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Exploring globally used antiurolithiatic plants of M to R families: Including Myrtaceae, Phyllanthaceae, Piperaceae, Polygonaceae, Rubiaceae and Rutaceae

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Abstract

Urolithiasis is a common worldwide problem with high recurrence. This review covers thirty six (36) families starting from alphabet M to R. It includes Rubiaceae (17); Phyllanthaceae and Rutaceae (09); Polygonaceae (08); Pinaceae and Piperaceae (06); Menispermaceae, Myrtaceae, Oleaceae, Oxalidaceae, Plantaginaceae and Ranunculaceae (05); Moraceae and Musaceae (04); Meliaceae, Orchidaceae and Rhamnaceae (03); Moringaceae, Onagraceae, Papaveraceae, Pedaliaceae, and Polygalaceae (02); Magnoliaceae, Malpighiaceae, Molluginaceae, Myoporaceae, Nyctaginaceae, Paeoniaceae, Parmeliaceae, Parnassiaceae, Periplocaceae, Platanaceae, Polypodiaceae, Portulacaceae, Primulaceae and Punicaceae (01) plant 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.

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 parts of the study entitled "Searching globally (orally) used antiurolithiatic plants belonging to different plant families". The plants of the 57 families such as Acanthaceae, Amaranthaceae, Amaryllidaceae, Anacardiaceae, Apiaceae, Apocynaceae, Arecaceae, Asparagaceae, Aspleniaceae, Asteraceae, Boraginaceae, Brassicaceae, Caesalpiniaceae, Capparidaceae, Caryophyllaceae, Chenopodiaceae, Convolvulaceae, Costaceae, Cucurbitaceae, Cupressaceae, Ebenaceae, Equisetaceae, Ericaceae, Euphorbiaceae, Fabaceae, Fagaceae, Hypericaceae, Lamiaceae, Lauraceae, Liliaceae, Lythraceae, Malvaceae, Poaceae, Rosaceae, Salicaceae, Salvadoraceae, Santalaceae, Sapotaceae, Saxifragaceae, Scrophulariaceae, Simaroubaceae, Smilacaceae, Solanaceae, Tamaricaceae, Theaceae, Tiliaceae, Tropaeolaceae, Typhaceae, Ulmaceae, Urticaceae, Valerianaceae, Verbenaceae, Violaceae, Vitaceae, Xanthorrhoeaceae, Zingiberaceae and Zygophyllaceae^[1-9] have already been discussed. The presented review article covered Magnoliaceae, Malpighiaceae, Meliaceae, Menispermaceae, Molluginaceae, Moraceae, Moringaceae, Musaceae, Myoporaceae, Myrtaceae, Nyctaginaceae, Oleaceae, Onagraceae, Orchidaceae, Oxalidaceae, Paeoniaceae, Papaveraceae, Parmeliaceae, Parnassiaceae, Pedaliaceae, Periplocaceae, Phyllanthaceae, Pinaceae, Piperaceae, Plantaginaceae, Platanaceae, Polygalaceae, Polygonaceae, Polypodiaceae, Portulacaceae, Primulaceae, Punicaceae, Ranunculaceae, Rhamnaceae, Rubiaceae and Rutaceae families in this regard (Table-1). The summarized information about each family is as follows.

- 1. Magnoliaceae:** The leaves were found to use in India.
- 2. Malpighiaceae:** The leaves were found to use in Brazil.
- 3. Meliaceae:** It covers three (03) plants used in China, India, Pakistan, Philippine and Trinidad. Among the plant parts leaves were noted the most common (66.66 %) followed by a bark (33.33 %). In terms of preparation, the decoction was observed the most common (60 %), followed by juices and infusion (20 % each).
- 4. Menispermaceae:** It covers the five (05) plants used in 04 different countries such as America, Brazil, India and Peru. Roots were noted the most common (42.85 %) followed by leaves and stem (28.56 % each). In terms of preparation, the decoction was observed the most common (50 %), followed by juices and infusion (25 % each).
- 5. Molluginaceae:** The leaves were found to use in India.
- 6. Moraceae:** Four (04) plants were found in 04 different countries such as Jordan, India, Pakistan and Palestine. Their historical antiurolithiatic background shared in well known

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- books of Al Razi / Rhazes, Dioscorides and Pliny the Elder. Among the plant parts fruits were noted the most common (60 %) followed by bark and leaves (20 % each). In terms of preparation, the decoction was observed the most common (66.66 %), followed by juices (33.33 % each).
7. **Moringaceae:** Two (02) plants were found to use in Pakistan and India. In terms of preparation, the decoction was observed the most common (80 %), followed by juices (20 %).
 8. **Musaceae:** Four (04) plants were found to use by Indians. Among the plant parts roots were noted the most common (50 %) followed by leaves, stem and flowers (16.66 % each). In terms of preparation, the decoction and infusions were equally observed.
 9. **Myoporaceae:** Leaves infusion or decoction was found to use in Trinidad.
 10. **Myrtaceae:** Aerial parts of plants were found to use in Australia, Bangladesh, India and Turkey. Their historical antiurolithiatic background shared in well known books of Dioscorides (De Materia Medica) and Pliny the Elder (Naturalis Historis). In terms of preparation, only decoctions were observed.
 11. **Nyctaginaceae:** Roots infusion or decoction was found to use in Brazil, Canada and India. In terms of preparation, only decoctions were observed.
 12. **Oleaceae:** We have found the data of five (05) plants used in Algeria, India, Iran, Italy, Jordan, Morocco, Palestine, Romania, Spain and Turkey against urolithiasis. Their historical antiurolithiatic background shared in well known book of Pliny the Elder. Among the plant parts leaves were noted the most common (60 %), followed by fruits and flowers (20 % each). In terms of preparation, the decoctions and infusions were observed the most common (40 % each), followed by an extract (20 %).
 13. **Onagraceae:** Two (02) plants were found to use by Indians. In terms of preparation, only decoctions were observed.
 14. **Orchidaceae:** It covers the three (03) plants used in Nepal, Uzbekistan and Kyrgyzstan. Their historical antiurolithiatic background shared in well known book of Dioscorides. Whole plant or tubers were equally used against urolithiasis. In terms of preparation, only decoctions were observed.
 15. **Oxalidaceae:** Five (05) plants were reported from India. Among the plant parts leaves were noted the most common (42.85 %) followed by roots (28.57 %), bark and fruits (14.28 % each). In terms of preparation, only decoctions were observed.
 16. **Paeoniaceae:** Fruits were found to use in Iran against urinary stones. Their historical antiurolithiatic background shared in well known book of Ibn Sina.
 17. **Papaveraceae:** The whole plant was reported from Iran, Mt. Pelion area of Greece and Romania. In terms of preparation, the decoctions were observed the most common (66.66 %), followed by infusion (33.33 %).
 18. **Parmeliaceae:** Indians were reported to use the whole plant for the same purpose.
 19. **Parnassiaceae:** The historical antiurolithiatic background of Parnassiaceae plants has shared in well known book of Dioscorides.
 20. **Pedaliaceae:** Indians were found to use seeds most commonly followed by fruits. In terms of preparation, only decoctions were observed.
 21. **Periplocaceae:** Leaves or root decoction was found to use by Indian and Latin American.
 22. **Phyllanthaceae:** Nine plants in Bangladesh, Brazil, Canada, India, Mauritius and Pakistan were reported for management of urolithiasis. The whole plant was noted the most common (45.45 %) followed by fruits (27.27 %), bark or stem (18.18 %) and leaves (9.09 %). In terms of preparation, the decoction was observed the most common (83.33 %), followed by infusion (16.66 %).
 23. **Pinaceae:** Six plants (06) were found to use in America, India, Iran, Nepal, Pakistan and Turkey. Their historical antiurolithiatic background shared in well known books of Al-Baitar (Al Advia Wal Aghdia), Dioscorides (De Materia Medica) and Ibn Sina (Al Qanoon Fit Tibb). Among the plant parts fruits were noted the most common (40 %) followed by bark, leaves and latex (20 % each). In terms of preparation, only decoctions were observed.
 24. **Piperaceae:** It covers six (06) plants used in Brazil, Canada, Colombia, India and Iran. Among the plant parts leaves were noted the most common (42.85 %) followed by fruits and roots (28.57 % each). In terms of preparation, the decoction was observed the most common (71.42 %), followed by infusion (28.57 %).
 25. **Plantaginaceae:** It covers five (05) plants used in Iran, Mauritius, Palestine, Spain and Turkey. The leaves were noted the most common (50 %) followed by whole plant, seeds and roots (16.66 % each). In terms of preparation, the decoction was observed the most common (60 %), followed by infusion (40 %).
 26. **Platanaceae:** Fruits or root infusion was found to use in Turkey.
 27. **Polygalaceae:** Two plants of family Polygalaceae were found to use against urolithiasis in Pakistan and Turkey.
 28. **Polygonaceae:** We have found the data of eight (08) plants used in Iran, Jordan, Pakistan and Turkey. Their historical antiurolithiatic background shared in well known books of Dioscorides and Ibn Sina. Among the plant parts roots and rhizome were the most common in use (50 %), followed by aerial parts, leaves (20 %) and whole plant (10 %). In terms of preparation, only decoctions were observed.
 29. **Polypodiaceae:** One plant was used in China for the same purpose.
 30. **Portulacaceae:** We have found the data from India, Israel, Palestine and Turkey. In terms of preparation, only decoctions were observed.
 31. **Primulaceae:** Plant decoction was found to use in Jordan.
 32. **Punicaceae:** Indians and the Palestinian people were found to use Punicaceae plant against urolithiasis. In terms of preparation, only decoctions were observed.
 33. **Ranunculaceae:** Five plants (05) were reported from Canada, India, Iran, Kyrgyzstan, Lebanon, Pakistan, Palestine and Uzbekistan. Their historical antiurolithiatic background shared in well known books of Dioscorides (De Materia Medica), Pliny the Elder (Naturalis Historis), Ibn Sina (Al Qanoon Fit Tibb) and Daoud al-Antaki (Tadhkirat Uli l-al-Bab wa l-Jami li-L-'Ajab al-'Ujab). Whole plant and roots were noted the most common (33.33 %) followed by leaves and stem (16.16 % each). In terms of preparation, only decoctions were observed.
 34. **Rhamnaceae:** It covers three (03) plants from Israel, Morocco, Pakistan and Turkey. Their historical antiurolithiatic background shared in well known book of Dioscorides. Among the plant parts roots were noted the

most common (50 %) followed by a bark and fruits (25 % each). In terms of preparation, the decoction was observed the most common (80 %), followed by infusion (20 %).

- 35. Rubiaceae:** Seventeen plants (17) were reported from America, Bangladesh, Bulgaria, India, Iran, Italian Peninsula, Korea, Kyrgyzstan, Nepal, Thailand, Turkey, Uzbekistan, Vietnam and Yemen. Among the plant parts roots were noted the most common (35.71 %) followed by whole plant (21.42 %), fruits, stem and flowers (7.14 % each). In terms of preparation, only decoctions were observed.
- 36. Rutaceae:** Nine (09) plants of this family were found to use in Iran, India, Italy, Pakistan, Trinidad and Tunisia. Their historical antiurolithiatic background shared in well known books of Dioscorides and Pliny the Elder. Among the plant parts fruits were noted the most common (55.55

%) followed by whole plant (22.22 %), aerial parts and leaves (11.11 % each). In terms of preparation, only decoctions were observed.

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.

Brushite = Calcium hydrogen phosphate dihydrate.

Whewellite: Calcium oxalate monohydrate.

MSUM: Mono sodium urate monohydrate.

Struvite: magnesium ammonium phosphate.

Table 1: Antiurolithiatic plants of different families.

Antiurolithiatic plants	Explanation
Magnoliaceae (01)	
<i>Magnolia grandiflora</i> L.	Leaves --- India ^[10] .
	Pharmacological activities: Lithotriptic ^[10] .
Malpighiaceae (01)	
<i>Byrsonima intermedia</i> A. Juss.	Leaves --- Brazil ^[11] .
Meliaceae (03)	
<i>Azadirachta indica</i> A. Juss. or <i>Melia azadirachta</i> L.	Leaves juice --- China ^[12] ; leaves decoction --- Pakistan ^[13] .
	India: 2 g of leaf ash with water. 250 ml OD for 30 days. OR 50 ml of fresh leaf extract OD for 20 days ^[14] .
	Pharmacological activities: Diuretic, lithotriptic ^[15] .
	Antiurolithiatic spectrum (reported): Leaves against whewellite ^[16] .
<i>Meliadubia</i> Cav.	Leaves decoction --- Philippine ^[17] .
	Pharmacological activities: Lithotriptic ^[18] .
<i>Urena sinuata</i> L.	Antiurolithiatic spectrum (reported): Leaves against whewellite ^[19] .
	Stem and leaves infusion or decoction --- Trinidad ^[20] .
Menispermaceae (05)	
<i>Chondrodendron tomentosum</i> Ruiz & Pavón.	Root decoction --- Brazil, Peru ^[17] .
	Latin America: Mix 1 tsp. dried root to 10 oz. water, boil for 10-15 mins, keep cover for 30 mins then filter. BD till stone expulsion ^[14] .
<i>Cissampelos pareira</i> L.	Roots infusion --- America, India ^[17] .
	Pharmacological activities: Analgesic, astringent ^[21] , antioxidant, diuretic ^[15] , litholytic ^[22] , lithotriptic ^[21] .
<i>Cocculus hirsutus</i> (L.) W. Theob.	Antiurolithiatic spectrum (reported): Roots against whewellite ^[23] .
	Aerial parts --- India ^[17] .
<i>Cyclea peltata</i> (Lam.) Hook. f. & Thomson.	Pharmacological activities: Antioxidant, astringent, diuretic, lithotriptic ^[15] .
	Leaves and roots --- India ^[17, 24] .
<i>Tinospora cordifolia</i> (Willd. L.) Miers.	Pharmacological activities: Diuretic ^[15] , litholytic ^[24] .
	Antiurolithiatic spectrum (reported): Roots against whewellite ^[24] .
<i>Tinospora cordifolia</i> (Willd. L.) Miers.	Leaves and stem juice --- India ^[17] .
	India: Boil 20 - 30 g of stem in one L of water. 250 ml BD till stone expulsion ^[14] .
	Pharmacological activities: Antioxidant, anti-inflammatory, astringent, litholytic ^[15] , lithotriptic ^[10] .
<i>Corbichonia decumbens</i> (Forssk.) Exell.	Antiurolithiatic spectrum (reported): Stem against whewellite ^[19] .
	Leaves --- India ^[25] .
<i>Corbichonia decumbens</i> (Forssk.) Exell.	Pharmacological activities: Litholytic ^[26] .
	Moraceae (04)
<i>Ficus carica</i> L.	Dioscorides (De Materia Medica): Fruits are diuretic ^[27] ; Pliny the Elder (Naturalis Historis): Fruits are diuretic ^[27] ; Al Razi / Rhazes (Al-Hawi fi al-Tibb): Fruits are diuretic ^[27] .
	Leaves decoction --- Palestine ^[17] ; fruits raw eaten --- Jordan, Pakistan, Palestine ^[17] .
	Pakistan: 2-4 figs (fruit) are soaked in water or milk at night and used in the morning on empty stomach to remove kidney stone. Used in the morning on empty stomach for 10 days ^[28] .
	Pharmacological activities: Anti-inflammatory, antioxidant, astringent, diuretic, litholytic ^[15, 28] .
<i>Ficus palmate</i> Forsk.	Fruits --- Pakistan ^[17] .
	Pharmacological activities: Antioxidant ^[15] .
<i>Ficus racemosa</i> L.	Bark decoction along with paste of long pepper --- India ^[29] .
	Pharmacological activities: Analgesic, anti-inflammatory, astringent, lithotriptic ^[21] .
<i>Morus alba</i> L.	Fruit juice --- Palestine ^[30] .
	Palestine: 150 ml of fruit juice every 2 h till stone expulsion ^[30] .
Moringaceae (02)	

<i>Moringa oleifera</i> Lam.	Flower or leaves or roots or seeds decoction --- India, Pakistan ^[28, 31] .
	India: Boil 25–50 g of root bark powder in one L of water. 25 ml BD till stone expulsion ^[32] ; Pakistan: Cut their root and boil it in water and after that add milk to this water and drink it which breaks the kidney stone ^[28] .
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, astringent, diuretic, litholytic ^[15] , lithotriptic ^[10] ; roots and bark are litholytic ^[33] .
<i>Moringa pterygosperma</i> Gaertn.	Bark juice --- India ^[17] .
	India: 10-20 ml of root bark juice OD till stone expulsion ^[14] .
Musaceae (04)	
<i>Ensete superbum</i> (Roxb.) Cheesman.	Root juice and seeds powder --- India ^[17] ; fruits and leaves --- India ^[34] .
	India: Mix powder of one seed with 250 ml of milk. 250 ml BD till stone expulsion ^[14] .
	Pharmacological activities: Litholytic ^[35] .
<i>Musa × paradisiaca</i> L.	Antiurolithiatic spectrum (reported): Fruits against brushite ^[19] .
	Stem or flowers juice and roots or leaves decoction --- India ^[17] .
	India: 10-20 ml of stem juice OD till stone expulsion ^[14] .
	Pharmacological activities: Antioxidant ^[36] , diuretic ^[15] , lithotriptic ^[10] .
<i>Musa balbisiana</i> Colla.	Antiurolithiatic spectrum (reported): Stem against brushite ^[37] and whewellite ^[36] .
	Roots decoction --- India ^[17] .
<i>Musa × sapientum</i> L.	Pharmacological activities: Anti-inflammatory ^[15] .
	Pharmacological activities: Diuretic, lithotriptic ^[38] .
	Antiurolithiatic spectrum (reported): Stem against whewellite and struvite ^[19] .
Myoporaceae (01)	
<i>Bontia daphnoides</i> L.	Leaves infusion or decoction --- Trinidad ^[20] .
Myrtaceae (05)	
<i>Leptospermum amboinense</i> Reinw. ex Blume.	Aerial parts --- Australia ^[17] .
<i>Leptospermum scoparium</i> J. R. Forst. & G. Forst.	
<i>Myrtus communis</i> L.	Dioscorides (De Materia Medica): Leaves are diuretic ^[27] .
	Pliny the Elder (Naturalis Historis): Leaves are diuretic ^[27] .
	Seeds decoction --- Turkey ^[17] .
	Turkey: Boil 2-5 g of seed powder in one L of water, cover for 30 mins then filter. 250 ml before breakfast for 10-15 days ^[14] .
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, diuretic ^[15] .
<i>Syzygium aromaticum</i> (L.) Merr. & Perry.	Inflorescence powder --- India ^[17] .
	India: Boil 1 tsp. powder of flower buds in one L of water. 100 ml OD for 7 days ^[14] .
<i>Syzygium cumini</i> (L.) Skeels.	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant ^[15] , lithotriptic ^[10] .
	Fruit pulp powder --- Bangladesh ^[39] , India ^[14] .
	India: 1tsp. fruit pulp powder with water BD for 15 days ^[14] .
	Antiurolithiatic spectrum (reported): Flowers against whewellite ^[40] .
Nyctaginaceae (01)	
<i>Boerhavia diffusa</i> L.	Roots decoction --- Brazil, India ^[17] .
	Canada: Mix 1 tsp. root powder in 250 ml of water. 250 ml TID till stone expulsion ^[14] ; Latin America: 250 ml of root decoction TID for 7 days ^[14] ; India: Plant decoction for 2-3 weeks for stone expulsion ^[33] .
	Pharmacological activities: ACE inhibitor, anti-inflammatory, antispasmodic, antioxidant, diuretic, litholytic ^[15] , lithotriptic ^[10] .
	Antiurolithiatic spectrum (reported): Roots against MSUM and struvite ^[19] .
Oleaceae (05)	
<i>Fraxinus angustifolia</i> Vahl.	Leaves infusion --- Spain ^[41] .
<i>Fraxinus excelsior</i> L.	Leaves decoction --- Iran ^[42] , Morocco, Romania ^[43, 44] .
	Pharmacological activities: Diuretic, litholytic ^[15] .
<i>Jasminum auriculatum</i> Vahl.	Flowers extract --- India ^[32] .
	Pharmacological activities: Lithotriptic ^[10] .
	Antiurolithiatic spectrum (reported): Flowers against whewellite ^[45] .
<i>Olea europaea</i> L.	Pliny the Elder (Naturalis Historis): Leaves are diuretic ^[27] .
	Leaves / fruit decoction --- Italy, Jordan, Palestine ^[17] ; leaves infusion --- Algeria ^[46] .
	Pharmacological activities: ACEinhibitor, analgesic, anti-inflammatory, antioxidant, astringent, lithotriptic ^[15] .
	Antiurolithiatic spectrum (reported): Fruit oil against whewellite ^[47] .
<i>Phillyrea latifolia</i> L.	Fruits --- Turkey ^[17] .
	Pharmacological activities: Anti-inflammatory, diuretic ^[15] .
Onagraceae (02)	
<i>Ludwigia perennis</i> L.	Plant decoction --- India ^[17] .
	India: 50-100 ml of plant decoction OD till stone expulsion ^[14] .
	Pharmacological activities: Analgesic ^[15] .
<i>Oenothera biennis</i> L.	Leaves decoction --- India ^[14] .
	India: 2 tsp. dried leaves in 8 oz. hot water, steep 45 mins. 8 oz. BD till stone expulsion ^[14] .
Orchidaceae (03)	
<i>Cypripedium himalaicum</i> Rolfe.	Whole plant --- Nepal ^[48] .
<i>Dactylorhiza umbrosa</i> (Kar. & Kir.)	Tuber decoction --- Uzbekistan, Kyrgyzstan ^[17] .

Nevski.	
<i>Serapiaslingua</i> L.	Dioscorides (De Materia Medica): Diuretic ^[27] .
Oxalidaceae (05)	
<i>Averrhoa carambola</i> L.	Bark, fruit, leaves --- India ^[17, 34] .
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, diuretic, lithotriptic ^[15] .
	Antirolithiatic spectrum (reported): Fruits against whewellite ^[19] .
<i>Biophytum abyssinicum</i> Steud. ex A. Rich.	Leaves / root decoction --- India ^[14] .
	India: 250 ml of leaves / roots decoction BD till stone expulsion ^[14] .
<i>Biophytum reinwardtii</i> (Zucc.) Klotzsch.	Roots decoction --- India ^[17] .
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant ^[15] .
<i>Biophytum sensitivum</i> (L.) DC.	Roots decoction --- India ^[17] .
	Pharmacological activities: Anti-inflammatory, antioxidant, litholytic ^[15] .
	Antirolithiatic spectrum (reported): Whole plant against whewellite ^[49] .
<i>Oxalis corniculata</i> L.	Leaves decoction --- India ^[17] .
	India: Boil 250 g of leaves in one L of water. 250 ml BD with a pinch of salt till stone expulsion. OR boil 100 g of plant in one L of water. 250 ml OD for 7 days ^[14] .
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, diuretic ^[15] , lithotriptic ^[10] .
Paeoniaceae (01)	
<i>Paeonia officinalis</i> L.	Ibn Sina (Al Qanoon Fit Tibb): Fruits are useful in children renal stones ^[27] .
	Fruit --- Iran ^[17] .
Papaveraceae (02)	
<i>Argemone mexicana</i> L.	Pharmacological activities: Litholytic ^[26] .
	Antirolithiatic spectrum (reported): Leaves against whewellite ^[50] .
<i>Fumaria officinalis</i> L.	Whole plant infusion --- Romania ^[51] ; fresh leaves decoction --- Iran ^[52] ; roots decoction --- Mt. Pelion area of Greece ^[53] .
	Pharmacological activities: Diuretic, litholytic ^[15] .
Parmeliaceae (01)	
<i>Parmelia perlata</i> (Huds.) Ach.	Whole plant powder with milk --- India ^[54] .
	Pharmacological activities: Astringent, anti-inflammatory, diuretic, lithotriptic ^[15] .
	Antirolithiatic spectrum (reported): Whole plant against struvite ^[55] .
Parnassiaceae (01)	
<i>Parnassiopalustris</i> L.	Dioscorides (De Materia Medica): Whole plant is diuretic ^[27] .
Pedaliaceae (02)	
<i>Pedaliium murex</i> L.	Fruits --- India ^[56] ; seeds decoction --- India ^[33] .
	India: 4 g fruit powder in 50 ml sheep milk. 50 ml OD for 7 days ^[14] .
	Pharmacological activities: Antioxidant, lithotriptic ^[15] .
<i>Sesamum indicum</i> L.	Antirolithiatic spectrum (reported): Fruits against whewellite ^[57] .
	Seeds 5-10, powder orally taken --- India ^[32] .
	Pharmacological activities: Lithotriptic ^[10] .
Periplocaceae (01)	
<i>Hemidesmus indicus</i> (L.) R.Br.	Leaves / roots decoction --- India ^[17] .
	India: Boil 20 - 30 g root in one L of water. 250 ml TID till stone expulsion ^[14] ; Latin America: Boil 3 leaves in 250 ml water for 10 mins then strain or filter. 250 ml OD till stone expulsion ^[14] .
	Pharmacological activities: Lithotriptic ^[10] .
Phyllanthaceae (09)	
<i>Phyllanthus acidus</i> (L.) Skeels.	10-20 g fruits raw eaten --- India ^[32] .
<i>Phyllanthus amarus</i> Schumach. & Thonn.	Whole plant decoction --- Pakistan ^[17] .
<i>Phyllanthus emblica</i> L.	Fruit juice --- India ^[17] .
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, astringent ^[15] .
<i>Phyllanthus fraternus</i> Webster.	Plant infusion --- India, Pakistan ^[17] .
	Pharmacological activities: Diuretic ^[15] .
<i>Phyllanthus lanceolatus</i> Poir.	Leaves / stem bark decoction --- Mauritius ^[17] .
<i>Phyllanthus niruri</i> L.	Whole plant decoction / infusion --- Brazil, Canada, India ^[14, 17] .
	Canada: 1 - 2 tsp. dried herb, 8 oz. hot water, cover for 30 mins then filter. 250 ml TID till stone expulsion ^[14] ; India: 12-24 ml of plant juice OD till stone expulsion ^[14] OR Leaves juice disintegrate stones ^[33] ; Latin America: Boil 3-6 g of powdered herb in one L of water. 250 ml TID till stone expulsion ^[14] .
	Pharmacological activities: ACE inhibitor, analgesic, anti-inflammatory, astringent, diuretic, litholytic ^[15] , lithotriptic ^[10] .
<i>Phyllanthus reticulatus</i> Poir.	Antirolithiatic spectrum (reported): Leaves against whewellite ^[19] .
	Whole plant --- Bangladesh ^[39] .
<i>Phyllanthus urinaria</i> L.	Whole plant decoction --- India, Pakistan ^[17] .
	Pharmacological activities: Antioxidant, diuretic ^[15] , lithotriptic ^[58] .
	Antirolithiatic spectrum (reported): Whole plant against whewellite ^[58] .
<i>Physalis alkekengi</i> L.	Dioscorides (De Materia Medica): Fruits are diuretic ^[27] .
	Fruit decoction --- India ^[17] .
	Pharmacological activities: Antioxidant, diuretic ^[15] .
Pinaceae (06)	
<i>Cedrus deodara</i> (Roxb. ex D. Don)	Al-Baitar (Al Advia Wal Aghdia): Latex is litholytic ^[27] .

G. Don.	Heart wood / latex --- India, Iran, Nepal ^[17] .
	India: 28 – 56 ml of decoction prepared from 3 – 6 g of wood. 25 ml BD till stone expulsion ^[14] .
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, diuretic, lithotriptic ^[15] . Antirolithiatic spectrum (reported): Heart wood against whewellite ^[59] .
<i>Picea mariana</i> (Mill.) Britton, Sterns & Poggenburg.	Bark decoction --- America ^[17] .
	Pharmacological activities: Anti-inflammatory, antioxidant ^[15] .
<i>Picea smithiana</i> (Wall.) Boiss.	Leaves decoction --- Pakistan ^[17] .
	Pharmacological activities: Antioxidant ^[15] .
<i>Pinus brutia</i> Ten.	Fruit--- Turkey ^[15] .
	Pharmacological activities: Litholytic ^[15] .
<i>Pinus eldarica</i> Medw.	Ibn Sina (Al Qanoon Fit Tibb): Fruits stop the formation of stones in bladder ^[27] .
	Fruit --- Iran ^[17] .
	Pharmacological activities: Litholytic ^[15] , lithotriptic ^[60] . Antirolithiatic spectrum (reported): Fruits against whewellite ^[60] .
<i>Pinushalepensis</i> Mill.	Dioscorides (De Materia Medica): Leaves are diuretic ^[27] .
Piperaceae (06)	
<i>Peperomia pellucida</i> (Linn.) Kunth.	Leaves decoction or infusion --- India ^[17] .
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, diuretic ^[15] .
<i>Piper aduncum</i> L.	Leaves decoction or infusion --- Brazil and Colombia ^[17] .
<i>Piper cubeba</i> L.	Ibn Sina (Al Qanoon Fit Tibb): Fruits expel stones ^[27] .
	Fruits --- Iran ^[17] . Pharmacological activities: Antioxidant ^[15] .
<i>Piper longum</i> L.	Leaves or roots or fruit decoction --- India ^[17] .
	Pharmacological activities: Roots possess analgesic, anti-inflammatory, antioxidant, diuretic ^[15] , lithotriptic ^[61] ; leaves are lithotriptic ^[10] .
	Antirolithiatic spectrum (reported): Fruits against whewellite ^[61] .
<i>Piper methysticum</i> G. Forst.	Root decoction --- Canada ^[14] .
	Canada: 1-2 tsp. dried root in 8 oz. water, boil for 15 mins, cover for 60 mins then filter. 4 oz. QID till stone expulsion ^[14] .
<i>Piper nigrum</i> L.	Dioscorides (De Materia Medica): Fruits are diuretic ^[27] . Al Razi / Rhazes (Al-Hawi fi al-Tibb): Fruits expel stones ^[27] . Ibn Sina (Al Qanoon Fit Tibb): Fruits are litholytic and expel stone ^[27] .
	Fruit decoction --- India, Iran ^[17] .
	India: Boil 1 tsp. of seed powder in one L of water. 100 ml OD for 7 days ^[14] .
	Pharmacological activities: Analgesic, anti-inflammatory, astringent ^[15] , lithotriptic ^[10] .
	Antirolithiatic spectrum (reported): Fruits against whewellite ^[62] .
Plantaginaceae (05)	
<i>Plantago coronopus</i> L.	Whole plant infusion --- Spain ^[51] .
	Pharmacological activities: Diuretic, litholytic ^[15] .
<i>Plantago major</i> L.	Leaves decoction --- Turkey ^[63] ; roots decoction --- India ^[17] .
	Pharmacological activities: Leaves possess analgesic, anti-inflammatory, antioxidant, demulcent and litholytic properties ^[15] . Antirolithiatic spectrum (reported): Whole plant against whewellite ^[64] .
<i>Plantago psyllium</i> L.	Leave or seeds decoction --- Iran ^[42, 52] .
<i>Plantago lanceolata</i> L.	Leaves infusion --- Mauritius ^[17] .
	Pharmacological activities: Anti-inflammatory ^[15] .
<i>Plantago ovata</i> Forssk.	Seeds powder --- Palestine ^[30] .
	Palestine: 50 g of seeds powder with water OD ^[30] .
Platanaceae (01)	
<i>Platanus orientalis</i> L.	Fruit / root infusion --- Turkey ^[17, 65] .
	Pharmacological activities: Analgesic, anti-inflammatory ^[15] .
Polygalaceae (02)	
<i>Rumex hastatus</i> D. Don.	Roots extract --- Pakistan ^[17] .
<i>Rumex tuberosus</i> L.	Aerial parts --- Turkey ^[65] .
Polygonaceae (08)	
<i>Emex spinosa</i> (L.) Campd.	Leaves decoction --- Pakistan ^[17] .
	Pharmacological activities: Astringent, diuretic ^[15] .
<i>Polygonum aviculare</i> L.	Dioscorides (De Materia Medica): Whole plant is diuretic ^[27] .
	Aerial parts --- Iran ^[42] . Pharmacological activities: Anti-inflammatory, antioxidant ^[15] .
<i>Polygonum cognatum</i> Meisn.	Leaves decoction --- Turkey ^[17] .
	Pharmacological activities: Antioxidant, diuretic ^[15] .
<i>Rheum emodi</i> Wall.	Roots decoction --- Pakistan ^[17] .
	Pakistan: Mix 1 tsp. dried root with egg and fried in ghee / fat. BD till stone expulsion ^[14] . Pharmacological activities: Antioxidant, diuretic ^[15] .
<i>Rheum ribes</i> L.	Whole plant decoction --- Turkey ^[66] ; aerial parts decoction --- Turkey ^[63] , fruits--- Iran ^[52] ; rhizome --- Jordan ^[67] .
<i>Rumex acetosa</i> L.	Roots decoction --- India ^[17] .
	Pharmacological activities: Antioxidant, diuretic ^[15] .

<i>Rumex acetosella</i> L.	Dioscorides (De Materia Medica): Roots are litholytic ^[27] ; Ibn Sina (Al Qanoon Fit Tibb): Roots are litholytic ^[27] .
<i>Rumex hastatus</i> D. Don.	Roots decoction--- Iran ^[17] . Roots decoction--- India ^[15] .
Polypodiaceae (01)	
<i>Pyrosia petiolosa</i> (Christ) Ching.	Plant decoction --- China ^[32] .
Portulacaceae (01)	
<i>Portulaca oleracea</i> L.	Aerial parts decoction --- Palestine, Turkey ^[17] .
	India: Whole plant juice to increase urine volume and disintegrate stones ^[33] ; Israel: Boil 50 g foliage in one L of water. 150 ml TID till stone expulsion ^[14] .
	Pharmacological activities: Anti-inflammatory, antioxidant, diuretic, litholytic ^[15] . Antiulithiatic spectrum (reported): Whole plant against whewellite ^[68] .
Primulaceae (01)	
<i>Primula veris</i> L.	Plant decoction --- Jordan ^[17] .
	Pharmacological activities: Antioxidant ^[15] .
Punicaceae (01)	
<i>Punica granatum</i> L.	Fruit or seeds juice or fruit rind decoction --- India ^[17] .
	India: 50 ml of fruit juice before breakfast till stone expulsion. OR boil rind of 1 fruit in one L of water, cover and keep for 30 mins then filter. 250 ml BD / TID for 7 days ^[14] ; Palestine: 300 ml of fruit juice five times a day ^[30] .
	Pharmacological activities: Anti-inflammatory, antioxidant ^[15] , litholytic ^[69] . Antiulithiatic spectrum (reported): Fruits against whewellite ^[69] .
Ranunculaceae (05)	
<i>Aquilegia fragrans</i> Benth.	Leaves or roots decoction --- India ^[17] .
	India: Boil 10 g of dry leaves in one L of water. 250 ml TID till stone expulsion. OR Boil roots in water for 2 to 3 h. 250 ml empty stomach daily early in the morning till stone expulsion ^[14] .
	Pharmacological activities: Anti-inflammatory ^[15] .
<i>Clematis flammula</i> L.	Whole plant decoction --- Lebanon ^[70] .
<i>Nigella sativa</i> L.	Dioscorides (De Materia Medica): Seeds are diuretic ^[27] ; Pliny the Elder (Naturalis Historis): Seeds are diuretic ^[27] ; Ibn Sina (Al Qanoon Fit Tibb): Seeds are useful in renal stone ^[27] ; Daoud al-Antaki (Tadhkirat Uli l-al-Bab wa l-Jami li-L-‘Ajab al-‘Ujab): Seeds are litholytic ^[71] .
	Seeds infusion --- Canada, Iran, Pakistan, Palestine, Uzbekistan, Kyrgyzstan ^[14, 17] .
	Canada: 1/2 tsp. dried seed in 8 oz. hot water, cover for 20 mins then filter. 4 oz. BD / TID till stone expulsion ^[14] .
	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, diuretic ^[15] , litholytic ^[72] , lithotriptic ^[10] . Antiulithiatic spectrum (reported): Seeds against whewellite ^[19] .
<i>Ranunculus sceleratus</i> L.	Whole plant --- India ^[10] . Pharmacological activities: Lithotriptic ^[10] .
<i>Thalictrum foliolosum</i> DC.	Roots --- India ^[73] .
	Pharmacological activities: Diuretic ^[73] .
Rhamnaceae (03)	
<i>Paliurus spina-christi</i> Mill.	Dioscorides (De Materia Medica): Aerial parts are diuretic and litholytic ^[27] .
	Fruit decoction --- Israel, Turkey ^[15, 74] .
	Roots decoction --- Pakistan ^[17] .
<i>Sageretia brandrethiana</i> Atich. J. L. S.	Pakistan: Boil 2 kg of roots in 7-8 L of water for 2-3 h. When 2 L of water is left filter with a cloth and store in a glass bottle. For adults: 250 ml of decoction (at one time) mix with 250 ml of water then 250 ml BD for 8-10 days. For children: 125 ml of decoction (at one time) mix with 250 ml of water then 250 ml BD for 7-8 days ^[14] .
<i>Ziziphus lotus</i> (L.) Lam.	Bark / roots infusion --- Morocco ^[17] .
	Pharmacological activities: Analgesic, anti-inflammatory, astringent ^[15] ; leaves possess antioxidant and lithotriptic properties ^[75] .
	Antiulithiatic spectrum (reported): Leaves against whewellite ^[75] .
Rubiaceae (17)	
<i>Coffea arabica</i> L.	Seed husk beverage --- Yemen ^[17] .
	Pharmacological activities: Analgesic, antioxidant, diuretic ^[15] .
<i>Galium aparine</i> L.	Plant decoction --- America ^[17] .
	Appalachia: Pour 250 ml of boiling water over 2 - 3 tsp. of dried herb; steep covered 10-15 mins. Take 250 ml TID till stone expulsion ^[14] .
<i>Galium verum</i> L.	Plant decoction --- India ^[17] .
<i>Hamelia patens</i> Jacq.	Roots decoction --- America ^[17] .
	Pharmacological activities: Anti-inflammatory, antioxidant, diuretic ^[15] .
<i>Ixora subsessilis</i> Wall. ex G. Don.	Fruits and seeds --- India ^[10] .
	Pharmacological activities: Lithotriptic ^[10] .
<i>Knoxia roxburghii</i> (Spreng.) M.A. Rau.	Leaves --- India ^[10] .
	Pharmacological activities: Lithotriptic ^[10] .
<i>Morinda citrifolia</i> L.	Fruit juice --- India, Thailand ^[76] . Pharmacological activities: Diuretic ^[15] .
<i>Morinda officinalis</i> F.C. How.	Roots --- Vietnam ^[77] .
<i>Neolamarckia cadamba</i> (Roxb.) F.	Bark decoction --- India ^[17] .

Bosser.	Pharmacological activities: Analgesic, anti-inflammatory, diuretic, litholytic ^[15] , lithotriptic ^[78] . Antirolithiatic spectrum (reported): Fruits against whewellite ^[78] .
<i>Oldenlandia herbacea</i> (Linn.) Roxb.	Whole plant decoction --- India ^[17] . Pharmacological activities: Antioxidant ^[15] . Leaves --- Bangladesh ^[17] .
<i>Paederia foetida</i> L.	Pharmacological activities: Analgesic ^[15] . Roots --- India ^[10] .
<i>Pavetta indica</i> L.	Pharmacological activities: Roots possess lithotriptic ^[10] and leaves are diuretic ^[79] . Flowers / leaves --- Iran ^[42] .
<i>Rosafoetida</i> Hermam.	Aerial parts --- India ^[73] ; roots decoction --- India, Korea ^[17] . India: Boil 100 g of plant in one L of water. 200 ml in empty stomach daily till stone expulsion ^[14] . Pharmacological activities: Anti-inflammatory, antioxidant, diuretic ^[15] , lithotriptic ^[80] . Antirolithiatic spectrum (reported): Roots against whewellite ^[80] .
<i>Rubia cordifolia</i> L.	Roots decoction --- India, Nepal ^[17] . Dioscorides (De Materia Medica): Roots are diuretic ^[27] .
<i>Rubia manjith</i> Roxb. ex Fleming.	Aerial parts --- Turkey ^[66] ; roots decoction --- Bulgaria, Italian Peninsula, Turkey, Kyrgyzstan, Uzbekistan ^[17] , Iran ^[42] . Pharmacological activities: Diuretic ^[81] . Antirolithiatic spectrum (reported): Roots against brushite and whewellite ^[37] . Leaves --- India ^[82] .
<i>Rubia tinctorum</i> L.	Pharmacological activities: Analgesic, anti-inflammatory, antioxidant, lithotriptic ^[15] .
<i>Spermacoce hispida</i> L.	Rutaceae (09)
<i>Aegle marmelos</i> (L.) Corrêa.	Fruits or leaves --- India ^[17] . India: Mix 1 tsp. fruit pulp powder with 100 ml coconut water. 100 ml OD for 14 days. OR Mix 1 tsp. Leaf powder with 100 ml coconut water. 100 ml BD till stone expulsion. OR Mix 1 tsp. of fruit pulp powder with 250 ml coconut water. 250 ml OD for 14 days ^[14] . Pharmacological activities: Antioxidant, diuretic, litholytic ^[15] .
<i>Citrus aurantifolia</i> (L.) (Christman) Swingle.	Fruit juice --- Pakistan ^[17] . Pharmacological activities: Antioxidant, diuretic ^[15] , lithotriptic ^[83] . Antirolithiatic spectrum (reported): Fruits against whewellite ^[83] .
<i>Citrus latipes</i> (Swingle) Yu. Tanaka.	Fruit infusion --- India ^[17] .
<i>Citrus x limon</i> (L.) Osbeck.	Fruit juice --- India, Pakistan, Trinidad ^[17, 20] . India: Boil 40-80 g of root or root bark in one L of water. 25 ml BD till stone expulsion ^[14] . Pharmacological activities: Analgesic, antioxidant, demulcent, diuretic ^[15] , litholytic ^[84] . Antirolithiatic spectrum (reported): Fruits against brushite, whewellite and struvite ^[19] .
<i>Citrus medica</i> L.	Antirolithiatic spectrum (reported): Fruits against struvite ^[19] . Fruit juice --- India, Pakistan ^[17] .
<i>Citrus sinensis</i> (L.) Osbeck.	Pharmacological activities: Anti-inflammatory, antioxidant ^[15] , lithotriptic ^[10] . Antirolithiatic spectrum (reported): Fruits against whewellite ^[19] .
<i>Haplophyllum buxbaumii</i> (Poir.) G. Don.	Aerial parts --- Iran ^[42] .
<i>Rutachalepensis</i> L.	Pliny the Elder (Naturalis Historis): Leaves are diuretic ^[27] . Dioscorides (De Materia Medica): Leaves are diuretic ^[27] .
<i>Ruta graveolens</i> L.	Whole plant decoction --- Italy, Tunisia ; leaves --- India ^[15] . Pharmacological activities: Diuretic ^[15] .

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