

# Cultivation and Morphological Characterization of different Ecotypes of Kala Zeera (*Bunium persicum* Boiss.) Across Kashmir Valley

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**Abstract**—The study was conducted to analyze morphological characters of different ecotypes of *Bunium persicum* Boiss in Kashmir valley. Plant material consisted of root tubers collected during August-September 2018 from natural populations growing at four locations of Kashmir region namely, Gurez, Harwan, Charar-e-Sharief and Khrew was cultivated and studied for plant height, branches, days of flowering number of umbels, umbel diameter, number of seeds per umbel and seed weight.

## 1. Introduction

The Himalayan region has been ubiquitously recognized as out-and-out repository of vast variety of flora and fauna since time immemorial. Exploration of properties of plants had created a vast heritage of knowledge and expertise in different cultures and civilizations. Medicinal and aromatic plants constitute most viable alternative cash crop for growers and is virtually a goldmine for pharmaceutical and essential oil industry. As such they can afford to be powerful supplement to agrarian reforms and economical emancipation of rural masses on one hand and industrial growth and enhancement on other. *Bunium persicum* (Boiss) is one of the noteworthy species of Himalayan region. *Bunium persicum* (Boiss), also known as black cumin or kala zira or shahi-zeera, belongs to family Apiaceae. The family consists of about 423 genera. The genus *Bunium* contains about 166 species, including *B. persicum*, *B. carum*, *B. bulbocastenum*, *B. elegans* and *B. cylendricum*. It is highly valued for its seeds, which are used as spice and medicinal constituents in many medications to cure a number of diseases. It is perennial, dicot, glabrous, branched herb native to Central Asia to Northern India<sup>1</sup>, having diploid chromosomal number of  $2n = 14^2$ . *Bunium persicum* has been found growing in dry temperate areas in the Western Himalayan region of the Indian sub-continent at an altitude between 2000–3000m above mean sea level and extending up to Baluchistan and Afghanistan<sup>3</sup>. High altitude regions of Kinnaur, Lahul Spiti, Pangi, and Bharmaur of Chamba area in Himachal Pradesh, Paddar valley, Gurez and Drass areas of Jammu & Kashmir are the potential areas of its production in India<sup>4</sup>. In Jammu and Kashmir, the crop species

grows mostly in the wild under natural conditions in forests on open hilly grassy slopes, low alpine and table lands mostly across the areas of Gurez, Tulail, Keran, Machil, Tangdar, Kargil, Paddar Kishtwar, Khrew and Charar-e-Sharief. The plant requires an optimum temperature of 24-27°C and sufficient moisture in the soil<sup>5</sup>. The oil is rich in cuminaldehyde and p-menthadienals, the essential oils extracted from seeds are reported to have noteworthy antioxidative, antibacterial and antifungal activities<sup>6</sup>. In India more than 2500 plant species are threatened with extinction out of which 100 are critical rare<sup>7</sup>. This number must have increased by now. Kashmir Himalayas which harbors number of economical plant species are also not exception to the increasing biotic and abiotic stress and there are about 34 plant species which have been enlisted from Kashmir Himalayas at various levels of extinction<sup>8</sup> and kala zeera is not exception to it.

## 2. Material and Methods

The present study was done to analyze the morphological differences in *Bunium persicum* across different ecotypes of Kashmir valley. Plant material consisted of root tubers collected during September 2018 from natural populations growing at four locations of Kashmir region namely, Gurez, Harwan, Charar-e-Sharief and Khrew. Tubers collected from various sites were weighed and planted in experimental plots. Tubers were weighed with digital Vernier Caliper. The spacing from row to row was maintained 16 cm and from plant to plant 10 cm. Each plot was planted with 20 tubers. The design for the experiment was completely random. Planting of tubers, recommended dose of N, P and K in the ratio of 30:40:20 along with farm yard manure were mixed with soil at the time of land preparation. Before planting, the tubers were subjected to fungicidal treatment with 0.2 per cent carbendazim for 10 minutes and latter with 0.03 per cent myclobutanil for 30 minutes. All agronomic measures were adopted for raising and maintaining a healthy crop. randomly selected plants from each ecotype were studied with respect to

Plant height (cm), number of branches plant<sup>-1</sup>, Days from tuber sprouting to initial, 50 percent flowering and full bloom, number of umbels plant<sup>-1</sup>, number of umblets umbel<sup>-1</sup>, umbel diameter, days to 80 per cent physiological maturity, number of seeds umbel<sup>-1</sup>, Seed yield (g) and 1000-seed weight (g)

### 3. Results

#### Plant height (cm)

Mean height of plants ranged from 47 cm to 54.26 cm. The maximum mean height was exhibited by plants of Charar-e-Sharief (54.26 cm). Plant height of Khrew and Harwan ecotypes (51.9 and 51.22 cm, respectively) were also at par with Charar-e-Sharief ecotype. However Gurez ecotypes which exhibited plant height of 47cm, which is significantly different from other ecotypes.

#### Number of branches plant<sup>-1</sup>

Mean number of primary branches plant<sup>-1</sup> ranged from 1.1 to 1.3. The maximum mean number of primary branches plant<sup>-1</sup> was exhibited by plants of Charar-e-Sharief and Khrew ecotypes (1.3 each). Gurez ecotype exhibited lowest number of primary branches plant<sup>-1</sup> (1.11). Harwan exhibited 1.25 number of primary branches plant<sup>-1</sup>, which was lower than Charar-e-Sharief and Khrew ecotypes although lower in magnitude but were statistically at par with each other. Mean number of secondary branches plant<sup>-1</sup> ranged from a maximum of 3.6 for Gurez ecotype to a minimum of 3.1 for Charar-e-Sharief ecotype. Harwan and Khrew ecotypes had 3.3 and 3.4 number of secondary branches plant<sup>-1</sup> respectively.

Higher mean number of tertiary branches plant<sup>-1</sup> was exhibited by Gurez (2.5). Khrew, Charar-e-Sharief and Harwan ecotypes show, (2.1, 2.2 and 2.3, respectively) which were at par with each other. The lowest number of 2.1 mean numbers of tertiary branches plant<sup>-1</sup> was exhibited by Khrew ecotype.

#### Days to initiation of flowering

Mean number of days to initial flowering from the date of tuber sprouting (date of emergence) ranged from to a minimum of 19 days to a maximum of 21.50 days. The minimum number of days to initial flowering was recorded for Gurez and ecotypes (19 days) followed by Harwan (20.4 days). Charar-e-Sharief ecotype showed 21 days. The highest mean number of days to initial flowering was exhibited by Khrew ecotype (21.5 days).

#### Days to 50 per cent flowering

**Days to 50 per cent flowering showed a significant variation. Analysis of data revealed that days to 50 per cent flowering ranged from a minimum of 33 days for Gurez ecotype to a maximum of 36 days for Charar-e-Sharief ecotype. Mean number of days to 50 per cent flowering for Harwan ecotype (34 days) and for Khrew was 35 days.**

#### Days to full bloom

Analysis of data for days to full bloom revealed that days from tuber sprouting to complete flowering ranged from a minimum of 49.7 days to a maximum of 52.18 days. The minimum mean number of days from tuber sprouting to complete flowering was observed in Gurez ecotypes being 49.7 followed by Harwan (51 days). The highest mean number of days to full bloom was exhibited by Charar-e-Sharief ecotype (52.18 days). Khrew was also close to maximum (52 days)

#### Number of umbels plant<sup>-1</sup>

Mean number of umbels plant<sup>-1</sup> ranged from 7.1 to 7.5. The maximum mean number of 7.5 and 7.30 umbels plant<sup>-1</sup> was exhibited by Gurez and Harwan ecotypes, respectively followed by Khrew ecotypes (7.2). The lowest value of 7.1 was noted in Charar-e-Sharief ecotype.

#### Number of umblets umbel<sup>-1</sup>

Mean number of umblets umbel<sup>-1</sup> in primary, secondary and tertiary umbels ranged from 10.09 to 10.92; 8.3 to 8.90 and 3.00 to 3.1, respectively. The maximum mean number of umblets umbel<sup>-1</sup> in primary, secondary and tertiary umbels was exhibited by plants of Charar-e-Sharief ecotype (10.92, 8.9 and 3.1, respectively) followed by Khrew, Harwan ecotypes (10.5, 8.8 and 3.09; 10.33, 8.4 and 3.00, respectively). Gurez ecotypes exhibited minimum number of umblets umbel<sup>-1</sup> in primary, secondary and tertiary umbels (10.09, 8.3 and 3.00 respectively).

#### Umbel diameter:

Umbel diameter of primary, secondary and tertiary umbels ranged from 10.3 to 10.9 cm; 7.4 to 7.7cm and 1.90 to 2.10 cm, respectively. The maximum umbel diameter was recorded in primary umbels of Charar-e-Sharief ecotype (10.9 cm), followed by Khrew, Harwan ecotypes (10.7 and 10.4 cm, respectively). The lowest umbel diameter of 1.90 cm was recorded for tertiary umbels of Gurez ecotype.

#### Days to 80 per cent Physiological maturity

Mean number of days to maturity of seeds from tuber sprouting ranged from 88 days to 91 days. The highest mean number of days to 80 per cent physiological maturity was recorded for Charar-e-Sharief ecotype (91 days) followed by Khrew (90), Harwan (89). The minimum mean number of days to 80 per cent physiological maturity was recorded Gurez ecotypes (88 days).

#### Number of seeds umbel<sup>-1</sup>

Number of seeds umbel<sup>-1</sup> in primary, secondary and tertiary umbels ranged from 185 to 216.7; 134 to 156 and 14 to 16, respectively. The maximum number of seeds umbel<sup>-1</sup> was found in primary umbels of Charar-e-Sharief ecotype (216.7) followed by Khrew (209), Harwan (187.20). The lowest

number of seeds umbel<sup>-1</sup> was recorded in tertiary umbels of Gurez ecotype (14.00).

#### Seed yield plant<sup>-1</sup>

Seed yield plant<sup>-1</sup> ranged from 1.28 to 1.85 g. The highest seed yield plant<sup>-1</sup> was exhibited by Charar-e-Sharief ecotype (1.85 g) followed by Khrew (1.55 g), Harwan (1.49g) Gurez ecotypes (1.28g).

#### 1000 seed weight

There were significant differences in 1000- seed weight between different ecotypes being maximum for Charar-e-Sharief ecotype (2.10 g) and minimum for Gurez (1.60). 1000-seed weight of 1.92 and 1.89g respectively was recorded for Khrew, Harwan ecotypes.

#### 4. Discussion

A comprehensive knowledge of relationship of yield with its components is of immense practical. Hence studies on morphological area were undertaken as an aid for selecting the better ecotypes of *Bunium persicum* (Boiss.) under temperate agro climatic conditions of Kashmir valley. The harvest and economical success of any cash crop depends on the presence of sufficient scientific techniques and effective selection of the ecotype in the particular plant. An overall glance depicting performance of ecotypes, revealed that Charar-e-Sharief ecotype besides being high yielder, also exhibited superior performance for other important traits like plant height, primary branches plant<sup>-1</sup>, umbels umbel<sup>-1</sup> in primary, secondary and tertiary umbels, seeds umbel<sup>-1</sup> in primary, secondary and tertiary umbels and 1000 seed weight. Khrew ecotype ranked side by side with Charar-e-Sharief ecotype for umbel diameter of tertiary umbels. Gurez ecotype ranked first for secondary and tertiary branches plant<sup>-1</sup>, maturity traits like initial, 50 per cent flowering, full bloom and 80 per cent physiological maturity, and number of umbels plant<sup>-1</sup>. It was also evident that ecotypes from lower altitudes (ecotypes from Charar-e-Sharief, Khrew and Harwan) tended to be taller, less branched, late in maturity traits and superior in almost all the yield and yield component traits. Ecotypes from higher altitudes (Gurez) were shorter in height, profusely branched, early in maturity traits but inferior in yield and yield component traits. It was therefore, concluded that the high seed yield plant<sup>-1</sup> was the function of superiority of some

morphological traits like plant height, number of primary branches plant<sup>-1</sup>, umbel diameter of primary, secondary and tertiary umbels, and yield and yield component traits like seeds umbel<sup>-1</sup> in primary, secondary and tertiary umbels and 1000 seed weight. There were significant differences in 1000 seed weight between different ecotypes being for Charar-e-Sharief ecotype (2.10 g) and minimum for Gurez (1.60). 1000-seed weight of 1.92 and 1.89g respectively was recorded for Khrew, Harwan ecotypes. Similar findings have also been reported by Dar et al (2011); zeerak et al.,<sup>9</sup> (2011) in Black Caraway. Since no single ecotype could be identified to have superior performance for all the characters studied, the ecotypes with diverse characteristics could be involved in well planned hybridization programmed to select better performing genotypes in the successive generations.

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