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FIRST REPORT OF AN ALIEN WHITEFLY PREDATORY BEETLE, *DELPHASTUS PALLIDUS* (LECONTE) (INSECTA: COLEOPTERA: COCCINELLIDAE) FROM SOUTH PUNJAB, PAKISTAN

Shahid Hussain, Wali Muhammad
Pest Warning & Quality Control of Pesticides, Punjab, Pakistan.

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ABSTRACT

Delphastus pallidus (LeConte) is an important predatory beetle reported for effective control of whiteflies including *Bemisia tabaci, Aleurotrachelus trachoides, Paraleyrodes bondari* and *Dialeurodes citrifolii.* Many other members of genus *Delphastus* are well known predators of multiple whitefly species such as *Delphastus catalinae* (Horn). The members of this genus have predatory potential against all the stages of whitefly including eggs, nymphs and adults. This genus was reported in earlier 1950s from Florida on citrus whitefly. The later studies have reported it from Beach and the Mims areas in 1951, Indian Rocks & Lake Alfred areas in 1953. It was not reported against cotton whitefly from anywhere of Pakistan. The Pest Warning & Quality Control of Pesticides, Punjab team Multan reported it from cotton fields. Samples were collected and got identified from the Department of Entomology, Muhammad Nawaz Sharif University of Agriculture, Multan. After morphological and taxonomic identification, it was identified as Whitefly Predatory Beetle, *Delphastus pallidus* (LeConte) (Insecta: Coleoptera: Coccinellidae). Extensive surveys during the 3rd week of August 2022 reported its presence in 15 tehsils of cotton zone, South Punjab, Pakistan.

Corresponding Author: Wali Muhammad
Email: walientomologist@gmail.com

INTRODUCTION

Pakistan is an agricultural country and considered as major cotton producer among the five top cotton producing countries in the world. Sixty five percent production of Pakistani cotton is produced in the Punjab province. About 15% of total agricultural area of Punjab is covered with this crop and approximately 26% farmers are engaged in its cultivation (Rana et al., 2020; Anonymous, 2020). Per unit yield of cotton is very low in Pakistan as compared to many other cotton producing countries. There are many factors affecting the cotton crop production in Pakistan since the last decade. The major factor responsible for deteriorated and low quantity of cotton is the attack of insect pests including jassid, thrips, whitefly, mealy bug and pink boll worm. Among these pests, cotton whitefly (*Bemisia tabaci*) is a serious threat to cotton production in the coming years as it sucks sap of cotton as well as transmits cotton leaf curl virus. In addition to cotton, whitefly is also responsible for the destruction of many other agronomic as well as horticultural crops (Naranjo, 2000).

Many control methods including mechanical control (yellow sticky traps), repellents (tobacco spray) and chemical control are followed for the management of cotton whitefly in cotton fields (Jones, 2003; Naranjo and Flint, 1994). Farmers mostly rely on the chemicals as major

pest control strategy. Chemical control of whitefly is instant but not long lasting. There are many negative impacts of chemical control including resistance, resurgence and replacement. Environmental contamination is also major result of chemical control. Chemical control is also depleting our sources and limiting the biodiversity in cotton fields (Naveen et al., 2017).

Many bio-control agents are reported to control whitefly but the results in the fields were very limited as compared to chemical control (Van Lenteren, 2000). Major bio-control agents are natural enemies consisting of entomopathogens, parasites, predators and parasitoids. Among these organisms, coccinellids have been reported to effectively control many sucking insect pests. The coccinellids are easy to consider in natural and applied biological control for keeping the pests below economic threshold levels (Hodek and Honek, 1996).

Delphastus pallidus (LeConte) is reported to control wide range of whitefly species efficiently. Members of *Delphastus* genus are small, active and whitefly specific predatory beetles including *Delphastus catalinae* (Horn) and *D. pallidus* (LeConte) (Ahmed et al., 2017). Agriculture Department, Pest Warning and Quality Control of Pesticides, Punjab surveyed a wide range of crops. During the extensive surveys of cotton crop, a tiny pale yellow colored beetle was observed in cotton fields by Multan team in Chak-1 Shumali Tehsil Multan. The insect samples were sent to the Department of Entomology, Muhammad Nawaz Sharif University of Agriculture, Multan for identification and was identified as *Delphastus pallidus* (LeConte) having high predatory potential in cotton zone, South Punjab, Pakistan. These small beetles are reared and sold for the management of whitefly species in the Florida and North America (Cloyd, 2001). Studies are needed on their ecology and behavior in Pakistan. Therefore, in the present study, this new pest found in the South Punjab was identified and reported.

MATERIALS AND METHODS

Study area

On 2nd August 2022, Pest Warning Team Multan spotted some grubs on cotton crop feeding the whitefly nymphs. The pictures of the samples were prepared and initial investigations were carried out through comparisons with available literature (Figure 1). The team collected the grubs and submitted to the Department of Entomology, Muhammad Nawaz Sharif University of Agriculture, Multan for identification. The taxonomists studied the morphological characters and declared it as genus *Delphastus* (Figure 2) and asked for more samples for further investigation.

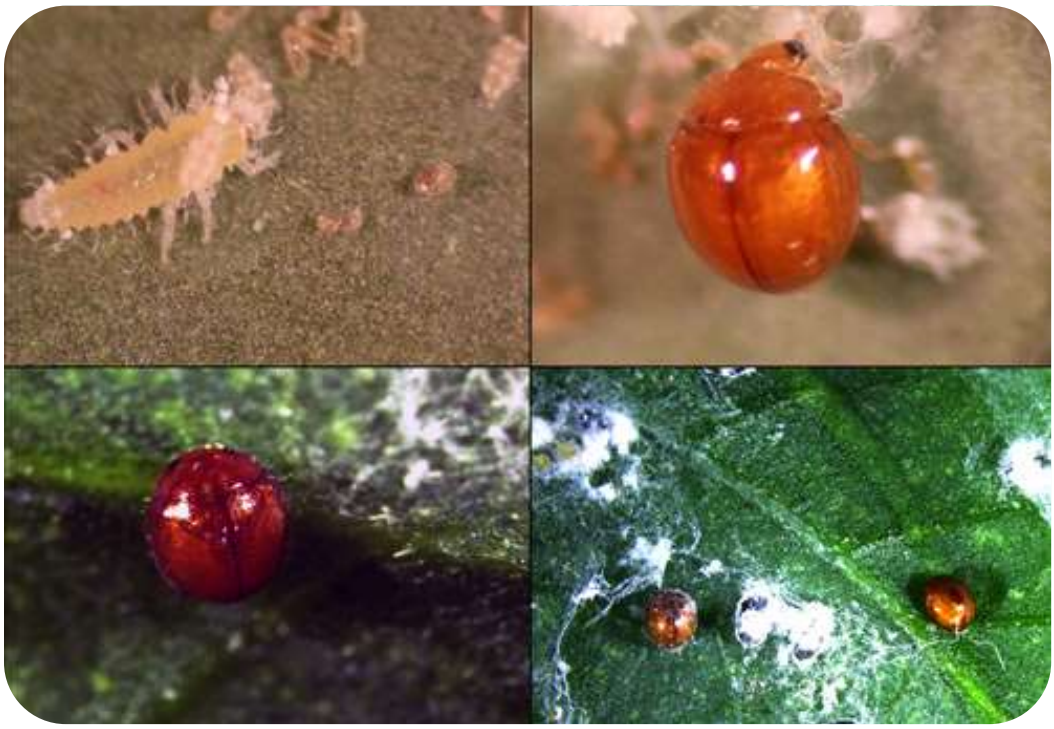

Figure 1: Grubs and adults of *Delphastus pallidus* (Source Internet).

Figure 2: *Delphastus pallidus* (A) grub (B) adult feeding on whitefly nymphs.

Collection and preservation of samples

All teams of District Multan were advised to collect the fresh samples in well aerated jars along with cotton leaves. The adults of beetle were kept in dry collection (Figure 3) as well as wet collection for dissection purpose. The grubs of beetle were kept in 75% alcohol solution and also kept on whitefly infested leaves in well aerated plastic jars (Figure 4) for further rearing. All the samples were shifted to the Department of Entomology, Muhammad Nawaz Sharif University of Agriculture, Multan for further preservation on 15th of August 2022.

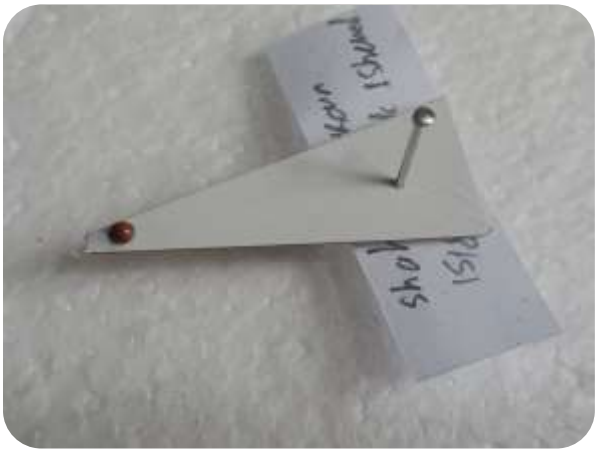

Figure 3: Dry collection of *Delphastus pallidus* adult.

Figure 5: Field collection of *Delphastus pallidus* culture.

Distribution of beetle in cotton zone

Teams of Agriculture Pest Warning & Quality Control of Pesticides, Punjab were directed to conduct special surveys of cotton fields to record the presence, abundance and distribution of beetle in the areas of cotton zone having 19 districts and 63 tehsils. Sixty three teams at tehsil level, 19 teams at district level and 6 teams at division level conducted special surveys. The teams covered 2494 spots and 13131 acres of area and reported the position of predatory beetle.

RESULTS AND DISCUSSION

Identification

The taxonomists, after careful inspection based on morphological and taxonomic characters, visual observations of grubs and adults, literature review and feeding habits, declared it as *Delphastus pallidus* (LeConte). The following characteristics were studied

- Genus *Delphastus* generally contains small-sized predatory beetles.
- The size of *D. pallidus* is 0.9 to 1.05 mm in length and 0.70 to 0.80 mm in width.
- It is comparatively smaller than other commonly known species in the genus like *D. catalinae* (1.40 to 1.50 mm in length and 1.10 to 1.18 mm in width) and *D. pusillus* (1.40 to 1.60 mm in length and 1.10 to 1.20 mm width).
- Body color is a pale reddish-brown with reddish-yellow legs. Several identification pictures of *D. pallidus*

are provided (Figure 2) (Ahmed et al., 2017).

Distribution in South Punjab

During field surveys of 2494 spots and 13131 acres of area, it was observed that *D. pallidus* was present in 16 out of 63 tehsils in 19 districts as shown in Table 1. The population/plant is mentioned in Table 1.

Table 1. Population of *Delphastus pallidus* beetle in cotton zone, Multan.

Sr. No.	District	Tehsil	No. of *D. pallidus*/plant
1	Muzaffar Garh	Muzaffar Garh	0.73
2	Sahiwal	Chichawatni	0.1
3	Sahiwal	Chichawatni	0.1
4	Sahiwal	Sahiwal	0.1
5	Bahawalpur	Hasilpur	1.2
6	Toba Tek Singh	Toba Tek Singh	0.33
7	Toba Tek Singh	Gojra	0.15
8	Toba Tek Singh	Pir Mahal	0.08
9	Faisalabad	Tandlianwala	0.44
10	Multan	Multan	2.2
11	Multan	Shujabad	1.3
12	Multan	Jalal Pur Pir Wala	0.6
13	Khanewal	Jahania	0.25
14	Khanewal	Mian Cahnnu	0.3
15	Khanewal	Khanewal	0.1
16	Lodhran	Lodhran	0.2

Historically, the beetle was identified initially as *Delphastus pusillus* (LeConte, 1852) and revised as *Delphastus catalinae* (Gordon, 1994). *D. catalinae* is commercially available for release internationally and throughout the United States. *D. pallidus* is reported by Ahmed et al. (2017). However, genus *Delphastus* is well known as efficient whitefly controlling agent having wide range of whitefly species to control. Members of *Delphastus* genus are small, active and whitefly specific predatory beetles including *D. catalinae* (Horn) and *D. pallidus* (Ahmed et al., 2017). The morphological characters of examined specimens are in conformity with those found in literature (Ahmed et al. 2017, Cloyd, 2001, Legaspi et al., 2006).

As reported in Table 1, where 16 tehsils out of 63 showed that in South Punjab, *D. pallidus* is present. *D. pallidus* has the potential to control the whiteflies from different hosts as reported by Legaspi et al. (2006).

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AUTHORS' CONTRIBUTION

SH supervised the field work and WM collected the samples for identification and reviewed the literature, SH and WM wrote and proofread the manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFRENCES

Ahmed, M.Z., Hernandez, Y.V., Kumar, V., Francis, A., Skelley, P., Rohrig, E., McKenzie, C., Osborne, L.S., Catharine Mannion, C., 2017. Pallidus beetle, *Delphastus pallidus* LeConte (Insecta: Coleoptera: Coccinellidae), a native predatory beetle of whitefly species in Florida. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Circular FDACS-P-01782, Issue No. 435.

Anonymous, 2020. Economic Survey of Pakistan, Economic Advisory Wing, Finance Division, Pakistan.

Cloyd, R.A., 2001. *Delphastus pusillus*: Whitefly Predator. VI (10) [Accessed 4 October 2017].

Gordon, R.D., 1994. South American Coccinellidae (Coleoptera). Part III: Taxonomic revision of the western hemisphere genus *Delphastus* Casey. Frustula Entomologica 17, 71-133.

Hodek, I., Honeck, A., 1996. Ecology of Coccinellidae. Luwer, Dordrecht, p. 464.

Jones, D.R., 2003. Plant viruses transmitted by whiteflies. European Journal of Plant Pathology 109, 195-219.

Legaspi, J.C., Simmons, A.M., Legaspi Jr, B.C., 2006. Prey preference by *Delphastus catalinae* (Coleoptera: Coccinellidae) on *Bemisia argentifolii* (Homoptera: Aleyrodidae): effects of plant species and prey stages. Florida Entomologist 89(2), 218-222.

Naranjo, S.E., 2000. Conservation and evaluation of natural enemies in IPM systems for *Bemisia tabaci* (Gen.) Crop Protection 20, 835-852.

Naranjo, S.E., Flint, H.M., 1994. Spatial distribution of preimaginal *Bemisia tabaci* (Homoptera: Aleyrodidae) in cotton and development of fixed precision, sequential sampling plans. Environmental Entomology 23, 254-266.

Naveen, N., Chaubey, R., Kumar, D., Rebijith, K.B., Rajagopal, R., Subrahmanyam, B., Subramanian, S., 2017. Insecticide resistance status in the whitefly, *Bemisia tabaci* genetic groups Asia-I, Asia-II-1 and Asia-II-7 on the Indian subcontinent. Scientific Reports 40634. https://doi.org/10.1038/srep40634

Rana, A.W., Ejaz, A., Shikoh, S.H., 2020. Cotton crop: A situational analysis of Pakistan. International Food Policy Research Institute.

Van Lenteren, J.C., 2000. A Greenhouse whiteout pesticides: fact or fantasy? Crop Protection, Guildford, pp. 375-384.