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A COMPARATIVE ANALYSIS ON THE TWO VARIANTS OF SOLANUM *TRILOBATUM*

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ABSTRACT

Solanum trilobatum is a well known medicinal plant that belongs to the family of Solanaceae, order: Solanales and Genus: Solanum. It is native to India and is found everywherein Tamil Nadu. Two variants of this plant are present in nature, the common one has purplish violet flowers and the rare one has white flowers. Literature claims the white variant to be more therapeutic but no scientific evidence has been reported. The variants breed true and distinction can be made only during flowering, showing the variation in gene regulation happens only during the flowering phase of the plant and not in the vegetative phase. Although the whole plant has medical properties, the preliminary tests show that the root is the most potent part of them all. The current paper reports that the white flowered variant has better anti-microbial, anti-fungal, anti-diabetic (11.97% more) and antioxidant (6.7 % more) properties. However, the purple leaf had the best inhibition effect in anticancer activity (33.48% more) followed by the purple root (15.91%). Phytochemical screening of both the variants showed the presence of carbohydrates, alkaloids, glycosides, xanthoproteins, terpenoids and saponins in leaves whereas, roots possess flavonoids, in addition to the other phytoconstituents mentioned above. Berries possess alkaloids, flavonoids, carbohydrates, glycoside, xanthoproteins and saponins. Flowers seem to possess only flavonoids, xanthoproteins and terpenoids. Literature shows that 2n=24 in *Solanum trilobatum* (purple flower variant). However, genetic analysis has to be done to showthe difference and the evolutionary connection between the 2 variants. This is the first report of the therapeutic properties of *Solanum trilobatum* white flowered variant, to our knowledge.

KEYWORDS: *Solanum trilobatum*, purple flowers, white flowers, root, leaf, berry,

phytochemical, antimicrobial activity, antifungal activity, anticancer activity, anti diabetic activity, antioxidant activity.

BACKGROUND

Medicinal plants can serve as a source of novel therapeutic agents due to the presence of diverse phytoconstituents like alkaloids, flavonoids, terpenoids, phenolic compounds, glycosides etc., in plants. They are widely used in human therapy, veterinary, agriculture and scientific research. Plants are playing an important role in the health of millions of people's lives in India. TheWorld Health Organization estimates, without reliable data, that some 80 percent (approximatelytwo billion people) of the world's population depends mainly on traditional medicine (Madhumitha *et al*. 2013). Plants synthesize hundreds of chemical compounds for functions including defense against insects, fungi, diseases, and herbivorous mammals.

The naturally arising nutritional and non- nutritional elements in numerous species of edible vegetation has its contribution in pharmacological action. *S. trilobatum* has a typical botanical description (Balakrishnan *et al.* 2013) It is habitually used to treat several diseases, like bronchial asthma, treatment for cancer, liver infection. It is also used as a nanomedicine for antibacterial activity and human breast cancer.

S. trilobatum is a green, perennial herb with all of its parts containing medicinal value. The whole plant is said to contain natural steroids. The steroid Solasoline is present in the leaves, fruits, seeds and stem which are widely used for steroid drug production (Mamun *et. al*., 2014). The flower is used to treat rheumatism, constipation and other gastric problems.

Plant description

Solanum trilobatum Linn (Solanaceae), the nightshade, Family: Solanaceae, order: Solanales and Genus: Solanum with 102 genera and nearly 2,500 species. It is a prickly diffuse, bright green perennial herb, woody at the base, 2–3 m height, found native to India and is found everywhere in Tamil Nadu. Muthukumar (1992) has reported that this plant grows and produces flowers between December and March. Gamble (1921)in his flora has reported this plant to be a climbing shrub with numerous short, strong and recurved prickles. Leaves are deltoid or triangular, irregularly lobed. Flowers are purplish- blue and white in cymes and berries are globose, red or scarlet. This plant is said to produce flowers with white colour (Gamble and Shanmugam 1989) but in wild natural habitats white-flower producing plants

are uncommon. White flowering plants are supposedly superior in their therapeutic properties than the violet flowering plants.

The purple flowered plant has been proven to have many medicinal properties (Pratheeba *et. al*., 14 2014). The leaves are bitter in taste and are used to cure throat infection, cold, cough, headaches, flu and sneezing. It prevents cancers like oral, uterus and throat cancers because of itsantitumor activity (Priya and Chellaram, 2014). It gives strength to bones as it is rich in calcium. It boosts memory and energy. It improves men's fertility and vitality. It improves blood circulation. It helps to control diabetes. It cures dullness of hearing (Nataraj *et. al*., 2014). It is good for gastritis, nerves, asthma, eosinophilia, tuberculosis, difficulty in breathing, constipation, rheumatism, lung disorders and all digestive and respiratory problems. Various Dishes like juice, kashayam, soup, chutney, rasam, kuttu, kulambu, etc from the leaves can be made (Priya and Chellaram, 2014).

The white flowered variant of *Solanum trilobatum* is expensive, new and is very hard to comeby. It takes a while to grow to its full capacity.

Traditional Uses

Solanum trilobatum Linn (Family: Solanaceae) is one of the most important wild medicinal plants. It has a variety of therapeutic properties such as antimicrobial, anti-diabetic, anti-inflammatory, Hepatoprotective, Respiratory problems, Bronchial Asthma etc. The steroid solasoline is present in the leaves, fruits, seeds and stem which are widely used for steroid drug production (Mamun et. al., 2014). The fruit from *Solanum trilobatum* has nutritional and mineral composition (Suganthi *et al*., 2017).They have been shown to possess immune stimulatingactivity acting at different levels of the immune system (Dhasarathan *et al.*, 2008). The leaves areused to treat dullness in hearing by making ear drops (Akilan *et. al.*, 2014). The leaf extract is used for treatment of cough and cold. The major alkaloids identified in the alcoholic extract from leaves and stem part of *S. trilobatum* has been shown to possess antimicrobial activity against bacteria and fungi. While all this is mentioned for the purple flowered variant of Solanum trilobatum, it has been mentioned that the white variant also possesses similar and better properties.

Siddha Properties

Solanum trilobatum is a widely used plant in the Indian indigenous systems of medicine. Since the ancient period, this herb has been used as a medicine by roasting it in oil or pure

ghee and making a powder out of it. It is mainly used in the treatment of respiratory diseases like bronchial asthma. Thuthuvalai kashayam or legiyam reduces the congestion of nose and chest. The Siddha doctors recommend *Solanum trilobatum* as one of the best medicines for sinusitis (Madhumitha *et al. 2019).* Consuming the juice of the plant with honey is used for respiratory problems like carcinoma, dyspnoea and anorexia. Most common recipes in siddha are Thuthuvalai candy, legiyam, rasam and chooranam. In Siddha treatment, the leaves are used to improve blood circulation and production. In addition it also prevents thickening of the blood which leads to many serious problems *(*Pratheeba *et. al., 2014).*

The objective of the present study was to compare the medicinal properties of both the variantsof S. *trilobatum* and also to find out the differences between them.

MATERIALS AND METHODS

Collection of sample

The plants (*Solanum trilobatum*) were collected during the month of March, 2022 from 'Atri Health Products,' Chennai, Tamil Nadu, India. They were carefully potted and maintained for further use.

Preparation of samples

Leaves, berries, roots and flowers of both variants were shade dried for 4 days.

Extraction: leaves, berries, flowers and roots Mortar and pestle were used to grind the leaves, berries, flowers and roots into a powder. The powders were weighed and extracted with ethanol using a soxhlet apparatus at 75°C ± 5°C. After 9 cycles, the extraction was complete. The extract was concentrated using a "Kjeldahl distillation" apparatus into a paste. It was stored at -4 C until use.

Antimicrobial Activity

Antibacterial activities of the leaves, berries, flowers and roots of both variants of *S. trilobatum* were determined by the well and disc diffusion methods. Bacterial cultures (E-*coli,* Streptococcus *and* Bacillus *subtilis)* were spread on nutrient agar plate and wells were punched on the agar surface with the help of sterile gel punchers. From the stock solution, concentrations of 25 µg/ml, 50µg/ml and 75 µg/ml were prepared from each part of the plant from bothvariants of S.trilobatum, amoxicillin (positive control, 10 µg/ml) and ethanol (negative control) were added in appropriate wells.

LB agar plates were inoculated with bacterial strain of Streptococcus and *Bacillus subtilis* under aseptic conditions and wells (diameter=6mm) were filled with 50 µl of the test samples and incubated at 37°C for 24 hours. After the incubation period, the diameter of the growth inhibition zones was measured. The similar steps were followed for the Nutrient Broth agar plates using bacterial strain of *E.coli* and were incubated for 24 hours at 37°C.

Antifungal activity

2-3 slices of bread were tightly sealed and refrigerated for 2 weeks in order to allow growth of bread mould or Rhizopus stolonifer. After 2 weeks, the fungal spores were scraped off and suspended in sterile water.

The ethanolic extracts of the leaves, roots, berries and flowers of both variants of Solanum *trilobatum* were concentrated into a paste by using a Kjeldahl distillation apparatus and a stock of solution of concentration 1 mg/ ml was prepared and from the stock solution, concentrations of 25 µg/ml, 50 µg/ml and 75 µg/ml were prepared from each part of the plant from both variantsof *S.trilobatum*.

Rose Bengal agar plates were inoculated with Fungal strain of *Rhizopus stolonifer* under aseptic conditions and wells (diameter - 6mm) were filled with 50 µl of the test samples (clotrimazole as the positive control and ethanol as the negative control) and incubated at 37°C for 24 hours. After the incubation period, the diameter of the growth inhibition zones was measured.

Discs made out of Whattman filter paper of 2-3 mm diameter were cut out and soaked in different concentrations of the extracts from both variants for 1-3 hours. The soaked discs were then placed on the inoculated plates and the diameter of the zone of inhibitions were measured after 24 hours.

Antioxidant Assay

DPPH radical scavenging assay: Determination of Antioxidant by DPPH (α,α- diphenyl-β-picrylhydazyl) method was performed based on Blois method with slight modification (Blois, 1958). Five ml of 0.2mM DPPH solution was prepared using ethanol and added to 1 ml of sample solutions. The mixtures were vortex-mixed and kept under darkroom conditions for 30 min. The optical density (OD) was measured at 517 nm. Ethanol was used as baseline control. The experiments were performed in triplicates. The capability to scavenge the DPPH

radical was calculated using the equation shown in figure (1).

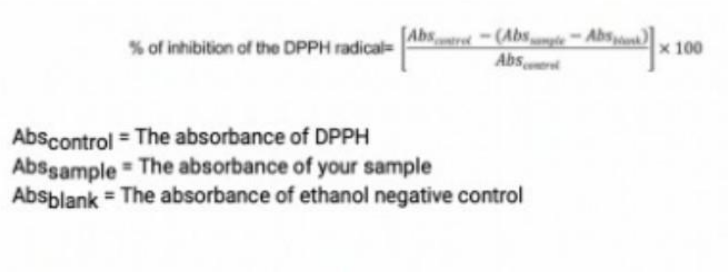

Fig 1: % inhibition of DPPH Radical equation.

Samples of Leaves, roots, berries and flowers from both variants were prepared in different concentrations of 10, 25, 50, 75, 100 µg/ml andfilled in microtubes as shown in figure (2).

Microtubes	EtOH (µL)	DPPH (µL)
Control	20	280
Sample	10	280

Fig 1: Sample preparation of ethanolic extracts of leaves, berries, flowers and roots for DPPH assay.

Anticancer activity

The MTT assay is used to measure cellular metabolic activity as an indicator of cell viability, proliferation and cytotoxicity. The insoluble formazan crystals are dissolved using a solubilization solution and the resulting coloured solution is quantified by measuring absorbance at 500-600 nm using a multiwell spectrophotometer. The darker the solution, the greater the number of viable, metabolically active cells. An equal volume of MTT solution was added to the existing media in the culture. 90 µL of serum-free media was added and 10 µL of MTT solution was added into each well. The plate was incubated at 37°C for 4 hours and 100 µL DMSO was added into each well. After incubation, 150 µL of MTT solvent was added into each well and incubated for 30 minutes. The absorbance was read at OD 590 nm within 1 hour.

Antidiabetic Assay

α-Amylase catalyses the hydrolysis of starch and ultimately produces glucose. This study was conducted to evaluate α-amylase inhibition for utilising the crude extracts of *Solanum trilobatum*. 250 µl of each of the samples were taken along with a standard (metformin) and 250 µl of buffered α-Amylase solution was added and incubated at room temperature for 10 minutes. 250 µl of buffered Starch solution was added and incubated at room temperature for

10 minutes and finally, 500 µl of DNSA was added and the samples were kept in the hot water bath for 10 minutes. Absorbance was read at 540 nm.

RESULTS AND DISCUSSION

1. Phytochemical screening and analysis

Both variants of the leaves *S. trilobatum* showed the presence of Alkaloids , Carbohydrates, Glycosides, Xanthoproteins, Saponins and Terpenoids. Both variants of the roots *S. trilobatum* showed the presence of Alkaloids, Flavonoids, Carbohydrates, Glycosides, Xanthoproteins, Saponins and Terpenoids. Both variants of the berries of *S. trilobatum* showed the presence of Alkaloids, Flavonoids, Carbohydrates, Glycosides, Xanthoproteins, Saponins and Terpenoids. Both variants of the flowers of *S. trilobatum* showed the presence of only Flavonoids, Carbohydrates, Xanthoproteins and Terpenoids. The presence and absence of the phytoconstituents depends on the solvent medium used for extraction and the physiological property of individual taxa. The whole plant has been said to have medicinal value and that has been proven.

Phytochemical screening analysis. While it has already been said in various Siddha Ayurveda texts that the root is the most potent part of the plant, running the Phytochemical screening proves that for a fact as the root shows the presence of the most number of phytoconstituents.

Table 1: Phytochemical screening and analysis of the leaves, root, berry and flowers of the 2variants of S. *trilobatum*.

	Leaf		Root		Berry		Flower	
	Purple	White	Purple	White	Purple	White	Purple	White
Alkaloids	+	+	+	+	+	+	-	-
Flavonoids	-	-	+	+	+	+	+	+
Carbohydrates	+	+	+	+	+	+	-	-
Glycosides	+	+	+	+	+	+	-	-
Proteins	-	-	-	-	-	-	-	-
Xanthoproteins	+	+	+	+	+	+	+	+
Saponins	+	+	+	+	+	+	-	-
Tannins	-	-	-	-	-	-	-	-
Terpenoids	+	+	+	+	-	-	+	+
Anthraquinones	-	-	-	-	-	-	-	-
Phlobatannins	-	-	-	-	-	-	-	-

2. Anti Microbial activity

Streptococcus thermophilus

Roots showed the best antimicrobial activity against Streptococcus strain, followed by the leaves. However, in all cases, the white flowered variant seems to be more efficient.

Table 2: Effect of Ethanolic extracts of leaf, root, berry and flower of *S.trilobatum* against Streptococcus thermophiles.

	Zones of Inhibitions (mm)							
Plant Part	**Leaf**		**Root**		**Berry**		**Flower**	
Concentrations(ug/ml)	**Purple**	**White**	**Purple**	**White**	**Purple**	**White**	**Purple**	**White**
25	8 ± 0.5	9 ± 0.9	10 ± 0.2	10 ± 0.5	5 ± 0.6	5 ± 0.0	5 ± 0.7	6 ± 0.0
50	9 ± 0.0	10 ± 0.6	12 ± 0.4	13 ± 0.2	7± 0.0	6 ± 0.9	7 ± 0.2	8 ± 0.5
75	11 ± 0.09	13 ± 0.0	13 ± 0.8	15 ± 0.7	8 ± 0.3	7 ± 0.1	7 ± 0.6	8 ± 0.1

Bacillus subtilis

White flowered variant's roots seem to be the most efficient with the highest antimicrobialactivity against B. subtilis, followed closely by purple flowered variant's roots.

Table 3: Effect of Ethanolic extracts of leaf, root, berry and flower of *S.trilobatum* against Bacillus subtilis.

Plant Part	**Zones of Inhibitions (mm)**							
	Leaf		**Root**		**Berry**		**Flower**	
Concentrations(ug/ml)	**Purple**	**White**	**Purple**	**White**	**Purple**	**White**	**Purple**	**White**
25	**8 ± 0.5**	**9 ± 0.9**	**10 ± 0.2**	**10 ± 0.5**	**5 ± 0.6**	**5 ± 0.0**	**5 ± 0.7**	**6 ± 0.0**
50	**9 ± 0.0**	**10 ± 0.6**	**12 ± 0.4**	**13 ± 0.2**	**7± 0.0**	**6 ± 0.9**	**7 ± 0.2**	**8 ± 0.5**
75	**11 ± 0.09**	**13 ± 0.0**	**13 ± 0.8**	**15 ± 0.7**	**8 ± 0.3**	**7 ± 0.1**	**7 ± 0.6**	**8 ± 0.1**

E.coli

Leaves and berries showed no zones of inhibition while roots and flowers showed antimicrobialactivity against E.coli. Yet again, the white root proves to be the best among all the extracts.

Table 4: Effect of Ethanolic extracts of leaf, root, berry and flower of *S.trilobatum* against E. coli.

	Zones of Inhibitions (mm)							
Plant Part	**Leaf**		**Root**		**Berry**		**Flower**	
Concentrations(ug/ml)	**Purple**	**White**	**Purple**	**White**	**Purple**	**White**	**Purple**	**White**
25	**8 ± 0.5**	**9 ± 0.9**	**10 ± 0.2**	**10 ± 0.5**	**5 ± 0.6**	**5 ± 0.0**	**5 ± 0.7**	**6 ± 0.0**
50	**9 ± 0.0**	**10 ± 0.6**	**12 ± 0.4**	**13 ± 0.2**	**7± 0.0**	**6 ± 0.9**	**7 ± 0.2**	**8 ± 0.5**
75	**11 ± 0.09**	**13 ± 0.0**	**13 ± 0.8**	**15 ± 0.7**	**8 ± 0.3**	**7 ± 0.1**	**7 ± 0.6**	**8 ± 0.1**

3. Anti Fungal Activity

Table 5: Effect of Ethanolic extracts of leaf, root, berry and flower of *S.trilobatum* against Rhizopus stolonifer.

	Zones of Inhibitions (mm)							
Plant Part	**Leaf**		**Root**		**Berry**		**Flower**	
Concentrations (ug/ml)	**Purple**	**White**	**Purple**	**White**	**Purple**	**White**	**Purple**	**White**
25	**8 ± 0.5**	**9 ± 0.9**	**10 ± 0.2**	**10 ± 0.5**	**5 ± 0.6**	**5 ± 0.0**	**5 ± 0.7**	**6 ± 0.0**
50	**9 ± 0.0**	**10 ± 0.6**	**12 ± 0.4**	**13 ± 0.2**	**7± 0.0**	**6 ± 0.9**	**7 ± 0.2**	**8 ± 0.5**
75	**11 ± 0.09**	**13 ± 0.0**	**13 ± 0.8**	**15 ± 0.7**	**8 ± 0.3**	**7 ± 0.1**	**7 ± 0.6**	**8 ± 0.1**

Berries showed the best antimicrobial activity against the fungal culture, followed by roots and flowers. Leaves showed no inhibitory activity. However, in all cases, the white flowered variant seemed to be more efficient. Generally,

White Flowered variant berry > Purple flowered Variant Berry >White Flowered variant Root > Purple flowered Variant Root > White Flowered variant Leaf > Purple flowered Variant Leaf > White Flowered variant Flower > Purple flowered Variant flower.

4. Anti Oxidant Activity

The roots of both variants showed the maximum antioxidative property followed by the flowers, berries and leaves. The white flowered variant of *Solanum trilobatum* seemed to possess more antioxidant activity when compared to that of the purple flowered variant of *Solanum trilobatum.*

Table 6: Antioxidative properties of Ethanolic extracts of the roots from both variants of *S.trilobatum*.

Concentrations(ug/ml)	**1**	**2**	**3**	**Avg**	**Inhibition**	**% Inhibition**
10	**0.398**	**0.456**	**0.435**	**0.430**	**0.599**	**59.911**
25	**0.388**	**0.432**	**0.419**	**0.413**	**0.616**	**61.626**
50	**0.370**	**0.402**	**0.395**	**0.389**	**0.641**	**64.095**
75	**0.367**	**0.399**	**0.379**	**0.382**	**0.648**	**64.849**
100	**0.354**	**0.378**	**0.369**	**0.367**	**0.664**	**66.358**
Concentrations(ug/ml)	**1**	**2**	**3**	**Avg**	**Inhibition**	**% Inhibition**
10	**0.356**	**0.369**	**0.366**	**0.364**	**0.667**	**66.701**
25	**0.342**	**0.361**	**0.356**	**0.353**	**0.678**	**67.798**
50	**0.338**	**0.335**	**0.344**	**0.339**	**0.692**	**69.239**
75	**0.332**	**0.323**	**0.342**	**0.332**	**0.699**	**69.925**
100	**0.322**	**0.312**	**0.328**	**0.321**	**0.711**	**71.125**

Table 7: Antioxidative properties of Ethanolic extracts of the flowers from both variants of S. trilobatum.

Concentrations(ug/ml)	1	2	3	Avg	Inhibition	% Inhibition
10	**0.385**	**0.396**	**0.417**	**0.399**	**0.630**	**63.032**
25	**0.375**	**0.388**	**0.401**	**0.388**	**0.642**	**64.198**
50	**0.363**	**0.376**	**0.388**	**0.376**	**0.655**	**65.466**
75	**0.320**	**0.340**	**0.355**	**0.338**	**0.693**	**69.307**
100	**0.309**	**0.330**	**0.347**	**0.329**	**0.703**	**70.302**
Concentrations(ug/ml)	**1**	**2**	**3**	**Avg**	**Inhibition**	**% Inhibition**
10	**0.386**	**0.395**	**0.403**	**0.395**	**0.635**	**63.512**
25	**0.370**	**0.384**	**0.399**	**0.384**	**0.646**	**64.575**
50	**0.356**	**0.367**	**0.369**	**0.364**	**0.667**	**66.667**
75	**0.312**	**0.334**	**0.345**	**0.330**	**0.701**	**70.130**
100	**0.302**	**0.322**	**0.335**	**0.320**	**0.712**	**71.228**

Table 8: Antioxidative properties of Ethanolic extracts of the berries from both variants of S.trilobatum.

Concentrations(ug/ml)	1	2	3	Avg	Inhibition	% Inhibition
10	0.502	0.497	0.489	0.496	0.531	53.086
25	0.493	0.488	0.472	0.484	0.543	54.287
50	0.483	0.467	0.468	0.473	0.555	55.487
75	0.470	0.442	0.438	0.450	0.578	57.819
100	0.463	0.431	0.429	0.441	0.587	58.745
Concentrations(ug/ml)	**1**	**2**	**3**	**Avg**	**Inhibition**	**% Inhibition**
10	0.460	0.530	0.487	0.492	0.535	53.464
25	0.460	0.530	0.487	0.492	0.535	53.464
50	0.443	0.479	0.471	0.464	0.563	56.344
75	0.439	0.388	0.446	0.424	0.605	60.460
100	0.421	0.379	0.432	0.411	0.619	61.866
Concentrations(ug/ml)	**1**	**2**	**3**	**Avg**	**Inhibition**	**% Inhibition**
10	0.594	0.579	0.601	0.591	0.433	43.278
25	0.589	0.577	0.592	0.586	0.438	43.827
50	0.572	0.568	0.575	0.572	0.453	45.302
75	0.567	0.542	0.554	0.554	0.471	47.085
100	0.542	0.532	0.549	0.541	0.485	48.457
Concentrations(ug/ml)	**1**	**2**	**3**	**Avg**	**Inhibition**	**% Inhibition**
10	0.491	0.484	0.468	0.481	0.546	54.630
25	0.478	0.468	0.450	0.465	0.562	56.241
50	0.461	0.427	0.412	0.433	0.595	59.534
75	0.449	0.412	0.400	0.420	0.609	60.871
100	0.421	0.404	0.398	0.408	0.622	62.174

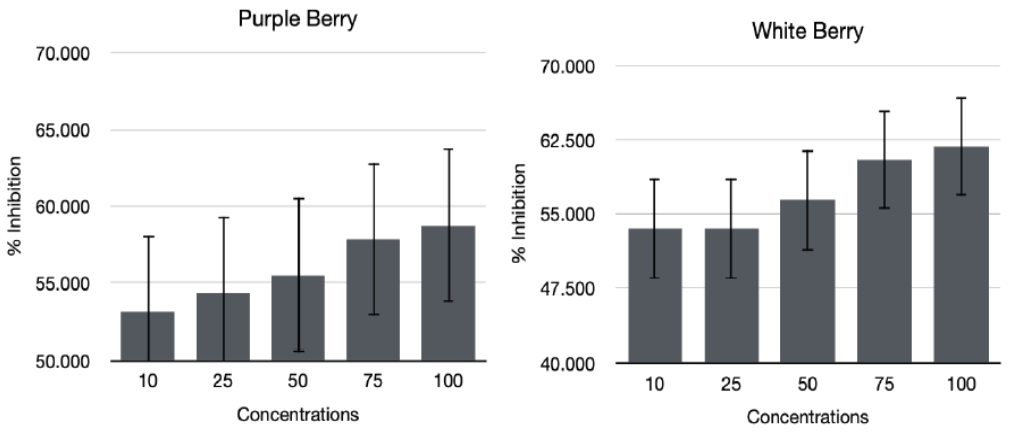

Figure 2: Antioxidant activity of berries from the purple flowered variant and white flowered variant of S. trilobatum

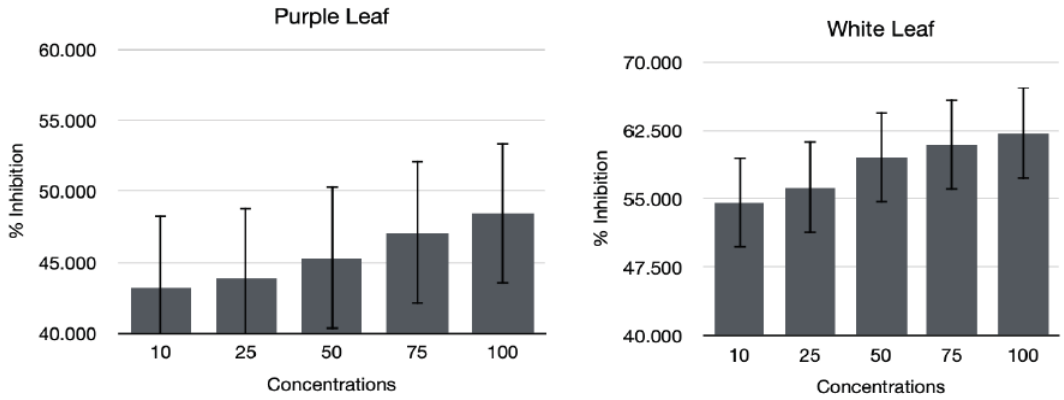

Figure 3: Antioxidant activity of leaves from the purple flowered variant and white flowered variant of S. trilobatum

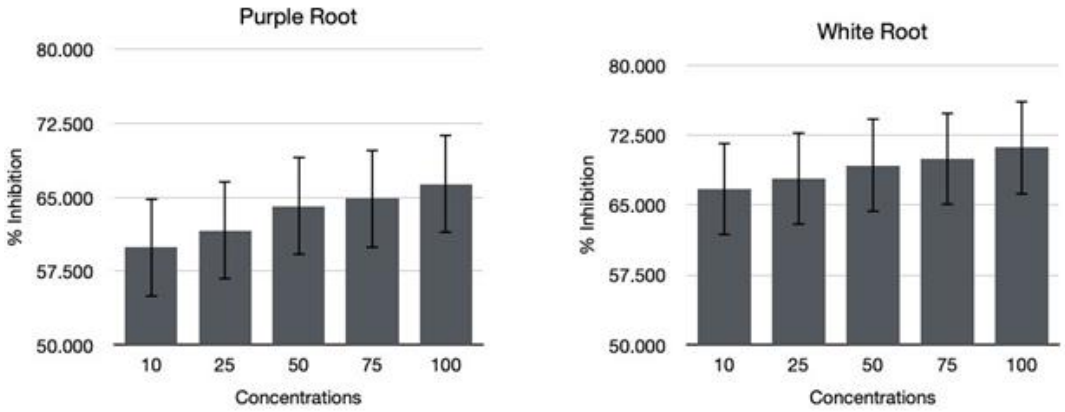

Figure 4: Antioxidant activity of leaves from the purple flowered variant and white flowered variant of S. trilobatum

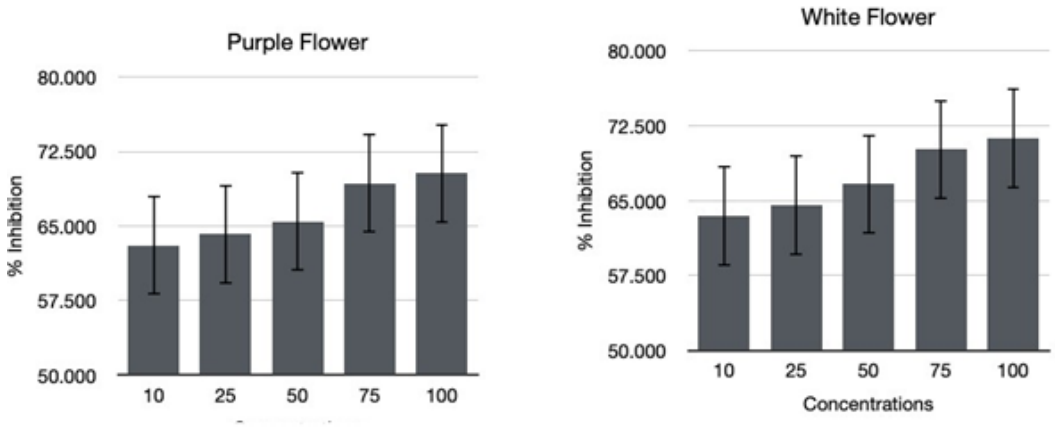

Figure 5: Antioxidant activity of flowers from the purple flowered variant and white flowered variant of S. trilobatum

5. Antidiabetic Activity

The white flowered variant root showed the maximum activity, followed by purple floweredroot. The berries and flowers also showed lesser activity. The leaf did not show any antidiabetic activity.

Table 10: Antidiabetic properties of Ethanolic extracts of the roots from both variants of S. trilobatum.

Concentrations(ug/ml)	1	2	Avg	Inhibition	% Inhibition
10	0.640	0.659	0.650	0.0751	7.511
25	0.615	0.620	0.618	0.1237	12.367
50	0.523	0.534	0.529	0.2587	25.873
75	0.483	0.496	0.490	0.3179	31.791
100	0.374	0.421	0.398	0.4575	45.751
Concentrations(ug/ml)	1	2	Avg	Inhibition	% Inhibition
10	0.650	0.668	0.659	0.0607	6.070
25	0.632	0.628	0.630	0.1047	10.470
50	0.565	0.542	0.554	0.2208	22.079
75	0.483	0.496	0.490	0.3179	31.791
100	0.374	0.421	0.398	0.4575	45.751

Table 11: Antidiabetic properties of Ethanolic extracts of the berries from both variants of S. trilobatum.

Concentrations	1	2	Average	Raw Inhibition	% Inhibition
	Purple Berry				
10	0.569	0.574	0.572	0.1935	19.347
25	0.531	0.549	0.540	0.2413	24.127
50	0.515	0.523	0.519	0.2731	27.314
75	0.457	0.499	0.478	0.3354	33.536

100	0.406	0.413	0.410	0.4393	43.930
	White Berry				
10	0.568	0.576	0.572	0.1927	19.272
25	0.541	0.568	0.555	0.2193	21.927
50	0.487	0.497	0.492	0.3141	31.411
75	0.436	0.466	0.451	0.3763	37.633
100	0.421	0.401	0.411	0.4370	43.703

Table 12: Antidiabetic properties of Ethanolic extracts of the flowers from both variants of S.trilobatum.

Concentrations(ug/ml)	1	2	Avg	Inhibition	% Inhibition
10	0.644	0.656	0.650	0.0744	7.436
25	0.630	0.621	0.626	0.1115	11.153
50	0.566	0.603	0.585	0.1737	17.375
75	0.434	0.544	0.489	0.3187	31.866
100	0.412	0.455	0.434	0.4029	40.288
Concentrations(ug/ml)	1	2	Avg	Inhibition	% Inhibition
10	0.626	0.634	0.630	0.1047	10.470
25	0.610	0.599	0.605	0.1434	14.340
50	0.570	0.534	0.552	0.2231	22.307
75	0.471	0.485	0.478	0.3354	33.536
100	0.450	0.468	0.459	0.3642	36.419

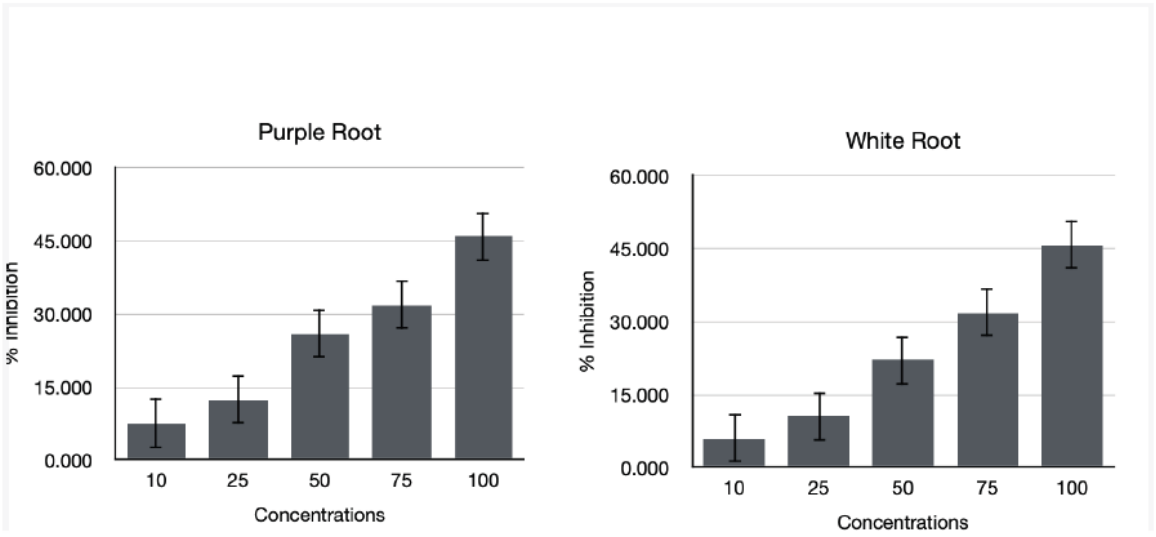

Figure 6: Antidiabetic activity of roots from the purple flowered variant and white flowered variant of S. trilobatum

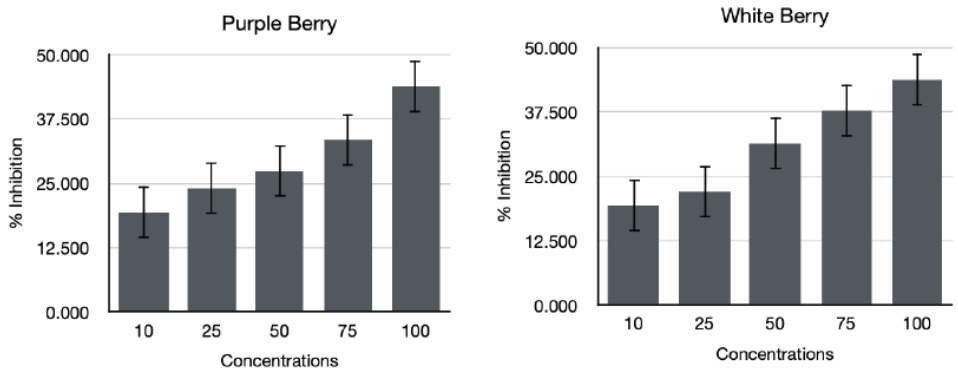

Figure 7: Antidiabetic activity of berries from the purple flowered variant and white flowered variant of S. trilobatum

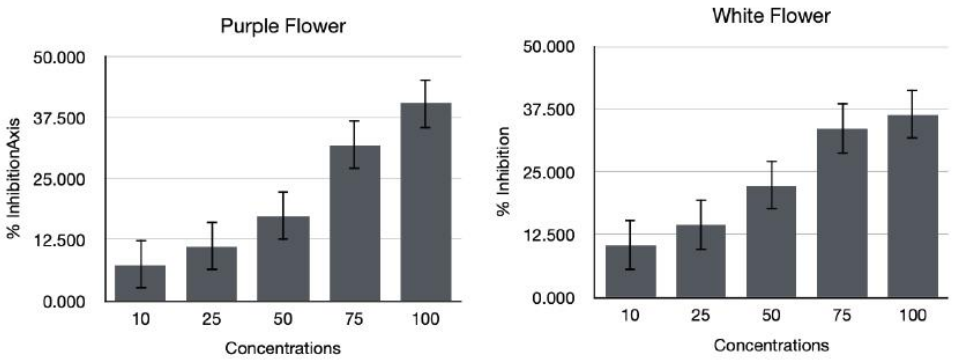

Figure 8: Antidiabetic activity of flowers from the purple flowered variant and white flowered variant of S. trilobatum

Anticancer activity

The leaves from the purple flowered variant proved to have the highest anticancer activity followed by the leaves of the white flowers variant of S.trilobatum. Roots of the purple flowered variant of *Solanum trilobatum* showed increased activity in comparison with the roots from the white flowered variant of *S.trilobatum.*

Table 13: Anticancer property of Ethanolic extracts of the leaves from the purple floweredvariant of S.trilobatum.

Concentrations(ug/ml)	R1	R2	R3	Mean	% Viability
20	1.699	1.738	1.737	1.725	79.2
40	1.736	1.715	1.693	1.715	78.7
60	1.504	1.532	1.501	1.512	68.7
80	1.308	1.329	1.334	1.324	59.4
100	1.012	1.051	1.098	1.054	46.1

Table 14: Anticancer property of Ethanolic extracts of the leaves from the white floweredvariant of S. trilobatum.

Concentrations(ug/ml)	R1	R2	R3	Mean	% Viability
20	1.799	2.038	2.037	1.958	90.6
40	1.958	1.671	2.178	1.936	89.5
60	1.554	2.232	1.701	1.829	84.3
80	1.66	1.835	1.188	1.561	71.1
100	1.108	1.729	1.734	1.524	69.3

Table 15: Anticancer property of Ethanolic extracts of the roots from the purple floweredvariant of S.trilobatum.

Concentrations(ug/ml)	R1	R2	R3	Mean	% Viability
20	**2.101**	**2.132**	**2.141**	**2.125**	**98.9**
40	**1.899**	**2.138**	**2.037**	**2.025**	**93.9**
60	**1.551**	**2.332**	**1.801**	**1.895**	**87.5**
80	**1.900**	**1.829**	**1.834**	**1.854**	**85.5**
100	**1.751**	**1.732**	**1.701**	**1.728**	**79.3**

Table 16: Anticancer property of Ethanolic extracts of the roots from the white flowered variant of S.trilobatum.

Concentrations(ug/ml)	R1	R2	R3	Mean	% Viability
20	2.154	2.132	2.101	2.129	99.1
40	2.108	2.129	2.134	2.124	98.8
60	2.199	2.038	2.037	2.091	97.2
80	2.116	2.015	2.113	2.081	96.7
100	2.018	2.071	2.008	2.032	94.3

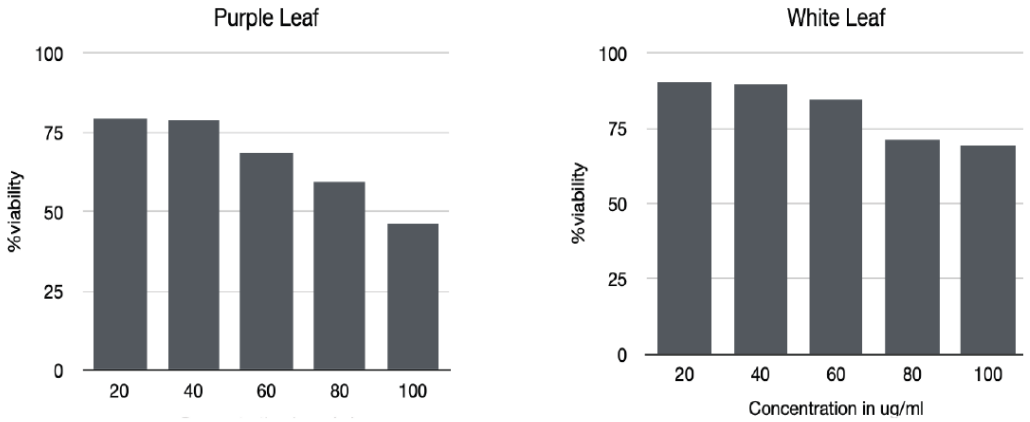

Figure 9: Anticancer activity of leaves from the purple flowered variant and white flowered variant of S. trilobatum

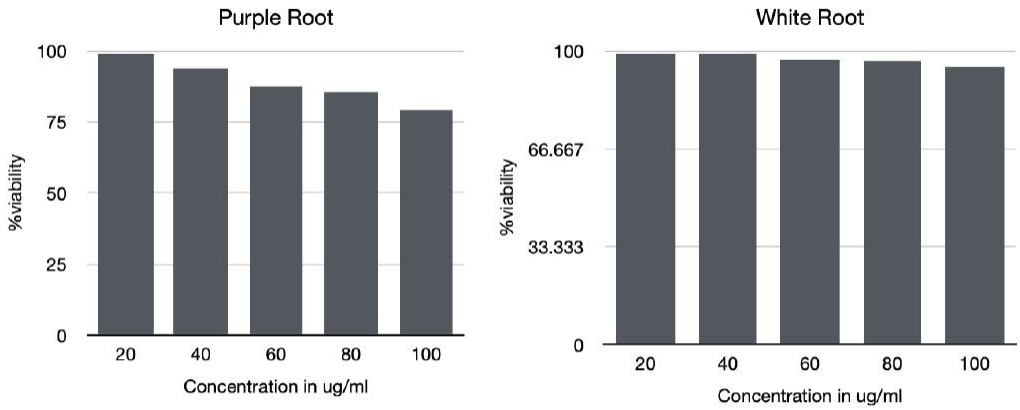

Figure 10: Anticancer activity of roots from the purple flowered variant and white flowered variant of S. trilobatum

RESULTS AND DISCUSSION

The main aim of this project was to compare the two variants of this plant and tabulate the differences as well as the similarities. There has been no prior research done on the new (white) variant of the plant and there is no information available on its whole genome sequence. With no source material related to the genetic variability of the 2 species and their other, physical differences, this research work shows clear comparison between the two, concluding that the white variant is more effective overall.

Previous research showed that the ethanolic extract of *Solanum trilobatum* showed the highest presence of 7 phytochemicals *(Mohan et al. 2021)*. The results of the phytochemical testsperformed on the purple variant extracts of *S.trilobatum* match those of other researchers *(Manivel K et al. 2020).*

Existing research done on the purple flowered variant suggests that the purple variant has antimicrobial, antifungal, antioxidant and anticancer properties. The findings of the work of P. Swapna Latha and K. Kannabiran in "Antimicrobial activity and phytochemicals of Solanum *trilobatum* Linn" suggest that aqueous and solvent extracts of S. *trilobatum* were found to be very effective against both Gram positive and Gram negative (tested) organisms. Further From the findings of Fabiola and Dr. V. Judia Harriet Sumathy (2018), ethanolic extracts of concentrations 50, 100, 150 and 200 µL proved to show good activity against the test organisms. It was concluded that antimicrobial activity of S. *trilobatum* extracts against the organismindicates medicinal value and supports the claim of traditional healers that it has

been used to relieve throat congestion, cough and cold. These are synonymous to the results of the experiments performed and tabulated in this paper.

Using the DPPH test, Sini & Devi (2004) had previously evaluated the antioxidant capacities of S. *trilobatum* for the purple-flowered variant. The aqueous extract was taken in different concentrations varying between 10 and 60µgmL and results showed that the percentage of inhibition was 40% *(Sini & Devi, 2004)* affirming the antioxidant activity of the purple flowered variant of S.*trilobatum*. The present studies prove that the white flowered variant of S.*trilobatum* has a better antioxidant activity of about 6.7% with the root of the white flower variant showing the highest percentage of inhibition.

The purple flowered variant of Solanum *trilobatum* has been studied to show effective anti diabetic activity (Sorna Kumar et al. 2016). The protocol followed in this study was supported by the In-vitro test tube based α–Amylase inhibition activity performed by Sorna Kumar (2016). Their findings showed a maximum inhibition of 22.72% at pH 3 and 4 followed by 18.92% for water extract of leaf. It also showed a maximum inhibition at pH 3 (Sorna Kumar et al.2016).With the antidiabetic activity of the purple flowered variant being previously confirmed, the current study proved the significant difference in the antidiabetic activity between both the variants, by confirming that the white flowered variant of *Solanum trilobatum* has an increased activity of 11.97% with the root triumphing over all the other parts of the plant.

Previous research and findings have proved *Solanum trilobatum* (purple flowered variant) tohave effective anticancer and antitumor activity (*Pratheeba et al. 2014).* Results from the current research also confirms the earlier findings, with the purple flowered variant showing the highest tumour inhibitory effect with the leaf showing the highest activity (33.38% more),followed by the purple root (15.91% more) outperforming the white flowered variant of Solanum*trilobatum*.

To summarise, although the whole plant has medicinal properties, the preliminary results show that the root is the most potent part of them all. Experimental evidence suggests that the white-flowered variant has better anti-microbial, anti-fungal, anti-diabetic (11.97% more), and antioxidant (6.7 % more) properties. However, the anticancer assay showed that the purple leaf had the best inhibition effect (33.48% more) followed by the purple root (15.91% more). Theroot of both the variants seem to be the most potent part of the plant,

with the white flowered variant triumphing over its purple counterpart.

Phytochemical screening of both variants showed the presence of carbohydrates, alkaloids, glycosides, xanthoproteins, terpenoids, and saponins in leaves, whereas, roots possess flavonoids, in addition to the other phytoconstituents mentioned above. Berries possess alkaloids, flavonoids, carbohydrates, glycosides, xanthoproteins, and saponins. Flowers seem to possess only flavonoids, xanthoproteins, and terpenoids.

In addition to all of the tests and assays, a taxonomist seal was obtained that proves that the white flowered variant of Solanum *trilobatum* is rare and new. This opens up various avenues with respect to the fields of medicine and research, especially for conditions such as cold, fever, cough and various other respiratory ailments. Further results from karyotyping and ISSR studies might give us more insight into the evolution of genetic variation which is currently an ongoing research. With the world going through pandemics like Covid-19, medicinal plants with great therapeutic value, such as the one chosen, will only be an asset to the medical field.

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Author contribution

Authors 1 and 2 had equal contribution and participation in the experimental part and in the drafting of this paper, with the concept developed by M.G. The experiments were designed and done equally by A.R and S.K.

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