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# Cardioprotective Activity in Medicinal Plants – A Review



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## ABSTRACT

The Siddha medical system is the component of Dravidian system of medicine belonging to Tamil Nadu. This system is based upon the literary evidences and oral commentaries which were passed from one generation to other. Siddhas who were eminent scholars and spiritual adepts documented their experiences in palm leaf manuscripts, scriptures etc., Siddha Medicine is being advocated to treat various diseases including acute and chronic conditions. Siddhas discovered thousands of raw drugs, medicines and invented their uses by using their Supernatural Powers. Plants play an important role in treating diseases like cardiovascular diseases. Mortality rate of CVD's were increased day by day. In order to overcome the mortality rate certain steps were taken to reduce the death rate. In this review, the authors explores the importance of cardioprotective actions in various plants such as *Azadirachta indica*, *Artocarpus heterophyllus*, *Bacopa monnieri*, *Curcuma longa*, *Hygrophila auriculata*, *Nigella sativa*, *Ocimum basilicum*, *Pongamia pinnata*, *Terminalia arjuna*, *Withania somnifera*.

## INTRODUCTION

The term cardioprotection has two meaning it implies not only “preservation” but also “favouritism” or “patronage” of heart. Cardioprotection includes all mechanisms and means that contribute to the preservation of the heart by reducing or even preventing myocardial damage<sup>[1]</sup>.

Heart is one of the vital organ which plays the vital role of circulation. However, it can be damaged in certain diseases such as coronary heart disease, Hypertension, cardiovascular diseases, Peripheral artery disease, Rheumatic heart disease, Congenital heart disease and Heart failure<sup>[2]</sup>.

Cardiovascular diseases are the major health problems of developed as well as developing countries of the world<sup>[3]</sup>. Cardiovascular diseases are the number one cause of death globally<sup>[4]</sup>. Heart diseases are increasing day by day in India and rest of the world. Most of the deaths in India are due to heart disorders besides deadly cancer. If this is allowed to continue, by 2030 an estimation of 23.6 million people will die because of cardiovascular diseases<sup>[2]</sup>.



Drugs used in modern medicines includes organic Nitrates, Calcium Channel antagonists, beta blockers are effective in preventing the heart diseases, their use is often limited because of their side effects and adverse reactivity. So the wide variety of plants and its active principles with minimal side effects provide an alternative therapy for heart diseases<sup>[5]</sup>.

The role of traditional medicines in the solution of health problems is invaluable on a global level.

### Nature is the healer of disease

#### Hippocrates.

Nature has been a source of medicinal treatment since ancient times. In recent decades plants and plants derivatives contribute a major role in healing diseases. Along with the associated side effects of modern medicine, traditional medicines are gaining their importance and are now being studied to find the scientific basis of their therapeutic action<sup>[6]</sup>.

In order to prevent adverse effects of modern medicine, herbals can be used in treating diseases in this modern World. A review of such plants with cardioprotective effect was carried out. Several herbs and herbal products has been recommended to promote a healthy heart.

### **Methods of Pharmacological view of cardioprotective plants:**

Phytoconstituents reported in cardioprotective herbs has altered the biochemical variation such as marker enzymes serum glutamate- pyruvate transaminase (SGPT) or alanine transaminase (ALT), serum glutamate oxaloacetate transaminase (SGOT) or aspartate transaminase (AST), creatinine phosphokinase (CPK), alkaline phosphatase (ALP), lactate dehydrogenase (LDH), lipid profile including low density lipoprotein (LDL), VLDL (very low density lipoprotein), triglycerides (TGs), high density lipoprotein (HDL), total cholesterol and antioxidant parameters including Superoxide dismutase (SOD), glutathione (GSH), catalase (CAT), Glutathione peroxidase (GPx), MDA (malondialdehyde) and glutathione reductase (GR) maintains within the normal limits. Cardioprotective activity was evaluated with various methods like isoprenaline induced myocardial necrosis in rats, doxorubicin (DOX) induced cardiotoxicity in albino rats, cyclophosphamide induced oxidative myocardial injury in a rat model, ischemia-reperfusion-induced myocardial infarction in albino rats.

Phytoconstituents likes carotenoids, triterpenes, flavonoids, cardiac glycosides, alkaloids, saponins, polyphenols, terpenoids, fatty acids were responsible for cardio-protective activity<sup>[7]</sup>.

### **HERBS USED FOR CARDIOPROTECTIVE ACTIVITY**

1. *Azadirachta indica*
2. *Artocarpus heterophyllus*
3. *Bacopa monnieri*
4. *Curcuma longa*
5. *Hydrophila auriculata*
6. *Nigella sativa*
7. *Ocimum basilicum*

8. *Pongamia pinnata*

9. *Terminalia arjuna*

10. *Withania somnifera*

S.No.	Botanical Name	Common Name	Phyto-constituents	Biological Activity
1	<i>Azadirachta indica</i>	Neem tree, Margosa tree.	Terpinoid, Flavonoids, Azadirachtin (ABDH), Azadradione, nimbozin, nimbozide, nimbinene, desacetyl nimbin, azadirone, salanin	Antioxidant activity, Anti inflammatory <sup>[8]</sup> .
2.	<i>Artocarpus heterophyllus</i>	Jack fruit.	Ethylacetate, Flavonoids, Sterols, Proteins, Tannins, Phenolic compounds	Antioxidant, Anti- inflammatory, hyperglycemia <sup>[9]</sup> .
3.	<i>Bacopa monnieri</i>	Theme leaved gratiola	Brahmine, herpestine, betulinic acid, stigmastenol, bacosides A & B.	Anti oxidant activity, Anti depression activity, , anti convulsant, analgesic <sup>[10]</sup> .
4.	<i>Cucuma longa</i>	Turmeric.	Curcumin	Antioxidant, Anti inflammatory, anti diabetic <sup>[11]</sup> .
5.	<i>Hydrophila auriculata</i>	Long – leaved barieria	Flavonoids, Tannins, Glycosides, Anti-oxidants.	Antioxidant, Hypoglycemic <sup>[12]</sup> .
6.	<i>Nigella sativa</i>	Black cumin	Alkaloids (pyrozol), Saponins, Carbacvol, Carvone, Thymol, Myristic acid, Anti-oxidants	Antioxidant, Antihypertensive effect, Immunomodulator <sup>[13]</sup> .
7.	<i>Ocimum basilicum</i>	Sweet basil	contains phenolic compound 5.36% (galic acid), flavnoids 1.86%, rosemarinic acid 15.74%	Anti oxidant, hypolipidemic, Immunomodulator <sup>[14]</sup> .
8.	<i>Pongamia pinnata</i>	Indian beech.	Flavonoids, Carotenoids, Triterpenes, Cardiac glycosides, Alkaloids, Saponins, Polyphenols, terpenoids	Antioxidant, Antilipid peroxidation effect, hypolipidemic, hypoglycemic <sup>[15]</sup> .
9.	<i>Terminalia arjuna</i>	Arjun.	Polyphenols, Anti- oxidants, Myricetin, Flavonoids (quercetin,kaempferol)	Antioxidant, Anti stress effect, hypolipidimic,hypocholesterolaemic effect <sup>[16]</sup> .
10.	<i>Withania somnifera</i>	Winter cherry	WithaferinA, Sitoindosides, Withanolides	Antioxidant,Anti stress, Anti inflammatory, Anti hyperglycemic <sup>[17]</sup> .

**1. *Azadirachta indica***



Common Name: Neem tree, Margosa tree.

Tamil Name: *Vembu, Veppu*.

Family: Meliaceae.

Distribution: Throughout India in deciduous forest, also widely cultivated.

Parts used: Bark, Leaves, Flowers, Seed oil.

Descriptions: Medium to large sized plant 15 – 20 m in height having greyish to dark grey tubercled bark. Flowers are cream or yellowish white in axillary panicles.

Properties and Uses: It is bitter, astringent, acrid, tonic. It is useful in conditions like skin diseases, anthelmintic, intestinal demulcent, antiperiodic, tuberculosis<sup>[18]</sup>.

The leaf extracts *A.indica* contains terpenoid, flavonoids, azadirachtin (ABDH), azadiradione, nimbin, nimbolide, nimbinene, desacetyl nimbin, azadirone, salanim. The leaf extracts of *A.indica* 600 mg/kg body weight stabilized the lipid profile. It reduced the LPO indices and increased the improvement of GSH content, and restoration of anti-oxidant enzymes and posses a Cardioprotective activity in cardiotoxin streptozoin induced rats<sup>[19]</sup>.

2. *Artocarpus heterophyllus*



Common Name: Jack fruit.

Tamil Name: *Pala, Palau*.

Family: Moraceae.

Distribution: Throughout India.

Parts used: Roots, Leaves, Fruits, Seeds, Wood, Latex.

Descriptions: A large monoecious evergreen tree with 18 – 25 m in height, bark black mottled with green.

Properties and uses: It has acrid, carminative, tonic, diuretic, aphrodisiac, nervine, sedative<sup>[20]</sup>.

The leaf extracts of *A.heterophyllus* contains ethyl acetate, flavonoids, sterols, proteins, tannins, phenolic compounds possess a potential Cardioprotective activity on the lactose induced arrhythmia in cladoceran<sup>[21]</sup>.

**3. *Bacopa monnieri***



Common Name: Thyme leaved gratiola.

Tamil Name: *Nirpirami, Piramiyapundu.*

Family: Scrophulariaceae.

Distribution: Throughout in India in wet places.

Parts used: Whole plant.

Descriptions: A prostate or creeping, juicy, annual herb.

Properties and Uses: It is astringent, tonic, bitter, laxative, carminative, cardiotonic, diuretic, broncho dialator. It is useful in epilepsy, leprosy, syphilis, elephantiasis<sup>[22]</sup>.

The hydroalcoholic extracts, contains Bacosides A and B with 150 mg/kg of *B.monnieriproduces a maximum Cardioprotection by significant restoration of endogenous anti-oxidants in cardiotoxin streptozoin induced rats*<sup>[23]</sup>.

**4. *Curcuma longa***



Common Name: Turmeric.

Tamil Name: *Manjal*.

Family: Zingiberaceae.

Distribution: Cultivated throughout India.

Parts used: Rhizomes.

Descriptions: A perennial herb, 60 – 90 cm in height, with short stem and erect leaves.

Properties and Uses: It is bitter, acrid, tonic, stimulant, anti-inflammatory, diuretic, haematinic. It is useful in inflammations, ulcer, dropsy, splenomegaly<sup>[24]</sup>.

The hydroalcoholic extracts of *C. longa* contain curcumin, which have anti-oxidant and Cardioprotective activity<sup>[25]</sup>

**5. *Hydrophila auriculata***



Common Name: Long-leaved barleria.

Tamil Name: *Neermulli*.

Family: Acanthaceae.

Distribution: Throughout India, in plains, marshy places, rice fields, margins of tank and canals.

Parts used: Roots, Leaves, Seed.

Descriptions: A semi wood, annual with numerous fasciculate sub- quadrangular stem.

Properties and Uses: It is sweet, sour, bitter, tonic, diuretic, anti-inflammatory. It is useful in treating ascites, jaundice, arthralgia<sup>[26]</sup>.

The methanolic extracts of *H.ariculata* leaves contains flavonoids, tannins, glycosides, anti-oxidants shows a potent Cardioprotective activity against doxorubicin cardiotoxicity in rats<sup>[27]</sup>.

#### **6. *Nigella sativa***



Common Name : Black cumin.

Tamil Name: *Karumciragam*.

Family: Ranunculaceae.

Distribution: In Punjab, Bihar, often cultivated.

Parts used: Seeds.

Descriptions: A pretty small herb, 30-60 cm in height.

Properties and Uses: It is acrid, bitter, tonic, stimulant, anti-inflammatory, It is useful in treating diseases such as hemorrhoids, paralysis, inflammation<sup>[28]</sup>.

The seeds extracts of *N.sativa* contains thymoquinone which reduces the lipid level, flavonoids inhibit the cholesterol synthesis, alkaloids (pyrazole), saponins, carbachol, carvone, thymol, myristic acid, anti-oxidants shows a potent Cardioprotective activity against cardiotoxin induced in rats<sup>[29]</sup>.

### **7. *Ocimum basilicum***



Common Name: Sweet basil.

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Tamil Name: *Tirunittru, Tiruniruppaccai*.

Family: Lamiaceae.

Distribution: Cultivated throughout India.

Parts used: Whole plant.

Descriptions: An erect, aromatic, glabrous branching herb, 60- 90 cm in height.

Properties and Uses: It is bitter, stimulant, acrid, carminative, anti-inflammatory, diuretic. It is useful in treating cardiac debility, spasmodic affections, arthralgia<sup>[30]</sup>.

The plant extracts of *O.basilicum* contains phenolic compound 5.36% (gallic acid), flavonoids 1.86%, rosmarinic acid 15.74% shows a potent Cardioprotective activity against cardiotoxin isoproterenol in rats<sup>[31]</sup>.

8. *Pongamia pinnata*



Common Name: Indian beech.

Tamil Name: *Ponka, Punkumaram*.

Family: Fabaceae.

Distribution: Throughout India, in Tidal and beech forest.

Parts used: Root, Bark, Leaves, Flowers, Seeds.

Descriptions: A medium sized semi-evergreen glabrous tree with 18 cm height.

Properties and Uses: It is bitter, tonic, acrid, anthelmintic, carminative. It is useful in treating hemorrhoids, anemia, beriberi.<sup>[32]</sup>

The hydroalcoholic leaf extracts of *P. pinnata* contains flavonoids, carotenoids, triterpenes, cardiac glycosides, alkaloids, saponins, polyphenols, terpenoids are responsible for Cardioprotective activity against experimentally induced cardiotoxin in Wistar albino rats<sup>[33]</sup>.

**9. *Terminalia arjuna***



Common Name: Arjun.

Tamil Name: *Attrumarutu, Venmarutu, Vellaimarutu, Marutu.*

Family: Combretaceae.

Distribution: Throughout India.

Parts used: Bark.

Descriptions: A large evergreen tree with buttressed trunk.



Properties and Uses: It is sweet, astringent, acrid, cardiotonic, styptic, tonic. It is useful in treating cardiomyopathy, hypertension, cirrhosis of liver<sup>[34]</sup>.

The bark extracts of *T. arjuna* contains polyphenols, anti-oxidants, myricetin, flavonoids (quercetin, kaempferol) posses a potential Cardioprotective activity<sup>[35]</sup>.

**10. *Withania somnifera***



Common Name: Winter cherry.

Tamil Name: *Amukkira, Amukkirakkilangu*

Family: Solanaceae.

Distribution: Throughout the drier parts of India. Particularly in waste places.

Parts used: Roots, Leaves.



Descriptions: An erect branching undershrub with 150 cm in height.

Properties and Uses: It is bitter, acrid, stimulant, tonic, diuretic. It is good for tissue building, ulcers<sup>[36]</sup>.

The plant extracts of *W. somnifera* contains withaferin A, sitoindosides , withanolides with 25-50 mg/kg shows a potent Cardioprotective activity against isoproterenol induced cardiotoxin in rats<sup>[37]</sup>.

**CONCLUSION:**

Cardiac diseases are the leading cause of death worldwide. This review is to prove that the Siddha system of medicine with its medicinal plants compile a detailed outline of some Cardioprotective plants. Secondary metabolites like carotenoids, triterpenes, flavonoids, cardiac glycosides, alkaloids, saponins, polyphenols, terpenoids, fatty acids are responsible for cardio-protective activity. The various chemical constituents present in the above Cardioprotective herbs will give the fingerprints for the clinical research. Hence the review plays an important role in reducing mortality rate due to cardiac diseases.

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