



## Research Paper

### Common Diseases of Betelvine (*Piper betle* L.) in Bhanpura Tehsil of Madhya Pradesh

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**Abstract:** Betelvine is an evergreen climber with heart-shaped leaves. It is known as “Paan” in Hindi. There are archaeological evidences that the betel leaves (Paan) have been chewed from very ancient times. In Indian traditional medicinal system betelvine has been used for its remedial properties. It is mainly cultivated in Madhya Pradesh, Bihar, Uttar Pradesh, Assam, Andhra Pradesh, Tamil Nadu and West Bengal. Cultivation under controlled condition is practiced in areas where relative humidity is often low and temperature remains high (above 40°C) in summer and low (below 10°C) in winter. Cultivation under controlled conditions (Panwari) is practiced in Bhanpura. Panwari is a hut like structure which provides shade and humid condition to the crop. Shade and humid condition is also favourable for fungal growth also. In Bhanpura we found two major types of diseases 1) caused by insects and Mites and 2) by microorganism (Bacteria and fungi). Common diseases of betelvine are Foot rot, Stem rot, Leaf rot, Yellow leaf disease, Leaf spot, Wilting,

Sooty Mold, Red spider mites and White fly. We identified six pathogenic soil fungi, which are responsible for major fungal diseases of betel vines. *Aspergillus sp.* was reported in all soil samples of all seasons. Comparatively more fungi were found in rainy season than in winter and summer.

**Keywords:** Betelvine, Foot rot, Fungi, Leaf rot, Panwari, Paan, Stem rot.

#### Introduction:

Betelvine (*Piper betle* L., family Piperaceae) is an evergreen, shade loving, vegetatively propagated perennial climber with heart-shaped leaves grown for its leaves. (Bajpai *et al.*, 2012). In Indian languages it is known as Nagavallari (Sanskrit), Nagbael (Marathi), Nagarbael (Gujurati), Nagballi (Telugu), Vettilla (Tamil), Villayadela (Kannada), Vettilakkoti (Malyalam) and Paan in Hindi. In other countries it is known as Tanbol in Arabic, Burg-e-Tanbol in Persian, Bulath in Sinhala, Pelu in Thai and Sirih in Malay (Pradhan *et al.* 2013).

The cultivation of betelvine a traditional agriculture in India, provides one major example of how from very mild climatic regions (tropics) plants were introduced to areas where climatic changes were sharp (sub-tropics) (Kumar, 1999). Both natural and controlled conditions are suitable for growth. Cultivation under controlled conditions it practice in a hut like structure (a type of green house) called as *Panwari*. It is regarded as the temple as people leave their footwears before entering the *panwari*. This symbolizes the maximum care and maintenance of cleanliness in the *panwari*.

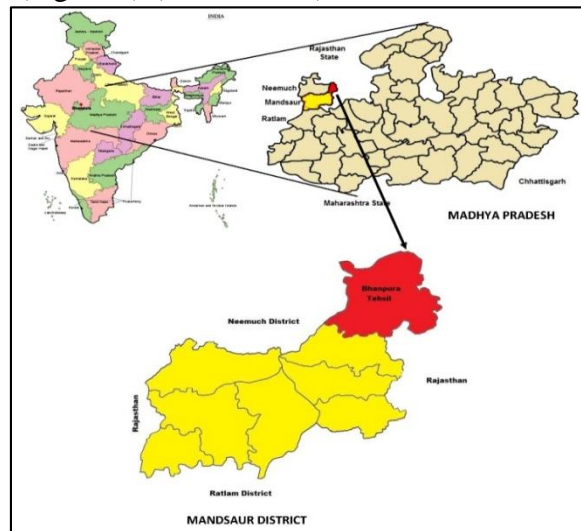
The cultivation under controlled condition is practiced in the areas where relative humidity is often low and temperature remains high (above 40°C) in summer and low (below 10°C) in winter. The microclimate plays an important role in the production of good quality *paan*. The exact period of *paan* cultivation is not known. However, as per literature available in Charak samhita this practice is mentioned as older than 600-400 BC.

Betelvine is an important commercial crop in India, It is mainly cultivated in Madhya Pradesh, Bihar, Uttar Pradesh, Assam, Andhra Pradesh, Tamilnadu and West Bengal (Verma, *et al.*, 2004). Majority of the people in Bhanpura are involved in agriculture and its allied activities. The major crop of the region is betel vine leaves. Bhanpura has a good agricultural potential that can be helpful in the growth of agro trade in the region but very little attention has been paid to improve this major economic crop. There are no major industries in the city.

## METHODOLOGY

**Study Area:** Bhanpura is a tehsil of Mandsaur district of Madhya Pradesh, India. It lies between latitude 24.52°N and longitude 75.73°E in the North western part

of Madhya Pradesh (Wikipedia). It is situated at 384 meters above the mean sea level at 127 km north-east from Mandsaur and 33 km south-east of Gandhi Sagar Dam (Figure 1) (UMC, 2013).



**Figure 1:** Location of Bhanpura Tehsil of Mandsaur District in India

**Experimental Sites:** On the basis of geographical position we divide our study area into three experimental sites (Figure 2): a) Billi-Khoh area, b) Indragarh Jalashay area and c) Forest area. We selected four *panwaris* on the basis of the age of *panwari* and the type of soil at each experimental site (Figure 3 to 5).



**Figure 2:** Experimental Sites at Bhanpura, 1) Billi-Khoh Area, 2) Indragarh Jalashay Area and 3) and Forest Area

Indragarh Jalashay Area



**Figure 3:** Selected *Panwaris* at Billi-Khoh Area



**Figure 5:** Selected *Panwaris* at Forest Area



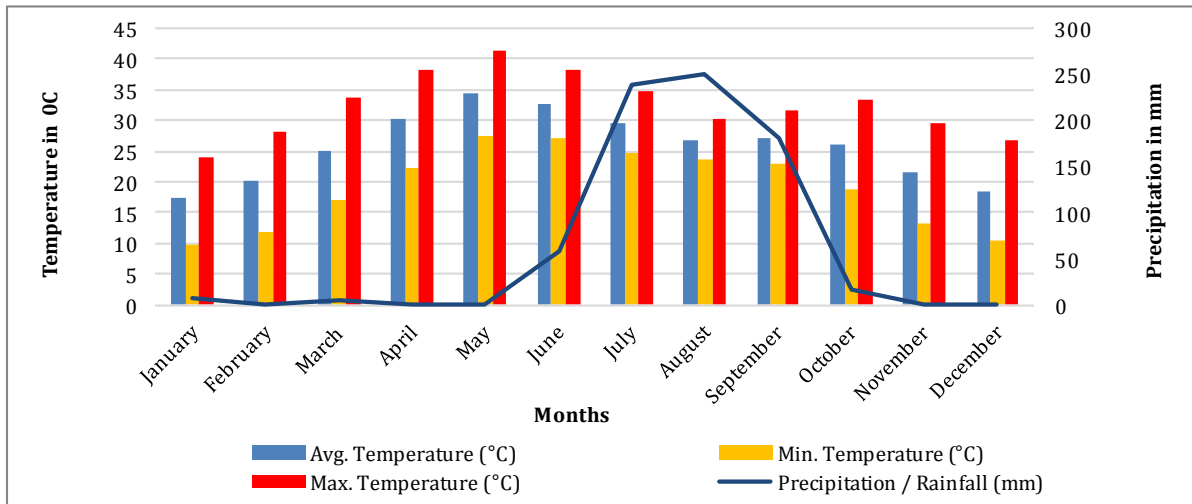
**Figure 4:** Selected *panwaris* at

**Climate**

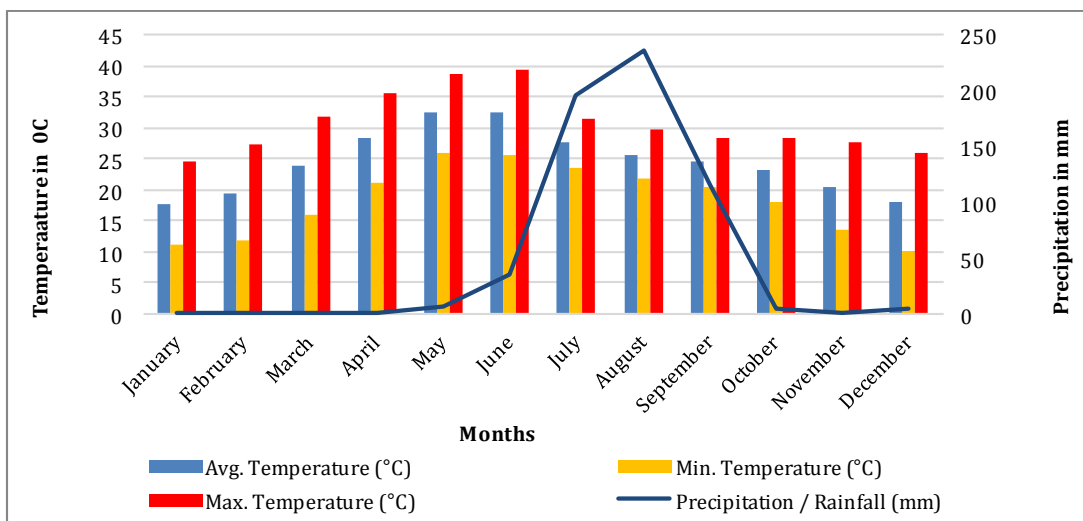
The climate of the Bhanpura is semi-tropical characterized by hot summer and well-distributed rainfall during the south-west monsoon. The optimum annual rainfall is 32 inches.

**Ombrothermic Diagram**

Ombrothermic diagrams were prepared for the year 2014 and 2017. (Figure 6 to 7).



**Figure 6:** Ombrothermic Diagram of Bhanpura Tehsil (2014)



**Figure 7:** Ombrothermic Diagram of Bhanpura Tehsil (2017)

### Survey of Betelvine Fields

Extensive surveys of *panwaris* of different areas of Bhanpura were done during various seasons of 2014 and 2017. Information was collected about various diseases of betel leaf in different seasons.

### Isolation and Identification of Soil Fungi from Different Betelvine Fields

#### 1. Soil Sample Collection

The soil samples were collected from the rhizosphere zone of infected betelvine plants of different experimental sites of Bhanpura (Piper, 1966). Soil samples were air dried and crushed to powder.

#### 2. Isolation of Soil Fungi

Soil fungi were isolated by soil dilution method (Waksman, 1922). Potato Dextrose Agar (PDA) medium was prepared and

poured into sterilized Petri dish within the aseptic cabinet (Aneja, 2001). Serially diluted (up to  $10^{-4}$ ) inoculums were inoculated on PDA media into sterilized Petri dishes. Petri dishes were incubated at  $28 \pm 2^\circ\text{C}$  for culturing soil fungi (Waksman, 1922).

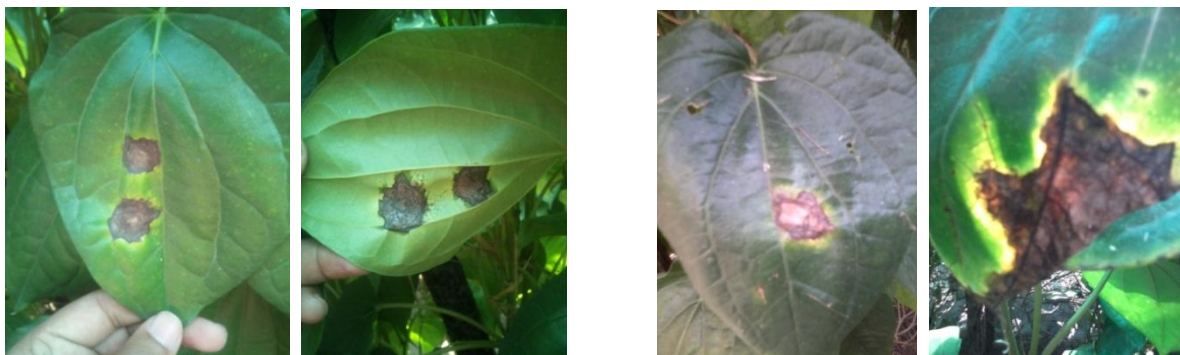
### 3. Identification of Soil Fungi

After inoculation observations were taken at regular intervals of 24 hrs. After 72 hrs the number of fungal colonies present in each Petri dish was counted and colony characters were noted. Pure cultures of all fungi were prepared (Webster and Weber, 2007). Various soil fungi were identified by

preparing sub-culture with the help of literature (Gilman, 2001, Nagamani, 2006).

### Result and Discussion:

In betelvine fields of Bhanpura we found two major types of diseases 1) caused by insects and Mites and 2) by microorganism (Bacteria and fungi). Common diseases of betelvine in Bhanpura tehsil are Foot rot, Stem rot, Leaf rot, Yellow leaf disease, Leaf spot and Wilting (Figure 8 and Table 1) (Chattopadhyay and Maiti, (1990). We identified six pathogenic soil fungi viz., *Alternaria alternata*, *Aspergillus sp.*, *Cladosporium sp.*, *Curvularia lunata*, *Fusarium semitectum* and *Phytophthora parasitica var. piperina*.



Leaf Spot Disease in Betelvine



Leaf Rot Disease in Betelvine



Foot rot and stem rot disease in betelvine



Red Spider Mites and White Fly in Betelvine

Sooty Mold in Betelvine

**Figure 8:** Major Diseases of Betelvine in Bhanpura Tehsil

**Table 1: Major Diseases of Betelvine in Bhanpura Tehsil**

S. No.	Disease of Betelvine	Symptoms	Causal Agent
1	Foot rot	sudden wilting of vine, drooping of the leaves from tip downwards	<i>Phytophthora parasitica var. piperina</i>
2	Leaf rot	Leaves show circular to irregular water soaked spots, leaves turn brown to dark brown and defoliation occur	<i>Phytophthora parasitica var. piperina</i>
3	Leaf spot ( <i>Phytophthora sp.</i> )	Leaves show black or brownish water soaked spots, In latter stage the spots cover a part or whole of the leaf blade	<i>Phytophthora parasitica var. piperina</i>
4	Leaf spot ( <i>Fusarium sp.</i> )	A large circular spot with a number of broad and distinct concentric zones of alternate chocolate brown and light brown colour	<i>Fusarium semitectum</i>
5	Leaf spot ( <i>Cladosporium</i> )	Infection start from the tip or margin and gradually increases towards the midrib, brown lesion formation	<i>Cladosporium sp.</i>
6	Leaf spot	Leaves show small circular to irregular brown	<i>Curvularia sp.</i>

	( <i>Curvularia sp.</i> )	spots on both surface of leaf, spots turn brown to dark brown or black and defoliation occur	
7	Leaf spot ( <i>Alternaria sp.</i> )	Dark brown or black circular spots, covered with yellow colour, defoliation occur	<i>Alternaria sp.</i>
8	Wilting	Yellowing of leaves, plant wilts gradually	<i>Fusarium sp.</i>
9	Stem rot	infected stems are firstly brown and turn to black later	<i>Aspergillus sp.</i> ,
10	Yellow leaf disease	Yellowing half of the leaf blade, rapidly enlarges and covers whole of the leaf blades, Finally, showed rotting and defoliation occurred	<i>Aspergillus sp.</i>
11	Sooty Mold	Black rusty particles seen on upper surface of leaf	Ascomycetes fungi
12	Bacterial leaf spot	tiny, brown water soaked specks on the leaves surrounded by a yellow halo, which enlarge later and become necrotic irregular brown spots, the affected leaves defoliate prematurely	<i>Xanthomonas campestris p.v. betlicola</i>
13	Red spider mites	Formation of red or brown spots on the lower surface of the leaves. Leaves turns to pale yellow and dry after some time	<i>Tetranychus sp.</i>
14	White fly	Formation white spots on the lower surface of the leaves, Leaves turns to pale yellow and dry after some time	<i>Dialeurodes sp.</i>

#### 2014

*Alternaria alternata* and *Cladosporium sp.* were not found in black and red soil of all three experimental sites in both seasons. *Phytophthora parasitica var. piperina* was present in sandy brown soil of all three experimental sites in both seasons while *Aspergillus sp.* was reported in all soil samples. *Fusarium semitectum* was found only three soil samples in summer but it found in ten soil samples in rainy season. *Curvularia lunata* was reported in only few soil samples of both seasons.

#### 2017

*Alternaria alternata* was present in four soil samples in both seasons. *Aspergillus sp.* was found in all soil samples of both seasons. *Cladosporium sp.* and *Curvularia lunata*

were reported in few soil samples in both seasons. *Fusarium semitectum* was present in six soil samples out of twelve in winter season but it was found in five soil samples in rainy season. *Phytophthora parasitica var. piperina* was reported two times in soil sample in rainy season as compared to soil samples of winter season.

During the study *Aspergillus sp.* was reported in all soil samples of Bhanpura of all seasons. It was also noticed that sandy brown soil of Forest area showed maximum numbers of fungi in both years. The findings revealed that the maximum fungi were reported in rainy season, while moderate in summer seasons.

Foot rot, Stem rot, Leaf rot and Yellow leaf disease were reported at Bhanpura in all seasons. Maw and Zaw (2016) found that

fungus diseases can cause loss of yield in betel leaves production in Myanmar. They isolated *Alternaria sp.*, *Aspergillus sp.*, *Cladosporium sp.*, *Colletotrichum sp.*, *Curvularia sp.*, *Fusarium sp.* from infected parts of betelvine in Myanmar. Primary symptom of the wilting disease is the loss of luster of the betel leaves. Soon after, the vines show signs of wilting and the leaves become pale. Finally the vine completely wilts and dries up. According to Dastur (1927) this disease is caused by *Phytophthora parasitica* in Madhya Pradesh. Later Dastur (1935) carried out an extensive study on this disease and found that Root-rot in Madhya Pradesh is primarily due to the attack of *P. nicotianae* var. *parasitica* and *Pythium piperinum*. There were two types of leaf rot symptoms caused by *Phytophthora sp.* as reported by Maiti and Sen (1977). Under favourable conditions the spots broaden rapidly. Leaf spot caused by *Fusarium sernitectum* has been identified from West Bengal (Chattopadhyay and Sen Gupta, 1955). Comparatively more fungi were found in rainy season than in winter and summer. Maiti and Sen (1979) found that foot rot, leaf rot, leaf spot and anthracnose are widespread and cause frequent annual losses to crop yield and quality where rainfall and temperature are favourable for soil fungi. Chakrabarty (2018) found role of climatic conditions on growth of betelvine plant and reported that occurrence of leaf spot was found more in rainy season.

### Conclusion:

Betelvine is an important cash crop of Bhanpura, There is a great possibility of betel leaf cultivation. Betel leaf is very sensitive so extreme climatic conditions can cause loss of yield. Fungal Diseases, Unsatisfactory marketing, insufficient transportation and storage facilities are the

major issue in this field. *Aspergillus sp.* and *Phytophthora parasitica* var. *piperina* were found to be highly virulent for betel leaf cultivation.

### References:

- Bajpai V., Pandey R., Negi M.P.S., Himabindu K., Kumar N. and Kumar B. (2012) Characteristic differences in metabolite profile in male and female plants of dioecious *Piper betle* L. J. Biosci., 37: 1061-1066.
- Pradhan D., Suri K. A., Pradhan D. K., and Biswasroy P. (2013) Golden Heart of the Nature: *Piper betle* L., Journal of Pharmacognosy and Phytochemistry, Volume 1 Issue 6, pp.147-167.
- Kumar N (1999) Betelvine (*Piper betle* L.) cultivation: A unique case of plant establishment under anthropogenically regulated microclimatic conditions, Indian journal of History of science, 34(1), pp.19-32.
- Kumar N., Misra P., Dube A., Bhattacharya, S., Dikshit M. and Ranade S. (2010) *Piper betle* Linn. a maligned Pan-Asiatic plant with an array of pharmacological activities and prospects for drug discovery. Current Science, Vol. 99, No. 7, 10 October 2010, pp-922-932.
- <https://en.wikipedia.org/wiki/Bhanpura>
- Urban Management Centre (UMC) (2013) City Development Plan, Bhanpura, District Mandsaur, Madhya Pradesh. Urban Administration & Development Department, Government of Madhya Pradesh. Web: [www.umcasia.org](http://www.umcasia.org).
- Verma A., Kumar N., Ranade A. (2004) Genetic diversity amongst landraces of a dioecious vegetatively propagated plant, betelvine (*Piper betle* L.), J. Biosci., Vol. 29, No. 3, September.
- Piper C. S., (1966) Soil and Plant Analysis. Hans Publishers Bombay. Reprint for Asia 1966. pp. 1-6.

- Waksman S. A. (1922) J. Bact., 7:339-341.
- Aneja K. R. (2001) Experiments in Microbiology, Plant pathology and Biotechnology, Newage International Publishers, Vol 4, 157-162.
- Webster J. and Weber R. W. S. (2007) Introduction to Fungi, Third Edition, Cambridge University Press. The Edinburgh Building, Cambridge CB2 8RU, UK.
- Gilman J. C., (2001) A Manual of Soil fungi, 2nd Indian edition, Biotech Books, Delhi.
- Nagamani A, Kunwar I.K, and Manoharachary C. (2006) Hand book of soil fungi, I.K.International Pvt. Ltd.
- Chattopadhyay S. B. and Maiti S. (1990) Diseases of betelvine and spices. New Delhi, Indian Council of Agricultural Research (ICAR), pp. 160.
- Jahan A., Islam Md. R., Rahman Md. M., Rashid, Md. H., and Adan, Md. J. (2016) Investigation on foot and root rot of betel vine (*Piper betle* L.) in Kushtia district of Bangladesh. Journal of Bioscience and Agriculture Research, Vol. 07, Issue 01: 590-599.
- Mishra R. Shrivastava D. K. and Kumar A. (2017) Diversity and seasonal variation of soil mycoflora of Bilaspur District of Chhattisgarh State, Indian J. Sci. Res. 13 (2), 184-187.
- Suryavanshi S. E. (2014) Studies on leaf spot disease of betelvine (*Piper betle* L.) caused by *Alternaria alternata* (Fr.). M Sc Thesis. Keissler. Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra.
- Maw S. S. and Zaw N. (2016) Isolation of pathogenic fungi from *Piper betle* L. Department of Botany, University of Mandalay Open Access Repository. Online available at: <http://umoar.mu.edu.mm/handle/123456789/41>.
- Dastur J. F. (1927) A short note on foot rot disease of pan in the Central Provinces. Agriculture Journal of India 22: 105-108.
- Dastur J. F. (1935) Diseases of pan (*Piper betle*) in the Central Provinces. Proceedings Indian Academy of Sciences I(B), 778-815.
- Malti S. and Sen C. (1977) Leaf and foot rot of *Piper betle* caused by *Phytophthora palmivora*. Indian Phytopathol. 30, 438-39.
- Chattopadhyay S. B., and Sen Gupta S. K. (1955) A new disease of *Piper betle* in W. Bengal. Indian Phytopathology, 8, 105-111.
- Maiti S. and Sen C. (1979) Fungal Diseases of Betel Vine, PANS 25(2), 150-157.
- Chakrabarty R. (2018) Effect of environmental factors on diseases of betelvine (*Piper betle*) in Assam. *Indian Phytopathology* 71, 537-542.  
<https://doi.org/10.1007/s42360-018-0076-1>

**Table 2: Soil Fungi Present in Various Panwaris of Bhanpura (2014)**

S. No.	Area and soil type		Name of fungi in different season											
			<i>Alternaria alternata</i>		<i>Aspergillus sp.</i>		<i>Cladosporium sp.</i>		<i>Curvularia lunata</i>		<i>Fusarium semitectum</i>		<i>Phytophthora parasitica var. piperina</i>	
			S	R	S	R	S	R	S	R	S	R	S	R
1	Billi Khoh Area	Brown	-	+	+	+	-	-	-	-	-	+	-	-
2		Black	-	-	+	+	-	-	-	+	-	-	-	-
3		Red	-	-	+	+	-	-	-	-	-	+	-	-
4		Sandy brown	+	-	+	+	-	+	-	-	-	+	+	+
5	Indragarh Jalashay Area	Brown	-	+	+	+	+	+	-	-	-	+	+	+
6		Black	-	-	+	+	-	-	-	-	-	+	-	-
7		Red	-	-	+	+	-	-	-	+	+	+	-	-
8		Sandy brown	-	+	+	+	-	+	-	-	+	+	+	+
9	Forest Area	Brown	+	+	+	+	+	+	-	-	-	+	+	+
10		Black	-	-	+	+	-	-	-	-	-	-	-	+
11		Red	-	-	+	+	-	-	+	+	+	+	+	+
12		Sandy brown	+	+	+	+	+	+	-	-	+	+	+	+

S= Summer, R= Rainy; Fungi present "+", absent "-"

**Table 3: Soil Fungi Present in Various Panwaris of Bhanpura (2017)**

S. No.	Area and soil type		Name of fungi in different season						
			<i>Alternaria alternata</i>	<i>Aspergillus sp.</i>	<i>Cladosporium sp.</i>	<i>Curvularia lunata</i>	<i>Fusarium semitectum</i>	<i>Phytophthora parasitica var. piperina</i>	

			W	R	W	R	W	R	W	R	W	R	W	R
1	Bili Khoh Area	Brown	-	-	+	+	-	-	-	-	+	+	-	+
2		Black	+	+	+	+	+	+	-	-	-	-	-	+
3		Red	-	-	+	+	-	-	-	-	+	-	+	-
4		Sandy brown	-	-	+	+	-	-	+	+	-	-	+	+
5	Indragarh Jalashay Area	Brown	+	+	+	+	-	-	-	-	+	+	-	+
6		Black	-	-	+	+	-	-	+	+	-	-	-	+
7		Red	+	+	+	+	-	+	-	-	+	+	-	-
8		Sandy brown	-	-	+	+	+	+	-	-	-	-	+	+
9	Forest Area	Brown	-	-	+	+	-	-	-	+	-	-	-	-
10		Black	-	-	+	+	-	-	-	+	+	+	-	+
11		Red	-	-	+	+	-	-	+	-	-	-	-	-
12		Sandy brown	+	+	+	+	-	-	-	-	+	+	+	+

W= Winter, R= Rainy; Fungi present “+”, absent “-”