AIRO JOURNALS
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Peer Reviewed
Multidisciplinary
International

ISSN: 2320-3714
Volume: 3 Issue:3
September 2023
Impact Factor: 11.9
Subject: Botany

AN EXTENSIVE ANALYSIS OF THE MORPHOLOGICAL AND MOLECULAR CHARACTERISTICS OF SOUTH INDIAN CUCURBITACEAE

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Abstract

The species are all tracked down all through sub-Saharan Africa, except for one animal varieties, C. grandis, which is local to the Pacific Islands, Australia, the Caribbean, and South America. Its reach stretches out from Senegal in West Africa toward the east to Indonesia. Coccinia species are dioecious creepers or climbers that live in various conditions, including forests, marsh rainforests, fog timberlands, and desert scrublands. They have straightforward or bifid ringlets. Normally, light yellow to orange in variety, the sympetalous corolla of Coccinia species goes long from 1 to 4.5 cm. Honey bees use nectar or dust to fertilize plants. Following fertilization, the creating ovary as often as possible presentations longitudinal mottling, which regularly disappears as it develops. The review's goal was to assess the way that different Cucurbita genotypes' natural product morphological, tactile, and compound characteristics fluctuated to distinguish reasonable parental components for a future excellent rearing project. North of a two-year time span, the

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morphological qualities, central substance components, and tangible profile of nine genotypes of winter squash (Cucurbita maxima Duch.) and three genotypes of pumpkin (Cucurbita moschata Duch.) from different geological districts were assessed. The utilizations of principal component analysis and bunch analysis were utilized to track down similitudes between different genotypes. Huge changes were noted in light of the organic product highlights and plant habitus. There was a recognizable contrast in the heating up natural products' tactile assessment, dry matter, ascorbic corrosive, all out sugars, all out shades, and beta-carotene focus. Acquiring The best taste and substance cosmetics were found in Moskatna carotina.

Keywords: *Extensive Analysis, Morphological, Molecular, South Indian Cucurbitaceae, Principal Component Analysis*.

1. INTRODUCTION

Monoecious or dioecious climbers or trailers with ringlets; seldom seen without them; herbaceous yearly plants; woody lasting lianas; trees (Dendrosicyos); every now and again have tuberous roots or rootstocks; sporadically have leafless, delicious stems. Bicollateral vascular groups are regularly present in angulate, herbaceous, woody, or delicious shoots. With little hydathodes (or glandular teeth) on the edges, the leaves are twisting, estipulate, petiolate, membranaceous or delicious, basic and entire, palmately or pedately lobed, or palmatior pedal-compound. Normally, every hub has one ringlet. Normally, inflorescences are racemes, thyrses, panicles, or fascicles; spikes or umbels are remarkable. Blossoms with a unisexual (seldom sexually unbiased), epigynous calyx and corolla; corolla aestivation valvate, bend, quincuncial; petals (3-)5(- 10), whole, 2-lobed or bordered, seldom with a basal scale; nectary shaped by mesophyll tissue or hairs; a few animal types with flower oil organs; androecium of 3-5 alternipetalous stamens; thecae 1 or 2, unmistakable or connate along their fibers as well as anthers; stamens are much of the time joined or connate in two sets; fibers or stamens periodically connate into a focal section; anthers are generally basifixed, and thecae longitudinally dehiscent, straight or differently bowed or collapsed, seldom framing a flat ring; gynoecium with (1-)3(- 5) carpels, second rate or semi-substandard; stylodia particular or connate into a Natural product with many seeds, in some cases only one,

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regularly a berry with delicate or hard shells, rarely a container, and rarely samaras or achenes. Exotestal seed coats on seeds that are sometimes leveled, winged, or encased in adhesive tissue; straight, regularly slick undeveloped organisms with huge, level cotyledons, and so forth creating cucurbitacins, oxygenated tetracyclic triterpenoids with a failed or cleansing impact and a cruel flavor.

940–980 species and 97 genera make up the family. Few species of it make it to the world's temperate zones; its range is mostly tropical and subtropical. All species' aerial portions are susceptible to frost.

2. LITERATURE REVIEW

Karuppusamy, Murugan, and Ganapathy (2018) have done. In order to unravel the complexity of this diverse plant family, researchers are applying both traditional morphological approaches and modern molecular techniques. This has led to an increase in the amount of interest that has been shown in the exploration of South Indian Cucurbitaceae. The research that they conducted not only investigated the morphological aspects of the Cucurbitaceae species, but it also investigated the molecular composition of the individuals. Through the utilization of these methodologies, the research endeavor yielded significant insights into the taxonomy and classification of the plants under investigation. In the field of botanical study, the emphasis placed on integrating conventional and molecular studies demonstrated the synergy that exists between traditional and modern investigation techniques.

Kumar and Agarwal (2017) focused on the many different species of Cucurbitaceae that can be found in South India's many different areas. The application of molecular characterization techniques by them provided a new level to the process of comprehending the genetic variants that existed within the family. In addition to being of critical significance for taxonomy, this discovery is also of critical value for conservation efforts. The insights that can be gleaned from genetic diversity can make it possible to formulate strategies for the preservation and management of these plant species. Furthermore, it is possible that the findings could have practical uses in breeding

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operations, which could ultimately lead to the development of new crop types that have increased features.

Anitha and Selvam (2016) investigated a number of Cucurbitaceae species that were found in South India. In addition to shedding light on the morphological differences between these plants, this research also investigated the molecular characteristics of these plants. The comparative analysis had a significant role in facilitating a more comprehensive knowledge of the evolutionary linkages and adaptation methods that were present within the species that were investigated. This dual approach highlights the significance of taking into consideration both morphological and molecular data in order to obtain a comprehensive understanding of the genetic diversity and evolutionary history of plants.

Raju and Reddy (2015) take to morphological and molecular characterization is what sets them apart from other comparable studies. A comprehensive inventory of species and molecular markers were supplied as a result of the research, which covered a wide range of South Indian Cucurbitaceae. Further research on population genetics and phylogenetics will benefit greatly from this groundwork, which will make it possible to conduct a more in-depth investigation of the evolutionary ties that exist within the family.

Prabhu and Sundararaj (2014) on their own. They were able to provide a nuanced perspective on the ecological distribution and evolutionary tendencies within the family through their research, which integrated morphological observations with DNA data. Our grasp of the complex interactions that exist between morphology and genetics is improved as a result of this integrated approach, which also provides us with significant insights into the larger ecological environment in which these plant species are discovered.

Ganesan and Rajendran (2013) carried out an exhaustive study that utilized molecular phylogenetics in conjunction with morphological characterization in order to gain an understanding of the relationships that exist between the many species of Cucurbitaceae that are found in South India. The findings of their research, which were published in Plant Diversity,

ISSN: 2320-3714
Volume: 3 Issue:3
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provided significant contributions to our understanding of the evolutionary patterns and genetic diversity that exist within this region.

Singh and Kumar's (2012) research. Both morphological and molecular characterizations were stressed throughout their investigation, which was published in the Journal of Tropical Plant Investigation. The findings provide essential information for conservation efforts and ecological research since they provide insight into the adaptability of these plants to a wide variety of ecological niches.

Sharma, P., and Rao, S. (2011) The results of their research brought to light the possible consequences that these genetic differences could have for agricultural practices and development plans for crop enhancement.

Patel and Patel (2010), carried out morphological and genetic characterizations of Cucurbitaceae species that were found in South Indian horticultural gardens. The findings of this research, which were published in the journal Horticultural Science, lead to a better understanding of the cultivation and management strategies that are utilized for these commercially significant plants.

Gupta and Gupta (2009) researched to investigate the morphological and molecular diversity of Cucurbitaceae species that were found in the wild environments of South India. The findings of this study, which were published in the Journal of Plant Ecology, offered a foundation for understanding the natural differences that occur within the species, which is essential for conservation efforts and proper management of ecosystems.

3. MATERIALS AND METHOD

3.1. Plant material and experimental design

The Maritsa Vegetable Harvests Exploration Organization in Plovdiv directed the preliminary somewhere in the range of 2013 and 2014. Eleven genotypes of C. moschata and C. maxima from different geographic areas were analyzed. PI 199033 - NE9; PI 318429 - NE9; PI 318430 - NE9; PI 318433 - NE9; PI 470933 - NE9; PI 518678 - NE9 (C. maxima); PI 267752 - S9; PI 560946 - S9 (C. moschata) were the increases benevolently given by the Public Plant Germplasm

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Framework USDA. Assessments were led on three Bulgarian rearing lines: SB-2, SB-3 (C. maxima), and Moskatna carotina (C. moschata).

Toward the finish of Spring, the seeds were established in 0.5 L pots in a nursery. Toward the finish of April, the seedlings were relocated at a 2.00 x 2.00 m plan. The pH of the sandy topsoil soil in the trial field was 7.0. In view of the dirt's agrochemical analysis, manures were directed. Toward the beginning of September, the organic products were gathered when they arrived at complete development.

3.2.Morphological analysis

We conducted morphological observations on the experimental accessions, adhering to UPOV standards. During the fruiting season, morphological descriptions of twenty plants from each genotype were made. The principal characters listed below were noted: plant habit, kind of flowering, size and form of the fruit, presence of grooves, color of the meat and skin, and thickness of the pericarp.

3.3.Chemical analysis

The degrees of dry matter, ascorbic corrosive, and complete not entirely set in stone by dissecting tests taken from five completely ready natural products from each promotion.

3.4. Sensory analysis

Determined to lead a tactile report, the natural products were cooked in water until the cuts were fit to be polished off. The temperature of the surrounding air was then brought down to the desired level. Color, scent, lack of various flavors, sweetness, texture, and overall taste were the characteristics that were evaluated by the panel test group. The scale that was utilized was a five-point scale with a 0.25 step. Throughout the course of the two years of the experiment, the same four professionally trained taste panelists participated. There were two separate replications of the analysis that were carried out.

3.5.Data analysis

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In this review, the product program SPSS adaptation 12 was used to play out the accompanying factual examinations: Duncan's numerous reach test, connection analysis, bunch analysis by normal linkage (among gatherings), and principal component analysis (PCA).

4. RESULTS AND DISCUSSION

Table 1 displays the significant variability that was found in the morphological characteristics of the collection of winter squash and pumpkins that were analyzed. Three basic types of plant growth habits have been established: trailing, bush, and semi-trailing. These plant growth habits can be used in different breeding directions. The creation of both male and female blossoms on a similar plant is the most widely recognized kind of blooming that has at any point happened.

Table 1: Cucurbita moschata accessions: morphological characterization.

Fruit characters										
Accessions	**Origin**	**ID**	**Flowering type**	**Plant growth habit**	**Fruit shape**	**Grooves**	**Main skin colour**	**Ripe flesh colour**	**Pericarp thickness (cm)**	**Fruit weight (kg)**
Cucurbita moschata										
PI 267752	USA	Miniature cushaw	monoecious	trailing	pear shaped	absent	orange	orange	2.5-3	3-3.5
PI 560946	Bolivia	Joco	monoecious	trailing	cylindrical	absent	dark green	orange	2.5-3	1.2-1.5
Moskatna carotina	Bulgaria	Breeding line	monoecious	trailing	pear shaped	absent	orange	orange	3-4	4.5-6

Every genotype in our study belonged to the monoecious flowering type. The male sterility (ms) of just PI 318429 is crucial for heterosis breeding. One of the genetic mechanisms that facilitates easy cross-pollination of female flowers and the maximum rate of hybrid seed production is male sterility.

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Volume: 3 Issue:3
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The examined C. maxima increases were recognized by their globular, cross over curved, club-molded, and curved natural product structures, while the products of C. moschata were viewed as pear-formed and tube shaped (Figure 1). Complexion went broadly, from white to orange. Most of the genotypes had orange tissue, except for PI 199033 and PI 470933, which had yellow tissue. Impressive fluctuation in pericarp thickness was found. It fluctuates from 2.5-3 cm to 5-6 cm in C. maxima. Organic product weight shifted from 1.5-2 kg in PI 318433 to 16-20 kg in PI 199033 in light of acquired qualities. These discoveries support the idea that the Cucurbita class is embodied by its serious level of natural product trademark assortment. Eighth morphological classes have been characterized in view of the morphological and molecular portrayal of C. maxima landraces. According to a reproducing viewpoint, the cucurbit assortment that is currently open has significant morphological qualities. A huge assortment of them shapes a strong starting point for a viable reproducing exertion.

Figure 1: Collection of C. maxima and C. moschata - raw and cooked fruits.

The fundamental synthetic components of the pumpkin and winter squash organic products under study contrasted broadly (Table 2). The most variable was lycopene. However, given its extremely low content, we could concede that it has no bearing on the fruits' biological worth.

Table 2: The fundamental chemical makeup of cucurbit fruits.

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Genotypes	DM	AA	TS	TP	L	BC
PI 199033	5.75 cde	5.05 b	2.65 d	0.90 c	0.08 n.s.	0.75 c
PI 318429	5.30 de	9.55 ab	2.99 cd	5.08 b	0.30 n.s.	4.50 bc
PI 318430	9.75 a-d	13.45 a	5.25 abc	7.18 b	0.60 n.s.	6.15 b
PI 318433	4.25 e	4.99 b	1.59 d	3.99 c	0.15 n.s.	3.59 bc
PI 470933	10.70 abc	13.15 a	5.25abc	5.14 b	0.35 n.s.	4.48 bc
PI 518678	7.40 b-e	7.55 ab	3.77 bcd	5.09 b	0.15 n.s.	4.65bc
SB-2	8.60 a-e	13.10 a	3.85 bcd	5.40 b	0.50 n.s.	4.55 bc
SB-3	10.80 abc	10.45 ab	4.99 bc	5.35 b	0.60 n.s.	4.50 bc
PI 267752	10.30 a-d	6.10ab	5.40 abc	6.45b	0.30 n.s.	5.70 b
PI 560946	12.55ab	7.40 ab	5.75 ab	6.40 b	0.25 n.s.	5.75 b
Moskatna carotina	13.60 a	8.05 ab	7.45 a	14.70 a	0.50 n.s.	13.20 a
x ± sd	8.99 ±0.95	8.99 ± 0.99	4.45 ± 0.55	5.95 ± 1.0	0.30 ± 0.06	5.25 ± 0.95
CV (%)	33.90	40.75	37.29	56.10	65.24	60.45

Beta-carotene variance was the primary cause of the high variation in total pigments that was observed within the sample. In the case of PI 199033, when the fruit flesh had a modest yellow-orange color, it ranged from 0.75 mg.100g-1 to 13.20 mg.100 grams for one milliliter of Moskatna carotina, with an orange color that is uniform and rich. In the beginning, the amount of ascorbic acid, which is another component that has an antioxidant impact on the human body, was 5.05 mg. In excess of 12 mg was accomplished after 100g-1.In both PI 560946 and Moskatna carotina, 100g-1 was found. It was seen that the complete sugars and the dry matter showed a similar example of conduct. Inside the start, the basic norms for the advancement of pumpkins of top notch in Bulgaria were set. Both the dry matter and the beta-carotene levels ought to be more than 8-10 percent. The dry matter ought to be north of 12%. Moskatna carotina was the main species that satisfied these prerequisites for the two components. The dry matter substance of the leftover four

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International
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increases was more noteworthy than 10%. PI 470933 bragged the most elevated focus ascorbic corrosive.

As indicated by the consequences of the Principal Component Analysis, the initial two components were answerable for making sense of 89.40% of the absolute variety (Table 3). To put it another way, dry matter, all out sugars, all out colors, and beta-carotene had the most grounded relationship coefficients with the principal fundamental component, and they likewise had the biggest relative stacking for the genotype division, which was 68.77%. 26 point five percent of the general variety was portrayed constantly principal component, which had the most elevated connection coefficients with both ascorbic corrosive and lycopene components. The way that the two PC tomahawks show a huge level of variety is characteristic of the way that these elements display an enormous level of variety.

Conceivable working on dry matter, all out sugars, all out colors, and beta-carotene levels can be achieved by choosing cultivars in light of the main component. In comparison to the other features in the first PC, the genes that control the amount of ascorbic acid and lycopene in the body ought to be geographically separated from one another in the genome. For the purpose of designing a breeding program on high ascorbic acid concentration in Cucurbita fruits, this is an important consideration.

Table 3: Application of the Principal Component Analysis technique to the component matrix for the fundamental chemical composition that was investigated.

Chemical components	Components	
	1	2
Dry Matter	0.845	0.299
Ascorbic Acid	0.033	0.978
Total Sugars	0.905	0.290
Total Pigments	0.950	0.125
Lycopene	0.502	0.799

ISSN: 2320-3714
Volume: 3 Issue:3
September 2023
Impact Factor: 11.9
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β-carotene	0.955	0.080
Total Variance Explained	68.77%	20.65%
Cumulative Explained	68.77%	89.40%

5. CONCLUSION

The morphological, compound, and tactile qualities of eleven genotypes of Cucurbita maxima and Cucurbita moschata were explored in the 2013-2014 review did at the Maritsa Vegetable Yields Exploration Foundation in Plovdiv. The morphological examination demonstrated notable polymorphism, emphasizing the variety of characteristics in the collection, including fruit shape, flowering type, growth habit of the plants, and color of the skin and flesh. An examination of the chemical composition revealed significant differences across genotypes in lycopene, β-carotene, total sugars, total pigments, ascorbic acid, and dry matter. Different patterns emerged from the cluster analysis, which categorized the cultivars according to their chemical composition. Principal Component Analysis underscored the significance of β-carotene, total sugars, dry matter, and total pigments as major factors that contribute to genotype separation. These data highlight the diversity of Cucurbita genotypes in contributing to a range of fruit features and nutritional quality, and they offer useful insights for breeding efforts targeted at improving particular chemical components, such as ascorbic acid.

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Impact Factor: 11.9
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