Crimson Publishers
Wings to the Research

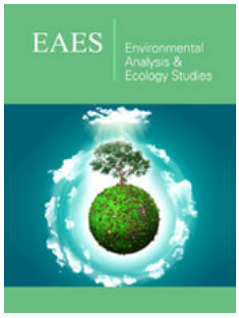
Short Communication

Sansevieria Species (Snake plants): An Interesting Biological Model and a Forthcoming Good Model Genetic Organisms for Popularization, Utilization and Conservation

Somashekara Rajashekara*

Centre for Applied Genetics, Department of Studies in Zoology, Bangalore University, India

ISSN: 2578-0336



***Corresponding author:** Somashekara Rajashekara, Centre for Applied Genetics, Department of Studies in Zoology, Bangalore University, India

Submission: August 03, 2024
Published: October 15, 2024

Volume 12 - Issue 4

How to cite this article: Somashekara Rajashekara*. *Sansevieria* Species (Snake plants): An Interesting Biological Model and a Forthcoming Good Model Genetic Organisms for Popularization, Utilization and Conservation. Environ Anal Eco Stud. 000791. 12(4). 2024. DOI: 10.31031/EAES.2024.12.000791

Abstract

Sansevieria species is a genus of xerophytic perennial herbs with a wide scope of spreading found in dry tropical and subtropical areas. It is commonly known as the 'Good luck plant', 'Hammock', and 'Snake plant'. Among the four plant species – *S. metallica, S. roxburghiana, S. trifasciata*, and *S. zeylanica*, the diploid chromosome number (2n) ranged from 36 to 42. The *Sansevieria* species are known to possess antitumor, antibacterial, antidiabetic, antimicrobial, anticancer, antioxidant, and analgesic activities. Thus, this plant species is considered a "natural herbal source" and can be used for its potential pharmacological applications in large-scale industries.

Keywords: Cytogenetics; Flowering; Fruiting; Medicinal properties

Introduction

Sansevieria species is a genus of xerophytic perennial herbs with a wide scope of dispersion found in the planet's dry tropical and subtropical areas [1]. It consists of about 70 species, and its distribution ranges from Africa through Asia to Burma and the islands of the Indian Ocean [2]. *Sansevierias* are the most popular ornamental plants such as long rhizomes and fibrous roots possessing traditional healing properties. The genus *Sansevieria* is represented in India by about 10 species mainly growing in the tropical region. The plant is generally cultivated in gardens for ornamentation in the leaves. It is called a 'Good luck plant', 'Hammock', 'Snake plant', 'Saint George's sword', 'Mother-in-law's tongue', and 'Viper's bowstring hemp', etc. [3].

The genus *Sansevieria* belongs to the family *Asparagaceae*, order *Asparagales*, and class *Angiosperm*. This genus has substantial species diversity globally, and many species are also characterized by a sufficient degree of genetic diversity. Cytogenetics is the study of chromosomal structure, location, and function in cells. It includes the study of chromosome number and appearance (karyotyping), the physical location of genes on chromosomes, and chromosomal behavior in processes such as cell division [4-7]. Cytogenetics is the branch of genetics that deals with the structure of DNA within the cell nucleus and chromosomal behavior. The number and morphology of chromosomes in cells of a particular species are always constant in the different species of *Sansevieria* species. This may be constant for a taxon and the cytological data is regarded as having more significance than other taxonomic evidence.

Methodology

Currently, the stomatal structures were observed under the phase contrast Lynx Binocular Microscope (LM-52-1803-S) manufactured by Lawrence and Mayo India Private Limited, and the method was followed by Meidner & Mansfield [8]. The preparation was done with the

commercially available quick fix (adhesive) [9]. Since *Sansevierias* species had amphistomatic (when the stomata are present on both sides of the leaf) type of stomata quick fix was applied and smeared as a thin layer on the abaxial surface of freshly collected *Sansevierias* leaves from each genotype and treatments. After 15 minutes, the thin film layer (≈5mmx15mm) was peeled from the leaf surface. The thin film was mounted on a glass slide and covered with a cover slip. The amphistomatic, flat, crescentic, and hemicylindrical leaves are present around the circumference of cylindrical leaves [10].

For this, the stomatal frequency was calculated by using the formula and expressed as a number of stomata/mm^2 [11].

$$Stomatal\ frequency = \frac{(Number\ of\ stomata)}{(Area\ of\ microscopic\ field)} X\ mm^2$$

To determine the real stomatal behavior distributions, the frequency distribution of stomatal apertures for single leaves was calculated from saplings and the canopy tree using Suzuki's Universal Micro-Printing (SUMP) method [12]. We have attempted to correlate the number of stomata with their chromosome numbers.

Results and Discussions

The morphological parts of the *Sansevieria* metallica Gérôme & Labroy, *Sansevieria roxburghiana* Schult. & Schult. f., *Sansevieria trifasciata* Prain and *Sansevieria zeylanica* (L.) Willd., was observed and used for further experimentations (Figure 1).

Figure 1: Morphology of the various Snake plants - a) *Sansevieria metallica* Gérôme & Labroy; b) *Sansevieria roxburghiana* Schult. & Schult. f.; c) *Sansevieria trifasciata* Prain and d) *Sansevieria zeylanica* (L.) Willd.

Chromosome numbers are usually ascertained at mitosis and denoted as the diploid number (2n). Based on the work done by earlier scientists [4-7], the chromosome numbers and karyotypes of four species of *Sansevieria* belonging to the family *Asparagaceae* were investigated (Table 1).

Table 1: Chromosomal composition of the familiar *Sansevieria* plants.

Sl. No.	Name of the Plants	Chromosome Numbers (2n)*	Distribution Range	Medicinal Properties	References*
1	*Sansevieria metallica* Gérôme & Labroy	40	Tropical Africa	Antimicrobial activity	Menzel & Pate [6]
2	*Sansevieria roxburghiana* Schult. & Schult. f.	40	India (Coromandel Coast, Goa, Karnataka, Maharashtra, Tamil Nadu)	Analgesic, antibacterial, anticancer, antidiabetic, antifungal, antimicrobial, antioxidant, and antitumor activities; to heal wounds in animals; to treat toothache, coughs, rheumatism;	Sharma & Chaudhuri [7]

3	*Sansevieria trifasciata* Prain	36, 40	Nigeria	Antiallergic, anti-diabetic, anthelmintic, antimicrobial, and antiulcerative activities; folk medicine for treating bronchitis, asthma, cough, snake bite, insect bite, etc.	Menzel & Pate [6]; Sharma & Chaudhuri [7]
4	*Sansevieria zeylanica* (L.) Willd.	40, 42	Sri Lanka, India (Tamil Nadu); rocky or sandy places in dry regions	Antimicrobial, antifungal, and cytotoxic activities	Matsuura & Suto Takagi [5]

*Indicate that the studies conducted by the various workers and the detailed corresponding references.

Among the four plant species such as *Sansevieria metallica*, *Sansevieria roxburghiana*, *Sansevieria trifasciata*, and *Sansevieria zeylanica*, the diploid chromosome number (2n) ranged from 36 to 42. The highest chromosome number is reported from *S. zeylanica* (42). However, changes in the chromosomal number can occur that reflect viability and phenotypic differences.

The stomatal observation was done on both abaxial and adaxial surfaces of flat, crescentic, and hemicylindrical leaves. This is in agreement with the earlier findings of Koller & Rost [3]. The results were obtained from photographs of the different species of *Sansevierias* under 40x magnification (Figure 2). However, there is a difference in the number of guard cells surrounding the stomatal structures. Therefore, the composition and distribution of stomatal structures and their guard cells may be associated with the number of chromosomes. Furthermore, the quantification of the guard cells and the main stomatal cells shall be required to complete the study.

Furthermore, the biological parts of the *S. zeylanica* species were studied (Figure 3) in particular and the methanolic leaf extracts produced from *S. zeylanica* plants showed a cytotoxic effect against the human breast cancer (MDA-MB-231) cell lines. The IC50 value of 1167.78µg/ml was obtained for the MDA-MB-231 cell lines after the exposure to 24h treatment. The increase in cell death of MDA-MB-231 cell lines with an increase in the concentration indicates that the methanolic leaf extract of *S. zeylanica* plants was found active [13]. Thus, the antimicrobial and cytotoxic activities of *S. zeylanica* indicate that this plant species is a "natural herbal source" and can be used for its potential pharmaceutical and pharmacological applications in a large-scale industry [13,14]. Owing to its adaptability, throughout India, it is predominantly used for traditional medical treatments. Due to its robust medicinal strength and efficiency, the effects of ethanolic extracts on the *in vitro* antimicrobial activity of 17 species of *Sansevieria Thunb*. the genus was studied [15]. The other medical properties of *Sansevieria* species are listed in Table 1.

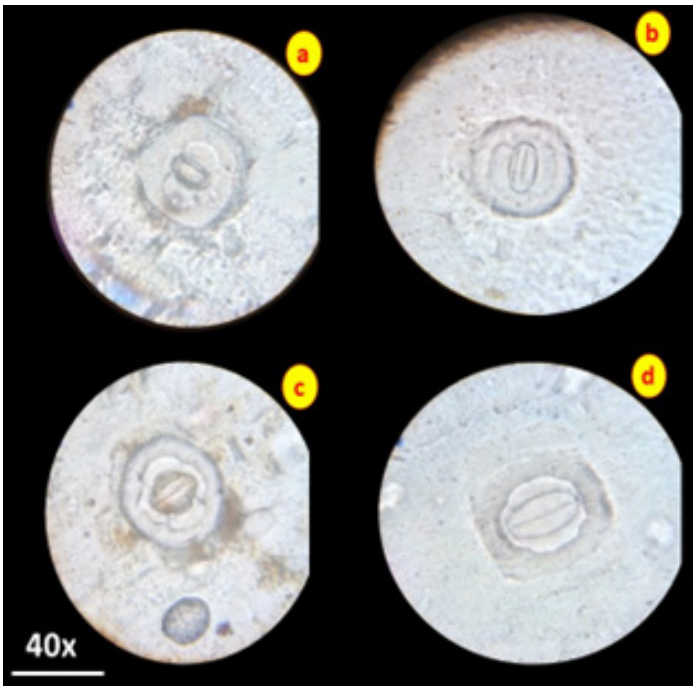


Figure 2: Stomatal structures of the various Snake plants (Photographs obtained from the phase-contrast microscopy under 40x magnification) - a) *Sansevieria metallica* Gérôme & Labroy; b) *Sansevieria roxburghiana* Schult. & Schult. f.; c) *Sansevieria trifasciata* Prain and d) *Sansevieria zeylanica* (L.) Willd.

Figure 3: Photographs showing the details of the various morphological parts (red circled ones) of the *Sansevieria zeylanica* plants with a) Uprooted whole plant, b) roots, c) leaves, d) potted plant, and e) fruits.

Conclusion, Recommendations and Future Prospectives

Accordingly, the genus *Sansevieria* is unique and has rich species diversity. The different species can be studied and compared for their differences and similarities. However, little information is available on early mitosis, meiosis, and cytotoxicity establishment under normal and abnormal climatic conditions. Therefore, *Sansevieria* species can be used for the study of abnormalities of chromosomal number and structures, chromosomal behavior, shape, size, etc. Furthermore, the information related to flowering and fruiting is still unknown; however, there is a famously defined good luck plant for nursery market selling plants with different economic prices. Wild populations are becoming sparse due to a lack of popularization, utilization, and conservation. These disadvantages indicate that adaptable, underutilized, and neglected medicinal and ornamental plants need much more research attention and scientific efforts for conservation and popularization in the following aspects:

A. The biology of seed formation, flowering, and fruiting needs to be studied, to understand the species' behavior in their germination and other phenological aspects under normal and abnormal climatic conditions.

B. Collection and characterization of *Sansevieria* species as underutilized herb has to be studied thoroughly and some variation in flowering and fruiting patterns due to the perennial nature.

C. Extensive research is needed to identify a leading type or superior genotype for flowers and fruits.

D. Plant tissue culture methods such as macro and micropropagation methods need to be standardized for faster multiplication and growth which is essential for the conservation of this species.

E. In situ conservation of these species is also a suitable method for the conservation of different germplasm of *Sansevierias* species.

F. Introducing the lesser-known species in horticulture, viz. floriculture, hedge rows, ornamental horticulture, silviculture, nursery business, and organized sole plantation will also serve the purpose of conservation and preservation.

Despite all this, the popularization of these species is the need of the hour to create awareness regarding cultivation, and conservation, which is essential for human populations and also for environmental sustenance. Thus, the current paper aims to excavate research areas for exploring the variability in wild populations and also choose the leading germplasms for further development studies which will provide a base for conservation and sustainable utilization.

Acknowledgment

I thank the Late Dr. M. N. Shivakameshwari, Associate Professor, Department of Studies in Botany, Bangalore University, Jnana Bharathi Campus, Off Mysuru Road, Bengaluru 560 056, India for the identification of plant species. I thank Ms. N. Chudamani, Ms. P. Rautela, Ms. S. G. Hegde, and Ms. S. Swaroopa, Post-graduate Students of the Centre for Applied Genetics, Bangalore University for the pilot study under my supervision.

References

1. Newton LE (2018) *Sansevieria Ruscaceae*. In: Eggli U, Nyffeler R (Eds.), Illustrated Handbook of Succulent Plants: Monocotyledons, Springer-Verlag, Berlin Heidelberg, Germany, pp. 1-37.
2. Alfani A, Ligrone R, Fioretto A, De Santo AV (1989) Histochemistry, ultrastructure and possible significance of dead parenchyma cells with specialized walls in the leaf and rhizome of *Sansevieria*. Plant Cell and Environment 12(3): 249-259.
3. Koller AL, Rost TL (1988) Leaf anatomy in *Sansevieria (Agavaceae)*. American Journal of Botany 75(5): 615-633.
4. Matsuura H, Suto T (1935) Contributions to the idiogram study in phanerogamous plants I. Journal of the Faculty of Science, Hokkaido Imperial University (Series V) 5: 33-75.
5. Takagi N (1938) A list of chromosome number in some ornamental plants. Bulletin of Miyazaki College of Agriculture and Forest 10: 83-87.
6. Menzel MY, Pate IB (1960) Chromosome and crossing behaviour of some species of *Sansevieria*. America Journal of Botany 47(3): 230-238.
7. Sharma AK, Chaudhuri M (1964) Cytological studies as an aid in assessing the status of *Sansevieria*, *Ophiopogon* and *Curculigo*. Nucleus 7: 43-58.
8. Meidner H, Mansfield TA (1968) Physiology of stomata. McGraw Hill, London.
9. Paul V, Sharma L, Pandey R, Meena RC (2017) Measurements of stomatal density and stomatal index on leaf/plant surfaces. Manual of ICAR sponsored training programme on ''Physiological techniques to analyze the impact of climate change on crop plants'', Division of Plant Physiology, ICAR - Indian Agricultural Research Institute (IARI), New Delhi, India.
10. Brown NE (1915) *Sansevieria*. A monograph of all the known species. Kew Bull Misc Inf 5: 185-261.
11. Sikder MAA, Hossiana AKMN, Siddique AB, Ahmed M, Kaisar MA, et al. (2011) *In vitro* anti-microbial screening of four reputed Bangladeshi medicinal plants. Pharmacognosy Journal 3(24): 72-76.
12. Kamakura M, Kosugi Y, Muramatsu K, Hiroyuki Muraoka (2012) Simulations and observations of patchy stomatal behavior in leaves of *Quercus crispula*, a cool-temperate deciduous broad-leaved tree species. Journal of Plant Research 125: 339-349.
13. Rajashekara S, Chudamani N, Rautela P, Hegde GS, Swaroopa S (2022) Evaluation of the cytotoxic and anti-microbial activities of the methanolic leaf extracts of *Sansevieria zeylanica* (L.) willd. against the human breast cancer, MDA-MB-231 cell lines. Journal of Ornamental Plants 12(1): 67-79.
14. Rajashekara S, Chudamani N, Rautela P, Hegde GS, Swaroopa S (2021) *Sansevieria zeylanica*: Potential origin of therapeutic applications, Medical Chemistry, Lap Lambert Academic Publishing, Mauritius.
15. Halyna T, Lyudmyla B, Zbigniew O, Myroslava M (2017) The antibacterial activity of certain *Sansevieria thunb*. species against *Escherichia coli*. Agrobiodiversity for Improving Nutrition, Health and Life Quality (1): 446-453.