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New Report of Rust Disease of Jangali gobhi (*Launaea procumbens* (Roxb.) Ramayya & Rajagopal,a medicinal plantin Satna, M.P.

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Introduction

Several plants are used as a source of medicine and improved human life from thousands of years. Several herbs possess bioactive compounds such as phenols andpolyphenols which regulate various immune systems. Therapeutic efficacy of many indigenous plants for several disorders has been described by practitioners of traditional medicine. Antimicrobial and nutritional properties of the plants are being increasingly reported from different parts of the world. It has also reported by World Health Organization (WHO) that 95% of the earth's population depend upon traditional medicine for their health care needs and most of this therapy involves the use of plant extracts and their active components. Plants used for traditional medicine contain a wide range of substances that can be used to treat chronic as well as infectious diseases. Since, human have been using many plants as medicine for ancient time but now a days these plants have lost their importance due to the availability of ready-made drugs manufactured by the use of phytochemicals extracted from these plants or synthetic chemicals related to the particular phytochemical.

*Launaea procumbens (Roxb.) Ramayya & Rajagopal*is also a such type of plant which has been used in many human diseases or even disorders like rheumatic affections, insecticidal activity (Chopra *et.al.* 1956; Kirtikar & Basu, 1975; Agharkar, 1991)rheumatism, inflammation and oxidative dysfunction in the kidney (Khan *et.al*., 2010), reproductive disorders (Ahmad, 2006), hormonal imbalances (Qureshi & Raza, 2008) and liver dysfunction(Khan *et.al*., 2011). Phytochemical analyses found that it has synergic acid, 2-methyl-resercinol, salicylic acid, vanillic acid, and gallic acid (Shaukat *et.al*., 2003) which have antioxidant, anticancer, neuroprotective and cardioprotective effects(Middleton *et.al*., 2000; Zhou *et.al*., 2009).Use of herbal medicines in Asia represents a long history of human interactions with the environment. It is Polymorphic perennial herb, with prostrate or decumbent stems and branches without roots at nodes. Basal Leaves of the plant are Rosset, radical, entire or pinnatifid, glabrous. Inflorescence is Head (Capitulum) flowers are yellow, solitary or a few together along the branches. Fruits are

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achenes truncate at both ends, strongly 4-ribbed. Flowering and fruiting occur is October onwards. It is used as fodder for goats. It is also used in the preparation of a cooling sherbet and in Gujarat,leaves are used in curries. It found throughout the plains of India,up to an altitude of 2,400m in Himalayas,in Bengal, Punjab and Southwards through Sindh to the Deccan.

Plant diseases damage not only quantity but they also reduce quality of economic yield. Medicinal plants also suffered from many diseases which reduce the medicinal properties of plants. No any plant pathogen is reported to cause *Launaea procumbens (Roxb.) Ramayya & Rajagopal*. The rust disease of this plant was observed on the experimental farm of AKS University, Satna, Madhya Pradesh in Rabi season of 2020-21. Since, the plant has medicinal properties and it is used as folk medicine by Indian people for ancient time therefore, the disease was considered for study on priority basis.

Materials and Methods

Collection of the Sample: Diseased plants showing symptoms were collected from experimental fields of plant breeding, horticulture, agronomy and from periphery of play ground in the month of January 2021 and were brought in the laboratory for microscopic diagnosis.

Disease Diagnosis: The disease was diagnosed macro and microscopically. Macroscopic diagnosis was done through symptoms produced on the leaves as well as on other plant parts except roots. Photographs of different stages of disease were also taken by mobile camera for evidence. Microscopic diagnosis of the disease was carried out through preparation of temporary as well as permanent slides stained with lactophenol. For the study of uredospores in uredopustules and teliospores in teliopustules,thin sections were cut and mounted on the slides in lactophenol and these slides were observed under binocular compound microscope (Magnus MLX Plus) with 10X and 40X magnifications. Photographs of different stages of causing fungus(aeciospores, uredeospores and teliospores) were also taken for the proof of the fungus.

Identification of the Fungus: The causative fungus of rust disease*of Launaea procumbens* was identified on the basis of morphology, size and color of different types of spores (uredospores and teliospores).Spore size was measured (Two dimensional i.e. two diameters of one urediospores & length & width of teleospores) by ocular micrometer calibrated forhigh-power(45X) magnification.One ocular division of high power (45X) was equal to 3.34µm. Average size was calculated by the formula –

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Size of spore = Number of ocular micrometer divisions occupied × Calibration factor for one ocular division of high power

Statistical analysis for values deviates from the mean was done as -

Standard deviation = $\sqrt{\frac{(X-\bar{X})2}{n-1}}$

Where,

X=the numerical value of spore

$\bar{X}$ = the arithmetic mean or average

n = the number of spores

Results

Sample collection:

Since,*Launaea procumbens*is also a weed grown in unfertile places of the university like on the pathways and edges of experimental fields, periphery of playground, experimental field of Horticulture, Agronomy and plant breeding were seen in mid of December 2020 with reddish-purple-colored vertical leaves. In mid-January 2021 yellowish colored powdery mass was seen and on plants brown - black colored spherical pustules were also seen on the green leaves. These infected plants were collected in the polyethene bags and brought to the laboratory for disease diagnosis.

Disease Diagnosis

Macroscopic Diagnosis: The stem emerged from infected plants become etiolated, pink to dark red colored and leaves also remain etiolated, red colored. Rosset leaves are absent in such type of plants but every node bear narrow etiolated red colored leaves (Fig. 1a). Initially, white colored inverted cups like structure(aecial cups) are formed mostly on lower surface of the lower leaves. Later on, these aecial cups found filled with yellow- colored spores and also were found scattered on the leaf surface(Fig. 1b). Disease incidence was increased in January and February months 2021 and brown or reddish colored rusty appearance (uredopustules) was also found on the upper surfaces of the leaves and on stems also (Fig. 1c). Black or dark brown colored rusty pustules (teliopustules) were also present on the upper surface of the leaves which were bicellular, dark brownish and pedicellate (Fig. 1d).

Microscopic Diagnosis: After observation of temporary slides prepared through infected plants, three types of spores (fungus stages) were recorded out of which -

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Yellow colored, echinulate, nonpedunculated, unicellular and globose, **Aeciospores** (Fig. 2)were seen under compound microscope which were filled in aecial cups. Second type of spores were found yellowish or orange colored, echinulate, pedunculate, unicellularand globose uredospores (Fig. 2) filled in uredopustules on the upper surface of the leaves. Average diameter of uredospores (20.24µm ±1.63µm [Table 1]) was measured by ocular micrometer under high power (45X) objective Lense. Third one type of spores were bicellular, dark-brown, twisted at the apex or tapered, smooth with thick wall, two clled and stalked**teliospores** (Fig. 2) found in the teliopustules either of the sides of the leaves. The average length and width of these telioospores was measured as 36.55µm± 6.96µm and 21.93µm± 2.50µm respectively(Table 1). Aeciospores of black rust of wheat also echinulate (Maherotra & Aggarwal 2014). The size of uredospores of black, brown and yellow rusts of wheat are 25-30 ×17-20, 16-28µmand 23-35×20-35µm respectively while teliospores of black rust of wheat were 40-50µm long and 15-20µm broad with pointed or round tip (Maherotra & Aggarwal 2014).On the basis of spores' morphology, it is confirmed that the causal agent of present disease(rust of *Launaea procumbens*)is *Puccinia* but species might be differentbecause the size of three types of spores (aeciospores, uredospores and teliospores) is differ as compare to spores of wheat rusts.The work is going on for identification of pathogen causing rust of *Launaea procumbens*upto species level.

It was concluded that the disease occurred on*Launaea procumbens*(jangali gobhi) is a rust disease which can damage the medicinal properties. Since, no buddy discovered this disease earlier therefore, it can not be compared. This disease (rust) can damage the plants and can destroy the whole plants population which is the signal of extinction of this medicinal plant.Since, rust fungus development in the plants depends on suitable environmental conditions and source of the fungus inoculum, therefore, rust of *Launaea procumbens*occurred in the Satna (Madhya Pradesh) due to favorable conditions in December and January months. The study of real etiology is goingon.

Standard deviation of uredospores = $\sqrt{\frac{24}{10-1}}$ — equation I

$= \sqrt{2.67}$

$= \pm 1.63\mu m$

Standard deviation of length of teliospores = $\sqrt{\frac{436.6}{10-1}}$ — equation II

$= \sqrt{48.5}$

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$= \pm 6.96\mu m$

Standard deviation of width of teliospores = $\sqrt{\frac{55}{10-1}}$ —equation III

$= \sqrt{6.01}$

$= \pm 2.5\mu m$

Table 1. Standard deviation of teliospores &uredospores

n	Teliospore (lengthinμm**)**			Teliospore (widthinμm)			Uredospore (avg. dia. in μm		
	X	**X-** $\bar{X}$	**(X-** $\bar{X})^2$	**X**	**X-** $\bar{X}$	**(X-** $\bar{X})^2$	**X**	**X-** $\bar{X}$	**(X-** $\bar{X})^2$
1	40.8	+1.7	2.9	22.1	00.0	00.0	21.3	+0.4	0.16
2	35.7	-3.4	11.6	20.4	-1.7	2.9	22.1	+1.2	1.44
3	23.8	-15.3	234.1	18.7	-3.4	11.6	19.2	-1.7	2.89
4	40.8	+1.7	2.9	20.4	-1.7	2.9	20.9	0.0	0.00
5	27.2	-11.9	141.7	20.4	-1.7	2.9	20.4	-0.5	0.25
6	40.8	+1.7	2.9	27.2	+5.1	26.0	21.7	+0.8	0.64
7	40.8	+1.7	2.9	23.8	+1.7	2.9	20.0	+0.9	0.81
8	34.0	-5.1	26.0	23.8	+1.7	2.9	20.9	0.0	0.00
9	39.1	00.0	00.0	22.1	00.0	00.0	18.4	-2.5	6.25
10	42.5	+3.4	11.6	20.4	-1.7	2.9	17.5	-3.4	11.56
	365.5		436.6	219.3		55.0	202.4		24.00
	X/N = 36.55			X/N = 21.93			X/N = 20.24		

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Competing interests: Authors have declared that no competing interests exist.

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Fig. 1. Symptoms of the disease; etiolation with dark pink & red colored leaves & stem a), aecial cups with yellow colored aeciospores b), brown colored uredopustules on the upper surface of the leaves c), black colored teliopustules.

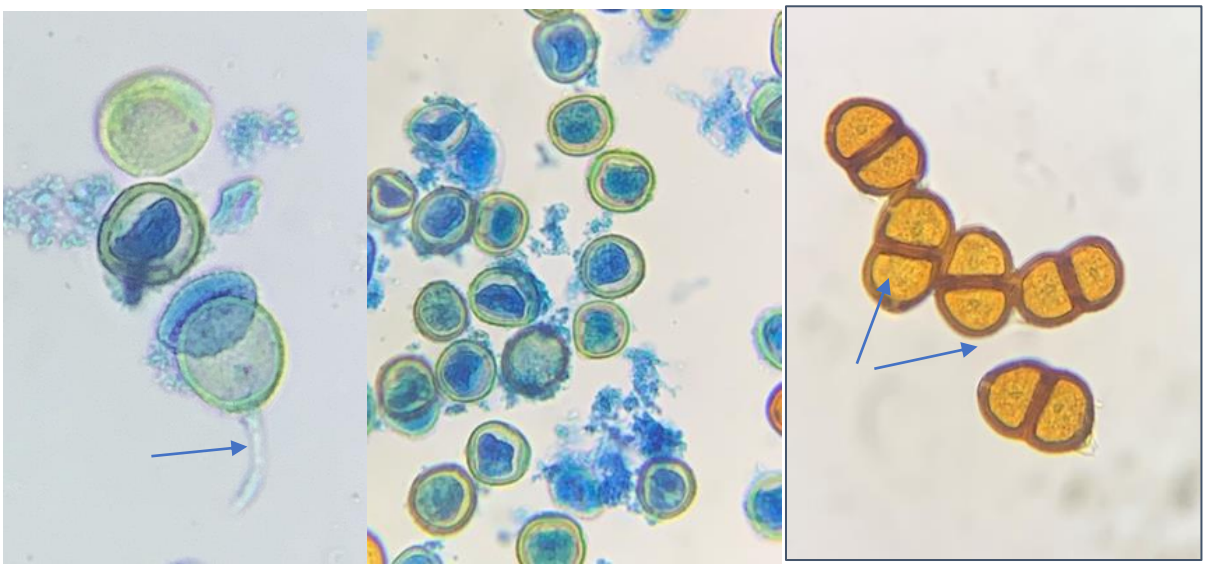

Fig. 2. Different type of spores: Aeciospores a), teleospores with pedicle b), new born teliospore c)

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Authers' Contribution: DScomposed the manuscript & measured the spores;**ML**taken the photographs & complete the statistical analysis.

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