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REVIEW ARTICLE

ETHNOMEDICAL PROFILES OF DIFFERENT PLANT PARTS OF *CATHARANTHUS ROSEUS* L. - A REVIEW

Running Title: A Review on *Catharanthus Roseus* L.

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ABSTRACT

Ethnopharmacological knowledge is based on traditional and conceptual base but lack documentation and scientific evidences. Researchers are blending traditional knowledge with experimental methodology for testing efficacy and safety of these herbal remedies. *Catharanthus roseus* L. (Nayantara locally) is an important medicinal plant for novel pharmaceuticals belongings to the family of Apocynaceae found all over Bangladesh. It has long been used in different systems of medicine in the treatment of cancer, diabetics, high blood pressure**,** anti-inflammatory, dysentery, brain stimulatory actions, anti-angiogenesis effects, anti-malarial also potent anti-microbial activities. However, the present comprehensive review deals with the enormous amount of scientific research and reports available in different aspects of this plant involving phytochemistry, traditional usages and pharmacology.

KEYWORDS: *Catharanthus roseus,* phytochemistry, traditional usages, pharmacology.

INTRODUCTION:

Plants have been used in the preparation of traditional medicine for a long time and most of these folk medicines were prepared from locally grown wild plants. Knowledge about the uses of plants was compiled by trial and error and passed down from one generation to another orally. Nowadays, world markets are turning to plants as the sources of ingredients in healthcare products. It offer alternative remedies with tremendous opportunities to generate income, employment and foreign exchange for developing countries (1). Many traditional healing herbs and their parts have been shown to have medicinal value and can be used to prevent, alleviate or cure several human diseases (2).

Herbal drugs constitute a major part in all traditional system of medicines. It is a triumph of popular therapeutic diversity. In developing countries, it is estimated that about 80% of the population rely on traditional medicine for their primary health care (3). Most of the pathogens causing enteric infections have developed resistance to the commonly prescribed antibiotics. Bacterial resistance to antibiotics increases mortality, likelihood of hospitalization and the length of stay in the hospital (4). Therefore, the research and reviews for new and effective anti-microbial agents with broad-spectrum of activity from natural sources is increasing day by day (5,6,7).

Catharanthus roseus Linn. is a species of the genus *Catharanthus* in the family Apocynaceae that is used in many herbal medicines preparation. It is found all over the world. All parts of this plant are used for different medical purposes. It has been reported to possess anticancer (8), antidiabetic (flowers and leaves) (9), hypolipidemic (10), antioxidant (11) and also used in alzheimer's disease (12). The main active constituents present in this plant are alkaloid (8), flavonoid, (13) and steroid (14).

In the present scenario, traditional knowledge system in our country is fast eroding and there is an urgent need to inventoried, record all ethnobotanical and cultural information among the diverse ethnic communities before the traditional cultures are completely lost. Therefore, documentation of information on ethnomedicinal uses will help in conserving the knowledge. A comprehensive database of the plants used for various purposes could be saved for the forthcoming generations. The present review was carried out on different plant parts of *C. roseus* (Root, stem, leaf and whole plant) to evaluate its traditional uses with scientific evidences.

TAXONOMY OF *C. ROSEUS* L.:

Medicinal plants are classified according to the part used, habit, habitat, therapeutic value etc., besides the usual botanical classification. But the botanical classification is the most comprehensive and scientific classification. The botanical classification of *C. roseus* L. is as following:

Kingdom	Plantae
Phylum	Magnoliophyta
Class	Magnoliopsida
Order	Gentianales
Family	Apocynaceae
Genus	*Catharanthus*
Species	*C. roseus*
Binomial name	*Catharanthus roseus* L.

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PLANT PARTS USED:

Aerial part, leaf, flower, stem, seed and root.

MONOGRAPH:

Bengali name: Nayantara
English name: Cape periwinkle, old-maid
Scientific name: *Catharanthus roseus*
Family: Apocynaceae
Duration: Perennial or annual
Growth habit: Herb
Bangladesh nativity: Native.

MORPHOLOGY:

It is an evergreen sub shrub or herb plant growing to 1 m tall. The leaves are oval to oblong, 2.5-9 cm long and 1-3.5 cm broad, glossy green, hairless with a pale midrib and a short petiole 1-1.8 cm long. The flowers are white to dark pink with a darker red centre, with a basal tube 2.5-3 cm long and a corolla 2-5 cm diameter with five petal-like lobes. The fruit is a pair of follicles 2-4 cm long and 3 mm broad (15, 16).

DISTRIBUTION:

It is native and endemic to Madagascar. It is also however widely cultivated and is naturalized in subtropical and tropical areas of the world (15).

PHYTOCHEMISTRY:

The plant *C. roseus* is found to contain various chemical constituents. The major constituents of various plant parts are shown in Table1.

Table 1: Chemical constituent of *C. roseus*

Parts used	Constituents	References
Stem	Alkaloid, carbohydrate, flavonoid, tannin, steroid	(17)
Whole plant	Vinblastine and vincristine, catharanthine and vindoline, monoterpenoid glycoside, steroid, phenolic, flavonoid and 7-O-methylated anthocyanin	(18, 19, 20, 21, 22)
Flower	Alkaloid, carbohydrate, saponin, flavonoid, tannin, steroid	(17)
Root	Alkaloid, carbohydrate, saponin, flavonoid, tannin, steroid, triterpenoid, ajmalicine and serpentine	(18, 17)
Leaf	Alkaloid, vinblastine and vincristine, carbohydrate, saponin, flavonoid, tannin, steroid, triterpenoid, chlorogenic acid, loganic acid, secologanin and vindoline.	(23, 17, 22)

FOLK REMEDIES AND TRADITIONAL USES:

It is a very popular herb amongst practitioners of traditional medicine and the herb is widely used in traditional medicine to treat a variety of diseased Conditions including asthma, coughs, diarrhea and dysentery. Various traditional uses of *C. roseus* are mentioned in Table 2.

Table 2: Folk remedies and traditional uses of *C. roseus*

Type of use	Symptoms	Part used and method	References
Non-insulin dependent diabetes mellitus	Diabetes	Water decoction of the leaf and/or the whole plant, fresh leaf juice	(24)
Diabetes mellitus	-	-	(25, 26, 21)
High **blood pressure**	-	-	(25)
Infection	-	-	(25)

PHARMACOLOGY:

Following the folk and traditional uses of the plant, it has been investigated scientifically to validate the potential of the plant in cure of variety of ailments. Some of the reported pharmacological activities of *C. roseus* are mentioned in Table 3.

Table 3: Pharmacological activities of *C. roseus*

Pharmacological activity	Plant parts and methods used	Doses	Organisms	References
Antidiabetic	Fresh leaf, flower, leaf powder suspension, methanolic, aqueous extract,	0.5-1.0 ml/kg or 500mg/kg body weight	Normal and alloxan diabetic rabbit, normal and streptozotocin-induced	(27, 24, 26, 28, 29, 30, 31, 32, 33)

	dichloromethane: methanol (1:1) extract		diabetic rat,0 male wistar rat, adult albino rabbit, adult female albino rat of wistar strain	
Hypolipidemic Effects	Ethanolic, petroleum-ether, ethyl acetate* and chloroform extract of leaf	0.5-1.0 ml/kg body weight	Normal and streptozotocin-induced diabetic rat	(28, 29)
Antihyperglycemic activity	Hydroalcoholic extract of flower, leaf*, stem and root, leaf powder, leaf dichloromethane and methanol extract	100-500 mg kg^{-1} for 20 days	Wistar diabetic rat, alloxan-induced hyperglycemic rat, male wistar albino rat	(10, 28, 30, 31, 34)
Hypoglycemic Activity	Hydroalcoholic extract of flower, leaf*, stem and root	100-500 mg kg^{-1}	Rat, fasted normal rats, streptozotocin (STZ) induced diabetic rat	(27, 28, 33)
Anticancer activity	Methanol extract	<15 µg ml^{-1}	Different cell types *in vitro*	(8, 28, 21, 35, 32)
Antioxidant activity	Methanolic leaf extract	-	-	(11, 28, 34)
Wound healing activity	-	-	-	(12, 28)
Vasodilating	-	-	-	(12, 28)
Blood thinning	-	-	-	(12, 28)
Memoryenhancing actions	-	-	-	(12, 28)
Used in Alzheimer's disease	-	-	-	(12, 28)
Hypoglycemia	Leaf juice	0.5-1.0 ml/kg body weight	Rabbit	(24)
Antihypertensive	Root	-	-	(22)
Hypotensive activity	Leaf extract (hydroalcoholic or dichloromethane-methanol)	-	Laboratory animal	(36, 10)
Body weight gain	Whole plant extract	Alloxan (500 mg/kg)	Rat	(31)
Cytotoxic Activity	Water, n-hexane, chloroform* and methanol extract	60 µg ml^{-1}	Human Colorectal Carcinoma Cell Line (HCT 116)	(21)
Antiangiogenesis effects	Crude decoction	200mg ml^{-1} water	-	(21)
Lowering blood glucose levels	Ethanolic, aqueous, dichloromethane* and methanol* extract of leaf and flower	-	Several animal, diabetic rat	(37, 27, 21)
Serum total cholesterol decreasing	Leaf juice	1.0 ml/kg	Rat	(10)

Total triglyceride decreasing	Leaf juice	1.0 ml/kg	Rat	(10)
LDL-cholesterol decreasing	Leaf juice	1.0 ml/kg	Rat	(10)
VLDL-cholesterol decreasing	Leaf juice	-	Rat	(10)
Antibacterial activity	Dichloromethane: methanol (1:1) extract	-	*B. cereus, B. pumilis, B. subtilis, S. aureus, E. faecalis, K. pneumoniae, E. coli*, P. aeruginosa, P. vulgaris, Streptococcus sp., S. thphi*, P. aeuroginosa, K. oxytoca, Proteus mirabilis, S. typhimurium, S. paratyphi,*	(38, 39, 34, 40, 32, 41)
Antihelminthic Activity	Ethanol extract of whole plant	200 mg/ml	Resistant strain of helminth parasite	(35)
Hypotensive, sedative	-	-	-	(35)
Antiviral activities	-	-	-	(38, 34, 32)
Antifungal	-	-	*A. fumigates, C. albicans, P. chrysogenum, A. flavus, A. niger*	(38, 34, 32)
Cytotoxic effects	Aqueous extract of leaf	2.55-2.38 µg/ml	Jurkat cells and normal peripheral blood mononuclear cells (PBMCs)	(42, 32)
Antiinflammatory	-	-	-	(32)
Antimalarial	-	-	-	(32)
Antimitotic	-	-	-	(32)
Anti-hypertensive	-	-	-	(32)
Anti-fertility	-	-	-	(32)
Anti-hypercholesterolemic	-	-	-	(32)
Antimutagenic	-	-	-	(32)
Antidiuretic	-	-	-	(32)
Antispasmodic	-	-	-	(32)
Cardio tonic	-	-	-	(32)
CNS depressant	-	-	-	(32)
Antispermatogenic	-	-	-	(32)
Acute leukemia	-	-	-	(43)
Hodgkin's disease	-	-	-	(43)

Antidiarrheal activity	Ethanolic leaf extract	200 and 500 mg/kg	Wistar rat	(44)
*= Highest activity				

DISCUSSION AND CONCLUSION:

The plant kingdom represents a rich store house of organic compounds, many of which have been used for medicinal and other purpose. There exists a plethora of knowledge, information and benefits of herbal drugs in our ancient literature of Ayurvedic and Unani medicine. In every ethnic group there exists a traditional health care system and they used it as a first and foremost line of defense which is culturally patterned. It is seen from the literature that *C. roseus* is a medicinal plant used a phytomedicine to treat a wide range of health complications like diabetics, cancer, microbial diseases as well as medicinally important chemicals like saponin, flavonoid, vinblastine and vincristine have been reported to be present in various parts of the plant. This plant can be explored further as per its diversity of traditional uses. The present review reveals that the herb Nayantara is used in treating various ailments. It elicits on all the aspects of the herb and throws the attention to set the mind of the researchers to carry out the work for developing its various formulations, which can ultimately be beneficial for the human beings as well as animals.

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REFERENCES:

1. Rawat RBS and Uniyal RC. National Medicinal Plants Board, Committed for overall development of the sector. Agrobios. 2004; 1: 12-17.
2. Dhar U, Rawal RS, Samant SS, Airi S and Upreti J. People's participation in Himalayan biodiversity conservation: a practical approach. Curr. Sci.1999; 76: 36-40.
3. Dash BK, Faruquee HM, Biswas SK, Alam MK, Sisir SM and Prodhan UK. Antibacterial and Antifungal Activities of Several Extracts of *Centella asiatica* L. against Some Human Pathogenic Microbes. Life Sci. Med. Res. Vol 2011: LSMR-35.
4. El-Mahmood MA. Antibacterial activity of crude extracts of *Euphorbia hirta* against some bacteria associated with enteric infections. J. Med. Plants Res. 2009; 3(7): 498-505.
5. Mamun-or-Rashid ANM, Islam MR and Dash BK. *In vitro* Antibacterial Effect of Bushy Matgrass (*Lippia alba* Mill.) Extracts. Res. J. Med. Plant. 2012; 6: 334-340.
6. Sen MK and Dash BK. A review on phytochemical and pharmacological aspects of *Cissus quadrangularis* L. Int. J. Green Pharm. 2012; 6: 169-173.
7. Sen MK, Faruquee HM and Mamun-or-Rashid ANM. Antibacterial Activity of *Cissus quadrangularis* Stem. A Preliminary *In vitro* Effort to Develop Antibiotic. Saarbrucken (Germany): Lap-Lambert Academic Publishing. 2012: 24-27.
8. Jean HR, Jean MN, Gaelle LC, Philippe T, Monique ZH and Louisette LMO. Isolation of indole alkaloids from *Catharanthus roseus* by centrifugal partition chromatography in the p^H-zone refining mode. J. Chromatogr. A.1999; 849: 421-431.
9. Sumana G and Suryawanshi SA. Effect of *Vinca rosea* extracts in treatment of alloxan diabetes in male albino rat. Indian J. Exp. Biol. 2001; 39: 748-759.
10. Antia BS and Okokon JE. Effect of leaf juice of *Catharanthus roseus* Linn. on cholesterol, triglyceride and lipoproteins levels in normal rats. Indian J. Pharmacol. 2005; 37: 401-402.
11. Jaleel CA, Gopi R, Manivannan P, Sankar B, Kishorekumar A and Panneerselvam R. Antioxidant potentials and ajmalicine accumulation in *Catharanthus roseus* after treatment with giberellic acid. Colloids Surfaces B Biointerfaces. 2007; 60: 195-200.
12. Nayak BS, Anderson M and Pereira LMP. Evaluation of wound-healing potential of *Catharanthus roseus* leaf extract in rats. Fitoterapia. 2007; 78: 540-544.
13. Gilles B, Marie GD, Bruno D and Anne MM. A new flavonol glycoside from *Catharanthus roseus*. Phytochem. 1999; 50: 167-169.
14. Akirai S. Brassinosteroid Biosynthesis. Plant Physiol. Biochem. 1999; 37: 351-361.
15. Huxley A. New RHS Dictionary of Gardening. Macmillan. 1992.
16. Frode TS and Medeiros YS. Animal models to test drugs with potential antidiabetic activity. J. Ethanopharamacol. 2008; 115: 173-183.
17. Edwin JE, Sheeja E, Motwani S, Dutt KR and Goel RK. Comparative Evaluation of Antihyperglycaemic and Hypoglycaemic Activity of Various Parts of *Catharanthus roseus* Linn. Res. J. Med. Plant 2008; 2: 10-15.

18. Kulkarni RN, Baskaran K, Chandrashekara RS and Kumar S. "Inheritance of morphological traits of periwinkle mutants with modified contents and yields of leaf and root alkaloids". Plant Breed. 1999; 118(1): 71-74.

19. Williams CA and Grayer RJ. Anthocyanins and other flavonoids. Nat. Prod. Rep. 2004; 21: 539-573.

20. Jaleel CA, Sankar B, Sridharan R and Panneerselvam R. "Soil salinity alters growth, chlorophyll content, and secondary metabolite accumulation in *Catharanthus roseus*," Tur. J. Biol. 2008; 32(2): 79-83.

21. Siddiqui MJ, Ismail Z, Aisha AFA and Abdul Majid AMS. Cytotoxic Activity of *Catharanthus roseus* (Apocynaceae) Crude Extracts and Pure Compounds Against Human Colorectal Carcinoma Cell Line. Int. J. Pharmacol. 2010; 6: 43-47.

22. Guilherme G, Cardoso L, Oliveira H, Santos C, Duarte P and Sottomayor M. Cytogenetic characterization and genome size of the medicinal plant *Catharanthus roseus* L. G. Don. 2012; doi:10.1093/aobpla/pls002.

23. Young HC, Tapias EC, Kim HK, Alfons WML, Cornelis E, Jacobus ThJV, Brzin J and Jana Z. Metabolic Discrimination of *Catharanthus roseus* Leaves Infected by Phytoplasma Using ^{1}H-NMR Spectroscopy and Multivariate Data Analysis**.** Plant Physiol. 2004; 135(4): 2398-2410.

24. Nammi S, Boini MK, Lodagala SD and Behara RBS. The juice of fresh leaves of *Catharanthus roseus* Linn. reduces blood glucose in normal and alloxan diabetic rabbits. *BMC Complement. Alter. Med.* 2003; **3**: 4.

25. Taylor WI and Farnsworth NR. The Catharanthus Alkaloids: Botany, Chemistry, Pharmacology and Clinical Use. 1st Edn., Marcel Dekker Inc., New York, USA. 1975.

26. Mostofa M, Choudhury ME, Hossain MA, Islam MZ, Islam MS and Sumon MH. Antidiabetic effects of *catharanthus roseus*, *azadirachta indica*, *allium Sativum* and glimepride in experimentally diabetic induced rat. Bangl. J. Vet. Med. 2007; 5(1&2): 99-102.

27. Singh SN, Praveen V, Shoba S, Radhey S, Kumria MML, Ranganathan S and Sridharan K. Effect of an antidiabetic extract of *Catharanthus roseus* on enzymic activities in streptozotocin induced diabetic rats. J. Ethnopharmacol. 2001; 76: 269-277.

28. Jarald EE, Sheeja E, Motwani S, Dutt KR and Goel RK. Comparative Evaluation of Antihyperglycaemic and Hypoglycaemic Activity of Various Parts of *Catharanthus roseus* Linn. Res. J. Med. Plant. 2008; 2: 10-15.

29. Islam MA, Akhtar MA, Islam MR., Hossain MS, Alam MK, Wahed MII, Rahman BM, Anisuzzaman ASM, Shaheen SM and Ahmed M. Antidiabetic and Hypolipidemic Effects of Different Fractions of *Catharanthus roseus* (Linn.) on Normal and Streptozotocin-induced Diabetic Rats. J. Sci. Res. 2009; 1(2): 334-344.

30. Karuna R, Ramesh B, Reddy SS and Desireddy S. Antihyperglycemic activity of *Catharanthus roseus* leaf powder in streptozotocin-induced diabetic rats. Pharmacognos. 2010; 2(3): 195-201.

31. Ahmed MF, Kazim SM, Ghori SS, Mehjabeen SS, Ahmed SR, Ali SM and Ibrahim M. Antidiabetic Activity of *Vinca rosea* Extracts in Alloxan-Induced Diabetic Rats. Int. J. Endocrinol. 2010, 2010: 6.

32. Ibrahim M, Mehjabeen SS and Narsu ML. Pharmacological Evaluation of *Catharanthus roseus.* Int. J. Pharm. App. 2011; 2(3): 165-173.

33. Navitha A, Helen SDA, Ramesh C and Banu MS. Hypoglycemic and anti-diabetic activity of ethanolic extract of *Catharanthus pusillus* (murray) G. Don. IOSR J. Pharm. 2012; 2(4): 17-21.

34. Jayanthi M, Sowbala N, Rajalakshmi G, Kanagavalli U and Sivakumar V. Study of anti hyperglycemic effect of *catharanthus roseus* in alloxan Induced diabetic rats. Int. J. Pharm. Pharm. Sci. 2010; 2(4): 114-116.

35. Agarwal S, Simi J, Nikkita C, Saloni B, Ayesha T, Vedamurthy A B, Krishna V and Joy Hoskeri H. Evaluation of *In-vitro* Anthelminthic Activity of *Catharanthus roseus* Extract. Int. J. Pharm. Sci. Drug Res. 2011; 3(3): 211-213.

36. Pillay PP, Nair CPM and Santi Kumari TN. "*Lochnera rosea* as a potential source of hypotensive and other remedies," Bulletin of Research Institute of the University of Kerala. 1959; 1: 51-54.

37. Chattopadhyay RR, Banerjee RN, Sarkar SK, Ganguly S and Basu TK. Anti-inflammatory and acute toxicity studies with leaves of *Vinca rosea* Linn. in experimental animals. Indian J. Physiol. Pharmacol. 1992; 36: 291-292.

38. Marcone A, Ragozzino E and Seemuller. Dodder transmission of alder yellows phytoplasma to the experimental host *Catharanthus roseus* (periwinkle). Forest Pathol. 1997; 27(6): 347-350.

39. Sathiya S, Karthikeyan B, Jaleel CA, Azooz MM and Iqbal M. Antibiogram of *Catharanthus roseus* Extracts. G. J. Mole. Sci. 2008; 3(1): 01-07.

40. Patil PJ and Jai SG. Antimicrobial Activity of *Catharanthus roseus*- A Detailed Study. British J. Pharmacol. Toxicol. 2010; 1(1): 40-44.

41. Govindasamy C and Srinivasan R. In vitro antibacterial activity and phytochemical analysis of Catharanthus

roseus (Linn.) G. Don. Asian Pac. J. Trop. Biomed. 2012: 155-158.

42. Nor HA, Rohanizah AR and Mat I. *Catharanthus roseus* Aqueous Extract is Cytotoxic to Jurkat Leukaemic T-cells but Induces the Proliferation of Normal Peripheral Blood Mononuclear Cells. Trop. Life Sci. Res. 2010; 21(2): 101-113.

43. Verma A, Into L, Seppänen-Laakso T, Aarre H and Marja-Liisa R. A Simplified Procedure for Indole Alkaloid Extraction from *Catharanthus roseus* Combined with a Semi-synthetic Production Process for Vinblastine. Mole. 2007; 12: 1307-1315.

44. Hassan KA, Brenda AT, Patrick V and Patrick OE. *In vivo* antidiarrheal activity of the ethanolic leaf extract of *Catharanthus roseus* Linn. (Apocyanaceae) in Wistar rats. Afr. J. Pharm. Pharmacol. 2011; 5(15): 1797-1800