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Basella rubra Linn. – A Review

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Abstract

Basella rubra belongs to the family Basellaceae, and commonly known as malabar spinach, indian spinach, ceylon spinach and vine spinach. It was used to treat large number of human ailments as mentioned in Charaka Samhita, and Sushruta Samhita. It has been found to be a good source of calcium, iron, vitamin A and vitamin C. In Ayurveda, the plant has shown immense potential in androgenic, antiulcer, antioxidant, cytotoxic, antibacterial activity, anti-inflammatory, central nervous system (CNS) depressant activity, nephroprotective and wound healing properties etc. This paper includes the evidence-based overview of pharmacological and phytochemical properties of the Basella rubra, which may be helpful to establish a standard natural drug for further research.

Keywords

Basella rubra, Androgenic, Basellaceae, Central nervous system

Greentree Group

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INTRODUCTION

Ayurveda is a native Indian healthcare system which is currently used by millions of people in India, Nepal and Sri Lanka for their day-to-day healthcare needs[1,2]. A large proportions of the world's population depends on traditional medicine because of the scarcity, high costs of orthodox medicine[3,4] and unpleasant side effects[5]. Medicinal plants have provided the modern medicine with numerous plant derived therapeutic agents[7-9]. Natural products play a dominant role in the development of novel drug leads for the treatment and prevention of diseases[10, 11].

Basella rubra L. (Basellaceae), commonly known as Indian or Malabar spinach belongs to family Basellacae, is an herbaceous annual or biennial climbing herb found in tropical and sub-tropical areas. It is a succulent, branched, smooth, twining herbaceous vine, several meters in length. Stems are purplish or green. Leaves are fleshy, ovate or heart-shaped, 5 to 12 cms long, stalked, tapering to a pointed tip with a cordate base. Spikes are axillary, solitary, 5-29 cm long. Fruit is fleshy, stalk less, ovoid or spherical, 5-6 mm long, and purple when mature and contain only one seed. The flowers are pink and about 4 millimeters long[12]. The leaves of the plant contain flavonoids (133.1±26.2 mg QC /100 g FM), β- cyanin and 7, 4´– di– ortho methyl kempferol. The flower contain phenolic compounds (269.0±3.1mg GAE/100 g FM) such as Rutin, Quercetin, Scopoletin, Coumarin, β-xanthin and β-cyanin pigments and Caffeic-, Homo-protocatechuic-, Chlorogenic-, trans- and cis-p-coumaric-, p-hydroxy-benzoic-, phloretic-, trans- and cis-sinapic-, cinnamic- acids; and the fruit consists of β-cyanin, gomphrenin I, gomphrenin II, and gomphrenin III.[13] *Basella rubra Linn.* is a rich source of nutrients and minerals. Per 100 grams (g) edible portion, alugbati leaves contain Water (g) – 92.5; Energy (kcal) – 23.0; Protein (g) – 2.0; Fat (g) – 0.3; Carbohydrates (g) – 3.0; Fiber (g) – 0.9; Ash (g) – 2.2; Calcium (mg) – 128.0; Phosphorous (mg) – 40.0; Iron (mg) – 4.9; Vitamin A (ug) – 456.0; Thiamine (mg) – 0.04; Riboflavin (mg) – 0.12; Niacin (mg) – 0.5; Ascorbic acid (mg) – 89.0[27]. It also contains calcium 2.32, potassium 5.8, magnesium 0.06, sodium 5.11, iron 0.04mg/100gm.[14]

VARIETIES

There are three common types of alugbati: *Basella alba* with green stem and oval to almost round leaves; *Basella rubra* with red stems and green, oval to round leaves; and a third type, which is a hybrid of the two. The Institute of Plant Breeding of the University of the Philippines Los Banos (IPB-UPLB) has released two stopgap varieties in 1981 through its Germplasm Registration and Release Office: the red-stemmed 'Pulahan' and the green-stemmed 'Luntian.' [15].

GEOGRAPHICAL DISTRIBUTION

Ceylon spinach, *Basella rubra* Linn. belongs to the family Basellaceae. Formerly it was included in the Chenopodiaceae, which includes true spinach and other pot herbs. It is widely distributed in the tropics and often cultivated in warm temperate areas of both the eastern and western hemisphere. It is usually considered to be nature of Southern Asia. *Basella rubra*, with white flowers and *Basella cardifolia*, with heart shaped leaves are the excluded names most often encountered in horticulture literature.

Watt stated that ceylon spinach is cultivated in almost every part of India, especially in lower Bengal and Assam where it is an important article of food. In Bengal almost every village has a hedgrew of it, the succulent leaves and stems are used as a pot herb by all classes[16].

According to Burkhill, Ceylon spinach is cultivated throughout Malaya for use as pot herb. The purpled leaves are used in both India and Malaya to poultice sore[16].

The laxative property of the plant is used for treating constipation in children in Indonesia. Ceylon spinach is listed as food plant of the Philippine, where it is boiled and eaten like spinach. It is cultivated extensively by Chinese gardener and is on sale in Manila market throughout the year. The white variety had been introduced into Fiji shortly before 1956. It has been also reported from Ethiopia, Mozambique, Sierra and Camroons[16].

The present article provides review on of *Basella rubra Linn*. and pharmacological studies conducted till date.

BASELLA RUBRA IN AYURVEDIC TEXTS-

Ayurvedic pharmacodynamics[17-20]

Rasa -Madhura

Guṇa – Pichhala, Snigdha and *Sara*

Virya - Shita

Vipaka- Madhura

Effect on dosha- *Vataghna, Pittaghna, Kaphakara* action

Organoleptic Character-[17,18]

Sparsh (Touch)-*Snigdha* (smooth)

Rupa (Apperance) – Dark green

Rasa (Taste*) Madhura*

Gandha (Smell)-No particular smell

PHARMACOLOGICAL ACTIVITIES

Antifungal Activities

Two novel antifungal peptides, designated α- and β-basrubrins, respectively, isolated from seeds of the *Basella rubra linn.*. α- and β-basrubrins exhibited a molecular weight of 4.3 and 5 kDa, respectively. They inhibited translation in a rabbit reticulocyte system with an IC_{50} value of 400 and 100nM, respectively α- and β-basrubrin inhibited HIV-1 reverse transcriptase by (79.4 ± 7.8)% and (54.6 ± 3.6)%, respectively, at a concentration of 40μM, and (10.56 ± 0.92)% and (2.12 ± 0.81)%, respectively, at a concentration of 40μM. Both α- and β-basrubrins exerted potent antifungal activity toward *Botrytis cinerea, Mycosphaerella arachidicola,* and *Fusarium oxysporum*[29]. Neither α-basrubrin nor β-basrubrins exhibited DNase, RNase, Lectin protease activity, indicating that their antifungal action is not due to these activities. HIV-1 reverse transcriptase was inhibited by α- and β-basrubrins with an IC_{50} of 246 and 370 μM, respectively. Translation in rabbit reticulocyte lysate was inhibited by α- and β-basrubrins with an IC_{50} of 400 and 100 nM. The heat shock protein-like peptide and serine–threonine kinase-like protein exhibited a molecular mass of 3 and 30 kDa, respectively. They inhibited neither translation in a rabbit reticulocyte system at concentrations up to 50 μM nor HIV-1 reverse transcriptase activity at concentrations up to 400 μM.[21]

Anticancer Activities

Fruit extracts of *Basella rubra linn.* which are rich in bioactive phenolics, flavonoids and betalains were investigated for their antioxidant and anticancer activities against human cervical carcinoma (SiHa) cells. The fruits contained total betalain contents of 0.34 g/100 g fresh weight and 1.9 g/100 g dry weight. Betanin, isobetanin and gomphrenin I were the major pigments identified. Phenolic compounds, such as generic acid, sinapic acid, ferulic acid, coumaric acid and chlorogenic acid, and flavonoids, such as myricetin, quercetin,

luteolin, apigenin and kaempferol were identified. Both water and aqueous methanol extracts of fruits showed significant free radical scavenging potential and ferric reducing antioxidant power. Fruit extracts at 50 mg/mL showed strong (81%) cytotoxic activity against human cervical carcinoma cells. Thus, fruit extracts have potential application for cancer treatments and as nutraceutical or dietary supplements[22]. The plant and leaves are ground with sour buttermilk with salt for preparing a poultice and indicated for arbuda[23].

Antioxidant activity

The antioxidant activity of two species of leafy vegetable *Basella* was investigated. The leaves of *Basella* spp. are very low in calories (95–110/100 g) and fats, but hold a good amount of vitamins, minerals, and antioxidants. The EC_{50} values were found high in BAW extract (3.4 mg/mL) for DPPH radical scavenging activity. BAW extract (1.04) at 50mg/mL showed high ferric reducing antioxidant power and least in BAM extract. Various extracts from leaves with different constituents were shown dose dependent antioxidant and high scavenging abilities which play a key role in combating the reactive oxygen species[24].

Methanolic extracts of all leafy vegetables tested exhibited antioxidant activity. A better oxidative activity was observed at 200µg/ml concentration at all temperature for tested leafy vegetable. To conclude leafy vegetables infers a protective radical scavenging activity which exhibit dose dependant stability irrespective of temperature and it shows substrate specificity[25].

When fruit flesh was extracted with 80% methanol (containing 0.2% formic acid) and subjected to solid-phase extraction, semi preparative HPLC isolation, mass spectrophotometric analysis, and structural elucidation. The major red pigment was identified as gomphrenin I. Its quantity increased with the increase of fruit maturity. The gomphrenin I extract yield from ripe fruits was 36.1 mg/100 g of fresh weight. In addition to gomphrenin I, betanidin-dihexose and isobetanidin-dihexose were also detected. The antioxidant activities of gomphrenin I determined by Trolox equivalent antioxidant capacity (TEAC), α,α-diphenyl-β-picrylhydrazyl (DPPH) radical scavenging activity, reducing power, and antioxidative capacity assays were equivalent to 534 µM Trolox, 103 µM butylated hydroxytoluene (BHT), 129 µM

ascorbic acid, and 68 μM BHT at 180, 23, 45, and 181 μM, respectively. Gomphrenin I as a principal pigment of *Basella alba* fruits and as a potent antioxidant and inflammatory inhibitor. These findings suggest that *Basella alba* fruit is a rich source of betalains and has value-added potential for use in the development of food colorants and nutraceuticals[26].

EtAc extract showed moderate radical scavenging activity in the DPPH assay. The crushed leaves and the flowers juice of both species have been used against skin inflammations and the most active extracts of the plants are likely to be the aqueous extracts. For instance, the aqueous extract of *Basella rubra* has demonstrated antiulcer activity and leaves masticated kept in mouth helped relief aphthae. As a result, in order to gain a higher level of pharmacological activities of *Basella alba* and *Basella rubra*, an aqueous extraction could be of interest for further investigation[27].

Antiviral activity

In vivo-two pectin-type polysaccharides BRP-2 and BRP-4 obtained from *Basella rubra linn.*were found to exert potential anti-HSV-2 effects *in vitro* mainly by interfering with the absorption of virus to host cells. Furthermore, the most abundant pectin-type polysaccharide BRP-4 showed a high therapeutic efficacy in the mouse model, intravaginally infected with HSV-2, as judged from the severity of herpetic lesions, the survival rate of mice and virus shedding. On the other hand, orally administered BRP-4 resulted in moderate therapeutic efficacy against IFV based on virus yields in the mice. Moreover, BRP-4 stimulated the production of neutralizing antibody and the secretion of mucosal IgA in IFV-infected mice in spite of less antigens (viruses), implicating an attribution to the protective effect of oral administration of BRP-4 on IFV[28].

Cai-Xia studied on four neutral polysaccharides (BRN-1, BRN-2, BRN-3 and BRN-4) isolated from the hot water extract of the aerial part of *Basella rubra linn.* They were found to consist of a large amount of d-galactose (81.0–92.4%) and small amounts of l-arabinose (5.4–7.8%), d-glucose (2.2–11.0%) and mannose (~2.9%). Linkage analysis revealed that all these neutral polysaccharides might be arabinogalactan type I polysaccharides in different molecular weight and chain length. Among them, only BRN-3 showed antiviral activity against herpes simplex virus type 2 (HSV-2) with 50% inhibitory concentration

of 55 µg/mL without showing the cytotoxicity up to 2300 µg/mL. Furthermore, the main antiviral target of BRN-3 was shown to be the inhibition of virus adsorption to host cell[29].

Anti-inflammatory

EtAc extract of *Basella alba* which is endowed with a moderate effect as an NF-κB inhibitor. The crushed leaves and the flowers juice of both species have been used against skin inflammations[27]. The anti-inflammatory function was tested at concentrations of 25, 50, and 100 µM in murine macrophages stimulated with lipopolysaccharide (LPS). The results revealed that gomphrenin I suppressed LPS-induced nitric oxide (NO) production in a dose-dependent manner and decreased PGE_2 and IL-1β secretions at the highest concentration tested. The transcriptional inhibitory activities of gomphrenin I on the expression of inflammatory genes encoding iNOS, COX-2, IL-1β, TNF-α, and IL-6 were also observed[30].

Antiulcer

The aqueous extract of *Basella rubra linn*. possesses significant and dose dependent anti-ulcer and cytoprotective effects[31]**.** The aqueous extract of *Basella rubra linn*. has demonstrated antiulcer activity and leaves masticated kept in mouth helped relief aphthae[27].

Anti-cholesterol Effect

In vivo study was designed to investigate the hypocholesterolemic and antiatherosclerotic effects of *Basella alba (B. alba*) using hypercholesterolemia-induced rabbits. Twenty New Zealand white rabbits were divided into 5 groups and fed with varying diets: normal diet, 2% high cholesterol diet (HCD), 2% HCD + 10 mg/kg simvastatin, 2% HCD + 100 mg/kg *B.alba* extract, and 2% HCD + 200 mg/kg B. alba extract, respectively. The treatment with *B.alba* extract significantly lowered the levels of total cholesterol, LDL, and triglycerides and increased HDL and antioxidant enzymes (SOD and GPx) levels. The elevated levels of liver enzymes (AST and ALT) and creatine kinase were noted in hypercholesterolemic and statin treated groups indicating liver and muscle injuries. Treatment with *B. alba* extract also significantly suppressed the aortic plaque formation and reduced the intima: media ratio as observed in simvastatin-treated group[32].

Basella alba leaf extract showed the inhibitory effect on enzyme 3-hydroxy-3-

methyl-glutaryl-coenzyme A (HMG-CoA) reductase that produces cholesterol at about 74%[33].

Antimicrobial

In vitro antimicrobial activity of methanolic extract of *Basella alba, Basella rubra* leaves and *Muntingia calabura* was investigated. The extracts exhibited marked antimicrobial activity against gram positive and gram negative bacteria and fungi. *Basella rubra* showed mild inhibitory activity against *Staphylococcus aureus, Basella alba* showed good inhibitory activity against *Aspergillus niger*[34].

Anti-hypoglycemic

Study evaluated an aqueous extract of *B. rubra* for antihyperglycemic activity in STZ-induced diabetic rats. Phytochemical screening showed a rich source of phytonutrients, including enzymic and nonenzymic antioxidants. Results concluded the aqueous extract exhibited significant antihyperglycemic activity[35].

A study of STZ-induced diabetic rats fed with *Basella rubra* showed the leaf pulp of *B. rubra* possesses a strong hypoglycemic effect[36].

Gastroprotective

The aqueous and ethanol extracts of the leaves of *Basella alba* L. var. *alba* Wight, Basellaceae, were investigated for antiulcer activity on rats employing the pylorus ligation and ethanol induced ulcer models. The various gastric secretion parameters such as total acidity, free acidity, gastric acid volume, pH and histopathological parameters such as ulcer index and percent protection were comparatively examined between control, test and standard groups. The antiulcer activity of aqueous extract of *B. alba* (AEBA) and ethanol extract of *B. alba* (EEBA) were studied in rats treated with the doses of 1 mL/kg of absolute ethanol, 200 and 400 mg of test extracts and 20 mg/kg of famotidine for control, test and standard groups respectively in both the models. The animals pretreated with AEBA and EEBA showed a dose-dependent protection against gross damaging action of ethanol and pylorus ligation on gastric mucosa of animals. Histopathological evaluation also revealed that Group I treated with absolute ethanol showed severe gastric mucosal damage. The AEBA and EEBA showed 68.25 and 58.11% protection in gastric mucosal damage as compared to control group. Both the extracts of *B. alba* var. *alba* were able to decrease the gastric acidity and increase the mucosal defense in the gastric mucosal area. This study indicate

that *B. alba* var. *alba* possesses significant gastro protective effect and the same is substantiated by the histopathological examination of the ulcerated stomachs of the animals[37].

Androgenic Effect

Basella alba leaves were extracted with water, ethanol, methanol, dichloromethane, hexane and successive methanol and mixed sex juveniles of Nile tilapia were subjected to dietary treatment with the extracts at the concentration of 0.5, 1.0 and 1.5 gm/kg feed. For dietary administration of *Basella alba* leaves, the highest percentage of males (83.2±0.7) was obtained by treatment with ethanol extract at the concentration of 1.0 gm/kg feed. For all the solvents, the highest percentage of males was observed at the concentration of 1.0 gm/kg[38]. *Basella alba* has been reported to be used in traditional medicine to treat sexual asthenia and infertility in man[39].The methanol extract of its leaves was found to stimulate testosterone production in testicular fractions and Leydig cell cultures, and in normal adult albino male rats[40]. *Basella alba* induce the required hormonal imbalance needed to observe an effect on sex differentiation in guppy[41].

Haematological and biochemical parameters

Basella alba leaves as part of daily diet may reduce anaemia and maintain good health. The effects of the aqueous leaf extract of *Basella alba* on haematological and biochemical parameters were studied in Wistar strain albino rats. Twenty four (24) Wistar strain albino rats were randomly distributed into four groups of six (6) rats each. Group I rats served as control and received 10 ml/kg of normal saline, while group II, III and IV received 60, 80 and 100 mg/kg of aqueous leaf extract of B. alba, respectively, for two weeks. Administration of the extract was done orally. At the end of the treatment period, haematological parameters (red blood cell count, white blood cell count, platelet count, packed cell volume and haemoglobin concentration) and biochemical parameters alkaline phosphatase(ALP), alanine aminotransaminase (ALT) and aspartate aminotransaminase (AST)) were determined. The results showed that Basella alba significantly increased ($p < 0.05, 0.01$) red blood cell count, white blood cell count, packed cell volume, haemoglobin concentration and platelet count. However, the extract significantly ($p < 0.05, 0.01$)

reduced the activity of the liver enzymes such as ALP, ALT and AST[42].

Immunomodulatory activity

BRP-4, polysaccharide isolated from *Basella rubra*, is suggested to activate macrophage function and stimulate splenocyte proliferation. The strong immunomodulatory activity of BRP-4 confirmed its good potential as an immunotherapeutic adjuvant[43].

The effects of the isoflavone genistein and methanol extract of *Basella alba* leaves were evaluated in *Nile tilapia, Oreochromis niloticus* on growth and immunostimulation. Adult tilapia (mean weight 39.55 g) was fed diets containing genistein (1 gm/kg) and methanol extract of *Basella alba* (1 g/kg) for 35 days. *Basella alba* extract treated tilapia showed significantly higher ($P<0.05$) weight gain, respiratory burst, phagocytic activity, plasma protein content and plasma lysozyme activity compared to fish fed control diet. The *Basella alba* extract treated fish showed the highest final individual mean body weight, final individual length, specific growth rate, hepatosomatic index and total immunoglobulin content[44]. .

Urticaria

The extracted juice is applied directly on the infected skin. The crushed leaves are mixed with cheese and it is then applied on the burnt places[45].

CULTIVATION AND PROPAGATION

Soil and Climate Requirements: The plant prefers light (sandy), medium (loamy) and heavy (clay) soils and requires well-drained soil .The plant prefers acid, neutral and basic (alkaline) soils and can grow in very acid soil. It cannot grow in the shade. It requires moist soil. *Basella rubra linn.* grows well under full sunlight in hot, humid climates and in areas lower than 500 m above sea level. Growth is slow in low temperatures resulting in low yields. Flowering is induced during the short-day months of November to February. *Basella rubra linn.* grows best in sandy loam soils rich in organic matter with pH ranging from 5.5 to 8.0[46].

Land Preparation

Basella requires a well-prepared seed bed for good germination and seedling growth. Plow or mechanical bed shaper are used to form beds that are 20 cm high during the dry season and 30 cm or higher during the wet season. The distance between centers of two adjacent furrows is about 150 cm with a 90-cm bed top. Flat beds may also be used but are more subject to flood damage[47].

Cultivation

Basella rubra linn. can be grown from seeds or cuttings[48]. It requires a well-drained moisture-retentive soil rich in organic matter and a warm sunny sheltered position[61]; prefers a sandy loam[62]. *Basella* can tolerates fairly poor soils but does much better in rich soils, high rainfall and a pH in the range 4.3 to 7[49]. A fast growing plant, capable of producing a crop within 70 days from seed in a warm climate[49,51] though it requires a minimum daytime temperature of 15°c if it is to keep growing vigorously[51]. It tolerate low light levels plus night temperatures occasionally falling below 10°c,[50] and so can do well in a cold greenhouse. Plants do not flower if the length of daylight is more than 13 hours per day[61].Widely cultivated for its edible leaves in the tropics, there are some named varieties. It is an excellent hot weather substitute for spinach. Some authorities recognize three different species, *B.alba*, *B. rubra* and *B. cordifolia*, they are all treated here as being part of one species[50]. The optimal planting season is from April to August. Typical crop spacing is 1'. It requires warm days for good production. Nitrogen is required for optimal growth. The best harvesting period is continuous. Propagation of *Basella rubra* can be achieved by seed[46].

Propagation

Seed sow period is March or April in a warm greenhouse. The seed requires a minimum temperature of 18 - 21°c in order to germinate it germinates within 10 - 21 days at 20°c, pre-soaking the seed for 24 hours in warm water shortens the germination time. As soon as they are large enough to handle, prick the seedlings out into individual pots of fairly rich compost and grow them on fast, planting them out after the last expected frosts.

Stem cuttings: These can be taken in the late summer, overwintered in a greenhouse and then be planted out in late spring or early summer.

Harvesting

Basella is usually ready for harvest in 30–45 days after planting. Plants may be harvested once or several times .Once-over harvest is adapted for early maturing and quick growing varieties. Stems or shoots 15–25 cm in length are cut close to the ground, washed, and tied in bundles. With multiple harvests, young leaves and shoots are picked at weekly intervals. Frequent harvesting delays flowering and stimulates growth of side shoots. When plants are not regularly

harvested, side shoots develop into longer vines. There is a need to support long vines with trellis[47].

Yield

A short-term crop yields up to 40 t/ha in 75 days; for long-term crops, yields are very variable, up to 1.5 kg of shoots or leaves per plant or 80 t/ha in 180 days. Yields of 20–50 t/ha per month of cultivation have been reported[48].

Controlling insect pests and diseases

Insect pests and diseases must be controlled to ensure good yield and quality. Just like any other leafy vegetable, *Basella* is susceptible to damage by foliar insects such as leaf miners and cutworms. Root-knot nematode is sometimes a serious pest. An effective method of controlling many insect pests is to cover the bed with fine screen or a fine mesh nylon net (32-mesh or finer) [47]. The damage is reduced by the application of a high dose of organic manure. Crop rotation with non-susceptible crops such as maize or amaranth is recommended. Ceylon spinach is remarkably free of foliar diseases and pests due to the thick leaf cuticle[53].Chemical control of pests should be used mainly as a corrective measure. A pesticide is chosen that targets the specific insect that is causing the damage, and avoid pesticides that kill beneficial insects. Chemical pesticides should be applied in the evening, and workers should not be allowed into the field until the recommended waiting period (usually 12 to 24 hours) has passed. Wear protective clothing and follow all instructions on the label. Numerous cultural practices can reduce the incidence of disease, including crop rotation, field sanitation, adequate plant spacing, and using furrow rather than overhead irrigation. Chemical fungicides are rarely used unless there is a history of fungal diseases for *Basella* in the region and conditions favour disease development[47].

Necrotic leaf spots caused by *Cercospora basellae* and *Acrothecium basellae* sometimes occur. Young plants are susceptible to *Rhizoctonia* rot. A rust (possibly *Puccinia* species) causing yellow-orange spots on the leaves is reported as problematic in Congo. Removal of all infected leaves is recommended in order to reduce the inoculum rate[53].

New diseases of *Basella rubra* [*alba*] occurred in Miyagi Prefecture, Japan, in 1997. The pathogenicity of isolates from all the diseased plants to each host plant was confirmed and the isolates were identified as *Sclerotinia sclerotiorum* on the basis of

morphological and cultural characteristics. This is the first report on *Sclerotinia* rot of these plants in Japan[54].

STORAGE

Acarya Carak says that collected herb should be placed in suitable vessles, they should be stored in a room which is windless (Ca. Ka. 1/11). Physical as well as chemical changes, enzymatic changes, yeast, bacteria, fungal infection are the factors which decrease the potency of Churna. Hence it is advisable to keep the Churna of *Basella rubra* in the vacuum container so as to avoid contact of these affecting factors with Curna.

CONCLUSION

From the above review we can conclude that the plant *Basella rubra Lin*.which is having a wide range of medicinal value due to their variety of chemical constituents can be further investigated on toxicological and other parameters to obtain a valuable marketed product. Apart from that the chemical constituents, who were found effective can also be synthetically prepared for better yield and obtain a pharmacophore which may be useful for drug design.

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