Evaluation of the Anti-Inflammatory Potential of Solanum Species Extracts in Laboratory Animals

S.Z. Sayyed[1], P.N. Nagane*[2], A.A. Kulkarni[3]

[1]Research Scholar, Department of Botany, BPHE Society's Ahmednagar College, Ahmednagar

[2]Assistant Professor, Research Centre, Department of Botany, Balwant College, Vita, Tal Khanapur, Dist. Sangali

[3]Professor, Department of Botany, BPHE Society's Ahmednagar College, Ahmednagar

***Corresponding Author**

DOI: https://doi.org/10.51584/IJRIAS.2025.100600129

Received: 26 June 2025; Accepted: 28 June 2025; Published: 21 July 2025

ABSTRACT

Context: *Solanum tuberosum, Solanum torvum, Solanum nigrum* are used in traditional medicine for the treatment of pain and inflammation.

Aims: To evaluate the anti-inflammatory potential of Solanum species. The present research work was planned to evaluate the anti-inflammatory activity of ethanolic extract of *Solanum tuberosum* leaves and roots, *Solanum torvum* leaves and roots, *Solanum nigrum* leaves and roots.

Settings and Design: Extraction is done by Soxhlet method. Ethanolic extract was evaluated at dosage of 500mg/kg per os (by mouth) in rats. Six rats in each group were used for this study, Test samples were given orally as per standard protocol and animals were observed for signs and symptoms along with weekly Body weight. The present study is divided into two parts Part one study was to evaluate the Anti-inflammatory activity of Solanum Species in Wistar rats by carrageenan induced paw edema model and part two study was to evaluate the Anti-inflammatory activity of Solanum Species in Wistar rats by Histamine induced paw edema model.

Statistical Analysis: pharmacological screening models- Carrageenan induced rat paw edema and Histamine induced rat paw edema. Data obtained was analysed using unpaired T- test and one way anova, where $P \leq 0.05$ is considered as statistically significant.

Results: Given treatment (500 mg/kg) did not show anti-inflammatory activity in *Solanum tuberosum* and *Solanum torvum* against carrageenan and histamine induced rat paw edema but *Solanum nigrum* showed anti-inflammatory activity against carrageenan and histamine induced rat paw edema.

Conclusion: Present study results supported the traditional use of plant *Solanum nigrum* in traditional medicine for their anti-inflammatory activity.

Keywords- Anti-inflammatory, Carrageenan, Histamine, *Solanum tuberosum, Solanum torvum, Solanum nigrum*.

INTRODUCTION

Inflammation is a normal part of body's responses to injury. It is helpful in healing but sometimes inflammation that happens when there is no invader can affect healthy body parts and can cause chronic diseases. Anti-inflammatory activity occurs by suppressing of inducible Nitric oxide synthase (iNOS) and other nuclear factor kappa B (NF-kB) dependent inflammatory mediators (Garcia *et al*., 2015). Steroid

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025

containing drugs can have harmful effects like vomiting, nausea or severe disease. Therefore, there is need to find anti-inflammatory agents that will be effective, safe and with less side effects. Following are the test plants used to examine the anti-inflammatory.

1. ***Solanum tuberosum***, commonly known as potato is herbaceous plant that grows up to 1.4 m tall. *S. tuberosum* is widely cultivated around the world. Potatoes contain anthocyanin compounds besides flavonoids, which act as anti-inflammatory agent. It is rich in starch, fibre which are anti-inflammatory agents (Wahyu Hidayat *et al.,* 2024). In recent study *in vivo* absorption of anthocyanins from an extract of *Ipomea batatas* L. was also demonstrated in rats and humans after their addition to the diet. Acylated anthocyanins, the main constituents of potato, were detected in plasma and urine after ingestion (Harada *et al*., 2004). Anthocyanins are known to contain different pharmacological properties and are used by humans for therapeutic purpose (Kong *et al*., 2003).

2. ***Solanum torvum*** also known as turkey berry, which is bushy and spiny perennial plant used in Cameroonian traditional medicine system to manage the pain and inflammation (Atta *et al.,* 1997). The plant is cultivated in the tropics for its tasting immature fruits. The plant extracts have been widely used for the treatment of a large number of human ailments. The chemical entities of this plant can be used as, antioxidant, cardiovascular, anti-microbial activity, anti-platelet aggregation activities, digestive, hemostatics and diuretic activities (Ashok *et al*., 2010),

3. ***Solanum nigrum*** commonly known as Makoi or black nightshade, commonly grows as weed in moist habitats. It is used as food as well as medicinal plant in Cameroon to treat pneumonia, acting teeth, pain, inflammation etc (Ramaya *et al.,* 2011). The whole plant of *S. nigrum* has good effects of dispersing blood stasis and detumescence, clearing away heat, as well as detoxification and has been commonly used for the treatment of canker sores (Geo *et al*., 2021).

MATERIAL AND METHODS

Area under Study:-

Plants are collected from different places such as,

Solanum tuberosum- Manchar, Taluka- Ambegaon Dist. Pune- 410 503.

Solanum nigrum- Dhokari, Taluka- Akole, Dist. Ahmednagar -422 601.

Solanum torvum- Dhokari, Taluka- Akole, Dist. Ahmednagar -422 601.

Chemicals:-

Carrageenan (TCI), Histamine (Sigma), Distilled water, Ethanol, Surgical cotton, Syringe, Soxhlet apparatus, Plethysmometer (VJ Instrument), Weighing balance (SKNOL), Rotary evaporator, Diclofenac Sodium tablet (medley pharmaceuticals ltd).

Preparation of Plant Extract:-

Plants were air dried at room temperature for 15-20 days and grounded into fine powder. Dried powder was extracted with ethanol at 75º C using Soxhlet apparatus. Excess solvent is removed using rotary evaporator at 50º C. Ethanolic extract is stored in refrigerator for further experiments.

Experimental Animals

Following are the details of the test,

- Rat Strain: Wistar, Swiss albino Source: Crystal Biological Solutions.
- Sex: Male

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025

- Body weight range: 220-250 gm
- Identification: Identification mark to animals and cages
- No. of animals: 108
- Acclimatization: The rats were acclimatized at test environment for 7 days.

Environmental Conditions

- Room temperature maintained between 22 ± 3ºC,
- Relative humidity 55 ± 5 % and 12-hrs light and 12 hrs dark cycle was maintained.
- Accommodation: Six rats in each cage with clean paddy husk.
- Diet: Pelleted feed supplied by Nutrivet Pvt. Ltd. libitum during the study.
- Water: RO filtered water was provided ad libitum.

All procedures such as housing, dosing, sacrifice, rehabilitation was done in accordance with the standard operating procedures and the guidelines provided by the committee for the Purpose of Control and Supervision of Experiments on Animals (CCSEA) as published in The Gazette of India, December 15, 1998 and biological evaluation of medical devices- Part 2: Animal welfare requirements. This Study has been approved in Institutional Animal Ethics Committee meeting of Crystal Biological Solutions.

Animal Acclimatization

Total 108 Wistar male rats were selected and allowed to acclimatize for period of seven days prior to dosing. During this period, animals were observed daily for clinical signs. All animal met the health and weight criteria.

Approval of the Research Protocol

Study Design

Six rats in each group were used for this study, test samples were given orally as per standard protocol and animals were observed for signs and symptoms along with weekly body weight. Present study is divided into two parts.

Part 1: study was to evaluate the Anti-inflammatory activity of *Solanum* Species in Wistar rats by carrageenan induced paw edema model.

Part 2: study was to evaluate the Anti- inflammatory activity of *Solanum* Species in Wistar rats by Histamine induced paw edema model. Following are the animal models and protocols for evaluation of Anti-inflammatory activity.

Carrageenan-induced paw edema in rats.

Rats were randomly divided into 9 groups. Treatment of test drug and standard drug Diclofenac sodium was done for 5 consecutive days. On 5th day single dose of standard drug, was administered 1 hour before the carrageenan injection. Initially Tibio-tarsal articulation of left hind paw was recorded by using a plethysmometer on fifth day. Edema was induced by injecting 0.1 ml freshly prepared 1% Carrageenan in sterile saline solution to the sub-plantar Apo-neurosis of the left hind limb 1 hr after the drug administration on the fifth day. To minimize variations in edema formation uniform hydration was maintained by administering tap water at a dose of 2 ml/100 g body weight. Paw volume was recorded at interval from zero hr, ½ hr, 1hr,

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025

2hr, 4hr, 8hr and 12hr after the carrageenan injection. Results were expressed by percentage increase in paw volume in comparison with the initial paw volumes and with the control group.

Histamine induced paw edema in rats.

Rats were randomly divided into nine groups. Treatment of test drug and standard drug Diclofenac sodium was done for 5 consecutive days. On 5th day single dose of standard drug, was administered 1 hr before the Histamine injection. Initially Tibio-tarsal articulation of left hind paw was recorded by using a plethysmometer on fifth day. Edema was induced by injecting 0.1 ml freshly prepared 1% Histamine in sterile saline solution to the sub-plantar Apo neurosis of the left hind limb 1 hr after the drug administration on the fifth day. To minimize variations in edema formation uniform hydration was maintained by administering tap water at a dose of 2 ml/100 g body weight. Paw volume was recorded at zero hr, ½ hr, 1hr, 2hr, 4hr, 8hr and 12 hr after the Histamine injection. Results were expressed by percentage increase in paw volume in comparison with the initial paw volumes and with the control group.

Statistical Analysis

The present study for optimization of Nano-emulsion gel was analysed by applying one way Anova and unpaired t-test. Multiplying comparison test and accomplished using Graph Pad Prism 8 software. The results were confirmed to be significant with P value less than 0.05 ($P \leq 0.05$).

Evaluation of Results

Percentage inhibition of paw edema i.e. acute inflammation was calculated using the following formulae-

(Paw Volume in disease control group – % Inhibition at given time interval =

Paw Volume in Test group) / Paw Volume in Disease control group) * 100

RESULTS AND DISCUSSION

Carrageenan induced paw edema in rats.

As compared to disease control group paw edema of ½ hr, 1hr, 2hr, 4hr, 8hr, and 12hr was reduced in Standard and Test group and Disease control group shows increased paw volume after histamine induction. Hence, *Solanum* species showed significant anti-inflammatory activity when compared with the Disease control group. Administration of *Solanum nigrum* (500mg/kg) leaves and roots showed significant anti-inflammatory activity when compared with the other test group.

Histamine induced paw edema in rats.

As compared to disease control group paw edema of ½ hr, 1hr, 2hr, 4hr, 8hr, and 12hr was reduced in Standard and Test group and Disease control group shows increased paw volume after histamine induction. Hence, *Solanum* species showed significant anti-inflammatory activity when compared with the Disease control group. Administration of *Solanum nigrum* (500 mg/kg) leaves and roots showed significant anti-inflammatory activity when compared with the other test group.

Effect of *Solanum* species on Carrageenan induced paw edema model

The basal mean paw volume was comparable in all the groups in carrageen induced paw edema model of acute inflammation in rats. Table no 1 shows the mean paw volume increase in all the groups at a various time interval in carrageen induced paw edema model of acute inflammation in rats. Paw volume was increased in disease control group after ½ hour of Carrageenan induction and also gradually increase till 8 hours and slightly decrease in 12 hours. Paw volume of standard group was increased half hour after carrageenan

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025

induction and decreased after 1 hr. Paw Volume of Test group 1, Test Group 3, Test Group 4 and Test Group 6 animals were increased half hour after induction and reduced in 2 hr. Test Group 2 and Test Group 5 animals was increased half hour after induction and reduced in 3 hr.

Table No 1: The values of mean paw volume increase in all the groups at a various time interval in carrageen induced paw edema model of acute inflammation in rats

Time point	Normal Control	Disease Control	Standard	Test Group - 1	Test Group - 2	Test Group - 3	Test Group - 4	Test Group - 5	Test Group - 6
0 hr	0.60 ± 0.03	0.60 ± 0.03	0.63 ± 0.04	0.60 ± 0.03	0.63 ± 0.04	0.61 ± 0.04	0.62 ± 0.04	0.63 ± 0.04	0.60 ± 0.03
½ hr	0.62 ± 0.03	1.00 ± 0.09	0.88 ± 0.03	0.92 ± 0.02	0.93 ± 0.02	0.90 ± 0.02	0.90 ± 0.04	0.94 ± 0.03	0.91 ± 0.02
1 hr	0.64 ± 0.02	1.26 ± 0.07	0.85 ± 0.04	±0.95 0.02	0.98 ± 0.04	0.93 ± 0.02	0.96 ± 0.03	0.98 ± 0.06	0.95 ± 0.02
2 hr	0.62 ± 0.02	1.89 ± 0.06	0.80 ± 0.03	0.93 ± 0.02	1.03 ± 0.04	088 ± 0.02	0.90 ± 0.01	1.01 ± 0.05	0.87 ± 0.01
4 hr	0.61 ± 0.02	2.40 ± 0.12	0.75 ± 0.02	0.88 ± 0.02	0.93 ± 0.01	0.79 ± 0.02	0.82 ± 0.02	0.90 ± 0.04	0.77 ± 0.02
8 hr	0.62 ± 0.02	2.58 ± 0.13	0.70 ± 0.01	0.79 ± 0.06	0.84 ± 0.03	0.74 ± 0.02	0.76 ± 0.04	0.84 ± 0.04	0.70 ± 0.02
12 hr	0.61 ± 0.02	2.13 ± 0.04	0.65 ± 0.02	0.67 ± 0.02	0.70 ± 0.02	0.66 ± 0.02	0.69 ± 0.02	0.73 ± 0.04	0.66 ± 0.02

Table No 2: The values are of Percentage Inhibition of paw volume using species of *Solanum tuberosum, Solanum torvum, Solanum nigrum* leaves and roots extract.

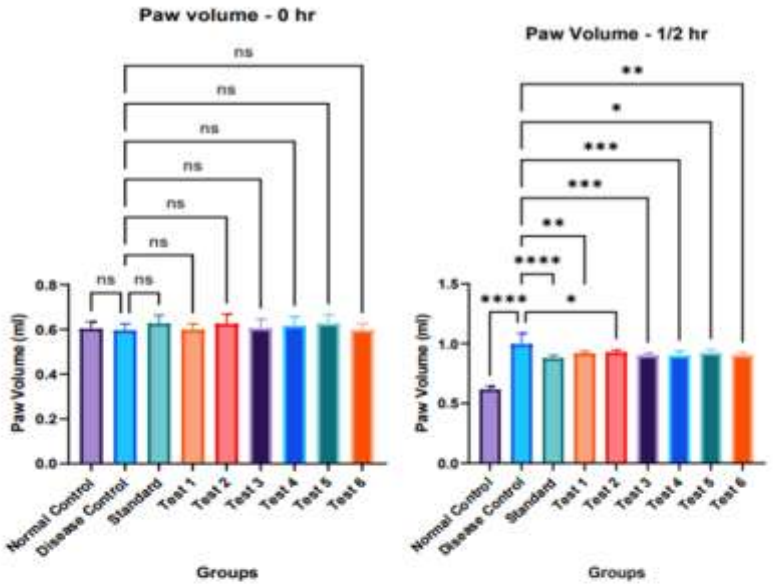
Time point	Normal Control	Disease Control	Standard	Test Group - 1	Test Group - 2	Test Group - 3	Test Group - 4	Test Group - 5	Test Group - 6
0 hr	-	-	-	-	-	-	-	-	-
½ hr	-	-	11.89 ± 2.59	7.71 ± 1.73	6.87 ± 2.08	9.55 ± 1.80	9.72 ± 3.78	5.70 ± 3.45	9.05 ± 1.71
1 hr	-	-	32.98 ± 2.95	24.54 ± 1.39	22.56 ± 3.14	26.12 ± 1.39	24.41 ± 2.11	22.43 ± 4.70	24.54 ± 1.71
2 hr	-	-	57.42 ± 1.63	50.62 ± 1.13	45.23 ± 2.14	53.53 ± 1.28	52.30 ± 0.67	46.47 ± 2.62	53.80 ± 0.78
4 hr	-	-	65.23 ± 1.67	59.62 ± 1.78	57.16 ± 1.89	63.39 ± 1.69	61.98 ± 2.23	58.49 ± 3.31	64.39 ± 1.77
8 hr	-	-	68.41 ± 2.55	63.75 ± 4.01	61.78 ± 2.04	66.06 ± 2.62	65.55 ± 2.68	61.72 ± 4.01	68.28 ± 2.19
12 hr	-	-	69.49 ± 1.17	68.47 ± 0.73	67.29 ± 0.77	68.94 ± 1.11	67.61 ± 1.09	65.49 ± 1.73	69.02 ± 1.17

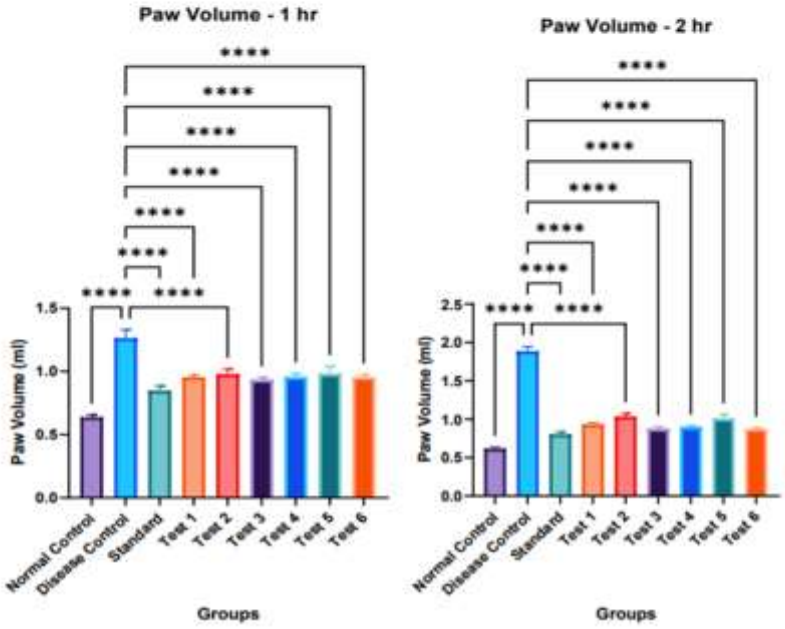
The basal mean paw volume was comparable in all the groups in carrageen induced paw edema model of acute inflammation in rats. 11.89 % inhibition at ½ Hr, 32.98 % inhibition at 1hr, 57.42 % inhibition at 2 hr, 65.23 % inhibition at 4 hr, 68.47 % inhibition at 8 hr and 69.49 % inhibition at 12 hr in paw volume was observed in standard group, whereas Test Group 1 (*Solanum tuberosum* leaves) animal showing 7.71 % inhibition at ½ Hr, 24.54 % inhibition at 1hr, 50.62 % inhibition at 2 hr, 59.62 % inhibition at 4 hr, 63.75 % inhibition at 8 hr and 68.47 % inhibition at 12 hr in paw volume was observed. In Test Group 2 (*Solanum torvum* leaves) animal showing 6.87 % inhibition at ½ Hr, 22.56 % inhibition at 1hr, 45.23 % inhibition at 2 hr, 57.16 % inhibition at

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025

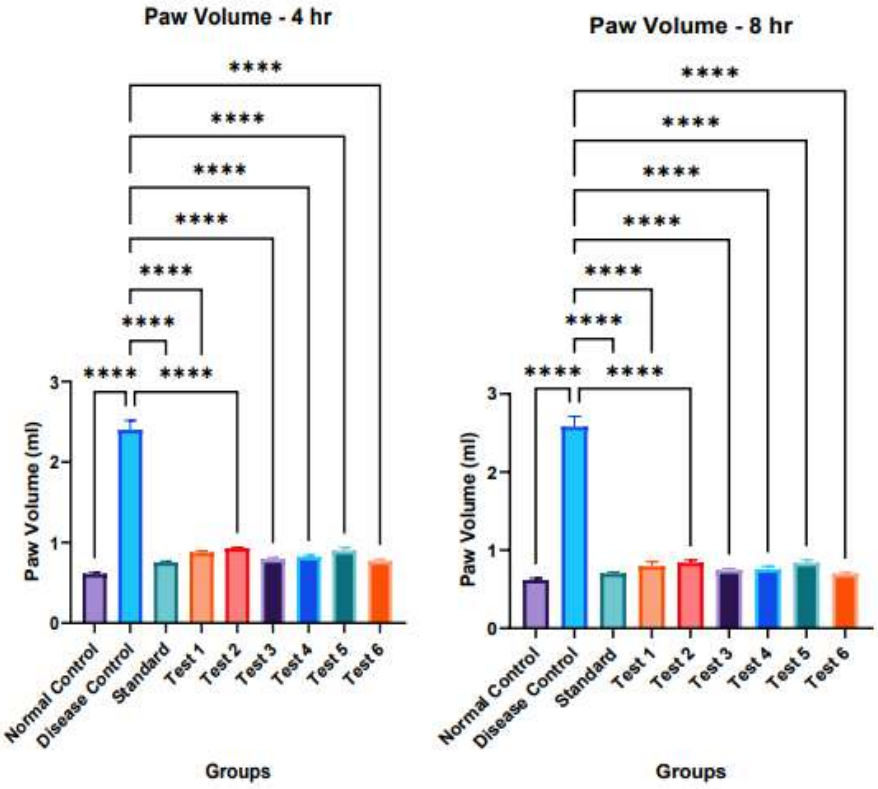
4 hr, 61.78 % inhibition at 8 hr and 67.29 % inhibition at 12 hr in paw volume was observed. In Test Group 3 (*Solanum nigrum* leaves) animal showing 9.55 % inhibition at ½ Hr, 26.12 % inhibition at 1hr, 53.53 % inhibition at 2 hr, 63.39 % inhibition at 4 hr, 66.06 % inhibition at 8 hr and 68.94 % inhibition at 12 hr in paw volume was observed. In Test Group 4 (*Solanum tuberosum* roots) animal showing 9.72 % inhibition at ½ Hr, 24.41 % inhibition at 1hr, 52.30 % inhibition at 2 hr, 61.98 % inhibition at 4 hr, 65.55 % inhibition at 8 hr and 67.61 % inhibition at 12 hr in paw volume was observed. In Test Group 5 (*Solanum torvum* roots) animal showing 5.70 % inhibition at ½ Hr, 22.43 % inhibition at 1hr, 46.47 % inhibition at 2 hr, 58.49 % inhibition at 4 hr, 61.72 % inhibition at 8 hr and 65.49 % inhibition at 12 hr in paw volume was observed. In Test Group 6 (*Solanum nigrum* roots) animal showing 9.05 % inhibition at ½ Hr, 24.54 % inhibition at 1hr, 53.80 % inhibition at 2 hr, 64.39 % inhibition at 4 hr, 68.28 % inhibition at 8 hr and 69.02 % inhibition at 12 hr in paw volume was observed.

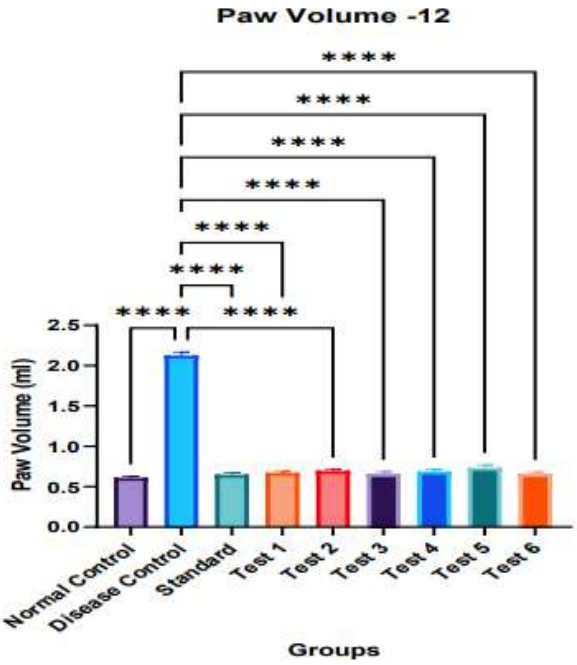
As compared to disease control group paw edema of half hr, 1hr, 2hr, 4hr, 8hr, and 12hr was reduced in Standard and Test Group and Disease control group shows increased paw volume after histamine induction. Hence, *Solanum* species showed significant anti-inflammatory activity when compared with the Disease Control Group. *Solanum nigrum* leaves and roots showed significant anti-inflammatory activity when compared with the other test groups.





ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025





Graph 1: The values are mean ± SD, n = 6 in each group. P ≥ 0.05 non- significant *P < 0.05 when compared with Disease Control **P < 0.01 when compared with Disease Control ***P < 0.001 when compared with Disease Control ****P < 0.0001 when compared with Disease Control Paw edema in 0 hr animals of normal control, standard and test group showed non-significant when compared with disease control group. As compared to disease control group paw edema of ½ hr, 1hr, 2hr, 4hr, 8hr, and 12hr was reduced and hence it is significant as shown in prism. P value ≤ 0.0001 which shows that is significant. We can see change in reduction score of paw edema in test group. Disease control group increased paw volume after carrageenan induction. Oneway anova was used to find out difference between Disease Control, Standard and Test group.

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025

Effect of *Solanum* species on Histamine induced rat paw model

The basal mean paw volume was comparable in all the groups in carrageen induced paw edema model of acute inflammation in rats. Table no 3 shows the mean paw volume increase in all the groups at a various time interval in carrageen induced paw edema model of acute inflammation in rats. Paw volume was increased in disease control group after ½ hour of Carrageenan induction and also gradually increase till 8 hours and slightly decrease in 12 hours. Paw volume of standard group was increased half hour after carrageenan induction and decreased in 2 hr. Paw Volume of Test group 1, Test Group 4 and Test Group 5 animals was increased half hour after induction and reduced in 8 hr. Test Group 2, Test Group 3 and Test Group 6 animals was increased half hour after induction and reduced in 4 hr.

Table No 3: The values of mean paw volume increase in all the groups at a various time interval in histamine induced paw edema model of acute inflammation in rats

Time point	Normal Control	Disease Control	Standard	Test Group - 1	Test Group - 2	Test Group - 3	Test Group - 4	Test Group - 5	Test Group - 6
0 hr	0.60 ± 0.02	0.61 ± 0.01	0.62 ± 0.04	0.62 ± 0.02	0.61 ± 0.02	0.61 ± 0.04	0.62 ± 0.03	0.60 ± 0.03	0.61 ± 0.04
½ hr	0.61 ± 0.01	0.94 ± 0.02	0.82 ± 0.02	0.86 ± 0.02	0.85 ± 0.02	0.85 ± 0.02	0.87 ± 0.02	0.88 ± 0.02	0.86 ± 0.01
1 hr	0.64 ± 0.02	1.24 ± 0.07	0.86 ± 0.04	0.92 ± 0.02	0.93 ± 0.03	0.88 ± 0.02	0.95 ± 0.02	0.96 ± 0.03	0.89 ± 0.02
2 hr	0.62 ± 0.02	1.29 ± 0.04	0.82 ± 0.05	0.94 ± 0.01	0.96 ± 0.04	0.91 ± 0.02	1.00 ± 0.05	1.01 ± 0.04	0.91 ± 0.02
4 hr	0.61 ± 0.02	1.70 ± 0.16	0.76 ± 0.03	0.96 ± 0.03	0.91 ± 0.01	0.83 ± 0.03	1.01 ± 0.03	1.02 ± 0.04	0.85 ± 0.04
8 hr	060 ± 0.02	2.04 ± 0.06	0.70 ± 0.03	0.85 ± 0.02	0.81 ± 0.02	0.74 ± 0.03	0.91 ± 0.02	0.85 ± 0.03	0.74 ±0.03
12 hr	0.63 ± 0.01	2.03 ± 0.06	0.65 ± 0.04	0.75 ± 0.03	0.74 ± 0.04	0.68 ± 0.02	0.83 ± 0.02	0.75 ± 0.02	0.66 ± 0.01

The basal mean paw volume was comparable in all the groups in carrageen induced paw edema model of acute inflammation in rats. 12.61 % inhibition at ½ Hr, 30.74 % inhibition at 1hr, 36.90 % inhibition at 2 hr, 55.38 % inhibition at 4 hr, 65.66 % inhibition at 8 hr and 67.81 % inhibition at 12 hr in paw volume was observed in standard group, whereas Test Group 1 (*Solanum tuberosum* leaves) animal showing 7.99 % inhibition at ½ Hr, 25.91 % inhibition at 1hr, 26.97 % inhibition at 2 hr, 43.84 % inhibition at 4 hr, 58.32 % inhibition at 8 hr and 63.04% inhibition at 12 hr in paw volume was observed. In Test Group 2 (*Solanum torvum* leaves) animal showing 9.06 % inhibition at ½ Hr, 25.37 % inhibition at 1hr, 25.68 % inhibition at 2 hr, 46.77 % inhibition at 4 hr, 60.53 % inhibition at 8 hr and 63.53 % inhibition at 12 hr in paw volume was observed. In Test Group 3 (*Solanum nigrum* leaves) animal showing 9.06 % inhibition at ½ Hr, 28.86 % inhibition at 1hr, 29.81 % inhibition at 2 hr, 51.17 % inhibition at 4 hr, 63.87 % inhibition at 8 hr and 66.66 % inhibition at 12 hr in paw volume was observed. In Test Group 4 (*Solanum tuberosum* roots) animal showing 7.46 % inhibition at ½ Hr, 23.36% inhibition at 1hr, 22.45 % inhibition at 2 hr, 22.06 % inhibition at 4 hr, 40.12 % inhibition at 8 hr and 59.18 % inhibition at 12 hr in paw volume was observed.

In Test Group 5 (*Solanum torvum* roots) animal showing 6.22 % inhibition at ½ Hr, 22.82 % inhibition at 1hr, 22.06 % inhibition at 2 hr, 40.12 % inhibition at 4 hr, 58.65 % inhibition at 8 hr and 62.88 % inhibition at 12 hr in paw volume was observed. In Test Group 6 (*Solanum nigrum* roots) animal showing 8.35 % inhibition at ½ Hr, 28.59 % inhibition at 1hr, 29.42 % inhibition at 2 hr, 50.00 % inhibition at 4 hr, 63.95 % inhibition at 8 hr and 67.48 % inhibition at 12 hr in paw volume was observed.

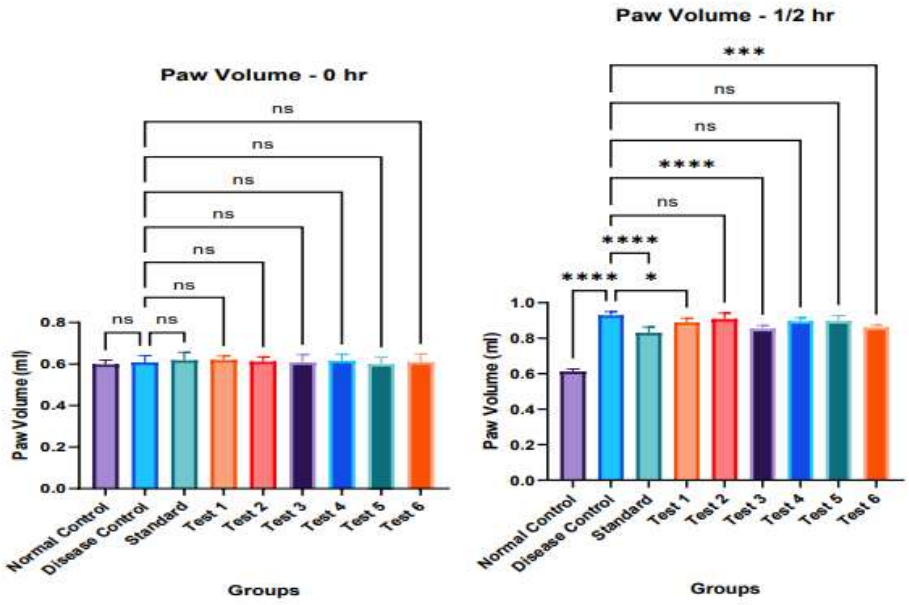
As compared to disease control group paw edema of ½ hr, 1hr, 2hr, 4hr, 8hr, and 12hr was reduced in Standard and Test Group and Disease control group shows increased paw volume after histamine induction. Hence, *Solanum* species showed significant anti-inflammatory activity when compared with the Disease Control Group. *Solanum nigrum* leaves and roots showed significant anti-inflammatory activity when compared with the other test group.

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025

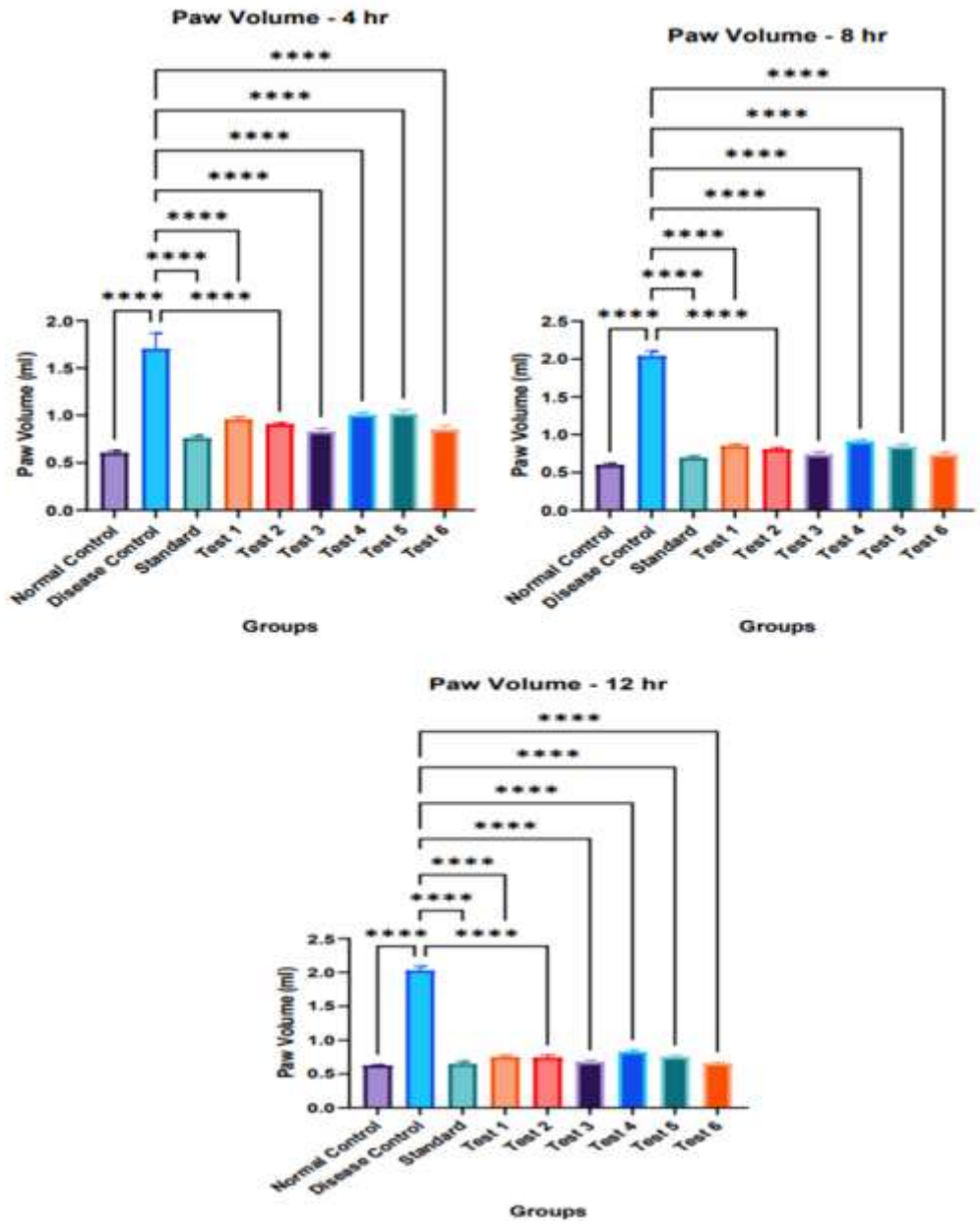
Table No. 4: The values are of Percentage Inhibition of paw volume using species of *Solanum tuberosum, Solanum torvum, Solanum nigrum* leaves and roots extract.

Time point	Normal Control	Disease Control	Standard	Test Group - 1	Test Group - 2	Test Group - 3	Test Group - 4	Test Group - 5	Test Group - 6
0 hr	-	-	-	-	-	-	-	-	-
½ hr	-	-	12.61 ± 2.43	7.99 ± 2.40	9.06 ± 1.87	9.06 ± 1.87	7.46 ± 2.07	6.22 ± 1.78	8.35 ± 1.51
1 hr	-	-	30.74 ± 3.60	25.91 ± 1.35	25.37 ± 2.37	28.86 ± 1.74	23.36 ± 1.87	22.82 ± 2.24	28.59 ± 1.58
2 hr	-	-	36.90 ± 3.97	26.97 ± 1.06	25.68 ± 3.25	29.81 ± 1.67	22.45 ± 3.58	22.06 ± 2.92	29.42 ± 1.79
4 hr	-	-	55.38 ± 1.66	43.84 ± 1.56	46.77 ± 0.80	51.17 ± 1.87	22.06 ± 2.92	40.12 ± 2.26	50.00 ± 2.45
8 hr	-	-	65.66 ± 0.72	58.32 ± 1.13	60.53 ± 1.19	63.87 ± 1.62	40.12 ± 2.26	58.65 ± 1.54	63.95 ± 1.60
12 hr	-	-	67.81 ± 1.52	63.04 ± 1.25	63.53 ± 1.76	66.66 ± 1.19	59.18 ± 1.18	62.88 ± 1.06	67.48 ± 0.70

Graph-4 Paw edema volume



ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025



Graph 2: The values are mean ± SD, n = 6 in each group. P ≥ 0.05 non- significant *P < 0.05 when compared with Disease Control **P < 0.01 when compared with Disease Control ***P < 0.001 when compared with Disease Control ****P < 0.0001 when compared with Disease Control Paw edema in 0 hr animals of normal control, standard and test group showed non-significant when compared with disease control group. As compared to disease control group paw edema of ½ hr, 1hr, 2hr, 4hr, 8hr, and 12hr was reduced and hence it is significant as shown in prism. P value ≤ 0.0001 which shows that is significant. We can see change in reduction score of paw edema in test group. Disease control group increased paw volume after histamine induction. Oneway anova was used to find out difference between Disease Control, Standard and Test group.

CONCLUSION

The findings of this study demonstrate that *Solanum* species possess notable anti-inflammatory potential, with *Solanum nigrum* leaves and roots exhibiting particularly strong activity. When compared to the disease control group, these plant parts showed significant inhibition of inflammation, highlighting their therapeutic relevance. Among the test groups evaluated, *Solanum nigrum* showed the most effective, suggesting its promise as a natural source for the development of anti-inflammatory agents. These results provide a scientific basis for the traditional use of *Solanum* species in managing inflammatory conditions and warrant further investigation into their cytotoxicity and mechanisms of action.

ACKNOWLEDGEMENTS

Authors are thankful to department of Botany, Ahmednagar College, Ahmednagar. department of Botany, Balwant College, Vita. Dist. Sangli and Crystal Biological Solutions Ltd., Pune for their contribution in this research work.

REFERENCES

1. Aftab, K., Atta-ur-Rahman, Ahmed, S. I., Usmanghani, K. (1997). Bioassay-directed isolation of active principle from Praganum harmala, Phytomedicine, 3 (Supplement I), 227
2. Anwikar S, Bhitre M. (2010) Study of the synergistic anti-infl ammatory activity of Solanum xanthocarpum Schrad and Wendl and Cassia fi stula Linn. Int J Ayurveda Res 1:167-71.
3. Ashok D. Agrawal, Puja S. Bajpei, Ashwini A. Patil, Sunil R. Bavaska. (2010). Solanum torvum Sw. - A Phytopharmacological review. Scholars Research Library Der Pharmacia Lettre, 2010, 2(4): 403-407 http://scholarsresearchlibrary.com/archive.html
4. Arulmozhi, D.K., Veeranjaneyulu, A., Bodhankar S. L, Arora SK. (2005) Pharmacological investigations of Sapindus trifoliatus in various in-vitro and in-vivo models of inflammation. Indian J Pharmacol 37:96-102.
5. Chakraborty A, Devi R.K, Rita S, Sharatchandra K and Singh T.I (2005). Preliminary studies on anti-inflammatory and analgesic activities of Spilanthes acmella in experimental animal models. Indian J. Pharmacol, 36: 148-150.
6. Duke J.A and Ayensu. E S (1985): Medicinal Plants of China. Reference Publications, Inc., ISBN 0-917256-20-4.
7. Fang QM, Zhang H, Cao Y, Wang C. (2007) Anti-inflammatory and free radical scavenging activities of ethanol extracts of three seeds used as “Bolengguazi”. J Ethnopharmacol 114:61-5.
8. G. and Vogel, W.H. (1997): Drug Discovery and Evaluation: Pharmacological Assays. Springer Verlag, Germany, Chapter H, 368-370.
9. Gao S, H., Su Z. Z., Yang L. J., Li Z. Y. (2021). Chemical Components From Stems of Solanum nigrum by LC-MS and NMR. Chin. Tradit. Herb. Drugs. 52 (5), 1263–1273. 10.7501/J.issn.0253-2670.2021.05.006 [DOI] [Google Scholar]
10. Gavimath CC, Kulkarni SM, Raorane CJ, Kalsekar DP, Gavade BG, Ravishankar BE, et al. (2012) Antibacterial potentials of Solanum indicum, Solanum xanthocarpum and Physalis minima. Int J Pharma Appl 3:414-8.
11. Gutiérrez et al., (2014). Anti-inflammatory and antioxidant activities of methanol extracts and alkaloid fractions of four mexican medicinal plants of Solanaceae. Afr J Tradit Complement Altern Med. 11(3):259-267
12. H. J.; Kwon, K. B.; Cho, H. I.; Seo, E. A.; Ryu, D. G.; Hwang, W. J.; Yoo, S. J.; Kim, Y. K.; Hong, S. H.; Kim, H. M. (2005) Methanolic extract of Pterocarpus santalinus induces apoptosis in HeLa cells J. Cancer Prev, 14, 345.
13. Heo K.S, Lee S. J, Ko J.H, Lim K. and Lim K.T (2004). Glycoprotein isolated from Solanum nigrum L. inhibits the DNA-binding activities of NF-êB and AP-1, and increases the production of nitric oxide in TPA-stimulated MCF-7 cells. J. Toxicol. in vitro, 18(6): 755-763.
14. Heo, K.S. and Lim, K.T. (2004) Antioxidative Effect of Glycoprotein Isolated from Solanum nigrum L. Journal of Medicinal Food, 7, 349-357. http://dx.doi.org/10.1089/jmf.2004.7.349
15. Jin-Ming Kong , Lian-Sai Chia, Ngoh-Khang Goh, Tet-Fatt Chia, R Brouillard (2003). Analysis and biological activities of anthocyanins. Phytochemistry 2003 Nov;64(5):923-33 doi: 10.1016/s0031-9422(03)00438-2.
16. Kale M, Misar AV, Dave V, Joshi M, Mujumdar AM. (2007) Anti-infl ammatory activity of Dalbergia lanceolaria bark ethanol extract in mice and rats. J Ethnopharmacol 112:300-4.
17. Katsuhisa Harada , Mitsuyoshi Kano , Tomomi Takayanagi , Osamu Yamakawa , Fumiyasu Ishikawa. (2004). Absorption of Acylated Anthocyanins in Rats and Humans after Ingesting an Extract of Ipomoea batatas Purple Sweet Potato Tuber. Bioscience, Biotechnology, and Biochemistry, Volume 68, Issue 7, 1 January 2004, Pages 1500–1507, https://doi.org/10.1271/bbb.68.1500
18. Malaya G, Upal K.M, Ramanathan S.K and Thangavel S.K (2003). Studies on Anti-inflammatory,

Analgesic and Antipyretic properties of methanolic extract of Caesalpinia bonducella leaves in experimental animal models. Iranian J. Pharmacol. and Therapeutics. 2:30-34.

19. Patel P, Patel M, Saralai M, Gandhi T. (2012) Antiurolithiatic effects of Solanum xanthocarpum fruit extract on ethylene-glycol-induced nephrolithiasis in rats. J Young Pharm 4:164-70.

20. Perez R.M, Perez J.A, Garcia L.M and Sossa H (1998): Neuropharmacological activity of Solanum nigrum fruit. J. Ethnopharmacol. 62(1):43- 48.
21. Purnima ashok, b. C. Koti1, A. H. M. Thippeswamy1, v. P. Tikare1, p. Dabadi1 and A. H. M. Viswanathaswamy1. (2010). Evaluation of Antiinflammatory Activity of Centratherum anthelminticum (L) Kuntze Seed. Indian j pharm sci. nov-dec; 72(6): 697–703. doi: 10.4103/0250-474x.84577.
22. Purohit A. (1992) Contraceptive efficacy of Solanum xanthocarpum berry in male rats. Anc Sci Life 12:264-6.
23. Radhika P, Rao PR, Archana J, Rao NK. (2005) Anti-infl ammatory activity of a new sphingosine derivative and cembrenoid diterpene (lobohedleolide) isolated from marine soft corals of Sinularia crassa TIXIER-DURIVAULT and Lobophytum species of the Andaman and Nicobar Islands. Biol Pharm Bull 28:1311-3.
24. Ramya Jain (Grad. stud.); Anjali Sharma (Grad. stu.); Sanjay Gupta,PhD; Indira P. Sarethy, PhD and Reema Gabrani, PhD (2011). Solanum nigrum: Current Perspectives on Therapeutic Properties, Alternative Medicine Review: a Journal of Clinical Therapeutic, 16(1):78-85.
25. Salar RK, Suchitra. (2012) Evaluation of antimicrobial potential of different extracts of Solanum xanthocarpum Schrad. and Wendl. Afr J Microbiol Res 3:97-100.
26. Shraddha K. More, Anirudha A. Lande, Priti G. Jagdale, Prafulla P. Adkar, Shirishkumar D. Ambavade (2013). Evaluation of anti-inflammatory activity of Solanumxanthocarpum Schrad and Wendl (Kaṇṭakāri) extract in laboratory animals. Ancient Science of Life Apr-Jun 2013 / Vol 32 / Issue 4
27. Suleyman H, Gul HI, Gul M, Alkan M, Gocer F. (2007) Anti-infl ammatory activity of bis (3-aryl-3-oxo-propyl) methylamine hydrochloride in rat. Biol Pharm Bull 30:63-7.
28. Sultana, S.; Perwaiz, S.; Iqbal, M.; Athar, M. (1995) Crude extracts of hepatoprotective plants, Solanum nigrum and Cichorium intybus inhibit free radical-mediated DNA damage J. Ethnopharmacol, 45, 189.
29. Tamaddonfard E, Farshid AA, Hosseini L. (2012) Crocin alleviates the local paw edema induced by histamine in rats. Avicenna J Phytomedicine 2:97-104.

30. Valerie Garcia, Stephen Gray , Rachal M Allison, Tim J Cooper , Matthew J Neale (2015). Tel1(ATM)-mediated interference suppresses clustered meiotic double-strand-break formation, Nature, doi: 10.1038/nature13993.

31. Vinegar R, Schreiber W, Hugo R. (1969) Biphasic development of carrageenin edema in rats. J Pharmacol Exp Ther 166:96-103
32. Wahyu Hidayat, Irna Sufiawati, Mieke Hemiawati satari, Ronny Lesmana and Solachuddin Ichwan (2024). Pharmacological Activity of Chemical Compounds of Potato Peel Waste (Solanum tuberosum L.) in vitro: A scoping Review, J Exp Pharmacol 16:61-69, doi: 10.2147/JEP.S435734.
33. Wannang N.N. and Bichi L.A. (2005). Determination of LD50 of the aqueous extract of Solanum nigrIum Linn in rats. Bio. Env. Sc. J. for the tropics. 2(1):117-119.
34. Wannang N.N. and Bichi L.A., Odutola A.A. and Anuka J.A. (2000): Effects of the aqueous extract of S. nigrum on electrically-induced seizures. 28 Ann. Reg. Conf. (West African Society for Pharmacology) Port Harcourt. October, 15-20 Supplementary (1):16.
35. Wannang N.N., Anuka J.A., Kwanashie H.O. and Bichi L.A. (2004). Effects of Solanum nigrum Linn aqueous extracts on the behavioural activities in chicks. Bio. Env. Sc. J. for the tropics. 1(1):139- 142.
36. Xing-Fu Cai, Young-Won Chin, Sei-Ryang Oh, Ok-Kyung Kwon, Kyung-Seop Ahn, and Hyeong-Kyu Lee, (2010). Anti-inflammatory Constituents from Solanum nigrum Bull. Korean Chem. Soc, Vol. 31, No. 1 199 DOI 10.5012/bkcs.2010.31.01.199
37. Z A Zakaria, H Patahuddin, A S Mohamad, D A Israf, M R Sulaiman (2010) In vivo anti-nociceptive and anti-inflammatory activities of the aqueous extract of the leaves of Piper sarmentosum, J Ethnopharmacol Mar 2;128(1):42-8. doi:10.1016/j.jep.12.021. Epub 2009 Dec 24.