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A BRIEF OVERVIEW ON RUGOSE SPIRALLING WHITEFLY (*ALEURODICUS RUGIOPERCULATUS* M.) AND IT'S BIOLOGICAL MANAGEMENT

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ABSTRACT

India's reliance on agriculture and globalization-driven trade has led to the unintentional import of various plant species, diseases, and insect pests, despite strict quarantine measures. These invasive species pose a significant threat to the nation's biodiversity and biosecurity by outcompeting native species due to the absence of natural enemies in the new environment. Pests like Leptocybe invasa, Phenacoccus solenopsis, and Aceria guerreronis have already invaded India. The Rugose spiraling whitefly (RSW), Aleurodicus rugioperculatus, first reported in Kerala in 2016, has spread across southern India, harming plants like coconuts and mangoes and encouraging sooty mold growth.

KEYWORDS: Biological management, Insect pest, Invasive species, Polyphagous, Sooty mold

INTRODUCTION

India's economy is primarily focused on the agriculture sector, which employs 50% of the labour force and accounts for 18% of the nation's GDP. The population of our nation is largely fed by agriculture. Due to low agricultural productivity and production, India experienced a severe food scarcity in the early years of its independence. However, since the start of the green revolution, everything has completely altered. The green revolution's objective was to boost food grain production by using innovative technologies to raise the output of food grain crops per hectare. The agriculture industry has benefited greatly from this adaptation (Joshi, 1999). The per-hectare yield of several agricultural and horticultural crops has improved since HYVs were introduced in the 1960s. Subsequently, the yield of cereals, pulses, vegetables, fruits, and milk per hectare in India has increased significantly. Horticultural crop production reached a peak in 2014–15, reaching 86283 metric tons from 65587 metric tons in 2007–2008 (Anonymous, 2018). The years 1990–1992 saw economic reforms pave the way for globalization, which boosted commerce in goods, particularly agricultural products, seeds, and planting materials. This increased trade

raised concerns about the biosecurity of foreign pests entering India. The primary factors to be taken into account when managing biosecurity risks are globalization, the growing demand for food production, the adoption of new technologies, the legal obligations for signatories to pertinent international agreements, the flow of individuals across borders increasing the incidence of pests and diseases worldwide, the reliance of some countries on food import/export, and movement of people across borders. Several plant, insect, and pathogen species have been introduced to new areas as a result of the unrestricted commerce and movement of plant materials across national and geographic borders. The term "alien species" refers to such non-native species. Non-native or exotic creatures that exist outside of their naturally occurring, appropriate habitat and dispersal potential are known as alien species. Our agricultural and forestry systems rely heavily on a substantial amount of alien species. However, some alien species exhibit the ability to establish, invade, and outcompete native species in new places when they are accidentally introduced outside of their usual habitats. This is when they are considered invasive. When these species proliferate rapidly and harm economically significant plant species and crop plants, they become invasive because they lack the natural enemies that keep them in check within their original habitat. As an illustration, consider the invasion by the coconut eriophyid mite Aceria guerreronis, the mealy bug Phenacoccus solenopsis in cotton, the mealybug *Paracoccus marginatus* in papaya, and the Leptocybe invasa and rugose spiralling whiteflies (Ananthakrishnan, 2009) Aleurodicus rugioperculatus Martin (Hemiptera: Alleyrodidae). Spodoptera frugiperda (J.E. Smith), often known as the fall armyworm, has been detected in Karnataka's maize fields recently (Ganiger et al., 2018). These invasive species are extensively dispersed throughout the planet and encompass all classes of living things in all types of environments. However, in terrestrial ecosystems, the most prevalent alien species are plants, animals, and insects.

ORIGIN AND DISTRIBUTION

In 2009, rugose spiralling whiteflies were first reported as pests in Miami-Dade County, Florida, affecting gumbo limbo trees (Bursera simaruba). However, the species was first documented in Belize in 2004, identified as coconut plants. Its distribution is primarily in Central and North America, including Belize, Mexico, Guatemala, and the United States, likely originating from Central America. After its discovery in Florida, the pest spread to 22 countries across Central and South America. In India, the whitefly was first detected in 2016 in Kerala and Tamil Nadu, affecting coconut, mango, and guava trees, later spreading to Andhra Pradesh.

Table 1: Overview of certain pest alien insects that are invasive

SCIENTIFIC NAME	COMMON NAME	INTRODUCE FROM	YEAR OF INTRODUCTION	HOST PLANTS
Eriosoma lanigerum	Woolly apple aphid	China	1889	Primarily apple and pea.
Quadraspidiotus Perniciousus	San Jose scale	China	1911	*Populus spp.; Salix spp.; Aesculus spp.; Alnus spp.; Betula spp.; Celtis spp.; Fagus spp.*
Orthezia insignis	Lantana bug	Sri Lanka; West Indies	1915	Mainly lantana, Coffee, Jacaranda, Citrus, Sweet potato, Gumwood, Brinjal, Rose etc.
Icerya purchasi	Cottony cushion scale	_	1921	*Acacia decurrens*; A. *dealbata* in addition to numerous other forestry and agricultural Plant species
Phthorimaea operculella	Potato tuber moth	Italy	1937	Tobacco, tomato & brinjal
Plutella xylostella	Diamondback moth	Europe	1941	Crucifers viz., cabbage, cauliflower, radish, knol khol (rabi), turnip, beetroot, mustard.
Pineus pini	Pine woolly aphid	Australia, Europe, New Zealand	1970	*Pinus* spp.*; Pinus patula*
Heteropsylla cubana	Subabul psyllid	Sri Lanka	1988	Subabul.
Liriomyza trifolii	Serpentine leaf miner	USA to Kenya & rest of the world	1990	It is a polyphagous species affecting more than 78 plant species, especially on greens, cucurbits, tomato, castor and ornamental plants (Srinivasan *et al.*, 1995).
Hypothenemus hampei	Coffee berry borer	Sri lanka	1990	Both *arabica* and *robusta* types of coffee.
Aleurodicus disperses	Spiralling whitefly	Hawaii to Sri Lanka and	1994	It is a polyphagous affecting wide range of host plants – 481 plants

Russell		India		
Quadrastichus erythrinae	Erythrina gall wasp	May be Taiwan	2006	Black Pepper
Phenacoccus solenopsis	Cotton mealybug	Central America	2008	Cotton, bhendi, tomato, potato, pomegranate, hibiscus, parthenium, etc
Leptocybe invasa	Eucalyptus gall wasp	Australia	2006	*Eucalyptus camaldulensis; E. tereticornis; E. grandis; E. deanei; E. globules; E. nitens; E.botryoides; E. saligna; E.gunnii, E. robusta; E. bridgesiana; E. viminalis.*

(Source:- Sujay *et al.*, 2010)

NATURE OF DAMAGE AND SYMPTOMS

Rugose spiraling whiteflies cause stress to plants by depleting their nutrients and water. Additionally, they produce a sticky substance called honeydew, which provides an ideal environment for the growth of sooty mold. As the honeydew dries, thick black layers of mold form on the leaves and other surfaces. This mold can disrupt photosynthesis, potentially leading to physiological issues in the host plant. Honeydew also attracts ants and wasps, which protect whiteflies from natural predators. The pest not only damages plants but also creates a mess on cars, furniture, patios, and other surfaces, often requiring professional cleaning to remove the stubborn mold.

BIOLOGICAL MANAGEMENT

Rugose spiraling whitefly (RSW), being polyphagous, poses a threat of spreading to other coconut-growing countries in the Oriental region, making its presence in India alarming. As a non-native species, it may become invasive if its natural predators or parasitoids are absent or insufficient to control its population (Duan et al., 2015). Extension entomologists must collaborate with farmers and stakeholders to raise awareness and develop rapid response strategies. A coordinated effort among coconut-growing nations is essential to contain its spread and devise appropriate management plans.

Research in Tamil Nadu (Poorani and Thanigairaj, 2017) identified *Encarsia dispersa* parasitizing *A. rugioperculatus*, though the more effective parasitoid was *Encarsia guadeloupae* (Hymenoptera: Aphelinidae), which caused 40–70% parasitism in banana and 20–60% in coconut in Tamil Nadu and

Kerala. *Encarsia dispersa* was far less prevalent, with under 5% parasitism, while *E. guadeloupae* accounted for 60–70% of total parasitism..

ENCARSIA GUADELOUPAE

The Lakshadweep's Minicoy Island is where Encarsia guadeloupae was initially discovered in 1999. It was subsequently purposefully brought to the mainland and established there (Ramani, 2000). With the help of deliberate release and colonization, these parasitoids most likely moved from the Maldives to Minicoy and other Lakshadweep islands before spreading to other parts of peninsular India (Ramani, 2000; Mani et al., 2000b). Although they had been introduced with the host, it is also possible that the parasitoids were only discovered after their numbers had grown dramatically over several years due to reproducing on the growing host population.

Female E. guadeloupae key diagnostic features include body dark brown, except the side lobes of the mesoscutum and scutellum; mid lobe mostly dark brown; axillae brown; TVII yellow or brown laterally; and third valvula pale yellow. Legs: pale yellow to white, wings hyaline, coxa behind and femur dark brown. Scutellum has two pairs of setae; axillae typically have one setae each; clava is as long as the final two segments of the funiculus; mesoscutum typically has nine pairs of setae (sometimes varies to fifteen or twenty). The basal cell of the forewing with three setae preceding the parastigma. Front and rear tarsi-5 are segmented; the mid tarsi-4 are segmented. Likewise, it has been documented that E. guadeloupae and Encarsia sp. may be parasitoids of many whiteflies, including RSW (Evans, 2008: Taravati et al., 2013; Francis et al., 2016). Moreover, Encarsia sp. (GenBank Acc. No. KY223606) was generated by amplifying, sequencing, and depositing the parasitoid's COI gene (658 kb). According to (Selvaraj et al., 2016), the percentage of parasitism varied depending on the geography, with Kerala having the highest rate of parasitism among the states surveyed.

ENCARSIA DISPERSA

An exotic parasitoid with Neotropical (New World) origins is *Encarsia dispersa* Polaszek. The names *Encarsia haitiensis* Dozier, *Encarsia* sp. nr. *haitiensis,* and occasionally *Encarsia* sp. nr. *meritoria* Gahan have been incorrectly and commonly used to refer to this species by several writers from India (Ramani *et al.,* 2002) and other places. It has been accidentally and purposefully introduced all over the world to manage the spiralling whitefly, *Aleurodicus dispersus* Russell, biologically (Polaszek *et al.,* 2004). Despite their close relationship, (Polaszek *et al.,* 1992) considered *Encarsia haitiensis*, *Encarsia* sp. nr. *haitiensis*, and *Encarsia* sp. nr. *meritoria* to be different entities. According to (Polaszek *et al.*, 2004), the original populations of E. *dispersa* that were transferred to Hawaii from Trinidad are likely the source of

the widely dispersed populations. *Encarsia dispersa* had been initially a species for both *Encarsia* that were unintentionally brought to South India in the 1990s, together with its host, A. *dispersus* and the other species E. *guadeloupae* (Ramani et al., 2002). Within two to three years, E. *guadeloupae* replaced E. *dispersa* in most of the South Indian locations where it was colonized, in what appears to be a case of competitive displacement (Ramani *et al.*, 2002; Mani *et al.*, 2004; Mani, 2010).

CONCLUSION

In conclusion, one alien pest that made its way to India is the rugose spiralling whitefly. Because it is polyphagous and challenging treatment, this insect has created a major dilemma for horticultural growers. A conscious effort was made to address every facet of this bug in our evaluation. Further research is necessary to have a better comprehension of this pest, including thorough examinations on some of its characteristics. In order to effectively combat the RSW in the field, mass multiplication strategies for parasitoids and predators must be standardized in a laboratory setting.

REFERENCES

Ananthakrishnan, T. N., and Jesudasan, R. A. (2009). Meeting Report: Invasive insects in agriculture, medicine and forestry. *Current Science*, 97(3), 300-301.

Anonymous. http://www.mospi.gov.in/statistical-yearbook-india/2017/178. 2018.

Duan, J. J., Bauer, L. S., Abell, K. J., Ulyshen, M. D., and Van Driesche, R. G. (2015). Population dynamics of an invasive forest insect and associated natural enemies in the aftermath of invasion: implications for biological control. *Journal of Applied Ecology*, 52(5), 1246-1254.

Evans, G. A. (2008). The whiteflies (Hemiptera: Aleyrodidae) of the world and their host plants and natural enemies. USDA/Animal Plant Health Inspection Service (APHIS). *Last Revised*: September 23, 2008.

Ganiger, P. C., Yeshwanth, H. M., Muralimohan, K., Vinay, N., Kumar, A. R. V., and Chandrashekara, K. J. C. S. (2018). Occurrence of the new invasive pest, fall armyworm, *Spodoptera frugiperda* (JE Smith)(Lepidoptera: Noctuidae), in the maize fields of Karnataka, India. *Current Science*, 115(4), 621-623.

Kumar, V., McKenzie, C. L., Mannion, C., Stocks, I., Smith, T., and Osborne, L. S. (2013). Rugose spiralling whitefly *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae). EENY578. *University of Florida, IFAS Extension. Available online: https://entnemdept. ufl. edu/creatures/orn/Aleurodicus_rugioperculatus. htm (accessed on 5 January 2018).*

Mani, M. (2010). Origin, introduction, distribution and management of the invasive spiralling whitefly *Aleurodicus dispersus* Russell in India. *Karnataka Journal of Agricultural Sciences*, 23(1), 59-75.

Mani, M., Dinesh, M. S., and Krishnamoorthy, A. (2000). Presence of *Encarsia* spp. on spiralling whitefly *Aleurodicus dispersus* (Russell) in Pennisular India.

Mani, M., Krishnamoorthy, A., and Venugopalan, R. (2004). Role of the aphelinidae parasitoid *Encarsia guadeloupae* in the suppression of the exotic spiralling whitefly *Aleurodicus dispersus* on banana in India. *Biocontrol Science and Technology*, 14(6), 619-622.

Polaszek, A., Evans, G. A., and Bennett, F. D. (1992). *Encarsia* parasitoids of *Bemisia tabaci* (Hymenoptera: Aphelinidae, Homoptera: Aleyrodidae): a preliminary guide to identification. *Bulletin of entomological Research*, 82(3), 375-392.

Polaszek, A., Manzari, S., and Quicke, D. L. (2004). Morphological and molecular taxonomic analysis of the Encarsia meritoria species-complex (Hymenoptera, Aphelinidae), parasitoids of whiteflies (Hemiptera, Aleyrodidae) of economic importance. Zoologica Scripta, 33(5), 403-421.

Ramani, S. (2000). Fortuitous introduction of an aphelinid parasitoid of the spiralling whitefly, Aleurodicus dispersus Russell (Homoptera: Aleyrodidae) into the Lakshadweep Islands with notes on host plants and other natural enemies.

Ramani, S., Poorani, J., and Bhumannavar, B. S. (2002). Spiralling whitefly, *Aleurodicus dispersus* in India. *Biocontrol News and Information*, 23(2), 55-62.

Selvaraj K, Sundararaj R, Venkatesan T, Ballal CR, Jalali SK, Gupta A (2016) . Potential natural enemies of the invasive rugose spiralling whitefly, *Aleurodicus rugioperculatus* Martin in India. *Journal of Biological Control*. 2016; 30(4):236-239.

Sujay, Y. H., Sattagi, H. N., and Patil, R. K. (2010). Invasive alien insects and their impact on agroecosystems. *Karnataka Journal of Agricultural Sciences*, 23(1): 26-34.

Taravati, S., Mannion, C., Glenn, H., and Osborne, L. (2013). Natural Enemies of Rugose Spiraling Whitefly, Aleurodicus rugioperculatus Martin (Insecta: Hemiptera: Aleyrodidae) in the South Florida Landscape: ENY-870/IN1004, 8/2013. EDIS, 2013(7).

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