CHAPTER - II

EXPERIMENTAL FAMILY AND PLANTS

The Family Euphorbiaceae

Distribution:

Euphorbiaceae is a complex hetero-geneous family consisting of about 322 genera and 8900 species in the World. In India, this family is represented by 73 genera and 410 species. The family is essentially tropical and occurs in diverse habitats from arid regions to humid tropics. As a result, the plants of this family have developed various life forms from herbs, shrubs, stunted succulents to tall canopy trees. Several important economic as well as medicinal plants, such as rubber, cassava, cástor, tung oil, Phyllanthus emblica (Embelica officinalis), Phyllanthus niruri (Phyllanthus amarus) Phyllanthus maderaspatensis, Phyllanthus reticulatus, Phyllanthus simplex, Phyllanthus urinaria, Euphorbia pulcherima, Euphorbia hirta, Ricinus communis Jatropha
*curcas* etc., are found in this family. *Jatropha curcas* has recently become economically very important plant as the oil from the seed of this plant can be used as non-polluting substitute for automobile fuels. Large scale cultivation of this species is being undertaking in India. The one and only comprehensive taxonomic treatment of the family for India was that of Hooker(1872-1897).

**Morphological Characteristics of Family Euphorbiaceae:**

The below given account based on Hutchinson, 1952 and Lawrence, 1951.

**Vegetative Character:**

The family shows a great range in vegetative as well as floral structure. The plants are mostly herbs (*Phyllanthus niruri*), Shrubs (*Euphorbia pulcherima*), or tress (*Emblica officinalis*). Several species of *Euphorbia* (*Euphorbia neriifolia* and *Euphorbia trigena*) are cactus-like in habitat with thick and fleshy stem and often with milky-Juice.

**Leaves:**

Leaves usually alternate, simple, entire of some deeply palmately lobed (*Ricinus and Jatropha*), compound (*Bischoflia*), The stipules usually small, caducous or persistent, rarely connate in a bud-protecting sheath, Some times replaced by gland of thorns. Leaves reduced to spines.

**Flowers:**

The flowers are unisexual, Actinomorphic and Hypogynous (Perigynous in *Bridellia*). They shows considerable variation. In
Euphorbia both male and female are nacked, whereas in Anthostema both have tubular perianth. In the remaining genera of tribes the male flower are nacked and the female have rudimentary perianth. In Phyllanthus disc present in the female and often in the male flower.

**Inflorescence:**

The inflorescence is complex type. The first branching is usually racemose and subsequent branching are cymose. The inflorescence (in Euphorbia and related genera) is a cyathium, which appears as a single flower. Each cyathium is surrounded by an involucre of 4 or 5 connate bracts and between these large and often coloured gland are present which bears petaloid appendages (Euphorbia splendens). In the middle of the cyathium there is a single female flower (Represented by a Tricarpelary gynoecium). In the axial of each bract a no of male flowers are arrangement resembles a single flower.

**Perianth:**

Perianth often small some times obsolete, often dissimilar in two sexes, usually simple.

Tepals-6 (Phyllanthus niruri), arranged in two whorls of three each, Imbricate, discs of minute glands are present inside the perianth.

Tepals-5 (Ricinus communis), gamophyllous, rarely polyphyllous and connate at the base, Volvate, caducous, ovate and green.

Some times, in Jatropha both Calyx and Corolla are present. In Euphorbia consisting of a five calyx like involucres are present but tepals are absent.
Androecium:

The number of stamen in the male flowers ranges from one to numerous. One (*Euphorbia*), Three (*Breynia*), Three to Five (*Phyllanthus*), Monadelphous, staminal column is formed by the fusion of the filaments. The anther are monotheous (*Phyllanthus* and *Ricinus*) of Dithecous (*Euphorbia*), Basifixed and introse. Duthie (1903) reported following genera in family Euphorbiaceae.

1. Acalypha
2. Antidesma
3. Baliospermum
4. Bischofia
5. Bridelia
6. Breynia
7. Chrozophora
8. Cleistanthus
9. Croton
10. Cyclostemon
11. Euphorbia
12. Fluggea
13. Glochidion
14. Homonia
15. Mallotus
16. Phyllanthus
17. Putranjiva
18. Ricinus
19. Sapium
20. Tragia
Gynoecium:

The Gynoecium is tricarpellary (*Bicarpellary* in *Mercurialis*) and syncorpus with superior and trilocular ovary. There are one or two anatropous ovule in each locule and the placentation is axile. The style are three, often free or more of less united. at the base of the ovary a nectariferous disc is present, which is annular of separate gland.

The Taxonomic classification of family Euphorbiaceae:

The Euphorbiaceae, although one of the largest dicot families and conspicuous through out the tropics, have been relatively neglected by systematists in the 20th century. While other families such as compositae, Leguminoseae and Solanaceae have been the subject of controversy (Webster, 1994).

The Genus- *Phyllanthus*, Linn:

The genus *Phyllanthus* have herbs, shrubs or trees. They are distributed in tropical and subtropical regions of the world. Hooker (1872-1897) divided this genus into 9th sections.

SECTION - 1

Peltandra:

Herbs or undershrubs leaves membranous. Flowers long (female,very long) pedicelled. Sepals 5 or 6 in both sexes, stamen 5,
filaments connate in a slender column; anther erect vertical connective not produced. Ovary 3-celled; styles 3, minute, 2-partite.

This section have 4 species.

1. Phyllanthus longipes, Muell.
2. Phyllanthus macropus, Hook. f.
3. Phyllanthus saberosus, Wight.
4. Phyllanthus thwaitesianus, Muell.

SECTION 2

Kirganelia:

Shrubs, leaves distichous, usually petiole sepals 4-6 in both sexes. stamen 5, in 2 series, filaments free, or of the outer series free, of the inner connate; anther erect, slits vertical, connective not produced. style very minute, 2-fid.

This section have 1 species.

5. Phyllanthus reticulatus, Poir.
6. Phyllanthus glaucus, Wall.

SECTION 3

Flueggeopsis:

A shrubs. leaves distichous, shortly petioled. sepals 5-6 in both sexes. stamen 5, filaments free; anther erect, slits vertical connective not produced. style 3, long, selender, quite entire united at the base.
This section have 1 species.

7. *Phyllanthus glaucus*, Wall.

**SECTION 4**

**Embla**

Tress, leaves very small, closely pinnately set on the slender branchlets. Male flower with disk. Sepals 5-6 in both sexes. Stamen 3, filaments united in a column; anther erect, slits vertical, connective produced. style 3, united below each twice 2-fid.

This section have 4 species.

8. *Phyllanthus emblica*, Linn.


**SECTION 5**

**Paraphyllanthus**

Herbs or shrubs, leaves various, sepals 5-6 in both sexes. Stamen 3, filaments united in a short or long column; anthers erect, slits vertical, connective usually produced. style 3, free or connate below 2-fid.

This section have 12 species.

**Shrubs or tress**

17. *Phyllanthus frondosus*, Wall.

- Herbs

22. *Phyllanthus urinaria*, Linn.

**SECTION 6**

**Euphyllanthus**

Herbs or Shrubs. leaves various. sepals 5-6 in both sexes. stamen-3, filaments more of less united, rarely free and recurved; anther didymous or reniform. Cells subglobose, slits very short, cells, sometimes confluent when the dehiscence appears transverse. style 3, free or connate below 2-fid.

This section have 17 species.

- Stipules semisagittate or peltate.

27. Phyllanthus macrei, Muell.

Stipule simple, not peltately attached of semisagittate.

- Shrubs.
  28. Phyllanthus myrtifolius, Moon
  29. Phyllanthus leschenaultii, Muell.
  30. Phyllanthus missionis, Hook.f.
  32. Phyllanthus brevipes, Hook.f.

- Herbs.
  33. Phyllanthus pendulus, Roxb.
  34. Phyllanthus niruri, Linn.
  35. Phyllanthus nanus, Hook.f.
  37. Phyllanthus rotundifolius, Klein.
  38. Phyllanthus scabifolius, Hook.F.

SECTION 7

Reidía

Herbs or shrubs, leaves various. Sepals often toothed or lacerate, of male fl. 4 or 6. stamen 2-4; anther didymous or reniform. sessile around a minute pistilloid on the top of a slender or short column, horizontal cells often confluent, slits transverse. Style 3, 2-fid or 2-partite.
This section have 15 species.

40. *Phyllanthus baillonianus*, Muell.
41. *Phyllanthus roxburghii*, Muell.
42. *Phyllanthus actus*, Wall.
43. *Phyllanthus macrocalyx*, Muell.
44. *Phyllanthus gomphocarpus*, Hook.f.
45. *Phyllanthus pulcher*, Wall.
47. *Phyllanthus anabaptizatus*, Muell.
49. *Phyllanthus oreophilus*, Muell.
50. *Phyllanthus wightianus*, Muell.
51. *Phyllanthus cinereus*, Muell.
52. *Phyllanthus affinis*, Muell.

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SECTION 8

Cicca

A tree. Sepals 4 (rarely 5-6) in both sexes. Stamens 4, filaments free; anthers oblong, erect, slits vertical. Style 4, free.

This section have 1 species.

54. *Phyllanthus distichus*, Muell
SECTION 9

**Prosorus**

Dioecious trees. Leaves deciduous. Sepals 4 in both sexes stamen 4, filaments free; anther erect, slits vertical, style 3, free, 2-fid.

This section have 2 species.

55. *Phyllanthus indicus*. Muell.

56. *Phyllanthus cyanospermus*. Muell.

**PHYLLANTHUS** Linn.

The below given details based on Kaushik & Dhiman (2000).

The generic name has been derived from Greek words phyllon = a leaf and Anthos = a flower, referring to the appearance of flowers on leaf-like branches.

The genus comprises of herbs, shrubs or trees the leaves are alternate and distichous, the branchlets with their leaves resembling pinnate leaves: stipules are narrow or none. The flowers are small, monoecious and axillary or on the old wood. The sepals are 4-6, free or shortly connate, imbricate and more or less biseriate. The petals are none. Male flowers: disk glandular, rarely none, stamens 3 or 4-5, pistillode none. Female flowers: disk is glandular, ovary 3-celled, style free or connate, 2 ovules in each cell. The fruit forms a capsule with 3 crustaceous or curvaceous 2-valved coci or berry or a drupe with 3-4-celled stone. The seeds are trigonous.
It is stated that about 700 species occur in tropics and subtropics; out of which 24 species have been reported from India, chiefly from Southern and Western parts and the Eastern Himalaya.

*Phyllanthus niruri, Sensu Hook.f.*

(*Phyllanthus fraternus, Webster*)

**Vernacular names:** Sans: Bhumyamalaki; Hind: Bhuian anvala; Beng: Bhuia amala; Tam: Keelanelli

**Description:** It is an erect and glabrous annual herb about 10-30 cm high. The leaves are sub sessile, elliptic-obleng of linear-oblong, dark green above, glucose on the lower surface, 0.5-2.0 cm x 0.2-5 cm. The flowers are axillary and yellowish or whitish. The male flowers are 1-3, stamens 3, disk-lobes 6, glandular. The female flowers are solitary, style free, apprised to the ovary. The fruits are depressed, globose, smooth capsules, 0.2-0.3 cm across. The seeds are trigonous, brown with 6-7 straight longitudinal ribs.

Flowering and fruiting is during May-September.

**Occurrence and distribution:** It is common throughout India in hotter parts from the Punjab to Assam and South wards to Travancore, ascending the hills upto 914 m.

**Chemical constituents:** The aerial parts of the plant yield 4-methoxy-secerinine, 4-methoxy-norsecurinine, nirphylin and phyllnirurin, phyllantheol, phyllanthenol, phyllanthenone, and 3,7,11,15,19,23-hexamethyl-2z, 6z, 10z, 14e,18e,22e-tetracosachexen-1-ol. The leaves contain lintetralin, niranthin, nirtetralin, phyllanthin, hypophyllanthin,
phyltetralin and phylochrysine alkaloids. The stem contains phylochrysine alkaloids. The roots yield lupa-20(29)-ene-3-ol, 3,5,7-trihydroxyflavonol-4' o-α-L(-)-rhamnopyranoside, 5,3',4',-trihydroxyflavanone-7-o-α-L (-)-rhamnopyranoside, nirurin [5,6,7,4',tetrahydroxy-8-(3-methylbut-2-aryl) flavones-5-0-rutinoside] and estradiol. The bark yields estradiol. Besides, corilagen, ellagic acid, gallic acid, geraniin, an angiotensin converting enzyme inhibitor and the flavonoids FG1 and FG2 have also been reported from the plant (Chatterjee and Pakrashi, 1994).

**Parts used:** The whole plant, leaves, shoot and root are used.

**Medicinal uses:** The whole plant used as antipyretic, antiseptic, astringent, cooling, deobstructant and diuretic and it is useful in dropsy, gastro-intestinal problems as colic, diarrhea, dysentery, dyspepsia, gonorrhea, menorrhagia and other genital diseases and in jaundice. The decoction of the plant is given in jaundice and gonorrhea. The juice of the plant is an efficacious dressing for offensive sores and mixed with some bland oil is used in ophthalmia.

The leaves are stomachic and diuretic. These are mixed with salt and applied locally to skin affection, swellings and ulcers in the form of a poultice. A decoction of the leaves is used as refrigerant for the scalp. the leaves boiled with milk are given in dropsical disorders and urinary complaints. An infusion of the young shoots is given in dysentery. Fresh roots are given in jaundice, with rice water in menorrhagia and with milk as a galactagogue (Chatterjee and Pakrashi, 1994).
**Folklore:** The decoction of the plant is given in jaundice and the latex from the plant is applied on the sores.

**Preparation:** It is an ingredient of decoction-component for Chanyanprash.

**Raw drugs sold in market:** The whole dried plant as panchang is sold. (Kaushik and Dhiman, 2000).

**PHYLLANTHUS**

David (2008) gave following account of *Phyllanthus*.

*Phyllanthus* is the largest genus in the flowering plant family Phyllanthaceae. Estimates of the number species in this genus vary widely, from 750 to 1200. *Phyllanthus* has a remarkable diversity of growth forms including annual and perennial herbs, shrubs, climbers, floating aquatics, and pachycaulous succulents. Some have flattened leaf like stems called cladodes. It has a wide variety of floral morphologies and chromosome numbers and has one of the widest range of pollen types of any plant genus.

Despite their variety, almost all *Phyllanthus* species express a specific type of growth called "Phyllanthoid branching" in which the vertical stems bear deciduous, floriferous (flower-bearing), plagiotropic (horizontal or oblique) stems. The leaves on the main (vertical) axes are reduced to scales called "cataphylls", while leaves on the other axes develop subtropical regions on Earth. Leaf flower is the common name for all *Phyllanthus* species.
The circumscription of this genus has been a cause of much confusion and disagreement. Molecular phylogenetic studies have shown that *Phyllanthus* is paraphyletic over *Reverchonia*, *Glochidion*, *Sauropus*, and *Breynia*. A recent revision of the family Phyllanthaceae has subsumed all four of these genera into *Phyllanthus*. This enlarged version of *Phyllanthus* might eventually be divided into smaller genera, but much more research will be needed before anyone knows how to do this.

**Scientific classification:**

- **Kingdom:** Plantae
- (unranked): Angiosperms
- (unranked): Eudicots
- (unranked): Rosids
- **Order:** Malpighiales
- **Family:** Phyllanthaceae
- **Tribe:** Phyllantheae
- **Genus:** *Phyllanthus*

**Diversity**

- About 800 species

- *Phyllanthus abnormis*, Baill.
- *Phyllanthus acidus*, (L.) Skeels- Otaheite gooseberry
- *Phyllanthus acuminatus*, Vahl-jamaican gooseberry tree
- *Phyllanthus amarus*, Schumacher
- *Phyllanthus angustifolius*, (Sw.) Sw.
Phyllanthus arbuscula, (Sw.) J.F. Gmel.
Phyllanthus atropurpureus, Bojer
Phyllanthus brasiliensis, (Aubl.) Poir.
Phyllanthus caesiifolius, Petra Hoffin. & Cheek
Phyllanthus caroliensis, Walt.
Phyllanthus cochinchinensis, (Lour.) Spreng.
Phyllanthus cuneifolius, (Britt.) Croizat
Phyllanthus debilis, Klien ex Willd.
Phyllanthus emblica, L.
Phyllanthus engleri, Pax
Phyllanthus epiphyllanthus, L.
Phyllanthus ericoides, Torr.
Phyllanthus fluitans,
Phyllanthus fraternus, G.L. Webster
Phyllanthus gentry, Webster
Phyllanthus grandifolius, L.
Phyllanthus haughtii, Croizat
Phyllanthus juglandifolius, Willd.
Phyllanthus lacunarius, F. Muell.
Phyllanthus liebmannianus, Muell.-Arg.
Phyllanthus maderaspatensis, L.
Phyllanthus microcladus, Muell.- Arg.
Phyllanthus mirabilis, Mull. Arg.
Phyllanthus muellerianus, (Kuntze) Exell
Phyllanthus niruri, L.
Phyllanthus Parvifolius, Buch-Ham. ex D. Don
Phyllanthus piscatorum, Kunth
Phyllanthus pentaphyllus, C. Wright ex Griseb.
Phyllanthus polygonoides, Nutt. ex Griseb.
Phyllanthus polyspermus, Shumach. & Thonn.
Phyllanthus Profusus, N.E.Br.
Phyllanthus pseudocanami, Mull.Arg.
Phyllanthus pudems, L.C. Wheeler
Phyllanthus pulcher, Wallich ex Muell.Arg.
Phyllanthus reticulates, Poir.
Phyllanthus saffordii, Merr.
Phyllanthus salviifolius, Kunth
Phyllanthus sepialis, Mull. Arg.\(^9\)
Phyllanthus stipulates, (Raf.)G.L. Webster
Phyllanthus tenellus Roxb.
Phyllanthus urinaria L.-chamberbitter
Phyllanthus virgatus G. Forst.
Phyllanthus watsonii A. Shaw
Phyllanthus polyspermus, Linn.

Medical interest

The herb *Phyllanthus* has gained interest as a potential treatment for human bone disorders as well as diabetes patients.

Gaining attention for its potential effects against hepatitis B, research on *Phyllanthus niruri* has revealed possible antiviral activity also against human immunodeficiency virus (HIV).

*Phyllanthus* plants have been used in folk medicine used to treat a wide number of diseases. In Indian Ayurvedic medicine, various
herbaceous *Phyllanthus* species are known as *bhuiamla*, a name previously assigned to *P. niruri* only. Bhuiamla is prescribed for jaundice, gonorrhea and diabetes (internal use) as well as poultices, skin ulcer and other skin problems (external use). Infusions are made from young shoots as a treatment of chronic dysentery. Not many of these supposed benefits, however, is established with modern scientific research.

*Phyllanthus muellerianus* extracts are antimicrobial. *Phyllanthus niruri* may possibly help prevent stone formation/uroolithiasis. *Phyllanthus amarus* root and leaf extract showed significant hepatitis C antiviral activity. *Phyllanthus* species for patients with chronic hepatitis B virus infection have been assessed in clinical trials, but no consensus regarding their usefulness exists. *Phyllanthus acidus* (leaf) showed antiplasmodial activity against *Plasmodium falciparum*. *Phyllanthus reticulatus* leaves showed potential R Nase H inhibition and protection against the viral cytopathic effects of HIV-1.

Leaves, roots, stem, bark and berries of this genus contain ligams (e.g. phyllanthin and hypophyllanthin) and a variety of other phytochemicals.

**PHYLANTHUS NIRURI (CHANCA PIEDRA)**

**Family** : Euphorbiaceae  
**Genus** : *Phyllanthus*  
**Species** : *Niruri. amarus*
Synonyms: *Phyllanthus carolinianus*, *P. sellowianus*, *P. fraternus*, *P. Kirganella*, *P. Lathyroides*. *P. Lonphali*, *Nymphanthus niruri*

Common Names: Chanca piedra, quebra pedra, stone-breaker, arranca-pedras, punarnava, amli, bhonya, bhoomi amalaki, bhui-ama, bhui amla, bhuanvalah, bhuimy-amali, bhuan-ama, bhunymalaki, cane peas senna, carry-me-seed, creole senna, daun marisan, derriere-dos, deye do, ervapombinha, elrageing, elrigeg, evatbimi, gale-wind grass, graine en has fievre, hurricane weed, jar-ama, jar amla, kizha nelli, malva-pedra, mapatan, para-parai mi, paraparai mi, pei, phyllanto, pombinha, quinine weed, sacha foster, cane senna, creole senna, shka-nin-du, viernes santo, ya-taibai, yaa tai bai, yah-tai-bai, yerba de san Pablo (David, 2008).

Additional Uses:

Phyllanthus blocks DNA polymerase, the enzyme needed for the hepatitis B virus to reproduce. It also prevent from jaundice, diabetes, dyspepsia, ulcers, sores, swellings, ophthalmia and chronic dysentery. Whole plant is useful for the treatment of some forms of gonorrhea, menorrhagia, dropsy, menorrhagia and other genito-urinary affections of a similar type. A poultice of the leaves mixed with salt cures itch and other skin affections. It is bitter, astringent, cold, anti-inflammatory, hepatoprotective and useful in liver disorders, cough, asthma, jaundice,
spleen disorders. *Phyllanthus* may help decrease the amount of hepatitis B virus found in the blood stream.

The *Phyllanthus* genus contains over 600 species of shrubs, trees and annual of biennial herbs distributed throughout the tropical and subtropical regions of both hemispheres. Unfortunately, there remains a great deal of confusion among scientists regarding plant identification and, in many cases, plant misidentification makes evaluation of published information difficult. *P. amarus* (Thonn and Schum) and *P. setlowianus* are often considered a variety of *P. niruri*, or no distinction is made among these three species in published clinical research. Oftentimes one name is indicated to be synonymous with another and, sometimes, both names are used interchangeably as if referring to one plant (David, 2008).

**TRIBAL AND HERBAL MEDICINE USES**

The Spanish name of the plant, *Chanca piedra*, means "stone breaker" or "shatter stone." It was named for its effective use to generations of Amazonian indigenous peoples in eliminating gallstones and kidney stones. In Brazil, the plant is known as quebra-pedra or arranca-pedras (which also translates to "break-stone"). In addition to kidney stones, the plant is employed in the Amazon for numerous other conditions by the indigenous peoples, including colic, diabetes, malaria, dysentery, fever, flu, tumors, jaundice, vaginitis, gonorrhea and dyspepsia. Based on its long documented history of use in the region, the plant is generally employed to reduce pain, expel intestinal gas, to stimulate and promote digestion, to expel worms, as a mild laxative. (David, 2008).
Chanca piedra has a long history in herbal medicine systems in every tropical country where it grows. For the most part, it is employed for similar conditions worldwide. Its main uses are for many types of biliary and urinary conditions including kidney and gallbladder stone; for hepatitis, colds, flu, tuberculosis, and other viral infections; liver diseases and disorders including anemia, jaundice and liver cancer; and for bacterial infections such as cystitis, prostatitis, venereal diseases and urinary tract infections. It is also widely employed for diabetes and hypertension as well as for its diuretic, pain-relieving, digestive stimulant, antispasmodic, fever reducing and cellular protective properties in many other conditions. (David, 2008).

PLANT CHEMICALS

Since the mid-1960s, Chanca piedra has been the subject of much phytochemical research to determine the constituents and their pharmacological activities. It is a rich source of plant chemicals, including many which have been found only in the Phyllanthus genus. Many of the "active" constituents are attributed to biologically active lignans, glycosides, flavonoids, alkaloids, ellagitannins, and phenylpropanoids found in the leaf, stem, and root of the plant. Common lipids, sterols and flavonols also occur in the plant.

The main plant chemicals in Chanca piedra include alkaloids, astragalin, brevifolin, carboxylic, acid, oils, protein, glycosides, corilagin, cymene, ellagic acid, ellagitannins, galloylchins, geranin, hypophyllanthin, lignans, linteralins, lupeols, methyl salicylate, niranthin, nirtetralin, niruretin, nirurin, nirurine, niruriside, norsecurinines, phyllanthin, phyllanthine, phyllanthenol, phyllochrysine,
phytretarin, repandusinic acids, quercetin, quercetol, quercitrin, rutin, saponins, triaccontanal and tricontanol (David, 2008).

BIOLOGICAL ACTIVITIES AND CLINICAL RESEARCH

It is little wonder that Chanca piedrka is used for so many purposes in herbal medicine systems: in clinical research over the years, the plant has demonstrated liver protective, antilithic (expels stones), pain-relieving, hypotensive, antispasmodic, antiviral, antibacterial, diuretic, antimutagenic and hypoglycemic activities. Due of the confusion among P. niruri, P. amarus and P. sellowianus over the years (and the reclassification of the genus), the research reviewed herein will encompass that which has been reported on all three of these very similar species. (David, 2008).

The first notable area of study has validated Chanca piedra's longstanding traditional use for kidney stones. In 1990, the paulista School of Medicine in Sao Paulo, Brazil, conducted studies with chanca and rats with kidney stones. They were given a simple tea of Chanca piedra for 1-3 months and it was reported that the tea promoted the elimination of stones. They also reported a significant increase in the medical school educated new doctors about the ability to treat kidney stones with this natural remedy and now it is found in many pharmacies throughout Brazil.

In a 1999 in vitro clinical study, a Chanca piedra extract exhibited the ability to block the formation of calcium oxalate crystals (the building blocks of most kidney stones) which indicates that it might be a useful preventative aid for people with a history of kidney stones. In a
2002 in vivo study, researchers seeded the bladders of rats with calcium oxalate crystals and treated them for 42 days with a water extract of *Chanca piedra*. Their results indicated that *Chanca piedra* strongly inhibited the growth and number of stones formed over the control group. Several of the animals even passed the stones which did form. Most recently scientists again confirmed in vitro that *Chanca piedra* could help prevent the formation of kidney stones stating, "that is may interfere with the early stages of stone formation and may represent an alternative form of treatment and/or prevention of urolithiasis" ((David, 2008).