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Original Research Article

Effect of *Scoparia dulcis* (Linn.) and *Aerva lanata* (Linn.) whole plant and fruit part extracts on urine volume of ethylene glycol induced urolithiasis in male albino rats

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Keywords

Scoparia dulcis, *Aerva lanata*, Urolithiasis, Ethylene glycol

A B S T R A C T

The potential of two commonly used phytotherapeutic agents such as *Scoparia dulcis* (Linn.) and *Aerva lanata* (Linn.) in the management of urine volume has been studied in Ethylene glycol induced urolithiatic male albino rats. Oral feeding of Ethylene glycol resulted in decreased urine volume. Administration with aqueous extract of whole plant and fruit part of *Scoparia dulcis* and *Aerva lanata* gradually increased the urine volume. Comparatively animal group supplemented with fruit part of *Scoparia dulcis* in combination with *Aerva lanata* showed significantly increased urine volume. This indicates that the fruit part of *Scoparia dulcis* in combination with *Aerva lanata* is endowed with higher antiurolithiatic activity than others.

Introduction

Kidney stone is a ubiquitous disease afflicting mankind and it continuous to pose a universal health problem. It is a complex multifactorial disease resulting from an interaction between environmental and genetic factors (Aggarwal *et al.*, 2000). Nearly 4-15% of human populations are suffering from urinary stone problem all over the globe and 80% of them are men between the ages of 20 and 50 years (Chauhan *et al.*, 2008). Areas of high incidence of urinary calculi include the British Isles, Scandinavian countries, Northern Australia, Central Europe, Northern India, Pakistan and Mediterranean countries.

In India, 12% of the population is expected to have urinary stones, out of which 50% may end up with loss of kidneys or renal damage (Mohamed *et al.*, 2009).

Currently surgical procedures and extra corporeal shock wave lithotripsy are commonly employed in the management of urinary stones. The major drawback of these procedures is the recurrence of stones. A number of plant extracts and their derivatives are also used in its management (Pharmacognosy reviews, 2007).

Scoparia dulcis belonging to the Family Plantaginaceae is commonly known as

Bitter broom, broom weed and licorice weed. It is an erect annual herb that grows to a height of 0.5 meters widely distributed in many tropical countries and is found abundance in South America and the Amazon rain forest. In many areas, the herb is considered as an invasive weed. Indigenous people in Ecuador consume tea of the entire plant to reduce swellings, aches and pains. The indigenous tribes in Nicaragua use a hot water infusion or decoction of the leaves or the whole plant for stomach pain, for menstrual disorder, as an aid in child birth, as a blood purifier, for insect bites, fever, heart problems, liver and stomach disorders, malaria, sexually transmitted diseases and as a general tonic (The healing power of Rain forest herbs. 2005). Extracts of the plant have been shown to have antihyperglycemic (Pari *et al.,* 2004), antioxidant (Latha *et al.,* 2004 and Coulibaly *et al.,* 2011) and antimicrobial activity (Zulfiker *et al.,* 2011). Scoparinol, an isolate of the plant was shown to have analgesic, diuretic and anti-inflammatory activity (Ahmed *et al.*,2001).

Aerva lanata belonging to the FamilyAmaranthaceae is commonly known as mountain knotgrass. It is a woody, prostrate or succulent, perennial herb, 30-60 cm in height, native to Asia, Africa, and Australia (Germplasm Resources Information Network (GRIN), 1987). It is common throughout the hotter parts of India. It is also found to be present in Sri Lanka, Arabia, Egypt, tropical Africa, Java and Phillipines (Annie *et al.,* 2004). It is one of the plants included in Dasapushpam, the ten sacred flowers of Kerala. This plant is used as food for people and animals. The whole plant, especially the leaves, is edible. The leaves are put into soup or eaten as spinach or as a vegetable (Medicinal Plants Used For Snake Treatment, 2013). In the traditional system of medicine, the plant is being used as diuretic, antihelminthic, antidiabetic (Gupta and Neerai, 2004), for arresting haemorrhage during pregnancy, burn healing, as an antiinflammatory, for head ache, skin disease, to dissolve kidney and gall bladder stones (Yoga *et al.,* 1979), to treat nasal bleeding, cough, scorpion stings, fractures and spermatorrhoea (Sikarwar and Kaushik, 1993), in rheumatism and bronchitis, as an antimalarial drug and in snakebite (Sing and Sing, 1992; Bedi, 1978). The active components present in *Aerva lanata* are flavonoids, glycosides, carbohydrates, alkaloids, tannins, saponins, terpenoids, phenols and phytosterols are responsible for its pharmacological activities (Devi Rajeswari *et al.,* 2012).

In the present study, an effort has been made to exploit the antiurolithiatic property of *Scoparia dulcis* and *Aerva lanata* whole plant and fruit part extracts in the management of urine volume of ethylene glycol induced rat model

Materials and Methods

Plant collection

The plant *Scoparia dulcis* was collected from Trichur District, Kerala, India and *Aerva lanata* from Tiruchirappalli, Tamil Nadu, India. The identification of both the plants was authenticated at Department of Botany, Holy Cross, College, Tiruchirappalli, Tamil Nadu, India. The whole plant and fruit part of both the plants were dried separately and were ground to get a coarse powder.

Preparation of extract

Powder of whole plant and fruit part of *Scoparia dulcis* and *Aerva lanata* (200 mg / Kg of body weight) was suspended in

distilled water just prior to oral administration.

Animal selection

Healthy adult male Wister albino rats weighing between 150 and 200g were selected for the antiurolithiatic activity. The animals were acclimatized to standard laboratory conditions. They were provided with regular rat chow and drinking water ad libitum and they were used as per the ethical committee recommendation.

Ethylene glycol induced urolithiasis model

Animals were divided into eight groups containing six animals in each. Group I served as control and received regular rat food and drinking water ad libitum. Ethylene glycol (1%) in drinking water was fed to Group II, III, IV, V, VI and Group VII for induction of renal calculi till 60^{th} day. Group III received *Scoparia dulcis* whole plant extract (200mg/kg body weight), Group IV received *Scoparia dulcis* fruit extract (200mg/kg body weight), Group V received *Aerva lanata* whole plant extract (200mg/kg body weight), Group VI received *Aerva lanata* fruit extract (200mg/kg body weight), Group VII received *Scoparia dulcis* in combination with *Aerva lanata* fruit extract from first day till 60^{th} day (After 60 days of Ethylene glycol induction) and Group VIII (Control without Ethylene glycol induction) received *Scoparia dulcis* in combination with *Aerva lanata* fruit extract (200mg/kg body weight). All extracts were given once daily by oral route.

Assessment of antiurolithiatic activity
Collection of Urine

All animals were kept in individual metabolic cages and urine samples of 24 h were collected on 60^{th} day. Animals had free access to drinking water during the urine collection period. A drop of concentrated HCL was added to the urine being stored at 4°C. The volume of urine was measured using measuring cylinder.

Statistical analysis

Results were expressed as mean ± SD. Significance among data were determined using Two – way ANOVA followed by Duncan's post multiple comparison test (SPSS 20 Tool). Differences between the data were considered significant at $P > 0.05$.

Results and Discussion

Administration of 1% Ethylene glycol aqueous solution to male albino rats resulted in decreased volume of urine (Table 1, Group II) compared to that of control (Table 1, Group I and Fig. 1). Supplementation with whole plant and fruit part extract of *Scoparia dulcis* and *Aerva lanata* significantly ($P>0.05$) increased the urine volume (Table 1, Group III, IV, V and VI and Fig. 1).

However, fruit part of *Scoparia dulcis* in combination with *Aerva lanata* more significantly ($P>0.05$) increased the volume of urine (Table 1, Group VII and Fig. 1). In Group VIII (fruit part of *Scoparia dulcis* in combination with *Aerva lanata* – control), the volume of urine was increased even than that of normal control.

Ethylene glycol is a nephrolithiasis causing agent, it would have caused urinary stone formation in rats. This finding is in corroboration with many earlier research evidences. Treatment with ethylene glycol (0.75%) for 14 days is reported to develop renal calculi in young male albino rats (Selvam *et al.,* 2001; Huang *et al.,* 2002;

Atmani *et al.,* 2003). The finding of a low urine volume is one of the most common abnormalities detected on a 24-h urine metabolic evaluation (Porena *et al.,* 2007). In urolithiasis, the glomerular fitration rate decreases due to the obstruction to the outflow of urine by stone in urinary system (Ghodkar, 1994).

The results on the various tested groups indicated that the treatment with whole plant and fruit part extract of *Scoparia dulcis* and *Aerva lanata* to rats with ethylene glycol induced lithiasis increased the urine volume. However, administration of fruit part of *Scoparia dulcis* in combination with *Aerva lanata* highly elevated the urine volume to a normal level. The fruit juice and seed extract of the medicinal plants is moderate to good inhibitor of calcium oxalate, calcium carbonate and calcium phosphate mineralization. Sequestering of this insoluble calcium salts by the fruit juice might be due to effective single and mixed ligand chelation by the hydroxyl acids present in them (Mohamed Farook *et al.*,2009).

Another important finding in our study is that in Group VIII ((fruit part of *Scoparia dulcis* in combination with *Aerva lanata* – control), the volume of urine was remarkably increased than that of normal control, this is because even in normal control the stone formation could occur due to some factors such as drinking water, diet and aging.

Table.1 Effect of *Scoparia dulcis* and *Aerva lanata* whole plant and fruit part extracts on Urine volume of control and experimental animals

Experimental Groups	**Urine volume (ml/rat /day)**	**P Values**
Normal Control	**11.1600 ± 0.11402**	**P□0.05**
Calculi induced	**5.1200 ± 0.08367**	**P□0.05**
Calculi induced + *Scoparia dulcis* whole plant treated	**12.5000 ± 0.00000**	**P□0.05**
Calculi induced + *Scoparia dulcis* fruit part treated	**13.0400 ± 0.15166**	**P□0.05**
Calculi induced + *Aerva lanata* whole plant treated	**12.8000 ± 0.10000**	**P□0.05**
Calculi induced + *Aerva lanata* fruit part treated	**13.1000 ± 0.22361**	**P□0.05**
Calculi induced + *Scoparia dulcis* + *Aerva lanata* fruit part treated	**13.3800 ± 0.17889**	**P□0.05**
***Scoparia dulcis* + *Aerva lanata* fruit part treated control**	**15.0000 ± 0.35355**	**P□0.05**

All values are mean ± SD. Values are significantly different among the groups by ANOVA with Duncan's multiple range test at $p<0.05$.

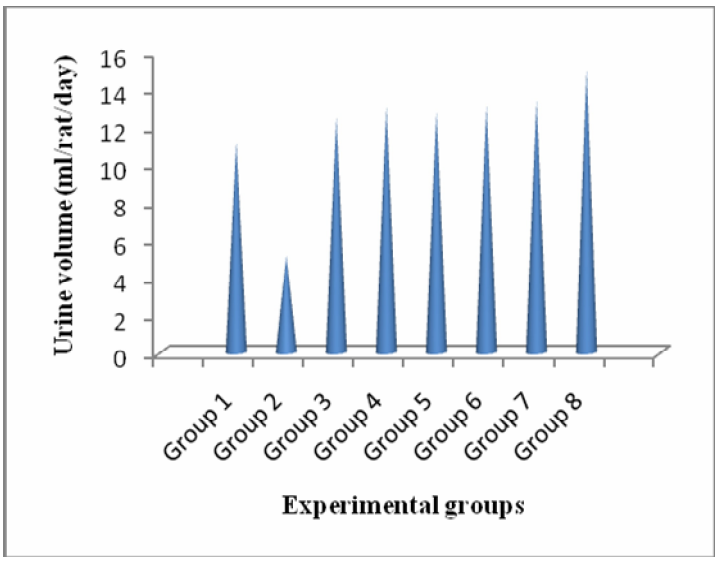

Fig.1 Effect of *Scoparia dulcis L*. and *Aerva lanata L*. Whole plant and fruit part extracts on Urine volume of Ethylene glycol induced male albino rats. (1) Control, (2) EG induced, (3) EG induced + *Scoparia dulcis* - whole plant, (4) EG induced + *Scoparia dulcis* – Fruit, (5) EG induced + *Aerva lanata* – whole plant, (6) EG induced + and *Aerva lanata* – Fruit, (7) EG induced + *Scoparia dulcis* – Fruit + with *Aerva lanata* – Fruit, (8) *Scoparia dulcis* fruit + *Aerva lanata* fruit control

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