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Screening of Chrysanthemum Cultivars for their Tolerance against Sucking Pests in Terai Region of West Bengal, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Chrysanthemum (*Chrysanthemum morifolium* Ramat.) is an important commercial flowering crop. This plant is often invaded by sucking pests like aphids, mealybugs and mites causing severe damage to the quality and quantity of flower yield. Searching for tolerant cultivars against these pests constitutes one of the most cost-effective pest management strategies. An experiment was

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conducted at Uttar Banga Krishi Viswavidyalaya, Pundibari, India to find out the reaction of forty different genotypes of spray chrysanthemum to aphids, mealybugs and mites. The results indicated that the genotypes exhibited significant variations in harbouring number of all the three sucking pests and the per cent plant infestation by aphids and mealybugs also varied significantly. The variation in pest infestation may be attributable to the genetic traits of these chrysanthemum cultivars. Out of all the genotypes tested the varieties Yellow Baby, Arka Kirti and Arka Yellow Gold were found to be the most tolerant against all the sucking pests and therefore, may be recommended for cultivation in the Terai agroclimatic region of West Bengal.

Keywords: Chrysanthemum; genotypes; tolerance; aphid; mealybug; mite.

1. INTRODUCTION

Chrysanthemum (*Chrysanthemum morifolium* Ramat.) is one of the most beautiful flowering plants glorified as Queen of East (Anderson, 2006). It is also known as 'Autumn Queen', or '*Guldaudi'* in hindi and it is the "National Flower of Japan" and an "Imperial Symbol of Japan," and it has a regal ancestry. Chrysanthemum is an important flower crop both in international and domestic market due to the wide variation in its colour, form and size as well as its long vase life (Bhattacharjee and De, 2013). Aphids, mealybugs and mites are the most devastating pests in chrysanthemum-producing locations (Khan, 2021). At the time of blossoming, either direct sap-sucking or indirect sooty mold development results in severe harm. When a crop is introduced as a new commercial crop to an area, it is important to inspect the pests that may attack it, since crop-pest behaviour differs from place to place. The best strategy to tackle the pest and lessen its resistance to other management techniques is to screen genotypes for tolerance to sucking pests. Earlier, the works on varietal resistance to aphid on chrysanthemum have been studied by several workers (Bethke et al., 2003, Wyatt, 1969). The optimum management techniques can be determined by looking at the interactions between crops and pests in relation to the growing environment in the Terai Region's productive production pockets. Identification of sucking pest tolerant cultivars is a cost effective and eco-friendly approach for cultivating this crop in this region. Hence, the present investigation aimed at screening the genotypes for their tolerance to different sucking pests.

2. METHODOLOGY

2.1 Experimental Site

The experiment was carried out in the Instructional farm of the Department of Floriculture, Medicinal and Aromatic Plants at the Faculty of Horticulture, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar. The location is at 26^0 19' N latitude and 89^0 23' E longitude in the Terai Region of West Bengal. The location is 43 metres above mean sea level in the (MSL) sub-Himalayan plains.

2.2 Experimental Materials

Table 1. Forty different genotypes of spray chrysanthemum were evaluated for their tolerance against sucking pests which are listed below

Sl. No.	Notation	Treatments	Sl. No.	Notation	Treatments
1	V_1	Local yellow	21	V_{21}	NBRI Little Kusum
2	V_2	Local Yellow- 2	22	V_{22}	Sweta Singar
3	V_3	Heritage	23	V_{23}	Vijay Kiran
4	V_4	Shukla	24	V_{24}	White Dolley
5	V_5	Anmol	25	V_{25}	Winter Queen
6	V_6	Doddabelegere	26	V_{26}	Marigold
7	V_7	Doddabelegere-1	27	V_{27}	BCC-4
8	V_8	Arka Kirti	28	V_{28}	Arka Yellow Gold
9	V_9	Arka Chandrakath	29	V_{29}	BCC-24
10	V_{10}	Bidhan Antara	30	V_{30}	Punjab Gold
11	V_{11}	Nanako Yellow	31	V_{31}	Arka Chandrika
12	V_{12}	Nanako White	32	V_{32}	BCC-38
13	V_{13}	White Anemone	33	V_{33}	BCC-79

Sl. No.	Notation	Treatments	Sl. No.	Notation	Treatments
14	V_{14}	White Prolific	34	V_{34}	Arka Usha Kiran
15	V_{15}	Yellow Baby	35	V_{35}	Arka Pink Star
16	V_{16}	Aparajita	36	V_{36}	Rekha
17	V_{17}	Basanti	37	V_{37}	Coffee
18	V_{18}	Flirt	38	V_{38}	Autumn Joy
19	V_{19}	Geetanjali	39	V_{39}	Vasanthika
20	V_{20}	Jaya	40	V_{40}	BCC-29

2.3 Experimental Layout

Ten plants of each genotype were planted for every replication in UV sterilized black polythene bags of 8-inch diameter to resemble pot culture. Garden soil and Farm Yard Manure (FYM) that had been coarsely sieved were thoroughly combined in a 1:1 ratio to produce the medium and 5 g DAP (Di-amino phosphate) per plant was added to the medium 15 days before planting. No plant protection chemicals were used for restricting pest attacks.

2.4 Statistical Analysis

The experiment was laid out in a completely randomized design and replicated twice. Collected data was analyzed with the help of SPSS (Statistical package for social sciences) software and critical difference (CD) values at 5% level of significance were calculated for comparing the means.

2.5 Observations Recorded

Aphid tolerance: Aphid tolerance of the different germplasms was judged on the basis of the population of aphids and per cent plant infestation measures.

Number of aphids per 10 cm of apical shoot: The populations of aphids were recorded from 10 plants by taking population counts from 10 cm of apical twig region of each plant.

Per cent plant infestation of aphids: Per cent plant infestation of each germplasm was measured by using the formula:

$$\text{Per cent plant Infestation} = \frac{Number\ of\ infested\ plants}{Total\ number\ of\ plants} \times 100$$

Mealybug tolerance: Mealybug tolerance of different germplasm was measured on the basis of population per leaf and percent plant infestation-derived values.

Number of mealybugs per leaf: The population of mealybugs were recorded from 10 plants. The populations of mealybugs were counted from three leaves selected at random from the top, middle and lower strata of the plant canopy.

Per cent plant infestation of mealy bugs: Per cent plant infestation of each germplasm was measured by using the formula:

$$\text{Per cent plant Infestation} = \frac{Number\ of\ infested\ plants}{Total\ number\ of\ plants} \times 100$$

Mite tolerance: Red spider mite tolerance was measured on the basis of population of mites.

Number of mature and immature stages of Red Spider mites per centimetre square leaf area: The population was recorded from 10 plants. The populations of mites were visually counted from 3 leaves selected at random from the top, middle and lower strata of the plant canopy.

3. RESULTS

3.1 Number of Aphids per 10 cm of Apical Shoot

Aphids are sucking insects that have a tendency to infest apical meristems or growth regions. Insect-resistant cultivars provide a significant cost-effective return on economic investment. The results revealed that BCC-24 (V_{29}) recorded the maximum number of aphids per 10 cm of apical shoot of 111.62 in the first year (2018-19) followed by BCC-4 and BCC-38 (107.83 and 105.28 respectively) while in the second year BCC-4 (V_{27}) recorded the maximum number of aphids per 10 cm of the apical shoot (102.83) followed by Aparajita (102.25) (Table1). The minimum number of aphids per 10 cm of the apical shoot (3.25 and 2.58) was observed in Yellow Baby (V_{15}) in the first and second year respectively.

Table 2. Number of aphids per 10 cm of apical shoot and per cent plant infestation by aphids of different spray chrysanthemum cultivars in the Terai region of West Bengal

Genotype	Aphid			
	Number per 10 cm of apical twigs per plant (No./apical twig/plant)		Per cent plant infestation (%)	
	2018-19	2019-20	2018-19	2019-20
Local Yellow	30.58 (5.62)*	26.00 (5.20)	66.66 (54.71)**	58.33 (49.85)
Local Yellow- 2	69.42 (8.39)	87.25 (9.39)	75.00 (60.29)	99.96 (88.82)
Heritage	32.00 (5.73)	24.83 (5.08)	66.66 (55.43)	50.00 (44.98)
Shukla	18.92 (4.46)	4.33 (2.31)	66.66 (54.71)	16.66 (24.08)
Anmol	15.17 (4.01)	11.75 (3.50)	41.67 (40.12)	25.00 (29.66)
Doddabelegere	11.08 (3.47)	13.25 (3.74)	50.00 (44.98)	66.66 (54.71)
Doddabelegere-1	26.75 (5.27)	12.67 (3.70)	66.66 (54.71)	33.33 (35.25)
Arka Kirti	6.58 (2.74)	14.75 (3.97)	41.67 (40.12)	58.33 (49.85)
Arka Chandrakath	10.25 (3.35)	11.00 (3.46)	66.66 (54.71)	33.33 (35.25)
Bidhan Antara	45.92 (6.83)	26.17 (5.21)	75.00 (60.29)	58.33 (49.85)
Nanako Yellow	93.42 (9.71)	85.25 (9.29)	91.65 (77.35)	99.96 (88.82)
Nanako White	38.67 (6.30)	24.75 (5.05)	83.33 (65.88)	66.67 (55.43)
White Anemone	55.58 (7.52)	42.92 (6.63)	91.65 (77.35)	75.00 (60.29)
White Prolific	97.08 (9.90)	77.17 (8.83)	91.65 (77.35)	83.33 (65.88)
Yellow Baby	3.25 (2.05)	2.58 (1.89)	25.00 (29.66)	16.66 (24.08)
Aparajita	82.08 (9.05)	102.25 (10.16)	91.65 (77.35)	99.96 (88.82)
Basanti	90.25 (9.55)	89.25 (9.49)	91.65 (77.35)	83.31 (71.76)
Flirt	29.50 (5.52)	27.08 (5.28)	83.33 (65.88)	75.00 (60.29)
Geetanjali	28.92 (5.47)	25.58 (5.16)	75.00 (60.29)	66.66 (54.71)
Jaya	25.83 (5.18)	22.42 (4.84)	75.00 (60.29)	66.66 (54.71)
NBRI Little Kusum	54.92 (7.48)	69.75 (8.41)	75.00 (60.29)	83.33 (65.88)
Sweta Singar	10.00 (3.31)	9.25 (3.15)	33.33 (35.25)	25.00 (29.66)
Vijay Kiran	55.67 (7.53)	41.08 (6.49)	91.65 (77.35)	83.33 (65.88)
White Dolley	21.17 (4.70)	28.33 (5.42)	50.00 (44.98)	66.67 (55.43)
Winter Queen	19.08 (4.47)	20.75 (4.66)	50.00 (44.98)	50.00 (44.98)
Marigold	13.33 (3.76)	13.83 (3.85)	66.66 (54.71)	50.00 (44.98)
BCC-4	107.83 (10.43)	102.83 (10.19)	99.96 (88.82)	99.96 (88.82)
Arka Yellow Gold	7.67 (2.92)	10.50 (3.39)	33.33 (35.25)	33.33 (35.25)
BCC-24	111.67 (10.61)	94.00 (9.74)	99.98 (89.41)	99.96 (88.82)
Punjab Gold	17.08 (4.22)	8.92 (3.15)	41.67 (40.12)	33.33 (35.25)
Arka Chandrika	16.58 (4.19)	12.42 (3.66)	50.00 (44.98)	33.33 (35.25)
BCC-38	105.28 (10.30)	85.25 (9.28)	99.96 (88.82)	99.96 (88.82)
BCC-79	89.42 (9.46)	93.08 (9.70)	99.96 (88.82)	99.96 (88.82)
Arka Usha Kiran	19.92 (4.57)	8.75 (3.08)	41.67 (40.12)	25.00 (29.66)
Arka Pink Star	15.67 (4.04)	8.75 (3.11)	50.00 (44.98)	41.67 (40.12)
Rekha	46.08 (6.86)	36.33 (6.10)	83.33 (65.88)	75.00 (60.29)
Coffee	21.67 (4.76)	26.75 (5.23)	50.00 (44.98)	41.67 (40.12)
Autumn Joy	22.00 (4.80)	22.33 (4.83)	50.00 (44.98)	50.00 (44.98)
Vasanthika	47.92 (6.99)	40.33 (6.43)	83.33 (49.85)	50.00 (44.98)
BCC-29	21.75 (4.70)	11.67 (3.55)	41.67 (40.12)	33.33 (35.25)
SE (m)±	**0.36**	**0.29**	**5.54**	**4.51**
CD at 5 %	**1.04**	**0.83**	**15.90**	**12.95**

**Square root transformed values √(x+1)*
***Angular transformed values*

3.2 Per Cent Plant Infestation by Aphids

Among the forty genotypes the maximum percentage of plant infestation by aphids of 99.98% was observed in BCC-24 (V_{29}) followed by BCC-4 (V_{27}), BCC-38 (V_{32}) and BCC-79 (V_{33}) in the first year. A similar trend was observed in the second year also while minimum per cent infestation of aphids (25.00% and 16.66%) was observed in Yellow Baby (V_{15}) in first year and second year, respectively followed by Arka Kirti (Table 1).

3.3 Number of Mealybugs Per Leaf

NBRI Little Kusum (V_{21}) recorded the maximum number of mealybugs per leaf of 15.33 in the first

year (2018-19) while BCC-79 (V_{26}) recorded the maximum number of mealybugs per leaf of 13.00 in the second year (2019-20). The minimum number of mealybugs per leaf of 0.00 was observed in BCC-29, Arka Yellow Gold, BCC-4, Winter Queen, White Dolley, Sweta Singar, Jaya, Geetanjali, Yellow Baby, White Anemone, Arka Chandrakath, Arka Kirti, Doddabelegere, Anmol, Heritage, Arka Usha Kiran, Arka Pink Star, Coffee, Autumn Joy, Arka Chandrika in both the years (Table 2).

Table 3. Number of mealybugs per leaf, per cent plant infestation by mealybugs and number of red spider mites per leaf of different spray chrysanthemum cultivars in the Terai region of West Bengal

Genotype	Mealybug				Red Spider Mite	
	Number per leaf (No./leaf)		Per cent plant infestation (%)		Number per leaf (No./leaf)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Local Yellow	8.83 (3.13)*	11.75 (3.56)	41.50 (40.02)**	50.00 (44.98)	0.00 (1.00)*	0.00 (1.00)
Local Yellow- 2	0.00 (1.00)	8.33 (3.04)	0.00 (0.00)	33.33 (35.25)	2.50 (1.87)	0.00 (1.00)
Heritage	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Shukla	1.25 (1.44)	4.58 (2.33)	8.33 (12.04)	33.33 (35.25)	0.00 (1.00)	0.00 (1.00)
Anmol	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	3.67 (1.94)
Doddabelegere	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Doddabelegere-1	8.00 (2.99)	8.50 (3.08)	41.67 (40.12)	33.33 (35.25)	1.08 (1.39)	0.00 (1.00)
Arka Kirti	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Arka Chandrakath	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Bidhan Antara	8.83(3.13)	0.00 (1.00)	33.33 (35.25)	0.00 (0.00)	7.75 (2.95)	5.42 (2.49)
Nanako Yellow	8.25 (3.02)	8.25 (3.01)	41.67 (40.12)	41.67 (40.12)	3.00 (1.82)	0.00 (1.00)
Nanako White	9.42 (3.19)	7.67 (2.87)	41.67 (40.12)	25.00 (29.66)	2.50 (1.85)	0.75 (1.29)
White Anemone	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	4.58 (2.30)
White Prolific	8.50 (3.06)	9.50 (3.22)	41.67 (40.12)	41.67 (40.12)	3.42 (2.10)	2.08 (1.64)
Yellow Baby	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Aparajita	2.75 (1.78)	10.50 (3.39)	16.67 (17.62)	50.00 (44.98)	4.67 (2.38)	6.08 (2.66)
Basanti	0.00 (1.00)	6.50 (2.70)	0.00 (0.00)	25.00 (29.66)	1.17 (1.41)	2.33 (1.69)
Flirt	8.75 (3.12)	9.67 (3.27)	33.33 (35.25)	33.33 (35.25)	1.08 (1.39)	4.08 (2.25)
Geetanjali	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	2.17 (1.65)	0.00 (1.00)
Jaya	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	1.58 (1.52)
NBRI Little Kusum	15.33 (4.02)	4.42 (2.07)	41.67 (40.12)	16.67 (17.62)	0.00 (1.00)	2.75 (1.78)
Sweta Singar	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Vijay Kiran	6.58 (2.64)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	6.17 (2.64)	1.33 (1.46)
White Dolley	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Winter Queen	0.00 (1.00)	0.00 (1.00)	25.00 (29.66)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Marigold	13.25 (3.77)	9.50 (3.22)	41.67 (40.12)	41.67 (40.12)	3.67 (1.94)	0.00 (1.00)
BCC-4	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	3.33 (2.06)	2.33 (1.69)
Arka Yellow Gold	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
BCC-24	6.17 (2.67)	0.00 (1.00)	33.33 (35.25)	0.00 (0.00)	3.92 (2.18)	0.92 (1.34)
Punjab Gold	0.00 (1.00)	6.58 (2.75)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Arka Chandrika	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
BCC-38	8.92 (3.09)	6.33 (2.69)	33.33 (40.12)	16.67 (17.62)	3.33 (2.06)	0.00 (1.00)
BCC-79	7.75 (2.92)	13.00 (3.71)	33.33 (35.25)	8.33 (12.04)	0.00(1.00)	2.75 (1.92)
Arka Usha Kiran	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Arka Pink Star	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Rekha	6.75 (2.78)	9.17 (3.16)	33.33 (35.25)	41.67 (40.12)	0.00 (1.00)	0.00 (1.00)
Coffee	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	1.75 (1.56)	0.00 (1.00)
Autumn Joy	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
Vasanthika	8.33 (3.03)	11.33 (3.50)	33.33 (34.53)	41.67 (40.12)	0.00 (1.00)	0.00 (1.00)
BCC-29	0.00 (1.00)	0.00 (1.00)	0.00 (0.00)	0.00 (0.00)	0.00 (1.00)	0.00 (1.00)
SE (m)±	**0.27**	**0.29**	**4.43**	**4.87**	**0.29**	**0.32**
CD at 5 %	**0.79**	**0.82**	**12.72**	**13.96**	**0.84**	**0.92**

**Square root transformed values √(x+1)*
***Angular transformed values*

3.4 Per Cent Plant Infestation by Mealybugs

Among the forty genotypes the maximum percentage of plant infestation by mealybugs of 41.67% (40.12) was observed in Marigold (V_{26}), Nanako Yellow (V_{11}), Nanako White (V_{12}), White Prolific (V_{14}), NBRI Little Kusum (V_{21}), Doddabelegere-1 (V_7) in the first year followed by Local Yellow. In the second year Aparajita (V_{16}) and Local Yellow (V_1) recorded the maximum percentage of plant infestation by mealybugs 50.00% (44.98) whereas minimum per cent plant infestation by mealybugs (0.00%) was observed in Heritage (V_3), Anmol (V_5), Doddabelegere (V_6), Arka Kirti (V_8), Arka Chandrakath (V_9), White Anemone (V_{13}), Yellow Baby (V_{15}), Basanti (V_{17}), Geetanjali (V_{19}), Jaya (V_{20}), Sweta Singar (V_{22}), Vijay Kiran (V_{23}), White Dolley (V_{24}), BCC-4 (V_{27}), Arka Yellow Gold (V_{28}), Punjab Gold (V_{30}), Arka Chandrika (V_{31}), BCC-29 (V_{40}), Arka Pink Star (V_{35}), Coffee (V_{37}), Autumn Joy (V_{38}) and Arka Usha Kiran (V_{34}) in the both year (Table 2).

3.5 Number of Mature and Immature Stages of Mites Per Leaf

Bidhan Antara (V_{10}) recorded the maximum number of mature and immature stages of mites per leaf of 7.75 (2.95) in the first year (2018-19) while Aparajita (V_{16}) recorded the maximum number of mature and immature stages of mites per leaf of 6.08 (2.66) in the second year (2019-20). The minimum number of mature and immature stages of mites per leaf of 0.00 (1.00) was observed in Local Yellow (V_1), Heritage (V_3), Shukla (V_4), Doddabelegere (V_6), Arka Kirti (V_8), Arka Chandrakath (V_9), Yellow Baby (V_{15}), Sweta Singar (V_{22}), White Dolley (V_{24}), Winter Queen (V_{25}), Arka Yellow Gold (V_{28}), Punjab Gold (V_{30}), Arka Chandrika (V_{31}), Vasanthika (V_{39}), Arka Pink Star (V_{35}), Rekha (V_{36}), Autumn Joy (V_{38}) and Arka Usha Kiran (V_{34}) (Table 2).

4. DISCUSSION

The variation in aphid infestation may be due to the genetic traits of these chrysanthemum cultivars. A cultivar of a plant that possesses genetic traits that provide constitutive insect resistance will be less harmed by pests than a susceptible cultivar that lacks these traits (Painter, 1951). Based on the comparative response of resistant and susceptible plants, cultivated under comparable conditions, to the pest insect, plant resistance to insects is a relative attribute. The genotypes Yellow Baby, Arka Kirti, Arka Yellow Gold etc. showed less infestation by sucking pests as a whole. These genotypes may be used for future breeding programmes against these pests. The use of host plant resistance is considered the most economical and sustainable approach for managing pests in modern days integrated pest management programmes. Variations in plant age, moisture content, insect population density, temperature, photoperiod, soil chemistry, or soil moisture can cause pseudo-resistance in vulnerable plants (Alfaro, 1995, Ampong et al., 1994, Letourneau, 1986). This result is in line with the literature of Reddy and Janakiram (Rami and Janakiram, 2004). They reported that the variety Heritage was least susceptible to aphid which justifies the results. The variation in the reaction of different cultivars to this pest may be due to the presence of higher concentration of phenols and polyphenols in the leaves of such chrysanthemum cultivars considered as a defence mechanism against mites (Kietkiewicz and van de Vrie, 1983, Larson and Berry, 1984). It may be possible that these secondary metabolites restricted mite feeding on these chrysanthemum varieties. According to Larson and Barry, (1984) as plant phenolics and monoterpene contents increased the number of eggs of mites decreased significantly. According to Tulisalo (1971, 1972), fecundity on chrysanthemum cultivars was constrained by the leaf structure and was unrelated to the concentration and variability of carbohydrates. Feeny (1970) reported that secondary chemicals like tannins showed a defence mechanism against insects.

5. CONCLUSION

Genotypes such as Yellow Baby, Arka Kirti and Arka Yellow Gold were found to be the most tolerant to aphids, mealybugs and mites. These genotypes may be recommended for commercial cultivation in the Terai region of West Bengal as an eco-friendly approach without applying any chemical insecticides.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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