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Impact of Plant Phenology and Coccinellid Predators on the Population Dynamic of Rose Aphid *Macrosiphum rosaeiformis* Das (Aphididae: Homoptera) on Rose

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Abstract: Research was conducted to determine the effect of Coccinellid predators and plant phenology on the population dynamics of *Macrosiphum rosaeiformis* Das (Aphididae: Homoptera) in the University of Arid Agriculture Rawalpindi from 5th November 2000 to 15th April 2001. The rose aphid population was peaked in the month of January 2001. Rose aphid population was negatively correlated with Coccinellids predators. Rose aphid preferred the tender portion of plant especially flowers and flower buds causing deformation and discolouration. The resistance of four varieties i.e. Ice White, Sarabande, Lake Como and Iceburg (*Rosa indica*: Rosaceae) was studied against rose aphid. None of variety had resistance against rose aphid to significantly reduce their population.

Key words: Phenology, coccinellid, population dynamics, *Macrosiphum rosaeiformis* Das

Introduction

Rose is older than man and has been grown on earth for millions of years. Fossils of rose thirty millions years old have been reported. The Greeks and the Romans mythology depict roses in ancient civilization. Rose is the symbol of Venus, a deity of love and peace. Among all the flowers the rose has hypnotized the mankind most and has therefore attained unique status in human hearts (Datta, 1997)

Rose (*Rosa indica,* Rosaceae) is one of the natures beautiful creation and is universally acclaimed as the "Queen of flower". No other flower is a symbol of love, odoration, innocence and other virtues than roses. Rose flowers are valued for extraction of rose oil and making other products such as rose water, gulkand, pankhuri, rose petal conserve and potpourri. (Datta, 1997)

Roses are used for beauty and decoration of garden, extraction of attar for making fragrant mixtures, for tables and house decoration, banquets and public functions, cut flowers and sprays on wedding banquets and funeral ceremonies (Sujatha and Gowda, 1997). Similarly, different rose species are grown for perfume purposes like *Rosa damascena, Rosa barboniana* etc. But main use of roses is in cut flower industry and land scaping where it is mainly use in production as trade (Datta, 1997).

It has also medicinal value and used for making medicines especially Gul-e-kand and Aurq-e-gulab. Gul-e-kand is used mainly for different stomach disorders Aurq-e-gulab is used as eye drop for different eye infections. The rose hips long valued for food were shown in 1934 to be richest natural source of Vitamin C and are now pressed commercially to give rose hip syrup (Anonymous, 1982). Tannin contents of rose hips are mildy diuretic and reduce thirst and alleviate gastric inflammation (Anonymous, 1996).

In Pakistan roses are grown on smaller scale hardly to fulfil the local demand. There is no recognized institution for its culture. In Holland alone the market is estimated to be about 500 million US dollars and is growing by about 7 to 8% annually (Reddy, 1997). It is estimated that 250 to 500 hectares were under modern floriculture in India during, 1996. The same is expected to cross-500 hectares by 2000 A.D., currently. Exports of floriculture products worth Rs 60 crores per annum. This is envisaged to increase to Rs 200 crores by 2001 A.D. (Demodaran, 1997).

Roses are attacked by a number of pests like rose aphid, large rose sawfly etc., out of which rose aphid (Aphididae; Homoptera) is very serious pest of rose plants. It causes disfiguring of the foliage, crippling of the shoot and deformation of buds and quickly smoothers the plant if allowed to feed freely (Becker, 1997).

Generally aphids are the probably most familiar plant pests commonly known as green fly or black fly and they're only few ornamental plants that are not liable to be infested by this persistent and destructive insect pest. Majorities of aphids suck the sap of the leaves and young shoots causing distortion, stunting and sometime premature leaves fall. Some species also feed on the flowers; producing discolouration and other infest the roots of the plants causing them to wilt.

Aphids colonies may persist throughout the year but are most numerous and troublesome in spring and early summer (Buczacki *et al*., 1981).

Apart from the damage done by aphids as a direct results

of their feeding, they may also be indirectly responsible for the infection of the plant by disease organism e.g. aphids are carrier for the plant viruses but also provide a mean of entry by bacteria and fungal spores by puncturing holes during feeding. Similarly aphid's pours sugary excreta known as honeydew which is a source of sooty mould which further disfigure the plant by effecting photosynthesis process of plants. According to Naeem (1996) honeydew also block the leaves stomata ultimately reducing the amount of light that reaches the photosynthetic tissues. According to Leach (1997) aphid also transmit viral diseases.

Rose aphid is also involved in transmitting viral diseases such as pea mosaic, cauliflower mosaic and cabbage black ring spot (Mandahar, 1987). Aphids reproduce either sexually or parthenogenetically and occur as winter pest mainly in the world (Becker, 1997).

Rose aphids includes many species but roses are attacked mainly by rose aphid *Macrosiphum rosaeiformis*; potato aphid *Macrosiphum euphorbiae;* cotton aphid *Aphis gosstpii.* This aphid disfigures the foliage, cripples the shoot and injures the bud as result vigour of the plant is reduced and the quality of flower deteriorates (Atwal, 1976).

Predators include several species of Coccinellids and Syrphis Genus. Both adult as well as larvae Coccinellids predator feed their host. These natural enemies constitute main aspect of biological approach to control insect pests of economic importance. In all predator-prey situations, the number of prey destroyed by predators is a product of two universal elements: the number of predator's presents and the number of prey killed per predator. The degree to which the predators respond to prey abundance strongly influences their regulative function in the community.

The present work was conducted to determine the resistance in different rose varieties against rose aphids on population density of rose aphid on roses. This investigation also included the study of rose aphid predators by estimating their population and pattern of build up in response to its prey density.

Materials and Methods

Research to determine the impact of plant phenology and Coccinellid predators were conducted at University of Arid Agriculture Rawalpindi from 5th November, 2000 to 15th April, 2001. Four rose cultivars were selected at university campus of University of Arid Agriculture, Rawalpindi. There were four treatments and four replications. These cultivars were Lake Como, Iceburg, Ice white and Sarabande. All of these cultivars belong to Floribunda group of roses. Sixteen plants were selected through draw randomly and the selected plants were tagged for data collection.

Sampling techniques were based on two parameters; plant based sampling and Insect based sampling. Plant based sampling, the plant were divided into three parts i.e. upper, middle and lower parts. The sampling of each plant part was again divided into leaf, stem, flower bud and flower base.

Insect based sampling, the aphids were divided into three categories i.e. Nymphs, Wingless Adults and Winged Adults on all plant parts. Coccinellids predator were counted weekly on the selected plants to evaluate their relation with the population of their prey i.e. aphids. Sampling was done on weekly basis and in the end of research the data were statistically analyzed for results e.g. ANOVA.

Results and Discussion

Seasonal population of rose aphid population was recorded on four different varieties of roses i.e. Ice white, Sarabande, Lake como and Iceburg (Table 1, Fig. 2). Analysis of variance result was non-significant i.e. there was no resistance in these varieties of roses against rose aphids. According to Sauer (1999) there were no resistant roses against shoot growth aphids in rose houses.

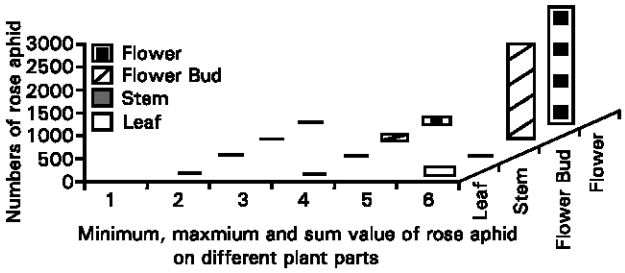

Fig. 1: Numbers of rose Aphid *Macrosiphum rosaeiformis* on different plant parts of rose

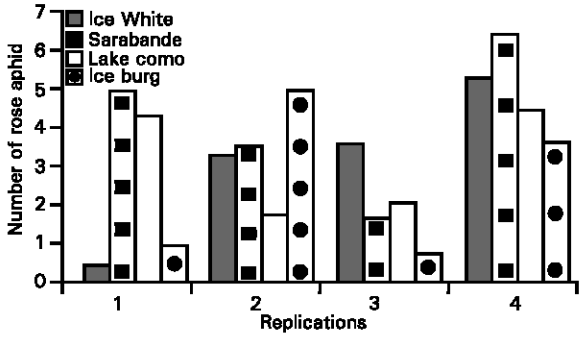

Fig. 2: Rose Aphid *Macrosiphum rosaeiformis* population on different rose cultivars

Table 1: Seasonal average population of rose aphid on four different varieties of roses

Replication	Ice white	Sarabande	Lake como	Iceburg
Rep.1	0.29	4.88	4.24	0.78
Rep.2	3.14	3.37	1.57	4.84
Rep.3	3.45	1.60	2.00	0.69
Rep.4	5.23	6.41	4.52	3.56

Table 2: Mean population of rose Aphid ± S.E. and coccinellids predator ± S.E. on different rose cultivars

Varieties	Mean aphid population±S.E	Mean coccinellids Population±S.E
Ice white	3.031±0.464	0.427±0.120
Sarabande	4.076±0.587	0.218±0.054
Lake como	3.086±0.504	0.271±0.060
Iceburg	2.468±0.396	0.537±0.082

Table 3: Weekly mean population relationship between rose aphid and coccinellids on roses

Dates	Mean aphid±S.E	Mean coccinellid±S.E
5th Nov.2000	9.278±1.662	0.813±0.227
12th Nov.2000	3.849±0.875	0.375±0.179
19th Nov.2000	2.777±0.873	0.187±0.101
26th Nov.2000	3.384±1.662	0.375±0.125
3rd Dec.2000	1.979±0.596	0.125±0.085
10th Dec.2000	2.418±0.819	0.500±0.182
17th Dec.2000	2.521±0.569	0.062±0.062
24th Dec.2000	5.730±1.231	0.250±0.144
31st Dec.2000	6.663±1.855	0.125±0.085
7th Jan.2001	6.926±2.335	0.062±0.062
14th Jan.2001	5.226±1.426	0.187±0.100
21st Jan.2001	5.692±1.514	0.187±0.100
28th Jan.2001	4.549±1.501	0.250±0.144
4th Feb.2001	3.103±0.931	0.062±0.062
11th Feb.2001	1.613±0.688	0.125±0.125
18th Feb.2001	1.290±0.470	0.125±0.085
25th Feb.2001	1.502±0.568	0.500±0.258
4th Mar.2001	1.705±0.760	0.812±0.501
11th Mar2001	0.906±0.466	0.750±0.295
18th Mar.2001	0.936±0.310	0.437±0.157
25th Mar.2001	1.771±0.703	0.500±0.258
1st Apr.2001	0.703±0.254	1.187±0.331
8th Apr.2001	1.529±0.488	0.062±0.062
15th Apr2001	0.057±0.035	0.875±0.256

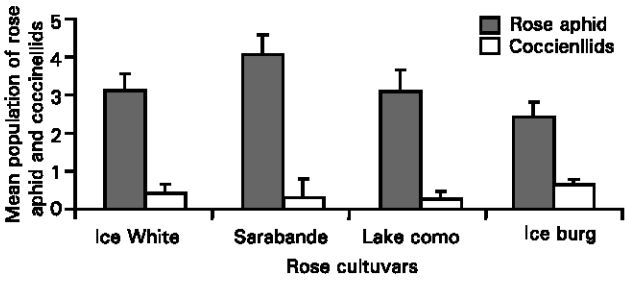

Fig. 3: Comparison of rose Aphid±S.E and conccinellid predators±S.E. on four rose cultivars

Population of rose aphid was different on different plant parts of roses (Fig. 1). Minimum rose aphid population was zero on all plant parts of roses i.e. leaf, stem, flower bud, and flower. Maximum value for rose aphid population was different on all parts, being lowest 4.580 on leaf, 7.000 on stem, 70.330 on flower bud and highest value 106.000 on flower. Kraz *et al.* (1977) reported that the aphid population build up reached a maximum in main growing period of plant upto the time of flowering. Jaskiewicz (1997) found the strong infestation by the rose aphid resulted in the deformation of stems, leaves and flowers. Atwal (1976) reported the aphid suck cell sap from the tender leaves buds and twigs resulting in the disfigurement and withering.

Different stages of rose aphid were recorded on roses to evaluate which stage i.e. Nymph, Wingless adults and Winged adults were most abundant during population build up. Minimum values were 0.000 in all stages of rose aphid and maximum values were recorded different for all stages varying from lowest value of 3.270 for Winged adult, Wingless adult 4.840 and highest was 29.520 of Nymph. The Nymph stage was most prominent in aphids than other stages. Becker (1997) aphids reproduce either

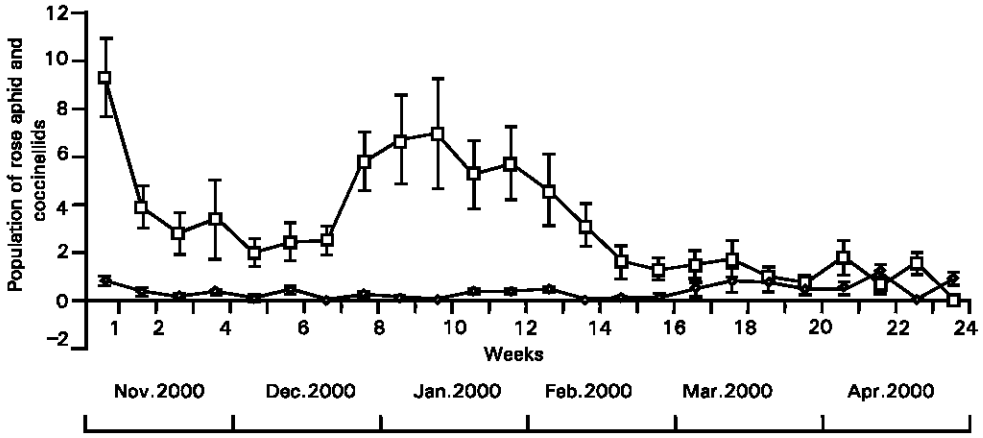

Fig. 4: Mean population relationship between rose Aphids and coccinellids on rose±S.E

sexually or parthenogenetically and occur as winter pest mainly.

Mean population of rose aphid and Coccinellids predator were recorded. Mean rose aphid population was negatively correlated with Coccinellids predators i.e., -0.159 (Table 3, Fig. 4) Dixon and Barlos (1979) observed a negative relationship between aphid and Coccinellids on lime trees. The predator's increase slowly in response to aphid numbers and reach their higher densities after aphid number had already declined. Peak population weeks of rose aphid, the population of Coccinellids were not significant to reduce their population. End of season the predator population become significant higher as compared to aphid population to reduce the declining population of rose aphid. According to Butler (1984) development stages of *Coccinella septumpunctata* was greatly effected by prevailing temperature like average 6.2 days at 32.5°C and 31.1 days at 17°C for larval stage. So at the end of season when rose aphid population declines to approximately to zero due to high temperature above 30°C and the activity of Coccinellids increase at this temperature. According to Tomiuk *et al.* (1982) climate factors merely modify the population of aphid, the main regulating factors being predators, competing species and physiological state of the food plant.

Average population of rose aphid and Coccinellids were observed on four varieties of roses (Table 2, Fig. 3). Maximum average population of rose aphid was observed on Sarabande variety i.e. 4.076 plant^{-1} ± 0.587 and minimum population on Iceburg variety i.e. 2.468 plant^{-1}±0.396. Maximum average population of Coccinellids predator was recorded on Iceburg variety i.e. 0.573 plant^{-1}±0.082 and minimum average population on Sarabande variety of rose 0.218 plant^{-1} ± 0.054.

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