International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 3, April 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Identification and Evaluation of Bacterial Blight Occurrence on Guar Crop in Gadarif State (Sudan)

Elsafi Mustafa Mohamed[1], Muna E. Suliman.[2], Mohamed Ibrahim Ismail[3]

[1]Gadarif University, Al Qadarif, Sudan
[2]University of Gezira, Wad Madani, Sudan
[3]Agricultural Research Corporation, Elfashir Research Station, Sudan

ABSTRACT

Guar crop grown in Gadarif State is attacked by leaf blight disease. Therefore, a disease survey in season 2014 and field experiments for examination of six sources of guar seeds in season 2015 respectively conducted in southern and northern geographical areas of Gadarif State to identify and evaluate the incidence of the disease. The results indicated that this disease is caused by bacterial disease identified as Xanthomonas spp. The disease survey in farmer fields revealed that, all guar grown in southern area at locations of (Azaza, Samsam and Saraf Saeed) was almost infected by the disease. The findings of the field experiment in southern geographic area indicate that, the disease incidence percent ranged between 37.5 to 47.3%, whereas the disease severity is reached up to 100% resulting in complete crop damage. However, in the northern area the disease was quite negligible with an average of 2.1%. The six sources of guar seeds at northern area, gave highest yield ranged between 234.8 to 214.5 kg/fed compared to those tested in southern geographical area of Gadarif state which were gave a very few numbers of capsules.

This study indicated that, the epidemic occurrence of the bacterial blight disease on guar crop is almost associated with the amount of high rather than the relatively low amount of rainfall areas of production of guar.

KEYWORDS: *Guar Cyamopsis tetragonoloba, Bacterial blight Occurrence*

How to cite this paper: Elsafi Mustafa Mohamed | Muna E. Suliman. | Mohamed Ibrahim Ismail "Identification and Evaluation of Bacterial Blight Occurrence on Guar Crop in Gadarif State (Sudan)" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-3, April 2020, pp.809-814, URL: www.ijtsrd.com/papers/ijtsrd30662.pdf

IJTSRD30662

INTRODUCTION

Guar, or cluster bean, (*Cyamopsis tetragonoloba* (L.) Taub) is a drought-tolerant annual legume hardy crop of the arid and semi-arid zones and cultivated under rain fed conditions of kharif season. It is a rich source of protein and galactomannose gum which is stored in endosperm and utilized in wide range of industrial processes (Mudgil, et al., 2011).World demand for guar has increased in recent years, leading to crop introductions in new several countries. Guar is an excellent soil-building crop with respect to available nitrogen (Undersander *et al., 1991*). Root nodules contain nitrogen-fixing bacteria, and crop residues, when plowed under, improve yields of succeeding crops (Undersander *et al*., 1991).

In Sudan, the guar seed is grown commercially in an agricultural scheme in Blue Nile State near the city of Singa for the purpose of wheat bread improvement (Osman 2005). The Total growing area during the seasons of 2005/06 and 2007/08 was 400 hectares produced a total of 2000 tons with an average yield of 543 kg/hectar annually (Osman 2005). The blue Nile, White Nile and the High Nile States are considered as the main producing areas of the guar crop under mechanized rain-fed conitions in Sudan (Hassan and Elasha, 2010). Guar is known to suffer many diseases which are responsible for its low quality and low yield which lead to severe economic losses to the producers as it is an important cash crop with a great potential for foreign exchange (Chand and Gandhi, 1978). The major disease constrains for the guar production are Fungal, bacterial and viral diseases. Among the different pathogens attacking the crop bacterial blight that caused by *Xanthomonas campestris* pv. *cyamopsidis*. Bacterila blight is known to be the most devastating disease of guar (Mihail and Alcorn (1985). The disease symptoms include wilt of seedling plants At later stages of plant growth, the infected plants exhibit rotting near the soil which results in wilting of the plant. The disease is aggravated by the monsoon season. Yield loss of up to 68% has been reported in India (Gandhi and Chand 1985).

During season 2013/014, the crop was grown under rain fed conditions in different geographical areas of Gedarif State, however, in southern geographical area of the state, the guar plants were subjected to leaf blight symptoms which caused drying of the leaves and eventually the death of the plants occurred before reaching the capsules stage. The objectives of this study were to:

1. Isolate and identify the causal agent of the blight symptoms
2. Evaluate the natural leaf blight infection

3. Recognize the factors enhance the intensity of the disease
4. Effect of disease on the crop yield.

Materials and Methods

Disease survey in guar farmers fields in Gadarif sate:

Disease survey was carried out during season 2014/2015/2016 in fields grown with guar crop in different geographical areas of Gadarif State, These areas were, Azaza, Saraf saaed, Sumsum (southern geographical area), Elfashaga (eastern geographical area), Gadarif research farm and Elmegreh (northern geographical areas of Gadarif State). The map on plate no (1) shows locations of those areas. The surveyed fields were randomly chosen according to a specified driving distance. Also data of rainfall of the surveyed area had been taken (Tables 5).

In each surveyed guar field, the incidence of the disease was assessed from ten random spots along the diagonal of the field. In each spot, the disease was assessed in a 1 m^2 area and the percent incidence of each disease was determined as a percentage according to the following formula (Ishii *et al*., 2001):

$$\text{Disease incidence (\%)} = \frac{\text{No. of infected plants}}{\text{Total No. of plants inspected}} \times 100$$

Description of the blight symptoms occurred on guar:

Initial field symptoms included water-soaked spots on leaves, at the later stages of disease infection, the color of the spots became dark. Also large, angular, necrotic lesions at leaf tips, black streaks on petioles and stems, split stems, defoliation, wilting or top withering, and dieback were among the observed symptoms (Plates 2 - 5).

Isolation and identification of the causal agent from infected guar leaves:

Isolation of the pathogen from infected guar leaves was conducted at Plant Pathology Laboratory, faculty of agricultural sciences at University of Gezira. Samples of diseased leaves and stems were surface sterilized using sodium hypochlorite 70% and then plated on nutrient agar medium culture (NA). Plates were then incubated at 28°C for 72 h. Gram staining and Potassium hydroxide test (KOH test) were used for the identification of the pathogen. Pathogen was aseptically removed from Petri plates with a tooth pick or an inoculating wire loop, placed on glass slide in a drop of 3% KOH solution, stirred for 5-8 seconds and observed for the formation of slime threads (Suslow, 1982, Schaad *et al*., 2006).

Field experiments:

Six seed samples of unidentified guar cultivars were used in the field trials in season 2016. Two field experiments were conducted at southern and northern geographical areas under natural rain-fed conditions. The field experiment was laid out in a randomized complete block design (RCBD) with 6 samples randomly allocated in 4 blocks, so that each sample appeared once in every block. The entire field area was (546 m^2). Each plot had 4 rows of guar (0.8 m) apart and each row is (5m) long, with an area of (9 m^2). One-meter spacing was maintained between plots and (2 m) between blocks. The border rows consisted of the 2 outer rows and (50 cm) on either of the remaining sides of the plot. Therefore, the net plot assessed was (2.4 m.) Minimum tillage was practiced and direct seeding was done mid-July. Weeding was done when necessary throughout the growing period. No disease control was implemented.

Incidence assessment of disease on the crop was done at the time symptoms started to develop on the leaves. Disease severity was scored using 1 – 5 disease scoring scale where,1 represented 0 % infection and 5 represented over 75 % infection, according to Ishii *et al*., (2001), (table 4). Hand harvesting of the capsules (pods) was done and the seeds were threshed and weighed after drying for yield purposes.

Results and Discussion

Incidence of disease on guar in farmer fields during the survey at different areas of Gadarif Sate:

Results of fields disease survey revealed that, occurrence of the bacterial leaf blight on the guar grown in the southern geographical area at locations of Azaza, Samsam and Saraf Saeed showed more disease intensity compared to the guar grown in the eastern at Elfashaga location and in the northern area at location of Elmegrih and ARC Farm. (table 1). The incidence of the disease in fields of the southern geographical area ranged between 44.3 and 39.7% with an average of 42.6% whereas in eastern and northern geographical areas the disease incidence was quite negligible ranged between 0.0-1.6 percent with an average of 0.6%. Guar fields in the southern regions of Gadarif had higher disease incidence as compared to guar fields in the eastern and northern regions of Gadarif and no disease incidence was detected on Gadarif Research farm (FHG-53).

Isolation of the disease:

Isolation of the disease from infected guar leaves showed typical yellowing characteristic features of *Xanthomonas* spp. on Nutrient Agar Medium Plates (6) and Table (2) shows bacterial characteristics.

Identification of the disease:

Isolates that were tested and found gram –negative by gram staining technique gave a positive with KOH test. Slime threads were formed when bacterial cultures were mixed with 3% KOH solution. Formation of slime threads, the mixture become viscous, string out, all these features is an indication of being gram negative, (plate 7).

The causal of this infection is a bacterial blight disease as indicated by the visual symptoms and the identification of the isolated bacterium from the infected plants. The disease outbreak occurred in the southern geographical region of Gadarif State before flowering stage after heavy rains (925.1mm) causing severe foliar defoliation and resulting in complete crop yield failure.

Field experiments

Incidence and severity of bacterial leaf blight disease:

As shown in table 3, the incidence of the disease on the guar cultivars tested in the southern geographical area ranged between 37.5 and 47.3% with an average of 41.2%, whereas in northern geographical area the disease was quite negligible since it was recorded very low percentages of incidence ranged between 1.5 and 2.7% with an average of 2.1%. Also they showed very severe bacterial blight disease infection up 90 to 100% as black streaks on stems in the southern geographical area. However, the black streaks were not observed on stems of the same tested sources of guar seed in northern Gadarif area.

The higher occurrence percent of the bacterial disease incidence on the guar in the southern area of Gadarif State may be attributed to the wet inductive climatic conditions caused by the higher amount of the rainfall (table 4). High rainfall act as the main conducive factor for disease development since. severity of the infection in southern area of Gadarif was up to 100%. These findings agree with Mihail and Alcorn (1985) who reported the occurrence of a high incidence of bacterial blight of guar in Arizona State after rainfall. Also, Ren *et al*. (2014) noticed the dependence of bacterial disease development in guar on frequent rains

Unlike the southern area, the disease incidence at the northern area of Gadarif State was negligible . No defoliation or death of plants had occurred and this due to the insufficient favorable conditions with relatively low amount of rainfall to induce epidemic infection by this disease.

Effect of Bacterial blight on yield of guar:

The results in Table (5) showed that no significant differences (at *p* 0.5) in seed yield among the six tested samples of guar in northern geographical area and gave significant higher yield ranged between (234.8 to 214.5 kg/ feddan) compared to those tested in southern geographical area of Gadarif state which were gave a very few and uncountable numbers of capsules. Yield loss of up to 68% has been reported in India (Gandhi & Chand 1985).

Thus, the study indicates that the epidemic occurrence of bacterial blight disease on guar crop is almost associated with the amount of high rather than the relatively low amount of rainfall areas of guar crop production.

Conclusions

1- Bacterial blight is important disease of guar crop in Gadarif State.
2- The disease is closely associated with the areas under high rainfall conditions
2- Guar crop was highly susceptible to the disease in southern Gadarif area.
5- Guar crop was most resistant to the disease in northern geographical area of the State.
6- For the time being, the northern is the most suitable area for production of the crop.

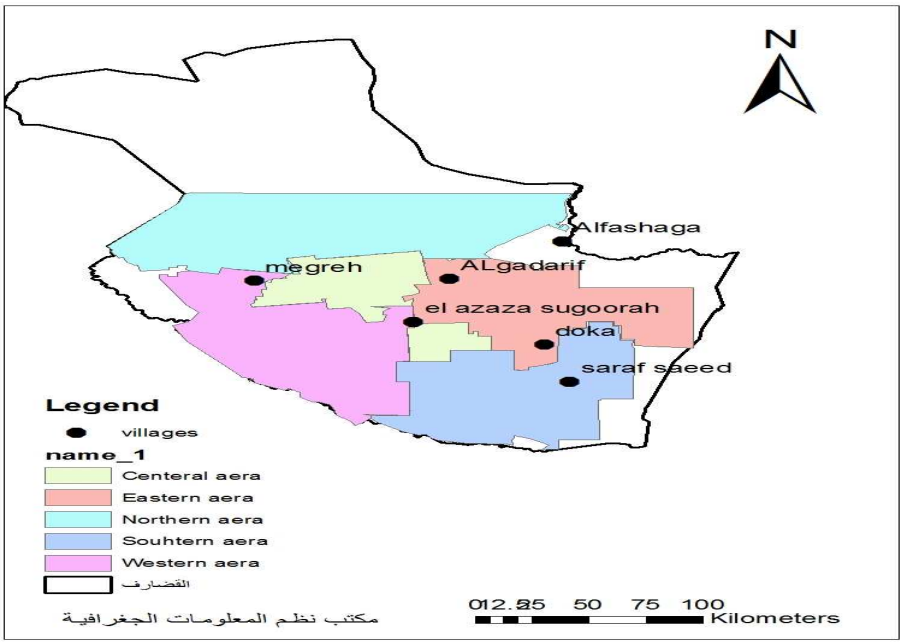

Plate1. Map shows the surveyed areas in Gadarif state (production zones), carried out during season 2015/2016

Plate2. General field symptoms of the disease on Guar crop during field survey, August, 2015.

Plate3. Symptoms development of bacterial leaf blight on true leaves of Guar

Plate4. Symptoms of the bacterial leaf blight disease on stems of Guar

Plate5. Disease progress (severity) appeared as black streaks and death on leaves and stem of guar.

Plate6. Morphological characters of colonies of bacterial blight disease, grown on NA medium

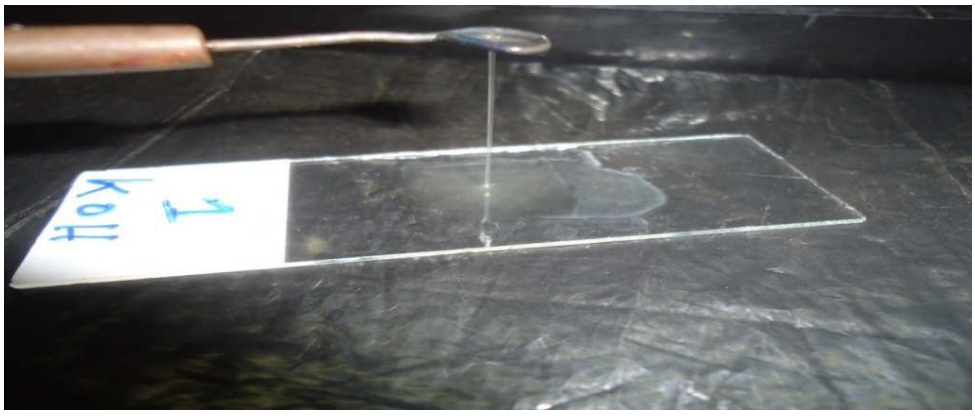

Plate7. KOH string test shows the formation of the slime threads on the loop that immerged on the mixer of the tested bacterial colony and a drop of KOH solution on a glass slide.

Table1. Diseas incidence percent on guar in farmer fields at different geographical areas of Gadarif Sate 2015/2016.

Disease	Southern area			Eastern area	Northern area	
	Azaza	Samsam	Saraf Saeed	Elfashaga	Elmegrih	ARC Farm
Bacterial leaf blight	44.3	39.7	43.8	1.6	1.3	0.0
Mean	42.6			1.6	0.6	

The variety grown in farmers fields were local type, whereas in Gadarif Research farm they grew the guar variety (FHG-53).

Table2. Morphological characterization of the bacterium grown on nutrient agar medium after 72 hrs

No	Morphology	Source of inoculums Leaves
1	colony form	Circular convex
2	colony color	pale yellow
3	Colony surface	Smooth mucoid
4	Shape	Rod shape
5	Colony elevation	Raised
6	Colony margin	Entire

Table3. Mean disease incidence percent and severity of bacterial blight disease on guar in northern and southern Gadarif area (season 2016/2017)

Source of guar seed	Northern Gadarif area		Southern Gadarif area	
	% Incidence	Severity	% Incidence	Severity
Gylani/azaza	2.7	0.0	47.3	98.6*
Medrak/Sarafsaeed	1.8	0.0	37.5	98.6
Zeraa/sumsum	2.5	0.0	40.7	90.8
Yassir/Elfashaga	1.7	0.0	43.1	99.3
Kamal/Elmegrih	2.6	0.0	41.0	99.6
Research farm(FHG-53)	1.5	0.0	37.6	100
Mean	2.1	0.0	41.2	97.8

*: > 75 % infection (scale 1 – 5)

Table4. Monthly and total rainfall for northern and southern parts of Gadarif State in seasons (2015/016 and2016/017) respectively

Month	Rainfall (mm)			
	Southern Gadarif		Northern Gadarif	
May	59.0	0.0	46.2	1.8
June	41.0	3.7	25.1	28.6
July	160.8	188.4	51.7	38.5
August	417.3	106.1	173.3	223.1
September	126.0	158.5	58.3	298.2
October	121.0	153.5	35.6	121.0
Total	925.1	950.7	390.2	610.2

Table5. Effect of *Bacterial blight* disease on yield of guar crop (season 2016)

Source of guar seed	Northern Gadarif area	Southern Gadarif area
	Yield (seeds kg/fed)	Yield (capsules/sub plot)
Gylani/Azaza	217.8	54.7
Medrak/Sarafsaeed	216.6	62.5
Zeraa/Sumsum	217.9	26.4
Yassir/Elfashaga	234.8	117
Kamal/Elmegrih	214.5	24.3
Research farm (FHG-53)	219.3	27.1
CV %	10.3 --	
SE ±	7.04 --	
LSD ±	21.1 --	

References.

[1] Chand JN and Gandhi SK (1978). Diseases of guar and their control. Forage Research 4A 49-66.

[2] Elsafi, M., M. (2013). A survey of disease in guar in Gadarif State. Plant Pathology Annual Report, Gedarif Research Station, Agricultural Research Corporation. Sudan.

[3] Gandhi, S. K. and Chand, J.A. (1985). Yield losses in guar due to bacterial blight caused by *Xanthomonas campestris* pv. *cyamopsidis*. Indian Phytopathology 38: 516-519.

[4] Hassan, A. E. and Elasha, A. E., 2010. Crop Production Under Mechanized Rain-fed Agricultural in Sudan. In: *Proceeding of the National Symposium on Sustainable Rain-fed Agricultural in Sudan.* 17-18 November 2009, Al Shariga Hall, University of Khartoum, Sudan. Mustafa, M. A. (eds.) UNESCO Chair of Desertification Studies, University of Khartoum, Sudan. pp. 89-112.

[5] Ishii, H., B. A. Fraaije, T. Sugiyama, K. Noguchi, K. Nishimura, T. Takeda, T. Amano, and D.W. Hollomon. (2001). Occurrence and molecular characterization of Strobilurin resistance in cucumber powdery mildew and downy mildew. Phytopathology 91:1166–1171.

[6] Mihail, J. D. and Alcorn, S. M. (1985). Bacterial blight (*Xanthomonas campestris* pv. *cyamopsidis*) of guar in Arizona. Plant Disease (Abstr.). 69: 811.

[7] Mudgil, D.; Barak, S.; Khatkar, B. S. (2011). "Guar gum: Processing, properties and food applications—A Review". Journal of Food Science and Technology.

[8] Osman. M. E. (2005). Performance of Guar as a new crop under food irrigation in Gash Dulta. In: *Proceeding of the National Crop Husbandry Committee,* Elsiddig, K (ed.) pp. 73-76, ARC, Wad Medani, Sudan.

[9] Ren, Y. Z., Y. L. Yue, G. X. Jin and Q. Du, 2014. First Report of Bacterial Blight of Guar Caused by Xanthomonas axonopodis pv. cyamopsidis in China. Phytopathology, 98(6): 840.2- 840.2.

[10] Schaad, N. W., Postnikova, E., Lacy, G., Sechler, A., Agarkova, I. V., Stromberg, P. E., Stromberg, V. K., and Vidaver, A. M. 2006. Emended classification of Xanthomonas.

[11] Suslow T.V (1982). Application of a rapid method for Gram differentiation of plant pathogenic and saprophytic bacteria without staining .phytopathology. 72:9117-918.

[12] Undersander D. J., Putnam D. H., Kaminski A. R., Doll J.D., Oblinger E. S. and Gunsolus J. L. 1991. Guar. University of Wisconsin-Madison, University of Minnesota [1] Accessed November 8, 2012.

[13] Watson, D. R. W. (1970). Bean common blight and Fuscous blight in New Zealand garden pea seed stocks. *Pl. Dis. Reptr.* 54: 1068 – 1072.