

# Prevalence and incidence of Tikka disease (*Cercospora* spp.) of groundnut in Pothwar region of Punjab

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Received:

March 23, 2018

Accepted:

August 27, 2018

Published:

December 31, 2018

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## Abstract

To monitor Tikka or *Cercospora* leaf spot disease of groundnut, surveys were carried out in the groundnut areas of four major districts of Pothwar region viz. Chakwal, Attock, Jhelum and Rawalpindi during main crop season in 2017. To assess prevalence and incidence of Tikka disease, 997 farmer's fields were visited. Clear disease symptoms were noted in the fields during the season. The disease prevalence ranged from 7.85 to 45% where highest prevalence was recorded in district Jhelum (45%) and lowest in Attock (7.85%). The disease incidence also varied and ranged from 9.35 to 22.48%. The highest mean disease incidence (22.48%) was observed in district Chakwal, whereas the lowest (10.57%) was observed in district Rawalpindi. The results of the study indicated that Tikka disease is significantly distributed in all the major groundnut producing districts of Pothwar region therefore, timely and possible management strategies are of vital importance to control this potential threat.

**Keywords:** *Cercospora*, Tikka disease, Leaf spot, Incidence, Prevalence

## Introduction

Groundnut (*Arachis hypogaea* L.) is a major cash crop of Pakistan being mostly planted in the Pothwar region during summer season (Ali et al., 2002). The major groundnut producing areas are Chakwal, Attock, Jhelum, Rawalpindi, Karak, Swabi and Sanghar (Khan, 2005). It is cultivated on an area of about 81.5 thousand ha, with a production of 91.4 thousand tons, 85% of which is contributed by the Pothwar region of Punjab, 12% by Khyber Pakhtunkhwa and 3% by Sindh (Asad et al., 2017). It is a traditional oilseed crop of the country, containing 43-55% oil contents (Shad et al., 2009). It is widely used in pharmaceuticals medicines, livestock, fuels (Ndiamé et al., 2004), confectionery, snacks etc. (Atasié et al., 2009). However, the productivity levels are much lower to meet the requirements of edible oil production (Shahid et al., 2010), mainly due to a number of production constraints including increased

incidence of insect pests and diseases, weeds infestation, its cultivation under rainfed conditions, prevalence of drought stress due to variation in rainfall, low input-use (improved seed material), inefficient fertilizer use, shortage of irrigation water, and insufficient research efforts (Ashfaq et al., 2003; Ashraf, 2004).

Groundnut is susceptible to a number of fungal diseases among which a known leaf spot disease of groundnut, commonly called Tikka disease is a widespread foliar disease that causes severe losses in crop (Ijaz et al., 2008). The disease infects crop directly as well as indirectly and results in huge losses due to leaf defoliation, disruption of photosynthesis and fewer pods that are inferior in quality (Waliyar et al., 2000). Losses are even more when crop is unsprayed (Anonymous, 2000). Infection starts as a result of irregular rains during flowering stage to pod formation. The temperature requirement for disease development ranges from 31



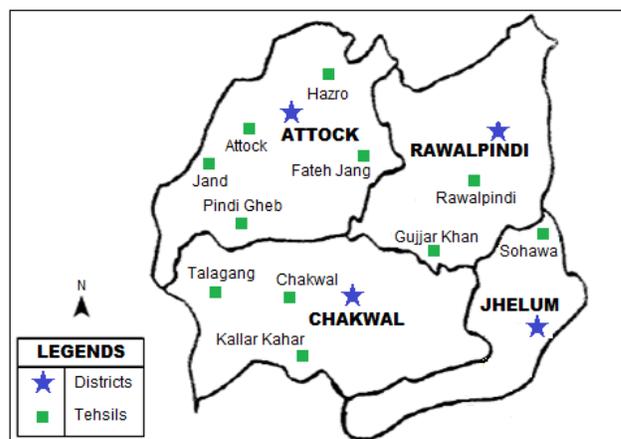
to 35 °C (maximum) and 18 to 23 °C (minimum) (Pande et al., 2000). It is generally of two types (early and late) caused by two different species of the genus *Cercospora* namely *Cercospora arachidicola* S. Hori (early leaf spot) and *Cercosporidium personatum* (Berk and Curt) Deighton (late leaf spot) (Mehrotra and Aggarwal, 2003). Disease symptoms generally appear at 30-36 days after sowing and increase in intensity up to crop harvest time. In the early stages, the disease is characterized by the appearance of light brown spots surrounded by yellow halo on the leaves on one to two months old plants due to the attack of *C. arachidicola*. In the later stages, black spots usually without yellow halo appear on the stem caused by *C. personatum* (Subrahmanyam et al., 1995; Van and Cilliers, 2000). The spots weaken the plant and lead to defoliation which adversely affects fruit size as well as the quality. Eventually, fewer leaves result in less photosynthesis and reduced yield. Both leaf spots can be controlled by growing disease resistant varieties and through chemicals which is not widely practiced due to high costs of fungicides and unawareness of farmers to chemicals. Tikka disease is a major restriction to increased groundnut productions and can cause higher yield losses up to 50% worldwide (Tshilenge et al., 2012). In India, yield losses of 15-59% have been estimated due to this disease. In Florida, a 10% reduction in groundnut yield has been reported due to tikka disease epidemics (Alderman and Nutter, 1994). According to Walls and Wynne (1985), loss in yield of up to 70% has been indicated worldwide. Varied incidence levels of disease have been reported in different countries. In Pakistan, 87.16% incidence of disease was reported in district Attock while 2.12% in district Bhakar (Ijaz et al., 2008). In Nigeria, highest incidence of 43.34% was observed during 2011 and 45.36% during 2012 (Richard et al., 2017). Keeping in view the economic importance of groundnut in Pothwar region of Punjab and significant losses caused by Tikka disease, the present study was conducted to assess the prevalence and incidence of Tikka disease of ground nut.

## Material and Methods

### Study area for disease survey

A survey of Tikka disease of groundnut was conducted during crop season (May to October) of 2017 in four major groundnut growing districts of Pothwar region viz. Rawalpindi (33°37'N; 73°4'E),

Jhelum (31°20'N; 72°10'E), Chakwal (32°56'N; 72°53'E) and Attock (33°52'N; 72°20'E). The altitude of the area is 508 meters above sea level. During the survey, 997 farmer's fields in 11 tehsils were assessed during the crop season (Figure 1). In district Chakwal, 295 fields were surveyed, in district Attock 525 fields, in district Jhelum 133 fields while 44 fields were surveyed during the year.



**Fig. – 1: Districts and tehsils of Pothwar region surveyed for groundnut Tikka disease during 2017 crop season.**

### Disease assessment

Each groundnut field was surveyed randomly and disease prevalence and incidence were documented. Disease assessment was performed using a quadrat (1 m<sup>2</sup>) and 4 spots were randomly selected from each field. Plants infected with Tikka disease were observed showing particular symptoms and an attempt was made to identify the symptoms of both early leaf spot and late leaf spot. Fields were visited regularly for the identification and characterization of the disease symptoms caused by two species viz. *C. arachidicola* and *C. personatum*.

Disease prevalence was observed to assess the distribution of Tikka disease in surveyed areas of Pothwar region and calculated by using the following formula:

$$\text{Disease Prevalence \%} = \frac{\text{No. of infected fields} \times 100}{\text{Total No. of Fields}}$$

For disease incidence, the number of total groundnut plants and infected plants in 1 m<sup>2</sup> were counted. These observations were used to calculate the

average Tikka disease incidence in each field visited using the following formula (Kanade et al., 2015):

$$\text{Disease Incidence \%} = \frac{\text{No. of diseased plants} \times 100}{\text{Total No. of plants observed}}$$

### Statistical analysis

Data collected during the study was analyzed through ANOVA using software program SPSS. The data was analyzed statistically and significance of results was expressed at 5% level.

## Results and Discussion

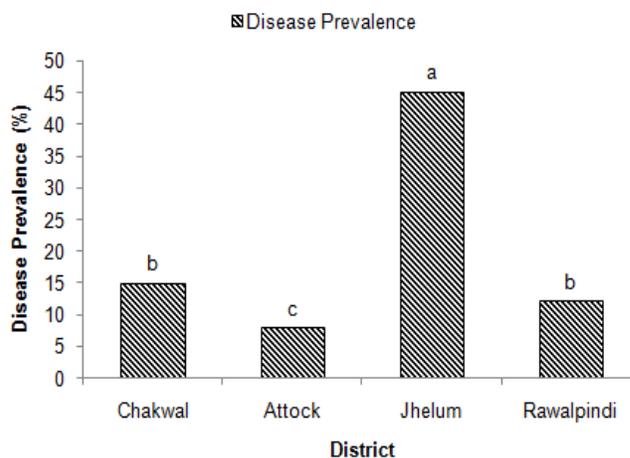
### Disease symptoms in field

For disease assessment, the disease symptoms were carefully observed in the surveyed fields from the start of appearance of symptoms. In the beginning around 30 to 35 days after sowing, small and chlorotic spots were noticed on the plant leaves. At early stages i.e. associated with *C. arachidicola*, the spots turned into black lesions surrounded by chlorotic or yellow halo on upper leaf surfaces while light brown spots on lower surface. During late leaf spot stage caused by *C. personatum*, small, circular, rough and darker lesions were identified on lower leaflet surfaces, petioles and stems. The symptoms observations were in accordance with the description by Van and Cilliers (2000) and Subrahmanyam et al. (1995).

### Disease prevalence and incidence

The study showed widespread prevalence of Tikka disease as shown in Figure 2. Results of the survey revealed variations among the farmer's fields assessed for disease prevalence and incidence. It was noticed that peak period for Tikka infestation was generally confined between the months of August and October during the pod formation of groundnut. The prevalence Tikka disease was apparent in all the fields under groundnut crop plantation in the four districts surveyed in 2017. The mean disease prevalence was 20% in the region where highest prevalence was witnessed in district Jhelum with 45% prevalence percentage followed by Rawalpindi (11.93%) and Chakwal (14.8%) while minimum prevalence was noted in district Attock (7.85%). Tikka was prevalent with varied percentages in various tehsils of surveyed districts as shown in Table 1. In district Chakwal, ground nut was found in three tehsils where maximum prevalence was

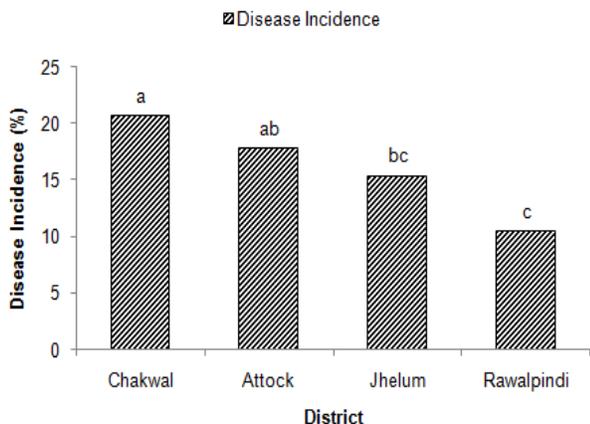
recorded in tehsil Chakwal (31.4%) followed by Kallar Kahar (7.74%) and Talagang (5.26%). In district Attock, groundnut plantation was observed in five tehsils and disease prevalence varied among them i.e. Pindigheb (15.09%), Hazro (14.70%), Jand (7%), Fateh Jang (1.96%) and Attock (0.52%). In district Jhelum, ground nut was found in tehsil Sohawa where highest prevalence of 45% was recorded. Groundnut found in two tehsils of district Rawalpindi viz. Rawalpindi and Gujjar Khan showed 27.78% and 8% prevalence, respectively. It is shown that both leaf spot diseases caused by two species viz. *C. arachidicola* and *C. personanta* are highly prevalent in the Pothwar region and can pose a serious threat to groundnut production. Similarly, Ambang et al. (2011) reported prevalence of both leaf spot disease every year on groundnut in the southeastern of the United States. In India, earlier it has been reported that early leaf spot (*C. arachidicola*) is generally more prevalent in northern groundnut growing states with varied levels of incidence and severity (Joshi, 2005). On the contrary, Macedo-Nobile et al. (2008) indicated that late leaf spot (*C. personanta*), is the most prevalent and destructive disease on groundnut in Brazil.



**Fig. - 2: Percentage of disease prevalence in major groundnut growing districts of Pothwar region of Punjab during 2017. Different letters indicated on bars represent significant differences in Tikka prevalence values (P=0.05).**

The disease incidence varied among the districts and mean disease incidence in the region was 16% during the crop season (Figure 3). Tikka disease appeared in low to moderate intensity at district Chakwal during the pod formation stage and the mean disease

incidence observed was 22.48%. In rest of the districts, low disease intensities were recorded where



maximum incidence was observed in Attock with 17.9% incidence percentage followed by Jhelum (15.45%). **Fig. - 3: Percentage of disease incidence in major groundnut growing districts of Pothwar region during 2017. Different letters indicated on bars represent significant differences in Tikka incidence values (P=0.05).**

**Table - 1: Percentage of Tikka disease prevalence and incidence in various tehsils of surveyed districts**

District	Tehsil	Disease Prevalence (%)	Disease Incidence (%)
Chakwal	Chakwal	31.4 <sup>b</sup>	19.28 <sup>b</sup>
	Talagang	5.26 <sup>de</sup>	25.16 <sup>a</sup>
	Kallar Kahar	7.74 <sup>d</sup>	23 <sup>a</sup>
Attock	Attock	0.52 <sup>e</sup>	11.67 <sup>c</sup>
	Pindigheb	15.09 <sup>c</sup>	20.76 <sup>b</sup>
	Hazro	14.70 <sup>c</sup>	20.8 <sup>b</sup>
	Jand	7 <sup>d</sup>	14.17 <sup>bc</sup>
	Fateh Jang	1.96 <sup>e</sup>	7 <sup>d</sup>
Jhelum	Sohawa	45 <sup>a</sup>	15.45 <sup>bc</sup>
Rawalpindi	Rawalpindi	27.78 <sup>b</sup>	6.5 <sup>d</sup>
	Gujjar Khan	8 <sup>d</sup>	12.2 <sup>c</sup>
<b>LSD value at α=0.05</b>		4.52	3.62

At α=0.05 level of significance means sharing same letters are non-significant

District Rawalpindi had least disease incidence (10.57%) among all the districts surveyed. Significant difference in disease incidence was

observed among tehsils of surveyed district as depicted in Table 1. In district Chakwal, maximum incidence was recorded in tehsil Talagang (25.16%) followed by Kallar Kahar (23%) and Chakwal (19.28%). In district Attock, the disease incidence was 20.8%, 20.76%, 14.17%, 11.67% and 7% in Hazro, Pindigheb, Jand, Attock and Fateh Jang, respectively. In district Jhelum, 15.45% incidence was observed in tehsil Sohawa. Two tehsils of district Rawalpindi viz. Rawalpindi and Gujjar Khan showed 6.5% and 12.2%, incidence, respectively. The study showed that groundnut crop in the region is prone to disease incidence throughout the season. Earlier, Ijaz et al. (2008) reported highest (87.16%) Tikka incidence in Attock while lowest (2.12%) incidence in Bhakar. Richard et al. (2017) recorded highest leaf spot incidence during 2011 (43.34%) and 2012 (45.36%) in Nigeria.

### Conclusion

It can be concluded from the study that Tikka or leaf spot is a potential threat to groundnut production. The study reports widespread distribution of leaf spot disease in the major groundnut producing districts of Pothwar region of Punjab with varied incidence percentages. Therefore, detailed studies are necessary to utilize appropriate practices to minimize the damage and future losses caused by this disease.

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