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Phytochemical and pharmacological aspect of *Amaranthus Tricolor* linn Review

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ABSTRACT

Mother Nature has bestowed us with a wide range of flora and fauna which are being used in various systems of medicine to treat various deadly diseases with their own mechanism or the components responsible for healing. *Amaranthus tricolor* (Family-Amaranthaceae) purple red colour leafy vegetable consumed as nutraceutical herb. It has wide distribution in India and it is a promising crop with high nutraceutical value of whole plants rich in proteins and micronutrients such as iron, calcium, zinc, vitamin C and vitamin *Amaranthus tricolor* is known as laalsaag or tandaljohaji in various part of india. The plant traditionally used as alexiteric , laxative and used in the treatment of piles and blood disorders , stomachic appetizer, toothache antipyretic, dysentery, astringent, diuretic, Haemorrhagic colitis and Hepato-protective agent. Carbohydrates, protiens, Aminoacids, steroids, cardiac glycosides, alkaloids, tannins, and Flavonoids phychochemicals was found in *Amaranthus tricolor L*. The Presence of tannins and flavanoids exhibited various biological activities such as antibacterial, antifungal, antioxidant, anthelmintic and Other pharmacological activities such as antinociceptive, anti-inflammatory, Antihyperglycemic, Antiproliferative, Cyclooxygenase Enzyme Inhibitory, Gastric antisecretory, cytoprotective,Hypolipidemic and Antiviral/ribosome inactivating protein.

Keywords: Amaranthustricolor l, Amaranthaceae, laalshaak, Hepatoprotective, Gastric Antisecretory, Cytoprotective, Hypolipidemic, Cyclooxygenase Enzyme Inhibitory, Flavonoids, tannins, antibacterial, antifungal, antioxidant

INTRODUCTION

Amaranthus tricolor linn plant commonly known as Lalshaak, tandalijo or tandaljohaji. In telgu and Andhara commonly known as peruguthotakura” is an plant belonging to the family Amaranthcea. It is annual erect stem stout, diffuse herb Attaining 1-2 m high, usually much

branched.[1] roots having tap root shape cylindrical, yellow in colour with roots lets. stem purplish pink with ridges and furrows, fracture, short, leaf simple 4-11 cm long, 2 – 8 cm wide very variable in shape. rhomboid, ovate, lanceolate, obtuse apex, petiolate, membranous and purplish pink seed 1.5 mm in diameter biconvex, smooth, shiny black coloured[2] infloresence an axillary,

globose cluster upto 2.5 cm in diameter, the upper cluster sometimes forming a terminal spike with male and female flower intermixed : brown or shiny black seed faintly reticulate. *Amaranthustricolor L* have excellent nutritional value because of their higher essential micronutrients such as iron, calcium, zinc, vitamin C and vitamin A [3]. the plant is alexiteric, laxative and used in the treatment of piles and blood disorders, stomachic appetizer, toothache antipyretic, dysentery, astringent, diuretic, Haemorrhagic colitis and Hepato-protective agent[4] The plant is well known for its purple Betalin pigments. Such as Amaranthine and

Isoamaranthine[5]. A water-soluble polysaccharide (PS-I), Found in extract of the stems of *Amaranthus tricolor* Linn. (*Amaranthus gangeticus* L.)[6]. Carbohydrates, proteins, Aminoacids, steroids, cardiac glycosides, alkaloids, tannins, and Flavanoids phytochemicals was found in *Amaranthus tricolor L*. The Presence of tannins and flavonoids exhibited various biological activities such as antibacterial, antifungal, antioxidant and anthelmintic[7]. Highest expected genetic variability in *Amaranthus tricolor L*. (vegetable Amaranth) was noticed for ascorbic acid (55.48%), followed by foliage Yield (48.30%) and leaf size (29.51%)[8].



TAXONOMIC CLASSIFICATION

Kingdom: plantae - plants
Sub kingdom: tracheobionta - vascular plants
Super division: spermatophyte - seed plant
Division: magnoliophyta - flowering plants
Class: magnoliopsida - dicotyledons
Sub class: caryophyllidae
Order: caryophyllales
Family: amaranthaceae - amaranth family
Genus: amaranthus l –pigweed p
Species: amaranthus tricolor l- joseph coat.

SYNONYMS

A. gangeticus Linn. ,
A. Melancholicus Linn.,
A. Polygamous Linn,

Hook. F. A. tristis Linn.

Family: Amranthacea

BOTANICAL DESCRIPTION

It is an annual erect, Diffuse, Stem stout herb, Found throughout the india as cultivated ,attaning 1.2 m high or more in cultivation, usually much branched.Branches angular glabrous. Infloresence a head,axillary and terminal. Fruit circumscissile below the middle, Ovoid, 1.5 mm long, Seeds avoid1.5mm in diameter, shinning brown smooth lenticular. Roots having tap root, shape cylindrical, yellow in colour, with rootlets. Stem purplish pink cylindrical with longitudinal ridges and furrows, fracture, short. Leaf Simple, 5-12 cm long, 2.5-7 cm wide, very variable in shape , rhomboid, ovate,

Lanceolate, memberanous with perianth, sepals 3, pinkish white, stamens three, anthers dorsifixed. Seed is 1.5 mm in diameter, biconvex, smoothy, shiny, black coloured [9].

CHEMICAL CONSTITUENT

Amaranthus tricolor l. Plant possess large numbers of chemical constituents which show various biological activity. The betalins pigments are betacyanins and Betaxanthin. Are the major pigments present in *Amaranthus tricolor l.* and glycosylated flavonoids (kaempferol and quercetin)[10]. *Amaranthus tricolor l.* leaf posses pigments, Such as Chlorophyll a(Chl a), Chlorophyll b(Chl b), Chlorophyll a/b(Chl a/b), Carotenoid(Ctn), Betacyanins[eg.betainin], Betaxanthine[eg.indicaxanthin], Betalains(B) and Total phenolic content: Hydroxybenzoic acids - Gallic acid (3,4-5Trihydroxybenzoic acid), vanilic acid (4-Hydroxy-3-methoxybenzoic acid), Syringic acid (4-Hydroxy-3,5-dimethoxybenzoic acid), p-hydroxybenzoic acid (4-hydroxybenzoic acid), Salicylic acid(2-Hydroxybenzoic acid), Ellagic acid (2,3,7,8-tetrahydroxy-chromeno) - [5,4,3-cde]chromene-5,10-dione], benzoic acids. Hydroxycinnamic acids - Caffeicacid(3,4-dihydroxy-trans-cinnamate), Chlorogenic acids(3,4-[dihydroxycinnamoyl]quinic acid), P-Coumarin acid(4- hydroxycinnamic acid), M-Coumaric acid (3-hydroxycinnamic acid). Flavanoids – Isoquercitin (quercetin-3-glucoside), Rutin (quercetin-3-rutinoside), Isorhamnetin, Kaempferol, quercitin [11]. Betalains are immonium derivatives of betalamic acid [4-(2-oxoethylidene)-1, 2, 3, 4tetrahydropyridine-2, [6-di carboxylic acid]. The plant is well known for its purple Betalin pigments. Such as amaranthine and isoamaranthine[12]. Amaranth L. had Calcium, Iron, Magnesium, Pottasium, Zinc, Protien and Vitamin C, A [13], [14].The fatty acids and sterols are present in *amaranthus tricolor L.* The major unsaturated fatty acid in the seeds and stems was linoleic acid, in leaves it was linolenic. The major saturated fatty acids found in seeds, stems and leaves was palmitic acid. Linolenic, lignoceric and arachidic present in trace amounts, sterols and Spinasterol was present in highest amount and 24-methylenecycloartenol was found in the seeds only [15].

TRADITIONAL USES

The whole plant is traditionally used as an astringent [16]. *Amaranthus tricolor l.* is one of the traditional medicines used in many folk claims and the plant has been extensively used in ayurveda and Sidda for treating menorrhagia, diarrhea, dysentery, haemorrhages, cough and bronchitis. It is also used externally as an emollient poultice or a mouth wash to treat ulcerated conditions of the throat and mouth [17].This plant is also used for variety of treatments for various ailments like Coughs, throat infections, toothache, eczema, piles, diarrhea, gonorrhea, leucorrhoea and impotence [18]. Whole plants are used by folk medicinal practitioners of Bangladesh for treatment of pain, anaemia, skin diseases, diabetes, and as a blood purifiers. The root decoction of *Amaranthus tricolor l.* along with *Cucurbitamoschata* is used to control haemorrhage following abortion [19].The plant Decoction is taken internally to strengthen the liver and improve vision. Traditionally root-paste mixed with warm water, when given internally, induces vomiting and purges out toxic matter from bowel. Powdered root is effective in onychia. Root-paste in Combination with honey and rice water is useful in Leucorrhea [20]. The leaves and Young stems may be used as salad and cooked as a leafy vegetable. Scientific Study on the plant suggests that it may inhibit calcium retention [21].The plant possesses hepatoprotective activity [22].

PHARMACOLOGICAL ACTIVITY

Antimicrobial activity

Pulipati Set al., Gonzalez CMet al. and Pulipati Set al. reported that it was possess antibacterial activity against various pathogens. The *Amaranthus tricolor l.* leaf extract was found to contain some bioactive compounds with potential antibacterial activity against urinary tract pathogens [23]. Bacterial infections are the most serious problem regarding premature death. Urinarytract infection (UTI) it is the second most common infectious disease in the community practice World Wide [24]. The phytochemicals analysis revealed the presence of various phytoconstituents such as Aminoacids, cardiac glycosides, alkaloids, steroids, flavonoids and tannins. The biological activities such as antimicrobial and anthelmintic activities exhibited by plants are due to the presence of

phytoconstituents tannins, steroids, and Flavonoids.[25]

Hepatoprotective activity

Wolf P Let al., Sharma S K et al., and Aneja, M. Vatset al. studied Liver regulates many important metabolic functions, and any injury causes distortion of these metabolic functions [26]. Liver-protective herbal drugs contain a variety of constituents like phenols, coumarins, lignans, essential oil, monoterpenes, carotenoids, glycosides, flavanoids, organic acids, lipids, alkaloids, and xanthenes derivatives. Extracts of about 25 different plants have been reported to cure liver [27]. The *Amaranthus tricolor* root possess hepatoprotective activity [28].

Antinociceptive – Antiinflammatory and Antihyperglycemic activity

M. Rahmatullah et al. and Gopal V. Bihani et al. studied that the *Diabetes* mellitus and pain are two afflictions which affect millions of people in the world on a daily basis. Allopathic medicine has no total cure for diabetes mellitus and pain. *Amaranthus tricolor L.* is a promising plant for prove their effectiveness against diabetes and pain without adverse side-effects. The methanolic whole plant extract of *Amaranthus tricolor L.* exhibited significant and dose-dependent lowering of serum glucose levels in glucose-loaded mice in oral glucose tolerance (Antihyperglycaemic) tests. In antinociceptive activity tests, the extract also exhibited dose-dependent and significant reductions in the number of writhings induced by intraperitoneal administration of acetic acid in mice [29], [30].

Antiproliferative activity and Cyclooxygenase Enzyme Inhibitory activity

Jayaprakasam, B et al. reported *Amaranthus tricolor L.* is consumed as a vegetable in Asia. Isolation of leaves and stems of *A. tricolor* yielded three galactosyldiacylglycerols (1–3) with potent cyclooxygenase and human tumor cell growth inhibitory activities. The galactosyldiacylglycerols 1–3 inhibited the cyclooxygenase-1 (COX-1) enzyme by 78, 63, and 93% and the cyclooxygenase-2 (COX-2) enzyme by 87, 74, and 95%, respectively. These compounds were tested for antiproliferative activity using human AGS (gastric), CNS (central nervous system; SF-268),

HCT-116 (colon), NCI-H460 (lung), and MCF-7 (breast) cancer cell lines. Compound 1 inhibited the growth of AGS, SF-268, HCT-116, NCI-H460, and MCF-7 tumor cell lines with IC₅₀ values of 49.1, 71.8, 42.8, 62.5, and 39.2 µg/mL. For AGS, HCT-116, and MCF-7 tumor cell lines, the IC₅₀ values of compounds 2 and 3 were 74.3, 71.3, and 58.7 µg/mL and 83.4, 73.1, and 85.4, [31].

Gastric antisecretory and cytoprotective activity

Devaraj, V. C et al. studied The effects of *Amaranthus tricolor L.* leaves extract on gastric secretion and the effect of gastric cytoprotection were evaluated using five different models of gastric ulcers: acetic acid-induced, pylorus ligation-induced, ethanol-induced, indomethacin-induced and ischemia-reperfusion-induced gastric ulcers. The different extracts, namely, ethanolic extract (EAT), petroleum ether extract (PEAT), chloroform extract (CAT) and ethyl acetate extract (EAAT). The EAT and EAAT showed gastric ulcer-healing effect in acetic acid-induced chronic gastric ulcers. The leaf extracts of *A. tricolor* are found to possess very good antiulcer property in gastric ulcers which is consistent with the literature report in folk medicine [32].

Hematological, Hypoglycemic, Hypolipidemic and Antioxidant Activity

A. Colaco E Clemente et al, Xueqing Let al, Choi, C. Wet al, Ozsoy, Net al. studied the *Amaranthus tricolor L.* useful in the management of Hyperglycemia and associated lipidemia. The plant also used as a food supplement and for the management of the overall health status of diabetic patients. *A. tricolor* is not only hypoglycemic but also a Weight-enhancing agent and antioxidant. Normally, diabetic animal and patient exhibit a decrease in body weight, due to loss of fluid from the body or loss of tissue mass. On treatment with the *A. tricolor L.*, the weight remained almost constant in the diabetic animals, it also show very high free radical scavenging activity and it's significantly reduced Cholesterol, triglyceride and LDL level and increase HDL level. Tannic acid, a major component of tannins, has capacity to decrease blood glucose level, by stimulating glucose transport while inhibiting adipogenesis [33], [34]. Antioxidant is an important property which possess the ability of protecting organisms

from damage caused by free radical-induced oxidative stress [35]. The antioxidant activity of phenolics is because of their redox property that allows them to act as hydrogen donors, reducing agents, metal chelators and single oxygen quenchers [36]. Flavonoids are also known for their free-radical scavenging and antioxidant activities.

Antiviral/ribosome inactivating protein from *Amaranthus tricolor* Leaves

Roy S, Sadhana *et al.* reported that *An* antiviral protein (AVP), imparting high level of resistance against sunnhemp rosette virus (SRV) was purified from the dried leaves of *Amaranthus tricolor*. The purified protein exhibited approximately 98% inhibition of local lesion formation at a concentration range of Approximately 30 µg/ml. The protein was found to be highly basic

glycoprotein monomer, with neutral sugar content of 4%. The purified protein exhibited N-glycosidase and RNase activities, also isolated full-length cDNA clone, encoding this protein designated as *A. tricolor* antiviral protein-1. Two primers, one designed on the basis of N-terminal sequence of the purified protein and the other from the conserved active peptides of other AVPs/RIPs were used for PCR amplification of double stranded cDNA, isolated from the leaves of *A. tricolor*. The amplified fragment was used as a probe for library screening. The isolated full-length cDNA consisted of 1058 nucleotides with an open reading frame encoding a polypeptide of 297 amino acids. The deduced amino acid sequence of AAP-1 has a putative active domain conserved in other AVPs/RIPs and shows varying homology to the RIPs from other plant species [37].

REFERENCE

- [1]. A.H.M. MahbubRahman*, M. iffatAraGulshana. Taxonomy and Medical uses of Amaranthaceae family of rajshahi, Bangladesh. Applied ecology and Environmental Science 2014 Reads 878.
- [2]. Srivastava R. review on phyto-pharmacological and pharmacognostical profile of *Amaranthus tricolor*: A herb of nutraceutical potentials. The pharama innovation journal 6(6), 2017, 124-129.
- [3]. Enoch G, Achigan-Dako Olga ED, SogbohossouPM. Current knowledge on *Amaranthus* spp.: research avenues for improved nutritional value and yield in leafy in sub-Saharan Africa. Euphytica 014, 2014, 1081-9.
- [4]. Pramanik P, Bhattacharjee R, Bhattacharyya S. Evaluation of *in vitro* Antioxidant Potential of Red Amaranth (*Amaranthus tricolor*) and Green Amaranth (*Amaranthus viridis*) leaves extracted at different temperatures and pH. Annals of Biological Sciences 2(4), 2014, 26-32.
- [5]. Jerz G, Arrey TN, Wray V, Du Q, Winterhalter P. Structural Characterization of 132-Hydroxy(132-S) – phaeophytin –a from leaves and stem of *Amaranthus tricolor* isolated by high speed countercurrent chromatography. Innovate food SciEmerg Tech 8(3), 2007, 413-418.
- [6]. RamsankarSarkar, Chanchal, K. Nandan, SoumitraMandal, PradipPatra, Debsankar Das, Syed S. Islam. Structural characterization of a heteropolysaccharide isolated from hot water extract of the stems of *Amaranthus tricolor* Linn. (*Amaranthus gangeticus* L.). Elsevier Carbohydrate Research 344(17), 2009, 2412-2416
- [7]. SowjanyaPulipati*. P SrinivasaBabu, U Naveena, S K RafeekaParveen, S K SumayaNausheen, M Tanmai Naga Sai. Determination of Total Phenolic, Tannins, Flavonoids Contents and Evaluation of Antioxidant Property of *Amaranthus tricolor* (L) International Journal of Pharmacognosy and Phytochemical Research 9(6), 2017, 814-819
- [8]. S. Shukla*, A. Bhargava, A. Chatterjee, A. Srivastava and S.p. Singh. Genotypic Variability in Vegetable Amaranth (*Amaranthus tricolor* L.) for Foliage Yield and its Contributing traits Over Successive Cuttings and Years. Euphytica 151, 2006, 103-110.
- [9]. Grubben, G.J.H., 2004. *Amaranthus tricolor* l. [Internet] Record from PROTA4U. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands.
- [10]. S. Das, S S. Gauri, B. Biswas Mishra, S. Dey. Purification and characterization of a betanin glucosyltransferase from *Amaranthus tricolor* l. catalyzing non-specific biotransformation of Flavonoids Plant Science · July 2013 with 487 Reads

- [11]. U. K. Salma Khanam, S. Oba. Bioactive Substances in Leaves of Two Amaranth Species, *Amaranthus Tricolor* and *A. Hypochondriacus*. *Can J. Plant Sci.* 93, 2013, 47-58.
- [12]. M. Graca Miguel. Betalains in Some Species of the Amaranthaceae Family: A Review. *Antioxidants* 2018, 7, 53.
- [13]. N. AlielKachiguma, W. Mwase, M. Maliro, A. Damaliphetsa. Chemical and Mineral Composition of Amaranth (*Amaranthus L.*). *Journal of Food Research*; Vol. 4, No. 4; 2015
- [14]. S. Shukla, A. Bhargava, A. Chatterjee, J. Srivastava, N. Singh, S. P. Singh. Mineral Profile and Variability in Vegetable Amaranth (*Amaranthus tricolor*). *Plant Foods for Human Nutrition*, 61(1), 2006, 21–26|
- [15]. T. Fernando, G. Bean. Fatty acids and sterols of *Amaranthus tricolor L.* *Science Direct Food Chemistry* 15(3), 1984, 233-237.
- [16]. Chopra RN, Nayar SL, Chopra IC (1956). *Glossary of Indian Medicinal Plants*. Council of Scientific and industrial Research (CSIR), New Delhi.
- [17]. Misra RC. Therapeutic uses of some seeds among the tribals of Gandhamardan hill range, Orissa. *Ind. J. Trad. Know.* 3, 2004, 105-115
- [18]. Aneja, S., Vats, M., Sardana, S., and Aggarwal, S. Pharmacognostic Evaluation and phytochemical studies on the root of *Amaranthus tricolor (Linn.)*. *International Journal of Pharmaceutical Sciences and Research.* 2, 2011, 2332-2336.
- [19]. Duke JA, Ayenshu Es. *Medicinal plants of china*. Reference Publication, Inc. 1985, 20-24.
- [20]. Prajapati ND, Kumar U. *India :Agrobios; 2003. Agro's Dictionary of Medicinal Plants; P. 22.*
- [21]. Larsen T, Thilsted SH, Biswas Sk, Tetenus I. The leafy vegetable amaranth (*Amaranthus gaganticus*) is a potent inhibitor of Calcium availability and retention in rice based diets. *British Journals of Nutrition* 90 (3), 2007, 521-527.
- [22]. Al-Dosari MS. The effectiveness of ethanolic extracts of *Amaranthus tricolor Linn*: A natural hepatoprotective agent. *Am J Chin Med.* 38, 2010, 1051–64.
- [23]. Pulipati S, SrinivasaBabu P, Lakshmi NM. Phytochemical analysis and antibacterial efficacy of *Amaranthus tricolor (L)* methanolic leaf extract against clinical isolates of urinary tract pathogens. *African Journal of Microbiology Research.* 2015; 9(20):1381-1385.
- [24]. Gonzalez CM, Schaeffer AJ. Treatment of urinary tract infection: What's old, what's new and what works. *World J. Urol.* 6, 1999, 372-382.
- [25]. Pulipati S, SrinivasaBabu P, Lakshmi NM. Quantitative determination of tannin content and evaluation of antibacterial activity of *Amaranthus tricolor (L)*. *international journal of biological and pharmaceutical research.* 5(7), 2014, 623-626.
- [26]. Wolf PL. Biochemical diagnosis of liver diseases. *Indian J Clin Biochem.* 14, 1999, 59–90.
- [27]. Sharma SK, Ali M, Gupta J. *Recent Progress in Medicinal Plants (Phytochemistry and Pharmacology)* Vol. 2. Houston: Research Periodicals and Book Publishing House; 2002. Evaluation of Indian Herbal Hepatoprotective Drugs; 253–70.
- [28]. S. Aneja, M. Vats, S. Aggarwal, S. Sardana. Phytochemistry and hepatoprotective activity of aqueous extract of *Amaranthus tricolor Linn*. *Roots. Journal of ayurveda and integrative medicine* 4(4), 2013, 211-215.
- [29]. M. Rahmatullah, M. Hosain, S. Rahman, S. Rahman, M. Akter, F. Rahman, F. Rehana, M. Munmun, M. Akter Kalpana. Antihyperglycaemic and antinociceptive activity evaluation of methnolic extract of whole plant of *Amaranthus tricolor L.* (*Amranthaceae*). *Afr J Tradit Complement Altern Med.* 10(5), 2013, 408-411.
- [30]. Gopal V. Bihani, Subhash L. Bhodankar, parag P. Kadam and Girish N. Zambare. Anti-nociceptive and anti-inflammatory activity of hydroalcoholic extract of leaves of *Amaranthus tricolor L.* *Scholars Research Library, Der Pharmacia Lettre,* 5(13), 2013, 48-55.
- [31]. Jayaprakasam, B., Zhang, Y., and Nair, M.G. Tumor cell proliferation and cyclooxygenase enzyme inhibitory compounds in *Amaranthus tricolor*. *Journal of Agricultural and Food Chemistry.* 52, 2004, 6939-6943.

- [32]. Devaraj, V.C., and Krishna, B.G. Gastric antisecretory and cytoprotective effects of leaf extracts of *Amaranthus tricolor* Linn. in rats. Zhong Xi Yi Jie He XueBao. 9, 2011, 1031-1038.
- [33]. A. Colaco E Clemente, PV. Desai. Evaluation of the Hematological, Hypoglycemic, Hypolipidemic and Antioxidant Properties of *Amaranthus Tricolor* Leaf Extract in Rat. Tropical Journal of Pharmaceutical Research October 10(5), 2011, 595-602
- [34]. Xueqing L, Jae-kyung K, Yunsheng L, Jing L, Fang L, Xiaozhuo C. Tannic acid stimulates glucose transport and inhibits adipocyte differentiation in 3T3-L1 cells. J Nutr 135, 2005, 165-171.
- [35]. Choi, C. W.; Kim, S. C.; Hwang, S. S. Plant Science 163, 2002, 1161-1168.
- [36]. Ozsoy, N.; Candoken, E.; Akev, N. *Oxid. Med. Cell. Longev.* 2, 2009, 99-106.
- [37]. Roy S, Sadhana P, Begum M, Kumar S, Lodha ML, Kapoor HC. Purification, characterization and cloning of antiviral/ribosomes inactivating protein from *Amaranthus tricolor* leaves. *Phytochemistry.* 67, 2009, 1865-73.

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