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Status of bondar nesting whitefly (*Paraleyrodes bondari* Peracchi) on coconut in Konkan region of Maharashtra

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ABSTRACT: Roving surveys for coconut Bondar nesting whitefly (BNW), *Paraleyrodes bondari* Peracchi were carried out in at monthly interval in Ratnagiri District of Maharashtra during 2022 to 2024 and incidence and intensity of BNW was worked out. The observations revealed that April month had the maximum incidence (19.8%), intensity (18.6%) and live colonies (32.1) of bondar nesting whitefly whereas minimum incidence (5.4%), intensity (2.6%) and live colonies (8.43) were observed during July. It was inferred that the infestation of BNW increased after rainy season and attend peak during November-October and April-May during high temperature. The maximum temperature was positively significant correlated with incidence, intensity and no. of live colonies/leaflet of BNW. However, rainfall and relative humidity (morning and afternoon) was negatively significant correlated with incidence, intensity and no. of live colonies/leaflet of BNW. The minimum temperature was negative correlated with incidence, intensity and no. of live colonies/leaflet of BNW.

Keywords: Bondar whitefly, coconut, Maharashtra, population dynamics

INTRODUCTION

Coconut is an important plantation crop in the southern and coastal states. It occupied 43,320 hector area in Maharashtra and 22,750 hector area in the Konkan region of Maharashtra. It is the most versatile tree crop cultivated in the tropics providing livelihood and employment securities to the rural region. The agricultural economy of India is vulnerable to the threat posed from the introduction of exotic pests/diseases. Mandal (2011) listed 116 exotic insect species in India. Among the insect pests, exotic whiteflies have invaded several countries causing direct losses in agriculture, horticulture and forestry. Currently, there are 442 species of whiteflies belonging to 63 genera known from India; of these, a few are economically important (Karthick *et al*., 2018). The presence of Rugose Spiraling Whitefly (RSW), *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) in India in coconut plantations was reported across Kerala, Tamil Nadu, Karnataka, and Andhra Pradesh States in 2016-2017 (Shanas *et al.,* 2016, Sundararaj and Selvaraj, 2017). Yield losses of up to 45 per cent were reported (Kalidas, 2019).

In recent years, an invasive whitefly, Bondar's nesting whitefly (*Paraleyrodes bondari* Peracchi) found in coexist with *A. rugioperculatus* feeding exclusively on coconut leaflets. In India it was reported for the first time, from Kayamkulam, Kerala (Joseph Rajkumar *et al*., 2019). The occurrence of egg clusters at creamy yellow nymphs with prominent Bre glass strands from the dorsum and single thick flagellum, characteristic nest-like woolly wax around the pupa. Adults are smaller in size (0.95 mm) than the rugose whitefly with conspicuous oblique grey bands forming a typical "X" pattern and construct unique woolly wax nests (hence the name nesting whitefly) on palm leaflets' abaxial surface (Joseph Rajkumar *et al*., 2019). The adaptation trait of the whiteflies to changing climate and to the new host is the key factor in their spatiotemporal distribution. The polyphagous nature of the non-native BNW warrants stringent quarantine protocols to prevent its further spread to other coconut growing areas. The nesting whitefly population was observed to increase phenomenally on oil palm during 2021 to 2022, a 100 per cent palm infestation was observed (Chalapati *et al*., 2023). The occurrence, diversity, and how this is impacted by host and variety variability, geographical dispersion, and environmental variability of whiteflies in India are unknown. Because this is a relatively new whitefly species. Hence, present studies were conducted to study the severity of its infestations, impact on coconut

cultivation and relation to weather factors in Konkan region of Maharashtra.

MATERIALS AND METHODS

Studies on surveillance and assessment of bondar nesting whitefly, *P. bondari* on coconut were carried out at All india Coordinated Project (AICRP) on Plantation Crops, Regional Coconut Research Station, Bhatye in the District of Ratnagiri in Maharashtra, India during 2022 to 2024. Roving survey were undertaken in three coconut gardens at monthly interval. Four-to-six-year aged coconut five palms in each location were selected for recording the observations. Per cent incidence of BNW on leaves /palms was calculated by recording number of leaves infested by BNW/total leaf per palm x100. Per cent intensity of pest damage from three pest infested leaves per palm from the outer/middle whorl representing three directions (no. of leaflets infested by BNW/total leaflets per leaf). Four leaflets from each observed sample leaf (total of 4 leaflet/palm (20 leaflets/plot) were collected and brought to laboratory for assessment of live colonies *viz.,* eggs, nymphs, adults and natural enemies like spiders and predators. The generated data were subjected for statistical analysis.

The severity of infestation was categorized as below.

- High >20 live BNW colonies/leaflet (Grade 3)
- Medium10-20 live BNW colonies/leaflet (Grade 2)
- Low < 10 live BNW colonies/leaflet (Grade1)
- No colony (Grade 0)

RESULTS AND DISCUSSION

The data presented in Table 1 indicated that the incidence of bondar nesting whitefly (BNW) was noticed in the range of 6.50 to 24.6 per cent. However, intensity of BNW was recorded 2.30 to 12.3 per cent from January to December 2022. The maximum incidence and intensity of BNW were recorded 24.6 and 12.3 per cent, respectively in April 2022 and December 2022, respectively. Whereas minimum incidence (6.50%) and intensity (2.30%) was observed in July 2022. The highest live population of BNW (33.7 nos.) was found in November 2022. Whereas, lowest was observed in July 2022. The low grade index was observed during the year. The average BNW pest records *viz.,* incidence, intensity, grade index and no. of live colonies were recorded 17.3, 7.27, 0.58 and 16.5/leaflet, respectively. The mean population of natural enemies like spiders and predators was noticed 0.55 and 0.20 per leaflet during the period.

The incidence of bondar nesting whitefly (BNW) was noticed in the range of 4.83 to 18.1 per cent (Table 2). The intensity of BNW was recorded 3.59 to 21.6 per cent between January and December 2023. The maximum incidence and intensity of BNW were observed 18.1 and 21.6 per cent in March 2023, respectively. The least

Table 1. Extent of infestation of Bondar Nesting whitefly (BNW) in coconut and their natural enemies (2022)

Month	Incidence (%)	Intensity (%)	Grade Index	No. of live colonies/leaflet	Natural Enemies
January	16.6	7.38	0.53	13.7	0.93
February	18.2	8.00	0.52	14.4	0.46
March	15.3	6.72	0.53	13.3	0.40
April	24.6	10.2	0.63	17.0	0.33
May	14.4	5.74	0.52	17.2	0.20
June	14.4	6.01	0.37	11.6	0.46
July	6.50	2.30	0.35	9.60	0.80
August	24.0	5.48	0.58	11.9	0.53
September	19.4	5.25	0.55	13.3	0.67
October	21.4	5.62	0.70	18.4	0.73
November	17.3	12.2	0.92	33.7	0.60
December	16.1	12.3	0.70	24.2	0.47
Mean ± SE	17.3 ± 1.46	7.27 ± 0.90	0.58 ± 0.05	16.5 ± 2.0	0.55 ± 0.06

Table 2. Extent of infestation of Bondar Nesting whitefly (BNW) in coconut and their natural enemies (2023)

Month	Incidence (%)	Intensity (%)	Grade Index	No. of live colonies *	Natural Enemies **
January	16.9	20.7	1.11	38.8	1.13
February	17.7	21.2	1.25	41.7	0.93
March	18.1	21.6	1.30	43.6	1.20
April	17.0	19.4	0.86	32.2	0.86
May	15.9	18.4	0.81	30.8	0.73
June	13.9	16.4	0.75	28.3	0.60
July	5.64	3.69	0.35	10.8	0.40
August	4.83	3.59	0.30	9.40	0.40
September	5.64	3.86	0.35	12.2	0.40
October	7.2	6.61	0.45	16.5	0.40
November	16.2	20.2	0.98	31.1	0.40
December	14.7	15.4	0.94	27.6	0.33
Mean ± SE	12.8 ± 1.6	14.3 ± 2.3	0.8 ± 0.1	26.9 ± 3.6	0.6 ± 0.1

*Live colony/ four leaflets /palm; **Natural enemies/ four leaflets/ palm

intensity (3.59%) and incidence (4.83%) was observed in August 2023. The medium grade index was observed during January to Manch months 2023 and rests of the months noticed low grade index. The maximum live colonies of BNW (43.6 nos.) were recorded in March 2023. Whereas, lowest (9.40 nos.) was found in August 2023. The average BNW pest records viz., incidence, intensity, grade index and no. of live colonies were recorded 12.8, 14.3, 0.80 and 26.9/four leaflet, respectively. The mean population of natural enemies like spiders and predators ranged from 0.2 to 0.93 per four leaflets.

The data presented in Table 3 indicated that the incidence of bondar nesting whitefly (BNW) was noticed in the range of 2.44 to 17.9 per cent. However, intensity of BNW was recorded 1.84 to 26.1 per cent from January to December 2024. The maximum incidence and intensity of BNW were recorded 17.9 and 26.1 per cent in April 2024, respectively. Whereas minimum incidence (2.44%) and intensity (1.84%) was observed in August 2024. The low grade index was observed during the year except April 2024 which recorded medium grade index (1.18). The maximum live colonies of BNW (47.2 nos.) were observed in April 2024. Whereas minimum (4.10 nos.) was noticed in August 2024. The average BNW pest records viz., incidence, intensity, grade index and no. of live colonies were recorded 10.5, 11.9, 0.65 and 22.5/four leaflet, respectively. The mean population of natural enemies like spiders and predators varied from 0.4 to 1.13 per four leaflets during the period.

Plate 1. Eggs of Bondar nesting whitefly

Plate 2. Pupa of Bondar nesting whitefly

Plate 3. Nymph of Bondar nesting whitefly

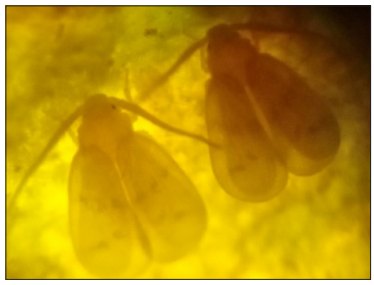

Plate 4. Live colony of Bondar nesting whitefly

Plate 5. Incidence of Bondar nesting whitefly (BNW) on coconut

Table 3. Extent of infestation of Bondar Nesting whitefly (BNW) and its natural enemies in coconut (2024)

Month	Incidence (%)	Intensity (%)	Grade Index	No. of live colonies *	Natural Enemies **
January	14.9	21.5	0.85	29.0	0.50
February	12.4	18.4	0.78	27.4	0.40
March	15.8	22.5	0.98	36.8	0.60
April	17.9	26.1	1.18	47.2	0.80
May	12.2	13.7	0.70	22.9	0.50
June	8.30	5.29	0.53	17.0	0.20
July	3.91	1.92	0.20	4.90	0.10
August	2.44	1.84	0.18	4.10	0.10
September	6.29	4.85	0.38	11.1	0.20
October	9.81	8.24	0.60	18.2	0.20
November	10.9	8.90	0.63	22.4	0.30
December	11.7	9.93	0.80	29.7	0.30
Mean ± SE	10.5 ± 1.4	11.9 ± 2.5	0.65 ± 0.09	22.5 ± 3.8	0.35 ± 0.06

*Live colony/ four leaflets /palm; **Natural enemies/ four leaflets/ palm

Overall data during 2022-24 depicted in Table 4 revealed that the maximum incidence (19.8%), intensity (18.6%) and live colonies of BNW (32.1) of bondar nesting whitefly were recorded in April month. Whereas, minimum incidence (5.4%), intensity (2.6%) and live colonies of BNW (8.43) were observed in July month on lower leaves of dwarf varieties of coconut. It was also noticed that the infestation of BNW increased after rainy season. and attend peak during November-October and April-May in high temperature. Wankhede *et al.* (2021) found that the indicated that the incidence (31.9%) and intensity (18.1%) of RSW had increased during the rainy season. Sundararaj and Selvaraj (2017) were observed the infestation was very severe on lower leaves as compared to that of the middle and upper young leaves in dwarf and hybrid coconut palm which are about four to six years old. Its infestation increased after over of rainy season were recorded 12.8 and 6.8 per cent, respectively in October. Later on, its increasing trends showed up to December, which noticed 14.2 and 12.5 per cent, respectively. Srinivasan *et al.* (2016) reported that prolonged dry spell during June to September 2016, after deficit rainfall (69 %) coupled with decreased relative humidity seem to favour the spread of the pest in coconut plantations of Pollachi tract of Tamil Nadu, India. January onwards, its populations was initiated and after that it gradually declined. In the month of April its populations attained a major peak (Incidence 19.8% and Intensity 18.6%) with increased of temperature. Bondar nesting whitefly live population was noticed maximum in the month of April (32.1 nos.). Whereas the lowest population was recorded in July (8.43 nos.). Spiders and

Table 4. Overall mean infestation of coconut BNW and its correlation with weather factors during 2022-24

Month	Incidence of BNW (%)	Intensity of BNW (%)	No. of live colonies/ leaflet	Max. Temperature (°C)	Min. Temperature (°C)	Morning Humidity (%0)	Evening Humidity (%0)	Rainfall (mm)
January	16.1	16.5	27.1	31.6	19.0	72.0	55.8	9.4
February	16.1	15.9	27.8	33.3	19.2	64.7	55.3	0.0
March	16.4	16.9	31.2	33.8	22.5	64.8	57.2	0.0
April	19.8	18.6	32.1	33.6	24.8	73.4	63.1	2.1
May	14.2	12.6	23.6	33.8	26.3	72.3	66.2	24.3
June	12.2	9.2	18.9	31.9	25.5	83.8	77.2	779.2
July	5.4	2.6	8.43	29.0	24.6	89.5	87.3	1341.2
August	10.4	3.6	8.47	29.8	24.7	87.5	82.4	567.5
September	10.4	4.7	12.2	31.0	24.8	88.0	80.2	338.8
October	12.8	6.8	17.7	32.5	23.9	81.5	74.9	209.9
November	14.8	13.8	29.0	35.2	23.3	62.0	58.6	11.8
December	14.2	12.5	27.1	34.0	21.4	63.8	57.3	0.0
Correlation Coefficient (r)								
mx t	0.769	0.761	0.869					
min t	-0.380	-0.495	-0.461					
mh	-0.743	-0.842	-0.904					
eh	-0.842	-0.921	-0.937					
rain	-0.864	-0.771	-0.800					
R-Value		0.68						

predators were observed maximum during April, and their population were increased after October onwards. The data is confirmed with the finding of Wankhede *et al.* (2021). Mondal *et al*. (2020) revealed a high population of Neuropteran predators, few parasitoids and some Phytoseiid mites as natural enemies for the rugose spiralling whitefly in coconut. A similar observation on the concomitant occurrence of RSW and nesting whiteflies was reported by previous researchers on coconut from Southern parts of India (Chandrika *et al*., 2017; Vidya *et al*., 2019). The feeding damage of BNW has lesser than RSW with minimum honeydew and sooty mold deposits. Suriya *et al*. (2024) conducted surveys to assess the intensity of damage caused by the *Paraleyrodes bondari* Peracchi in coconut, poses a significant threat to coconut crops, affecting both yield and overall plant health. The nesting whitefly population was observed to increase phenomenally on oil palm and within a year i.e., from 2021 to 2022, the intensity per palm increased by 24.49 per cent and per leaf increased by 63.28 per cent by Chalapati *et al*. (2023).

The maximum temperature was positively correlated with incidence, intensity and no. of live colonies/leaflet of BNW. However, rainfall was negatively correlated with incidence, intensity and no. of live colonies/ leaflet of BNW. Wankhede *et al.* (2021) observed that the maximum temperature had positive impact on the incidence and intensity of RSW. However, intensity of RSW was negatively correlated with rainfall and evening humidity. The minimum temperature was negatively correlated with incidence, intensity and no. of live colonies/leaflet of BNW.

From the results of the study, it can be cocluded that the infestation of BNW increased after rainy season and attend peak during November-October and

April-May during high temperature. The maximum temperature was positively significant correlated with incidence, intensity and no. of live colonies/leaflet of BNW. However, rainfall and relative humidity (morning and afternoon) was negatively significant correlated with incidence, intensity and no. of live colonies/leaflet of BNW.

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