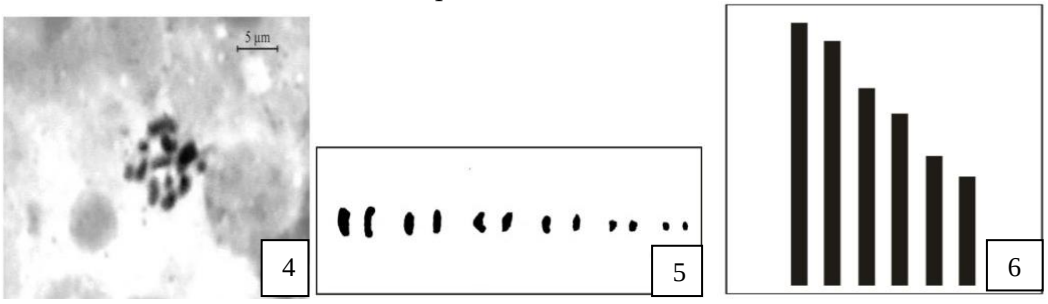
The diploid chromosome number of this species has ten (2n = 10) (Figs. 1, 2). The actual length of chromosomes ranged from 0.94 µm ± 0.14 to 3.79 µm ± 0.29. The total complement length was 23.05 µm ± 0.82. The relative length of chromosomes ranged from 3.97 ± 0.36 to 16.57 ± 0.52. The idiogram of this species showed a pair of long, a pair of medium size and three pairs of gradually decreasing short chromosomes (Fig. 3).



Figures 1-3: *Macrosiphum euphorbiae*. 1. Somatic chromosomes. 2. Karyotype. 3. Idiogram. (Scale = 5 µm)

***Myzus ascalonicus* Doncaster**

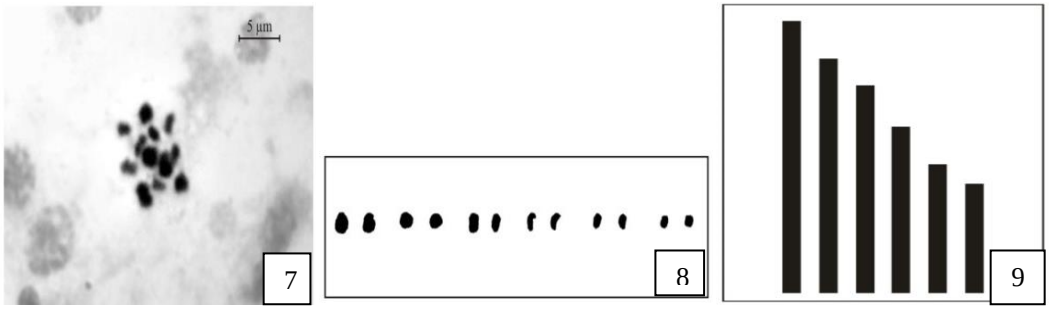
These aphids of this species have a diploid chromosome number of twelve (2n = 12) (Figs. 4, 5). In these aphids, the actual length of chromosomes ranged from 1.47 µm ± 0.07 to 3.46 µm ± 0.08. The total complement length was 29.54 µm ± 0.66. The relative length of chromosomes ranged from 4.88 ± 0.21 to 11.76 ± 0.14. The idiogram of this species showed a gradual decrease in chromosomes length (Fig. 6).



Figures 4-6: *Myzus ascalonicus*. 4. Somatic chromosomes. 5. Karyotype. 6. Idiogram. (Scale = 5 µm)

***Myzus ornatus* Laing**

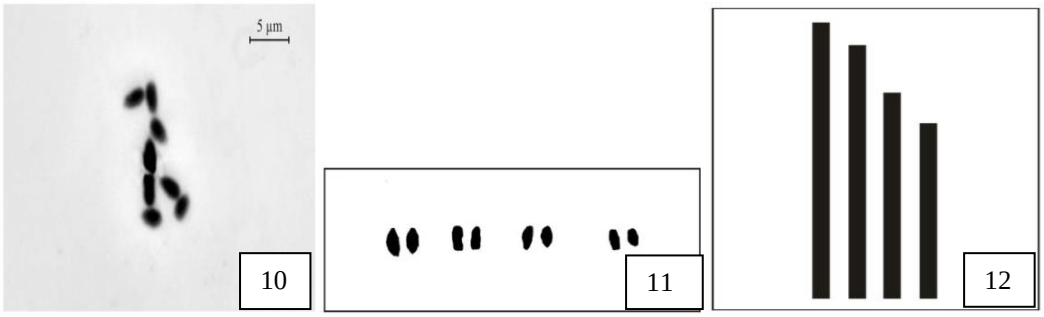
These aphids of this spices have a diploid chromosome number of twelve (2n = 12) (Figs. 7, 8). The actual length of chromosomes ranged from 1.57µm ± 0.06 in the shortest chromosome to 3.89 µm ± 0.04. The total complement length was 32.18 µm ± 0.70. The relative length of chromosomes ranged from 4.89 ± 0.09 to 12.14 ± 0.24. The idiogram of this species showed a gradual decrease in chromosomes length (Fig. 9).



Figures 7-9: *Myzus ornatus*. 7. Somatic chromosomes. 8. Karyotype. 9. Idiogram. (Scale = 5 µm)

***Toxoptera odinae* (van der Goot)**

This species has a diploid chromosome number of eight (2n = 8) (Figs. 10, 11). The actual length of chromosomes ranged from 1.82 µm ± 0.04 to 2.87 µm ± 0.08. The total complement length was 18.90 µm ± 0.30. The relative length of chromosomes ranged from 9.64 ± 0.24 to 15.16 ± 0.25. The idiogram of this species showed a gradual decrease in chromosomes length (Fig. 12).



Figures 10-12: *Toxoptera odinae*. 10. Somatic chromosomes. 11. Karyotype. 12. Idiogram. (Scale = 5 µm)

DISCUSSION

In the present investigations, karyotypes of four species of aphids have been studied. The most common diploid chromosome number observed is 12. Genus *Macrosiphum* belonging to tribe Macrosiphini includes 120 species. *Macrosiphum* is a polyphagous species of North American origin that feeds on up to 200 plant species belonging to 20 different families (Le Roux et al, 2010). In the present study, *M. euphorbiae* was collected from *Malva parviflora* revealed the diploid chromosome number as 2n = 10. Earlier, the same chromosome number reported by Anupriya and Gautam (2017) was collected from *Cucurbita pepo* and *Solanum tuberosum*. In genus *Myzus*, the diploid chromosome number varies from 8 to 20 in different species. Genus *Myzus* comprises about 55 species. Here, two species of *Myzus* has been investigated, *M. ascalonicus* collected from *Dahlia pinnata* with diploid chromosome number 2n=12 and *M. ornatus* collected from *Ajuga bracteosa* with diploid chromosome number 2n = 12. *Myzus ascalonicus* is

extremely polyphagous with hosts in more than 20 families, but particularly Alliaceae, Caryophyllaceae, Compositae, Brassicaceae, Liliaceae and Rosaceae (Blackman & Eastop, 2000). Genus *Toxoptera* is an important vector of viruses of economically important plants (Blackman & Eastop, 2000). In *Toxoptera odinae* the diploid chromosome number was reported 2n = 8, earlier Kurl (1980) reported the same diploid chromosome number as (2n = 8) in *T. odinae* but from a different host plant.

CONCLUSION

It has been concluded that karyotypes of four species of aphids have common diploid chromosome number (2n=12). Many aphid species have variations in their chromosome numbers due to the presence of holocentric chromosomes as seen in the *Myzus* genus whose chromosome numbers vary 8-20 and here chromosome number reported 2n = 12. This study helps solve the taxonomic problem as many aphids look similar morphologically. So this is also useful in certain evolutionary assumptions.

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CONFLICT OF INTEREST

Authors have no conflict of interest.

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