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Original article

Transcriptional alterations associated with overexpression of a chlorogenic acid pathway gene in eggplant fruit

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ABSTRACT

The fruits of eggplants have different shapes and sizes, which render them ideal for metabolic engineering. They can aid in increasing eggplant chlorogenic acid content, a critical nutrient. Among the phenolic acids found in eggplants, chlorogenic acid is the most important and highly bioactive. This phenolic acid is essential because it promotes good health in humans, and for its production in the fruit flesh, the hydroxyquinone CoA transferase (SmHQT) enzyme is crucial. Therefore, we explored this further by using the agroinfiltration protocol, thereby comparing transgenic and wild type expression via RNA-seq analysis. Given the SmHQT overexpression of 415, the characteristics of the phenylpropanoid pathway are regulated in transgenic eggplants. Furthermore, agroinfiltrated fruit showed around twofold (3.98 g/mg of FW) chlorogenic acid content as compared to the wild type (2.02 g/mg of FW). As a result, the findings shed new light on how to increase eggplant chlorogenic acid content at the molecular level.

1. Introduction

Eggplants are the same plant family members as tomatoes and peppers, i.e., Solanaceae and the cultural practices and production techniques are almost like those plants (Welbaum, 2015; Knapp and Peralta, 2016). Eggplants originated in India and continued to grow as a wild type, but thanks to breeding techniques that improved these wild varieties' yield, appearance, taste, and color to be consumed and cooked easily (Page et al., 2019). Eggplants have a high amount, i.e., 95 % of chlorogenic acid, a phenolic compound that has proven beneficial for humans and the plant itself (Docimo et al., 2016). Phenolic acids benefit human health significantly because they protect against diseases like diabetes, cancer, and rheumatoid arthritis. Similarly, these phenolic acids are valuable for plants because they help protect the plant against insects and pathogen infestations (Kaushik et al., 2015). Moreover, a high percentage of chlorogenic acid is present in Eggplant compared to other vegetables of Solanaceae.

As a result, increasing the amount of chlorogenic acid in eggplant is a significant breeding objective currently being pursued (Caruso et al., 2017). Hydroxycinnamoyl CoA:quinate hydroxycinnamoyl transferase (SmHQT) plays a critical role in catalyzing chlorogenic acid synthesis (Kaushik and Saini, 2019). While cultivated eggplants contain fewer phenolic acids than wild ones, using wild species in the eggplant breeding program requires additional time to eliminate undesirable genes resulting from the severed connection. Also, planting wild species is difficult because of the duration of the plants and their adaptability (Kaushik et al., 2017). Agrofiltration is the most common technique that allows the expression of transient genes in plant networks (Ahmad et al., 2012). The agroinfiltration approach for gene expression is regularly performed in fleshy fruits such as tomatoes, strawberries, melons, and cucumber and succeed (Guidarelli and Baraldi, 2015). Therefore, changes in the expression of SmHQT gene via agroinfiltration in the eggplant fruits will open new insights.

Several breeding techniques have been adopted for enhancing the effect of chlorogenic acid, but they gave fewer results (Garg et al., 2018; Lu et al., 2020). Certain unwanted genes also interfere with chlorogenic acid production in wild relatives of eggplants, and certain techniques were unable to eradicate these undesirable

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A review of the genus *Stratiomys* Geoffroy (Diptera: Stratiomyidae) from India with description of a new species

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Abstract. A review of the genus *Stratiomys* from India is presented. The new species *Stratiomys brunettii* sp. nov. is described based on male and female specimens collected from the Kashmir Himalayas. The only other congener previously recorded in India, *Stratiomys approximata*, is redescribed. A key to the species is presented.

Keywords. Morphology, new species, nomenclature, soldierfly, taxonomy.

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Introduction

The flies belonging to the family Stratiomyidae Latreille, 1802 are commonly known as soldierflies. The global extant fauna of Stratiomyidae contains over 2800 species, distributed across 12 subfamilies and 378 genera (Woodley 2001, 2011; Hauser *et al.* 2022). The genus *Stratiomys* Geoffroy, 1762 is a medium-sized genus of soldierflies with above 90 species recorded worldwide (Woodley 2001, 2011; Nerudová *et al.* 2007). The members of the genus are mostly medium-sized flies with elongated antenna and a broad-flattened abdomen (Nerudová *et al.* 2007).

The majority of *Stratiomys* are found in the Holarctic Region and just a few species from the Neotropics and Oriental Region (Woodley 2001; Nerudová *et al.* 2007). There are just five species known from

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Research

High energy density storage, antifungal activity and enhanced bioimaging by green self-doped heteroatom carbon dots

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Abstract
Self-heteroatom-doped N-carbon dots (N-CDs) with a 2.35 eV energy gap and a 65.5% fluorescence quantum yield were created using a one-step, efficient, inexpensive, and environmentally friendly microwave irradiation method. FE-SEM, EDX, FT-IR, XRD, UV–VIS spectroscopy, FL spectroscopy, and CV electrochemical analysis were used to characterise the produced heteroatom-doped N-CDs. The graphitic carbon dot surface is doped with heteroatom functional groups such (S, P, K, Mg, Zn) = 1%, in addition to the additional passivating agent (N), according to the EDX surface morphology and the spontaneous heteroatom doping was caused by the heterogeneous chemical composition of pumpkin seeds. These spontaneous heteroatom-doped N-CDs possess quasispherical amorphous graphitic structure with an average size of less than 10 nm and the interplaner distance of 0.334 nm. Calculations utilising cyclic voltammetry showed that the heteroatom-doped N-CDs placed on nickel electrodes had a high specific capacitance value of 1044 F/g at a scan rate of 10 mV/s in 3 M of KOH electrolyte solution. Furthermore, it demonstrated a high energy and power density of 28.50 Wh/kg and 3350 W/kg, respectively. The higher value of specific capacitance and energy density were attributed to the fact that the Ni/CDs electrode material possesses both EDLC and PC properties due to the sufficient surface area and the multiple active sites of the prepared N-CDs. Furthermore, the heteroatom N-CDs revealed the antifungal action and bioimaging of the "Cladosporium cladosporioides" mould, which is mostly accountable for economic losses in agricultural products. The functional groups of nitrogen, sulphur, phosphorus, and zinc on the surface of the CDs have strong antibacterial and antifungal properties as well as fluorescence enhanced bioimaging.

Keywords Heteroatom-doped N-CDs · Microwave irradiation · Ni/N-CDs · Supercapacitance · Cladosporium cladosporioides

Introduction

Photoluminescence, super capacitive, anti-bacterial, bioimaging, photocatalytic and much more capabilities may be seen in carbon dots which are created via pyrolysis, that incorporates the breakdown, dehydrolysis, and carbonisation of carbonaceous materials. Xu and colleagues unintentionally discovered carbon NT'S in mid-2004 [1] while examining it, which further got their name as "Carbon Dots" in 2006 [2], when Sun and his colleagues verified their synthesis process and associated structure. Carbon dots (C-dots), a luminous carbon nanomaterial with a size smaller than 10 nm, constitutes a member of the family of carbon nanomaterials. The high quantum yield (HQY) and controlled emission

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