Prevalence of Fungal Disease Agents in Garlic Growing Areas of Gaziantep Province

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- Garlic
- Fungal disease
- Prevalence
- Gaziantep

Abstract: Surveys were carried out in garlic cultivation areas of Gaziantep province in April 2018 and April 2019 to determine the prevalence of fungal diseases of garlic. After the isolation process was conducted according to routine mycological methods, fungi were identified according to their cultural and morphological characteristics. Fungi belonging to genera of Fusarium, Rhizoctonia, Macrophomina and Puccinia were determined in garlic production areas. The most prevalent genus among all fungi was determined as the Fusarium isolated from all areas. The rust disease caused by Puccinia porri has not been detected in the Islahiye district and its prevalence in other areas varies between 5.1-18 %.

Gaziantep İli Sarımsak Yetiştirme Alanlarında Fungal Hastalık Etmelerinin Yaygınlıkları

Anahtar Kelimeler
- Sarımsak
- Fungal hastalıık
- Yaygınlık
- Gaziantep


1. Introduction

Garlic (Allium sativum L.), one of the members of the Alliaceae family and first cultivated Allium species, is a bulbous plant [1, 2]. There are two subspecies of garlic, which is known to have almost 600 varieties [3]. One of these species is A. sativum var. ophioscorodon, the other one A. sativum var. sativum is cultivated widely and economically important in Türkiye. Garlic, which has an important role in terms of agricultural and human health benefits, is widely grown in Mediterranean countries, India, China, the Far East and the USA [4].

Garlic is a plant that likes mild climates as well as being a long-day plant. It can be grown easily in climates where the average temperature is above 15-20 °C. As the temperature increases, problems occur in the development of garlic and plant growth rate reduce.

Bulbs that grows below the ground can protect themselves against cold damage up to -10 °C [5].

In 2018, the garlic growing areas and production in Türkiye were reported as 15.000 hectares, over 140.000 tonnes. Although Kastamonu was the first province to be remembered for its garlic production, Kastamonu province replaced with Gaziantep based on garlic production amount in 2018. Gaziantep has a considerable role in the total area with its production area of 21.516 decares. In terms of dry garlic production, Kahramanmaraş (13.47%) follows Kastamonu (17.45%) and Gaziantep (17.61%) provinces [6].

Plant protection problems occur frequently in agricultural areas and from these, fungal plant diseases are responsible for seriously yield losses in production processes [7, 8]. Fungal diseases lead to
economic losses in garlic and onion production areas. Plants belonging to the genus *Allium*, such as onions and garlic, are affected by certain soil borne plant pathogens such as *Fusarium* spp., *Rhizoctonia* spp., *Pythium* spp., *Sclerotium* spp., *Sclerotinia sclerotiorum*, and *Macrophomina phaseolina*. These pathogens cause significant losses in the quality and yield of agricultural products all over the world [9, 10]. In a study on onion production areas in seven provinces of Turkey in 2007, samplings were performed in 223 fields, and 332 isolates belonging to 7 *Fusarium* spp. were obtained. The isolates were identified as *F. oxysporum*, *F. solani*, *F. acuminatum*, *F. equiseti*, *F. proliferatum*, *F. redolens*, and *F. culmorum* based on morphological and cultural characteristics [11]. In the other study conducted by Türkkan and Karaca [12], fungal root-rot agents associated with onion fields in Amasya province and their incidence and severity were investigated. Moreover, some studies have been conducted on fungal causal agents in garlic and onion cultivation areas in North America and Serbia [13, 14]. As a result of the literature review on the losses caused by fungal disease agents in the garlic growing areas of Gaziantep Province, study has not been found.

In this study, it was aimed to guide future studies by determining the fungal disease agents and prevalence in the garlic cultivation areas of Gaziantep Province.

2. Material and Method

2.1. Survey study

According to 2017 data of Gaziantep Provincial Directorate of Agriculture, random sampling was performed in garlic production areas in April of 2018 and 2019. The surveying areas were indicated in Figure 1.

![Figure 1. Garlic cultivation areas and sampled districts in Gaziantep Province](image)

Survey areas were randomly selected in Gaziantep. Diseased plants were collected according to the randomized sampling method [15]. The collected samples were kept in plastic bags and taken to the laboratory, and then subjected to isolation procedures.

Some information about garlic cultivation and sampled areas in Gaziantep Province is given in Table 1.

### Table 1. Garlic growing areas and sampling data in Gaziantep province

<table>
<thead>
<tr>
<th>Cultivation area (da)</th>
<th>Sampled area (da)</th>
<th>Sampled fields</th>
<th>Collected plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Araban</td>
<td>1200</td>
<td>145</td>
<td>7</td>
</tr>
<tr>
<td>Sahinbey</td>
<td>500</td>
<td>54</td>
<td>3</td>
</tr>
<tr>
<td>Oguzeli</td>
<td>3615</td>
<td>361</td>
<td>18</td>
</tr>
<tr>
<td>Nurdagi</td>
<td>1500</td>
<td>152</td>
<td>8</td>
</tr>
<tr>
<td>Sehitkamil</td>
<td>900</td>
<td>94</td>
<td>5</td>
</tr>
<tr>
<td>Isahhiye</td>
<td>50</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>7765</td>
<td>816</td>
<td>42</td>
</tr>
</tbody>
</table>

2.2. Isolation of the fungal disease agents

For the isolation process, the roots and stem of affected plants were washed thoroughly under tap water and dried. The infected tissues were cut into small pieces (approximately 4-5 mm length) from the plant parts containing both symptomatic and asymptomatic tissues. All pieces were surface-sterilized in 2% sodium hypochlorite (NaOCl) solution for 3 minutes and washed twice in sterile distilled water and dried again. Afterwards, sterilized tissues were plated on a potato dextrose agar (PDA) medium. After incubation of the Petri dishes for 7 days at 25 °C in the dark, colonies growing from the tissue were transferred to fresh Petri plates.

2.3. Identification of fungal disease agents

Species were identified by preparing a slide culture separately for each isolate [16]. *Fusarium* spp. was identified according to The *Fusarium* Laboratory Manual published by Leslie and Summerell [17]. After 10 days of incubation at 25 °C in the dark, the isolates were identified considering its morphological characteristics including hyphal branching, phialides, microconidia, macroconidia shapes and sizes, chlamydospore and sporodochium formation. *Rhizoctonia* spp. was identified according to the characteristic features of vegetative hyphae [18], the number of nuclei in the cells [19], colony colour and characteristics in the PDA medium [20]. *Macrophomina* and *Puccinia* species were identified with reference to Ashby [21] and Goidanich [22] and *Puccinia* to Laundon and Waterson [23] and Koike [24].

2.4. Determination of prevalence of the fungal disease agents

The disease rates (%) were determined by proportioning the plants showing the characteristic symptoms of the disease to the total number of plants in each garlic field. After determining the disease rates for each cultivation area, the prevalence rates of district were calculated [15].
3. Results

In the result of the surveys carried out in the garlic production areas of Gaziantep province in 2018 and 2019, the prevalence (%) of fungi were indicated in Table 2.

The prevalence of Fusarium was the highest in garlic production areas of Gaziantep. The genus Fusarium exhibited different rates of prevalence (52.0-67.4%) in all fields surveyed.

The genus Macrophomina could not be determined in Sehitkamil and Oguzeli districts which have the highest garlic production area. Besides, it was determined that the Rhizoctonia genus showed varying rates (8-24%) in all survey areas, except Sehitkamil. The prevalence of the other group, including the genera Rhizopus, Sordaria, Aspergillus and Trichoderma varied between 6.6% and 38.4% (Table 2).

As a result of the diagnostic studies, a total of 8 species, 6 of which belong to the Fusarium genus, were identified. The areas where the identified species are isolated and their frequencies of isolation (%) are presented in Table 3.

As can be seen from Table 3, F. oxysporum and F. poae were isolated from all fields surveyed. F. sporotrichioides was only isolated from Sehitkamil and its prevalence was 11.4%. Other soilborne pathogens obtained and identified in garlic growing areas were R. solani and M. phaseolina.

These results show that Fusarium species have a wide range of prevalence in garlic cultivation areas. Onion-garlic rust disease pathogen P. porri was detected in all cultivation areas except Islahiye. The disease and prevalence rate of garlic rust in garlic cultivation areas are presented in Table 4. Its disease rate was determined to be 14% in Gaziantep province.

4. Discussion and Conclusion

Pathogens attack Allium species throughout their production periods. Garlic is vegetatively propagated by planting its cloves [25]. In this case, especially soil-borne pathogens invade the vegetative materials and easily cause diseases in the next cultivation period. It is well known that pathogens such as Fusarium spp., Rhizoctonia spp., Pythium spp., Sclerotium spp., S. sclerotiorum, and M. phaseolina cause diseases in onion and garlic production areas. In addition, it causes decreases in product quality and yields worldwide [9]. F. proliferatum is the most common fungal pathogen in garlic and onion cultivation areas in Serbia. Although F. oxysporum, F. solani, F. acuminatum and F. equiseti were other species isolated and identified in Serbia by Stankovic [12], the prevalence of these species was reported to be less than the F. proliferatum. In a study conducted in onion cultivation areas of Bursa, Ankara, Eskisehir, Yozgat,
Garlic cultivation is very important for Gaziantep and Turkey. As a result of this study, the prevalence and isolation frequency of fungi were determined in the garlic cultivation areas of Gaziantep. The negative effects of fungal diseases on yield and quality constantly poses a serious problem in garlic cultivation. Although much research has been performed in different garlic and onion cultivation areas of Turkey, no research has been conducted in Gaziantep. For this reason, it is important to determine garlic fungal diseases and its prevalence in this province.

According to the results obtained from this study, it is understood that the range of fungal agents occurring in garlic production is quite common. Therefore, this study constitutes the basis of many future studies.

Declaration of Ethical Code

In this study, we undertake that all the rules required to be followed within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with, and that none of the actions stated under the heading "Actions Against Scientific Research and Publication Ethics" are not carried out.

References


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