Date: 02.01.2020

To
The Teacher-in-Charge,
Parimal Mitra Smriti Mahavidyalaya,
Post-Mal, Dist-Jalpaiguri

Subject: Request to perform collaborative research work with Kalimpong College

Respected Ma'am,

I would like to inform you that I wish to continue my research work in collaboration with Dr. Pranay Bantawa, Assistant Professor, Department of Botany, Kalimpong College. This work will not affect my allotted duties for this College.
I will be highly obliged if you kindly allow me to continue my research work.

Rai 02/01/2020

Dr. Ritu Rai,
Assistant Professor, Department of Botany,
Parimal Mitra Smriti Mahavidyalaya

PARIMAL MITRA SMRITI MAHAVIDYALAYA
POST-MAL, DIST-JALPAIGURI

Date: 03.01.2020

This is to certify that Dr. Ritu Rai, Assistant Professor, Department of Botany is a bonafide teacher of this College and is serving this College from 05.09.2019. The undersigned has No Objection if Dr. Ritu Rai continues her research work in collaboration with Dr. Pranay Bantawa, Assistant Professor, Department of Botany, Kalimpong College after doing her normal duties of this College.

03/01/2020.
Teacher-in-Charge
Parimal Mitra Smriti Mahavidyalaya
Post-Mal, Dist-Jalpaiguri

Teacher-in-charge
PARIMAL MITRA SMRITI MAHAVIDYALAYA
MAL, JALPAIGURI

KALIMPONG COLLEGE

27.05°N
88.46°E
1248 M

(Govt. Aided)

ACCREDITED BY NAAC WITH GRADE 'B' (CYCLE 3)

RINKINPONG ROAD, P.O. & DIST. KALIMPONG, WEST BENGAL, PIN-734301

Email: principalkalimpongcollege@gmail.com 03552-351002 Website: www.kalimpongcollege.org.in

CERTIFICATE OF RESEARCH COLLABORATION

Date: 03/04/2024

TO WHOM IT MAY CONCERN

This is to certify that Dr. Ritu Rai of Department of Botany, Parimal Mitra Smriti Mahavidyalaya, Malbazar, Jalpaiguri, West Bengal, is continuing research work in collaboration with Dr. Pranay Bantawa of Department of Botany, Kalimpong College, Kalimpong, West Bengal, since 15th of February, 2022.

Signature and Seal

Devi Chettri

Mrs. Devi Chettri

Teacher-In-Charge

Teacher-in-charge
Kalimpong College
Kalimpong

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Research Article

Preliminary Observation on The Ecological Amplitude of *Hypoestes phyllostachya* Baker in Darjeeling and Kalimpong Himalayas

Ritu Rai[1], Sajeed Ali[2] and Pranay Bantawa[3*]

[1]Department of Botany, Parimal Mitra Smriti Mahavidyalaya, Malbazar, Jalpaiguri, West Bengal, India. 735221
[2]Regional Research Station, Uttar Banga Krishi Viswavidyalaya, Hill Zone, Seed Farm, Kalimpong, West Bengal. 734301
[3]Department of Botany, Kalimpong College, Kalimpong, West Bengal, India. 734301.

Abstract

Hypoestes phyllostachya Baker ("Polka dot Plant") is an exotic species that is quite problematic weed of Madagascar origin in Darjeeling and Kalimpong regions of Eastern Himalayan Vegetation. Present study was carried out in 26 different localities covering a vertical distribution from an altitude of 90 msl (Teesta Bazar) to 2,478 msl (Senchal Lake) and horizontal distribution from Rimbik (27.1182° N, 88.1084° E) to Bindu (27.0977° N, 88.8713° E), which revealed its very high invasive potential and ecological amplitude. Its presence in agricultural land together with forest and open land has been a matter of concern as it is creating a threat to the local floras. It was strongly felt that its control measure has to be implemented immediately in order to restore the ecological balance in these local areas.

Article info

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Keywords: Weed; Invasive species; Ecological amplitude; Control measure; Horizontal and vertical distribution.

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Introduction

Hypoestes phyllostachya Baker commonly known as "Polka dot plant" belongs to Acanthaceae family is a plant of Madagascar origin. It is thought to be a foreign element and has very high invasive nature (Annon, 2016a, Moktan, 2017). Therefore, it is considered as one of the most problematic weeds (Annon, 2016b), particularly in Eastern Sub-Himalayan region. The increasing population of such exotic species in local region has been a great threat to the local floristic environment which may cause enormous loss of genetic diversity and ultimately species extinction.

While working on the plant resources of Mahananda Wildlife Sanctuary located in the Darjeeling district of West Bengal, Kumar et al. (2009) added new record of *H. phyllostachya* from West Bengal. Similarly, this species was also reported from the State of Kerala as an addition to the Flora of India (Remadevi and Binojkumar, 2001). This species was originally described from Madagascar and is also distributed in North America (Kumar et al., 2009). However, its frequent presence in many places of Darjeeling and Kalimpong districts of West Bengal prompted us to conduct the survey to find out the ecological amplitude as well as its distribution pattern in these two districts of West Bengal.

*** Correspondence** - bantawapranay@rediffmail.com

Materials and Methods

Regular surveys were conducted covering different seasons and various regions (table 1) of Darjeeling and Kalimpong hills. Relevant samples were collected, and herbarium sheets were prepared (Paul et al, 2020). Collected samples were identified using available literatures and also by comparing the herbarium sheets at the Herbarium of Department of Botany, Kalimpong College. Local farmers and tea garden workers were also asked regarding the invasion problems and other related issues of *Hypoestes phyllostachya* in their localities.

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Research Article

Polyethylene Gycol (PEG) Induced Water Stress in Four Different Genotypes of Pea Seedlings and Evaluation of The Induced Defense Mechanism

Pranay Bantawa[1], Ritu Rai[2*]

[1]Department of Botany, Kalimpong College, Kalimpong, West Bengal – 734 301, India

[2]Department of Botany, Parimal Mitra Smriti Mahavidyalaya, Malbazar, Jalpaiguri, West Bengal, India. 735221

Abstract

The present work was undertaken on artificially induced water stress on pea seedlings under in vitro conditions in order to select the drought tolerant line. Artificial water stress was induced with PEG-6000 on 15-day old seedlings of four varieties for 4, 8 and 12 days. The activities of antioxidative enzymes like peroxidase, catalase, ascorbate peroxidase, glutathione reductase and superoxide dismutase were assayed in the stressed and control plants. POX activity was increased in the initial stages of stress, but its activity was decreased significantly on the 12th day in all the varieties. APOX also showed a similar trend but the maximum activity was noted in Var 3 on the 8th day. CAT activity decreased in var 1 and var 2 when compared with the control, which, however, increased significantly in var 3 and var 4. A slight increase in the GR activity was observed in var 1 and var 2 at the initial stages of the drought stress but its activity decreased significantly on the 12th day in both these varieties when compared with control plants. However, its activity also increased steadily in var 3 and var 4. Maximum SOD activities were noted on the 4th day of drought stress in all four varieties but its activities decreased steadily on the subsequent 8th and 12th days when compared with control. When antioxidative activities were compared among the four varieties, var 3 and var 4 showed maximum increase in antioxidant activity during the period of drought stress. Among the four varieties, var 3 and var 4 showed greater accumulation of H2O2 during the stress days and were maximum at 12th day. Lipid peroxidation also increased in the same varieties. Maximum proline content was noted in both the root and leaf of var 3, followed by var 4. It was further noted that the chlorophyll content decreased significantly in all four varieties in subsequent longer drought stresses. The accumulation of proline content was steadily higher with an increase in the stress length in all the four varieties. During the drought stress, all the varieties showed an increase in ascorbate content but, it was maximum in var 4 followed by var 3 and the least ascorbate was noted in var 1. The present findings indicate that water stress induces oxidative stress in all the four varieties. However, antioxidative mechanisms were found to be more pronounced in var 4 which, therefore, may be considered as the most tolerant to drought stress.

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Introduction

Plants have limited mechanisms of drought stress avoidance; therefore, they require flexible means of adaptation to change drought conditions (Zhang et al., 2004; Pradhan and Chakraborty, 2012). Tolerance to this abiotic stress is a complex phenomenon, comprising a number of physiochemical processes at both cellular and whole organism levels activated at different stages of plant development. Both enzymatic and non-enzymatic antioxidants provide protection against oxidative damage (Munne-Bosch and Algere, 2000). Water induces several physiological and biochemical and molecular responses in several crop plants, which

*** Correspondence** - ritu7rai@gmail.com