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ORIGINAL ARTICLE



Hydrogen Peroxide Stress Induced in the Marine Cyanobacterium *Synechococcus aeruginosus* and *Phormidium valdarianum*

J. Mohammed Hussain¹ · P. Muruganatham² · Khaleel Ahamed Abdul Kareem³

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Abstract

Biochemical markers against hydrogen peroxide-induced oxidative stress were developed in marine cyanobacteria under standard laboratory conditions. To find out the ability to cope with different concentrations of hydrogen peroxide, two species of marine cyanobacteria including unicellular and filamentous forms were exposed for shorter duration. *Synechococcus aeruginosus* and *Phormidium valdarianum* tolerated hydrogen peroxide by showing the highest growth of Superoxide dismutase in *Synechococcus aeruginosus* and *Phormidium valdarianum*, catalase in *Synechococcus aeruginosus*, peroxidase in *Synechococcus aeruginosus* and *Phormidium valdarianum*, Glutathione S-transferase in *Synechococcus aeruginosus* and *Phormidium valdarianum* which were identified as biochemical markers of oxidative stress against H₂O₂ in marine cyanobacteria. *Synechococcus aeruginosus* showed new isoforms for Superoxide dismutase, catalase, peroxidase, Glutathione peroxidase, and Glutathione S-transferase and *Phormidium valdarianum* for Superoxide dismutase, peroxidase, and Glutathione S-transferase. *Synechococcus aeruginosus* is suggested as the indicator species for biochemical markers against hydrogen peroxide in marine cyanobacteria. Peroxidase is suggested as biochemical enzyme marker. The present investigated on these new isoenzymes were identified as biochemical markers for oxidative stress.

Keywords Hydrogen peroxide · *Synechococcus aeruginosus* · *Phormidium valdarianum* · Antioxidative enzymes · Biomarkers

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The screenshot displays the Web of Science Master Journal List interface. At the top, there is a navigation bar with links for 'Web of Science Group', 'Master Journal List', 'Search Journals', 'Watch Manuscript', 'Downloads', and 'Help Center'. A 'Login' button and a 'Create Free Account' button are also present. Below the navigation bar, a blue banner features the Web of Science logo and the tagline 'The power of the Web of Science® on your mobile device, whenever inspiration strikes.' To the right of the banner are links for 'Journals' and 'Learn More'.

The main content area is divided into several sections. On the left, there is a sidebar with a 'Find a Match' button and a 'Filters' section. The 'Filters' section includes a 'Clear All' button and several filter categories: 'Web of Science Coverage', 'Open Access', 'Category', 'Country/Region', 'Language', and 'Frequency'. The 'Web of Science Coverage' filter is expanded, showing a list of journals relevant to 'applied biochemistry and biotechnology'.

The 'Refine Your Search Results' section on the right contains a search bar with the text 'applied biochemistry and biotechnology' and a 'Search' button. Below the search bar, there is a 'Sort By' dropdown menu set to 'Relevance'. The 'Search Results' section shows 'Found 1,538 results Page 2' and a 'Share These Results' button. The 'Journals Relevant To "applied biochemistry and biotechnology"' section lists the following journals:

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- ISSN (print):** 0275-1283 | ISSN (online): 1559-1201
- Web of Science Core Collection:** Science Citation Index Expanded
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At the bottom right of the journal list, there are buttons for 'Share This Journal' and 'View profile page'. A small note at the bottom right corner says 'Requires login'.

THE GENUS *OPHIOGLOSSUM* (OPHIOGLOSSACEAE) IN PUDUKKOTTAI DISTRICT, TAMIL NADU, INDIA

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Abstract

The survey of Snake tongue fern in Pudukkottai district of Tamil Nadu, India, revealed the presence of five species of the genus *Ophioglossum*. A detailed description, illustrations, SEM image of spores, and key to the species of the genus in Pudukkottai district are provided.

Keywords: Pteridophytes; Adder's tongue ferns; Enumeration; spore SEM images; Key

Introduction

The genus *Ophioglossum* L. (Ophioglossaceae) is eusporangiate, monophyletic and cosmopolitan and represented by 59 accepted species (Hauk et al., 2003; Hassler & Schmitt, 2020; POWO, 2022). Adder's Snake tongue ferns are the species of *Ophioglossum* which were recognized greatly based on simple morphological features though at times confused due to complex morphological variations (Burrows & Johns, 2001). The variations within the genus are due to the large number of chromosomes owing to polyploidy, and consequently, several morphological variants were reported.

The species of *Ophioglossum* in India were first documented by Beddome (1883) and then followed Chakravarty (1951), Balakrishnan et al. (1960), Mahabale (1962), Panigrahi & Dixit (1969), Dixit (1984, 2000), Vasudeva & Bir (1993), Khullar (1994), Yadav & Tripathi (2002), Goswami (2007), Goswami et al. (2008), Singh et al. (2009), Patil & Dongare (2014), Kachhiyapati et al. (2018), Patil & Rajput (2020), Mandal et al. (2020) and Jadhav & De (2020). Several new species of *Ophioglossum* were described from India in the last decade of which *O. chalconotum* H.K.Goswami et al., *O. indicum* B.L.Yadav & H.K.Goswami, *O. raphanellum* Anto

et al., *O. malvaceum* M.Patel & M.N.Reddy, *O. aleotum* M.Patel et al. and *O. littorale* M.Patel & M.N.Reddy were not accepted by POWO (2022). The novelties accepted are *O. gujaratense* S.M.Patil et al. and *O. joykrishane* S.M.Patil et al. So, the total number of species of *Ophioglossum* in India varies from 12-20 (Jadhav & De, 2020) of which, only 14 species were accepted by Fraser-Jenkins et al. (2017).

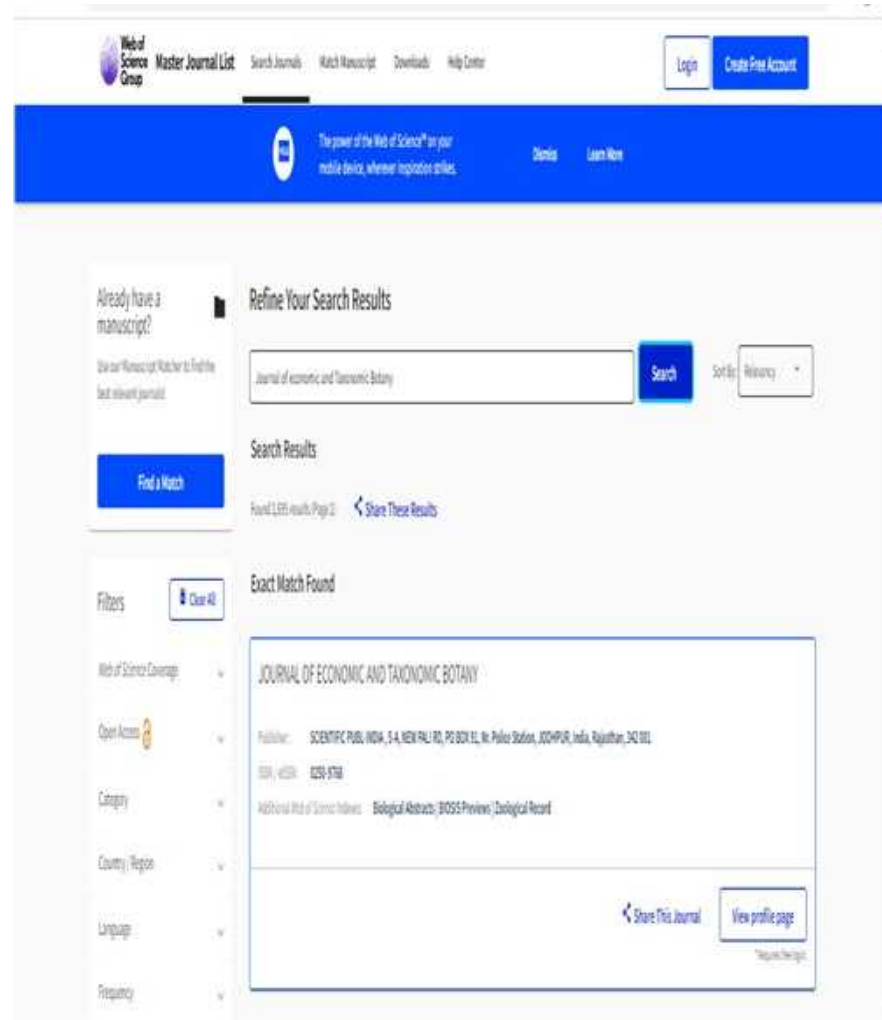
The pteridophytes of Tamil Nadu were studied by Matthew (1979), Bir & Vasudeva, (1971), Manickam, (1986), Manickam & Irudayaraj, (1992), Anandhan & Komalavalli (2011), Raja (2017), Kavitha et al. (2017), Alagesabooopathi et al. (2018) and Sureshkumar et al. (2020). However, there is no comprehensive work on the genus *Ophioglossum*. Hence, the present study was undertaken to study the morphology, taxonomy, distribution, and spore morphology of the genus in the Pudukkottai district.

Study area

The Pudukkottai district was once a princely states (Raju, 1985). It is situated (9°50' and 10°40' N; 78°25' and 79°15' E) covering an area of 4663.29 sq km in the eastern part of Tamil Nadu in Peninsular India (Fig. 1). The district has a coastline of 42 km, bordered on the south by Sivagangal and Ramanathapuram districts, east by Bay of Bengal, north and west by Tiruchirappalli district and in the north by Thanjavur district (Raja, 2017).

Field Survey and Documentation

The field surveys were conducted throughout the Pudukkottai district during 2020-2021 to collect *Ophioglossum* specimens. During post-monsoon seasons,



The screenshot displays the website interface for the Journal of Economic and Taxonomic Botany. At the top, there is a navigation bar with links for 'Web of Science Group', 'Master Journal List', 'Search Journals', 'Watch Manuscript', 'Downloads', and 'Help Center'. A 'Login' button and a 'Create Free Account' button are also present. Below the navigation bar, a blue banner features the journal's logo and the tagline 'The power of the Web of Science® in your mobile device, whenever inspiration strikes.' On the left side, there is a section for 'Already have a manuscript?' with a 'Find a Match' button. The main content area is titled 'Refine Your Search Results' and shows a search bar with the text 'Journal of Economic and Taxonomic Botany'. Below the search bar, there is a 'Search' button and a 'Sort By' dropdown menu. The search results section shows 'Found 1,071 results, Page 2' and a 'Share These Results' link. A 'Filters' section on the left includes 'Web of Science Coverage', 'Open Access', 'Category', 'Country/Region', 'Language', and 'Frequency'. The 'Exact Match Found' section displays the journal's title, 'JOURNAL OF ECONOMIC AND TAXONOMIC BOTANY', along with its publisher, 'SCIENTIFIC PUBL INDIA', and its ISSN, '0259-5780'. A 'Share This Journal' button and a 'View profile page' button are also visible.

*Pharmacological and Phytochemical
Investigation of Chloroxylon swietenia DC.*

Nagarajan M, Amzad Basha Kolar, Anumugam M and
Mohamed Rafi K.

Research Journal of Agricultural Sciences
An International Journal

P- ISSN: 0678-1675
E- ISSN: 2049-4538

Volume: 13
Issue: 05

Res. J. of Agr. Sci. (2022) 13: 1444-1448

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(V) *Jasminum greenii* sp. nov. (Oleaceae): A new species from Tamil Nadu, India

Jasminum greenii Soosairaj & P. Raja, sp. nov.

Type: Vamban, 10°2'11.4"N, 78°55'51.2"E, 12-15 m, Pudukkottai district, Tamil Nadu, India, 27 Aug 2016; S. Soosairaj and P. Raja 4733 (holotype: RHT1, isotypes: MHT).

Climber; branchlets pubescent when young, later glabrescent. Leaves simple, opposite, decussate, broadly elliptic, 3.9-5 × 1.5-4.7 cm, sub-orbiceous,

obtusate at both ends, occasionally acute at apex, slightly retuse, apiculate, glabrous above, tufts of hairs in axils of main nerves and midrib below; lateral nerves 4-6 pairs; petiole 2-6 mm long, pubescent when young, glabrous at maturity. Cymes compound; peduncle 2 mm in flower, 5-6 mm in fruit; bracts leafy, lanceolate, 1-2.2 × 0.5-1.3 cm, pubescent at a distal, puberulent at abaxial; bracteoles 6-9 × 0.9-3 mm, linear-lanceolate, spatulate, pubescent. Flowers shortly pedicellate or subsessile,

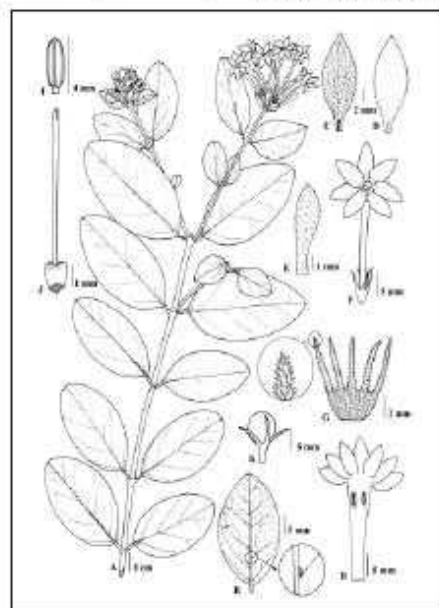


Fig. 1: *Jasminum greenii* Soosairaj & P. Raja. A, a twig; B, a leaf; C and D, adaxial and abaxial views of bract; E, a bracteole; F, a flower; G, split position of calyx; H, split position of corolla with stamens; I, a stamen; J, a pistil; K, a fruit.



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NORDIC JOURNAL OF BOTANY

Research article

Theriophonium blumei (Araceae), a new species from Tamil Nadu, India

Lourdusamy John Peter Arulanandam, Sebastian Soosairaj, Prakasam Raja and Balakrishnan Balaguru

L. J. P. Arulanandam, Rapinat Herbarium Tiruchirappalli, Tiruchirappalli, Tamil Nadu, India – S. Soosairaj (<https://orcid.org/0000-0002-7429-6110>) (jpsosairaj@yahoo.co.in), Dept of Botany, St. Joseph's College, Tiruchirappalli, Tamil Nadu, India – P. Raja, Dept of Botany, JJ College of Arts and Science, Padukottai, Tamil Nadu, India – B. Balaguru, Dept of Botany, Jamal Mohamed College, Tiruchirappalli, Tamil Nadu, India

Theriophonium blumei sp. nov., a new species is described and illustrated from Tamil Nadu, India based on morphological and leaf epidermal features. Although morphologically *T. blumei* appears to be similar to *T. sivagangamum* (Ramam. & Sebastine) Bogner having long acuminate spathe, it is different from *T. sivagangamum* in various aspects such as ellipsoid seed with ridged surface, spinulose and bifid stigma, filiform neuters and berries with purplish strands. *T. blumei* has echinate pollen sculpture and *T. sivagangamum* has verrucate sculpture. Added to that, molecular based (*rbcL*, *matK*, *trnL-F*) phylogenetic analysis also indicate that *T. blumei* is genetically distinct from *T. sivagangamum*.

Keywords: *matK*, new species, *rbcL*, SEM, Tamil Nadu, *Theriophonium*, *trnL-F*

Introduction

The genus *Theriophonium* was first described by Blume in 1857. It is a cormous aroid genus of five to seven species that is endemic to the south and central parts of India with only *T. minusum* (Willd.) Baill. extending to Sri Lanka (Sivadasan and Nicolson 1982). *Theriophonium* shows variation in lamina shape, size and structure due to various ecological parameters such as soil type, shade and climatic condition (Sivadasan et al. 2014). Schott (1860) and Engler (1920) both recognized three species of *Theriophonium* from India. Thereafter, Bogner (1969) added *T. sivagangamum* (Ramam. & Sebastine) Bogner followed by Sivadasan and Nicolson (1982) who added *T. fischeri* Sivad. to the list. Later, two more new species viz. *T. mantchamii* Muragan and Natarajan (2008) and *T. danieli* Rajakumar et al. (2010) were published. However, Sivadasan et al. (2014) reduced the latter two species to synonyms of *T. fischeri* and *T. minusum* respectively. At present, the Plant List database (<www.theplantlist.org/>) accepts these two taxa as distinct species whereas the Plants of the World online (<www.plantsoftheworldonline.org/>) treats them as synonyms as proposed by Sivadasan et al. (2014).

During a field collection in Tiruchirappalli district of Tamil Nadu, we collected a specimen of *Theriophonium* from scrub forests. The identity of the specimen was examined at Rapinat Herbarium, Tiruchirappalli (RHT) and Madras Herbarium

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