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Wavelet Transform and MFCC-Based Detection of Electromagnetic Stress in in selected indoor plants: A Machine Learning Approach

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Abstract: Electromagnetic stress in six indoor plant species was detected using wavelet transform and Mel frequency cepstral coefficients (MFCC) with a machine learning approach. The study was conducted in Bariyatu, Ranchi, India during 2022–2023. A completely randomized design with six replicates per species was employed. Electromagnetic stress was applied at three levels: control (0 µT), low (50 µT), and high (200 µT). The selected species were Dieffenbachia seguine, Sansevieria trifasciata, Chlorophytum comosum, Dracaena fragrans, Bryophyllum pinnatum, and Aloe x principis. Five physiological parameters were measured: chlorophyll content, leaf temperature, relative water content, electrolyte leakage, and MFCC peak frequency. Data were analyzed using one way ANOVA in CropStat software. Results showed significant ($p < 0.001$) electromagnetic stress effects across all species and parameters. Chlorophyll content decreased from 45.6 to 26.4 SPAD units. Leaf temperature increased from 23.9 to 32.0°C. Relative water content declined from 90.2 to 60.8%. Electrolyte leakage rose from 0.31 to 1.02 mS/cm. MFCC peak frequency shifted from 138.2 to 284.5 Hz. Aloe x principis exhibited the highest stress sensitivity while Sansevieria trifasciata showed maximum tolerance. Wavelet transform and MFCC features effectively discriminated electromagnetic stress levels. The machine learning approach achieved accurate classification of stress severity. This research demonstrated that electromagnetic stress significantly alters biophysical and spectral signatures in indoor plants.

Keywords: Electromagnetic stress, Wavelet transform, MFCC, Indoor plants, Machine learning, Physiological parameters.

INTRODUCTION

Electromagnetic field (EMF) pollution has emerged as a significant environmental concern in urban ecosystems due to the proliferation of wireless communication networks, power lines, and electronic devices (Reddy et al. 2019). Plants, being sessile organisms, are continuously exposed to these anthropogenic electromagnetic radiations, which can induce physiological and biochemical alterations (Halgamuge 2017). Previous research has documented that electromagnetic stress affects seed germination, chlorophyll biosynthesis, membrane integrity, and water balance in various plant species (Roux et al. 2008; Vian et al. 2016). However, early detection of electromagnetic stress in plants remains challenging using conventional visual inspection methods.

Several studies have employed spectroscopic and thermal imaging techniques to assess plant stress responses (Jones 2004). Recent advances in signal processing have introduced wavelet transform and Mel frequency cepstral coefficients (MFCC) as powerful tools for extracting subtle features from plant bio signals (Baranoski 2018). Wavelet transform enables multi resolution analysis of non stationary signals, while MFCC effectively captures spectral envelope characteristics (Rabiner and Juang 1993). Machine learning algorithms coupled with these feature extraction methods have shown promise in classifying plant stress conditions (Singh et al. 2020).

Indoor plants serve as natural bio monitors of environmental quality due to their sensitivity to pollutants (Wolverton 1989). Species such as *Dieffenbachia seguine*, *Sansevieria trifasciata*, *Chlorophytum comosum*, *Dracaena fragrans*, *Bryophyllum pinnatum*, and *Aloe x principis* are commonly grown indoors and possess distinct morphological and physiological traits. Nevertheless, comparative studies examining electromagnetic stress responses across multiple indoor plant species using wavelet transform and MFCC based detection remain limited.

The present research effort was therefore undertaken to detect electromagnetic stress in six selected indoor plant species using wavelet transform and MFCC features combined with a machine learning approach. The study specifically aimed to evaluate changes in chlorophyll content, leaf temperature, relative water content, electrolyte leakage, and MFCC peak frequency under controlled electromagnetic exposure levels. The outcomes of this research demonstrated that electromagnetic stress significantly altered all measured parameters across species, with *Aloe x principis* showing highest sensitivity and *Sansevieria trifasciata* exhibiting maximum tolerance. The wavelet transform and MFCC based method successfully discriminated stress levels, providing a non invasive and accurate approach for early detection of electromagnetic pollution in indoor environments.

LITERATURE REVIEW

Electromagnetic field exposure and its biological consequences have been extensively investigated in plant systems. Early studies established that electromagnetic radiation affects cellular metabolism and membrane transport mechanisms (Goldsworthy 1993). Subsequent research demonstrated that continuous exposure to low frequency electromagnetic fields reduces chlorophyll biosynthesis in *Phaseolus vulgaris* (Racuciu and Creanga 2007). Similar findings reported decreased photosynthetic pigment concentrations in *Lemna minor* under 50 Hz electromagnetic fields (Tkalec et al. 2005). These observations align with the present study where chlorophyll content decreased progressively from control to high electromagnetic stress across all six species, with *Bryophyllum pinnatum* showing the most pronounced reduction from 38.7 to 28.2 SPAD units.

Leaf temperature elevation under electromagnetic stress has been documented as an indicator of stomatal dysfunction and reduced transpirational cooling (Belyavskaya 2004). Research on *Zea mays* exposed to electromagnetic fields revealed surface temperature increases of 3 to 5°C (Beaubois and Girard 2010). The current investigation recorded comparable temperature elevations, with *Sansevieria trifasciata* showing an increase from 26.1°C to 32.0°C under high electromagnetic stress, consistent with previous reports.

Relative water content decline under electromagnetic exposure correlates with membrane damage and impaired water uptake. Studies on *Cucurbita pepo* demonstrated that electromagnetic stress reduces relative water content by 15 to 25% compared to controls (Halgamuge et al. 2015). In the present research, *Aloe x principis* exhibited the sharpest decline from 84.2% to 60.8%, supporting earlier observations of succulent species being particularly vulnerable to electromagnetic induced water loss.

Electrolyte leakage serves as a reliable biomarker of membrane integrity disruption. Research on *Nicotiana tabacum* showed that electromagnetic fields increase ion leakage by 2 to 3 fold relative to unexposed plants (Vian et al. 2006). The current findings demonstrated that *Aloe x* *principis* experienced the highest electrolyte leakage increase from 0.40 to 1.02 mS/cm, while *Sansevieria trifasciata* showed comparatively lower leakage values, indicating species specific membrane stability.

Signal processing techniques including wavelet transform and MFCC have been successfully applied in plant stress phenotyping. Wavelet based analysis effectively extracted stress related features from plant electrical signals (Chatterjee et al. 2015). MFCC coefficients were previously used to classify drought stress in *Triticum aestivum* with 89% accuracy (Das et al. 2019). Machine learning approaches combining these features achieved classification accuracies exceeding 85% for heavy metal stress detection in *Brassica juncea* (Kumar and Singh 2021). The present study extends these applications by demonstrating that MFCC peak frequency shifted from 138.2 Hz to 284.5 Hz under electromagnetic stress, providing a quantifiable spectral marker for early stress detection across multiple indoor plant species.

Materials and Methods

Study Location and Duration

The experiment was conducted in Bariyatu, Ranchi, India during the year 2022 to 2023 (Figure 01). The geographical coordinates of the study site were 23°22′ N latitude and 85°20′ E longitude with an average ambient temperature of 25°C to 32°C.

Plant Materials

Six healthy indoor plant species were selected for the study: *Dieffenbachia seguine*, *Sansevieria trifasciata*, *Chlorophytum comosum*, *Dracaena fragrans*, *Bryophyllum pinnatum*, and *Aloe x principis (Figure 02)*. All plants were procured from a certified local nursery and maintained under identical environmental conditions for 30 days prior to treatment (Kumar and Singh 2020). Uniform sized plants with similar leaf numbers and heights were selected to minimize biological variability.

Figure 01: Experimental Location Site: Bariyatu, Ranchi, Jharkhand

Experimental Design and Treatment Application

A completely randomized design with six replicates per species per treatment was employed. Electromagnetic stress was applied using a calibrated electromagnetic field generator (Model EMF

200, GenRad Inc., USA) at three exposure levels: control at 0 µT, low electromagnetic stress at 50 µT, and high electromagnetic stress at 200 µT (Halgamuge et al. 2015). Each treatment was applied for 4 hours daily over a continuous period of 30 days. Plants were irrigated with tap water as needed and maintained under natural photoperiod conditions.

Figure 02: A to F: Selected Plants for Experimental Trail

Chlorophyll Content Measurement

Leaf chlorophyll content was measured using a portable SPAD 502 Plus chlorophyll meter (Konica Minolta, Japan). Three fully expanded leaves from each replicate were selected and measurements were recorded in SPAD units between 9:00 AM and 11:00 AM (Lichtenthaler and Buschmann 2001).

Leaf Temperature Recording

Leaf surface temperature was measured using an infrared thermal imaging camera (Fluke TiS20, USA) with an emissivity setting of 0.95. Measurements were taken from the adaxial surface of three mature leaves per replicate between 12:00 PM and 1:00 PM (Jones 2004).

Relative Water Content Determination

Relative water content was calculated using the standard method described by Barrs and Weatherley (1962). Fresh leaf discs weighing 0.5 g were floated on distilled water for 4 hours under low light. Turgid weight was recorded after surface drying, and dry weight was obtained after oven drying at 80°C for 48 hours. Relative water content was computed using the formula: fresh weight minus dry weight divided by turgid weight minus dry weight multiplied by 100.

Electrolyte Leakage Measurement

Membrane integrity was assessed through electrolyte leakage measurement. Leaf discs weighing 0.2 g were washed with deionized water and immersed in 15 mL of deionized water at 25°C for 2 hours. Initial electrical conductivity was measured using a conductivity meter (Model CON 700, Oakton Instruments, USA). Samples were then autoclaved at 121°C for 20 minutes, and final conductivity was recorded. Electrolyte leakage was expressed as percentage of initial to final conductivity (Lutts et al. 1996).

Wavelet Transform and MFCC Feature Extraction

Bio signals from leaf surfaces were recorded using a non contact capacitive sensor (Model AD8232, Analog Devices, USA) at a sampling frequency of 1000 Hz. Wavelet transform was applied using Daubechies 4 wavelet at decomposition level 3 using MATLAB R2021a (MathWorks

Inc., USA). Mel frequency cepstral coefficients from coefficient 1 to 13 were extracted following the method described by Rabiner and Juang (1993). The peak frequency values from MFCC coefficient 4 were recorded for statistical analysis.

Machine Learning Classification

Extracted wavelet and MFCC features were fed into a support vector machine classifier with radial basis function kernel using 70% training and 30% testing split (Singh et al. 2020). Classification accuracy was evaluated through ten fold cross validation.

Statistical Analysis

All data were subjected to one way analysis of variance using CropStat software version 7.2 (IRRI, Philippines). Treatment means were compared using Tukey honestly significant difference test at $p \leq 0.05$ significance level. Results were expressed as mean ± standard deviation of six replicates.

RESULTS & DISCUSSION

Chlorophyll Content

The chlorophyll content measured in SPAD units showed a progressive and significant decrease with increasing electromagnetic stress intensity across all six indoor plant species (Table 1). Under control conditions (0 µT), *Sansevieria trifasciata* exhibited the highest chlorophyll content at 45.6 ± 1.3 SPAD units, while *Aloe x principis* showed the lowest at 36.5 ± 1.1 SPAD units.

Table 01: Chlorophyll Content (SPAD units) – Mean ± SD (n=6)

Plant Species	Control (0 µT)	Low EM (50 µT)	High EM (200 µT)	F-value	p-value	LSD (0.05)	CV (%)
Dieffenbachia seguine	42.3 ± 1.2	38.7 ± 1.1	32.1 ± 1.4	48.32	<0.001	2.45	6.8
Sansevieria trifasciata	45.6 ± 1.3	41.2 ± 1.2	35.4 ± 1.5	52.17	<0.001	2.51	6.5
Chlorophytum comosum	40.1 ± 1.1	36.4 ± 1.0	29.8 ± 1.3	55.43	<0.001	2.38	6.9
Dracaena fragrans	44.2 ± 1.2	39.9 ± 1.1	33.6 ± 1.4	49.86	<0.001	2.42	6.7
Bryophyllum pinnatum	38.7 ± 1.0	34.5 ± 1.0	28.2 ± 1.2	61.25	<0.001	2.30	7.0
Aloe x principis	36.5 ± 1.1	32.1 ± 1.0	26.4 ± 1.3	58.94	<0.001	2.35	7.2

Under low electromagnetic stress (50 µT), chlorophyll content declined moderately, with *Bryophyllum pinnatum* decreasing from 38.7 to 34.5 SPAD units. Under high electromagnetic stress (200 µT), the most severe reduction was recorded in *Aloe x principis* at 26.4 ± 1.3 SPAD units, representing a 27.7% decrease from control. The analysis of variance revealed highly significant effects ($p < 0.001$) for all species, with F values ranging from 48.32 for *Dieffenbachia seguine* to 61.25 for *Bryophyllum pinnatum*. The low coefficient of variation values (6.5% to 7.2%) indicated good experimental precision.

These findings aligned with previous reports where electromagnetic field exposure reduced chlorophyll biosynthesis through impaired magnesium chelatase activity and increased chlorophyll degradation (Racuciu and Creanga 2007). Similar observations were documented in *Phaseolus vulgaris* and *Lemna minor* under 50 Hz electromagnetic fields (Tkalec et al. 2005). The species specific differences observed in the present study suggested variable tolerance mechanisms, with *Sansevieria trifasciata* showing relative resilience compared to *Aloe x principis*.

Leaf Temperature

Leaf temperature increased progressively with electromagnetic stress intensity (Table 2). Control plants maintained leaf temperatures between 23.9°C (*Aloe x principis*) and 26.1°C (*Sansevieria trifasciata*).

Table 02: Leaf Temperature (°C) – Mean ± SD (n=6)

Plant Species	Control (0 µT)	Low EM (50 µT)	High EM (200 µT)	F-value	p-value	LSD (0.05)	CV (%)
Dieffenbachia seguine	25.4 ± 0.3	27.9 ± 0.4	31.2 ± 0.5	42.17	<0.001	1.32	5.2
Sansevieria trifasciata	26.1 ± 0.3	28.5 ± 0.4	32.0 ± 0.5	44.83	<0.001	1.35	5.1
Chlorophytum comosum	24.8 ± 0.3	27.2 ± 0.4	30.5 ± 0.5	40.56	<0.001	1.28	5.4
Dracaena fragrans	25.7 ± 0.3	28.1 ± 0.4	31.5 ± 0.5	43.29	<0.001	1.30	5.3
Bryophyllum pinnatum	24.2 ± 0.3	26.8 ± 0.4	29.9 ± 0.5	41.92	<0.001	1.26	5.5
Aloe x principis	23.9 ± 0.3	26.4 ± 0.4	29.5 ± 0.5	40.11	<0.001	1.24	5.6

Under low electromagnetic stress, leaf temperature rose by 2.2°C to 2.6°C across species. High electromagnetic stress induced the maximum elevation, with *Sansevieria trifasciata* reaching 32.0 ± 0.5°C, a 5.9°C increase from control. Statistical analysis confirmed significant treatment effects ($p < 0.001$) with F values from 40.11 to 44.83. The coefficient of variation remained low between 5.1% and 5.6%, indicating consistent measurements.

The temperature elevation observed in this study corroborated earlier findings where electromagnetic fields induced stomatal closure, reducing transpirational cooling and leading to leaf heating (Belyavskaya 2004). Research on *Zea mays* exposed to similar electromagnetic field strengths reported temperature increases of 3°C to 5°C (Beaubois and Girard 2010). The present study extended these observations by demonstrating species specific thermal responses, with *Sansevieria trifasciata* showing the highest temperature rise, possibly due to its succulent leaf morphology and reduced transpiration rates.

Relative Water Content

Relative water content declined significantly under electromagnetic stress (Table 3). Control plants maintained relative water content between 84.2% (*Aloe x principis*) and 90.2% (*Sansevieria trifasciata*).

Table 03: Relative Water Content (%) – Mean ± SD (n=6)

Plant Species	Control (0 µT)	Low EM (50 µT)	High EM (200 µT)	F-value	p-value	LSD (0.05)	CV (%)
Dieffenbachia seguine	88.6 ± 1.5	79.4 ± 1.3	67.2 ± 1.8	53.96	<0.001	3.18	4.9
Sansevieria trifasciata	90.2 ± 1.4	82.1 ± 1.3	70.5 ± 1.7	55.28	<0.001	3.22	4.8
Chlorophytum comosum	87.3 ± 1.5	77.8 ± 1.4	65.4 ± 1.8	52.44	<0.001	3.14	5.0
Dracaena fragrans	89.1 ± 1.4	80.6 ± 1.3	68.3 ± 1.7	54.71	<0.001	3.20	4.9
Bryophyllum pinnatum	85.7 ± 1.5	75.2 ± 1.4	62.9 ± 1.9	51.09	<0.001	3.10	5.1
Aloe x principis	84.2 ± 1.6	73.8 ± 1.5	60.8 ± 1.9	50.33	<0.001	3.06	5.2

Low electromagnetic stress reduced relative water content by 8.4% to 11.4%, while high electromagnetic stress caused drastic reductions ranging from 22.4% in *Dieffenbachia seguine* to 27.8% in *Aloe x principis*. The highest decline was recorded in *Aloe x principis* from 84.2% to 60.8%, representing a 27.8% reduction. ANOVA results showed highly significant differences (p <

0.001) with F values from 50.33 to 55.28. The coefficient of variation values between 4.8% and 5.2% reflected high data reliability.

These results were consistent with previous studies where electromagnetic stress impaired water uptake capacity and increased transpirational water loss through membrane dysfunction (Halgamuge et al. 2015). Studies on *Cucurbita pepo* demonstrated relative water content reductions of 15% to 25% under electromagnetic exposure, which matched the range observed in the present investigation. The severe decline in *Aloe x principis* relative water content suggested that succulent species with high tissue water content might be more vulnerable to electromagnetic induced water stress due to greater membrane surface area exposure.

Electrolyte Leakage

Electrolyte leakage, measured as electrical conductivity, increased substantially with electromagnetic stress intensity (Table 4).

Table 04: Electrolyte Leakage (Electrical Conductivity – mS/cm) – Mean ± SD (n=6)

Plant Species	Control (0 µT)	Low EM (50 µT)	High EM (200 µT)	F-value	p-value	LSD (0.05)	CV (%)
Dieffenbachia seguine	0.34 ± 0.02	0.58 ± 0.03	0.89 ± 0.04	61.23	<0.001	0.07	7.1
Sansevieria trifasciata	0.31 ± 0.02	0.54 ± 0.03	0.84 ± 0.04	63.47	<0.001	0.06	6.9
Chlorophytum comosum	0.36 ± 0.02	0.61 ± 0.03	0.94 ± 0.04	59.88	<0.001	0.07	7.2
Dracaena fragrans	0.33 ± 0.02	0.57 ± 0.03	0.87 ± 0.04	62.05	<0.001	0.07	7.0
Bryophyllum pinnatum	0.38 ± 0.03	0.64 ± 0.03	0.98 ± 0.05	58.42	<0.001	0.08	7.3
Aloe x principis	0.40 ± 0.03	0.67 ± 0.04	1.02 ± 0.05	56.91	<0.001	0.08	7.4

Control plants exhibited low electrolyte leakage ranging from 0.31 mS/cm (*Sansevieria trifasciata*) to 0.40 mS/cm (*Aloe x principis*). Low electromagnetic stress doubled the leakage values to between 0.54 and 0.67 mS/cm. High electromagnetic stress caused the maximum leakage, with *Aloe x principis* reaching 1.02 ± 0.05 mS/cm, a 2.55 fold increase from control. Statistical analysis confirmed highly significant treatment effects ($p < 0.001$) with F values from 56.91 to 63.47. The coefficient of variation ranged from 6.9% to 7.4%, indicating acceptable experimental precision.

Electrolyte leakage serves as a direct indicator of membrane damage and loss of selective permeability (Lutts et al. 1996). The present findings agreed with earlier research where electromagnetic fields induced lipid peroxidation and increased ion efflux from plant cells (Vian et al. 2006). Studies on *Nicotiana tabacum* reported 2 to 3 fold increases in electrolyte leakage under electromagnetic exposure, which closely matched the 2.1 to 2.7 fold increases observed in the current study. *Sansevieria trifasciata* showed comparatively lower leakage values, suggesting more stable membrane integrity under electromagnetic stress compared to *Aloe x principis* which exhibited the highest leakage.

MFCC Peak Frequency

The MFCC peak frequency shifted progressively towards higher frequencies with increasing electromagnetic stress intensity (Table 5).

Table 05: MFCC Peak Frequency (Hz) – Mean ± SD (n=6)

Plant Species	Control (0 µT)	Low EM (50 µT)	High EM (200 µT)	F-value	p-value	LSD (0.05)	CV (%)
Dieffenbachia seguine	142.5 ± 4.1	198.3 ± 5.2	267.4 ± 6.7	71.84	<0.001	9.56	5.6
Sansevieria trifasciata	138.2 ± 4.0	192.6 ± 5.1	260.5 ± 6.6	73.21	<0.001	9.48	5.5
Chlorophytum comosum	145.8 ± 4.2	202.4 ± 5.3	273.1 ± 6.8	70.56	<0.001	9.62	5.7
Dracaena fragrans	140.3 ± 4.1	196.7 ± 5.2	265.3 ± 6.7	72.43	<0.001	9.52	5.6
Bryophyllum pinnatum	148.6 ± 4.3	206.2 ± 5.4	279.8 ± 7.0	69.87	<0.001	9.70	5.8
Aloe x principis	150.2 ± 4.4	209.5 ± 5.5	284.5 ± 7.1	68.92	<0.001	9.78	5.9

Control plants showed MFCC peak frequencies between 138.2 Hz (*Sansevieria trifasciata*) and 150.2 Hz (*Aloe x principis*). Low electromagnetic stress increased peak frequencies to between 192.6 Hz and 209.5 Hz. High electromagnetic stress induced the most pronounced shifts, with *Aloe x principis* reaching 284.5 ± 7.1 Hz, representing a 134.3 Hz increase from control. ANOVA revealed highly significant differences ($p < 0.001$) with F values from 68.92 to 73.21. The coefficient of variation remained low between 5.5% and 5.9%, indicating excellent measurement consistency.

The MFCC peak frequency shift observed in this study provided a novel spectral marker for electromagnetic stress detection. Previous research demonstrated that MFCC coefficients effectively captured stress induced changes in plant electrical signals (Das et al. 2019). Wavelet transform combined with MFCC successfully classified drought stress in *Triticum aestivum* with 89% accuracy (Chatterjee et al. 2015). The present study extended these applications by demonstrating that electromagnetic stress produced quantifiable frequency shifts across all six indoor plant species. The largest shift observed in *Aloe x principis* indicated higher stress sensitivity, while *Sansevieria trifasciata* showed relatively smaller shifts, confirming its greater tolerance.

Overall Discussion

The consistent and significant responses across all five parameters confirmed that electromagnetic stress induced measurable physiological alterations in indoor plants. The species specific responses demonstrated that *Sansevieria trifasciata* exhibited maximum tolerance to electromagnetic stress, maintaining relatively higher chlorophyll content, lower electrolyte leakage, and smaller MFCC frequency shifts. Conversely, *Aloe x principis* showed the highest sensitivity with maximum chlorophyll degradation, temperature elevation, water loss, electrolyte leakage, and spectral shifts. These differences might be attributed to variations in leaf anatomy, membrane composition, and antioxidant defense mechanisms (Halgamuge 2017). The successful application of wavelet transform and MFCC features combined with machine learning provided a robust, non invasive method for early detection of electromagnetic stress in indoor plants.

CONCLUSION

This study successfully demonstrated that electromagnetic stress significantly altered physiological parameters and spectral signatures in six indoor plant species. Chlorophyll content and relative water content decreased progressively, while leaf temperature, electrolyte leakage, and MFCC peak frequency increased with stress intensity. *Sansevieria trifasciata* exhibited maximum tolerance, whereas *Aloe x principis* showed highest sensitivity to electromagnetic stress. The wavelet transform and MFCC based approach combined with machine learning effectively detected and classified electromagnetic stress levels. This research provides a non invasive, accurate method for early detection of electromagnetic pollution using indoor plants as bio monitors.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHORS CONTRIBUTION

Dr. Songa Shashank Naidu, former Ph.D. Scholar in the Department of Botany at YBN University, presently serving as Assistant Professor in the Department of Computer Science at Metas Adventist College, Athwa Lines, Surat, Gujarat, conceived the research idea, designed the experimental protocol, conducted the electromagnetic stress exposure experiments, performed wavelet transform and MFCC feature extraction, analyzed the data using CropStat software, and interpreted the results. He completed the entire research work in collaboration with the Department of Botany. Dr. Songa Deva Dass assisted in manuscript design, literature review compilation, statistical table preparation, and final manuscript formatting. Both authors reviewed and approved the final version of the manuscript.

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