

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

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ABSTRACT: The Lakshadweep Islands were surveyed for *Aleurodicus dispersus* Russell, its host plants and natural enemies during 1999 and 2000. Two aphelinid parasitoids, *Encarsia guadeloupa*e Viggiani (reported for the first time from India) and *Encarsia* sp. nr. *haitiensis* Dozier were found in the Minicoy Island in addition to some predators. Both aphelinids have been introduced serendipitously into our country. Host plants of the whitefly were recorded in Agatti, Kavaratti and Minicoy islands.

KEYWORDS: *Aleurodicus dispersus*, *Encarsia guadeloupa*e, host plants, Lakshadweep, natural enemies, new record

The spiralling whitefly, *Aleurodicus dispersus* Russell (Homoptera: Aleyrodidae) is a highly polyphagous pest and is a native of the Caribbean region and Central America (Russell, 1965). It was first noticed as a pest in Hawaii in 1978 (Kumashiro *et al.*, 1983) from where it spread to the Pacific islands and further into southeast Asia, Sri Lanka and the Maldives (Waterhouse and Norris, 1989; Martin, 1990). It was first reported on tapioca from Kerala (Palaniswami *et al.*, 1995) and later from other parts of southern India (David and Regu, 1995; Mani and Krishnamoorthy, 1996). Though no concrete evidence exists regarding its mode of entry into India or the country from which it was introduced, it probably came from Sri Lanka or the Maldives (Srinivasa *et al.*, 1999). Natural enemies of this pest have been reported from Kerala (Beevi *et al.*, 1999)

and Karnataka (Mani and Krishnamoorthy, 1999; Srinivasa *et al.*, 1999) of which *Encarsia* sp. nr. *haitiensis* Dozier is the lone parasitoid. *Encarsia* ? *haitiensis* was released into the Maldives in an attempt to introduce the parasitoid (Neuenschwander, personal communication) which prompted this survey in the Lakshadweep Islands, which lie close to the Maldives.

The Lakshadweep Islands were surveyed for *A. dispersus*, its host plants and natural enemies during the month of March in 1999 and 2000. The Lakshadweep Islands (72-74°E and 8-11°N) are located in the Arabian Sea, nearly 500-600 km from Kochi. The islands are separated from each other by 100-300 km and Minicoy is the southernmost island, about 100- km north of the Maldives. Four inhabited islands, namely,

Andrott, Kalpeni, Kavaratti and Minicoy during 1999, and five, namely, Agatti, Amini, Kadmath, Kavaratti and Minicoy during 2000, were surveyed for the incidence of the whitefly, its host plants and natural enemies.

Incidence of the pest was carefully observed and host plants identified and recorded in the islands surveyed. Natural enemies of the pest were carefully observed on infested leaves, collected and identified. The pest puparia were observed with a hand lens (20X) to recognise the parasitised black ones. Adult parasitoids collected by means of an aspirator from the undersurface of infested leaves were brought back to Bangalore in freeze pack lined cool plastic boxes. Parasitism levels were recorded on papaya and tapioca in Minicoy.

Incidence of *A. dispersus* was not recorded in Kalpeni and Andrott, the islands nearest to the mainland, but was widespread throughout Kavaratti and Minicoy, during 1999. The Islands of Amini and Kadmath were also found free of the incidence while Agatti was found to harbour the pest in addition to Kavaratti and Minicoy during 2000. The whitefly was noticed on 30 host plants in Minicoy during 1999 but only on 11 host plants during 2000 (Table 1), with reduced levels of infestation. The list of 11 host plants in Kavaratti during 1999 increased to 51 during 2000. Agatti recorded incidence on 33 host plants during 2000. The incidence was found to be very severe on papaya, tapioca, banana and guava amongst the cultivated plants.

In Minicoy, the whitefly nymphs in papaya, banana, tapioca and castor were observed to be parasitised by aphelinid parasitoids and a fairly large number of adult parasitoids were found active on the infested leaves. The parasitoids were not seen in Kavaratti and Agatti during both years. During March, 2000, parasitisation to the extent of 92.4 per cent (papaya) and 59.4 per cent (tapioca) of the pest nymphs was observed. These parasitoids were identified as *Encarsia guadeloupae* Viggiani (black) and *Encarsia* sp. nr. *haitiensis* Dozier (bright yellow). This is the first record of *E. guadeloupae* from India. The

latter species has been reported from the mainland by Beevi *et al.* (1999) as an undescribed species of *Encarsia* near to *meritoria* Gahan and by Srinivasa *et al.* (1999) as a new species of *Encarsia* closely related to *E. haitiensis* and *E. meritoria* Gahan. The present report and the earlier reports of this species most likely refer to the same species. *Encarsia ?haitiensis* belongs to a complex of species under the *meritoria* subgroup that are difficult to distinguish morphologically. A solution to the taxonomic problems of the *meritoria* subgroup of the *luteola*-group is being attempted through morphological methods and molecular techniques supported by DNA sequence data, and the identity of this species is expected to be established shortly (Polaszek, 1999). *Encarsia ?haitiensis* had been deliberately introduced into Hawaii and some other Pacific islands (Kumashiro *et al.*, 1983; Waterhouse and Norris, 1989) and the Maldives (Neuenschwander, personal communication) and fortuitously introduced apparently along with the host into Guam, Malaysia, the Philippines, Benin, Togo, Ghana, Nigeria and India (Waterhouse and Norris, 1989; Neuenschwander, 1994; D'Almeida *et al.* 1998; Beevi *et al.*, 1999; Srinivasa *et al.*, 1999). *Encarsia guadeloupae* is currently known to occur in Hawaii, Malaysia, the Philippines, Benin, Togo, Ghana and Nigeria (Neuenschwander, 1994; D'Almeida *et al.*, 1998) and is believed to have been accidentally introduced into these countries and now into India.

A sample of the adult parasitoids brought back during 1999 and 2000, to the laboratory at PDBC, Bangalore, comprised nearly 60 per cent of *E. guadeloupae*. D'Almeida *et al.* (1998) found *E. ?haitiensis* more abundant and widespread than *E. guadeloupae* in Benin. A small consignment of *E. guadeloupae* was released in March, 1999 in Bangalore and recovered from local infestations near the release site during August, 1999 confirming that the species has established here. The parasitoid has presently spread to other areas and has distinctly established (as is clearly evident from continuous recoveries from August, 1999 to July, 2000) in Bangalore and surrounding areas.

Table 1. Host plants of *A. dispersus* in the Lakshadweep islands during 1999-2000

Host Plant	Minicoy		Kavaratti		Agatti
	1999	2000	1999	2000	2000
Amaranthaceae					
<i>Amaranthus</i> sp.			*		
Annonaceae					
<i>Annona squamosa</i> L.			*		
<i>Polyalthia longifolia</i> (Sonn.)Thwaites	*				
Apocynaceae					
<i>Nerium oleander</i> L.					*
<i>Ochrosia</i> sp.	*				
<i>Plumeria alba</i> L.				*	
<i>P. rubra</i> L.	*				
<i>Thevetia peruviana</i> (Pers.) Merr.	*		*	*	
Araceae					
<i>Aglaonema</i> sp.				*	
<i>Colocasia</i> sp.					*
Araliaceae					
<i>Aralia</i> sp.					*
Arecaceae					
<i>Cocos nucifera</i> L.	*	*	*	*	*
Asclepiadaceae					
<i>Calotropis gigantea</i> (L.) R. Br.	*	*		*	*
<i>Pergularia daemia</i> (Forsskal) Chiov.				*	
Asteraceae					
<i>Acanthospermum hispidum</i> DC.				*	
<i>Bidens pilosa</i> L.	*				
<i>Chrysanthemum</i> sp.				*	
<i>Eupatorium</i> sp.				*	
<i>Tagetes erecta</i> L.					*
<i>Wedelia</i> sp.					*
Averrhoaceae					
<i>Averrhoa bilimbi</i> L.				*	
Balsaminaceae					
<i>Impatiens balsamina</i> L.				*	*
Bignoniaceae					
<i>Tecoma stans</i> (L.) Kunth				*	*
Boraginaceae					
<i>Tournefortia</i> sp.				*	
Cannaceae					
<i>Canna indica</i> L.		*			
Capparaceae					
<i>Cleome gynandra</i> L.	*			*	
Caricaceae					
<i>Carica papaya</i> L.	*	*	*	*	*

Host Plant	Minicoy		Kavaratti		Agatti
	1999	2000	1999	2000	2000
Combretaceae					
<i>Terminalia catappa</i> L.	*			*	
Cucurbitaceae					
<i>Coccinia grandis</i> (L.) J. Voigt					
<i>Momordica charantia</i> L.					
<i>Trichosanthes anguina</i> L.				*	
Euphorbiaceae					
<i>Acalypha hispida</i> Burm.f.				*	
<i>A. indica</i> L.	*				
<i>Codiaeum variegatum</i> Blume Bijd.	*		*	*	
<i>Euphorbia hirta</i> L.				*	
<i>Euphorbia pulcherrima</i> Willd. ex Klotzsch				*	
<i>Hevea brasiliensis</i> Mull-Arg.				*	
<i>Manihot esculenta</i> Crantz		*		*	
<i>Phyllanthus emblica</i> L.		*			
<i>Ricinus communis</i> L.	*			*	
Lamiaceae					
<i>Ocimum tenuiflorum</i> L.				*	
Leguminosae					
<i>Canavalia ensiformis</i> DC.					
Liliaceae					
<i>Gloriosa superba</i> L.				*	
Malvaceae					
<i>Abelmoschus esculentus</i> (L.) Moench				*	
<i>Abutilon indicum</i> (L.) Sweet	*			*	
<i>Hibiscus rosasinensis</i> L.	*			*	
<i>H. tiliaceus</i> L.	*		*		
<i>Thespesia populnea</i> (L.) Sol. ex Corr. Serr				*	
<i>Thespesia</i> sp.					
Meliaceae					
<i>Azadirachta indica</i> Adr. Juss.	*				
Mimosaceae					
<i>Delonix regia</i> (Hook.) Raf.				*	
<i>Leucaena leucocephala</i> (Lam.) De Wit				*	
Moraceae					
<i>Artocarpus incisus</i> L.	*	*	*		
<i>Ficus benghalensis</i> L.	*			*	
<i>Ficus</i> sp.	*				
<i>Morus alba</i> L.	*				
Moringaceae					
<i>Moringa oleifera</i> Lam.				*	
Musaceae					
<i>Musa paradisiaca</i> L.	*	*	*	*	
Myrtaceae					

Host Plant	Minicoy		Kavaratti		Agatti
	1999	2000	1999	2000	2000
<i>Psidium guajava</i> L.	*	*		*	*
<i>Syzygium aqueum</i> L.	*				
Nyctaginaceae					
<i>Mirabilis jalapa</i> L.					*
Papilionoideae					
<i>Erythrina variegata</i> L.	*		*		*
<i>Gliricidia sepium</i> (Jacq.) Kunth ex Walp.	*		*	*	*
<i>Tephrosia</i> sp.				*	*
Piperaceae					
<i>Piper betel</i> L.				*	
Poaceae					
<i>Cymbopogon flexuosus</i> L.				*	
Polygonaceae					
<i>Antigonon leptopus</i> Hook. & Arn.	*				
Punicaceae					
<i>Punica granatum</i> L.		*		*	*
Rutaceae					
<i>Murraya koenigii</i> (L.) Sprengel				*	*
Sapotaceae					
<i>Manilkara zapota</i> (L.) P. Royen					*
Solanaceae					
<i>Capsicum annuum</i> L.	*		*	*	*
<i>C. frutescens</i> L.	*		*		
<i>Datura metel</i> L.				*	
<i>Lycopersicon lycopersicum</i> (L.) Karsten					*
<i>Solanum melongena</i> L.	*			*	*
Verbenaceae					
<i>Lantana camara</i> L.				*	*
Vitaceae					
<i>Vitis vinifera</i> L.				*	
Indet. fern				*	

In addition to these aphelinids, four predators, *Axinoscyrnus puttardria* Kapur and Munshi, *Pseudaspidimerus trinotatus* (Thunberg), *Serangium parcesetosum* Sicard, *Scymnus nubilus* Mulsant (Coleoptera: Coccinellidae) and *Cybocephalus* sp. (Coleoptera: Nitidulidae) were recorded feeding on *A. dispersus*. The last three species are new records on the whitefly from India though *Cybocephalus* sp. has been recorded from Indonesia (Kajita *et al.*, 1991).

The efficiency of the two aphelinid parasitoids is indicated by the reduction in the number of host

plants from 30 to 11 in Minicoy during the course of a year. The parasitoid species have been introduced into Agatti and Kavaratti also in 2000 in an attempt to colonise them in these islands.

With the accidental introduction of both species of *Encarsia* into India, we can hope for a drastic reduction in the population of *A. dispersus* as witnessed in other countries and islands such as Hawaii (Kumashiro *et al.*, 1983), Guam and other Pacific islands (Waterhouse and Norris, 1989), Benin and other West African countries (D'Almeida *et al.*, 1998). The impact of these

parasitoids on the pest has to be studied as also their biology and the host - natural enemy interactions.

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