INTRODUCTION

In addition to the allopathic system of medicine, Ayurveda, Homeopathy, Unani, Siddha and Yoga are also used as traditional systems of medicines in India. Among these, Ayurveda is the oldest system of medicines which originated in pre-vedic period. Rigveda and Atharvaveda are the most primitive documented evidences on ancient Indian knowledge about medicines. Ayurveda is an upvedas of Rigveda and Atharvaveda. Of the different Ayurvedic texts, Charak Samhita and Sushruta Samhita deal elaborately with maintenance of health throughout the life and its various phases and developed a wide range of therapeutic measures related to physical, mental, social and spiritual health. Ayurveda, mostly deals with the herbal based medicines which contains therapeutic potentials description of over 2000 plants. As the Ayurvedic medicines are of natural origin, found to be many beneficial effects over allopathic system, as observed satisfactory effects of these medicines to temperament of individuals and fewer side effects. The overall cost of treatment is also low as compare with the allopathic systems. In India, more than 7500 plant species are being used in various alternative medicinal systems (Mukherjee & Wahle, 2006). Recently, the interest in the use of herbal preparations has grown dramatically throughout the world (Patwardhan et al., 2003).

Most of recent pharmaceutical drug have been discovered from the traditional knowledge and methods used by tribal peoples (Balick & Cox, 1996; Gilani & Rahman, 2005). Many of the modern day drugs are derived from plant based products. Furthermore, it is estimated that about 25% of modern drugs and as many as 60% of antitumor drugs are derived from natural products (Brower, 2008; Newman & Cragg, 2012). According to the World Health Organization (WHO), as many as 80% of the world’s population depends on traditional medicine and about 65% of the population in the rural areas use Ayurvedic and medicinal plants to meet their primary health-care needs in India (WHO, 2002).

Among the Ayurvedic medicines, Dashmula plants are top traded group. It is estimated that more than 10,000 Metric tonnes of Dashmula plant raw drugs are being consumed every year by Indian herbal industry contributing to nearly

Uraria picta: A comprehensive review on evidences of utilization and strategies of conservation

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ABSTRACT

Uraria picta (Jacq.) DC. (Prishnaparni) is one of the most important medicinal plants used in different traditional systems of medicines including the Ayurveda and Traditional Chinese medicine. The major use of this plant was found in the most popular Ayurvedic formulation “Dashmula” and in several many other important Ayurvedic formulations. IUCN placed this woody herb in the least concern category as per version 3.1. It has extensive therapeutic uses and pharmacological activities. Though this plant is a source of many phytochemicals, the uses are uncertain because the raw plant parts or crude extracts are being used in all formulations. Therefore, extensive investigations are necessary to focus on the identification of these phytochemicals. It is an urgent need to give special attention to collecting various aspects and more efforts are required in all areas for utilization and conservation of this valuable medicinal herb. Herein, a compilation of all information with various aspects has been presented, including the authors published work on Uraria picta. This review pursues attention towards biological activity, phytochemical profile, utilization, propagation and conservation of Uraria picta.

KEYWORDS: Biological activity, Dashmula, In vitro propagation, Phytochemical
CLASSIFICATION AND DISTRIBUTION OF URARIA PICTA

Classification of Plant

Kingdom: Plantae
Clade: Fabids (Eurosids I)
Order: Fabales
Family: Fabaceae
Subfamily: Faboideae
 Tribe: Desmodieae
Subtribe: Desmodiniae
Genus: Uraria
Species: U. picta

Distribution

U. picta is commonly found in areas of dry grass-lands, grassland with scattered trees including Acacia; waste places, on rocky ground, deep sandy soils; by riverbanks, flood-plains and gallery forest. U. picta is a widespread species found in tropical Africa, South and South East Asia and Australia. It is not considered to be specifically threatened or in decline at present. The species does not meet any threatened criteria therefore a rating of Least Concern is given (Groom, 2012).

BOTANICAL DESCRIPTION

Uraria picta is annual herb, stem woody at maturity, and it covered with scarce modified fine, short and hooked hairs. Plant body is erect, height ranging from 0.5 to 2.0 m. Leaves are dimorphic, young leaves are simple and at maturity they are odd-pinnately compound covered with the hairs as present of stem (Figure 1). Inflorescence is of raceme type. Racemes are terminal and elongated upto 1.5 feet. The flowers are small, present in large number (55-75) on dense spike (figure 1). The inflorescence axis is pink, purple or pale lead in colour. Flowers are purple, pink or bluish in colour. Flowers are bracteate, bracts persistent at the base and apex. Calyx is four mm long; teeth plumose much longer than the short tube. Corolla papilionaceous, sepals are 4-5 mm long Pods are segmented with 3-6 segments, each 2-3 mm broad and 5-9 mm long, smooth, polished, folded on one another (Hutchinson & Dalziel, 1958; Bhattacharya & Datta, 2010). Pods contain 2-6 seed and segments are nearly separated (Waghire & Dalziel, 1958; Hutchinson & Dalziel, 1958; Groom, 2012). Flowering and fruiting time in the month of august to September.

PHYTOCHEMICAL CONSTITUENTS

U. picta constitute number of important bioactive compounds such as phenolics, tannins, saponins, cardiac glycosides, flavonoids, isoflavonones, triterpens and steroids (Table 1). Two Isoflavonones namely 5,7-dihydroxy-20-methoxy-30,40-methylenedioxyisoflavonane and 40,5-dihydroxy-20,30-dimethoxy-7-(5-hydroxyxychromen-7yl)-isoflavonane were isolated from roots (Rahman et al., 2007). Additionally...
researcher also identified stigmasta-4,22-diene-3-one, b-sitosterol and luped by direct comparison of the spectral data to those published in the literature (Kojima et al., 1990; Parsons, 1991; Rahman et al., 2007). Yadav and his team reported the isolation, quantitation and validation of flavone glycoside Rhoifolin from aerial parts of U. picta (Yadav et al., 2009). Turner & Harborne, 1967 and Ambe et al., 2010, reported the Canavanine, essential and non-essential amino acids from the seed of it. The albumin like proteins and different fatty acids such as linoleic acid (38.9%), palmitic acid (14.2%), linolenic acid (11.3%) and oleic acid (11.1%) from seeds (Ambe et al., 2010; Waghire et al., 2011). Along with different phytochemical, determined different macro elements such as Na, K, Ca, Mg and P in leaves of the plant (Saxena et al., 2014).

### ETHNOMEDICINAL USES

Ethnomedicines defined as the use of plants by humans as medicines (Farnsworth, 1994). Ethnopharmacology is a highly diversified approach to drug discovery involving the observation, description and experimental investigation of indigenous drugs and their biologic activities. Attention of people received towards the traditional ethno-botany due to their wide local acceptability in recent years (Tripathi, 2000). Tribal peoples of Purulia district in West Bengal used root paste of U. picta, Mahadevjata and Ishwarjata, with honey (4:2) once daily for 5 days as abortificients. Leaf paste is given twice daily as antidote to snakebite (Chakraborty & Bhattacharjee, 2006). Tribal’s of the Saurashtra region used seed paste for haemorrhoids disease (Jadeja et al., 2006). Tribal of Chittagong hill used the leaf paste for suppuration of boil disease and applied on it for burst (Yusuf et al., 1994, 2007). The combination of leaves and roots of Aristolochia indica, Desmodium motorium and U. picta are crushed and the juice taken orally. Tribal communities of Chitrakoot (MP) and Wayanadu districts of Kerala applied leaf paste on cuts and wounds twice a day (Sikarvar et al., 2008; Thomas et al., 2014). U. picta alone or on combination with others are used as an antidote or for gall bladder pains in Kushita and Sherpur district in Bangladesh (Rahmatullah et al., 2009; Alom et al., 2011). Jain & Singh in 2010, reported that, half teaspoon of root decoction is taken orally for seven days in snakebite and sore mouth (Jain & Singh, 2010). The paste made from three gram flowers of U. picta is taken once a day in empty stomach to sterile women for one month for pregnancy (Sahu et al., 2010). The different communities like Gond, Kols, Mushar, Baiga

![Habit of Uraria picta (Jacq.) DC. a: Well grown mature plant; b: Inflorescence and c: Matured inflorescence of U. picta with green pods](image)

#### Table 1: Phytochemicals constituents from different plant parts of *Uraria picta*

| Phytochemical constituents | Plant parts used                  | Solvent used for extraction                                                                 | Reference                        |
|----------------------------|-----------------------------------|----------------------------------------------------------------------------------------------|----------------------------------|
| Alkaloid                   | leaves, roots and stem            | ethanol and methanol                                                                          | Saxena et al., (2014)            |
| Amino acids                | Leaves                            | ethanol and water                                                                             | Garg et al., (2012)              |
| Carbohydrate               | Leaves                            | ethanol and water                                                                             | Garg et al., (2012)              |
| Cardiac glycosides         | leaves, roots and stem            | diethyl ether, chloroform, ethanol, ethyl acetate, methanol, petroleum ether and water       | Saxena et al., (2014)            |
| Flavonoides                | leaves, roots and stem            | chloroform, ethanol, methanol and water                                                      | Garg et al.,(2012) and Saxena et al.,(2014) |
| Phenols                    | leaves, roots and stem            | aqueous and methanol                                                                          | Saxena et al.,(2014)             |
| Saponin                    | leaves, roots and stem            | ethanol, methanol and aqueous                                                                  | Saxena et al.,(2014)             |
| Steroids                   | leaves, roots and stem            | aqueous, diethyl ether, chloroform, ethanold, ethyl acetate, methanol, petroleum ether and water | Garg et al.,(2012) and Saxena et al.,(2014) |
| Tannins                    | leaves                            | diethyl ether, ethanol, ethyl acetate and water                                               | Garg et al.,(2012) and Saxena et al.,(2014) |
| Triterpenoides             | leaves                            | aqueous, diethyl ether, chloroform, ethanold, ethyl acetate, methanol, petroleum ether and water | Garg et al.,(2012) and Saxena et al.,(2014) |
and Nutts from Vindhya region of Uttar Pradesh used U. picta against body ache and wounds (Chaudhary, 2010). Whole plant is used by the tribal’s of Tamil Nadu for the antibacterial purpose (Jayaprasad et al., 2012). Root decoction is used against snake bite in Chhattisgarh region (Minu et al., 2012). The root for snake bite, vomiting, fever, cough and gonorrhea in Nasik district (Ahire, 2012). The tribal of Jhabua district of Madhya Pradesh used root decoction for respiratory diseases (Wagh & Jain, 2014, 2015). A decoction of whole plant is used for the treatment of female infertility by the Badagy people of Lagos State, Nigeria (Makinde et al., 2015).

THERAPEUTIC USES

U. picta has been historically used as purported medicines and magic’s. The whole plant and different plant parts are being used in different therapeutic treats (Prasad et al., 1965; Osazuwa & Igboechi, 1988; Igboechi et al., 1989). The leaf powder is used to cure the gonorrhea and for uterus contraction which leads to abortion (Ainslie, 1937). Aphrodisiac ingredient detected in alcoholic and aqueous extracts in roots (Dalziel, 1937). The leaves are used as antiseptic. These are also used in treating child malaria as it showed traces of alkaloids (Adegoke et al., 1968). The leaves prove to reactivate the movement of foetus in pregnant women and have the power to change the sex of a foetus (Lumbo, 1979). It is also reported that the fresh leaves juice was proved to be skin hardener against sword or knife cut when rubbed on skin (Lumbo, 1979). It is used in the preparation of Ayurvedic drug Abana, which is useful in the treatment of hypertension, tachycardia and angina (Khamna et al., 1991). Pods are useful in sore-mouth of children. Roots and leaves are used for treatments of typhoid and tetanus. Traditionally, the plant is used as an antidote to the venom of Echis carinata (Kirtikar & Basu, 1993; Hamid et al., 2004). The use of dashmula, for significant improvement in neurological disorder (Garg et al., 2012). Decoction of root and whole plant is given on heart trouble, fractured bones, cough, chills, fevers, gonorrhea, gout, swelling, obesity and on skin diseases (Mishra et al., 2012; Rahman & Parvin, 2014). Protective effect of aqueous extract of Uraria Pieta on acetonaminphen induced nephrotoxicity in rats (Kale et al., 2012; Odubanjo et al., 2013). Odubanjo et al., 2013 reported that use of phytochemicals for treatment of Alzheimer’s disease (Odubanjo et al., 2013).

PHARMACOLOGICAL ACTIVITIES

Antimicrobial Activity

Different plant part extract and isolated bioactive compounds showed antimicrobial activity. Chemical isolate from the leaf extract of U. picta showed antimicrobial activity (Osazuwa & Igboechi, 1988). Two isoflavanones isolated from root bark showing the antimicrobial activities against both Gram +ve and Gram -ve bacteria and fungi (Ved & Goraya, 2008). The methanol extract showed significantly higher inhibitory effects on the growth of Escherichia coli, Salmonella typhi, Staphylococcus aureus and Streptococcus pneumoniae (Khalili et al., 2013). Additionally, the antibacterial activity of methanolic extracts of leaf, root and callus against the pathogenic bacteria (Ahire et al., 2011).

Acaricidal Activity

Potent acaricidal properties of methanolic extracts of U. picta by using human and domestic animal model compared to the aqueous extract (Ahirrao et al., 2007).

Hypolipidaemic Activity

Abana tablets is prepared from mixture of different herbas including Uraria showed hypolipidaemic activity in rats (Khamna et al., 1991).

Anti-inflammatory Activity

The anti-inflammatory of aqueous and methanolic extracts of U. picta using in vitro and in vivo animal models. The evaluation parameter of in vitro model was nitrous oxide radical scavenging assay, lipoxygenase assay and Carrageenan induced rat paw edema model was used in vitro model (Ahirrao et al., 2007).

Anti-oxidant Activity

The total antioxidant capacity of ethanolic extract. U. picta extract showed significant antioxidant activity. The antioxidant activity was found to be associated with presence of phenolic, flavonoid, sterol and terpene derivatives (Patel et al., 2011). It also inhibits the acetylcholineesterase and butyrylcholinesterase which could make it a good resource to treat Alzheimer’s disease (Odubanjo et al., 2013). Poly herbal formulation consisting with U. picta helps to protect the liver cells from CCl4 induced liver damages (Ghosh et al., 2015).

IN VITRO CULTURE

Natural regeneration of Prishnaparni is less due to poor seed viability and low percentage of germination. Studies were conducted to enhance the percentage of germination of the viable seeds (Okusanya et al., 1991; Ahire et al., 2009). Although plants can be raised by sowing seeds directly in the field, it results in very poor crop stand and yield. In vitro clonal propagation technique is applied to produce large numbers of identical individuals and conservation. In plant species like Prishnaparni, the whole plants are uprooted for the medicinal preparations as the roots contains the active metabolites. This generated extra pressure on natural populations of the plant. In earlier reports, the plant is considered to be rare and endangered in some parts of India (Anand et al., 1998; Gurav et al., 2008; Ahire et al., 2009; Rai et al., 2010). Recently, the plant is categorized in least concern category by IUCN (Groom, 2012). In this context, several authors has made efforts for in vitro clonal propagation of this plant using different plant parts as explants (Table 2). Micropropagation of Prishnaparni using cotyledonary node and node as explants has been reported through direct organogenesis (Anand et al., 1998; Mukundan et al., 2002; Gurav et al., 2008; Rai et al., 2010).
In addition to this, callus mediated shoot organogenesis using leaf explants as well as hardening and acclimatisation of these plantlets (Figure 2). Among the different reports on shoot organogenesis, higher number of shoots per culture was reported (Ahire et al., 2011).

Efficient root initiation and survival of the hardened plantlets under field condition is the key success of any micropropagation protocol (Nikam et al., 2013). Among the different micropropagation reports available on *U. picta*, most of the authors succeeded to produce roots either on half strength MS basal medium or the medium fortified with IBA. Maximum number of roots/shoot (16.2±2.4) was found on half strength MS basal medium + 0.25 mg/l IAA + 0.50 mg/l IBA (Rai et al., 2010). The acclimatized *in vitro* grown plantlets showed 98% survival (Ahire et al., 2011). The genetic fidelity analysis using randomly amplified polymorphic DNA (RAPD) analysis of regenerants revealed 100% uniformity as mother plants (Figure 3). Quantitative estimation of isoflavones from the roots of *in vitro* raised plantlets further confirmed the genetic identity of regenerants (Rai et al., 2010). In addition to the genetic fidelity, the antibacterial activity of methanolic extracts of *in vitro* raised callus in comparison with leaves and root harvested from wild plants (Ahire et al., 2011). Among the different extracts, callus extract showed strong antibacterial activity against pathogenic bacteria. The results suggested that, presence of higher concentrations of active chemical components (isoflavanoids) in callus cultures of *U. picta*.

### Table 2: Shoot organogenesis in *Uraria picta*

| Explant                  | Medium and PGR used                                      | Development Stage                                | Number of shoots per explant/culture | References                  |
|--------------------------|----------------------------------------------------------|--------------------------------------------------|-------------------------------------|-----------------------------|
| Axillary bud and node    | MS + 2.47 µm AS                                          | Direct organogenesis (Bud formation)              | 7.1±0.6                             | Anand et al., (1998)        |
|                          | MS + 5.37 µm NAA + 2.22 µm BAP                             | Indirect organogenesis (Callus inoculated on 0.13 µm BAP) | 17.3±2.8                            |                             |
| Node                     | MS + 1 mg/l BAP                                           | Direct organogenesis                             | -                                   | Mukundan et al., (2002)    |
| Cotyledonal node         | MS + 13.2 µM BAP                                          | Direct organogenesis                             | 36.3±1.7                            | Gurav et al., (2008)       |
| Nodal stem segment       | MS + 0.1 mg/l IAA + 0.1 mg/l BAP + 25 mg/l AS + 0.5 mg/l GA₃ | Direct organogenesis                             | 19.6±2.6                            | Rai et al., (2010)         |
| Leaf                     | MS + 4.44 µM BAP                                          | Indirect organogenesis                            | 58.8±0.8                            | Ahire et al., (2011)       |
| Node                     | MS + 0.5 mg/l TDZ                                         | Direct organogenesis                             | 14.4±3.8                            | Parmar et al., (2012)      |
| Node                     | MS + 0.5 mg/l TDZ                                         | Direct organogenesis                             | 10.3                                | Parmar et al., (2015)      |

**Figure 2:** Indirect shoot regeneration of *Uraria picta*. (a) Leaf derived organogenic callus (b) Induction of shoot primordia from callus (c) elongated shoots (d) rooted shoot and (e) mature plant in natural conditions.

**Figure 3:** Genetic fidelity analysis of micropropagated plants using randomly amplified polymorphic DNA (RAPD), M 100-bp DNA ladder, lane 1 Mother plant, 2–26 micropropagated plants.
CONCLUSIONS AND FUTURE PERCEPTIVE

Dashmula is one such preparation where roots of ten different plant species are used in mixture, among these U. picta is one. Low rate of seed germination, long maturation period are major reason to restrict the population of it. Multiple uses of U. picta have resulted in destructive over-exploitation from the wild to satisfy the ever-increasing demand of pharmaceutical industries. Due to this reasons the available drug of Dashmula in the market is devoid of U. picta roots and hence the necessity of conserving it is almost needful. Though there were some attempts on in vitro shoot culture of U. picta but development of further methods are necessary for large scale propagation of this. Focus on root culture, somatic embryogenesis, elicitation, mutagenesis and transformation research may help in large scale propagation, improvement and their applications in many diseases. In vitro culture techniques can be an alternative to overcome the shortage of natural source of plant material and conservation of this plant. From phytochemical techniques the chemical profile, biological activity and characterization may be helpful in development of specific drug of *Uraria picta*.

DECLARATION OF COMPETING INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

ACKNOWLEDGEMENTS

The authors greatly acknowledge to the staff members of Department of Botany, Savitribai Phule Pune University and Department of Life Science (School of Science), Sandip University Nashik for providing constant support and facility.

ABBREVIATIONS

BAP = 6-Benzylaminopurine, GA3 = Gibberellic acid, IAA = Indole-3-acetic acid, IBA = indole-3-butyric acid, m = meter, mg/l = milligram per litre, mm = millimetre, MS = murashige and Skoog, NAA = α-naphthaleneacetic acid, PGRs = Plant Growth Regulators, RAPD = Random Amplified Polymorphic DNA, TDZ = 1-phenyl-3-(1,2,3-thiadiazol-5-yl)-urea, μM = micro-molar

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