

Morphological Superiority of Candidate Upright Bird's Eye Chili Varieties (*Capsicum frutescens* L.) in Lowlands

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ABSTRACT

Bird's eye chili (*Capsicum frutescens* L.) is one of the most popular chili types in Indonesia. It contains valuable nutritional components, particularly vitamin C at a concentration of 11 mg per 10 grams of sample. The development of new varieties is undertaken to improve the genetic quality of chili plants, thereby producing cultivars with higher productivity and more stable yields. This study aims to obtain the morphological characteristics and specific distinguishing features of the bird's eye chili candidate variety RTJHL. The research was conducted using a Randomized Complete Block Design (RCBD) with one factor consisting of four variety treatments. These varieties included RTJHL as the candidate test variety, and three comparison varieties: Abayomi from Halbanero, O'Ertavi from Halbanero, and Brengos-99 from Benih Kelud Nusantara. Morphological traits were analysed descriptively based on the Guidelines for Conducting Tests of Distinctness, Uniformity, and Stability (DUS) in chili. The result revealed that superior traits identified as distinguishing characteristics of the bird's eye chili candidate variety RTJHL were the number of flower petals and the number of fruit locules. morphological character analysis serve as a reference for determining the distinctive markers of the proposed candidate variety

Keywords: Bird's Eye Chili, Morphological Characteristics, Superiority Test

ABSTRAK

Cabai rawit (*Capsicum frutescens* L.) merupakan salah satu jenis cabai populer di Indonesia. Cabai Rawit memiliki kandungan gizi yang baik terutama vitamin C dengan kadar 11 mg per 10-gram sampel. Perakitan varietas baru dilakukan untuk memperbaiki genetik tanaman cabai sehingga menghasilkan tanaman dengan produktivitas tinggi serta hasil produksi yang stabil. Penelitian ini bertujuan untuk mendapatkan karakter morfologi dan penciri khusus dari tanaman cabai rawit calon varietas RTJHL. Penelitian dilakukan dengan metode rancangan acak kelompok lengkap (RAKL) dengan satu faktor terdiri dari 4 perlakuan varietas. Varietas tersebut yaitu RTJHL sebagai calon varietas uji, serta 3 varietas pembanding yang terdiri dari Abayomi dari Halbanero, O'Ertavi dari Halbanero, dan Brengos-99 dari Benih Kelud Nusantara. Karakter morfologi dianalisis secara deskriptif dengan berpedoman pada Panduan Pelaksanaan Uji (PPU) Keunikan, Keragaman, dan Kestabilan Cabai. Hasil penelitian menunjukkan bahwa karakter unggul yang dijadikan sebagai penciri khusus tanaman yaitu jumlah mahkota bunga dan jumlah rongga buah pada calon varietas RTJHL.

Kata Kunci: Cabai Rawit, Karakter Morfologi, Uji Keunggulan

INTRODUCTION

Chili (*Capsicum* sp.) is one of the horticultural commodities widely cultivated in Indonesia. Chili has many types and distinct characteristics. Popular chili types in Indonesia include bird's eye chili (*Capsicum frutescens* L.) and large chili (*Capsicum annuum* L.). Bird's eye chili is more favoured because it has a spicier taste, is easy to cultivate, and offers promising business opportunities. (Wisnujati & Siswati, 2021). In addition, bird's eye chili contains good nutritional value for health, especially vitamin C at a level of 11 mg per 10 grams of sample. (Asmal, 2023). This makes bird's eye chili a strategic commodity that is important for society.

The Chili Outlook released by the Centre for Agricultural Data and Information Systems. (Pusdatin, 2024) states that the projected per capita demand for chili in 2024–2028 is expected to continue increasing, with an average growth rate of 4.6% per year over the past decade. National consumption is predicted to keep rising until 2028, in line with Indonesia's population growth of 0.98% per year. The increasing demand and consumption of chili create significant opportunities for the seed sector; thus, genetic improvement and cultivation system development must continue to be carried out to ensure optimal chili production and meet market needs (Mustafa et al., 2023).

The development of bird's eye chili in the field shows changes in form, taste, and colour as a result of adaptation to cultivation environments influenced by climate, soil conditions, and other environmental factors (Sofiarani & Ambarwati, 2020). In addition, market demand for product quality has driven the emergence of numerous new varieties with distinct characteristics. Therefore, breeding bird's-eye chili varieties has become an important step toward increasing productivity while meeting consumer preferences.

The rapid development of the horticultural seed industry, along with continuously changing market trends, requires seed companies to consistently innovate their products. Plant breeding is carried out to obtain lines that meet the breeder's objectives. In chili plants, morphological traits are influenced by genotype as well as environmental conditions; therefore, each variety possesses distinct characteristics. Generally, chili flowers are star-shaped with 5–6 petals. According to PPVT (2014) in the Guidelines for Chili Commodity Testing (PPU), the number of cavities or locules in chili fruits is classified into three categories: two locules, three locules, and four locules. However, it has not yet been determined whether these morphological traits will be expressed in the candidate bird's eye chili variety RTJHL.

This process must be accompanied by superiority testing as an absolute technical requirement in the release of a variety. The testing is conducted through field trials according to the agroecological conditions of the development area to determine the interaction of the variety with the environment, as well as its specific advantages, which is known as an adaptation test (Sunandar et al., 2023). Candidate varieties to be released must possess advantages and distinctive traits that differ from the comparison varieties. This study aims to identify the morphological characteristics and distinctive traits of the candidate bird's eye chili variety RTJHL. Superiority testing was carried out on the candidate upright bird's eye chili variety, which is the result of breeding by CV Jogja Horti Lestari. The results of the superiority test are expected to serve as a consideration for releasing a new superior variety.

METHODOLOGY

Time and Place

The study was conducted in the research field of CV Jogja Horti Lestari, located in Balong Hamlet, Sukoharjo Village, Ngaglik Subdistrict, Sleman Regency, Special Region of Yogyakarta, during the period from June 2025 to January 2026. The research site is a lowland area at an elevation of 268 m a.s.l. and has sandy clay soil.

Tools and Materials

This study used various tools, including a digital scale, measuring tape, ruler, caliper, stationery, micrometer, and RHS Mini Colour Chart. The materials involved in this research included chili seeds from four varieties (candidate variety RTJHL, Abayomi, O'Ertavi, and Brengos-99), observation forms, labeling tags, urea fertilizer, NPK fertilizer, insecticides, fungicides, and water.

Research Design

The study was conducted using a randomized complete block design (RCBD) with a single factor consisting of four variety treatments. The varieties included RTJHL as the candidate test variety, along with three comparison varieties: Abayomi from Halbanero, O'Ertavi from Halbanero, and Brengos-99 from Benih Kelud Nusantara. The experiment was carried out with four replications in one season, resulting in 16 experimental plots. Each plot contained 40 individual plants arranged in two planting rows (double row). A total of 12 plants were sampled in each replication, giving an overall sample size of 192 plants. The area of each experimental plot was 1 m × 12 m (12 m²), while the total experimental field measured 63.75 m × 7,75 m (494 m²). The planting distance used was 50 cm × 60 cm with an inter-bed spacing of 0,75 m. In this experiment, approximately 640 plants were cultivated.

Parameters and Data Analysis

The observed parameters included morphological traits such as stem cross-sectional shape, stem colour, leaf shape, leaf colour, flower shape, flower colour, fruit shape, fruit colour, fruit taste, seed shape, and seed colour. The parameters were analysed at the age of above 1 years. The qualitative data on plant characteristics were analysed descriptively through tabulation to emphasize differences among the observed varieties. Relevant images were included to support and strengthen the analysis results.

RESULT AND DISCUSSION

Macroclimatic Conditions

The superiority test was conducted at a single location within the same season. The research site was situated in a lowland area at an elevation of 268 m a.s.l. Optimal conditions are an essential requirement for the growth of bird's eye chili plants, enabling them to thrive and produce abundant fruit. The optimal temperature range required for bird's eye chili growth is between 18–27 °C. The humidity needed for growth ranges from 50% to 80% (Aryani et al., 2022).

Table 1. Sleman Regency Climate Data

Month	Total Rainfall (mm)	Max Temp (°C)	Min Temp (°C)	Avg Temp (°C)	Relative Humidity (RH %)	Sunshine Duration (Hours)
June	102,5	30,5	23,6	26,6	86,1	5,1
July	1,9	30,5	22,3	25,5	84,6	5,4
August	114,3	31,3	23,0	26,1	83,2	5,5
September	14,5	31,7	23,5	26,6	84,1	6,3
October	317,7	31,7	23,8	26,7	88,6	4,9
November	273,5	30,9	23,5	26,3	89,3	3,6
December	210,0	31,3	24,0	26,9	86,5	4,9
January	478,0	31,5	23,5	26,4	87,1	3,6
Average	189,1	31,2	23,4	26,4	86,2	4,9

Source: BMKG Sleman DIY, 2026

Based on climate data from BMKG for the period June 2025 to January 2026 in the Sleman region, the microclimatic conditions during the study are presented in Table 1. The research was conducted during the rainy season, with the highest rainfall recorded in January 2026 at 478.0 mm/month, while the lowest rainfall was observed in July 2025 at 1.9 mm/month. The average rainfall throughout the study period was 189.1 mm. The high rainfall from October to December resulted in an average humidity of 86.2%, a condition prone to pest and disease attacks. (Ramadhan, 2025). This factor became one of the constraints in chili production, but can be managed through irrigation practices and the implementation of Integrated Pest Management (IPM). In addition, the average temperature during the study was recorded at 26.4 °C, with an average sunshine duration of 4.9 hours per day (BMKG, 2026). The field conditions at the site were still considered suitable for the cultivation of bird's eye chili.

Morphological Characteristics

Morphological traits of chili plants, also referred to as qualitative variables, are plant characteristics that can be directly observed with the naked eye and cannot be expressed in numerical form. Genetic factors play a major role in determining these traits, while environmental factors contribute only minimally. (Huda et al., 2025). Morphological traits were analysed descriptively based on the Guidelines for The Conduct of Test of Distinctness, Uniformity and Stability (GCT DUS) of Chili (PPVT, 2014). The results of morphological observations of the candidate bird's eye chili variety RTJHL, compared with the three reference varieties tested, are presented in the following table.

Table 2. Morphological Data of Bird's Eye Chili Plants

No	Character	Variety			
		RTJHL	Abayomi	O'Ertavi	Brengos-99
1	Stem cross-sectional shape	Pentagonal cylindrical	Pentagonal cylindrical	Pentagonal cylindrical	Pentagonal cylindrical
2	Stem colour	Green (RHS 137 C)	Green (RHS 137 C)	Green (RHS 137 C)	Green (RHS 137 C)
3	Leaf shape	Ovate	Ovate	Ovate	Ovate

No	Character	Variety			
		RTJHL	Abayomi	O'Ertavi	Brengos-99
4	Leaf colour	Dark Green (RHS 137 A)	Dark Green (RHS 137 A)	Dark Green (RHS 137 A)	Dark Green (RHS 136 A)
5	Flower shape	Star-shaped	Star-shaped	Star-shaped	Star-shaped
6	Flower corolla colour	White (RHS 157 B)	White (RHS 157 B)	White (RHS 157 B)	White (RHS 157 B)
7	Number of corolla segments	Seven	Five	Five	Five
8	Stigma colour	Yellow Green (RHS 145 C)	Yellow Green (RHS 145 C)	Yellow Green (RHS 145 C)	Yellow Green (RHS 145 C)
9	Stamen Colour	Green (RHS 137 C)	Green (RHS 137 C)	Green (RHS 137 C)	Green (RHS 137 C)
10	Calyx colour	Dark Green (RHS 144 A)	Dark Green (RHS 143 A)	Dark Green (RHS 144 A)	Dark Green (RHS 144 A)
11	Fruit shape	Elongated, flat base, pointed apex	Elongated, base flat, apex blunt	Elongated, flat base, pointed apex	Elongated, base flat, apex blunt
12	Fruit: number of locules	Predominantly three	Predominantly two	Predominantly two	Predominantly two
13	Fruit: Colour before maturity	Yellow Green (RHS 145 B)	Yellow Green (RHS 145 C)	Yellow Green (RHS 145 B)	Yellow Green (RHS 145 C)
14	Fruit: Colour at maturity	Red (RHS 44 A)	Red (RHS 47 A)	Red (RHS 44 A)	Red (RHS 44 A)
15	Fruit taste	Pungency	Pungency	Pungency	Pungency
16	Seed shape	Oval	Oval	Oval	Oval
17	Seed colour	Light Yellow (RHS 8C)	Light Yellow (RHS 8C)	Light Yellow (RHS 8C)	Light Yellow (RHS 8C)

Source: Personal data

Observation of the stem cross-sectional shape in the four tested varieties showed no differences, with all stems exhibiting a pentagonal cylindrical shape. This finding is consistent with the varietal descriptions, namely: Abayomi variety (Direktorat Perbenihan Hortikultura, 2016), O'Ertavi variety (Direktorat Perbenihan Hortikultura, 2022), and Brengos-99 variety (Direktorat Perbenihan Hortikultura, 2021), all of which are characterized by pentagonal cylindrical stems. Accordingly, the observations support the conformity of stem morphological traits with the respective varietal descriptions. For another stem character, namely stem colour, all four varieties exhibited Green (RHS 137 C).

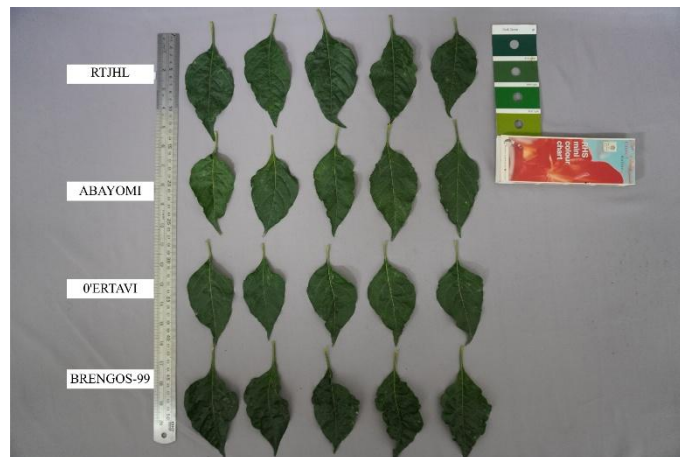


Figure 1. Observation of leaf characters

Previous studies have shown that chili pepper varietal genotypes influence leaf characteristics, which in turn affect adaptation and productivity (Putri *et al.*, 2025). In the present study, the observed leaf characters included leaf shape and leaf colour. Figure 1 illustrates that all varieties exhibited an ovate leaf shape without differences. However, variation was observed in leaf colour: the Brengos-99 variety displayed Dark Green (RHS 136 A), while the other varieties exhibited Dark Green (RHS 137 A).



Figure 2. Observation of flower characters

The observed flower characters included flower shape, corolla colour, stigma colour, stamen colour, and calyx colour. In general, chili flowers exhibit a star-shape, as was the case in all four tested varieties. The corolla colour of the four varieties was White (RHS 157 B). For stigma colour, all varieties showed Yellow Green (RHS 137 C), while the stamens exhibited Green (RHS 144 A). Variation was observed in calyx colour: the Abayomi variety displayed Dark Green (RHS 143 A), whereas the other varieties exhibited Dark Green (RHS 144 A).

Figure 2 shows differences in the number of corolla segments in chili plants, where the RTJHL variety possesses 7 corolla segments, while the other comparative varieties have only 5 segments. This variation in corolla segment number is presumed to be influenced by genotypic differences that affect growth and yield traits, including flower formation (Azizah *et al.*, 2023).

Observation of the corolla segment number can thus serve as a distinctive marker of the RTJHL candidate chili variety.



Figure 3. Observation of fruit characters

Fruit represents the final outcome of plant growth and serves as a primary indicator of cultivation productivity. The success of fruit formation and development not only reflects the quality of vegetative growth but also determines the overall yield value. Observations of fruit shape in the four tested chili varieties revealed elongated fruits with a flat base. Differences were observed at the fruit apex: the RTJHL and O'Ertavi varieties exhibited pointed tips, whereas the Abayomi and Brengos-99 varieties had blunt tips. Young fruits of RTJHL and O'Ertavi were Yellow Green (RHS 145 B), while Abayomi and Brengos-99 were Yellow Green (RHS 145 C). Regarding mature fruit colour, the Abayomi variety displayed a darker shade compared to the others, namely Red (RHS 47 A), whereas the other varieties exhibited Red (RHS 44 A). The fruit taste in all four tested varieties was pungent.



Figure 4. Observation number of locules

Another fruit character, namely the number of locules, can be observed after cutting the chili fruit. Observations showed that the candidate RTJHL variety was characterized by a dominant number of 3 locules, whereas the other three varieties Abayomi, O'Ertavi, and Brengos-99 were characterized by a dominant number of 2 locules. As shown in Figure 4, fruits with 3 locules tended to have a larger size compared to those with 2 locules. Other studies have reported that fruit size influences yield (Sofiarani & Ambarwati, 2020). According to Anantiastiti *et al.*, (2023) lines with larger fruit size tend to produce higher harvest weight compared to lines with smaller fruits. Thus, the number of locules can be considered one of the morphological indicators affecting chili productivity.

In terms of seed shape, the candidate RTJHL variety did not differ from its comparative varieties, all of which exhibited an oval form. Observations of seed colour in the four tested varieties showed the same result, namely Light Yellow (RHS 8 C).

CONCLUSION

The analysis of morphological characters across 17 observed traits showed that the candidate RTJHL variety shared similarities with the Abayomi variety in 11 traits, namely stem cross-sectional shape, stem colour, leaf shape, leaf colour, flower shape, corolla colour, stigma colour, stamen colour, fruit taste, seed shape, and seed colour. In comparison with the O'Ertavi variety, RTJHL exhibited similarities in 14 traits, including stem cross-sectional shape, stem colour, leaf shape, leaf colour, flower shape, corolla colour, stigma colour, stamen colour, calyx colour, fruit shape, immature fruit colour, fruit taste, seed shape, and seed colour. The comparison with the Brengos-99 variety revealed similarities in 12 traits, namely stem cross-sectional shape, stem colour, leaf shape, flower shape, corolla colour, stigma colour, stamen colour, calyx colour, mature fruit colour, fruit taste, seed shape, and seed colour. The results of morphological character analysis serve as a reference for determining the distinctive markers of the proposed candidate variety. Based on these observations, the distinctive markers of the RTJHL candidate chili variety are the presence of 7 corolla segments and a dominant number of 3 fruit locules.

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