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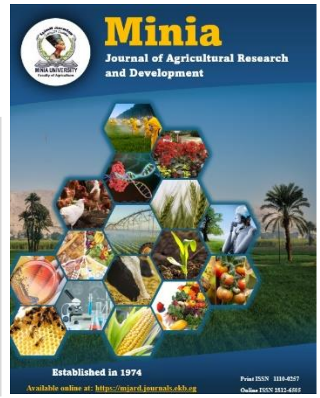

Epidemiological Analysis of Purple Blotch Disease on Onion under the Climatic Conditions of El-Minya Governorate, Egypt.

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ABSTRACT

Purple blotch, caused by the fungus *Alternaria porri,* is a serious disease affecting onion crop in Egypt. This study aimed to analyze the epidemiology of purple blotch under the climatic conditions of El-Minya governorate, Egypt. Infected onion samples were collected from six areas in middle Egypt. The systemic survey was carried out to record the severity of purple blotch disease in three onion major growing districts of El-Minya governorate, Egypt, during 2020-2021 and 2021-2022 crop seasons. The survey for disease, severity, distribution, and spread was carried out at physiological maturity. Significant increase in onion purple blotch DI, DS%, the Area Under Disease Progress Curve (AUDPC) and the disease pressure was higher in the first than in second seasons. Also, there is a significant increase in both disease parameters in Giza-6 than Giza red cvs. When recorded every two weeks, from the 11th the standard week to the 22nd standard week. Based on the mean data, a multiple regression equation was developed to predict the disease. The results show that in 2021-2022, two weather parameters; the maximum temperature <20^{o}C and relative humidity (80%), spell contributed to an increase in the infection rate. The maximum AUDPC was recorded in February-March of each season. The severity of purple blotch disease in onions varies significantly across different locations in Egypt, influenced by both environmental conditions and pathogen virulence. The variation in disease severity can be attributed to factors such as local climatic conditions, agricultural practices, and the presence of different pathogenic isolates.

Keywords: Purple blotch of onion, *Alternaria porri*, Apparent rate of infection, Area under disease progress curve, Disease Severity, Epidemiology.

INTRODUCTION

Onions (*Allium cepa* L.) hold a significant place in Egypt's agricultural sector, both as a staple in the local diet and as a vital export commodity. As one of the top producers of onions globally, Egypt has leveraged its favorable climate and fertile

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soils to cultivate this crop extensively, making it a cornerstone of the nation's agricultural output. In recent years, the importance of onions has grown not only due to their role in sustaining local consumption but also because of their substantial contribution to Egypt's export economy (**Fangary and Adam, 2020).**

The onion crop supports numerous smallholder farmers and contributes to rural livelihoods across the country. Its versatility in various culinary applications ensures a stable demand within the domestic market. Furthermore, the export of onions has become increasingly important, especially as global demand for fresh produce rises and as Egypt continues to expand its agricultural exports to new markets. In 2022, Egypt exported over 600,000 metric tons of onions **(FAO, 2023),** accounting for a significant share of the global market. This export activity not only provides essential foreign currency earnings but also enhances Egypt's agricultural trade balance. Additionally, the government's focus on improving agricultural practices and expanding irrigation infrastructure has led to increased yields and better-quality produce, further solidifying Egypt's competitive position in the global market. Given the strategic importance of onions in Egypt's economy, both as a staple food and an export product, it is crucial to explore the crop's economic impact in detail.

Many diseases and insect pests attack onion crop at various phases of growth, resulting in significant yield losses. Aside from reducing crop output, disease and insect pests also have negative consequences during the harvesting, post-harvesting, processing, and marketing stages, lowering crop quality and export potential and causing significant economic loss. (**Mishra *et al*. 2014**). Diseases and insect pests disrupt crop production and have an impact on both domestic and international markets. Pathogen distribution is influenced by the seasons, variation, and location. Onion foliar and bulb infections have been linked to a wide variety of fungal pathogens. A variety of agro-ecologies face challenges in maintaining sustainable onion production and storage due to foliar diseases like purple blotch (*Alternaria porri* and *Stemphylium vesicarium*), leaf blight (*Alternaria alternata*), Twister (*Colletotrichum gloeosporioides*; *Gibberilla moniliformis*), leaf blight (*Stemphylium vesicarium).* Size, colour, form, and pungency are only a few of the many traits that exhibit significant diversity (**Griffiths *et al*., 2002; Hassan *et al*. 2007**). More than 60 diseases affect onions, but purple leaf blotch (PLB) caused by *A porri* is the most harmful fungal disease. Every region of the world where onions are grown is affected by purple blotch, which has resulted in worldwide losses of 5 to 50% (**Maini *et al*., 1985; Abdel-Megid *et al* 2001; Aveling *et al*., 2011 and Hay, 2022**). The pathogen *A. porri* damages the leaf tissue, which slows bulb maturity and eliminates the stimulus for bulb start. PLB is an important disease of *Allium* spp. worldwide, especially in warm and humid environments **(Maude, 1990; Miller & Lacy, 1995)**, causing up to 60% damage on garlic in India **(Bisht and Agrawal, 1993)** and 59% losses in onion bulb yield **(Gupta and Pathak, 1988). Everts and Lacy (1990) and Bayoumi *et al* (2019)** reported the disease can cause a loss of 30%, compared to bulb crops, seed production is more severely affected by the disease, which can occasionally result in a 100% loss of seed output. According to **Gupta and Pathak (1998), Lakra (1999), and Papu (2010)**, *A. porri* can induce PB disease in onion-growing nations such as Egypt, resulting in a significant drop in bulb and seed yield (2.5-97%). The pathogen attacks both leaves and flower stalks and reducing foliar production by 62–92% (**Suheri and Price, 2001).** According to **La Forest (2011)**, purple blotch significantly reduced seed yield by breaking flowering stalks, which in turn made older plants more susceptible to the spread of fungal infections in fields exposed to wind and rain. **Also,** according to **Abo-Elyousr *et al.* (2014),** *Alternaria porri* can harm any portion of the plant above ground, including the bulb. Typically, symptoms appear on the oldest leaves in late summer. Relics that have been polluted carry spores under rainwater and wind. **McDonald (1999) and Yalamalle *et al* 2019.** reported that *A. porri* was observed to be internally seed-borne and external infection on the seeds. However, none of the seedlings showed symptoms of Stemphylium blight.

Disease forecasting models, which are based on infection risk, can be used to determine the precise timing of fungicide applications, minimizing the adverse effects of fungicides and optimizing the efficiency of control measures. Instead of using a set spray schedule, plant disease forecasting models assist growers in making decisions. When compared to a predetermined spray schedule, disease forecasters lower the number of pesticide sprays needed to manage a given plant disease while maintaining a similar level of disease control **(Llorente *et al*., 2000).**

This study aimed to find relation between environmental conditions at middle Egypt area, presented in El-Minia governorate, and distribution epidemiology of purple blotch disease on onion.

MATERIAL AND METHODS

1. Experimental design

A roving survey was carried out for recording the incidence (DI) and severity (DS) of purple blotch disease on onion cvs. Giza 6 and Giza red, which are common cultivated in this area, during December-March 2020 – 2021 and 2021-2022, which covers the main cropping season, in three major onion growing districts of northern, middle and southern Minia governorate, *viz*., Al-Edwa (El-Misid and El-Atef villages), Beni Mazar (Sholkam and El-Grnous villages) and Abou Qurqas (Nazlet- Asmant and Com al- Zuhair villages) respectively. Plants were at the physiological maturity stage of the growth and the data pertaining to survey work is presented in Table 1. Two fields were randomly surveyed in each village. In each field, one square meter of the field, contains 40 onion plants, was randomly selected in five locations, four corners of the field and one in the center to record the DI and DS of suppressed plans of purple blotch.

Samples from infected leaves showing purple blotch symptoms were collected from different selected villages and brought to the laboratory in polyethylene bags so that the relevant fungus could be investigated. The scraping was elevated using a needle, placed on a glass slide submerged in clear lactophenol, and examined under a light compound microscope at x100 magnification to see whether conidia of *A. porri* were present **(Suheri and Price, 2001).**

2. Isolation and purification of causal organism (s):

The infected leaves of each sample were thoroughly washed with tap water, air dried, cut into small pieces, each piece contains single lesion, surface disinfected with sodium hypochlorite (5 % active chlorine) for 2 minutes, washed several times with sterilized distilled water and dried between two sterilized filter papers. Small portions of spotted lesions were placed in Petri dishes containing potato dextrose agar (PDA) medium **(Kumar *et al.*, 2023)** at the rate of five pieces/plate and incubated at 25±2°C for 7 days. The growing fungi were examined microscopically as described before and purified using hyphal tips or single spore method. Either hyphal tips or single spores were carefully transferred to slopes of PDA medium. Pure cultures of each isolate were maintained on PDA slant and kept at 4°C for identification and further experiments.

3. Pathogenicity test:

3.1 Identification and Pathogenicity test

The isolated fungi were identified depending on their morphological and microscopic characters and using internal transcribed spacer 1 (ITS 1) and ITS 2 and 5.8s rDNA and used for identification of the isolated pathogenic fungi. This application pointed to *Alternaria* were the causal pathogens of onion purple blotch disease **(Ishak *et al.*, 2023)**. The pathogenicity test of the *A. porri* isolates were carried out and mentioned in **Ishak *et al*., (2023).**

3.2 Tested parameters

The percentages of disease Incidence (DI %) was determined according to the following formula which was used previously by **Ishak *et al* (2023**):

DI % = Number of infected plants / Total number of plants x 100

The disease severity index (DSI %) described by **Islam *et al*. (2020**) was used to classify the disease severity in this study. However, a sample of 200 onion leaves / treatment was rated on a scale of 0 to 5 categories as follows:

0 = no disease symptoms (leaves are completely healthy), 1= a few white spots towards the tip covering less than 10% of leaf area, 2 = several dark purplish brown patches covering up to 20% of leaf area, 3 = several patches with paler outer zone covering up to 40% of leaf area, 4= leaf streaks covering up to 75% of leaf area or breaking of the leaves from the center, and 5= complete drying of the leaves or breaking of the leaves from the base.

The disease severity index (DSI, %) of Alternaria purple blotch was estimated using the formula described by **Liu *et al.*, (1995)** as follows:

Disease severity index (DSI), % = $[\Sigma (n \times v) / ZN] \times 100$

Where:

n = Number of leaves in each category, v = Numerical value of each category,

z = Numerical value of highest category, and N = Total number of leaves in the sample.

3.3 Apparent rate of infection "r"

The apparent rate of infection (r) at different intervals was calculated by using the formula given by **Van der Plank (1963),** "r" value is calculated using the following equation.

$$r = \frac{1}{t_2 - t_1} \log_e \frac{X_2 (1 - X_1)}{X_1 (1 - X_2)}$$

Where, "t" is time interval, "x" is the value of disease severity, % and the $\log_e$ is written as Inverse (IN)

3.4 Area under the disease progress curve (AUDPC)

The area under the disease progress curve (AUIDPC) was calculated for rating through 203 days, and the standard weeks after appearance the first sign of purple blotch symptoms using the following equation given by **Shanner and Finney (1977).**

$$AUDOC = \sum_{i}^{n-1} (y_i + y_1 + 1/2)(t_i + 1 - t)$$

where "y"$_i$ is the percent disease index (PDI) observed for the "i^{th}" treatment "t_i" is the date of the observation and observation were made on "*n"* dates.

The most commonly used method for estimating the AUDPC disease intensity between each pair of adjacent time points (**Madden *et al*. 2007).** We can consider the sample time points in a sequence (*ti*), where the time interval between two time points is consistent, and we also have associated measures of the disease level (*yi*).

4. Climatic characters:

To investigate the effect of climatic factors on the incidence of onion purple blotch in Middle Egypt, caused by *Alternaria porri* a comprehensive study was conducted. This study focused on the period from November 2020 to March 2021 and the corresponding period in 2021-2022. The methodology includes the following steps:

4.1 Collection of Climatic Data

Daily climatic data, including temperature and relative humidity, were obtained from the Climate Change Information Center at the Agricultural Research Center (ARC) in Giza, Egypt. The data covered the period from November 2020 to March 2021 and the same months in 2022. These climatic variables were selected based on their known influence on the development and severity of fungal diseases in onions.

4.2 Comparative Analysis

A comparative analysis was conducted between the two study periods (2020/2021 and 2021/2022) to evaluate any changes in disease patterns and their association with climatic variations. This comparison helped to assess the consistency of the findings and to identify any emerging trends in the disease's response to climatic factors. Data were presented in Figures 1.

(A)

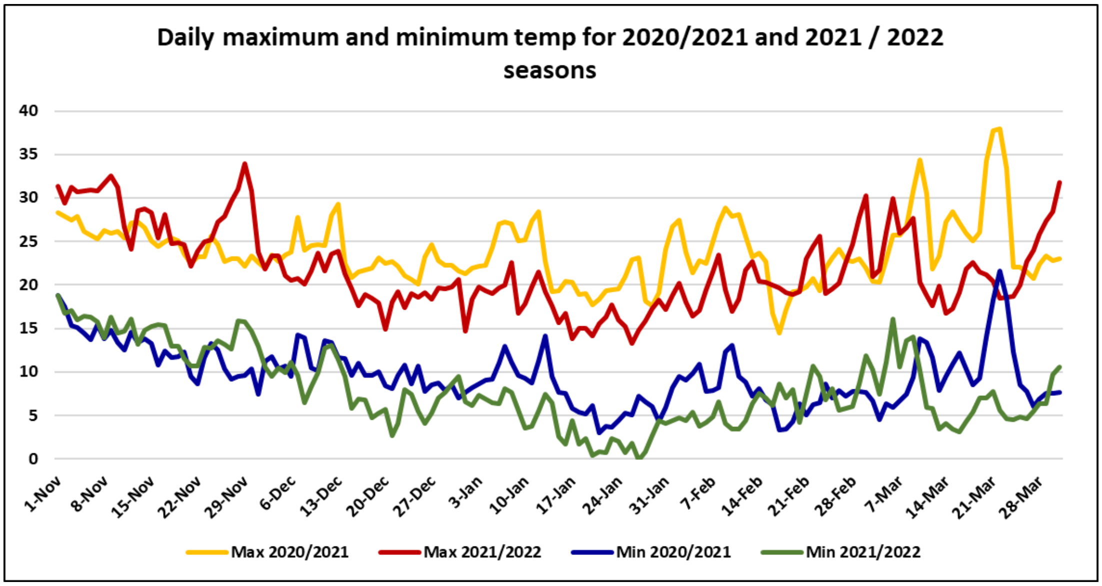


Fig. 1(A):

(B)

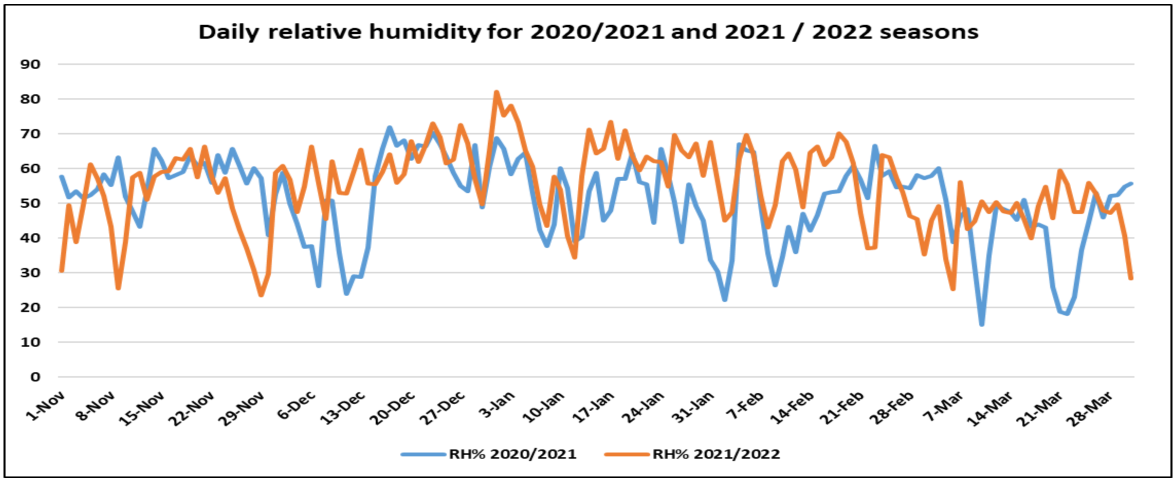


Fig. 1 (A-B) : Daily maximum and minimum temperature for 2020/2021 and 2021 / 2022 seasons daily relative humidity for 2020/2021 and 2021 / 2022 seasons.

Statistical analysis

Data was coded and entered using the statistical package SPSS V.22. Data were tested for satisfying assumptions of parametric tests, continuous variables were subjected to Shapiro- Wilk, and Kolmogorov-Smirnov test for normality. Probability and percentile data were standardized for normality using **Arcsine Square Root.** Data was presented as **mean, and stander deviation**. ANOVA analyses were done for observed groups regarding the disease severity and infected plants; post-hoc analysis evaluated using Tukey pairwise comparison; P-value were considered significant at<0.05 using MiniTab V(**Shtienberg and Vintal (1995).**

RESULTS

1. Isolation and identification of causal organism(s):

The first identification of onion purple blotch came from visual observation of the disease's symptoms under field conditions. The earliest symptoms starting on older leaves are small brown elliptical spots on leaves which enlarge over time and may result in brown, necrotic streaks. Lesions will eventually turn purple as fungal spores develop. In severe cases, lesions enlarge and coalesce to blight the entire leaf (figure 2).

Figure 2: Natural infected onion, symptoms of purple blotch on leaf of onion

2- Surveys for disease incidence and severity in onion growing areas of the El-Minya governorate:

Surveys for disease incidence and severity were conducted in onion growing areas of the El-Minya governorate includes Al-Edwa (El-Misid and El-Atef villages), Beni Mazar (Sholkam and El-Grnous villages), and Abou Qurqas (Nazlet- Asmant and Com al- Zuhair villages) districts during the year 2020-21 and 2021-2022 to assess the actual position of purple blotch occurrence.

Onion purple blotch disease in different districts of El-Minya governorate showed significant differences in 2020- 2021 when compared with 2021-2022 crop seasons and between the onion cultivars (Giza-6 and Giza red cvs.). The data presented in Table (1) and the Boxplot and Violin chart Figure (3 a and b) showed that the prevalence of disease on Giza-6 cv. is higher than on Giza Red cv. in the two crop seasons from all the surveyed locations with varying degrees of mean incidence and severity when recorded every ten/fifteen-day intervals from 11th standard week to 22nd standard week. In order to onion Giza 6 cv., the percent of disease incidence was 42.64±21.83 and 13.87±8.62 in 2020-2021 and 2021-2022 crop seasons, respectively, while it was 16.10±10.36 and 2.13±1.68% on Giza red onion, respectively (Table 1). Whereas the purple blotch severity (PDS) on Giza 6 cv was 36.59±14.51 and 19.56±13.18 in 2020-2021 and 2021-2022 crop seasons, respectively, while it was 4.25±2.91 and 7.48±5.07% on Giza red onion.

Table (1): Disease severity and Infected plants (%) recorded during studied seasons (2020/2021 and 2021/2022).

Disease assessment	Season	Onion Giza 6	Onion Giza red
Disease Severity (%)	2020/2021	36.59±14.51 ^{b**}	4.25±2.91^{b}
	2021/2022	19.56± 13.18^{a}	7.48±5.07^{c}
Infected Plants (%)	2020/2021	42.64±21.83^{a}	16.10±10.36^{b}
	2021/2022	13.87±8.62^{b}	2.13±1.68^{c}

* Standard deviation (SD)

** Means in a row that do not share a letter are significantly different.

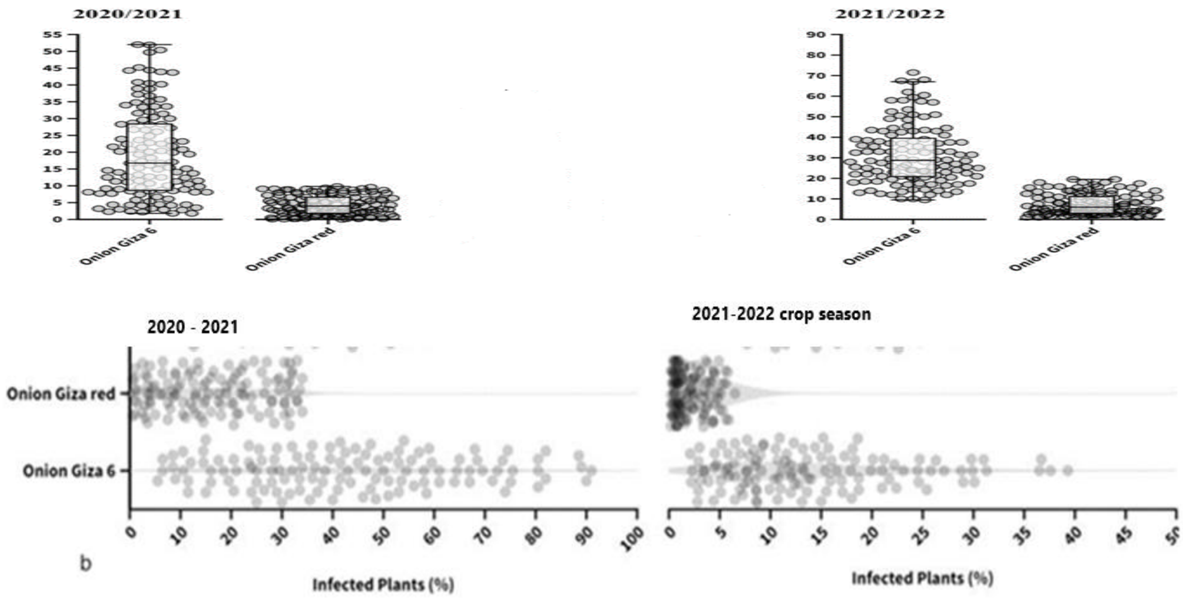


Fig. (3): a. Boxplot represents disease severity (%), b. Violin chart represents infected plants (%) during studied seasons (2020/2021 & 2021/2022)

A total of three districts comprising of two locations in each district were surveyed for the collection of purple blotch infected samples. Data in Table (2) showed that during 2020 and 2021, prevalence of disease in the surveyed north districts (El-Edwa and Beni-Mazar) ranging between 38.58 - 56.72%. with district El-Edwa recording the maximum (55.52%). The minimum incidence (29.85%) was recorded in Abo-Qurqas district for 2020-2021. Similarly, disease severity (30.07% and 17.91%) during the year 2020 -2021 was recorded with the Northern districts recording the maximum (30.64%) while the lowest disease severity was recorded in Abo-Qurqas district (10.66%). Similar data was recorded in 2021-2022 crop season.

Figures (4; A-D and 5; A-D) presented that the percent of disease index (PDI) of onion purple leaf blotch ranged from 6.00 to 90.00% and from 2.10–51.95% when recorded every fifteen day intervals from 11th standard week to 22nd standard week for the cultivar Giza 6 and Giza red, respectively, at 2020-2021 and 2021-2022 crop seasons.

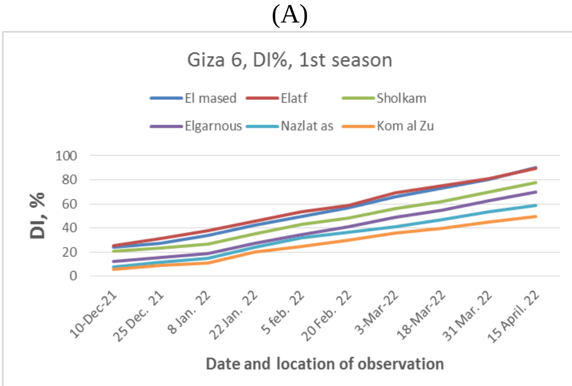
Figure (6, A-D) shows the AUDPC for both disease incidence and severity at the two crop seasons. Data show that the AUDPC for disease severity ranged between 317.5 – 37380 in Giza-6 cv. and between 33.75-2563.5 from Giza Red cv. at the first crop season. Whereas the AUDPC for disease severity was ranged between 544 and 22223.75 in Giza 6 cv. and between 48.75 – 1842.5 for Giza Red cv at the second season. The AUDPC for disease severity increases gradually from December to March. The maximum AUDPC was recorded in March of each season. The maximum disease incidence (37380 and 5340) was recorded in El Edwa village, followed by Beni Mazar (26528 and 4593.8). While the lowest one was recorded in Abo-Qurqas (14519 and 1628.75) for Giza 6 and Giza Red, respectively.

Table (2): Survey of Purple blotch on onion in different districts of El-Minia governorate, during 2020-2021 and 2021-2022 crop seasons.

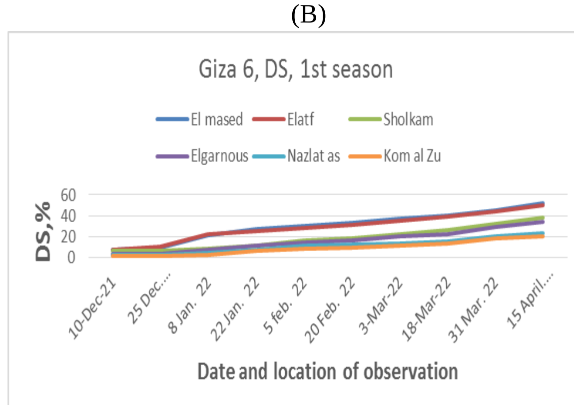
District	Village	2020-2021 crop season				2021-2022 crop season			
		Onion Giza 6		Onion Giza red		Onion Giza 6		Onion Giza red	
		% of infected Plants	% disease Severity	% of infected Plants	% disease Severity	% of infected Plants	% disease Severity	% of infected Plants	% disease Severity
El-Edwa	El-Misid	54.33(*)	30.64	20.78	5.70	38.3	18.9	10.25	3.2
	El-Atef	56.72	29.51	20.84	5.63	38.8	20.7	9.9	3.1
	Mean	55.52	30.07	20.81	5.66	38.55	19.8	10.1	3.15
Beni-Mazar	Sholkam	46.35	19.04	18.35	4.855	33.5	14.7	9.95	2.8
	El-Grnous	38.58	16.79	16.60	4.64	31.6	13.2	8.12	2.1
	Mean	42.46	17.91	17.48	4.75	32.55	13.95	9.1	2.45
Abo-Qurqas	Nazlet- Asmant	32.65	11.57	11.73	2.81	24.3	7.8	3.42	0.7
	Com al- Zuhair	27.05	9.76	8.28	1.85	23.32	7.7	3.22	0.6
	Mean	29.85	10.66	10.00	2.33	23.81	7.75	3.32	0.65

(*) Average of ten observations carried out during November to March 2020 -2021 and 2021-2022

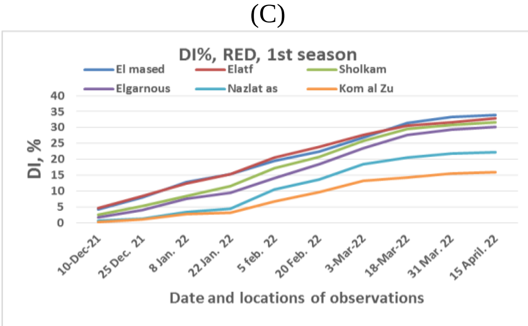
(A)



(B)



(C)



(D)

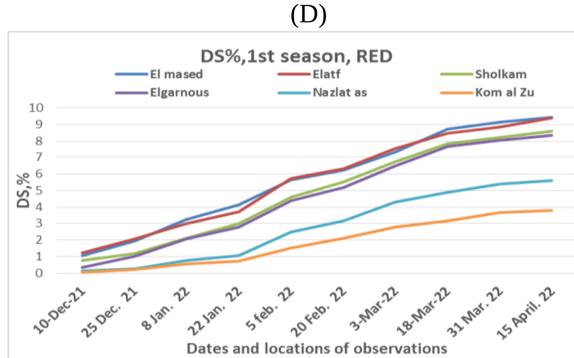


Fig. (4, A-D.): Onion (Giza 6 and Giza Red cvs.) purple blotch disease incidence (DI,%) and severity (DS,%) in different villages for the period from 10 December 2020 to 15 April 2021.

(A) (B)

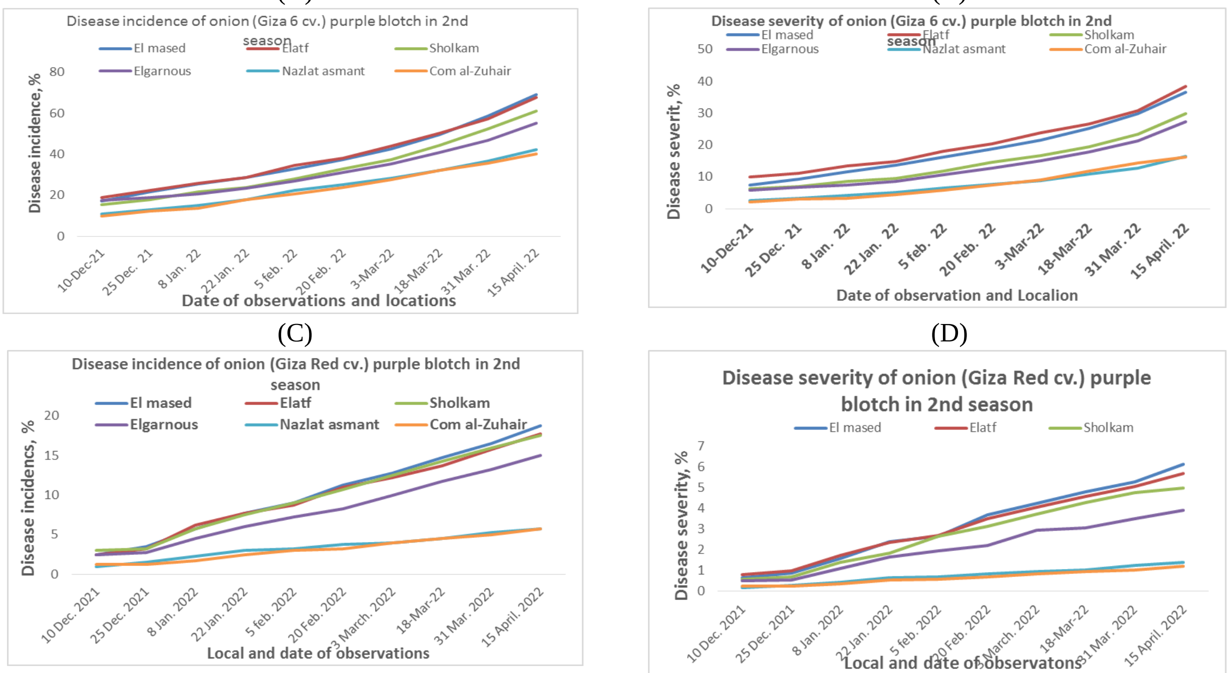


Fig. (5, A-D.): Onion (Giza 6 and Giza Red cvs.) purple blotch disease incidence (DI,%) and severity (DS,%) in different villages for the period from 10 December 2021 to 15 April 2022.

(A) (B)

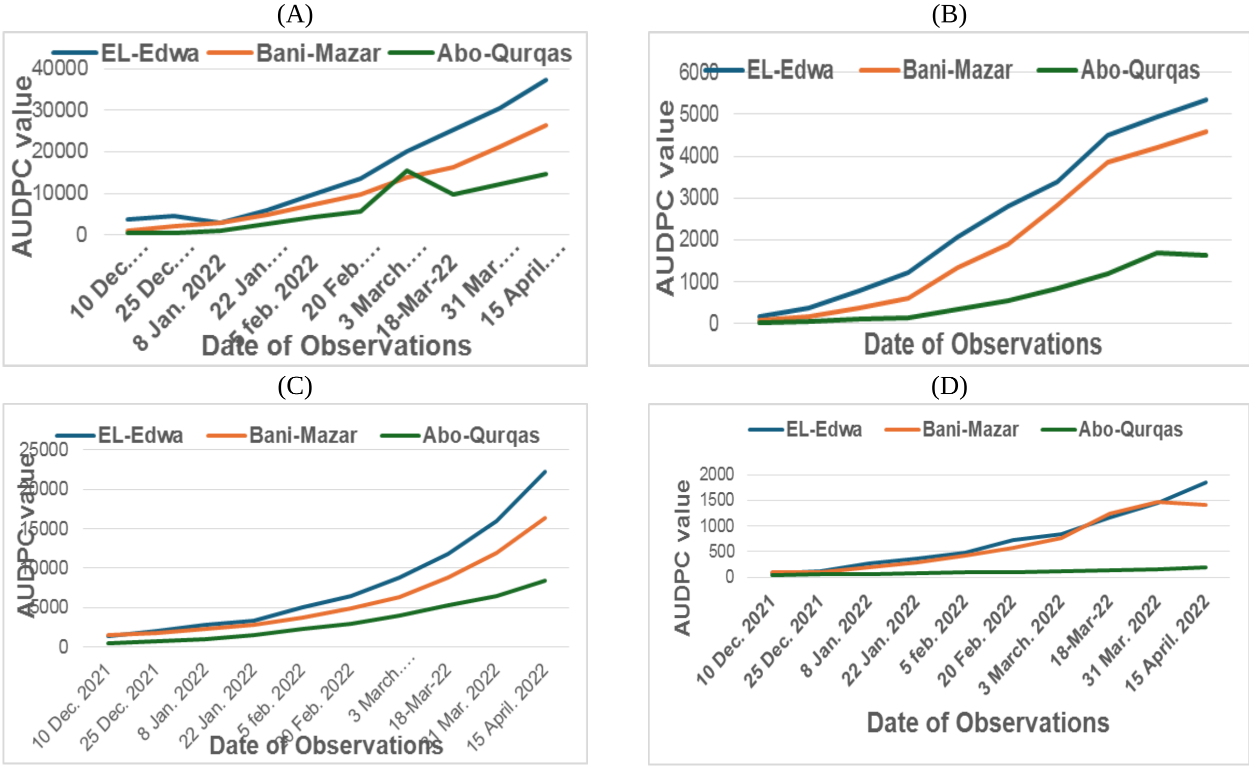


Fig. (6, A-D): Show the AUDPC for disease severity of onion purple blotch at 2020-2021 (A and B) and 2021-2022 (C and D), on Giza 6 and Giza Red cvs., respectively, in three districts of El-Minia governorate.

3- Relation between climatic factors and disease incidence

Tables (3 and 4) show that a comparative analysis was conducted between the two study periods to evaluate changes in disease patterns and their association with climatic variations. The 2020 / 2021 season recorded the highest incidence of purple blotch, which was linked to higher maximum temperatures, warmer minimum temperatures, and elevated average relative humidity. These conditions were found to be more conducive to the development and spread of the disease compared to the 2021 / 2022 season, where the incidence was comparatively lower due to milder climatic conditions.

This comparative analysis helped to assess the consistency of the findings and to identify emerging trends in the disease's response to climatic factors. The correlation between higher temperatures and humidity with increased disease incidence and severity suggests that these climatic conditions may serve as critical predictors for future outbreaks.

Table (3): Predication regression equation for disease severity (%) during studied seasons

2020/2021 Season	**Onion Giza 6=** 60.2 - 2.23 Temp - 0.116 Rh
	Onion Giza red= 13.4 - 0.532 Temp - 0.0184 Rh
2021/2022 Season	**Onion Giza 6=** 51.8 + 0.43 Temp - 0.399 Rh
	Onion Giza red= 11.8 + 0.072 Temp - 0.078 Rh

Table (4): Predication regression equation for Infected plants (%) during studied seasons

2020/2021 Season	**Onion Giza 6=** 119.8 - 4.16 Temp - 0.240 Rh
	Onion Giza red= 47.6 - 1.86 Temp - 0.053 Rh
2021/2022 Season	**Onion Giza 6=** 25.5 + 0.211 Temp - 0.224 Rh
	Onion Giza red= 3.06 + 0.030 Temp - 0.0189 Rh

DISCUSSION

One of the most significant diseases affecting onion crops worldwide, particularly in warm and humid climates, is purple blotch, caused by *Alternaria porri* (Ellis) Cif. **(Miller and Lacy, 1995)**. According to **Miller (1983)** the main cause of yield losses is the loss of leaf tissue and the ensuing slowdown in bulb growth. The disease regularly results in significant loss in El-Minya's subtropics. The earliest symptoms starting on older leaves are small brown elliptical spots on leaves which enlarge over time and may result in brown, necrotic streaks. Lesions will eventually turn purple as fungal spores develop **(Suheri and Price, 2000)**. Under subtropical environments, **Kumar (2020)** reported that purple blotch severely affected seed production through reduction in seed yield by breaking of floral stalks.

For efficient disease management, the link between meteorological variables and disease progression is crucial. The process of infection, penetration, spore germination, and dispersion/spread of spores are all impacted by humidity. This moisture may have originated via irrigation, precipitation, or the relative humidity of the air. Because pathogens often need a layer of water or moisture to be able to perform specific infections or host penetrations, humidity has a significant impact on the development of disease. A layer film of water is necessary for the sporulation and germination of spores in certain fungal diseases. In certain cases, the fungi themselves require the release of spores. Irrigation is one of the other physical environmental elements. The effects of irrigation on the disease's course are multifaceted. Irrigation has the potential to directly or indirectly impact how a disease develops. Plants that receive direct irrigation will be more vulnerable to diseases. For instance, *Phytophthora infestans* **(Supriya *et al*., 2020)** and *Alternaria porri* **(Everts and Lacy, 1990)** fungal attacks will be particularly severe when crop irrigation is wet. Indirect irrigation may cause the surrounding air to become more humid and colder, hastening the spread of the disease.

The systemic survey was carried out to record the severity of purple blotch disease in three onion major growing districts of El-Minya Governorate, Egypt, during 2020-2021 and 2021-2022 crop seasons. The survey for disease, severity, distribution, and spread was carried out at physiological maturity. *Altrnaria porri* is known as polyphagus, infects crops such as shallot, garlic, onions and other crops belonging to the genus *Allium*. It is necessary to have a maximum temperature of 24±2^{o}C and high relative humidity (80 to 90%). Under ideal circumstances, an epidemic might result in the crop's complete failure. Purple blotch was shown to have caused severe losses **(**Efath ***et al.*, 2007 and Mishra *et al.*, 2009, Abdel-Rahim *et al.*, 2017)** and about 97% loss in seed crop. **Lokra (1999)** mentioned that when there is onion crop that is susceptible to thrips harm, the purple blotch is significantly more severe. According to the data obtained, significant increase in both onion purple blotch DI and DS% in 20-2021 than in 2021-2022 crop seasons. Also, there is a significant increase in both disease parameters in Giza-6 than Giza red cvs.

The Area Under Disease Progress Curve (AUDPC) calculation revealed that the disease pressure was higher in the first season than it was in second season. This finding may have been related to the low relative humidity and temperature that prevailed throughout 2021-2022. Based on the mean data collected for each of the six villages and the overall average of the disease index for the two seasons, a multiple regression equation was developed to predict the disease. The results show that in 2021-2022, two weather parameters; the maximum temperature <20^{o}C and relative humidity (80%), spell contributed to an increase in the infection rate. The maximum AUDPC was recorded in February-March of each season, this may be due to the reduced temperature and rases the R.H. values. Climate change has a direct impact on the emergence of diseases that are specially brought on by particular pathogens. Plant diseases are influenced by physical environmental elements, such as temperature, sun radiation, humidity, irrigation, and wind. Each of these elements can have an individual or combined effect on the onset of a disease **(Damiri, 2017).**

Daljeet *et al.* (1992), and **Suheri and Price (2000)** stated that the weather conditions are favorable going to lose 100% of the seed yield. Temperature and humidity are the most predominant factors for the development of purple blotch disease. The disease is favored by moderate temperature (24-30˚C) and high relative humidity, more than 90%) **(Gupta and Pathak. 1986 and Islam *et al*., 2020)**. Optimum infection and disease development of *A. porri* on onion leaves occurred following a prolonged period of R. H. 90%, or dew deposition and temperatures of 20-25^{o}C **(Everts and Lacy, 1990 and 1996)**. The purple blotch occurred especially during warm-wet conditions (**Gupta and Pathak; 1998; Suheri and Price, 2000**; **Cramer, 2000 and Ishak *et al*., 2023).** For the creation of PLB control strategies, knowledge of the environmental factors influencing infection and disease progression is crucial. Disease forecasting models help us predict and prevent the outbreak of destructive diseases by analyzing the atmospheric and environmental parameters.

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الملخص العربي:

دراسة وبائية على مرض اللطعة الأرجوانية علي البصل في ظل الظروف المناخية في مصر الوسطي

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مرض اللطعة الأرجوانية، الناتج عن الفطر *Alternaria porri*، مرض وبائي يصيب محصول البصل في مصر تهدف هذه الدراسة إلى تقدير حدوث وتحليل وبائية مرض اللطعة الأرجوانية للبصل في ظل الظروف المناخية بمصر الوسطى. تم جمع عينات البصل المصابة من ستة مناطق مختلفة في مصر الوسطى وإجراء الحصر لتسجيل شدة مرض اللطعة الأرجوانية في ثلاث مناطق رئيسية لزراعة البصل في محافظة المنيا، مصر، خلال الموسمين 2020-2021 و2021-2022. تم عمل حصر للمرض وشدته وتوزيعه وانتشاره عند النضج الفسيولوجي للنبات. فلوحظ زيادة كبيرة في كل من نسبة حدوث المرض DI% وشدته DS% في الموسم 2020-2021 مقارنة بموسم 2021-2022. كما أن هناك زيادة معنوية في كل من مؤشرات المرض في صنف الجيزة 6 مقارنة بـالصنف جيزة الأحمر.

أُخذت قراءة كل أسبوعين، من الأسبوع الحادي عشر إلى الأسبوع الثاني والعشرين وعند حساب المساحة تحت منحني المرض (AUDPC) تبين أن المرض كانت نسبة حدوثه وشدته أعلى في موسم 2020-2021 عما كان عليه في 2021-2022 وبالاعتماد على متوسط البيانات المجمعة لكل قرية من القرى الست والمتوسط العام لمؤشر المرض للموسمين، تم عمل مقياس معدل زيادة المرض r-value للتنبؤ بالمرض. وأظهرت النتائج أنه في الموسم الاول، كان هناك عاملان من العوامل المناخية وهما درجة الحرارة القصوى أقل من20 درجة مئوية والرطوبة النسبية (80%) ساهمتا في زيادة معدل الإصابة خلال هذا الموسم. تم تسجيل الحد الأقصى للمساحة تحت منحنى الإصابة AUDPC لحدوث وشدة المرض في شهري فبراير ومارس من كل موسم، وقد يكون هذا بسبب انخفاض درجة الحرارة وارتفاع نسبة الرطوبة. تختلف شدة مرض اللطعة الأرجوانية في البصل بشكل كبير عبر مناطق مختلفة في مصر، وتتأثر بكل من الظروف البيئية ومسببات الأمراض. يمكن أن يرجع التباين في شدة المرض إلى عوامل مثل الظروف المناخية، والممارسات الزراعية، ووجود عزلات ممرضة مختلفة الشراسة والقدرة المرضية تؤثر فى حدوث المرض.