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# POPULATION DYNAMICS OF A POLYPHAGOUS PEST, *ALEURODICUS DISPERSUS*(RUSSEL) (HOMOPTERA: ALEYRODIDAE)AND ITS NATIVE PREDATOR,*AXINOSCYMNUS PUTTARUDRIAHI*(COLEOPTERA : COCCINELLIDAE)

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**Abstract**

Spiralling whitefly, *Aleurodicus dispersus* is a polygphagous pest of wide range of crop, ornanmental and wild plants. The feeding of this insect results in chlorosis, leaf curl and sootymold in the host plants and causes wide range of damage. The adaptations of egg and nymphal stage makes the insect successful in its population buildup. Presence of flight activity in adults, makes the management programs ineffective. As this pest is having more than 280 host plants in India, application of effective pesticides on a single crop won't yield desired result due to the adults' migration behavior. On wild host plants like *Terminaliacatapa* (Badam), where the pest multiplies with full vigour, insecticidal application is not feasible due to the huge height of the plants and its canopy. With ever increasing awareness about the disastrous effects of pesticide use, investigations were made to find out the biological control agents that are associated with this polyphagous pest. Screening of the colonies of *A.dispersus*, revealed the presence of some grubs and adults of*Axinoscymnusputtarudriahi* feeding on the eggs and nymphal stages of whitefly. After confirming the identification of the native predator, the studies were initiated to study the abundance of this polyphagous pest and its native predator in KarveerTaluka of Kolhapur district during October, 2015 and continued through, September, 2017 at fortnightly intervals. The incidence studies were correlated with abiotic factors, viz., maximum temperature, minimum temperature, maximum Relative Humidity and Minimum Relative Humidity and rainfall. The outcome of this study is useful in developing prediction model for *A.dispersus*, so as to aware the farmers regarding possible outbreaks of this pest well in advance and natural incidence of its biological control agent, *A.puttarudriahi*.

**Keywords:** *Aleurodicusdispersus*, polyphagous pest,*Axinoscymnusputtarudriahi*, abiotic factors

## Introduction

Spiralling whitefly, *Aleurodicus dispersus*Russel is a polypagous pest which feeds on the foliage of agricultural, ornamental and wild plants. This exotic pest, a native of Caribbean Islands, was reported from India on Tapioca plant in 1993 at Thiruvananthpuram, Kerala [1]and later on this pest is spread in remaining parts of India.Theadaptations of life stages have made the whitefly a difficult to control pest, as the eggs are deposited on the lower surface of leaves with a filamentous stalk, that is inserted into the deeper tissues, the eggs can't be dislodged by the gale winds and incessant rains. The nymphalstages are sessile and settles on the lower surface of leaf and continuously drains the leaf sap. The nymphal stages exude honeydew, which acts as a medium for the growth of sootymold fungus. This fungus covers the upper surface of leaf and prevents the sun rays from reaching to the leaf surface, thus affecting the photosynthetic activity of leaves. The adults are phloem suckers and active fliers, due to their flight habit, they spread very rapidly among the fields. The infestation by adults and nymphal stages results in chlorosis, leafcrul and sootymold disease that renders severe crop losses ranging from 30-100%.

Though, several measures are in vogue, the farmers are resorting to application of stronger doses of pesticides. As the whitefly is polyphagous, the adults easily migrate to adjacent plantation and escape from the wrath of pesticidal application. Moreover, the application of chemical pesticides is having several adverse effect on the environment. As biological control has already proven to be a living weapon over chemical control, efforts were made to find out the biological control agents that are associated with the life stages of *A.dispersus*. Screening of the whitefly infested leaves of various host plants have revealed the presence of a native predator, *Axinoscymnusputtarudriahi* (Coleoptera :Coccinellidae). In the present study, attempts were made to find out the seasonal incidence of *A.dispersus* and its native predator, *A.puttarudriahi* and their correlation with abiotic factors with an aim to provide an advisory to the farmers regarding probable occurrence of this polyphagous pest and its native predator.

## Material and Methods

To study the populations of *A.disperus* and it's native predator, *A.puttarudriahi*, threevillages from Karveertaluka of Kolhapur district in Maharashtra stateviz.,Pachgoan, Kalamba and Wadakshivalay were selected. Samples were collected from ten host plants viz., Guava, *Terminaliacattapa*,Sonchafa, Jasmine, Anjeer, Karanj. From each plant ten infested leaves were collected individually in perforated

plastic bagswere brought to the laboratory for further screening with their openings tied. The data was collected at fortnightly intervals for a period of two years (October, 2015 – September, 2017).The field collected samples were screened in the laboratory and data was recorded on number of egg masses, nymphs and adults of *A.dispersus* and grubs, pupae and adults of the native predator, *A.puttarurdriahi*. The culture of the native predator were maintained on sprouted potatoes with established mealy bug colonies. The incidence data of the pest and its native predator was correlated with abiotic factors, Maximum Temperature, Minimum Temperature, Maximum Relative Humidity, Minimum Relative Humidity and Rainfall.

**Observations**

During the first year of the study, it was observed the population of *A.dispersus* was persistent throughout the year with fluctuations. During October, 2015, the mean population of whitefly per leaf was recorded as 27.2 and 28.1 and 29.4 during November and December respectively. During January – September, 2016, the population was 27.3, 30.16, 38.10, 23.80, 19.50, 12.50, 9.50, 68.70 and 96.20 respectively. During the first year of the study, the maximum incidence was recorded in September (96.20/leaf) followed by August (68.70) and March (38.10) (Fig.1). During the second year (2016-17), the whitefly population was 24, 28.2, 30.30, 30.8, 41.1, 12.10, 09.20, 7.30, 13.50, 22.30, 27.60, 23.60 from October, 2016 – September, 2017 respectively. The maximum incidence was recorded during February (41.1) followed by January (30.8) and December (30.30).

Whereas the population of *A.puttarudriahi* was found to be negligible during the entire study period (0 – 0.6/leaf). For most of the period, the population was persistent except during May, 2016, June, 2016 and June, 2017 where the population was nil. The population of *A.puttarudriahi* during 2015-16 was 0.0 – 0.6 with a peak during September, 2016(0.6/leaf). During the second year of study, the maximum population of the predator was observed during October, 2016 (1/leaf). The incidence data of whitefly, its native predator were correlated with abiotic factors and represented in fig 1.

**Discussion**

The correlation studies between *A.dispersus*, *A.puttarudriahi* and abiotic factors (Maximum Temperature, Minimum Temperature, Maximum Relative Humidity, Minimum Relative Humidity and Rainfall) revealed that Maximum Temperature is having negative effect on the population buildup of *A.dispersus*(Fig.: 1 ). This is evident from the population of *A.dispersus* (7.3-12.1/leaf) during March – May, 2017, when Maximum Temperature is at 35.9 to 37.7° C. During the entire study period,the minimum population of *A.dispersus* was recorded when Maximum Temperature reached to the peak. The observations are in agreement with the findings made by [2] wherein it was observed that maximum temperature is negatively correlated with the population buidup of whitefly. Similar observations were made with *Micraspis discolor* Fab. (Coleoptera :Coccinellidae) [3].Similar observations were made with the seasonal incidence of a whitefly parasitoid, *Eretmocerusadustiscutum* (Krishnan & David) (Hymenoptera :Chalcidoidea) where in it was observed that the incidence of the parasitoid is positively correlated with maximum temperature [4] .

Minimum Temperature showed positive correlation with incidence of *A. dispersus*, which is evident from the population recorded during 2015-2016, wherein with the rise in Minimum Temperature the population level of *A.dispersus* also increased and the trend continued during 2016-2017 (Fig.1).

Maximum Relative Humidity expressed positive correlation with *A.dispersus* build up during August and September, 2016, The whitefly population was 68.7 and 96.2 , which is coinciding with the Maximum Relative Humidity (93and 89%) months of the year (2015-2016). These findings are in agreement with the observationsof [4] in*Micraspis discolor* Fab. (Coleoptera:Coccinellidae), a native predator of mulberry whitefly, *D.decempuncta*.

Minimum Relative Humidity found to have negative influence on whitefly population. When the Minimum Relative Humidity was at peak (89% in July, 2016), the whitefly population was minimum (9.5/leaf). Similarly, in the consecutive year also (83% in July, 2017), the whitefly population was low (22.3/leaf). During the second year, the month that experienced maximum infestation of whitefly (41.1/ leaf in July, 2017) had lowest minimum Relative Humidity (29%) of the year (2016-2017) (Table:1).The findings were in disagreement with the observations made by [5] who have found that minimum Relative Humidity is found to have positive significant influence on the population of the pest, *D.decempuncta*.

Rainfall is having negative impact on the population build up of *A.dispersus*. Similar observations were found with *Micraspis discolor* (Fab.) (Coleoptera :Coccinellidae), a native predator of mulberry whitefly, *D.decempuncta*[3]

During 2015-16, when peak rainfall was recorded in July, 2016 (478.15 mm), the whitefly population was minimum with 9.5/leaf. But, this rainfall made the availability of huge moisture in the soil, that has lead to optimum ascent of sap. Due to increase in the succulence of leaves of host plants, in the subsequent months, the whitefly population has increased (68.7/leaf in August and 96.2/leaf in September, 2016) (Fig.1).During the second year of the study (2016-17), the maximum incidence of whitefly was observed in February, 2017 (41.1/leaf). During this month and prior two months the rain fall was nil. From, this it can be postulated that maximum rain fall will directly affect the population of whitefly, but in the subsequent months, it helped in population buildup of whitefly due to increased levels of sap contents in the leaves of host plants (Table:1).

The predator, *A.puttarudriahi* population was found to be negligible as it continuously remained less than one for most of the study period. The population reached to maximum of 1 /leaf during the course of second year study, i.e. October, 2016 (Table:1) During previous months, the whitefly population peaked with a population of 68.7 and 96.2/leaf. As the predator got enough hosts for feeding and breeding, in the consecutive month, i.e. it has reached to peak population (Fig.:1).From this study, it has become evident that in KarveerTaluka eco-system, plenty of damage is being caused to the host plants by *A.dispersus*. For the effective management of this pest, the native predator need to be augmented in the laboratory and then field release programmes have to be taken up by creating awareness amongst farmers' community.

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**Table 1:**Studies on the seasonal incidence of spiraling whitefly, *A.dispersus* and it's native predator, *A. puttarudriahi*

| Sr. No. | Month &Year | Whitefly | *Axinoscymnus puttarudriahi* | Temprature (° C) | | Relative Humidity (%) | | Rainfall (mm) |
|---|---|---|---|---|---|---|---|---|
| | | | | Max. | Min. | Max. | Min. | Total |
| 1 | Oct-15 | 27.2 | 0.2 | 30.9 | 14.8 | 86 | 72 | 0 |
| 2 | Nov-15 | 28.1 | 0.2 | 31.1 | 15.3 | 84 | 73 | 0 |
| 3 | Dec-15 | 29.4 | 0.3 | 31.7 | 12.9 | 81 | 46 | 0 |
| 4 | Jan-16 | 27.3 | 0.3 | 30.2 | 16.7 | 68 | 35 | 0 |
| 5 | Feb-16 | 30.16 | 0.5 | 33.2 | 19.6 | 71 | 35 | 0 |
| 6 | Mar-16 | 38.1 | 0.2 | 36.4 | 22 | 67 | 34 | 0 |
| 7 | Apr-16 | 23.8 | 0.1 | 38.3 | 23.3 | 67 | 39 | 0 |
| 8 | May-16 | 19.5 | 0 | 36.7 | 24.3 | 73 | 45 | 0 |
| 9 | Jun-16 | 12.5 | 0 | 29.7 | 22.6 | 86 | 76 | 96.48 |
| 10 | Jul-16 | 9.5 | 0.1 | 26 | 21.3 | 93 | 89 | 478.2 |
| 11 | Aug-16 | 68.7 | 0.3 | 26.5 | 21.3 | 93 | 85 | 310 |
| 12 | Sep-16 | 96.2 | 0.6 | 27.7 | 21 | 89 | 80 | 51.79 |
| 13 | Oct-16 | 24 | 1 | 30.2 | 20.1 | 82 | 64 | 23.4 |
| 14 | Nov-16 | 28.2 | 0.1 | 30.9 | 16.8 | 66 | 42 | 0 |
| 15 | Dec-16 | 30.3 | 0.3 | 30.3 | 16.2 | 68 | 39 | 0 |
| 16 | Jan-17 | 30.8 | 0.1 | 29.7 | 15.9 | 67 | 36 | 0 |
| 17 | Feb-17 | 41.1 | 0.2 | 33.4 | 18.4 | 61 | 29 | 0 |
| 18 | Mar-17 | 12.1 | 0.2 | 35.9 | 20 | 61 | 30 | 0 |
| 19 | Apr-17 | 9.2 | 0.1 | 37.7 | 22.3 | 70 | 39 | 0 |
| 20 | May-17 | 7.3 | 0.1 | 36.5 | 23.5 | 76 | 56 | 0 |
| 21 | Jun-17 | 13.5 | 0 | 29.9 | 22.7 | 86 | 78 | 102.5 |
| 22 | Jul-17 | 22.3 | 0.1 | 27.7 | 21.9 | 89 | 83 | 296.3 |
| 23 | Aug-17 | 27.6 | 0.2 | 28.2 | 22 | 90 | 81 | 67.83 |
| 24 | Sep-17 | 23.6 | 0.4 | 29.2 | 22.2 | 92 | 80 | 245.6 |

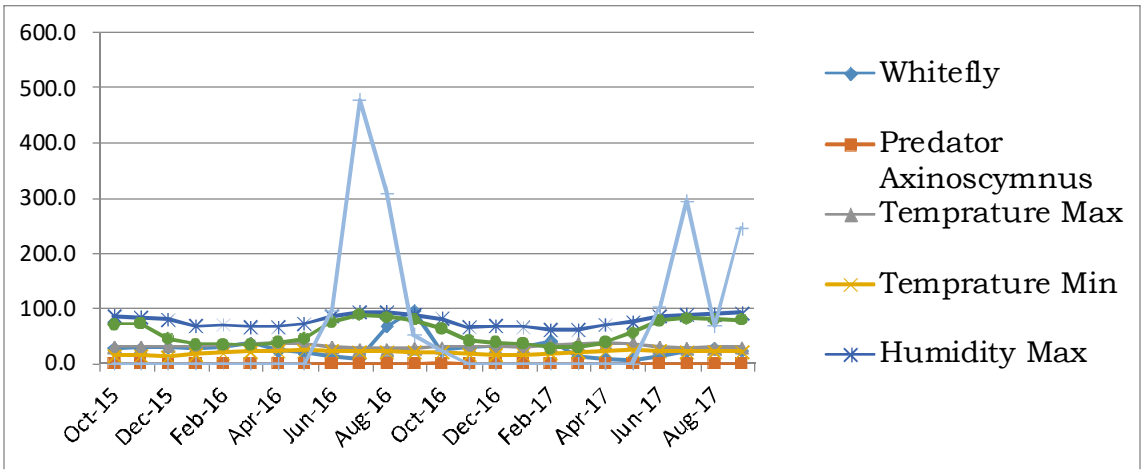


**Figure 1** Correlation between *A.dispersus* and *Axinoscymnusputtarudriahi* and abiotic factorsfrom Oct-15 to Sep- 17

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