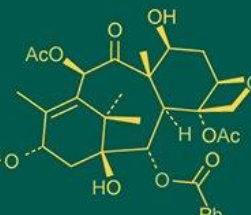
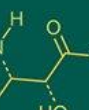
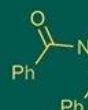


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(4): 1026-1028
www.biochemjournal.com
Received: 13-01-2026
Accepted: 16-02-2026

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Germination studies on winged bean accessions (*Psophocarpus tetragonolobus* L.)

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i4Sm.8256>

Abstract

The winged bean (*Psophocarpus tetragonolobus* L.) is an underutilized legume crop that has a good nutritional profile and has great potential to improve food security in the tropics. The purpose of this experiment was to study the genetic variability between 20 accession types from the germplasm (seed, root, and leaf material) grown in a controlled laboratory environment. The germplasm was grown using the roll towel method in a completely randomized design with three replications (three separate trials). The seedlings were assessed for their performance after 14 days of growth by measuring a number of key parameters: germination percentage, shoot length, root length, and number of leaves. The germination percentage for the 20 accessions ranged from 5.33--9.33%, and there was a significant amount of variation in the seed vigour of the accessions due to the high coefficient of variation associated with this measurement. In addition, there was approximately 10% variation in root length (11.17-30.67 cm) and shoot length (18.27-40.90 cm) but only moderate variability in the number of leaves (2.33-9.33 leaves per plant). The two accessions that had the best performance for germination were NUWB-03 and NUWB-22, whereas Malappuram and NUWB-34 had the best performance for root and shoot growth. On the other hand, the GOA accessions had the least performing accession type with respect to all of the above parameters. These results indicate that there is substantial genetic variability between the germplasm accessions studied, which could be exploited to select superior genotypes for crop improvement and further breeding programmes.

Keywords: Winged bean, germplasm evaluation, seedling traits, genetic variability, laboratory screening

Introduction

The Winged bean is one of the highly nutritious and underutilized minor legume tuber crops widely known for its potential in food and nutritional security in tropical regions. The various part of winged bean plant can be valued for its edible pods, seeds, and tubers, all of which are highly rich in protein, vitamins, and minerals (Bhadmus *et al.*, 2023) [6]. It is one of multipurpose utility, the crop is still largely unexplored in breeding programs, particularly under controlled environmental conditions.

Evaluation of genetic variability among germplasm is a crucial step in crop improvement, it helps identify superior genotypes with desirable agronomic traits among all the germplasms (Sathe *et al.*, 1982) [5]. Early growth parameters such as germination percentage, root length, shoot length, and number of leaves serve as important indicators of seed vigour, adaptability, and overall plant performance. Laboratory based studies provide a uniform environment to assess these traits accurately, minimizing environmental variability and enabling precise comparison among genotypes (Kashyap *et al.*, 2022) [2].

In this content the present study was conducted to evaluate diverse present among the germplasm of winged bean germplasm under laboratory conditions to assess variability in germination and seedling growth traits. The findings aim to identify promising genotypes with superior performance that can be utilized in breeding programs and for the development of improved cultivars suited to different agro climatic conditions (Mohanty *et al.*, 2013) [3].

Materials and Methods

In this study 20 different accessions numbers of winged bean used (Table.1.) which were collected across India. For germination, roll towel method was used with three replications.

The observations were taken from 14th day onwards.

Table 1: Passport data for 20 different accessions numbers.

S. No	No. of accessions	Site of collection			
		Country	Latitude	Longitude	Altitude
1	Nithya	India	8.5° N	76.5° E	75.45ft
2	NUWB-1	India	25.73° N	93.80° E	2,612 ft
3	NUWB-3	India	25.73° N	93.80° E	2,612 ft
4	NUWB-6	India	25.73° N	93.80° E	2,612 ft
5	NUWB-10	India	25.73° N	93.80° E	2,612 ft
6	NUWB-11	India	25.73° N	93.80° E	2,612 ft
7	NUWB-12	India	25.73° N	93.80° E	2,612 ft
8	NUWB-13	India	25.73° N	93.80° E	2,612 ft
9	NUWB-15	India	25.73° N	93.80° E	2,612 ft
10	NUWB-22	India	26.26°N	94.37°E	3,106 ft
11	NUWB-23	India	10.04°N	76.36°E	4137 ft
12	NUWB-34	India	23.71° N	92.72° E	2,822 ft
13	Pt9 Salem local	India	11.57° N	78.51° E	755 ft
14	Pt15 Trichy	India	10.83° N	78.86° E	295.27 ft
15	Pt5 Gadalur local	India	11.50° N	76.49° E	3,517 ft
16	Pt20 Erode green	India	11.47° N	77.66° E	574 ft
17	ECC0038959 (PNG)	PAPUA NEW GUINEA	6°S	147°E	14,793 ft
18	Malappuram	India	11.03° N	76.08°E	224 ft
19	IC0026170 Goa	India	15.40° N	74.02° E	138 ft
20	EC0251020 USA	UNITED STATES OF AMERICA	39.82° N	98.57° W	2,493 ft

Results and Discussions

Germplasm	Germination	Shoot Length (cm)	Root Length (cm)	No. of Leaves
NETHYA	9.00	33.20	25.10	6.67
NUWB-01	6.67	32.17	27.87	5.00
NUWB-03	9.33	31.73	27.30	9.33
NUWB-06	5.33	36.07	26.13	7.33
NUWB-10	9.00	30.63	28.87	7.00
NUWB-12	7.33	24.07	26.67	6.33
NUWB-13	6.00	33.10	29.47	9.00
NUWB-15	7.33	24.10	28.37	3.00
NUWB-22	9.33	22.30	28.27	3.00
NUWB-23	7.00	22.50	25.37	2.33
NUWB-34	8.67	32.70	30.57	6.33
Pt9 LOCAL	7.00	36.90	18.00	4.00
Pt15 LONG	7.67	34.27	12.30	4.67
Pt 6	8.00	25.40	22.50	7.33
Pt 5	6.00	29.17	18.07	4.33
Pt 20	5.67	26.30	12.50	5.33
PNG	5.33	31.03	20.17	7.67
Malappuram	7.67	40.90	30.67	8.67
GOA	7.00	18.27	11.17	7.67
USA	6.67	27.77	20.67	6.00
MAX	9.33	40.90	30.67	9.33
MIN	5.33	18.27	11.17	2.33
C.D.	2.67	1.39	1.57	1.49
SE(m)	0.93	0.48	0.55	0.52
SE(d)	1.32	0.68	0.78	0.73
C.V.	22.09	2.82	4.04	14.93

Germination (%)

Germination varied from 5.33 to 9.33, exhibiting a comparatively high (CV 22.09%) so it has high significant variability among the winged bean genotypes. The highest germination percentage was observed in NUWB-03 and NUWB-22 which is (9.33), with NETHYA and NUWB-10 shows second highest germination percentage. The least germination occurred in NUWB-06, PNG, and Pt 20 which is (5.33). This indicates that some genotypes have superior seed viability and vigour. Due to the relatively high CD value (2.67), only substantial differences between genotypes

are statistically significant. Genotypes exhibiting higher germination rates may be viewed as more suitable to improved crop establishment.

Root Length (cm)

The root length showed moderate variability (CV = 4.04%), ranging from 11.17 to 30.67 cm. Malappuram (30.67 cm) and NUWB-34 (30.57 cm) had the longest roots, indicating vigorous root growth. GOA (11.17 cm) and Pt 15 long (12.30 cm) had the shortest roots, indicating the less vigour root growth. With significant variation, the CD (1.57) shows

that the variations are statistically significant among the winged bean germplasms. Longer-rooted genotypes can be further studied and can be used in stress situations like drought.

Shoot Length (cm)

With low variability (CV = 2.82%), shoot length ranges from 18.27 cm to 40.90 cm, indicating similar expression across genotypes. Malappuram has the longest shoot value (40.90 cm), followed by Pt9 LOCAL (36.90 cm) and NUWB-06 (36.07 cm). GOA had the lowest value shoot length (18.27 cm). Even tiny variations are significant variations since CD value is low (1.39) (Prasad *et al.*, 2021).

Number of Leaves

The number of leaves ranged from 2.33 to 9.33, with low variance (CV = 14.94%). The highest number of leaves was recorded in NUWB-03 (9.33) and NUWB-13 (9.00), indicating more effective vegetative growth. The lowest was observed in NUWB-23 (2.33) and NUWB-15/NUWB-22 (3.00). The CD (1.497) suggests slight significance among genotypes. More number of leaves generally contribute to higher photosynthetic efficiency and growth potential (Adegboyega *et al.*, 2019) ^[1].

Discussion

The overall results conclude that while NUWB-03 performed highly in germination and leaf production, Malappuram performed better in terms of shoot and root growth. While GOA performed less when compared to other germplasms, indicating poor adaptability or growth performance under the suitable conditions, genotypes like NUWB-34 and NUWB-13 also showed promising performance across various characteristics. These results demonstrate the potential of specific genotypes can be utilized in breeding programs or improvement, development and establishment.

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