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A REVIEW ON GLOBALLY USED ANTIUROLITHIATIC MONOHERBAL FORMULATIONS BELONGING TO BORAGINACEAE, BRASSICACEAE, MALVACEAE AND POACEAE FAMILIES

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ABSTRACT

Urolithiasis is a common worldwide problem with high recurrence. This review covers thirteen (13) antiurolithiatic plants of family Boraginaceae, twenty (20) from Brassicaceae, twenty three (23) from Malvaceae and twenty four (24) from Poaceae used globally in different countries. Hopefully, this review will not only be useful for the general public but also attract the scientific world for antiurolithiatic drug discovery.

KEYWORDS: Urolithiasis, antiurolithiatic, natural products, drug development, Boraginaceae Brassicaceae, Malvaceae, Poaceae.

INTRODUCTION

Urolithiasis is a common worldwide problem with high recurrence. Medicinal plants have been used globally in different countries and cultures for its prophylactic management and treatment. Current attempt is one of the part of the study entitled "Searching globally (orally) used antiurolithiatic plants belonging to different plant families". The plants of the family Asteraceae[1], Apiaceae[2], Fabaceae[3] and Lamiaceae[4] have already been discussed in a similar way. The presented review article covered Boraginaceae, Brassicaceae, Malvaceae and Poaceae families in this regard.

Boraginaceae: This review covers the thirteen (13) medicinal plants of family Boraginaceae used in 15 different countries such as Algeria, Brazil, Cuba, India, Iran, Kyrgyzstan,

Morocco, Mt. Pelion area of Greece, Pakistan, Phillipines, Réunion, Romania, Senegal, Spain and Uzbekistan. Their historical antiurolithiatc background shared in well known book of Dioscorides (01 plant). Among the plant parts leaves were noted the most common (37.5 %) followed by whole plant, roots and fruits (18.75 % each) and stem (6.25 %). In terms of preparation, decoction was observed most common (75 %), followed by infusion (25 %).

Brassicaceae: This review covers the twenty (20) medicinal plants of family Brassicaceae used in 11 different countries such as America, Appalachia, Germany, India, Iran, Israel, Lebanon, Morocco, Palestine, Spain and Turkey. Their historical antiurolithiatc background shared in well known books of Dioscorides (07 plants), Daoud al- Antaki (02 plants), Al Razi, Ibn Sina and Pliny the Elder (01 plant from each). Among the plant parts seeds were noted the most common (30.4 %) followed by leaves, fruits and aerial parts (17.39 % each), roots (8.6%) and whole plant and stem (4.3 %). In terms of preparation, decoction was observed most common (43.75 %), followed by infusion (37.5 %), and juices, ash and raw eaten (6.25 % each).

Malvaceae: It covers the twenty three (23) medicinal plants of family Malvaceae used in 12 different countries such as Canada, India, Iran, Iraq, Italy, Jordan, Kyrgyzstan, Lebanon, Togo, Tunisia, Turkey and Uzbekistan. Their historical antiurolithiatc background shared in well known books of Dioscorides (02 plants), Al-Baitar, Ibn Sina and Pliny the Elder (01 plant from each). Among the plant parts leaves were noted the most common (35.71 %) followed by whole plant (21.42 %), roots (17.8 %), flowers and aerial parts (7.1 %) and fruits, stem and seeds (3.5 % each). In terms of preparation, decoction was observed most common (68.42 %), followed by infusion (21 %) and juices and extracts (5.2 % each).

Poaceae: This review covers the twenty four (24) medicinal plants of family Poaceae used in 16 different countries such as Algeria, Bangladesh, Bosnia and Herzegovina, Canada, China, India, Iran, Italy, Jordan, Libya, Pakistan, Spain, Tunisia, Turkey, Vietnam and Yemen. Their historical antiurolithiatc background shared in well known books of Dioscorides (05 plants), Ibn Sina (02 plants) and Pliny the Elder (01 plant). Among the plant parts roots were noted the most common (33.3 %) followed by leaves and whole plant (18.5 % each), flowers (11.1 %), aerial parts and seeds (7.4 %), and fruits (3.7 %). In terms of preparation, decoction was observed most common (73.3 %), followed by infusion (20 %) and extract (6.6 %).

ABBREVIATIONS USED

h.= hour.

OD= once daily.

QID = four times a day.

tbsp.= table spoon.

TID= three times a day.

tsp.= tea spoon.

days= days required to dissolve / expel kidney stones.

before breakfast= every morning in empty stomach.

Whewellite: Calcium oxalate monohydrate.

MSUM: Mono sodium urate monohydrate.

Struvite: magnesium ammonium phosphate.

Table 1: Antiurolithiatic plants of Boraginaceae, Brassicaceae, Malvaceae and Poaceae families.

Plants	Explanation
Boraginaceae (13)	
Anchusa azurea Mill.	Leaves and roots cooked and eaten --- Spain.[5]
Arnebia euchroma L.	Roots decoction --- Iran.[6]
Borago officinalis L.	Whole plant maceration to expel stones --- Algeria.[7]
Cordia ecalyculata Vell.	Fruit roasted and brewed and eaten --- Brazil.[6]
	Latin America: Fruits roasted and brewed for 30-60 mins. BD in empty stomach till stone expulsion.[8]
Cordia grandis Roxb.	Fruit juice --- India.[6]
Heliotropium crispum Desf.	Whole plant decoction --- Morocco.[9]
Heliotropium indicum L.	Whole plant decoction --- Phillipines and Senegal.[10]; leaves decoction --- Cuba.[6]
	Pharmacological activities: Leaves possess anti-inflammatory [9] and whole plant possess diuretic, lithotriptic properties.[10]
Heliotropium strigosum Willd.	Leaves infusion --- India[8], Pakistan.[6]
	India: Keep 3-4 g of dried plant overnight in an earthen pot containing 500 ml of water, then filter. 250 ml before breakfast till stone expulsion.[8]
Lithospermum officinale L.	Dioscorides (De Materia Medica): Whole plant is diuretic and litholytic.[11]
	Fruit decoction --- Uzbekistan , Kyrgyzstan.[6]
	Pharmacological activities: Diuretic, lithotriptic.[9]
Lithospermum purpurocaeruleum L.	Leave or stem decoction --- Mt. Pelion area of Greece.[12]
	Pharmacological activities: Litholytic.[12]
Pulmonaria officinalis L.	Leaves ---- Romania.[13]
	Pharmacological activities: Antioxidant, diuretic, lithotriptic.[9]
Rotula aquatica Lour.	Roots / stem decoction --- India, Pakistan.[6]

	Pharmacological activities: Diuretic[9], lithotriptic.[14]
	Antiurolithiatic spectrum (reported): Roots against Whewellite and MSUM.[15]
Tournefortia acuminata DC.	Leaves infusion --- Réunion.[6]
Brassicaceae (20)	
Alyssum desertorum Stapf.	Seeds --- Iran.[16]
Armoracia lapathifolia Glib.	Roots / seeds decoction --- Palestine.[6]
	Pharmacological activities: Antioxidant, diuretic, litholytic.[9]
Barbarea vulgaris R.Br.	Leaves infusion --- Israel, Palestine.[6, 8]
	Pharmacological activities: Litholytic.[9]
Brassica cretica Lam.	Dioscorides (De Materia Medica): Seeds are diuretic.[11]
Brassica napus L.	Leaves juice --- Israel, Palestine.[6, 8]
	Israel: 1 tsp. of leaves juice TID till stone expulsion.[8]
	Pharmacological activities: Antioxidant, litholytic.[9]
Brassica nigra (L.) K.Koch.	Seeds infusion --- Palestine[17]; seeds decoction ---Germany.[18]
	Palestine: Steep 50 g of the powder in 300 ml water for four hours. 100 ml of this infusion is to be given 4–5 times a day.[17]
Brassica oleracea L.	Dioscorides (De Materia Medica): Seeds are diuretic.[11]
	Fruit ash --- Iran.[6]
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant[9], lithotriptic.[19]
	Antiurolithiatic spectrum (reported): Aerial parts against whewellite.[19]
Brassica rapa L.	Daoud al-Antaki (Tadhkirat Uli l-al-Bab wa l-Jami li-L-'Ajab al-'Ujab): Seeds are litholytic.[20]
	Seeds extract --- India.[21]
Capsella bursa-pastoris (L.) Medik.	Whole plant decoction / infusion --- America, Appalachia, Palestine, Turkey[6, 8]; fruits / leaves --- Iran.[16]
	Appalachia: Add 2 tbsp. of dried herb in 250 ml of boiling water cover and keep for 15 mins. Take 250 ml BD till stone expulsion.[8]
	Pharmacological activities: Anti-inflammatory, diuretic[9], lithotriptic.[22]
Cardamine hirsuta L.	Aerial parts --- India.[22]
	Pharmacological activities: Lithotriptic.[22]
Cardamine uliginosa M. Bieb.	Aerial parts decoction / infusion --- India, Turkey.[6]
Descurainia sophia (L.) Webb ex Prantl.	Seeds --- Iran.[16]
Eruca sativa Mill.	Dioscorides (De Materia Medica): Seeds are diuretic.[11] Pliny the Elder (Naturalis Historis): Seeds are diuretic.[11]
Fibigia clypeata (L.) Medik.	Fruits / stem decoction --- Lebanon.[23]
Lepidium latifolium L.	Dioscorides (De Materia Medica): Whole plant is diuretic.[11]
	Leaves infusion --- Spain.[24]
	Pharmacological activities: Diuretic, litholytic.[9]
Lepidium sativum L.	Seeds --- Spain.[24]
	Pharmacological activities: Anti-inflammatory[25], diuretic, litholytic.[9]
Nasturtium officinale R.Br.	Dioscorides (De Materia Medica): Whole plant is diuretic.[11]

	Aerial parts --- Iran[16], Turkey.[26]
Raphanus raphanistrum L.	Dioscorides (De Materia Medica): Seeds are diuretic.[11]
Raphanus sativus L.	Dioscorides (De Materia Medica): Leaves are diuretic.[11] Al Razi / Rhazes (Al-Hawi fi al-Tibb): Leaves juice is litholytic.[11] Ibn Sina (Al Qanoon Fit Tibb): Fruits are litholytic and expel stones.[11] Daoud al-Antaki (Tadhkirat Uli l-al-Bab wa l-Jami li-L-'Ajab al-'Ujab): Leaves are useful in renal stone.[20]
	Fruit juice --- Iran[6]; leaves / roots juice and seeds powder ---- India[6]; roots infusion ---- Iran[16], Pakistan[6]; roots raw eaten--- Germany[18]; seeds decoction --- Palestine.[17]
	India: Root juice TID after meals. OR leaf juice before breakfast after this no intake up to lunch. OR seed powder before breakfast. OR dried tuber pieces burn to ashes and mix 3 g of this ash with water. 250 ml OD for 30 days.[8] Palestine: Boil 250 g of seeds powder in 750 ml. Take 150ml of decoction TID.[17]
	Pharmacological activities: Antioxidant, diuretic, litholytic.[9]
	Antiurolithiatic spectrum (reported): Leaves against whewellite[27]; roots against struvite[15]; and whewellite.[28]
Zilla spinosa (L.) Prantl.	Aerial parts decoction --- Morocco.[6]
Malvaceae (23)	
Abelmoschus moschatus Medik.	Leaves decoction --- India.[9]
	Pharmacological activities: Antioxidant, diuretic, litholytic[9], lithotriptic.[22]
	Antiurolithiatic spectrum (reported): Whole plant[29], seeds[30] against whewellite.
Abrus precatorius L.	Leaves infusion --- India.[6]
Abutilon indicum (L.) Sweet.	Leaves juice --- India.[6]
	India: 3 leaves in empty stomach daily early in the morning for 15 days. OR 250 ml of leaves juice BD for 15 days.[8]
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, diuretic[9], lithotriptic.[31]
	Antiurolithiatic spectrum (reported): Leaves against whewellite.[31]
Alcea apterocarpa (Fenzl) Boiss.	Roots / shoots decoction --- Turkey.[6]
Alcea calvertii (Boiss.) Boiss.	Plant decoction --- Turkey.[6]
Alcea fasciculiflora Zohary.	Root decoction --- Turkey.[32]
Alcea flavovirens (Boiss. & Buhse) Iljin.	Plant decoction --- Turkey[6]; roots decoction with honey --- Turkey.[33]
	Turkey: Roots decoction concentrated to 1 / 5 of the original volume and kept overnight in a cool place before use and then taken along with honey.[33]
Alcea pallida (Waldst. & Kit. ex Willd.) Waldst. & Kit.	Seeds / flowers decoction --- Turkey.[6]
	Turkey: 250 ml of seeds decoction before meal TID for 7 days.[8]
Alcea rosea L.	Roots --- Iran.[34]
	Pharmacological activities: Analgesic, anti-inflammatory, diuretic, lithotriptic.[34]
	Antiurolithiatic spectrum (reported): Roots against whewellite.[34]

Althaea aucheri Boiss.	Aerial parts decoction --- Iran.[35]
Althaea officinalis L.	Dioscorides (De Materia Medica): Leaves / roots are diuretic and used against dysuria[11]; Ibn Sina (Al Qanoon Fit Tibb): Fruits / roots decoction is litholytic and expel stones.[11] Al-Baitar (Al Advia Wal Aghdia): Roots are litholytic.[11]
	Plant decoction / infusion --- Canada, Iran, Iraq, Turkey, Uzbekistan, Kyrgyzstan[6, 8, 36]; whole plant infusion --- Turkey.[32]
	Canada: 1-2 tsp. dried herb, 8 oz. hot water, steep covered 20 mins. 4-8 oz. TID till stone expulsion.[8]
	Pharmacological activities: Demulcent, diuretic, lithotriptic.[9]
Arum detruncatum C.A.Mey. ex Schott.	Leaves infusion --- Turkey.[32]
Gossypium herbaceum L.	Fruit extract --- India.[8]
	India: 250 ml of fruit extract OD till stone expulsion.[8]
Grewia flavescens Juss.	Roots --- India.[37]
	Pharmacological activities: Litholytic.[37]
Hibiscus rosa-sinensis L.	Whole plant --- India.[38]
	Pharmacological activities: Flowers contain lithotriptic properties.[39]
	Antiurolithiatic spectrum (reported) : Flowers against whewellite.[39]
Hibiscus sabdariffa L.	Flower decoction --- Canada[8]; leaves decoction --- India[6]; leaves / flowers infusion --- Jordan.[40]
	Canada: 1-2 tsp. dried flowers in 8 oz. hot water, cover for 20 mins then filter. 8 oz. BD / TID till stone expulsion.[8] India: Boil leaves extract with crab. 250 ml OD till stone expulsion.[8]
	Pharmacological activities: Antioxidant[9], lithotriptic.[41]
	Antiurolithiatic spectrum (reported) : Leaves against whewellite.[42]
Lavatera arborea L.	Leaves infusion --- Italy.[43]
	Pharmacological activities: Diuretic.[9]
Malva sylvestris L.	Dioscorides (De Materia Medica): Leaves are diuretic.[11] Pliny the Elder (Naturalis Historis): Leaves are diuretic.[11]
	Aerial parts decoction --- Italy, Tunisia[44], Turkey[45]; whole plant decoction --- Jordan.[40]
	Turkey: 125 ml of aerial parts decoction BD for 15 days.[45]
Malva nicaensis All.	Leaves decoction --- Lebanon.[23]
Malva parviflora L.	
Malvella sherardiana (L.) Jaub. & Spach.	Whole plant decoction--- Turkey[6]; leaves decoction --- Turkey.[46]
Sida acuta Burm.f.	Leaves --- India , Togo.[6, 47]
	Pharmacological activities: Roots are lithotriptic.[22]
	Antiurolithiatic spectrum (reported): Leaves against whewellite.[15]
Sida rhombifolia L.	Roots decoction --- India.[6]
Poaceae (24)	
Agropyron repens (L.) P.Beauv.	Rhizome decoction --- India[9], Turkey.[48]
	Pharmacological activities: Demulcent, diuretic, lithotriptic.[9]

Bambusa nutans Wall. ex Munro.	Bamboo shoot decoction --- India.[6]
	India: Boil 250 g of sliced bamboo shoots in one L of water. 250 ml OD for 7 days.[8]
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, astringent, diuretic[9], lithotriptic.[22]
Coix lacryma-jobi L.	Leaves / roots --- India.[6]
	Antiurolithiatic spectrum (reported): Leaves against whewellite.[49]
Cymbopogon citratus (DC.) Stapf.	Plant decoction --- India.[6]
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant[9], lithotriptic.[22]
Cymbopogon schoenanthus (L.) Spreng.	Dioscorides (De Materia Medica): Whole plant is diuretic.[11] Ibn Sina (Al Qanoon Fit Tibb): Flowers are litholytic and expel stones.[11]
	Flowers --- Iran.[6]
	Pharmacological activities: Diuretic**,** litholytic[9]
	Antiurolithiatic spectrum (reported): Whole plant against whewellite.[50]
Cynodon dactylon (L.) Pers.	Dioscorides (De Materia Medica): Whole grass is litholytic and used against dysuria[11]; Ibn Sina (Al Qanoon Fit Tibb): Whole grass is litholytic and expels stones.[11]
	Rhizome decoction --- India, Iran, Libya, Spain, Turkey, Yemen[5, 6, 26], Italy, Tunisia[44], Pakistan[51] ; rhizome infusion --- Turkey[52]; leaves decoction --- Bangladesh, India.[6, 53]
	India: Roots decoction with honey BD for 21 days[54]; Iran: Boil 15 g of dried roots in one L of water for 10 mins. 250 ml BD for 21 days.[8]
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, diuretic, litholytic.[9]
	Antiurolithiatic spectrum (reported): Roots against whewellite.[55]
Dactyloctenium aegyptium (L.) Willd.	Whole plant --- Pakistan.[51]
Desmostachya bipinnata (L.) Stapf.	Aerial parts --- India.[19]
	Pharmacological activities: Lithotriptic.[19]
	Antiurolithiatic spectrum (reported): Aerial parts against whewellite.[19]
Eleusine coracana (L.) Gaertn.	Pharmacological activities: Litholytic[37], lithotriptic.[56]
	Antiurolithiatic spectrum (reported): Whole plant against whewellite.[56]
Elymus repens (L.) Gould.	Whole grass --- Canada.[6]
	Canada: 2-3 tsp. dried rhizome in 12 oz. water, boil for 30mins, keep cover for 30mins then filter. 250 ml TID till stone expulsion.[8]
Globularia alypum L.	Flowers and roots --- Algeria.[57]
	Pharmacological activities: Lithotriptic.[57]
	Antiurolithiatic spectrum (reported): Flowers and roots against whewellite.[15]
Hordeum vulgare L.	Dioscorides (De Materia Medica):Shoots are diuretic[11] Pliny the Elder (Naturalis Historis):Shoots are diuretic.[11]

	Seeds decoction / infusion --- Jordan, Pakistan[6], Turkey[48]; Leaves extract --- India.[58]
	Pharmacological activities: Anti-inflammatory, antioxidant, diuretic , demulcent[9], litholytic.[59]
	Antiurolithiatic spectrum (reported): Whole plant against whewellite.[60]
Hyparrhenia hirta (L.) Stapf.	Whole plant infusion --- India.[9]
	Pharmacological activities: Diuretic, litholytic.[9]
Imperata cylindrica (L.) Raeusch.	Roots decoction --- India, Vietnam.[58, 61]
	India: Boil 10 – 20 g of roots one L of water. 25ml BD till stone expulsion.[58]
Lolium perenne L.	Aerial parts --- Bosnia and Herzegovina.[6]
Panicum miliaceum L.	Dioscorides (De Materia Medica): Seeds are diuretic.[11]
	Flower decoction --- Turkey.[6]
	Turkey: 250 ml of decoction prepared from spikelets BD.[46] (Note: Spikelets are the basic unit of a grass flower, consisting of two glumes or outer bracts at the base and one or more florets above).
Phragmites australis (Cav.) Trin. ex Steud.	Root decoction --- China.[62]
	Pharmacological activities: Diuretic, lithotriptic.[9]
Saccharum officinarum L.	Roots decoction --- Pakistan.[6]
	Pharmacological activities: Diuretic[9], leaves possess diuretic and lithotriptic properties.[63]
	Antiurolithiatic spectrum (reported): Leaves against whewellite.[63]
Saccharum spontaneum L.	Roots decoction --- India.[6]
	India: Mix 3-6 g of root powder with water. 200 ml OD till stone expulsion.[8]
	Pharmacological activities: Diuretic , lithotriptic.[64]
	Antiurolithiatic spectrum (reported): Roots against whewellite.[64]
Stipa tenacissima L.	Leaves --- Algeria.[57]
	Pharmacological activities: Lithotriptic.[57]
	Antiurolithiatic spectrum (reported): Leaves against whewellite.[15]
Triticum aestivum L.	Wheat bran --- India.[65]
	Pharmacological activities: Litholytic.[9]
	Antiurolithiatic spectrum (reported): Wheat bran against Whewellite.[66]
Triticum repens L.	Dioscorides (De Materia Medica): Roots decoction is diuretic and litholytic.[67]
Vetiveria zizanioides (Linn.) Nash.	Roots decoction --- India.[6]
Zea mays L.	Leaves / fruit --- Bangladesh[6]; seeds decoction --- Iran[16], Israel[8], Palestine[6]; flowers decoction --- India, Jordan, Pakistan, Yemen [6, 68], Uzbekistan[69]; corn silk decoction --- Spain, Turkey[5, 70], Italy, Tunisia[44]; corn silk infusion --- Algeria.[7]
	India: 50 ml of corn silk extract OD for 30 days. OR Decoction of styles obtained from female inflorescence or immature cobs. BD for 7 days. OR boil 50 g silky hairs from the female inflorescence (tassel) in 2 L of water till reduced to half. 50 ml 10 x / day for 2days. OR 50 ml of corn silk extract OD for 30 days[8]; Israel:

	Boil kernels and fibers in one L of water. 150 ml TID till stone expulsion.[8] Turkey: 125 ml of corn silk decoction BD for 5 – 7 days.[45]
	Pharmacological activities: Anti-inflammatory, antioxidant, demulcent, diuretic, litholytic.[9]
	Antiurolithiatic spectrum (reported): *Zea mays* hair (corn silk) against brushite and whewellite.[15]

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