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Short communication

WOOLLY WHITEFLY *ALEUROTHRIXUS FLOCCOSUS* (MASKELL) (HOMOPTERA: ALEYRODIDAE): A NEW INVASIVE ALIEN INSECT PEST OF CITRUS FRUITS IN ETHIOPIA

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ABSTRACT: The woolly whitefly, *Aleurothrixus floccosus* (Maskell) (Homoptera: Aleyrodidae), is a new invasive alien insect pest of citrus fruits recorded in Ethiopia in 2001 in Nazareth town. Woolly whitefly was recorded in Ethiopia on all citrus fruits. The pest sucks phloem sap, causing leaves to wilt and drop when populations are large. Honeydew droplets collect dust and support the growth of sooty mold. Heavy infestations where copious amounts of honey dew are produced can result in the blackening of the entire tree. Honeydew and sooty mold can also contaminate the fruit. The pest has invaded Central Rift Valley starting from Dukem to Shashemene. In Western Ethiopia, the pest invaded Ambo and Bako towns. Pupal parasitoid, *Cales noacki* Howard (Hymenoptera: Aphelinidae) was recorded on woolly whitefly. The description of woolly whitefly aided by pictures, its current status in Ethiopia and some experiences in the managen ent of the pest elsewhere are discussed in this paper. More over, future research direction to solve the problem is indicated.

Key words/phrases: *Cales noacki*, citrus fruits, Homoptera, Hymenoptera, invasive alien

INTRODUCTION

The Woolly whitefly, *Aleurothrixus floccusus* (Maskell) (Homoptera: Aleyrodidae) was recorded in 2001 in Ethiopia from garden orange in Nazareth town and identified in the laboratory. The specimen was sent to the International Center of Insect Physiology and Ecology (ICIPE) for confirmation of the identification and ICIPE confirmed it positively. Woolly whitefly first appeared as a citrus pest about 1909 in Tampa, Florida (Kerns, 2002). The insect is native to tropical and subtropical America and introduced to North Africa and Southern Europe in the 1970's. Currently, the pest is widely distributed in America, Europe, Asia and Africa. In East Africa this pest was first recorded in Kenya in 1990. Currently, it is prevalent in Uganda, Tanzania, Zambia, Malawi, Mozambique and Zimbabwe (Emana Getu , 2003a). In Ethiopia, this pest was first reported by Emana Getu (2003 a & b) from Nazareth town. In citrus growing areas of the world where this pest was recorded, the pest management strategy was skewed towards the management of this pest because of its devastating nature (ACTA, 2002; Kerns, 2002). The damage of the pest results in difficulty of pruning and harvesting, hinder photosynthesis ability of the plant, severe premature defoliation of leaves and reduce fruit yield and quality (Kerns, 2002). This paper reports on the description, distribution, severity and natural enemies of woolly whitefly as it is a new alien species that invaded the country with little and/or no information available under Ethiopian condition. Hence, there is a need to report the occurrence and status of this new pest on a permanent publication such as a journal, so awareness is created to design appropriate management.

MATERIALS AND METHODS

Surveys were conducted between 2001-2006 at Bako, Ambo, Dukem, Debrezeit, Nazret, Melkassa, Mojo, Meki, Zewayi, Adami Tulu, Bulebula, Abadir, Sodere, Arsi-Negele and Sheshemne towns. All citrus fruits grown in each location were assessed. These include orange, mandarin, lime, lemon and grape fruit. At each location 30 citrus plants (total 450 plants) were randomly sampled

and assessed. Of the 450 plants assessed, 350 were orange, 50 mandarin, 20 grape fruit, 10 lime and 20 lemon. The variation in number of assessed citrus species is due to the abundance of some species and rareness of others. The top, middle and lower canopies were assessed. During each assessment time all stages (eggs, nymphs and adults) of woolly whitefly and sooty mold infection were recorded. The parameters assessed include twig and leaf infestation of woolly whitefly, severity of sooty mold and incidence of natural enemies. Apart from field assessment, some specimens of woolly whitefly from each location were taken to laboratory to check for parasitoid emergence and for investigation under microscope.

RESULTS AND DISCUSSION

Woolly whitefly was constantly recorded in all years (from 2001 to 2006) from Dukem, Debrezeit, Nazareth, Melkassa, Mojo, Meki, Zewayi, Adami Tulu and Bulebula towns. But, it was recorded since 2004 in Sodere town and in 2006 in Ambo, Bako and Abadir towns (Table 1). The highest proportion of the assessed twig and leaves infestation were 78% and 54%, respectively.

Figure 1 (A, B, C & D) shows woolly whitefly infestation, eggs, adults and honeydew formation. Figure 1 (E & F) showed parasitism of the woolly whitefly pupae by the Hymenopteran *C. nbacki* Howard (Hymenoptera: Aphelinidae). The parasitism rate recorded by the parasitoid ranged between 4% and 11%. Emerging adults are yellowish white and seldom fly. Adult females are surrounded by waxy filaments. The first instar nymphs of the woolly whitefly are light green, and the rest are brown. Parasitized nymphs are black. Woolly whitefly derives their name from the waxy filaments which develop during the pupal stage. Woolly whitefly eggs are laid on the underside of mature leaves. This differs from other whitefly species that lay eggs on young leaves. Woolly whitefly eggs are laid in a circle with the female at rest in the center. The eggs are brown and sausage-shaped (Martin, 1987).

Table 1. Status of woolly whitefly in Ethiopia (Over years Mean).

Locations	Altitude range (meters above sea level)	Mean percent twig infestation	Mean percent leaf infestation	*Status of sooty mold
Dukem	1750-1800	83	55	High
Deberezeit	1800-1850	89	66	High
Nazereth	1550-1650	100	78	High
Melekassa	1500-1550	100	73	High
Mojo	1650-1700	100	68	High
Meki	1650-1700	100	74	High
Zewayi	1500-1650	100	72	High
Adami Tulu	1500-1550	100	82	High
Bulebula	1500-1500	90	66	High
Arsi-Negele	1700-1750	52	48	Intermediate
Shashemene	1700-1800	48	41	Intermediate
Sodere	1450-1500	35	23	Low
Ambo	1850-1900	42	27	Intermediate
Bako	1700-1750	24	15	Low
Abadir	1300-1400	32	18	Low
Mean		78	54	High

* High means: all stages of woolly whiteflies present and greater than 60% of the twigs and leaves were infested with high sooty mold growth; intermediate means: some stages of woolly whiteflies only present and the mean of twigs and leaves infestation were between 30% and 59%; low means: few stages of woolly whiteflies only present and the mean of twigs and leaves infestation were less than 30%.

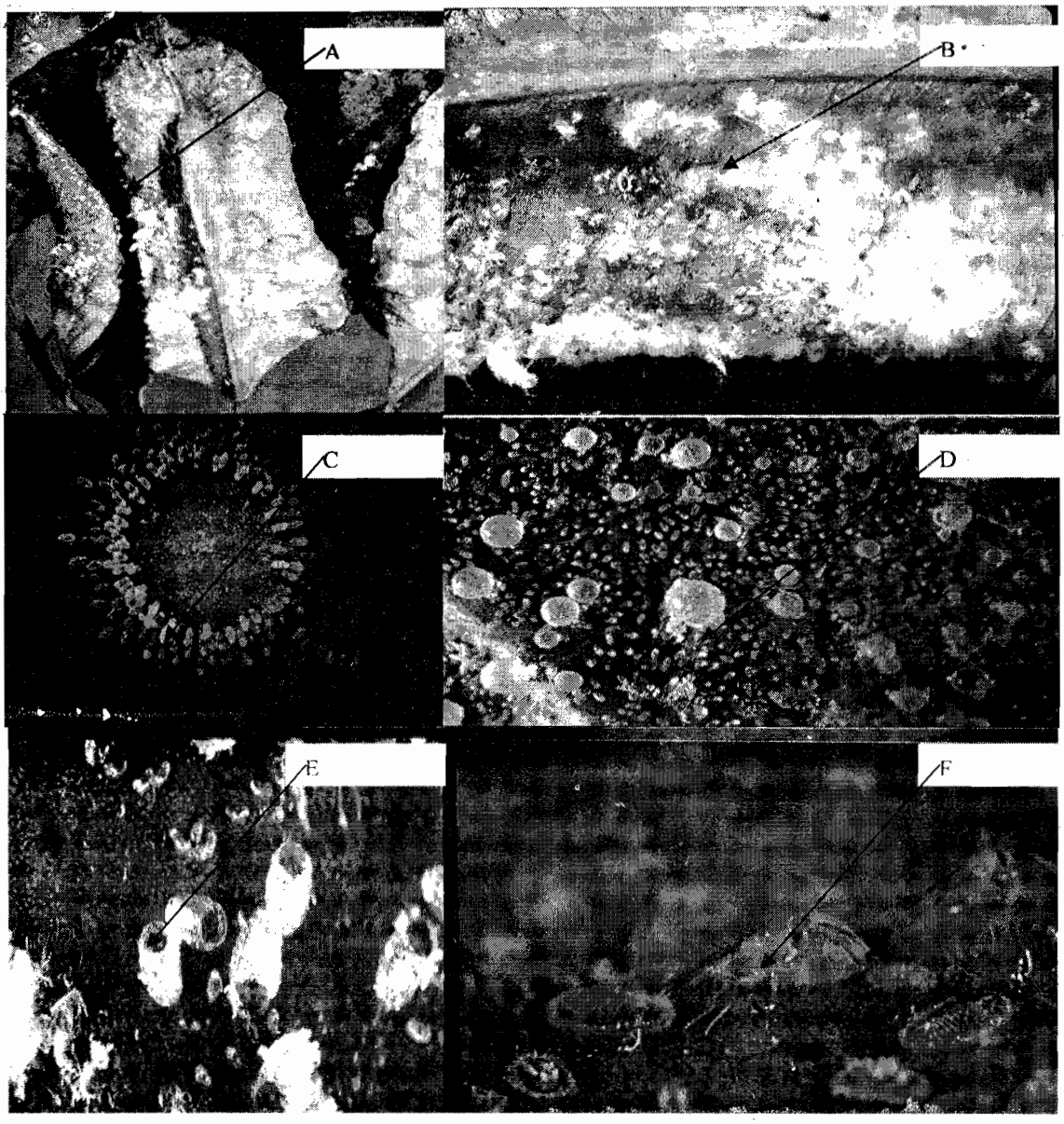

Fig. 1. Woolly whitefly infestation (A&B), eggs with the adults in the centre (C), honey dew exudating nymphs (D), pupal parasitism (E) and adult parasitoid, *Cales noacki* (F).

From the surveys made it became evident that woolly whitefly is invading the citrus growing areas of Ethiopia very fast the same way it invaded the rest of the continent. Efforts to manage woolly whitefly using chemical insecticides were effective; temporary suppression may be followed by a resurgence of the pest (Ferran, 2001). Chemical control is recommended when ants are present to control them to enhance biological control. Management efforts are focusing on biological control using different nymphal and pupal parasitoids wherever the pest occurs (ACTA, 2002; Kerns, 2002). A nymphal parasitoid, *Encarsia partenopea* (Walker) (Hyemenoptera: Aphelinidae) and pupal parasitoid, *C. noacki* give partial to complete biological control when undisturbed by ants, dusts, or insecticide treatment. *C. noacki* is already recorded in Ethiopia indicating the existence of some natural enemies associated to the pest in the country. For countries where the pest and its natural enemies created strong association, conservation of natural enemies through the use of reduced rates and frequencies of insecticides and use of less toxic bio-pesticide such as *Bacillus*

thuringiensis (Bt) is recommended. However, when the pest just invaded a new country like Ethiopia now classical biological control is the approach to be followed. Locally available natural enemies create new association with introduced pest and provide good suppression of a pest, but it may take time to build its population to impact the population of the pest (Southwood, 1978). Hence, launching of strong classical biological control program as the case with other introduced pests should be an immediate program to stop the invasion of woolly whitefly in Ethiopia and relief the endangered citrus industry of the country from this problem.

Dust control and alternate row prune to provide refuge for the available natural enemies, use of less toxic bio-pesticide, and use of reduced rate and frequency of insecticide in citrus agro-ecosystem in Ethiopia can serve as a conservation mechanism for the locally available natural enemies of wooly whitefly such as *C. noacki*.

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