Distribution and upsurge of invasive whiteflies on coconut in Odisha

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Coconut, Cocos nucifera L. is a multi-product crop and widely used as food, beverage, medicine, natural fiber, fuel, wood and raw materials for units producing a variety of goods. In India, it is grown in an area of 2.277 million hectares with a production of 535.88 million nuts and productivity of 9,430 nuts/ha. Among the leading coconut producing states in the country, Odisha is one of the major producer and the crop is cultivated in 52.84 lakh hectares as major crop with production of 397.77 million nuts. In the state, coconut productivity is about 7528 nuts per hectare and about 60 percent of the total coconut production is from the five coastal districts viz., Puri, Ganjam, Cuttack, Nayagarh and Khorda as per Ministry of Agriculture and Farmers Welfare, Government of India. The major constraints for achieving higher production and productivity of coconut in the state are frequent cyclones, prolonged dry spell, deficit rainfall and insect pest attack. Besides, coastal region of Odisha with high humidity during summer months (June to September) is highly favourable for the insect pests especially sucking pests of coconut.

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Across India, insect pest dynamism in coconut ecosystem is ever increasing which lead to diminishing palm productivity and threatening livelihood security after succession of several invasive whiteflies. During 2016, infestation of rugose spiraling whitefly (RSW), *Aleurodicus rugioperculatus* was observed on coconut palm in India (Sundararaj and Selvaraj, 2017) and warrant control measures. Subsquently, three more whitefly species viz., Bondar's nesting whitefly (BNW), Paraleyrodes bondari; nesting whitefly (NW), P. minei and palm infesting whitefly (PIW), Aleurotrachelus atratus (Sundararaj et al., 2021) invaded coconut ecosystem. All these whitefly species are high polyphagous pests and therefore, they spread very rapidly to other coconut-growing states in India. The most insidious spread of these whiteflies are mostly through transportation of infested seedlings. Keeping in view, the present study is aimed to document and assess the range of invasion in Odisha, expansion of host plants, patterns of co-occurrence, damage caused and the natural enemies of the species of invasive whiteflies to develop a sustainable management strategy.

Survey and identification

Intensive surveys were conducted across the state covering districts of Gajapati, Khorda, Puri, Cuttack, Koraput, Koenjhar, Sundargarh, Deogarh, Mayurbhanj, Angul, Sambalpur, Kendrapara, Jajapur and Dhenkanal in Odisha during October - November, 2024, to investigate the species diversity, distribution, intensity of infestation and their natural enemies in Odisha. Surveys were

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Fig. 1. Damage symptoms of invasive whiteflies on coconut in across Odisha

focused on coconut plantation in both rural and urban areas, road side garden and household areas in various locations of Odisha. To study the species diversity and distribution of invasive whiteflies of coconut, atleast 5–10 locations were selected randomly in each district for sampling. Pest occurrence was recorded in each location and their damage was categorized into different grades by visual observation on all the active /live life stages. Further, infested coconut leaves were collected for further identification and documentation of natural parasitism.

Similarly, the coexistence pattern of these invasives in coconut was observed at each location, recorded the insect communities and dominant species location wise wherever coexistence was noticed. Assessment of parasitism (%) was determined based on the number of puparium parasitized versus un-parasitized pupae at each location and mean natural parasitism was determined district-wise.

Species diversity of invasive whiteflies

Study revealed the occurrence of invasive whiteflies viz., rugose spiraling whitefly, Aleurodicus rugioperculatus and Bondar's nesting whitefly, Paraleyrodes bondari across the surveyed locations in Odisha (Fig.1). Although, RSW invaded into India during late 2016 at Pollachi, Tamil Nadu (Sundararaj and Selvaraj, 2027), the occurrence in Odisha

Table 1. Infestation of invasive whiteflies on coconut and their natural parasitism in Odisha				
Location	District	Infestation level		Natural Parasitisation (%)
		Rugose spiraling whitefly	Bondari nesting whitefly	Rugose spiraling whitefly
Koraput	Koraput	High	Low	-
Garabanda	Gajapati	-	High	
Turumunga	Kendujhar	High	Low	80%
Karanjia	Mayurbhanj	High	Low	-
Handapa	Angul	No	High	-
Banapur	Khordha	No	High	-
Balugaon	Khordha	High	Very low	60%
Badachana	Jajpur	High	Low	20%
Bhitarkanika National Park	Kendrapara	Very high	Low	80%
Niali	Cuttack	Low	High	-
Konark	Puri	Very low	Very high	-
Pipili	Puri	Low	Very high	-

Low less than 10 live egg spirals or adults/leaflet, Medium 11–20 live egg spirals or adults/leaflet), Severe above 20 live egg spirals or adults/leaflet)

was reported during 2020. The RSW infestation is easily identified based on the spiral pattern of egg laying, presence of bigger size of adults and white flocculent matter coverage over the body surface. The damage was caused by both immature and adult stages congregating at the leaf's lower side (Fig.2a).

Large amounts of phloem sap drained from the plant system paramount with black fungus growth, leading to premature fall of frond, resulting in drastic effect on nut yield and productivity. Similarly, infestation of BNW was noticed across the study locations with moderate to severe (20-30 live colonies and adults/ leaflet). Initial occurrence was reported in India on coconut palms from Kerala during 2018 (Josephrajkumar et al., 2019), subsequently, expanded it's distribution very rapidly to other coconut growing states in India. Paraleyrodes bondari adults are smaller than A. rugioperculatus and it constructs nests with densely woven, irregular layer of fiberglass-like woolly wax strands. They lay yellowish stalked eggs in clusters in the woolly wax nest without wax covering (Fig.2b). Survey also revealed that occurrence of palm infesting whitefly, Aleurotrachelus atratus on coconut is still restricted in South India as it was not found in Odisha.

Fig.2. Rugose spiraling whitefly (a) and Bondars nesting whitefly (b)

Distribution and infestation in Odisha

Occurrence of rugose spiraling whitefly and Bondar's nesting whitefly across the study locations and their natural parasitism is given table 1. Study revealed that the RSW heavily ravaged the coconut

plantations of every household in the observed locations especially coastal districts. Highest incidence on coconut was observed in Chilika Lake which is the largest brackish water lagoon in Asia and Bhitarkanika which is India's second largest mangrove ecosystem. It believed that the staggered and untimely rainfall coupled with high relative humidity might cause the sudden upsurge of these invasive whiteflies especially in coastal and many interior districts of Odisha where coconut is predominantly cultivated. Invasion of these exotic species leads to abrupt outbreaks in several locations due to favourable weather condition and availability of host plants.

Economic importance of invasive whiteflies

These whiteflies are highly invasive, mobile and capable of spreading very fast from one location to another location. Available evidence suggests that new infestations have often resulted from transportations of infested plants. Invasive species pose a constant threat to agriculture and a strategic science based approach is needed to promote environmentally sustainable plant health management practices to reduce excessive reliance on chemical pesticides. Biological control through parasitoids, predators and entomopathogens constitutes a significant component in holistic management of insect pests especially invasive species. Chemical control is not practical because of the abundance of host plants and wide spread distribution. It is fortunate to note that biological control agents can readily reduce rugose spiraling whitefly and Bondars nesting whitefly populations to sub-economic numbers. Awareness, early detection of invasive species and immediate implementation of biological control methods could minimize the economic losses caused by the invasive whiteflies.

Biointensive Integrated Management strategies

1. Continuous monitoring on pest and natural enemies in the field on different host plants.
2. Avoid transportation of infested coconut seedling or any other ornamental host plants from pest infested areas.
3. Install yellow sticky traps @ 15 /ha for monitoring the pest population.
4. Apply water forcefully along with sticker if water is available in plenty.
5. Avoid excess irrigation and nitrogenous fertilizers, apply/ follow only recommended dose and maintain palm health.
6. Periodic release of predator, Apertochrysa (=Psudomallada) astur @ 1000 eggs/ha at 15 days interval.
7. Re-distribution of parasitoid, Encarsia guadeloupae to the affected areas for the management of A. rugioperculatus.
8. Pesticide holiday declare and application of unwarranted insecticides may be avoided to enhance the natural parasitism.
9. Conserve /encourage natural build up of E. guadeloupae through providing reservoir plants/ banker plants like banana and Canna indica which protect them from the pesticides and unfavourable weather factors.
10. In undisturbed gardens, natural parasitism is also increased phenomenally over the period of time through breeding, favorable weather conditions and perennial nature of palms.
11. Foliar application (two sprays) of entomopathogenic fungus, Cordyceps (=Isaria) fumosorosea @ 2 x 108 cfu/g (5 g/litre of water) in 15 days intervals.
12. Under severe outbreak and absence of natural parasitism, neem oil (0.02%) may be applied.
13. Awareness programmes on the natural build-up of the parasitoid E. guadeloupae is to be conducted in all epidemic zones to sensitize the farming community.
14. Community based approach warranted for the effective management of these invasive pests in coconut. ■

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