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## Effect of seasonal variation on the population dynamics of whitefly (*Bemisia tabaci*) on tobacco

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### Abstract

The whitefly *Bemisia tabaci* Gennadius (Homoptera: Aleyrodidae) is an important pest throughout the world for the field crops. It is the natural vector of geminivirus disease of different hosts. The *Bemisia* is a species complex having many biotypes and it has two extant cryptic species. In the present study, effect of seasonal variation on the population dynamics of whitefly was investigated on tobacco plants. Meteorological data were recorded regularly throughout the year, for a consecutive 3 years. Whitefly population per plant was recorded at experimental field of Basirhat District of West Bengal, India. A second trial was also carried out at field condition of North 24 Parganas District of West Bengal, India. For the maintenance of the insect, large wooden cages covered with galvanized insect-proof wire mesh were used and kept in the glasshouse. The result revealed that the whitefly population dynamics were influenced by many parameters, among which temperature, relative humidity, total rainfall, evaporation, number of rainy days, and bright sunny hours are important factors. In this study, it was observed that the minimum temperature has two peaks, one during the month of June, and the second peak during the month of September. The September peak is highest one. Observations on three years data indicated that the whitefly population was highest during August-October and it reached its maximum peak at September with a short peak during June in a year.

**Keywords:** whitefly, population dynamics, temperature, relative humidity, tobacco

### Introduction

The whitefly *Bemisia tabaci* Gennadius (Homoptera: Aleyrodidae) is an important pest throughout the world for the field crops (Brown, 1994a,b; Butler and Hennesberry, 1994; Byrne *et al.*, 1992; Mehta *et al.*, 1994)<sup>[1-3]</sup>. In 1889, in Greece, it was first collected and then described from tobacco, i.e. *Nicotiana* spp., and it was then named as *Aloxoides tabaci* (Gennadius) (Russell, 1957)<sup>[4]</sup>. In 1905, in India, the first record of *Bemisia tabaci* was observed on cotton (Mitra and Lambda, 1929; Reddy and Rao, 1989)<sup>[5-9]</sup>.

One hundred and twenty eight (128) plant species have been reported as hosts of the whitefly (Ali *et al.*, 1995)<sup>[10]</sup>. The most important host for culture of whiteflies is brinjal among vegetables. *Lantana* sp. and sunflower among ornamentals, *Achyranthes* sp., *Citrullus* sp. and *Xanthium* sp. among weeds, *Mulberry* sp. among fruit and forest plants are most important hosts to maintain whitefly population during off-season in cotton cultivation. The whitefly population develops during different months in different crops like cucurbits, tomato, sunflower, chillies, potato, rapeseed, okra beans, brinjal and menthe. Some weed plants like *Xanthium strumarium* L., *Achyranthes aspera* var *porphyrostachya* (L.) Mart., *Mentha longifolia* (L.) Huds., *Sida* sp. L., *Abutilon indicum* (L.) Sweet, *Amaranthus spinosus* L., *Euphorbia hirta* L., *Elettaria indica* (L.) Gaertn., *Datura metel* L., *Digera muricata* L., *Solanum nigrum* L., *Crotalaria arvensis* L., *Malva parviflora* L., *Carcharias capitatus* L., growing in and around crop field also harbour adult whiteflies population. Studies on host preferences revealed that the oviposition and larval survival have been found maximum on soybean (Naresh and Nene, 1980)<sup>[10]</sup>. Although cowpea under Indian condition is the least preferred host, the vector breeds well on cowpea under West African conditions (Vetten and Allen, 1983)<sup>[11]</sup>. In

Pakistan, very high level of *B. tabaci* population was found on mungbean crop (200-250 whiteflies per plant) during June to August (Malik, 1992)<sup>[12]</sup>.

At different periods in day time, the *B. tabaci* population varies significantly on plant. In Black gram, at noon when the light intensity is maximum the *B. tabaci* number is lowest, and the highest during late evening hours or early morning times (Subrahmanyam and Varma, 1986)<sup>[13]</sup>. Longevity of whiteflies is found to be maximum in French bean (Varma *et al.*, 1989)<sup>[14]</sup>.

The *B. tabaci* move by two main ways, short movement and long distance movement. The short movement is an active movement covering distances measuring in meters (Melamed-Madjar *et al.*, 1979; Fauquet *et al.*, 1986)<sup>[15, 16]</sup>. The long distance movement is a passive one controlled mainly by the wind (Youngman *et al.*, 1986)<sup>[17]</sup>. The largest flight distance is 7 km. The flight activity mainly occur during morning hours, sometimes a second short peak can be observed in late afternoon time (Fauquet *et al.*, 1986)<sup>[16]</sup>. Besides attracted to the yellow part of the spectrum, they are also attracted by ultraviolet light (Mound, 1962)<sup>[18]</sup>.

*Bemisia tabaci* is the natural vector of geminivirus disease of different hosts (Chatterjee, 2021; Chatterjee and Ghosh, 2007a, 2007b)<sup>[19-21]</sup>. Control of *B. tabaci* can be achieved by using different insecticides (Hoque *et al.*, 2003; Pan *et al.*, 2005)<sup>[22, 23]</sup>. Beside this some predators of whitefly like *Encarsia formosa* (parasitic wasp) and *Macrolophus caliginosus* (assassin bug) are also used to control this vector (Erikgaard *et al.*, 2001; Gerling, 1993)<sup>[24, 25]</sup>.

The *Bemisia* is a species complex having many biotypes and it has two extant cryptic species (Perring, 2001)<sup>[26]</sup>. The *B. tabaci* biotype relationships can be clarified by the electrophoretic pattern differences (Brown, 2000; Brown *et al.*, 1995a; Barban *et al.*, 2000; Costa and Brown, 1991; Liu *et al.*, 1992; Prabhakar *et al.*, 1987)<sup>[27-32]</sup>. In India, different