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Review Article

Lifecycle, Distribution, Nature of Damage and Economic Importance of Whitefly, *Bemisia tabaci* (Gennadius)

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Abstract

Whitefly, *Bemisia tabaci* (Gennadius) plant sap feeding insect. *B. tabaci* is a polyphagous pest attacking of tomato, brinjal, pulses, cotton and many other plant species of economic importance worldwide. Many farmers are not interested to grow such crops in their filed after they have gone through some bad experience due to severe infestations of whitefly. Whiteflies cause damage to plants in two ways firstly by sucking the sap and transmitting viral disease secondly honeydew secreting onto leaves where black sooty mold can grow. Whiteflies have become one of the most serious crop protection problems. Whiteflies typically lay eggs undersides of leaves. Tiny crawlers hatch that settle on leaves and molt into immobile nymphs. The escalating whitefly problem has led to an increased use of insecticides, which not only put pressure on the environment, but has led to resistance problems. The management strategies for the insect pests can become sound and economically viable when the information on pest succession is integrated in to it. To understand about life cycle and management's tactics is help to reduce the yield losses. In present review articles discusses about life cycle, distribution, nature of damage whitefly, which could support an effective pest management and crop improvement strategy.

Keywords: Whitefly*; Bemisia tabaci;* Hemiptera; Aleyrodidae; Pest

Introduction

The whitefly (*Bemisia tabaci* Gennadius) comprises the family Aleyrodidae, the only family in the superfamily Aleyrodoidea order Hemoptera. It was first recorded over 100 years ago in tobacco crop in Greece [1]. Whitefly was first record as a pest in cotton fields of Greece in 1889 [2]. In India *B. tabaci* was first recorded on cotton from Pusa (Bihar) during 1905 and was described as M. and L. (Mishra and Lamba, 1929). *Bemisia tabaci* is a polyphagous insect has a wide host range of more than 500 host plant species [3] belonging to more than 60 plant families [4] economic importance, such as vegetables, oil and ornamental plants [5]. Despite their name, whiteflies are not true flies (in the insect order Diptera) but are in the order Hemiptera, related to aphids, scales and mealybugs. They derive their name from the mealy white wax covering the adult's wings and body. Whiteflies are small Hemipterans that typically feed on the undersides of plant leaves. Several species of whiteflies exist [6]. More than 1550 species have been described out of which 50 are agricultural pests. Most whitefly species have a narrow range of host plants, but the ones that are may feed on many vegetable, pulses crops, ornamental and house plants considered as a pest. The genus *Bemisia* contains 37 species and is thought to have originated from Asia [4]. *B. tabaci,* being possibly of Indian origin [7], was described under numerous names before its morphological variability was recognized. Outbreaks of this pest were reported in southern parts of India during 1985-87 and in northern parts during 1987-95 on cotton, tobacco, eggplant, okra, tomato and several ornamental plants [8,9]. Damage caused includes reduction in yield and fruit quality as well as virus transmission [10-12]. In addition, *B. tabaci* is a polymorphic species. It is variable not only in its morphology (size and form of nymphs) [4,13] but also in its ecological characteristics (environmental requirements, development, fecundity, insecticide resistance, virus transmission, natural enemy complexes and endosymbiont complement [14-23]. Therefore, for each pest management program, an exact determination of the crucial population parameters is required. Henceforth, these studies are indeed appropriate to generate a comprehensive understanding on the insect population, which could support an effective pest management programme and crop improvement strategy.

Distribution

Bemisia tabaci is primarily a pest of cultivated plants in tropical and warm temperate regions of the world. It is a polyphagous species with a worldwide distribution [4,24]. It is present throughout much of southern Europe, Africa, India, and has recently moved

into Australia. *B. tabaci* has a global presence. However, certain areas within Europe are still *Bemisia* free, e.g. Finland, Sweden, Republic of Ireland and the United Kingdom [25]. There are a number of closely related strains (or biotypes) that appear the same as the local strains, but can only be identified by molecular techniques.

India	Widespread	CABI/EPPO, 1998; EPPO, 2014
Andaman and Nicobar Islands	Present	NHM, 1990; CABI/EPPO, 1998; EPPO, 2014
Andhra Pradesh	Present	CABI/EPPO, 1998; EPPO, 2014
Assam	Present	CABI/EPPO, 1998; EPPO, 2014
Bihar	Present	CABI/EPPO, 1998; EPPO, 2014
Chhattisgarh	Present	Netam., *et al*. 2007
Delhi	Present	CABI/EPPO, 1998; EPPO, 2014
Gujarat	Present	CABI/EPPO, 1998; EPPO, 2014
Haryana	Present	CABI/EPPO, 1998; EPPO, 2014
Punjab	Present	CABI/EPPO, 1998; EPPO, 2014
Jammu and Kashmir	Present	CABI/EPPO, 1998; EPPO, 2014
Karnataka	Present	CABI/EPPO, 1998; EPPO, 2014
Kerala	Present	CABI/EPPO, 1998; EPPO, 2014
Lakshadweep	Present	EPPO, 2014
Madhya Pradesh	Present	CABI/EPPO, 1998; EPPO, 2014
Maharashtra	Present	CABI/EPPO, 1998; EPPO, 2014
Meghalaya	Present	CABI/EPPO, 1998; EPPO, 2014
Odisha	Present	CABI/EPPO, 1998; EPPO, 2014
Rajasthan	Present	CABI/EPPO, 1998; EPPO, 2014
Tamil Nadu	Present	CABI/EPPO, 1998; EPPO, 2014
Uttar Pradesh	Present	CABI/EPPO, 1998; EPPO, 2014
Uttarakhand	Present	Rashmi., *et al*. 2008
West Bengal	Present	CABI/EPPO, 1998; EPPO, 2014

Table 1: Distribution of *B. tabaci* in India.

Bio-ecology or life cycle of (*Bemisia tabaci Gennadius*)

Eggs: Eggs are usually laid in circular groups, underside of the leaves, with the broad end touching the surface and the long axis perpendicular to the leaf. Eggs are pear shaped with a pedicel spike at the base, approximately 0.2 mm long. Hatching occurs after 5 - 9 days at 30°C but this depends very much on host species, temperature and humidity. On hatching, the first instar, or 'crawler', is flat, oval and scale-like in shape.

Nymph: The pupa is flat, irregular oval shape, about 0.7 mm long, with an elongate, triangular vasiform orifice. On a smooth leaf the puparium lacks enlarged dorsal setae, but if the leaf is hairy, 2 - 8 long dorsal setae are present. The first instar is the only nymphal stage of this whitefly which is mobile. It moves from the egg site to a suitable feeding location on the lower surface of the leaf, after which its legs are lost in the next moult and the larva becomes sessile. It does not move again throughout the remaining nymphal stages. The fourth nymphal stage is termed the puparium, or also known as "red-eye nymphs" because the relatively large eyes of the developing adult are already visible through the nymph integument (skin) during this stage.

Adult: Adults are approximately 1 mm long, the male slightly smaller than the female. The body and both pairs of wings are covered with a powdery, waxy secretion, white to slightly yellowish in colour. The life span of the female can extend to 60 days. The life of the male is generally much shorter, being between 9 and 17 days. Each female can oviposit over 300 eggs during her lifespan; these are often arranged in an arc around the female as she rotates on her stylet. Some 11 to 15 generations can occur within 1 year according to climatic condition.

Economic importance

B. tabaci damage the crop by sucking the sap and reduce the crop yield about 50%. To control the whitefly used insecticides which increased input cost and create pest resistance. Although recognized as pests for at least 100 years, they attained major pest status only in the last two decades, possibly through the indiscriminate use of pesticides. In the past two decades or so, the upsurge in whitefly severity has prompted scientists and extension workers worldwide to find ways to manage this pest. During the past decades, whiteflies have risen in notoriety as important plant pest species particularly of horticultural crops. Huge agricultural losses have prompted many scientists and researchers to investigate the causes of and find solutions to this new phenomenon.

Nature of damage

Whiteflies cause damage to plants in two ways firstly by sucking the sap and secondly by excreting honey dew on which sooty mould grows. Direct damage is caused through Adults and nymphs feed by inserting their mouthparts especially in young plants phloem sap from sieve tubes with their sucking mouthparts [26]. Due to sucking phloem sap from the leaves and plant tissue they removing nutrients, reduces the photosynthetic activities of the foliage [13] resulting turning the leaves yellow, causing them to fall early and generally weakening the plants; leading to the symptoms on the plants are common under heavy infestations [7,27,28]. Die-back of branches can occur, and in rare cases death of smaller plants, although dying plants are often in poor health due to other factors reducing its value as well as fruit quality grade [17,29]. Another more serious problem is the large amount of honeydew they secrete onto leaves and fruit. The honeydew is colonized by sooty molds, which reduces the quality of greenhouse vegetables and ornamentals, and through transmission of leaf curl virus disease. The honeydew attracts ants, which interfere with the activities of natural enemies that may control whiteflies and other pests. In addition indirect damage, whiteflies may carry and transmit viral diseases that can severely damage susceptible plants. Viral plant pathogens such as gemini viruses and clostero viruses [30]. B. tabaci vectored viruses can cause losses that are much more economically damaging than those resulting from feeding alone. Frequent use of pesticides on whitefly has raised environmental concerns and produced resistance in whitefly population [31]. As a result, whitefly became a major problem for the green houses and many field crops of commercial importance.

Virus transmission

Bemisia tabaci is the vector of over 60 plant viruses in the genera Geminivirus, Closterovirus, Nepovirus, Carlavirus, Potyvirus and a rod-shaped DNA virus. Whitefly-transmitted geminiviruses, now designated Begomoviruses are the most important of these agriculturally, causing yield losses to crops of between 20 and 100%. More than a hundred virus diseases are spread by this whitefly, among which begomoviruses (previously called geminiviruses) are some of the most important, causing, for example, African cassava mosaic virus, Cotton leaf curl virus, and Tomato yellow leaf curl virus. The host plants are indirectly damaged by the transmission of more than 50 Gemini viruses e.g., tomato yellow leaf curl virus [17] tomato mottle virus and bean golden mosaic virus [29]. Begomoviruses cause a range of different symptoms which include yellow mosaics, yellow veining, leaf curling, stunting and vein thickening. Tomato crops throughout the world are particularly susceptible to many different begomoviruses, and in most cases exhibit yellow leaf curl symptoms. This has caused their initial characterization as Tomato yellow leaf curl virus (TYLCV) [21,32-34].

Conclusion

Bemisia tabaci is a polyphagous insect which can cause damage to various crop viz. cotton, brinjal, ladyfinger, some other vegetables, and ornamental plants. Whiteflies cause damage to plants in two ways firstly by sucking the sap and secondly by excreting honey dew on which sooty mould grows. The present review article discussion about lifecycle, distribution, nature of damage and economic importance of whitefly. To management of whitefly, neither chemical, biological nor cultural controls used singly have controlled whitefly. However, the integration of several control tactics can be effective in reducing the overall impact of this pest, and may lead to an acceptably low level of whitefly infestation. The chemical control with selective insecticides, crop plant resistance, and physical/mechanical method are also important tactics to management of whitefly. The correct implementation of natural enemies will help to reduce whitefly numbers. At present, the insecticides mostly used to control of whitefly population, but this practice is cause environment pollution and widespread resistance of *B. tabaci*. To counter all over the problem to used IPM tactics, that effective, environmentally safe, and social to acceptable.

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