Aleurodicus dispersus

Introduction

Aleurodicus dispersus is a polyphagous pest that is native to the Americas. Since 1901, it has spread eastward to South Asia, Australia and the Pacific islands. The main hosts of this pest are citrus, coconut, and mango. *Aleurodicus dispersus* is of quarantine significance to the Caribbean sub- region.

Fig. 1: Aleurodicus dispersus

Identity

J.H. Martin (1998)

Authority : Russell (1945)
Classification
- Kingdom : Animalia
- Phylum : Arthropoda
- Class : Insecta
- Order : Hemiptera
- Family : Aleyrodidae (Aleurodicinae)
- Genus : *Aleurodicus*
- Species : *dispersus*
- Common names : Whitefly, spiralling whitefly, coconut whitefly, mosca blanca
- Role : Pest

Signs & Symptoms

Jayma L.M. Kessing (1993)

Direct feeding damage is caused by the piercing and sucking of sap from foliage by immature and adult stages of whiteflies. This feeding causes premature leaf drops. When feeding, dense populations of this polyphagous pest produce ample honeydew which serves as a substrate on which sooty mould grows. This growth which can be so severe as to lead to

the abandonment of cassava fields (Akinlosotu *et al.*, 1993). Sooty mould blackens the leaf, decreases photosynthetic activity and decreases vigour often causing disfigurement of the host.

Morphology — Jayma L.M. Kessing (1993)

Eggs

The eggs of *A. dispersus* are smooth surfaced, yellow to tan elliptical about 0.3 mm long. As in other whiteflies the eggs of *A. dispersus* have a characteristic short subterminal stalk or pedicel which is inserted during oviposition into the host plant, usually on the lower surface of a leaf. In *A. dispersus* and many other species the pedicel is inserted into the stomata (Paulson and Beardsley 1985).

Larve

There are four immature instars, the first three being referred to as larvae and are continuous feeders. First instar larvae or "crawlers" have distinct antennae and functional legs and can crawl actively. The legs and antennae of the remaining instars are atrophied and these instars tend to be sedentary.

A characteristic structure of aleyrodids is the vasiform orifice, a large dorsal opening on the last abdominal segment of all stages. It receives the anus, is partly protected by a cover (the operculum), and contains a tongue-like process, the lingula. Honeydew accumulates there in globules and is flicked off from time to time by the lingula.

Third instar larvae (0.65 mm long) can be distinguished by the numerous evenly spaced short, glass-like rods of wax along the sides of the body.

Pupa

The fourth instar larva (1.06 mm long) is considered the pupa and is soon covered with copious amounts of white cottony material. Long glass-like rods are produced from the single pair of cephalic and three pairs of abdominal pores. Rods up to 8 mm in length may occur, although most are shorter due to fragmentation. Pupae are colourless or yellowish, nearly oval, flat and approximately 1mm long and 0.75mm wide.

Adults

The adults are white and small 1/12-1/8 inch (2-3mm) in length and coated with a fine dustlike waxy secretion.(Fig 1). They somewhat resemble tiny moths, and both sexes are winged. The wings of newly emerged adults (body length 2.28 mm in males and 1.74 mm in females) are clear on emergence, but develop a covering of white powder over the next few hours. The eyes are dark reddish-brown and the forewings each have two characteristic dark spots.

Biology & Ecology — G.A.W.Wijesekera (1990)

Aleurodicus dispersus lives on the lower surfaces of leaves; leaf structure appears to influence feeding preference (Wen *et al.*, 1994). Immatures and adults feed by sucking phloem sap and the resultant honeydew excretions that fall on surfaces below colonies often develop a layer of sooty mould. The unsightly secretion of white, flocculent wax is mostly produced by the final immature stage, which also secretes long, glassy wax filaments from the compound pores. The adults are active in temperatures between 12.3 and 32.3 °C, and

Wijesekera & Kidamagamage (1990) found that maximum fecundity occurred at 25°C. Low temperatures cause high mortality and are a major factor limiting geographical distribution of this species (Cherry, 1979). Heavy rain and high winds reduce populations of *A. dispersus*; dry conditions favour population increase.

Manzano et al. (1995) described the biology of *A. dispersus* in the Canary Islands: reproduction is sexual, both sexes are winged and can fly relatively short distances, but could be carried further by high winds. Each female lays 14-26 eggs in a distinctive spiral of white wax on the leaf underside (Wijesekera & Kidamagamage, 1990). It is this oviposition spiral that gives the species its common name, although some other aleurodicine whiteflies make similar spirals too (Martin, 1990). The eggs hatch after 7-10 days and there are four immature instars with a total development time of 22 - 47 days; the adults live for about two weeks (Wijesekera & Kidamagamage, 1990). Heavy sporadic rains and cool temperatures may result in a temporary reduction in *A. dispersus* populations which, however, rise again in warmer, drier weather. Mortality of immature stages increases significantly between 40° - 45°C and that of adults between 35° and 40°C. Temperatures below about 10°C also cause mortality (Cherry 1979).

Life cycle

Eggs

These are laid singly at right angles to the leaf veins in association with irregularly spiralling deposits of waxy white flocculence, from which the whitefly derives its common name.

Larve

On hatching, the tiny (0**.**32 mm long) first instar larvae (crawlers) generally settle in a spiral pattern near the eggs from which they were derived, although some move within the confines of their leaf.

Second (0.5 mm long) and subsequent instar larvae usually remain feeding in the same place. The final (fourth) instar larva is at first a feeding stage like earlier instars, but later ceases feeding and undergoes internal tissue reorganisation before moulting to the adult. The fourth instar cuticle on which most of the taxonomy is based is referred to as the 'pupal case'.

Adult

whiteflies copulate side-by-side and in this they are similar to psyllids but unlike aphids (Martin and Lucas, 1984, Mound and Halsey, 1978).

Adults are particularly active during the morning hours. Mating occurs during the afternoon. Stationary males attract females by partially spreading their wings and beating them up and down rapidly on the leaf surface. Males then copulate with females that approach (Henderson, 1982).

Dispersal/vectors

Jayma L.M. Kessing (1993)

Both sexes are winged and can fly relatively short distances, but could be carried further by high winds. New infestations have often resulted from the transportation of infested plants. However once in a country, both human activities and prevailing winds aid dispersal.

Management

G.A.W. Wijesekera (1990)

Biological Control

A. dispersus can be successfully controlled by various biological control agents, for example, as early as 1981 Kumashiro *et al.* (1983) reported control in Hawaii due to the establishment of parasitoid p.pulations (*Encarsia haitiensis* and the coccinellid *Nephaspis oculatus).* Successful biological control has been observed in from many other locations, as reported by Waterhouse & Norris, (1989) and Neuenschwander, (1994).

In Benin, initially damaging populations of *A. dispersus* declined sharply in 1994, and was attributed to the serendipitous introduction of *Encarsia haitiensis* as reported by Neuenschwander, (1994). Therefore, biological control, which is often established near-spontaneously when various parasitoids take control of *A. dispersus* populations (Waterhouse & Norris, (1989) and Bennet & Noyes, (1989), should be considered as the best option to manage *A. dispersus* populations.

In Florida, *A. dispersus* is frequently parasitized (Russell, 1965). In many tropical countries where it has been accidentally introduced, *A. dispersus* is successfully controlled by imported natural enemies. The most effective agents for controlling heavy infestations are coccinellid beetles of the genus *Nephaspis*, such as *N. oculata* (*N. amnicola*) and *N. bicolor* from the Neotropical region. Once populations of spiralling whitefly have been reduced, they can be regulated at low levels by parasitoid wasps such as *Encarsia sp.* near *haitiensis* (Dozier) and *E. guadeloupae* (Kumashiro *et al.*, (1983, Waterhouse & Norris, 1989)). Each of these parasitoids has slightly different requirements that determine which of them becomes dominant in any specific area (IITA, 1998). Gerling (1990) provided a short key to parasitoids of whiteflies.

Natural Enemies

Several natural enemies are known to attack *Aleurodicus dispersus*.

Parasitoids: *Encarsia haitiensis* and the coccinellid *Nephaspis oculatus* in Hawaii and Benin. *Encarsia guadeloupae*.

Predators: Coccinellid beetles of the genus *Nephaspis*, such as *N. oculata* (*N. amnicola*) and *N. bicolor* from the Neotropical region are most effective agents for controlling heavy infestations.

Pest significance and Phytosanitary Risk

Aleurodicus dispersus damages plants directly by sap depletion. Unsightly white wax secretions and sooty mold growth on honeydew deposits reduce the market value of plants and produce. The pest also causes indirect damage due to sooty mold growth blocking light and air from the leaves, thereby so impeding photosynthesis and reducing yield. *A. dispersus* presents a serious phytosanitary risk to tropical and subtropical areas on the edges of its current range. Quarantine areas have been declared in Queensland, Australia. The movement of plants, plant material, and fruits out of quarantine areas can only proceed after official inspections (Lambkin, 1998). The spread of *A. dispersus* on citrus is of particular concern in Australia, Mexico and other countries.

In Nigeria and India, *A. dispersus* is an economic pest of cassava. It causes yellowish speckling of leaves and, in heavy infestations, leaf crinkling and curling. The infestation spreads from the lowest leaves upwards (Palaniswami *et al.*, 1995). In Indonesia *A. dispersus* is a potential pest of soybean (Kajita *et al.*, 1991).
Because of its small size, *A. dispersus* can be transported among countries easily by man, as immature stages and adults on fresh foliage.

Phytosanitary Measures

Inspection Methods

Human transport of live foliage is the main means of dispersal of *A. dispersus* over long distances. Movement of fresh plant material from non-infested countries should be avoided unless the material is thoroughly examined. Plants should be closely inspected for flocculent white wax on leaf undersides and white adults that fly erratically when disturbed. Sooty mould growth on leaves (usually on surfaces below a colony) should alert the inspector to the need for closer examination.
The steady spread of *A. dispersus* westwards in the Pacific suggests that, in the next few years, the spiralling whitefly may well be discovered to have reached additional oceanic countries and, quite possibly, also Australia. Strict quarantine procedures for introducing living plant material into countries currently uninfested may delay its entry, as action by Californian authorities seems to have done. Also, any measures that will reduce its abundance in infested countries will tend to reduce the chances of such countries serving as the source of new infestations. Available evidence suggests that new infestations have often resulted from the transportation of infested plants. Furthermore, once in a country, both human activities and prevailing winds aid dispersal. There is no evidence that *A. dispersus* is transported far away to new countries in upper air movements, as seems to have been the case with the leucaena psyllid, *Heteropsylla cubana* (Waterhouse and Norris 1987).

Host Notes — Jayma L.M. Kessing (1993)

This species is highly polyphagous, especially in the absence of its natural enemies. The spiralling whitefly has been recorded on 38 genera of plants belonging to 27 plant families and more than 100 species. It is common to find this pest attacking many vegetable, ornamental, fruit and shade tree crops in Hawaii. Specific plants that are attacked include *Annona* (cherimoya, atemoya, sugar apple), avocado, banana, bird-of-paradise, breadfruit, citrus, coconut, eggplant, guava, kamani, Indian banyan, macadamia, mango, palm, paperbark, *papaya*, pikakae, *Plumeria, poinsettia*, rose, sea grape, ti and tropical almond.
In Taiwan it has been recorded on 144 host-plant species belonging to 64 families, including fruit and shade trees, palms, ornamentals and annual crops including soybean (Wen *et al.*, 1994). Guava and papaya are favoured hosts, and the whitefly has caused problems on cassava in West Africa (IITA, 1998) and India (Palaniswami *et al.*, 1995).

Distribution — J.H. Martin (1990)

Aleurodicus dispersus is native to parts of southern North America, Central and northern South America. Since the early 1980s it has spread to some of the islands of the Pacific, the

Austro-oriental region, Australia (Queensland), southern Asia, southern India, Sri Lanka and the Maldives, West Africa and the Canary Islands (IIE, 1993; Palaniswami *et al.*, 1995). In Africa it was first recorded in Nigeria and Togo in 1992 (IIBC, 1993) and has since spread to Benin and Ghana (Neuenschwander, 1996), Congo (M. Kairo, personal communication), Sao Thomé (A. Polaszek, personal communication), and possibly some other countries in West Africa.In the Caribbean and Central America *A. dispersus* is known from the Bahamas, Barbados, Costa Rica, Cuba, Dominica, Haiti, Martinique and Panama. In North America it occurs in southern Florida (first observed 1957) (Anon, 1986; Russell, 1965). It is not known from California, although it has been intercepted there many times by quarantine authorities. In South America it occurs in Brazil, Ecuador and Peru; in Asia in the Philippines (1982) and in Africa in the Canary Islands (1962), (Anon, 1986; Paulson and Kumashiro, 1985; Russell 1965).

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Web Resources -

www.extento.hawaii.edu/kbase/crop/Type/a_disper.htm
www.spc.int/pps/biological_control.htm - 21k