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## A BRIEF DESCRIPTION ON POTATO

**Dr. Jyoti Sharma\***; **Dr. Sudheesh Shukla\*\***; **Dr. Manisha Rastogi\*\*\***

\*School of Humanities, Physical & Mathematical Sciences,  
Faculty of Engineering and Technology,  
Shobhit Institute of Engineering and Technology,  
(Deemed to be University), Meerut, INDIA  
Email id: Jyoti2@shobhituniversity.ac.in,

<sup>2,3</sup>School of Biomedical Engineering,  
Faculty of Engineering and Technology,  
Shobhit Institute of Engineering and Technology,  
(Deemed to be University), Meerut, INDIA

Email id: <sup>2</sup>sudheesh.shukla@shobhituniversity.ac.in <sup>3</sup>Manisha.rastogi@shobhituniversity.ac.in

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### ABSTRACT

*Potato (Solanumtuberosum L.) is a self-pollinated annual herbaceous plant. Potato is a member of the Solanaceae family and the Solanum genus, having a basic set of 12 chromosomes (x = 12). It's a vegetable that's also utilized in businesses to make starch, alcoholic drinks, and other processed foods like French fries and chips. A fresh potato has a carbohydrate content of 16-20% and a crude protein content of 2.5-3.2 percent. Despite the fact that potatoes have a low protein content, their nutritional quality is superior than cereals. Potatoes have the ability to generate more calories and protein per unit land area with less time and water than the majority of major food crops. As a result, knowing its genetic diversity is critical for improving this crop as well as making efficient use of germplasm. Because morphological characterisation is heavily affected by the environment, diversity study based on molecular characterization is preferable. As a result, in-depth research using both morphological and molecular markers will aid in a better understanding of potato germplasm genetic diversity.*

**KEYWORDS:** *Genetic, Potato, Molecular Marker, Morphological Marker, Solanum Tuberosum L.*

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### 1. INTRODUCTION

After wheat, rice, and maize, potato (*Solanumtuberosum L.*) is the most widely grown tuber crop and the world's fourth most significant food crop. Potato is a member of the Solanaceae family and the Solanum genus, having a basic set of 12 chromosomes (x = 12). Potatoes are not only a common vegetable, but they are also utilized to make processed meals. Potatoes are also utilized in the production of starch and alcoholic drinks. One of the difficulties for

potato breeders is to develop varieties with agronomically essential characteristics and excellent maintaining quality. Genetic diversity evaluation is a need for every crop development effort, and it allowed for the selection of parents for successful hybridization[1]–[4].

The following methods are often used to evaluate genetic diversity within and between potato plant populations: (i) morphological, (ii) biochemical evaluation (allozyme), and (iii) molecular marker analysis. Because commercial potatoes have a limited genetic basis, molecular markers play an essential role in assessing genetic variety. Appropriate DNA markers (polymorphic) should be expressed at the DNA level in all tissues, organs, and phases of crop growth. When compared to conventional breeding programs, molecular markers may improve the efficiency and efficacy of breeding operations. RAPD, SSR (Microsatellite markers), AFLP, chloroplast RFLP, nuclear RFLP, and other molecular methods are used in potato breeding for genetic diversity evaluation and other reasons. In order to comprehend the germplasm of potato for the study of population structure, identification, conservation, and use of genuine and superior agricultural materials, in-depth research on genetic diversity based on morphological and molecular markers are needed.

### *1.1 History of Crops:*

Potatoes are one of the earliest agricultural plants used for human consumption. Linnaeus gave the botanical name *Solanum tuberosum* in his book "Species Plantarum." Potato cultivation began in the Andes Mountains of South America between 8000 and 5000 BC, near Lake Titicaca, which is situated at 3,800 meters (12,500 feet) above sea level on the Bolivian-Peruvian border. People may have eaten wild potatoes from the wet coastal plains of South America as early as 13,000 years ago. Because many wild potato species contain compounds like glycoalkaloids (solanine and chaconine), they are resistant to insects and diseases, but they have a bitter taste and are toxic to humans at high enough levels, so selecting non-bitter potatoes for cultivation was the first step in domestication. Freeze-drying is a method used in the Andes to remove bitterness from potato tubers, but non-bitter tubers are progressively selected and propagated to eradicate bitter tubers. Hunter-gatherer tribes that arrived on the South American continent at least 7,000 years ago began domesticating the abundant wild potatoes that flourished around the lake. Potatoes were utilized as nourishment for horses and animals for many years following their introduction in the United States. Planting tubers remains the most important activity of the agricultural year around Lake Titicaca, where the potato is known as *Mama Jatha* (mother of growth)[5], [6].

### *1.2 Origin, Distribution and Domestication:*

The origin of the potato and its wild cousins may be traced back to Western South America. Where it grows wild in nature and has the most variety in tuber shape, size, color, and flavor. *Solanum tuberosum* is thought to be the progenitor of all cultivated potatoes. Potatoes arrived in Europe late from South America, but they were very important in the 1530s when Spanish conquistadors were looking for gold in Peru. Between 1570 and 1593, they introduced potato to Europe. The potato arrived in India from Europe in the early 17th century, barely 40 years after the Portuguese brought it to Europe. Potatoes were one of the most popular and widely produced foods in the twentieth century. Potato was embraced by the United States of America as the final major nation to do so. Potatoes are now grown in over 100 nations across the globe, including Europe, North America, former Soviet Union countries, Asia, Africa, and Latin America[7]–[9].

### *1.3 Growth Habit:*

Potatoes are an annual herbaceous plant that may be grown in temperate, subtropical, or tropical climates. It's basically a "cold-weather crop." Temperature is the primary constraint on potato production. Tuber development is severely slowed at temperatures below 10°C (50°F) and over 30°C (86°F). 16-19°C is the ideal soil temperature. They produce their best

yields when the average daily temperature is 18 to 20°C. Potatoes need a constant supply of water as well as sufficient aeration of the soil. Potatoes may reach a height of 3.5 feet in most cases. Tuber development begins 25 days after the seed is planted. Because blooming potatoes require a lengthy day period, they may or may not blossom in the field. Potatoes may be harvested at any time between 60 and 70 days after planting and 100 to 110 days after planting, depending on the variety.

#### 1.4 *Crop Botany:*

Potatoes are an annual herbaceous plant with edible subterranean tubers that are eaten as a food. Potato is a member of the Solanaceae family and has 12 chromosomes ( $x = 12$ ). It belongs to the Solanum genus. The most widely farmed species is *Solanum tuberosum* L., which is tetraploid ( $4n=48$ ). Only four cultivated species, *S. tuberosum*, *S. ajanhuiri*, *S. juzepczukii*, and *S. curtilobum*, are included in the most recent classification. The most common and commonly cultivated species is *S. tuberosum*. The tubers are larger portions of subterranean stems called stolons, and the roots are fibrous. The stem is angular and branching, and the leaves are pinnately complex and alternating, up to 30 cm long, with tiny inserted leaflets between the main pinnae. The inflorescence is cyme, and the flowers are yellow, white, red, blue, pink, or purple, with yellow stamens placed on a short corolla tube, although they are seldom produced when the days are short and the temperatures are high. Although potatoes are autogamous, some cross pollination occurs, mostly by insects (Bumblebees). Poisonous alkaloids (Solanine) are present in the fruits, which are tiny, inedible berries[10]. Generally, white flowered types generate white skinned tubers, whereas colorful flower variants yield pinkish skinned tubers. Tubers, chopped portions of tubers with at least one or two eyes, and "real seeds" are used to reproduce potatoes.

#### 1.5 *Importance:*

After wheat, rice, and maize, potato (*Solanum tuberosum* L.) is the most widely grown tuber crop and the world's fourth most significant food crop. Increasing levels of wealth are pushing a "nutrition shift" toward more energy-dense meals and processed food items in most emerging nations, and particularly in metropolitan areas. That is why potato demand is increasing. In metropolitan parts of South Africa, potatoes constitute a staple meal. Potatoes are a low-fat, high-nutrient, healthy food that provides many essential nutrients. Potatoes have 75-80 percent water, 16-20 percent carbs, 2.5-3.2 percent crude protein, 0.8-1.2 percent minerals, 0.1-0.2 percent crude lipids, 0.6 percent crude fiber, and some vitamins when they are freshly picked. Despite the fact that potatoes have a low protein content, they have a higher nutritious value than grains. Isoleucine, leucine, and tryptophan are among the necessary amino acids found in potatoes. Potatoes also include dietary antioxidants, dietary fiber, thiamine, iron, and folic acid, all of which may help to avoid illnesses associated with aging. It's a vegetable that's also utilized in businesses to make starch, alcoholic drinks, and other processed foods like French fries and chips. It's also used to treat gastrointestinal and liver infections, among other things.

#### 1.6 *Taxonomy and Nomenclature:*

Potatoes are dicot plants that belong to the Solanaceae family and the genus Solanum. This is the biggest angiosperm genus, with over 2,000 species. According to the most recent taxonomy, the genus Solanum is split into two subgenera: Pachystemonum and Leptostemonum. Pachystemonum is further split into five divisions, with Petota containing the majority of tuber-bearing species. Estolonifera and potatoe are the two subsections that make up Section petota. All cultivated species are classified as Tuberosa under the subcategory Potatoes. Nearly 12 percent of the species are tetraploid ( $2n=48$ ), while 72 percent are diploid ( $2n=24$ ). Triploid ( $2n=36$ ), pentaploid ( $2n=60$ ), and hexaploid ( $2n=72$ ) are the remaining genotypes. The extensively farmed potato, *Solanum tuberosum* L., is a tetraploid species.

### 1.7 *Agronomical Aspects:*

Potatoes are a short-season crop that works well in a variety of multiple and intercropping systems. Potatoes may be cultivated in a variety of soil types (alluvial, hill, black, red, and laterite) with pH levels ranging from 5 to 7.5. Because they provide enough oxygen, well-drained coarse or sandy loam to loamy soils are ideal for the development of roots, stolons, and tubers. Potatoes grow best in soils with a lot of organic content. When the days are bright and the nights are cold, with temperatures not exceeding 23°C, good crop growth is seen. From 20 to 25 days following planting, tuber development begins. When the daytime temperature is 20°C and the nighttime temperature is 14°C, the highest tuber development occurs. Potatoes are harvested on the lowlands during the autumn/inter/spring seasons and in the hills during the summer/autumn. Planting period, on the other hand, is dependent on the cultivar and the surrounding circumstances. Clods are broken and the fields are ploughed to a depth of 20-35cm. On the summer months in the plains, plowing the field deep and turning the soils one or two times and leaving it fallow helps to control the issue of soilborne diseases and perennial weeds. Fields are ploughed before planting, followed by one or two tillings. Tubers have historically been used to propagate potatoes. Seed tubers are sliced into pieces weighing 30-40 g and about 3.5-5 cm in diameter, with 2-3 healthy eyes in each piece.

The most common planting technique is ridge and furrow. Potatoes may reach a height of 3.5 feet in most cases. After 30 days of planting, thorough earthing should be done with a double mould board plough or ridger to ensure that enough dirt covers the tubers. Blossoms range in color from white to purple. When the weather is bad, the blooms will fall off. Depending on the soil type, temperature, and crop length, total water requirements range from 350 to 550mm. Potatoes may be harvested at any time after 60-70 days (early types) after planting to 100-110 days after planting since they are a short-duration crop (late varieties). Potatoes are harvested before the temperature rises over 30°C. The crop is harvested 10-15 days after the final irrigation is turned off. Early cultivars may yield 20 to 25 tons per hectare, whereas late types can yield 30 to 35 tons per hectare.

### 1.8 *Production and Area:*

Potatoes are grown on approximately 20 million hectares each year, with a worldwide output of 320 million tons. China is currently the world's top potato grower, with China and India producing almost a third of all potatoes. Egypt, South Africa, Algeria, and Morocco are the major African nations, producing more than 80% of the continent's potatoes in that order. Since the early 1960s, potato output has quickly surpassed all other food crops in Africa and Asia. The world's potato output is changing dramatically. Until the early 1990s, most potatoes were produced and eaten in Europe, North America, and former Soviet Union nations. According to FAO statistics from 2005, developing nations' potato output has surpassed that of industrialized countries for the first time. In 2014, a total of 381,682,000 tonnes is expected.

### 1.9 *Genetic Diversity and Its Importance:*

All of the variation that occurs among the members of a species is referred to as genetic diversity. Genetic diversity comes after ecological and species diversity in the hierarchy of variety. Crop plant survival and improvement are dependent on genetic variety. Plant breeders may use the diversity in plant genetic resources to create new and better varieties with desired characteristics including high yield potential, pest and disease resistance, abiotic stress tolerance, and light insensitivity, among others. Natural genetic diversity has been used within crop species from the dawn of agriculture to satisfy subsistence food needs. Later, the emphasis switched to producing an abundance of food to meet the demands of growing people. To fulfill the needs of a rising population and offer a balanced diet, the emphasis is now on both production and quality elements of key food crops. The creation of types that can resist climatic fluctuations is becoming increasingly essential as the climatic situation

evolves. Land races, obsolete cultivars, cultivated varieties, breeding stocks, mutant lines, and other forms of genetic diversity serve as a source of desirable alleles for developing climate resilient varieties with traits such as tolerance to potential new insect pests and diseases, extreme heat, extreme cold, and various pollutants. Different genes should be conserved in the germplasm since breeding objectives are always changing. Introgression of genes between wild and farmed species is required to increase the genetic diversity of potato breeding variants. Heterosis and the production of transgressive segregants need genetic variation between two parents. Knowing about genetic diversity is important for selecting the best parents, designing appropriate crossing methods, and selecting novel lines for non-traditional applications such as biofuel generation from agricultural crops such as sorghum and maize.

#### *1.10 Potatoes and Potato Nutrients in Health and Disease:*

Potatoes include a variety of minerals and nutritional components that may help to promote health and avoid illness. These nutrients, as well as the studies that supports their potential functions in human health, are discussed in the following paragraphs:

##### *1.10.1 Blood Pressure/Hypertension:*

According to various statistical sources, between 29 and 32 percent of American people have hypertension, with another one in three having pre-hypertension (CDC websites). According to research, eating a potassium-rich, low-sodium diet lowers the risk of hypertension and stroke.

##### *1.10.2 Weight Management/Obesity:*

Overweight and obesity have risen dramatically in the United States and across the world during the past three decades. Despite the fact that dietary patterns and other essential lifestyle habits (e.g., physical exercise) are more significant than specific items when it comes to obesity and weight control, potatoes have been singled out in studies and the popular press as being particularly obesogenic. In a well recognized research, Harvard University's Mozaffarian and colleagues (2011) looked at the link between particular foods and weight increase in three large cohorts (Nurses Health Study I and II and the Health Professionals Follow-up Study). The consumption of potato chips, potatoes, sugar-sweetened drinks, and unprocessed and processed red meats was shown to be substantially related with four-year weight increase. This research, however, had a number of methodological flaws, the most serious of which was the inability to statistically adjust for calorie intake.

##### *1.10.3 Glycemic Response/Type 2 Diabetes:*

Potatoes are not only often limited in diabetic dietary advice due to their carbohydrate content and alleged high glycemic index, but they are also linked to the disease's development. Halton and colleagues from Harvard University looked into the link between potato intake and the risk of getting diabetes in a large cohort of women who were tracked for 20 years (the Nurses Health Study).

## **2. DISCUSSION**

Potato (*Solanum tuberosum* L.) is an annual herbaceous plant that is self-pollinated. Potato belongs to the Solanaceae family and the *Solanum* genus, with a basic chromosomal pair of 12 ( $x = 12$ ). It's a vegetable used in the production of starch, alcoholic beverages, and other processed foods like as French fries and chips. Potatoes are high in fiber, which may aid weight loss by keeping you fuller for longer. By keeping cholesterol and blood sugar levels in control, fiber may help avoid heart disease. Potatoes are also high in antioxidants, which assist to prevent illnesses, as well as vitamins, which aid in healthy bodily function. Potato fiber is a kind known as "resistant starch," which offers the health advantages of both soluble and insoluble fiber and produces less gas than other fiber types. Potatoes are high in

antioxidants, which are chemicals that prevent free radicals from damaging your cells. Heart disease and cancer risk are reduced by eating a diet rich in antioxidant-rich fruits and vegetables.

### 3. CONCLUSION

For ages, the potato has been a nutritional mainstay, and its hardiness has enabled it to thrive when other, less hardy crops have failed. Potatoes provide essential nutrients such as potassium, vitamin C, and dietary fiber to the diet, as well as increasing total vegetable intake among children, adolescents, and adults in the United States. Blood pressure, satiety, and gastrointestinal health have all been proven to benefit from potatoes and potato nutrients. With the assistance of high throughput molecular marker technologies, quality data can now be generated quickly, allowing for the characterization of large amounts of germplasm in less time and with fewer resources. NGS lowered the cost and time needed to sequence an organism's whole genome. With today's software programs, potato breeders may easily evaluate phenotypic and molecular diversity factors to speed up crop development.

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