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Studies on Host Range and Morphological Confirmation of *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) in Pusa

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ABSTRACT

An intensive survey was conducted in and around Pusa during *rabi* 2020-21 in order to study the host range of the whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) as well as its morphology using specific identification keys. *B. tabaci* infestated over 23 plants from 12 families. Interestingly, mustard was found to be new host for *B. tabaci,* which may pose a potential threat in future as an emerging pest because of polyphagous nature of *B. tabaci*. Among different families, Solanaceae recorded the highest infestation (21.70%) while the least infestation was observed in Rhamnaceae, Oleaceae, Rutaceae, Petiveriaceae, Apocyanaceae (4.35%). The widespread incidence of whitefly, *B. tabaci* on a variety of host plants in Pusa, was likely to create a menace to the cultivation of economically important crops in the near future.

Keywords Whitefly, Host range, Ecosystem, Solanaceae, *B. tabaci.*

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INTRODUCTION

Whitefly, *Bemisia tabaci* (Gennadius 1889) belonging to the family Aleyrodidae; order Homoptera, was a minor pest before four decades, but devastated in early 1980's in vegetables and commercial crops like cotton. Out of 1556 known whitefly species in 161 genera, *B. tabaci* has attained significance because of its capacity to infest over 1000 different plant species and transmit over 300 different pathogenic plant viruses (Gangwar and Gangwar 2018). As a result, this infamous sap-sucking insect pest has emerged as a main menace to global food security. They are present in abundance in vegetable and ornamental plantings. They are highly polyphagous and active on various hosts viz., brinjal, tomato, chilli, potato, cucurbits, soybean, mentha, cotton, tobacco, sunflower, rapeseed-mustard and weeds like common wire weed, In-

dian abutilon, common hollyhock, common lantana, asthma plant and goat weed. However, ornamentals and plants grown in greenhouses like cucumber, beans and pepper are also being attacked by the *B. tabaci* (Mound and Hasley 1978, Cock 1986).

B. tabaci is predominantly reported from all over the world excluding Antarctica (Lowe *et al.* 2000). For the first time it was recorded as a pest in Greece in Cotton fields during the year 1889 (Cock 1993). It was first reported in India in 1905 on Cotton in Pusa (Bihar) (Misra and Lamba 1929). *B. tabaci* can cause devastating yield losses of up to 100% (Cathrin and Ghanim 2014). It induces losses by way of transmitting several viral diseases, direct feeding damage, accumulation of honeydew and associated fungal development on hosts. Human activities such as the frequent application of synthetic pesticides and widespread national and international movement of fresh plant materials may facilitate the spread of *B. tabaci* and its adaptation to plants and the environment. The goal of this study was to examine and identify host plant species of *B. tabaci* in Pusa, Bihar which could pose a threat to the production of economically important crops in the near future if left unchecked.

MATERIALS AND METHODS

Survey

The present investigation was conducted during 2020-21 in different ecosystems of Pusa, Bihar, India (25°59'10.7" N latitude and 85°40'51.5" E longitude). The major areas covered in RPCAU, Pusa were Sugarcane Research Institute (SRI), Botanical garden, Hitech- Horticulture, AICRP Vegetable center and Apiary unit (Fig. 1). Whiteflies were collected in the early morning hours from the abaxial sides of leaves using aspirator and preserved in 2 ml Eppendorf tubes containing absolute ethanol. The specimens were stored at –4°C in the deep fridge for further morphological studies

Identification

Identification of adults was made in the laboratory using compound microscope, based on descriptions in Hill (1969), Calvert *et al*. (2001), Baig *et al.* (2015) and also with available keys and literature.

RESULTS AND DISCUSSION

In the present study, a total of 23 plant species from 12 families including 10 vegetable crops, five ornamental plants, two weeds, three fruit trees, one oilseed crop, one medicinal plant and one aromatic plant were found infested by the whiteflies (Table 1 and Fig. 1). Out of 23 plant species 10 vegetable crops viz., *Phaseolus vulgaris* L., *Lablab purpureus* L., *Trichosanthes dioica* Roxb, *Cucumis sativus* L., *Solanum lycopersicum* L., *Solanum tuberosum* L., *Abelmoschus esculentus* (L.) Moench, *Solanum melongena* L., *Capsicum frutescens* L., *Brassica oleracea* var. botrytis L; five ornamental plants viz., *Gerbera jamesonii Bolus* ex Hooker f., *Tagetes minuta* L., *Hibiscus rosa-sinensis* L., *Jasminum officinale* L., *Rivina humilis* L.; three fruit trees viz., *Ficus virens* Aiton, *Zizyphus mauritiana* Lam., *Ficus racemosa* L.; two weeds viz., *Parthenium hysterophorus* L., *Solanum americanum* Mill.; one medicinal plant viz., *Rauvolfia serpentina* (L.) Benth. ex Kurz; one oilseed crop viz., *Brassica nigra* L. and one aromatic plant viz., *Murraya koenigii* (L.) Sprengel were found to be infested by whiteflies. Among these host plants, whitefly was discovered to be a new infestation on mustard and Garg *et al.* (2017) recently described mustard as a host plant for *B. tabaci* which is in support with our findings. Similarly in India, Hussain and Trehan (1933) recorded 44 host plants for *B. tabaci* and Attique *et al.* (2003) in Punjab-Pakistan region, found 160 plant species in 113 genera and 42 families including field crops, ornamentals, fruits, forest trees and weeds. Likewise, Kedar *et al.* (2018) reported *B. tabaci* on 114 host plants belonging to 32 families in which 20 were field crops, 17 vegetables, 25 ornamentals, 35 weeds, 13 medicinal and four fruit trees. In the same way in India *B. tabaci* was reported on cassava by Lal (1981), cinnamon by Koya *et al.* (1983), tomato: Bhardwaj and Kushwaha (1984) and Qiu *et al.* (2006), okra: Bhagabati and Goswami (1992), black pepper: Ranjith *et al.* (1992), eggplant: Balaji and Veeravel (1995), sunflower: Men and Kandalkar (1997) and Qiu *et al.* (2006) and pulses: Patel and Srivastava (1998).

In comparison among plant families, it was

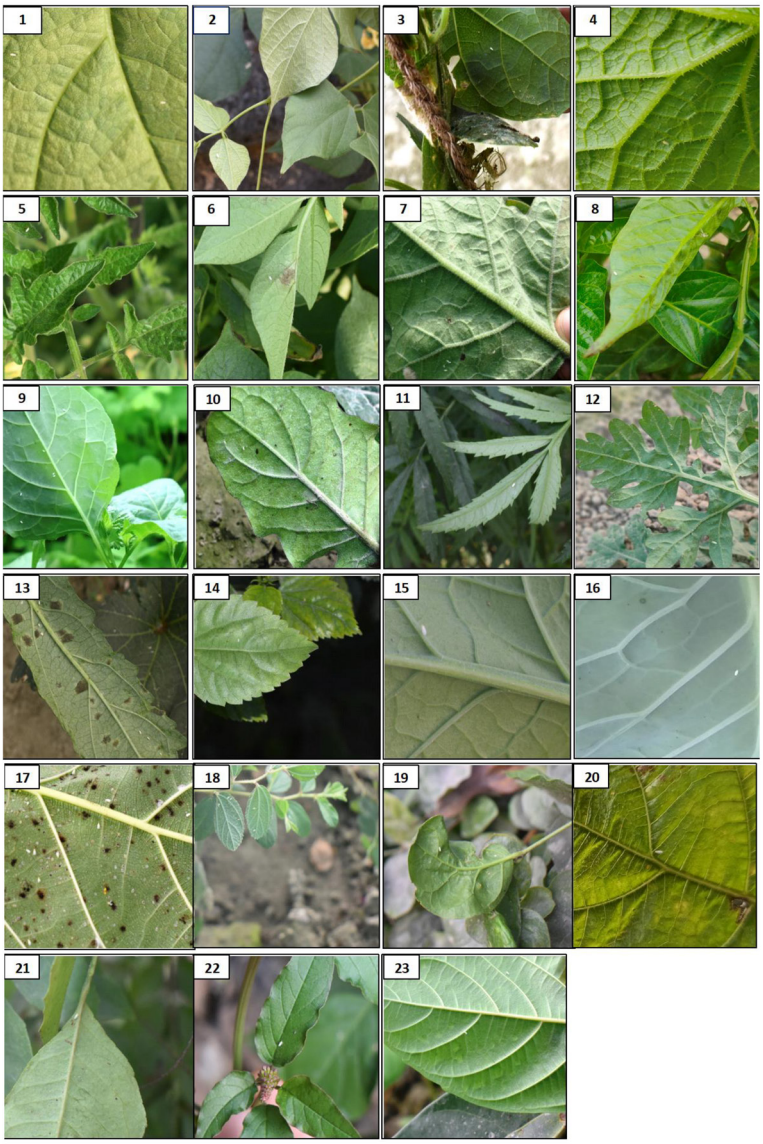

Fig. 1. Host range of whiteflies in Pusa, Bihar.

1.*Phaseolus vulgaris*; 2. *Lablab purpureus;* 3. *Trichosanthes dioica*; 4. *Cucumis sativus*; 5. *Solanum lycopersicum;* 6. Solanum tuberosum; 7. Solanum melongena; 8. *Capsicum frutescens;* 9. *Solanum americanum;* 10. *Gerbera jamesonii;* 11. *Tagetes minuta;* 12. *Parthenium hysterophorus;* 13. *Abelmoschus esculentus;* 14. *Hibiscus rosa-sinensis;* 15. *Brassica nigra;* 16. *Brassica oleracea var. botrytis;* 17. *Ficus virens;* 18. *Zizyphus mauritiana;* 19. *Jasminum officinale;* 20. *Ficus racemosa;*21. *Murraya koenigii;* 22. *Rivina humilis;* 23. *Rauvolfia serpentina.*

found that Solanaceae was highly infested (21.70%) followed by Asteraceae (13.04%) followed by Cucurbitaceae, Fabaceae, Malvaceae, Brassicaceae, Moraceae (8.69%) followed by Rhamnaceae, Oleaceae, Rutaceae, Petiveriaceae, Apocyanaceae (for 4.35%) (Fig. 2). All the host plants surveyed were dicots, which indicated *B. tabaci* preference for dicotyledons over monocotyledons. These results are in accordance

Table 1. List and details of host range of *B. tabaci* in Pusa, Bihar.

Sl. No.	Host	Common name	Family	Ecosystem
1	*Phaseolus vulgaris* L.	French bean	Fabaceae	Vegetable
2	*Lablab purpureus* L.	Dolichos bean	Fabaceae	Vegetable
3	*Trichosanthes dioica* Roxb	Pointed gourd	Cucurbitaceae	Vegetable
4	*Cucumis sativus* L.	Cucumber	Cucurbitaceae	Vegetable
5	*Solanum lycopersicum* L.	Tomato	Solanaceae	Vegetable
6	*Solanum tuberosum* L.	Potato	Solanaceae	Vegetable
7	*Solanum melongena* L.	Brinjal	Solanaceae	Vegetable
8	*Capsicum frutescens* L.	Chilli	Solanaceae	Vegetable
9	*Solanum americanum* Mill.	Black nightshade	Solanaceae	Weed
10	*Gerbera jamesonii* Bolus ex Hooker f.	Barberton daisy	Asteraceae	Ornamental
11	*Tagetes minuta* L.	Mexican marigold	Asteraceae	Ornamental
12	*Parthenium hysterophorus* L.	Congress grass	Asteraceae	Weed
13	*Abelmoschus esculentus* (L.) Moench	Okra	Malvaceae	Vegetable
14	*Hibiscus rosa-sinensis* L.	Chinese hibiscus	Malvaceae	Ornamental
15	*Brassica nigra* L.	Mustard	Brassicaceae	Oilseed
16	*Brassica oleracea* var. *botrytis* L.	Cauliflower	Brassicaceae	Vegetable
17	*Ficus virens* Aiton	White fig	Moraceae	Fruit tree
18	*Zizyphus mauritiana* Lam.	Indian jujube	Rhamnaceae	Fruit tree
19	*Jasminum officinale* L.	Common jasmine	Oleaceae	Ornamental
20	*Ficus racemosa* L.	Cluster fig	Moraceae	Fruit tree
21	*Murraya koenigii* (L.) Sprengel	Curry leaf	Rutaceae	Aromatic plant
22	*Rivina humilis* L.	Blood berry	Petiveriaceae	Ornamental
23	*Rauvolfia serpentina* (L.) Benth. ex Kurz	Serpentine wood plant	Apocyanaceae	Medicinal

with that of Rathore and Tiwari (2014), who identified 910 host plant species of whitefly, in which 844 were dicotyledons and 66 were monocotyledons. Survey of host range results at Pusa are in accordance with Li *et al.* (2011) who reported that *B. tabaci* fed on 361 plant species belonged to Solanaceae, Compositae, Cruciferae, Cucurbitaceae and Leguminosae families mostly. Similarly Garg *et al.* (2017) reported that incidence of *B. tabaci* in Vindya Plateau was maximum in the Fabaceae followed by Cucurbitaceae, Malvaceae, Solanaceae, Euphorbiaceae, Moraceae, Asteraceae and Brassicaceae.

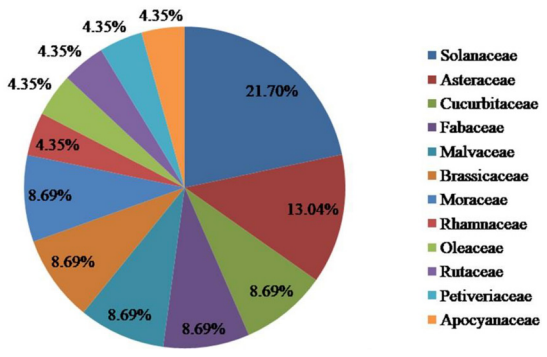

Fig. 2. Host plant species composition percentage of different families infested by *Bemisia tabaci.*

Morphological confirmation of *B. tabaci*

The adult whiteflies of all the hosts were subjected to morphological confirmation. Eggs are found to be oval in shape with a broad round base and fourth instar (puparia) was oval or elliptical in shape with a transparent yellow coccoid body, red eyes and a pair of visible yellow abdominal mycetomes. However, adult whiteflies had shown yellow colored body, red eyes and hyaline wings dusted with powdery wax. The fore wings of the insect are held in a tent-like position when it was at rest, allowing the middle region of the abdomen to be seen. To confirm the *B. tabaci* species, a single ommatidium connecting the upper and lower compound eyes of adults were examined by positioning them on lateral side (Fig. 3). Similar identification procedure was followed by Martin (1987), Calvert *et al.* (2001) and Baig *et al*. (2015).

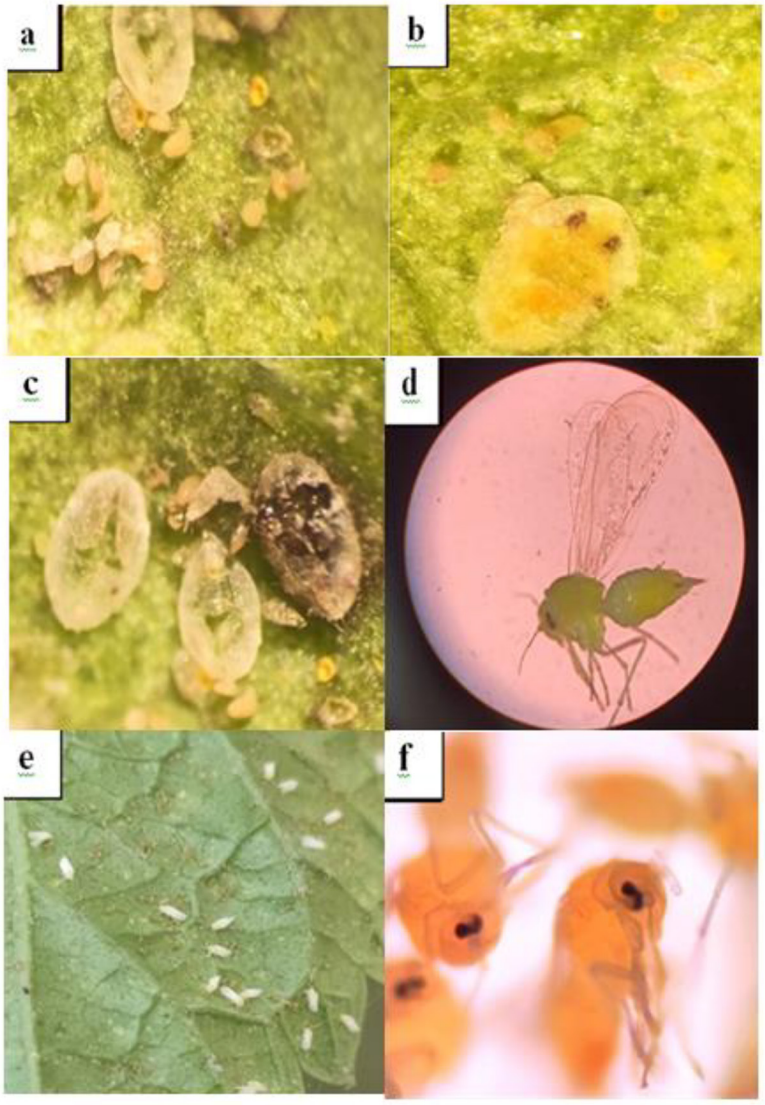

Fig. 3. Life stages of *Bemisia tabaci.*

Note: a. Oval shaped golden brown eggs b. Nymphs-oval shaped body with reddish eyes and yellow abdominal mycetomes c. Empty nymphal case after adult emergence d. Adult e. Adults infestation on underside of the leaves f. Single ommatidium in between the upper and lower compound eyes.

CONCLUSION

This study reveals the occurrence of *Bemisia tabaci* on different host plants of Pusa, Bihar, which is of significant importance as these pose a menace to the cultivation of economically important crops in the near future. During the study *B. tabaci* was found on 23 host plants, and in view of abundant availability of host plants in Pusa, *B. tabaci* has great scope to spread in the region. However, *B. tabaci* infestations were found dominant in Solanaceae family and vegetable ecosystems. *B. tabaci* recorded for the first time on mustard might pose a potential threat in future as an emerging pest.

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