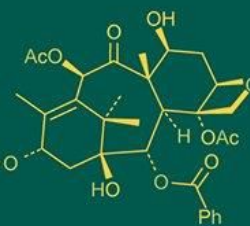
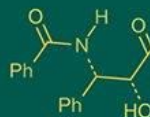


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Morphological characterization of soybean (*Glycine max* L.) varieties using qualitative traits

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Abstract

Soybean (*Glycine max* L. Merrill) is a vital crop for food and industry due to its high protein and oil content. In India, particularly Madhya Pradesh, it forms the backbone of *kharif* cropping systems. This study aimed to characterize 30 soybean genotypes based on qualitative traits using the guidelines provided under Distinctness, Uniformity, and Stability (DUS) testing. Traits studied included plant growth type and habit, flower and leaf characteristics, pod traits, seed morphology, and reaction to diseases like *Cercospora* leaf spot and *Rhizoctonia* aerial blight. Results showed significant variability among genotypes, with implications for breeding programs targeting pest resistance, mechanical harvesting, and varietal identification. The study offers a foundation for varietal development using stable, heritable qualitative markers.

Keywords: Soybean, DUS testing, qualitative traits, genotype characterization, pest resistance

Introduction

Soybean, often termed the "golden bean," holds global significance for its rich nutritional profile and diverse industrial applications. Originating in China, its introduction to India in the late 1960s spurred regional adaptation, particularly in Madhya Pradesh, which now accounts for a majority of national production. As the need for varietal improvement intensifies in response to climate variability and consumer demand, characterizing soybean genotypes through qualitative traits becomes imperative. Qualitative traits such as flower color, leaf shape, pod color, and seed morphology are genetically stable and less influenced by environmental fluctuations, making them ideal for use in breeding programs and seed certification. Moreover, certain traits—like pod pubescence—play a direct role in insect resistance and post-harvest quality. This study was undertaken to characterize 30 soybean genotypes based on such traits, aligning with DUS standards to support varietal registration and crop improvement.

Materials and Methods

The study was conducted during *kharif* 2019 and 2020 at the Instructional Farm, College of Agriculture, Ganj Basoda, Madhya Pradesh. The site is located at 23°51' N latitude and 77°55' E longitude, featuring subtropical climate and clay loam soils with low nitrogen and high potassium levels. Thirty soybean genotypes were selected from diverse agro-ecological regions of India. The trial was laid out in a Randomized Block Design (RBD) with three replications. Each plot measured 3 × 1.2 m. Sowing was carried out using hand dibbling at a spacing of 30 cm × 10 cm. Qualitative data were collected at various growth stages. Traits were recorded on five randomly selected plants per plot based on DUS guidelines (Anonymous, 2009) [1]. The traits included plant growth type and habit, flower and leaf traits, pod color and pubescence, pod shattering, seed shape and color, cotyledon color, and resistance to major diseases.

Results and Discussion

Plant Growth Type: The genotypes were grouped into two categories based on plant growth type. Fourteen genotypes were found to be determinate while sixteen were semi-determinate. None of the genotypes exhibited an indeterminate growth habit. Determinate types are typically compact and mature uniformly, which makes them suitable for mechanical

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harvesting. Semi-determinate types, on the other hand, provide a slightly longer flowering window and may be better adapted to variable climatic conditions.

Plant Growth Habit: Out of 30 genotypes, 22 showed a semi-erect growth habit, and 8 showed an erect habit. Erect types facilitate better light penetration and are less prone to lodging. The predominance of semi-erect genotypes indicates a trend toward selection for plant types with balanced architecture conducive to good yield and adaptability.

Flower Colour: The flower colour ranged from white to violet among the genotypes. Seventeen genotypes had violet flowers while thirteen had white. This trait is genetically stable and provides a quick reference point for varietal identification during field inspections.

Leaf Shape: Three different leaf shapes were observed: lanceolate, pointed ovate, and rounded ovate. Most genotypes (22) exhibited pointed ovate leaves, followed by lanceolate (5) and rounded ovate (3). Variation in leaf shape influences light interception and photosynthesis rate, indirectly affecting yield. Similar findings have been reported by Tarasatyavathi *et al.* (2004) [5].

Leaf Colour: Leaf colour also varied from green (21 genotypes) to dark green (9 genotypes). Dark green leaves are often correlated with higher chlorophyll content and enhanced photosynthetic efficiency, making them a desirable trait in breeding programs.

Pod Colour: Pod colour exhibited three distinct types: brown, yellow, and black. The majority of genotypes (23) had brown pods, while 4 had yellow and 3 had black. Pod colour can affect marketability and consumer preference, as well as provide varietal distinction.

Pod Pubescence: Pod pubescence (presence of hair) was observed in 23 genotypes, while 7 were without it. Pubescence helps in reducing insect attack and desiccation, contributing to post-harvest quality. This trait is a preferred selection marker in breeding.

Pod Pubescence Colour: Pod pubescence colour was classified as tawny (17 genotypes) and grey (13 genotypes). Tawny colour is more common and may be preferred in environments with higher solar exposure, providing protective benefit to developing seeds.

Pod Shattering: Only one genotype (JS 80-21) exhibited pod shattering, while the remaining 29 were non-shattering. Non-shattering genotypes are critical in modern agriculture for reducing field losses and improving harvest index. Selection against shattering is a key breeding goal.

Seed Shape: The genotypes were divided into spherical (23) and elongated (7) types. Spherical seeds are preferred for uniformity and ease of mechanical planting. The predominance of spherical shape suggests progress in breeding for machine-compatible seed types.

Seed Colour: Seed colour was predominantly yellow (29 genotypes), with only one genotype showing yellow-green

seeds. Yellow seeds are favored in Indian markets due to consumer preference. The uniformity in seed colour reflects stability and selection pressure.

Cotyledon Colour: All 30 genotypes exhibited yellow cotyledons, indicating a strong genetic control of this trait. Cotyledon colour has implications in food processing and consumer appeal.

Disease Resistance: The study also included screening for Cercospora leaf spot and Rhizoctonia aerial blight using a 0-9 scale. Variation was noted among the genotypes in resistance levels. Identification of resistant lines provides a valuable resource for disease management in breeding programs.

These results affirm the diversity and selection potential in Indian soybean germplasm, contributing foundational data for breeding programs targeting improved resistance, yield stability, and quality.

Table 1: List of genotypes of soybean along with used in the present investigation

S. No.	Name of Genotypes	Source
1	JS 75-46	JNKVV Jabalpur
2	JS 79-81	JNKVV Jabalpur
3	JS-335	JNKVV Jabalpur
4	NRC-7	IISR, Indore
5	NRC37	IISR, Indore
6	JS 71-05	JNKVV Jabalpur
7	JS90-41	JNKVV Jabalpur
8	JS 93-05	JNKVV Jabalpur
9	JS 95-60	JNKVV Jabalpur
10	JS 97-52	JNKVV Jabalpur
11	JS 80-21	JNKVV Jabalpur
12	JS 20-29	JNKVV Jabalpur
13	JS 20-34	JNKVV Jabalpur
14	MAUS 81	MAU, Parbhani
15	PK-472	MPKV, Rahuri
16	SL688	PAU, Ludhiana
17	PRATAP SOYA-2	MPUA & T, Udaipur
18	MAUS-71	MAU, Parbhani
19	NRC-12	IISR, Indore
20	NRC-2	IISR, Indore
21	MAUS-2	MAU, Parbhani
22	JS20-98	JNKVV, Jabalpur
23	PK-471	MPKV, Rahuri
24	PK-262	MPKV, Rahuri
25	PK-416	MPKV, Rahuri
26	PK-308	MPKV, Rahuri
27	SL-295	PAU, Ludhiana
28	SL-525	PAU, Ludhiana
29	MAUS-01	MAU, Parbhani
30	MAUS-32	MAU, Parbhani

Conclusion

This study successfully characterized 30 soybean genotypes based on key qualitative traits. The observed variability in morphological and disease-resistance traits is valuable for selecting parent lines in breeding programs. Traits like non-shattering pods, pod pubescence, and flower color offer direct advantages in terms of harvestability, pest resistance, and varietal identification. The findings contribute to genetic improvement strategies and the development of high-performing, DUS-compliant soybean varieties.

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