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COMPARATIVE STUDY ON DIURETIC ACTIVITY OF DIFFERENT PLANT SOURCES USED AS MORAT [CONTROVERSIAL AYURVED PLANT]

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ABSTRACT

Morat is considered as a significant medicinal plant in the Indian system of medicine [Ayurveda] as it is very effective in various Urinary disorders. Under the name of *Morat*, botanical identity such as *Leea macrophylla* Roxb., *Saccharum officinarum* L., *Alangium lamarkii* Thw. *Marsdenia tenacissima* Wight. & Arn., *Maerua arenaria* Hook, *Chonemorpha macrophylla* (Roxb) G. Don are considered as they exhibit same medicinal properties. The purpose of this work was to differentiate the plants which are known as *Morat* by determining and comparing their diuretic activity by Lipschitz method. Two positive control Furosemide (standard drug) & Cystone (herbal plant compound) were compared. The effect on electrolytes changes and urine output were measured. In the result, decoction of all plants has shown diuresis except *M. tenacissima.* In inter comparison *C. macrophylla* decoction produced most significant diuresis & excretion of electrolytes. This suggest that use of *C. macrophylla* root as *"Morat"*; most effective diuretic plant.

KEYWORDS

Morat, Controversial plants, Diuretic, Ayurveda, Furosemide

INTRODUCTION

Controversial is term used for medicinal plants having controversial botanical source due to polynomial nomenclature system of Sanskrit, non-availability of plants and parallel evolved knowledge. This controversy is creating problem for uniformity in standardization of Ayurvedic products.

Morat is one of the controversial plants, which is mentioned in *Virataravadi Gana* [type of classification] of *Sushrut Samhita* [Ayurved classical text on Surgery] alleviate disorders of Vata, Retention of urine, Calculus, Dysuria, Cephalalgia and internal abscesses[1].

Literature review suggest that under the name of *Morat*, botanical identity such as *Leea macrophylla* Roxb., *Saccharum officinarum* L., *Alangium lamarkii* Thw., *Marsdenia tenacissima* Wight & Arn., *Maerua arenaria* Hook, *Chonemorpha macrophylla* (Roxb) G. Don are considered as they exhibit same medicinal properties [2] & it also imply that *Morat* is used as diuretic and litholytic drug. Therefore, in the present study, these six plants were selected for the comparison of diuretic activity & to identify most suitable plant source as *Morat.*

MATERIAL AND METHOD

Plant collection and authentication

Test drugs were identified on the basis of its morphological characters with the help of local taxonomist, botanist, botanical texts & flora & self-collected from following parts of India in its natural habitats. Drug samples were authentified & Specimen Vouchers prepared by Regional Ayurveda Institute for Fundamental Research (**RAIFR**), Pune, Maharashtra, India.

Table 1: Collection and authentication of plants

Species	Parts collection date	Natural habitat	Specimen Voucher
Leea macrophylla Roxb. ex Hornen of Vitaceae	Roots September 2017	Vile village, located at the foothills of Tamhini hills in north Konkan, Dist. Raigad, Maharashtra, India [3].	No.13944
Alangium lamarkii Thw. of Alangiaceae	Flowers March 2017	Jeuor village in Tal. Purandar, Dist. Pune, Maharashtra, India [4].	No. 13946
Chonemorpha macrophylla (Roxb) G. Don of Apocynaceae	Roots May 2017	Near sacred groves Nagachi Devarai in Amboli Ghat in south Maharashtra, India [5].	No. 13945
Marsdenia tenacissima (Roxb.) Moon. of Asclepiadaceae	Roots April 2017	Hilly region of Chitrakoot, a town in the Dist. Satna, Madhya Pradesh, India [6].	No. 13943
Saccharum officinarum L. of Poaceae	Roots September 2017	Mahadevwadi village, Tal. Bhor, Dist. Pune, Maharashtra, India [7].	No. 1312
Maerua arenaria Hook of Capparaceae	Roots April 2017	Khambatki Ghat, Dist. Satara (Western Ghats) Maharashtra, India [8].	No. 1313

Collected plant samples were shade dried, powdered with mechanical grinder, sieved through 80# mesh and stored in air tight glass vessel. These powders were utilized for various experimental studies.

Animals

Wistar strain albino rats of either sex; weighing 180 to 250 g were obtained from National Institute of Biosciences, **1091/ ABC/ 07/ CPCSEA** & maintained in the animal house of BharatiVidyapeeth University, Poona College of Pharmacy, Pune. Animals were housed on straw bedding 6 per cage & exposed to natural day and night cycles with ideal laboratory conditions in term of ambient temperature and humidity. The Institutional Animal Ethics Committee approved the protocol of this study **(CPCSEA/PCP/PCL04/2018)**

Grouping and posology

Animals were divided into nine groups containing 6 animals in each group. The dose for experimental animals was calculated on the basis of body surface area ratio by referring to the standard table of Paget and Barnes (1969) [9].

Table 2: Treatment groups [10 - 17]

Group	Form
Group – I Vehicle control	Liquid
Group – II Cystone 750 mg/kg b.w. as positive control.	Powdered tablet mixed in saline
Group – III furosemide 25mg/kg body weight	Powdered tablet mixed in saline
Group – IV *L. macrophylla* (Root) 540mg/kg b.w.p.o	Powder mixed in saline
	Decoction
Group – V *S. officinarum* (Root) 540mg/kg b.w.p.o	Powder mixed in saline
	Decoction

Group – VI *M. tenacissima* (Root) 540mg/kg b.w.p.o	Powder mixed in saline
	Decoction
Group – VII *C. macrophylla* (Root) 540mg/kg b.w.p.o	Powder mixed in saline
	Decoction
Group – VIII *A .lamarckii* (flower) 540mg/kg b.w.p.o	Powder mixed in saline
	Decoction
Group- IX *M. oblongifolia*(Root) 540mg/kg b.w.p.o	Powder mixed in saline
	Decoction

Powder of test drugs were triturated with adequate saline water first into a fine paste consistency and then saline was further added till the adequate stalk solution for each rat was reached according to body weight. Decoctions of test drugs were freshly prepared prior to administration to the animals. The method quoted in Ayurved classical texts was applied for decoction preparation i.e. 16 parts water and one part drug which was boiled on low flame till 1/8th part remained. This was filtered and allowed to cool before administering to the animals. Decoction-1.44 ml / 200 g rats or 7.2 ml /kg p.o. rat [18].

Evaluation of diuretic activity

The diuretic study was carried out as per the method of lipschitz [19]. All animals were deprived of food and water 18 hr prior to experiment. The animals were individually placed in metabolic cages for 24 hrs. All the urine produced in 24 h period was collected in a test tube through plastic pipe attached to a specially designed metabolic cage. During this period no food or water was made available to the animals. The volume and electrolyte concentration of urine were estimated for the assessment of diuretic activity. The sodium and potassium contents of urine were determined by flame photometry [20]. The chloride ion concentration was estimated by titration method [21].

Statistical analysis

Results were presented as Mean±SEM. Student's *t* test for unpaired data was used for analyzing the data generated during the study with the level of significance set at $P<0.05$.

RESULTS

Effects on urine output

The details of urine volume are presented in **Table 3**. From result it appears that the groups of animal treated with decoctions (Kwath) of *L. macrophylla, S. officinarum*, *C. macrophylla*, *M. arenaria, A .lamarckii* have shown increase in urine volume at the dose levels of 7.2 ml /kg.

Table 3 Effect of six plant drugs on urinary volume in Wistar rats

Group	Form	Volume of Urine (ml)
Group – I Vehicle control	Liquid	7.583±1.129
Group – II Cystone	Powdered tablet mixed in saline	13.92±1.734
Group – III furosemide	Powdered tablet mixed in saline	17.42±0.9167 *
Group – IV *L. macrophylla* (Root)	Powder mixed in saline	7.3±7937
	Decoction	20.33±2.801 **
Group – V *S. officinarum* (Root)	Powder mixed in saline	14.67±1.73
	Decoction	18.33±3.283*
Group – VI *M. tenacissima* (Root)	Powder mixed in saline	6.45±0.1979
	Decoction	14.67±3.451
Group – VII *C. macrophylla* (Root)	Powder mixed in saline	16.17±1.222
	Decoction	31±4.282***
Group – VIII *A .lamarckii* (flower)	Powder mixed in saline	9.967±1299
	Decoction	19.83±3.06**
Group- IX *M. arenaria* (Root)	Powder mixed in saline	9.967±1299
	Decoction	22±2.733***

Values are expressed as mean ± SEM.*p<0.05, **p<0.01, ***p<0.001 when compared to vehicle control

Effects on diuretic action, and diuretic activity

The details of diuretic action (Diuretic Index) and diuretic activity (Lipschitz value) are presented in **Table 4** The diuretic activity of a drug is considered nil if it is less than 0.72, little if it is between 0.72 and 1.00, moderate if it is within 1.00–1.50 and good if it is above 1.50. From result it appears that the groups of animal treated with decoction of *L. macrophylla*, *S. officinarum*, *M. arenaria*, *A. lamarckii* have moderate activity & *C. macrophylla* exhibits good diuretic activity.

Table 4 Effect of *six plants drugs* on diuretic action and activity in Wistar rats

Group	Form	Diuretic Index	Lipschitz value
Group – I Vehicle control	Liquid	1±0	0.4451±0.07661
Group – II Cystone	Powdered tablet mixed in saline	2.003±0.3697	0.8323±0.1498
Group – III furosemide	Powdered tablet mixed in saline	2.493±0.2972	1±0
Group – IV *L. macrophylla (Root)*	Powder mixed in saline	1.073±0.1937	0.4304±0.06316
	Decoction	2.871±0.5297	1.153±0.1356 **
Group – V *S. officinarum* (Root)	Powder mixed in saline	2.148±0.4	0.8692±0.1352
	Decoction	2.454±0.3666	1.063±0.2012 *
Group – VI *M. tenacissima* (Root)	Powder mixed in saline	0.9166±0.09709	0.3791±0.03361
	Decoction	2.156±0.5483	0.8455±0.1913
Group – VII *C. macrophylla* (Root)	Powder mixed in saline	2.271±0.2499	0.9502±0.1025
	Decoction	4.358±0.6886	1.786±0.2626 ***
Group – VIII *A .lamarckii* (flower)	Powder mixed in saline	1.366±0.1726	0.5816±0.08234
	Decoction	2.75±0.4496	1.184±0.2255 **
Group- IX *M. arenaria* (Root)	Powder mixed in saline	2.271±0.2499	0.9502±0.1025
	Decoction	3.284±0.597	1.252±0.1219 **

Values are expressed as mean ± SEM.*p<0.05,**p<0.01,***p<0.001 when compared to vehicle control

Effects on electrolyte excretion

The effect of once dose of furosemide, Cystone and different test drug groups on electrolyte (Na +, K+ and Cl -) excretion in the 24 hr urine is summarized in **Table 5**.Furosemide, Cystone & All test drug groups were enhanced the excretion of the electrolytes Na +, K+, and Cl – significantly which were greater than produced by furosemide, especially that of K+.

Table 5 Effect of *six plants drugs* on urine sodium, Potassium, Chloride excretion in Wistar rats

Group	sodium (mEq/L)	potassium (mEq/L)	Chloride(mEq/L)
Group – I Vehicle control	72.67±0.8819	95.17±1.302	100.7±.406
Group – II Cystone	114.7±0.8819 ***	133.7±0.8819 ***	122.3±1.667***
Group – III Frusemide	133.7±1.282 ***	152.7±1.282***	143.2±0.8724***
Group – IV *L. macrophylla* (Root)	84±1.065 ***	105±1.065 ***	104±1.155
	141.5±1.335***	160.5±1.335***	120±0.9309***

Group – V *S. officinarum* (Root)	93.67±1.282***	111.7±1.282***	100.7±2.171
	124.5±1.088***	145.5±1.088***	132.3±2.963***
Group – VI *M. tenacissima* (Root)	73.17±0.9458	92.17±0.9458	104.7±0.9888
	112.2±2.04***	130.2±2.04***	120±1.033***
Group – VII *C. macrophylla* (Root)	94±1.065***	115±1.065***	100.2±1.424
	147.2±2.151***	166.2±2.151***	133.2±2.535***
Group – VIII *A .lamarckii* (flower)	87.5±1.176***	105.5±1.176***	102.5±1.057
	117±1.238***	138±1.238***	119.8±1.108***
Group- IX *M. arenaria* (Root)	93.67±1.282***	111.7±1.282***	100.7±2.171
	132.7±1.82***	150.7±1.82***	139±2.352***

Values are expressed as mean ± SEM.*p<0.05,**p<0.01,***p<0.001 when compared to vehicle control

pH of urine

Urinary pH was measured at 24 h the data related to the effect of the test drugs on Urinary pH has been summarized. Administration of test drugs did not affect the urine pH to significant extent in comparison to normal control rats.

DISCUSSION

In the present study, the diuretic effect of *L. macrophylla*, *S. officinarum*, *M. tenacissima, C. macrophylla*, *M. arenaria* & *A .lamarckii* was evaluated in Wister albino rats. Test drugs were given in the form of Churna (Powder mixed in saline) and Kwath (Decoction). The results indicate that Decoction of *L. macrophylla*, *S. officinarum*, *C. macrophylla*, *M arenaria* & *A .lamarckii* at the dose levels of 7.2 ml /kg p.o. significantly increased urine output over a period of 24 h. The inter-group comparison of different test group animals suggests that *C. macrophylla*is the most suitable source of Morat. However, the phytoconstituents responsible for this activity need to be investigated. Good Diuretic activity was observed among rats treated with *C. macrophylla* at dose levels of 7.2 ml /kg p.o. In *L. macrophylla*, *S. officinarum*, *M arenaria* & *A. lamarckii* moderate activity was observed. The Diuretic activities of all test drug groups were found to be significant when compared to the normal control group, except *M. tenacissima,* wherein nil activity was observed. All the test drugs have significant increase in urinary excretion of sodium, potassium and chloride ions. The observations showed, test drugs had a diuretic spectrum similar to that of furosemide & acting as a loop diuretic due to significant increase of excretion of water, sodium, potassium and chlorine etc.

CONCLUSION

In the present study, decoction of *C. macrophylla, L. macrophylla*, *S. officinarum*, *M arenaria* & *A. lamarckii* were found capable in diuretic activity & can be used in renal conditions as potential diuretic. The research reveals that decoction of *C. macrophylla* has most potent action. So this is most suitable plant source as *Morat.*

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