First report of *Carpophilus dimidiatus*(Fabricius) (Coleoptera: Nitidulidae) in stored groundnut and field maize from West Bengal, India

Abstract

Genus*Carpophilus* belongs to the family nitidulidae under the order coleoptera. Majority of the members under this genusare either sap feeder or fungus feeder. A small number of these, however, is economically categorised as stored grain pests. The commonly known species under this genus are*C.dimidiatus*, *C.hemipterus*, *C.humeralis*, *C.marginellus*, *C.mutilatus*, *C.obsoletus*, *C.davidsoni*,*C.lugubris*etc.Among these, *Carpophilus dimidiatus* (Fabricius) has been reported worldwide as a pest causing significant post-harvest loss.In India, different cereals like bajra, rice products, sago flour as well as oil seeds have been found to be infested by this pest.This pest was reported earlier from our country. But the information on identification as well as the name of the crop(s) infested by the pest were lacking. It was recordedwith proper identification in stored groundnut from Bangalore and Chennai for the first time from our country in the year 2022. This report is going to be the first ever report of *Carpophilus dimidiatus* on groundnut in storage and on maize in field from West Bengal.

Keywords: *Carpophilus dimidiatus*, groundnut, maize, nitidulid beetle,West Bengal

1. Introduction

Nitidulids are the most diverse group of beetles distributed widely in all zoogeographical regions of the world. This family is represented by 350 genera with more than 4500 species [1]. They show tremendous diversity in their feeding habitat. Many species are associated with decaying materials, some are sap feeders found on sap-flows or wound of trees [2], some are pollinators[3], whereas many species are recorded as stored product insects [4]. These beetles also display great diversity in their morphological adaptations and general body form. As majority of the Nitidulids are saprophagous and mycetophagous, they receive less importance and are thought to be without any economic importance. However, a small group of nitidulids is regarded as economically important, particularly the genus *Carpophilus*, infesting different stored products like grain product, cracked rough rice, wheat bran, nuts and nut products [5], spoiled commodities and vegetable products including the dry fruits[6]. Some of these are *Carpophilusdimidiatus* (Fabricius), *C. hemipterus* (Linnaeus), *C. humeralis* (Fabricius), *C. marginellus* (Motschulsky), *C. mutilatus* (Erichson) and *C.*

obsoletus (Erichson), *C. davidsoni* (Dobson), *C. lugubris* (Murray) etc.Among these, *Carpophilus dimidiatus* (Fabricius) has been reported from several countries, throughout the globe, to cause significant post-harvest loss [7].This beetle was found to infest corn fields around Uttar Banga Krishi Viswavidyalaya, Pundibari (26° 31' N, 89° 06' E) region (Block – Coochbehar II: District – Coochbehar), West Bengal, India from 2020 onwards at irregular basis. Afterwards the infestation was decreased. Again the infestation was started from 2022 onwards. This time the infestation was not restricted only within Pundibari region, but also in the other areas under Coochbehar – II block. Add to this, the pest was also found to infest groundnut in storage. The stored groundnut samples infested by this pest were also found in the several parts of different districts under Sub-Himalayan region of West Bengal; *i.e.* Alipurduar,Coochbehar and Darjeeling. Afterwards, a study was initiated to record the presence of *C. dimidiatus* in the said region covering different areas.

2. History of Nomenclature

Carpophilusdimidiatus was described originally as *Nitidula dimidiata* by Fabricius in the year 1792 [8]. Afterwards,this species strived a long path to arrive at *Carpophilusdimidiatus.Nitidula dimidiata*(Fabricius) was changed to *Carpophilus auripilosus* Wollaston, *Carpophilus lewisi* Reitter, *Carpophilus pusillus* Stephens, *Carpophilus vittiger* Murray, *Carpophilus biguttatus* Gemminger and Harold and finally *Carpophilus dimidiatus,* Grouvelle [9].The reason behind this was the close similarity between the species. Several misidentification throughout the globe had happened earlier among the several species of *Carpophilus.*

3. Materials and methods:

Surveys were conducted in the different districts mentioned above; i.e.Alipurduar,Coochbehar and Darjeeling under Terai region of West Bengal.Groundnut samples of 500g were collected from each of the grocery shops. Collected samples from storage were kept separately (within glassjars) in the laboratory. After a certain period, small beetles were found to emerge from the said samples.

Under field condition, the infestation of the said pest was spotted only on maize.Cob samples with specific damage symptoms were collected from fields of Coochbehar district and put into plastic zip covers and were taken to the laboratory for further observation.

All the images and photographs were captured by Magnus TZM6 stereozoom microscope andSamsung Galaxy S21 FE handset. The specimens were stored at the laboratory of Department of Agril. Entomology, Uttar Banga Krishi Viswavidyalaya (26° 31' N, 89° 06' E), Pundibari, Coochbehar West Bengal, for further identification. Regarding taxonomic identification, keys of different scientists were utilised [7,9,10,11]. Identification of this beetle was confirmed on the basis of molecular characterisation, too.

4. Results and Discussion

4.1Survey report

Table 1 and Table 2 describes the occurrence of *C. dimidiatus* from both storage and field condition:

Table 1. Survey report on *C. dimidiatus* infesting stored groundnut from Terai region of West Bengal

Name of District	Location	GPS Code	Damage (%)*
Coochbehar	South Khagrabari	$26^0$33'N$89^0$44'E	65-70%
	Malgudam Road	$26^0$31'N$89^0$45'E	
Darjeeling	Pradhan Nagar, Siliguri	$26^0$72'N$88^0$41'E	20-25%
	Bidhan Nagar, Siliguri	$26^0$71'N$88^0$42'E	
Alipurduar	Sobhaganj	$26^0$49'N$89^0$52'E	55-60%
	Samuktala Road	$26^0$48'N$89^0$52'E	

* Damage (%) was calculated on the basis of how many seeds were damaged out of 100 after keeping it in laboratoryfor three months

Table 2. Survey report on *C. dimidiatus* infesting Maize under field condition in Coochbehar

Name of District	Location	GPS Code	Cob infestation (%)
Coochbehar	Kaminirghat	$26^0$33'N$89^0$43'E	25-30%
	Tengnamari	$26^0$34'N$89^0$42'E	
	Platoon Bridge	$26^0$36'N$89^0$37'E	
	Singimari Paschimpar	$26^0$46'N$89^0$36'E	

* Cob infestation (%) was calculated on the basis of how many cobs were infested out of 100

4.2 Identification of the pest

The identification of this pest was done with the help of both taxonomic and molecular characterisation.

4.2.1 Taxonomic identification

The key taxonomic identifying characters of this beetle are as follows –

i) Dorsum dark red-brown to black

ii) Each elytron contains large dull-orange yellow spot.

iii) Elytra short. It exposes two abdominal tergites and pygidium thereby. The tergite VII is visible dorsally, whereas the VIIIth one is visible from ventral surface. In case of male, this VIIIth tergite is button like.

iv) Cuticle is clothed with light yellow hairs.

v) Punctures on pronotum are very deep.

vi) Labrum is somehow visible and free.

Adults

A B

VIIIth tergite button like

Ventral view of Male (A)and Female (B)

Fig. 1. Images of *Carpophilus dimidiatus* under stereozoom microscope

4.2.2 Molecular characterisation

The taxonomic identification of this pest was confirmed through molecular characterisation. Fragment of mitochondrial 16S rRNA (ribosomal RNA) gene was amplified and then sequencing process was completed. The submission of the said sequences to National Center for Biotechnology Information (NCBI) database resulted in generation of GenBank accession number. The sequence showed more than 99% match with species recorded or reported elsewhere and already submitted in NCBI database.The submission of amplified 16S rRNA resulted in generation of GenBank accession number **OP346785**.

4.2.3 Damage Symptom

In maize field, it was observed that a good number of cobs remained partially opened (due to some unknown reason). That cobs were found harbouring adult *C. dimidiatus* beetle. The adults were found to damage the seeds which, ultimately, turned brown and dried. The partial opening of the immature cob has been reported as a common symptom from several maize growers in this region. Further investigation is needed to ascertain whether *C. dimidiatus* is the sole causal agent for this immature cob opening or some other factors (like bird attack) are also present. But this was a confirmed observation that *C. dimidiatus* was found to be present in each and every partially opened cob.

In storage, both the grubs and adults damage the groundnut seeds. These bore the seeds and the bore holes are prominently visible. In case of excessive damage, only shells are left and internal content of the seed is converted into a powdery mass.

In stored groundnut	In field maize

Fig. 2. Damage caused by *Carpophilus dimidiatus*

5. Summary and Conclusion

Naveena *et. al.* (2022) [12] reported this pest in stored groundnut (from Bangalore and Chennai) for the first time from our country with proper identification. In the said article, the author clearly mentioned thatthe earlier authors like Sengupta *et. al.* (1984) [13] and Dasgupta *et. al.* (2013) [14] from West Bengalhad reported*C. dimidiatus*.But there were lack of specific information regarding the grain infested by the pest as well asidentification of the pest. That is why, the present report of *Carpophilus dimidiatus* in both field (corn) and store (groundnut)is going to be the first report from West Bengal with taxonomic and molecular identification.

Disclaimer (Artificial intelligence):

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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