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Bindhu KG
Agricultural Extension and
Education Center, Lingasuguru,
UAS, Raichur, Karnataka, India

Aravind Rathod
Agricultural Extension and
Education Center, Lingasuguru,
UAS, Raichur, Karnataka, India

Vanishree S
Agricultural Extension and
Education Center, Lingasuguru,
UAS, Raichur, Karnataka, India

Umesh Babu
Agricultural Extension and
Education Center, Lingasuguru,
UAS, Raichur, Karnataka, India

DS Zaheer Ahamed
Agricultural Extension and
Education Center, Lingasuguru,
UAS, Raichur, Karnataka, India

Ambrish KV
Agricultural Extension and
Education Center, Lingasuguru,
UAS, Raichur, Karnataka, India

Geographical indication system and Geographical positioning system: To determine the prevalence and variability of Phytophthora blight of pigeonpea

Bindhu KG, Aravind Rathod, Vanishree S, Umesh Babu, DS Zaheer Ahamed and Ambrish KV

Abstract

Survey was conducted for three consecutive years, 2019, 2020 and 2021 at major pigeonpea growing areas of Raichur district pertaining to Lingasuguru taluk, Karnataka. Pigeonpea crop was prone to many diseases viz., collar rot, Fusarium wilt, dry root rot, Sterility mosaic disease and phytophthora blight. While the highest Phytophthora blight incidence was observed during the year 2021 with incidence of 18.25 per cent observed at Buddini village.

Keywords: Phytophthora, PB, pigeonpea, GIS & GPS

Introduction

Pigeonpea (Arhar) commonly known as red gram or tur is a very old crop of this country. After gram, arhar is the second most important pulse crop in the country. Pigeonpea is prone to 100s of diseases and pests. The losses caused by the diseases are from 10 to 100%. Collar rot, Fusarium wilt, dry root rot, sterility mosaic disease (SMD), and phytophthora blight are major loss causing diseases of pigeonpea. Among them Fusarium wilt caused *Fusarium udum* causes heavy losses upto 10 to 100% (Kannaiyan, 1984). Followed by other diseases like Phytophthora blight (PB) which is increasing its havoc in recent days. In the Indian subcontinent, sterility mosaic (SMD) is the most destructive disease of pigeonpea. Seven decades of research have yielded significant results. Advances in the field of identification detection and transfer of causal agents of this major disease are allowing it to spread. Development of a broad-based, long-lasting pigeonpea varieties that are resistant to disease.

Plate 1. Pigeonpea crop at different stages

(a. Pigeonpea flower, b. Pod formation stage, c. Pods, d. Raecemes, e. matured pods and f. healthy pigeonpea plant)

Materials and Methods

During the months of September, October and November 2019, 2020 and 2021. A Fixed plot survey was conducted for the occurrence of Fusarium wilt, Phytophthora blight, collar rot, SMD & dry root rot of pigeonpea was conducted using GPS coordinates in major pigeonpea growing areas of in thirty villages of Lingasuguru taluk, viz., Echanal, Upperi, Gorebal, Gudihal, Buddini, Adavibhavi, Neeralakere, Baiyapur, Hilalpur, Ammenagad, Yaradoni, Karadkal, Kuppigudda, Hatti, Anwari, Kasaba Lingasuguru, Sarjapura, Chikka hesarur, Kalli lingasuguru, Mincheri Amarawati, Gonwara, Parampur, Kachapur, Margantanal, Nagarhal, Harnapur, Santekallur, Mudgal, Mattur of during Survey was conducted at flowering to pod filling stage of the crop to determine the status of incidence of Phytophthora blight of pigeonpea at field level. Observations were drawn for the disease incidence (Fig. 1, Table 1). Percentage PB incidence was calculated as (Sharma *et al.*, 2006)

$$\text{PB incidence (\%)} = \frac{\text{Number of PB infected plants}}{\text{total number of plants}} \times 100$$

Results and Discussion

A. Symptoms of Phytophthora blight observed in the field

Phytophthora blight or stem rot of pigeonpea was described for the first time from India (Pal

Corresponding Author:

Bindhu KG
Agricultural Extension and
Education Center, Lingasuguru,
UAS, Raichur, Karnataka, India

and Choudary 1970), although its suspected occurrence was reported by Williams *et al.*, (1968) [6]. The disease is periodically found in the regions of India, Panama, Kenya, Dominican Republic and Puerto Rico. The causal agent of fungus was identified as *Phytophthora drechsleri* Tucker var. f. sp. *cajani*. It is a potentially important disease of pigeonpea in India next to wilt and sterility mosaic disease (Kannaiyan *et al.*, 1981) [4].

The characteristic symptoms of the Phytophthora blight disease are water-soaked lesions on the leaves and slightly

sunken lesions on the stem and petioles (Plate 1). Lesions girdle the stem and the foliage dries up. As per as economic importance is concerned, the disease is potential enough to kill young seedlings of 1-7 weeks old leaving the plants with large gaps in between. Visible snaky patches on the stem (Plate 2, 3 & 4). Stem bending being a typical symptom of Phytophthora (Plate 1, Fig 1). The short duration varieties are very much prone to the yield losses rather than medium and long-duration varieties.

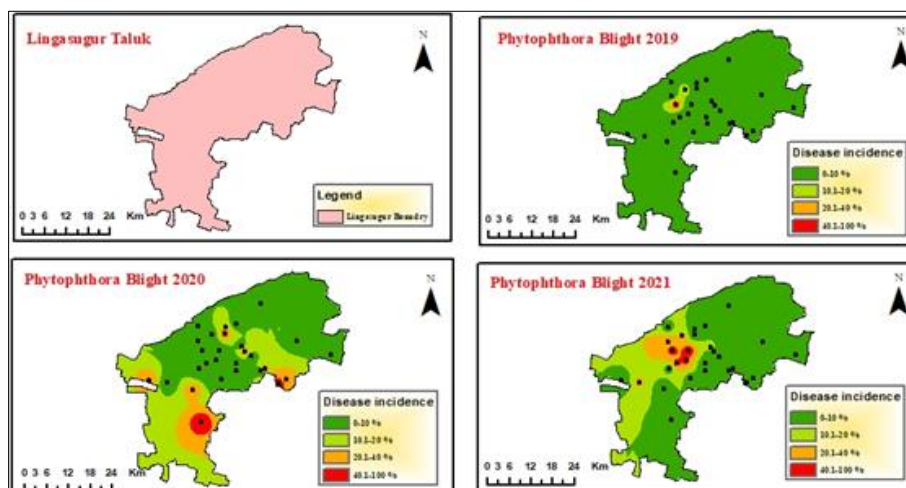


Fig 1: Cartographic representation of Phytophthora blight infected villages of Lingasugur taluk during 2019, 2020, 2021



Plate 1: Water soaked lesions on the leaves



Plate 2: Snaky patches on the stem



Plate 3: Stem bending a typical symptom of Phytophthora blight



Plate 4: Survey for incidence of Phytophthora blight during 2021

B. Occurrence and distribution of diseases of pigeonpea

Survey was conducted during September –November 2019, 2020 and 2021 to know the status of PB of pigeonpea and its incidence under field condition.

The highest Phytophthora blight incidence of 5.00 per cent was recorded (2019) in Echanal village, followed by 2.60 per cent (Gorebal). No incidence was recorded by Upperi and other villages.

The highest blight incidence of 17.23 per cent was recorded

by Mincheri village (2020) followed by 16.73 per cent in Ammenagad village. On contrary no incidence was observed by Gudihal, Echanal, Yaradoni etc.

During the year 2021 the highest blight incidence of 18.25 per cent was observed by Buddini village followed by Adavibhavi with the incidence of 15.75 per cent. No incidence of blight was observed in Hilalpur village (Table 1).

Conclusion

GIS and GPS serves as a common platform for convergence of multi-disease surveillance activities. It is a fantastic tool for visualising and analysing epidemiological data and finding trends, dependencies, and inter-connectivity. The current study provides the data on the occurrence, prevalence and distribution of Fusarium wilt incidence in major pigeonpea growing areas of Lingasuguru taluk and to find out the hot spots of *F. udum* in different places. The pathogen is gaining more importance especially in the current scenario of climate change. Even though various control measures are taken so far, more focus on the breeding aspects so that the diseases will be prevented naturally with the innate resistance. The management of PB is essential to provide increased and stable pigeonpea yields throughout the pigeonpea growing regions. The PB management should not be completely rely on the use of fungicides, as the development of fungicide resistance in *Phytophthora* spp. has been commonly observed. Hence, IDM programs suitable for adoption by resource poor farmers should be emphasized. It is advised that the PB management in pigeonpea should be based on the location specific disease predictive models.

HPR should be emphasized over other control measures as the most environmental-friendly and economic disease control strategy. Selection of resistant sources for genetic improvement programs should be based on resistance to PB at seedling, vegetative, flowering and podding stages since many lines resistant in seedling/vegetative stage can be susceptible/or show disease symptoms at later growth stages. However, there is a need of developing inoculation and screening procedures for exploiting HPR.

Table 1: Survey for the incidence of Phytophthora blight in major pigeonpea growing areas of Lingasugur taluk for three consecutive years (2019, 2020, 2021)

Sl. No	Village	Latitude	Longitude	Variety	Soil type	Disease incidence Phytophthora blight (%)		
						2019	2020	2021
1	Echanal	16.173942364432193	76.43873237474632	TS-3R	Red soil	5.60	0.00	15.50
2	Upperi	16.195950895623753	76.42731689341558	TS-3R	Red soil	0.00	0.00	13.75
3	Gorebal	16.210222278967045	76.4620712654747	TS-3R	Black soil	2.60	0.00	10.00
4	Gudihal	16.041091544068223	76.70345648337864	Gulyal	Red soil	0.00	0.00	7.50
5	Buddini	15.930278402283928	76.79040297165551	Gulyal	Black soil	0.00	0.00	18.25
6	Adavibhavi	16.15015140433791	76.47089052388418	TS-3R	Black soil	0.00	0.00	15.75
7	Neeralakere	16.142883443350737	76.44859109597215	TS-3R	Red soil	0.00	0.00	15.55
8	Baiyapur	16.09639096716929	76.35622072402442	Gulyal	Black soil	0.00	0.00	10.00
9	Hilalpur	16.048605680994083	76.68559660686059	GRG-811	Black soil	1.50	0.00	0.00
10	Ammenagad	16.110460303015557	76.72233214142393	Gulyal	Black soil	0.00	16.73	0.00
11	Yaradoni	16.16289791685124	76.74275984536386	GRG-811	Black soil	2.5	0.00	0.00
12	Karadkal	16.158898262952874	76.55318342625417	TS-3R	Black & Red soil	0.00	0.00	1.23
13	Kuppigudda	16.124855481169455	76.57791141416969	TS-3R	Black soil	0.00	0.00	1.00
14	Hatti	16.19606711668055	76.66148181786735	GRG-811	Black soil	0.00	0.00	0.00
15	Anwari	16.16289791685124	76.74275984536386	TS-3R	Black soil	0.00	0.00	0.00
16	Kasaba Lingasuguru	16.125087003642744	76.51989984688865	TS-3R	Black soil	1.39	0.00	0.00
17	Sarjapura	16.12881323371069	76.58623699068504	TS-3R	Black soil	0.00	12.00	0.00
18	Chikka hesarur	16.105560305304603	76.63670543558348	TS-3R, Gulyal	Red soil	0.00	10.00	0.00
19	Kalli lingasugur	16.10463738003517	76.48367929683305	TS-3R	Black soil	0.00	0.00	1.23

20	Mincheri	16.214231301449345	76.49222808397408	Gulyal	Red soil	0.00	17.23	0.00
21	Amarawati	16.095829548369114	76.62065509659355	TS-3R	Black soil	0.00	16.28	0.00
22	Gonwara	16.092036073054974	76.60091403887675	Gulyal	Black soil	0.00	5.73	0.00
23	Parampur	16.28460259144882	76.57685714214615	TS-3R	Red soil	0.00	1.23	1.23
24	Kachapur	16.08047442376144	76.41595888336927	TS-3R	Black soil	0.00	12.73	0.00
25	Margantanal	16.13028153083976	76.43089342330724	Gulyal	Black soil	0.00	0.00	1.00
26	Nagarhal	16.101009000236722	76.31321954948018	TS-3R	Black soil	0.00	12.72	0.00
27	Harnapur	16.0257876807873	76.28978777171872	TS-3R	Black soil	0.00	0.00	0.00
28	Santekallur	16.05504425236521	76.6586486999207	TS-3R	Black soil	0.00	3.56	1.23
29	Mudgal	16.00353348427886	76.43574699932957	TS-3R. Gulyal	Red soil	0.00	16.72	0.00
30	Mattur	16.039327219273414	76.50678016398346	TS-3R	Red soil	0.00	0.00	0.00

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