



Seasonal Incidence of Gall Forming Psyllid *Pseudophacopteron tuberculatum*, Crawford Infesting *Alstonia scholaris* R. Brown at Bhubaneswar, Odisha

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ABSTRACT

The present study was undertaken in Bhubaneswar on a popular ornamental tree *Alstonia scholaris* (L.) R. Br. during October 2016 to May, 2018. The psyllid, *Pseudophacopteron tuberculatum* attack gives ugly appearance for which it fails to serve the original purpose. The study revealed that maximum percentage branch infestation was recorded during the month of October in 2nd fortnight (86.18 %) followed by 1st fortnight of November (83.51%). Lowest branch infestation was recorded during 1st fortnight of April (57.04%). Maximum percentage leaf infestation was recorded in 1st fortnight of October (88.31%) followed by 2nd fortnight *Alstonia* leaves infested with galls of October (88.10%). The 1st and 2nd fortnight of November also witnessed high leaf infestation. The lowest infestation recorded was 66.20% during the 1st fortnight of March followed by 66.83% during 2nd fortnight of February. Maximum no. of galls were found to be 67.2 on an average during the 2nd fortnight of October. There was a positive and significant correlation (both at 5% and 1%) found between percent RH with all the infestation parameters. A negative but significant correlation was found between mean maximum temperature and basic sunshine hour (BSH) with all the infestation characters as mentioned above.

Key Words:

Devil tree, leaf infestation, Psyllid, Seasonal incidence,

INTRODUCTION

Alstonia scholaris (L.) R. Br. is an evergreen, tropical landscape tree with white funnel-shaped flowers and milky sap and belongs to family Apocynaceae and is severally called *viz.* scholar tree, blackboard tree, Indian devil tree, saptarni and satpatia in several parts of the world. The

plant grows throughout the humid regions of India, especially in West Bengal, Odisha and west-coast forests of south India. *A. scholaris* is attacked by several insect pests among which Leaf gall former, *Pseudophacopteron tuberculatum* Crawford (Psylloidea: Homoptera) is one of the major pest. It induces gall formation on stem, leaves, inflorescence, fruits *etc* Galls on the leaves

of *A. scholaris* were first noticed in 2005 in Chandigarh (Chander, 2014), In 2010, there was an epidemic of black brown galls on *A. scholaris* leaves in Punjab, Haryana, Chandigarh and Delhi. The causal organism of this leaf galls was identified as a psyllid (jumping plant louse), *P. tuberculata*. Galled leaves become unfit for photosynthesis because of which leaves get distorted, growth is stunted and tree dries up either temporarily or permanently. Galls are also observed on the newly developing leaves which do not reach to maturity. *P. tuberculata* also makes galls on the inflorescence and follicle fruits of *A. scholaris* due to which reproduction of plant is also affected (Jain and Dhiman 2014). Losses in seedling production is more because they become bushy, could not reach to expected height and cannot be used for transplanting making total failure of the plantation programme. Reports of pest status of *Pseudophacopteron tuberculatum* Crawford infesting *Alstonia scholaris* (L.) R. Br. at global level is quite meager. Mathur (1975) probably was the first to give a description of this pest in the country.

As the plant is used as a popular ornamental tree in landscapes, gardens as well as roadside plantations after being infected with the psyllid, *Pseudophacopteron tuberculatum* it gives ugly appearance and fails to serve the purpose for which it is meant for. Keeping these facts in view the present study is undertaken.

MATERIALS AND METHODS

The present investigation was carried out during October 2016 to May 18 on the avenue plantation nearer to Orrisa University of Agricultural Science and Technology (OUAT) campus at Bhubaneswar. Number of infested leaves, no of infested branches, intensity of galls (no. of galls per leaf) at fortnightly interval by selecting ten tagged plants. No. of infested leaves were calculated from 1 m² area from the tree. Infestation was calculated using the standard formula, % leaf infestation = (Total no. of leaves infested with galls / total no. of leaves observed)

$\times 100$ % branch infestation = (Total no. of branches infested with galls / total no. of branches observed) $\times 100$. Observations were recorded at fortnightly interval along with major weather parameters viz., temperature, relative humidity (6 hrs and 14 hrs) and rainfall of the location of study (Fig.1). Based on those data linear correlation was worked out as per Gomez and Gomez (1984). The adult psyllids, both male and female specimens were collected from the devil tree, *Alstonia scholaris* and preserved appropriately. Identification was established by consulting professors of Entomology Department and from Internet sources.

RESULTS AND DISCUSSION

Maximum per cent branch infestation was recorded during the month of October in 2nd fortnight (86.18 %) followed by 1st fortnight of November (83.51%). Lowest branch infestation was recorded during 1st fortnight of April (57.04%). The details of branch and leaf infestation during different months of the year is given in Table 1 and Fig. 2. The leaf infestation varied from 66.20% to 88.31% in different months of observation (Fig.3). Maximum percentage leaf infestation was recorded in 1st fortnight of October (88.31%) followed by 2nd fortnight of October (88.10%). The 1st and 2nd fortnight of November also witnessed high leaf infestation by the psyllid, *P. tuberculatum*. The lowest infestation recorded was 66.20% during the 1st fortnight of March followed by 66.83% during 2nd fortnight of February. The no. of galls per leaf depends upon the no. of eggs laid by the adult female of psyllid which varied according to different seasons of the year. Maximum number of galls were found to be 67.2 on an average during the 2nd fortnight of October. The 1st fortnight of October witnessed an average of 65.6 no. of galls per leaf. Lowest no. of galls per leaf was recorded during 2nd fortnight of May (13.4/leaf). Maximum no. of galls per leaf were recorded during the rainy and post rainy seasons of the year (August-November, Fig.4) The correlation coefficient of weather parameters viz.

Table 1 : Infestation (%) of branches and leaves along with gall intensity of *Alstonia scholaris* R.Brown by psyllid, *P. tuberculatum* during the study period (2016-17) at Bhubaneswar

Month	Mean percentage* branch infestation \pm SD	Range value percentage	Mid value	**Mean percentage leaf infestation \pm SD	Range value percentag e	Mid value	Gall intensity ***Mean \pm SD
OCT I(2016)	85.65 \pm 0.89	75.00 \pm 88.89	81.95	87.07 \pm 0.95	83.33	93.28 \pm 88.31	65.6 \pm 1.52
OCT II(2016)	85.41 \pm 0.88	82.35 \pm 90.00	86.18	88.74 \pm 0.93	81.23	94.96 \pm 88.10	67.2 \pm 1.48
NOV I(2016)	84.34 \pm 0.97	78.13 \pm 88.89	83.51	88.03 \pm 1.26	81.23	94.41 \pm 87.82	53.8 \pm 2.28
NOV II(2016)	81.38 \pm 0.96	70.27 \pm 86.11	78.19	83.23 \pm 1.18	72.07	88.57 \pm 80.32	53.4 \pm 1.14
DEC I(2016)	73.97 \pm 1.52	64.29 \pm 80.56	72.43	79.54 \pm 1.02	70.04	83.58 \pm 76.81	57.2 \pm 0.84
DEC II(2016)	68.52 \pm 1.44	60.50 \pm 78.95	69.73	78.77 \pm 1.03	75.35	83.23 \pm 79.29	55.8 \pm 1.10
JAN I(2017)	60.92 \pm 1.62	50.02 \pm 66.67	58.35	75.46 \pm 1.22	75.25	83.69 \pm 79.47	34.2 \pm 1.92
JAN II(2017)	58.42 \pm 1.54	46.45 \pm 71.88	59.17	73.45 \pm 1.19	65.06	83.67 \pm 74.37	32.4 \pm 1.67
FEB I(2017)	56.45 \pm 1.69	46.43 \pm 71.89	59.16	67.05 \pm 1.11	64.48	78.45 \pm 71.47	31.4 \pm 1.67
FEB II(2017)	56.57 \pm 1.58	42.84 \pm 70.53	56.69	66.45 \pm 1.13	60.18	73.47 \pm 66.83	31.0 \pm 1.41
MAR I(2017)	55.23 \pm 1.72	42.89 \pm 70.56	56.73	67.00 \pm 1.22	58.05	74.34 \pm 66.2	24.0 \pm 1.00
MAR II(2017)	55.34 \pm 1.64	46.43 \pm 70.59	58.51	70.45 \pm 1.25	58.77	75.89 \pm 67.33	23.4 \pm 1.52
APR I(2017)	57.32 \pm 1.57	46.43 \pm 67.65	57.04	71.34 \pm 1.39	60.33	76.31 \pm 68.32	20.4 \pm 1.52
APR II(2017)	57.54 \pm 1.53	48.45 \pm 70.43	59.44	73.34 \pm 1.42	62.21	72.34 \pm 67.28	20.2 \pm 1.92
MAY I(2017)	66.72 \pm 1.64	60.03 \pm 75.23	67.63	73.45 \pm 1.12	64.42	72.14 \pm 68.28	17.8 \pm 0.84
MAY II(2017)	77.99 \pm 1.58	62.55 \pm 80.23	71.39	73.87 \pm 1.15	64.58	74.32 \pm 69.45	13.4 \pm 1.14
JUNE I(2017)	71.69 \pm 2.03	62.64 \pm 82.14	72.39	74.65 \pm 1.04	65.09	74.81 \pm 69.95	32.4 \pm 1.82
JUNE II(2017)	76.42 \pm 1.89	65.03 \pm 83.24	74.14	75.78 \pm 1.12	66.31	76.32 \pm 71.32	31.4 \pm 0.55
JULY I(2017)	78.07 \pm 0.96	71.34 \pm 83.45	77.4	77.56 \pm 0.74	75.05	84.58 \pm 79.82	39.6 \pm 1.67
JULY II(2017)	80.83 \pm 0.89	75.04 \pm 85.34	80.19	79.54 \pm 0.82	75.23	84.63 \pm 79.93	36.8 \pm 0.84
AUG I(2017)	81.36 \pm 0.83	75.36 \pm 85.65	80.51	80.02 \pm 0.70	75.76	84.85 \pm 80.31	44.8 \pm 1.10
AUG II(2017)	81.63 \pm 0.88	75.45 \pm 86.34	80.9	82.45 \pm 0.75	75.63	86.92 \pm 81.28	45.0 \pm 1.58
SEPT I(2017)	82.23 \pm 1.06	76.34 \pm 88.03	82.19	85.65 \pm 0.79	79.87	86.94 \pm 83.41	54.4 \pm 1.34
SEPT II(2017)	82.25 \pm 1.03	77.04 \pm 88.21	82.63	85.76 \pm 0.81	80.76	91.27 \pm 86.02	57.8 \pm 0.84

I-First fortnight, II- Second fortnight *Each figure is the mean of observation from 10 plants \pm SD; ** Each figure is the mean of observation of leaves of 1 m² area from ten selected plants \pm SD; ***Each figure is mean of observations of all the five plants \pm SD

Table-2 : Correlation coefficient (r) of different weather parameters with several infestation characters due to *P. tuberculatum* in *Alstonia scholaris* at Bhubaneswar during the study period (2016-17)

Infestation characters→ Weather paramaters↓	% branch infestation	% leaf infestation	Gall intensity
T _{max} (in °C)	-0.22767 NS	-0.43963 NS	-0.34497 NS
T _{min} (in °C)	0.36220 NS	0.13796 NS	0.40373 NS
Rainfall (mm)	0.65434**	0.48193**	0.74108 **
RH (%) (7 hr)	0.07062 NS	0.12713 NS	0.35844 NS
RH (%) (14 hr)	0.79117**	0.73524**	0.95065**
BSH(hr)	-0.56414 NS	-0.48137 NS	-0.69221 NS

*Significant at 5% level, **Significant at 1% level, NS-Non significant

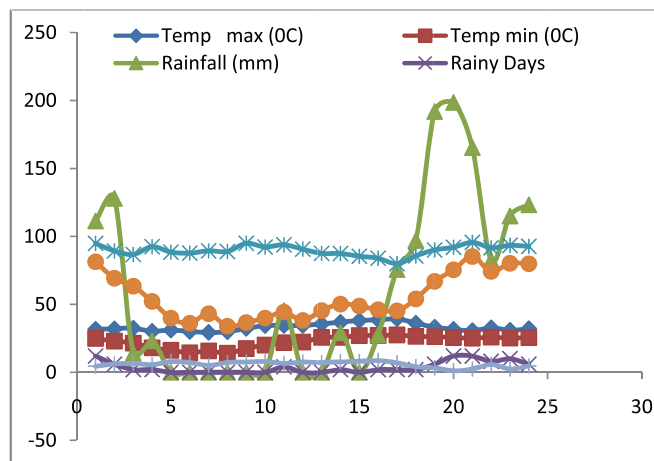


Fig.1. Weather parameters during the study period (2016-17)

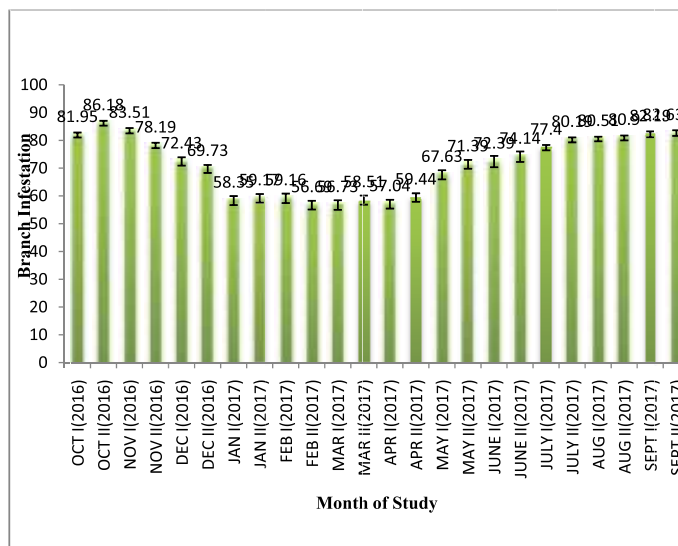


Fig.2. Branch infestation % by *P. tuberculatum* on *Alstonia scholaris*

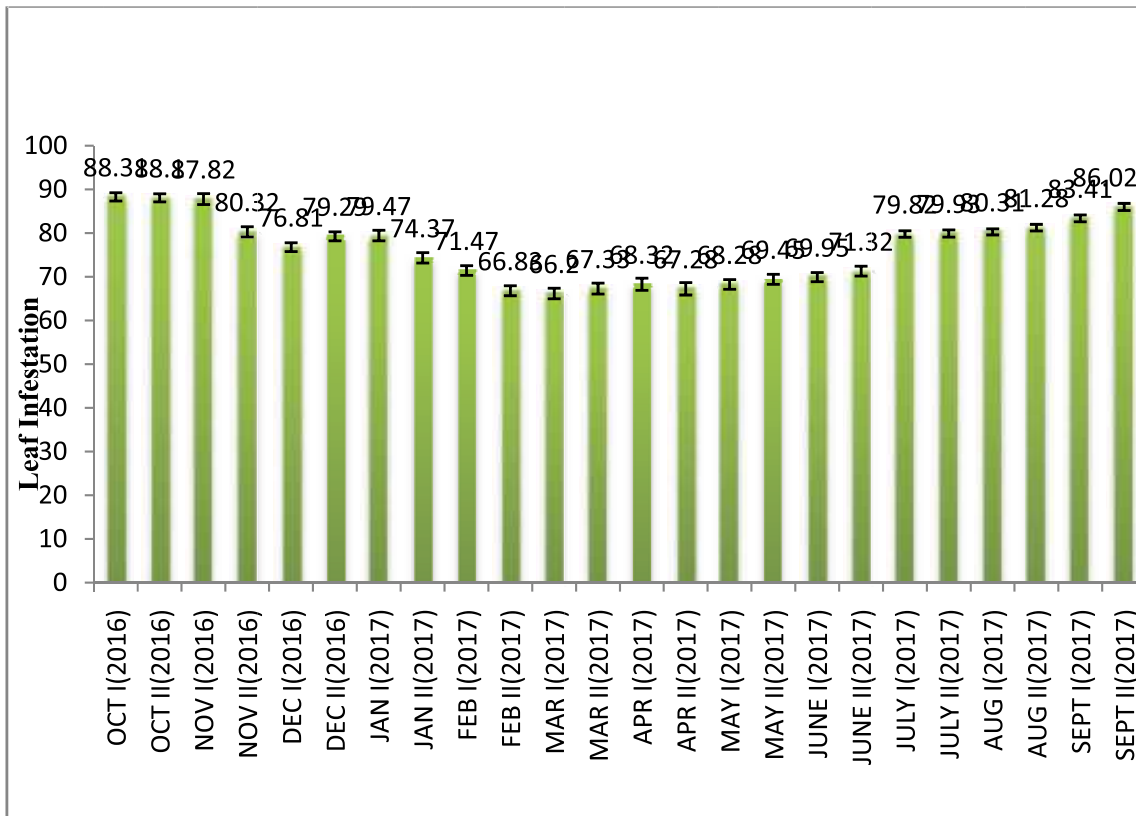


Fig. 3. Leaf infestation % by *P. tuberculatum* on *Alstonia scholaris*

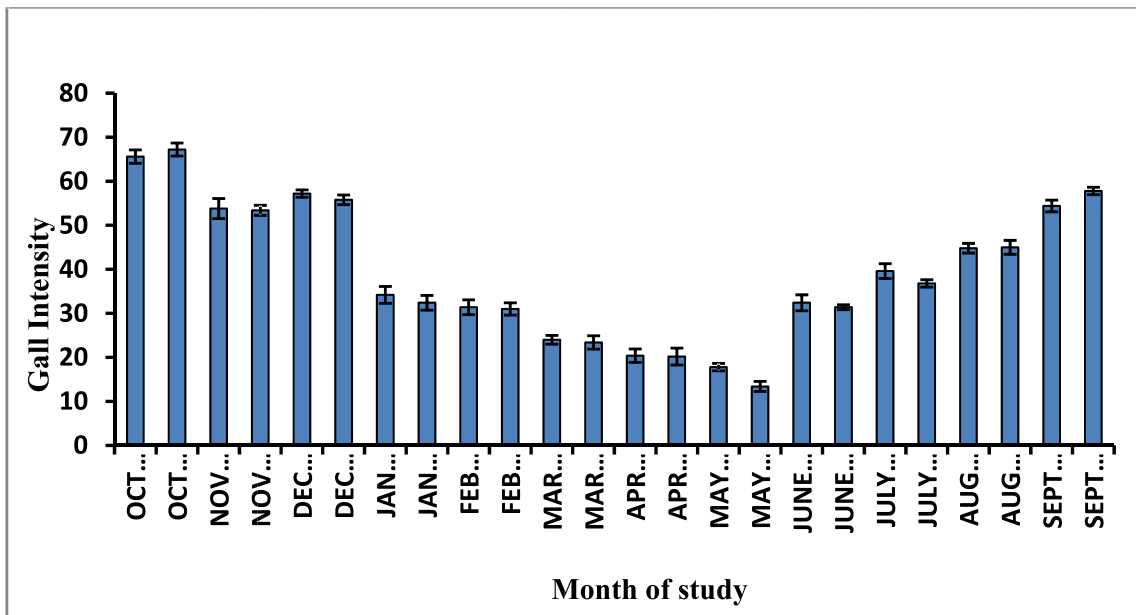


Fig.4. Gall Intensity (no. of galls/leaf) of *Alstonia scholaris* caused by *P. tuberculatum*



A



B



C



D



E



F

Plate. 1. A & B: Leaf Infestation; C & D: Adult Male (smaller) and Female (bigger); E: Eggs laid at leaf edges; F: Bursted stem galls

temperature, RH (%), rainfall, basic sunshine hours with mean per cent branch infestation, percentage leaf infestation, gall intensity (no. of galls/leaf), of *A. scholaris* were computed and presented in Table 2. The value of correlation coefficient between rainfall and all the infestation characters i.e. percentage branch infestation, percentage leaf infestation, Gall intensity (no. of galls/leaf), were positive and statistically significant both at 5% and 1% level of significance. There was a positive and significant correlation (both at 5% and 1%) found between percent RH with all the infestation parameters. A negative but significant correlation was found between mean maximum temperature and basic sunshine hour (BSH) with all the infestation characters as mentioned above.

The plant *Alstonia scholaris* was infested by the psyllid, *P. tuberculatum* throughout the experimental period (2016-17) at Bhubaneswar condition. Highest branch infestation (86.18%) was recorded during the month of October, 2016 and lowest during April, 2017 (57.04%). The infestation was maximum during rainy season of the year and minimum infestations were experienced during summer periods. The leaf infestation was highest in October, 2016 (88.31%) and lowest infestation was recorded in March, 2017 (66.20%). As observed during study the upper canopy of large plants were not infested by the psyllid galls. The leaf infestation varied with different seasons and in rainy season (August-October, 2017) the infestation was more than that observed during summer and winter season of the same observation year. Leaf infestation, adult male, egg etc of the insect are given in plate 1.

The gall intensity also followed the same trend with minimum during both the fortnights of May of the study period. Prevalence of high temperature coupled with low relative humidity prevailed during that periods may be attributed to those characters. McFarland and Hoy 2001 viewed that survivorship of Asian citrus psyllid is best at humidity above 53%. This psyllid doesn't undergo diapause during winter but density is decreased

due to lack of suitable nutrients in form of availability of new flushing foliages. Hodkinson 1983 also reported that generation of tropical species of psyllid was continuous with growth rate governed by climate and host plant condition which is in agreement with present finding. Tropical species viz. *Diphorina citri* are reported to pass 10 generations per annum, (Hodkinson 1974). Here, we have also observed the psyllid incidence throughout the year. This finding contradicts the finding of Dhar (2017) who reported that higher gall intensity of 52.30 no of galls per leaf during August, highest emergence of psyllid per leaf 81% was also reported during August, 2017 at Jammu Kashmir of India. The same author opined that temperature is an important abiotic factor for propagation of infestation, besides influence of light and relative humidity was also seen.

The causal plant parasitic psyllid *P. tuberculatum*, being a small, soft and succulent insect, belongs to order Hemiptera; Psylloidea and activity is much reduced during summer season because of prevalent high temperature coupled with low RH. Being a small insect its habit is to remain confined to the lower branches nearer to ground level and thus pole sized plants, seedlings, and regenerated plants are infested to maximum extent by this pest although it is location specific. Increased level of defense due to biochemical secretions in matured plants may inhibit the oviposition capacity. Our findings pertaining to galling intensity and damage incidence also corroborate the findings of workers like Jain and Dhiman (2014) who reported the same trends in both the infestation characters in Western UP conditions. Literature pertaining to seasonal incidence of *P. tuberculatum* is quite meager as report is only available on gall morphology, histology or biochemical changes in the host infested by this pest inside India. However, like other species of gall making psyllids, it is having very narrow host range like *Alstonia* and Pumpkin only.

Jain and Dhiman (2014) reported that *P. tuberculatum* appear in late March and oviposit on leaves or gall formation increases from late April onwards in Western UP condition which is in disagreement with these findings. Singh (2016) from Punjab reported the higher emergence of adults from galls during July, 2015 and significantly lower no. was emerged during the month of February, 2016. Monsoon onset is late in Punjab situation in comparison to Odisha and climatic conditions prevailed there may be responsible for this which is also in agreement with Singh (2016). Prevalence of lower temperature coupled with lack of adequate fresh succulent leaves at BBSR may be the reason for this. No work has been cited anywhere regarding the correlation of climatic factors with infestation parameters. However, Singh (2016) from Punjab has worked out correlation between galls on leaves with climatic factors like minimum temperature, maximum temperature and rainfall which was reported as positive. Hence, it can be suggested from the present experiment that Maximum percentage branch infestation in this plant is seen during the month of October in 2nd fortnight (86.18 %) and that of leaf was in 1st fortnight of October (88.31%) where as maximum gall intensity in Bhubaneswar condition is during 1st fortnight of October (65.6 no. of galls per leaf).

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