

Occurrence and Infestation Level of Sucking pests: Aphids on various host plants in Agricultural Fields of Vadodara, Gujarat (India)

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Abstract- The three years of field study were undertaken during the year September 2008 – September 2011. 49 species of insect pests were recorded. The maximum numbers of insect pests are identified from order Hemipterans, Lepidopterans and Coleopterans. The major damage was seen from order Hemipterans, sucking pests mainly Aphids. There are around 6 species of aphids are prevalent; damaging approx. 30 host plants species from 16 different families were recorded. Host plant species belonging to family Malvaceae (16%), Fabaceae (15%), Solanaceae (12%) and Asclepiadaceae (10%) were found as preferred hosts of aphids in agro- ecosystem of Vadodara. Hence the present study provides the good information about the assessment of incidence and infestation rate of sucking pest, Aphids in the agro- ecosystem of Vadodara.

Index Terms- Aphids, Sucking pests, Host plants, Hemipterans.

I. INTRODUCTION

Agriculture is the backbone of the Indian economy because 75% of India's population depends on agriculture or agro-industries for livelihood. However, it is disheartening to know that India's economic growth is not keeping up with the expectations because its agricultural growth is lagging behind (Bedi, 2008). The major crops of India are categorized into Cereals, Oilseeds, Pulses, Vegetables and Fruits. These crops are damaged by the insect pests. Today the health of the crops is one of the major issues which farmers have to take into consideration and protecting these crops from insect pests is one of the most important subjects of present times. Dhaliwal *et al.* (2010) reported that the Indian agriculture is currently suffering an annual loss of about Rs. 8, 63, 884 million due to insect pests. The aphid infested 70.3% of US cotton, causing a 0.119% reduction in yield in 9,307,757 infested acres, resulting in a loss of 31,450 bales (Anwar *et al.*, 2007). In spite of various control measures against pests farmers are mainly depend on chemical control. The un-realistic and injudicious use of synthetic pesticides for the past several years led to outbreaks of many insect and non-insect pests. Overwhelmingly farmers in both developed and underdeveloped countries depend on synthetic insecticides, to control insect pest problems spending an enormous sum in the order of US \$ 9,000,000,000 per annum (Cork *et al.*, 2003). The rampant use of these chemicals, under the adage, "if little is good, a lot more will be better" has played havoc with human and other life forms. The extensive field

survey was done during 2008-2011 to record the insect pests mainly sucking pests, Aphids and their various host plant in agricultural fields of Vadodara. This study will be helpful in knowing the assessment of incidence and severity of damage caused by the aphids so that proper control measures can be used in future to minimize the load of insecticides.

II. MATERIALS AND METHODS

Vadodara is in the eastern part of the state of Gujarat in western India. It is located at 22°11' N latitude and 73° 07' E longitude. Vadodara District covers an area of 7,794 sq km. Agriculture fields were selected in all the four directions on the basis of accessibility and location of ecoregion. Economically important crops severely damaged by sucking pests (Aphids) were examined; to know about the assessment of incidence and extent of damage to the crop, as well as to collect insect stages from the crop. Insect's pests were then identified in the laboratory.

A. Study Sites

Agricultural fields located within 80Kms from the city centre, all fields sampled were 5 ha or more in size. Soil type was sandy loam. The annual average day time soil temperature ranged from 28°C to 32°C, slightly lower than the air temperature.

Areas included were:

1. **A Site 1 – Channi** (15Kms , North of the Vadodara) :- The field surveyed dominant crops and flora of Cotton, Castor, Pigeon pea, Sorghum, Bajra, Brinjal, Spinach, Cabbage, Cauliflowers, Beans, Mango, Banana, Hibiscus, Nerium, Marigold, Calotropis.
2. **A Site 2 - Ankleshwar** (80Kms , South of the Vadodara) :- The field surveyed dominant crops and flora are Cotton, Chick pea, Pigeon pea, Maize, Ladies finger, Beans, Cabbage, Banana, Gauva, Nerium, Hibiscus, Marigold, Canna, Calotropis, Datura, Spiny amranthus .
3. **A Site 3 - Dabhoi** (30Kms , Southeast of the Vadodara): - The field surveyed dominant crops and flora are Wheat, Pigeon pea, Castor, Sorghum, Cabbage, Spinach, Nerium, Hibiscus, Marigold, Calotropis .

4. **A Site 4 – Wagodia** (25Kms , East of Vadodara) : - The field surveyed dominant crops and flora are Cotton, Castor, Sugarcane, Brinjal, Radish, Banana, Gauva, Nerium, Hibiscus, Vinca, Calotropis, Spiny amaranth .
5. **A Site 5 – Timbi** (15Kms, West of Vadodara): The field surveyed dominant crops and flora are Wheat, Castor, Pearl millet, Paddy, Jowar, Spinach, Mango, Gauva, Nerium.

B. Sampling techniques

Collection of insects was carried out depending upon the season in which crop was grown. During the sampling period of three years (2008-2011), each year was divided into two phases of four months: Phase 1 (January - April) and Phase 2 (September - December). Each phase had four sampling periods as field visits were conducted four times in every month. Each study site was visited twice a month. On each day the sampling was done twice once in morning hrs (7 am to 9 am) and second time in evening hrs (5pm to 7pm).

C. Collection Method

Collection was done by sweeping and hand picking method. In sweep net method each quadrat was swept several times. Every sweep was repeated after a gap of 10 minutes and 10 sweeps were performed each time. Large sized caterpillars, Adult females of Aphids and bugs were handpicked. Large insects were killed using killing jars with potassium cyanide powder. The tiny ones like Aphids were transferred in the vials having 70-90% ethyl alcohol, brought to the laboratory, mounted on slides and then observed and identified.

D. Identification

Identification and labeling was done using standard taxonomic literature. Collected insects were identified with the help of keys available in (Richards & Davies, 1997), (Borror *et al.*, 1992), (Leffroy, 1909), (Ananthkrishnan & David, 2004) and standard manuals. Aphids were identified by using taxonomic key provided by (Blackman & Eastop, 2000). A stereomicroscope; Leica MPS 60 Ø28/8x/MPS was used for identification and photographic record. The identified species were confirmed from Entomology Division, Anand Agricultural University, Anand, Gujarat. The identification of host plant species were done by Department of Botany of The Maharaja Sayajirao University of Baroda.

E. Host Plants and Assessment of Incidence and Infestation Rate of Sucking pests (Aphids)

The assessment of infestation by insect pests on various crops was done as per the scale given by Nagrare and his co-workers in the year 2011. (Central Institute for Cotton Research, Nagpur).

1-4 Scale infestation

1 Grade: Scattered appearance of few aphids on the plant.

2 Grade: Severe infestation of aphids on any one branch of the plant.

3 Grade: Severe infestation of aphids on more than one branch or half portion of the plant.

4 Grade: Severe infestation of aphids on the whole plant.

The percentage of incidence was calculated by suitable formulae:

Percentage incidence (PI) = Number of infested plants / Total plant observed X 100.

Severity index (SI) = Sum of total grade points (1-4 infestation grade G-I to G-IV, respectively) of the infested plants / Total number of infested plants observed.

III. RESULTS AND DISCUSSION

Vadodara has a rich bio-diversity of insects. There are large numbers of agricultural fields of 2-5 hectares surrounding the city. An extensive survey of the agricultural fields in and around Vadodara was done for a period of three years from September 2008 to September 2011.

In the fields, Insect pests were identified for the purpose of assessing the incidence and severity of the insect pests. The infestation based on presence or absence of insect pests and the severity using one to four scale of infestation. Assessment showed that agricultural fields having economically important crops like Cotton, Maize, Castor, Wheat, Sorghum, Pigeon pea, Chick pea, Brinjal, Ladies Finger, Beans, Cauliflower, Cabbage etc. were being damaged by a wide range of insect pests. The present study identified 49 species of insects as pests. The number was reported from the collection and identification of insects from the severely damaged crops.

The results of insect pest percentage within the agro ecosystem of Vadodara reported the maximum insect pests, 33% from order hemiptera. Order lepidoptera was showing 27% of pest percentage followed by coleopteran i.e. 18%. However, the minimum pest percentage was recorded from order diptera (2%) in vadodara agricultural fields (Fig.1). The maximum severity of insect pests was observed in the order Hemiptera, Lepidoptera and Coleoptera. The occurrence of insect pests was observed in the month of September till April in all the three consecutive years in the agroecosystem of Vadodara.

In order hemiptera, *Aphis gossypii*, *Aphis craccivora*, *Aphis nerii*, *Aphis fabae*, *Aphis brassicae* and *Myzus persicae* (Family: Aphididae) are considered as serious threat to the economically important crops of the agro ecosystem of the Vadodara. The species of Aphididae families attack various plants, infesting leaves, stems, fruits and roots (Blackman and Eastop, 2000). Aphids are considered to be a serious pest to almost all agricultural crops and alternative host plants because of their polyphagous feeding habits (Minks and Harrewijn, 1987).

They cause severe damage to many host plants. In Vadodara agro ecosystem, approx. 30 host plant species from 16 different families were recorded (Table 1). Similarly, Takaloozadeh in 2010 reported *Aphis gossypii* attacking more than 70 various host plants in Iran. Host plant species belonging to family Malvaceae (16%), Fabaceae (15%), Solanaceae (12%) and Asclepiadaceae (10%) were found as preferred hosts of aphids in Vadodara (Fig 2). Vennila (2008) reported that the sap sucking pest like aphids, white flies and mealybug as emerging serious pest in India. The peak population of aphids was observed from the month of December – February. The assessment of incidence and

infestation rate was observed by 1-4 Scale of infestation. The maximum percentage of incidence and severity of damage caused by the *Aphis gossypii* on cotton crops, *Aphis craccivora* on Pigeon pea and Cow pea and *Aphis nerii* on Nerium plant. (Table 1).

Gujarat is in 5th Position in cotton production (Vennila *et al*, 2010). *Aphis gossypii* is major threat for cotton crop. Malik and Riazuddin (2006) reported the cotton aphids, *Aphis gossypii* Glover (Homoptera: Aphididae) are significantly devastating pests of cotton in Pakistan. Gujarat is famous for the staple food. *Aphis craccivora* damaged the leguminous crops. Attle *et al*. (1987) reported as high as 100% yield reduction of different bean crops due to aphid infestation and during 2006. *Aphis nerii* and *Aphis fabae* damaged the beautiful ornamental plants whereas *Aphis brassicae* and *Myzus persicae* damaged the vegetables mainly cabbage (Francis *et al*, 2001)

To prevent yield loss farmers are mainly depend on chemical control method. Due to indiscriminate use of chemical caused

pest resistance, resurgence of pests, residues in food, water, air and soil, elimination of natural enemies and disruption of ecosystem (Palikhe, 2002). Therefore the proper management of insect pests are needed as suggested by Gupta *et al*. (2004) integrating them with other proven methods of pest control against the target pests which replace insecticides to which the pest had developed resistance by reducing the number of spray and increases the yield (Ahuja *et al.*, 2012).

Hence, the information provided by present study gives the important understanding of vast range of host plant which is helpful in survival of sucking pests throughout the year. To focus on the assessment of incidence and infestation rate. Therefore, in future the proper effective and significant ecofriendly method were used for management of these polyphagous insect pests.

Table 1: Host plants of Aphids with its infestation level in agro systems of Vadodara

Host category	Aphids Species	Botanical Name	Common Name	Family	Infestation Scale
Field crops	<i>Aphis gossypii</i> , <i>Myzus persicae</i>	<i>Gossypium hirsutum</i> (L.)	Cotton	Malvaceae	4 Grade
	<i>Aphis craccivora</i>	<i>Cajanus cajan</i> (L.Millsp.)	Pigeon pea	Fabaceae	4 Grade
	<i>Aphis craccivora</i>	<i>Vigna unguiculata</i> (L.)	Cow pea	Fabaceae	4 Grade
	<i>Aphis nerii</i>	<i>Zea mays</i> (L.)	Maize	Poaceae	2 Grade
	<i>Aphis nerii</i>	<i>Triticum aestivum</i> (L.)	Wheat	Gramineae	2 Grade
	<i>Aphis gossypii</i>	<i>Ricinus communis</i> (L.)	Castor	Euphorbiaceae	1 Grade
	Vegetables	<i>Aphis gossypii</i>	<i>Abelmoschus esculentus</i> (L.)	Lady's finger	Malvaceae
<i>Aphis gossypii</i> , <i>Myzus persicae</i>		<i>Solanum melongea</i> (L.)	Brinjal	Solanaceae	3 Grade
<i>Aphis fabae</i>		<i>Solanum tuberosum</i> (L.)	Potato	Solanaceae	3 Grade
<i>Aphis fabae</i>		<i>Lycopersicon esculentum</i> (L.)	Tomato	Solanaceae	4 Grade
<i>Aphis gossypii</i>		<i>Cucumis sativus</i> (L.)	Cucumber	Cucurbitaceae	2 Grade
<i>Myzus persicae</i>		<i>Spinacia oleracea</i> (L.)	Spinach	Amarathaceae	2 Grade
<i>Aphis brassicae</i> , <i>Myzus persicae</i>		<i>Brassica oleracea</i> (Linn)	Cabbage	Brassicaceae	2 Grade
<i>Myzus persicae</i>		<i>Raphanus sativus</i> (L.)	Radish	Brassicaceae	2 Grade
<i>Aphis fabae</i>		<i>Beta vulgaris</i> (L.)	Beet	Papaveraceae	0 Grade
	<i>Aphis gossypii</i>	<i>Hibiscus mutabilis</i> (L.)	Cotton Rose-mallow	Malvaceae	3 Grade
	<i>Aphis gossypii</i>	<i>Hibiscus rosa-sinensis</i> (L.)	China rose	Malvaceae	4 Grade

Host category	Aphids Species	Botanical Name	Common Name	Family	Infestation Scale
Ornamental crops/ Fruit trees /trees and shrubs	<i>Aphis nerii</i>	<i>Nerium indicum</i> (Mill.)	Oleander	Apocynaceae	2 Grade
	<i>Aphis nerii</i>	<i>Nerium oleander</i> (L.)	Oleander	Apocynaceae	4 Grade
	<i>Aphis nerii</i>	<i>Vinca rosea</i> (L.)	Periwinkle	Apocynaceae	1 Grade
	<i>Aphis fabae</i>	<i>Tagetes erecta</i> (L.)	Marigold	Asteraceae	1 Grade
	<i>Aphis fabae</i>	<i>Helianthus annuus</i> (L.)	Sunflower	Asteraceae	1 Grade
	<i>Aphis fabae</i>	<i>Atriplex rosea</i> (L.)	Red orach	Asteraceae	0 Grade
	<i>Aphis fabae</i>	<i>Matricaria recutita</i> (L.)	Chamomile	Asteraceae	0 Grade
	<i>Aphis fabae</i> , <i>Aphis gossypii</i>	<i>Chrysanthemum</i> sp. (L.)	Chrysanthus	Asteraceae	3 Grade
	<i>Aphis fabae</i>	<i>Papaver somniferum</i> (L.)	Opium poppy	Amaranthaceae	0 Grade
	<i>Aphis gossypii</i>	<i>Urtica dioica</i> (L.)	Stinging nettle	Urticaceae	0 Grade
	<i>Aphis craccivora</i>	<i>Ocimum sanctum</i> (L.)	Tulsi	Lamiaceae	1 Grade
	<i>Aphis nerii</i>	<i>Citrus limonium</i> (L.)	Lemon	Rutaceae	2 Grade
Weeds	<i>Aphis gossypii</i>	<i>Datura metel</i> (L.)	Angel's trumpet	Solanaceae	0 Grade
	<i>Aphis fabae</i>	<i>Chenopodium album</i> (L.)	Pigweed	Asteraceae	1 Grade
	<i>Aphis fabae</i>	<i>Cirsium arvense</i> (L.Scop)	Canada thistle	Asteraceae	1 Grade
	<i>Aphis nerii</i>	<i>Calotropis procera</i> (W.T.Aiton)	Apple of sodom	Asclepiadaceae	4 Grade
	<i>Aphis nerii</i>	<i>Gomphocarpus</i> sp. (E.mey.)	Cotton bushes, Balloon bushes	Asclepiadaceae	2 Grade
	<i>Aphis nerii</i>	<i>Asclepias</i> (E.mey.)	Butterfly weed	Asclepiadaceae	2 Grade

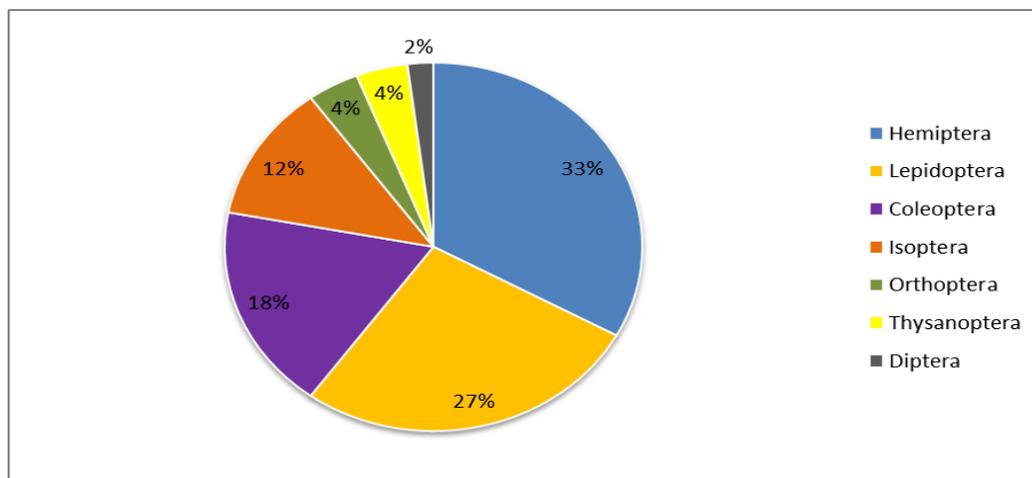


Fig.1: Insect Pest Percentage within the Agro ecosystem of Vadodara

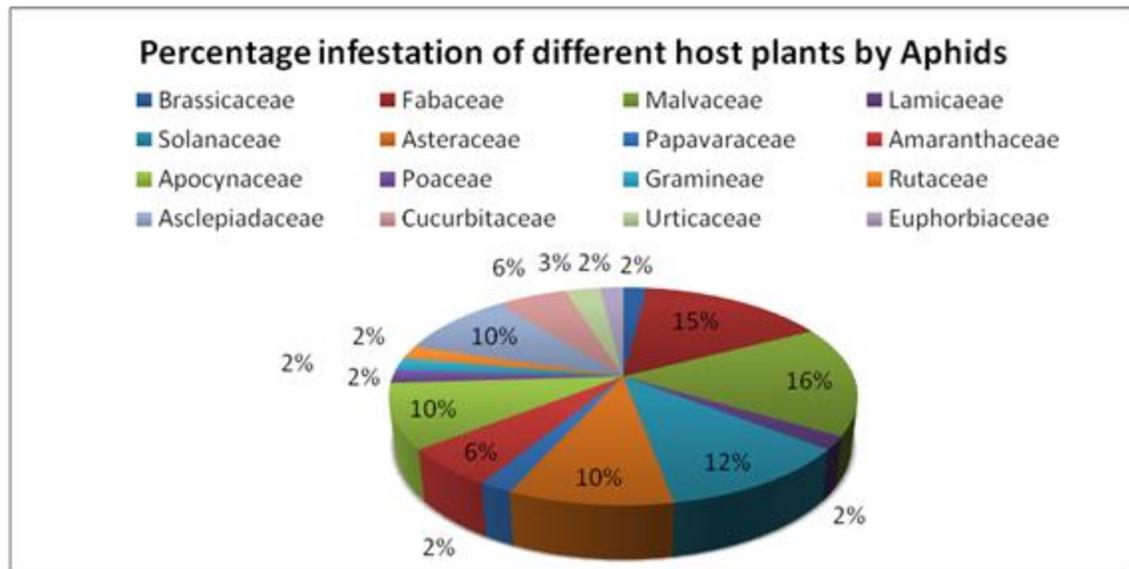


Fig.2: Percentage infestation of different host plants by aphids

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