Int.J.Curr.Res.Aca.Rev.2019; 7(5): 65-70

EXCELLENT PUBLISHERS

International Journal of Current Research and Academic Review

ISSN: 2347-3215 (Online) Volume 7 Number 5 (May-2019)

Journal homepage: http://www.ijcrar.com

doi: https://doi.org/10.20546/ijcrar.2019.705.009

Fungicidal Activity of Component Composition of *Alhagi maurorum* Medik

Aytan Sh. Safarova*

Institute of Microbiology of the NAS of Azerbaijan, Baku, Azerbaijan

**Corresponding author*

Abstract

The purpose of the presented work is research fungicide properties of camel's thorn plant grown in ecologically different geomorphological units of Azerbaijan. From the obtained results became clear that environmental condition causes to change optical density as well as a quantitative and qualitative change of component composition of aqueous extract and the essential oil obtained from the plant. This change is also manifested in the fungicidal activity of the obtained plant material. The fungicidal activity of the essential oil obtained from camel's thorn included in the flora of Azerbaijan depends on its component composition and essential oil which major component is thymol both in separately and in the form of composition are characterized by higher quantitative indices. The difference of major and minor components of essential oils used in the preparation of compositions compared to the initial ones does not cause a decline of fungicide activity.

Article Info

Accepted: 04 April 2019
Available Online: 20 May 2019

Keywords

Ecological conditions, Camel's thorn, Aqueous extract, Essential oil, Component composition, Fungicidal activity

Introduction

Plants that are a large group of living things spread in nature grow wild and cultural forms are widely used in all areas (food, feed, medical, technical, etc.) from very ancient times[7] and still holds that status, moreover, is expanding application areas. On the one side, the expansion of their use and, on the other side, intensification of the intervention of people in the environment is observed with narrowing of the area of plants.

Besides, the quality and productivity of plants are diminished as a result of diseases caused by some living thing in plants [6]. On the other hand, they also enrich the plants with their toxic metabolites, more precisely with mycotoxins [3]. The preparation methods and approaches reflecting the use of consistent with the principles of sustainable development is one of the topical issues of today. First of all, is necessary comprehensive to the research of plants namely research in accordance with changing environmental conditions.

It should be noted that the Republic of Azerbaijan also has a rich and colorful plant wealth. Thus, its flora includes about 4700 species among which is included carriers of quality as feed, medicines, food, technical, etc[1, 10]. Many of them were investigated by botanical, physiological, biochemical, etc. aspects and have been suggested effective methods and approaches for their use. However, many of these plants are not comprehensively examined in the mycological aspect, although their research in this aspect is important for the efficient use of plants.

One of the plants that not comprehensively examined in the mycological aspect is Alhagi maurorum Medik which can spread about in all regions of Azerbaijan[1] and resources are also enough. In this regard, it should be noted one issue that the quantitative indicators of content components of this or that plant may vary depending on the ecological condition [9] and this is one of the points to be considered during their use. So that, like all the plant camel's thorn is one of the settlements of fungi[8] and a wide range of fungi can participate in the formation of its mycobiota which has been confirmed in our previous studies [16].

As a result of all the above, the purpose of the presented work was dedicated to the study of effects components content of plants grown in the ecologically different regions of Azerbaijan to its fungicidal activity.

Materials and Methods

Samples for the research were taken from the plant Alhagi maurorum Medik in the large geomorphological units of the territory Azerbaijan such as the Greater Caucasus, including Absheron, Talish mountains and Kur-Araz plain in 2017-2018. These works were carried out based on methods both the route and the selection of permanent areas used in our previous work [16]. The samples were taken from the visually healthy vegetative and generative organs of the plant and passportization for laboratory analysis. In total, more than 200 samples were taken during the research and according to the purpose of the study by the known methods were investigated fungicidal properties In totally, more than 200 samples were taken during the research and according to the purpose of the study fungicidal properties were investigated by the know methods [2, 5, 12].

From the collected materials were extracted both aqueous extracts (AE) and essential oils (EO) and they were used for the study of fungicidal properties. The crushed surface part of the camel's thorn plant used for this purpose is mixed with ordinary water at a ratio of 1:10 and extracted in a water bath for 30 minutes at 40^0C. The resulting aqueous extract is filtered after cooling down and 100 ml pour to the each of flasks with a volume of 200 ml, the pH is delivered to 6.5-7.0. After that, under pressure at 0.5 atm. is sterilized within 45 minutes. Following this, we adding fungi cultures into flasks where aquatic extracts of the studying plant and keep the flasks in the thermostat for 7 days at 25-27 °C. As a control variant was used Czapek medium. After the filtration of the culture, the solution is determined by the weight of biomass. The received filters are dried at 105 ° C until formed constant (permanent) weight. During the cultivation of cultures of fungi in the cultural solution with EO obtained from the plant the Czapek medium before that was sterilized within 45 minutes under pressure at 0.5 atm. Then, 0,001-0,1% alcohol solution of essential oil adds to the flasks containing a nutrient medium. Essential oil solution is not added to the flasks, which considered as control options.

During the study of fungicidal activity was not used from the fungus *Candida albicans* which classically used were used from the toxigenic fungi (*Aspergillus niger, A.ochraseus, Cladosporium herbarium, Fuzarium oxysporium, Penicillium citrinum,* and *P.cyclopium*) which spread in Azerbaijan. Fungi were taken from the Microbiological Biotechnology Laboratory of Microbiology Institute of ANAS.

The fungicidal feature of both EO obtained from the camel's thorn and its composition with other plants were carried out by the disk diffusion method [2], and the process was evaluated according to the diameter of the lysis zone. The optical density of the AE and EO obtained from the camel's thorn plant were determined on the SF 2000 spectrophotometer and the component composition of EO by the chromatography method [15].

Results and Discussions

As known, essential oil plants, including camel's thorn, have healing properties [4,13], but nevertheless, they, including camel's thorn are characterized as one of the locations of toxic, allergen and opportunistic fungi [11, 16]. Camel's thorn plant has medicinal significance and one of the places of residence of toxigenic fungi, in other words, has contrasting properties, therefor was advisable to study their fungicidal properties. For this purpose, were studied the fungicidal properties of EO, AE, and compositions of EO obtained from others plant with letters. In the first place, materials received in the same way from the plants collected from different ecological conditions were characterized by optical density in visible light wave (656 nm wavelength). From the obtained result became clear that there is a certain degree of dependence between the optical density of the studied materials and the moisture content, so that high moisture is characterized by relatively low optical density (Tab. 1). So, the optical density of camel's thorn collected from Absheron is high than collected from the Talısh mountains. Those gathered from the Kur-Araz lowland are located between them (Table 1–3).

Table.1 The optical density of AE and EO obtained from the camel's thorn plant collected in various ecological conditions(656 nm wavelength)

Plant material	The Greater Caucasus (including Absheron)	Kur-Araz lowland	Talısh mountains
AE	1,07(1,09)	1,03	1,01
EO	5,65(5,87)	5,25	5,07

Table.2 Component composition of EO of *A. maurorum* plant (%)

Components	BC	KA	LA	Ab
4-Hexyl-2,5-dihydro-2,5-dioxo-3-furanacetic acid	4,2	3,7	3,0	3,2
ß-Damascenone	1,2	1,2	1,2	1,2
E-Geranyl acetone	1,6	1,6	1,6	1,6
trans-ß-Ionone	2,4	2,4	2,4	2,4
Actinidiolide	2,0	2,0	2,0	2,0
2-(1,3-Butadienyl)-1,3,5-trimethylbenzene	0,2	0,2	0,2	0,2
2-Nonadecanone	1,4	1,4	1,4	1,4
Isopropyl myristate	1,0	1,0	1,0	1,0
9-Octylheptadecane	8,2	7,8	7,2	10,2
Drimenol	20,2	23,2	19,2	22,2
13-Tetradecen-1-ol acetate	1,0	1,0	1,0	1,0
E-Nuciferol	1,4	1,4	1,4	1,4
Octadecane	0	0,4	0,3	0,6
6,10,14-Trimethyl-2-pentadecanone	2,2	2,2	2,2	2,2
Nonadecane	0,3	0,3	0,3	0,3
Farnesyl acetone	1,2	1,2	1,2	1,2
Hexadecanoic acid methyl ester	0,5	0,5	0,5	0,5
Isopropyl palmitate	0,8	0,8	0,8	0,8
E-15-Heptadecenal	0,1	0,1	0,1	0,1
Eicosane	0,5	0,5	0,5	0,5
Docosane	0,7	0,7	0,7	0,7
Neophytadiene	2,0	0,9	2,2	2,9
Tricosane	1,3	1,3	1,3	1,3
Tetracosane	1,1	1,1	1,1	1,1
1,21-Docosadiene	1,2	1,2	1,2	1,2
Pentacosane	1,3	1,3	1,3	1,3
Squalene	2,2	2,2	2,2	2,2
Octacosane	1,1	1,1	1,1	1,1
Nonacosane	2,0	1,9	1,3	2,3
Hentriacontane	1,1	1,1	1,1	1,1
Oxygenated monoterpenes	0,5	0,9	0	0,8
Triterpene hydrocarbons	2,2	2,2	2,2	2,2
Oxygenated sesquiterpenes	2,6	2,6	2,6	2,6
Terpene-related compounds	2,4	2,4	2,4	2,4
Acid derivatives	1,8	1,8	1,8	1,8
Hydrocarbons	1,9	1,9	1,9	1,9
Others	2,6	2,6	2,6	2,6
Total	81,7	80,7	78,7	83,7

Table.3 The fungicidal activity of AE obtained from the camel's thorn plant collected in various ecological conditions(according to biomass yield, relative to the control %)

Test cultures	The Greater Caucasus (including Absheron)	Kur-Araz lowland	Talısh mountains
Cladosporium herbarium	60(54)	59	63
Fuzarium oxysporium	71(66)	69	73
Aspergillus niger	69(64)	67	71
Aspergillus ochraseus	67(61)	65	69
Penicillium citrinum	64(57)	60	67
Penicillium cyclopium	67(60)	62	70
Control	100	100	100

Table.4 Fungicidal properties of EO from *A.mourorum*

EO	Test cultures	Activity	
		By the biomass yield (according to the control %)	According to the diameter of the lysis zone (mm)
A.mourorum	*Cladosporium herbarium*	0,6	26
	Fuzarium oxysporium	0,8	24
	Aspergillus niger	1,2	21
	Aspergillus ochraseus	1,0	22
	Penicillium citrinum	1,4	20
	Penicillium cyclopium	1,3	20

Note: The biomass of fungi in the Czapek medium taken as control is 100%.

Table.5 Fungicide properties of compositions obtained from the EO of camel's thorn with EO obtained from

Composition	Test cultures	Activity	
		By the biomass yield(according to the control %)	According to the diameter of the lysis zone (mm)
Artemisia absinthium/A.mourorum 1:1	*Cladosporium herbarium*	0	38
	Fuzarium oxysporium	0	29
	Aspergillus niger	0	31
	Aspergillus ochraseus	0	32
	Penicillium citrinum	0	33
	Penicillium cyclopium	0	36
Nepeta cataria / A.mourorum 1:1	*Cladosporium herbarium*	0,3	29
	Fuzarium oxysporium	2,2	21
	Aspergillus niger	1,7	22
	Aspergillus ochraseus	1,1	24
	Penicillium citrinum	0,9	25
	Penicillium cyclopium	0,7	26
Achillea millefolium / A.mourorum 1:1	*Cladosporium herbarium*	0	35
	Fuzarium oxysporium	0,1	28
	Aspergillus niger	0,2	28
	Aspergillus ochraseus	0	31
	Penicillium citrinum	0	32
	Penicillium cyclopium	0	30

The Similar distinction is also expressed in the component composition of EO obtained from the camel's thorn and in this case the differences carry quantitative and qualitative. Although the quantitative differences may show in both major and minor components, qualitative differences show only in small components(tab. 2). Depending on the differences of the environmental conditions according to the optical density, as well as between quantitative and qualitative indicators of major and minor components of EO and AE obtained from plant reflected in the fungicidal activity of these materials which is one of the issues of interest. Therefore, at the next stage, these issues were clarified.

First of all, according fungicidal properties of AE should be noted that (the results became clear that) in the content of the aqueous extract obtained from plant contains composition carried fungicidal properties and quantitative indicator of its impact is determined by biological properties of the used fungi, as well as the location of the plant(tab. 3). As seen, highest fungicidal activity of 10% aqueous extract obtained in the same methods was observed in the AE obtained from the camel's thorn collected in Absheron.

On the other side, the growth rate in all test cultures were weakened and the highest quantitative indicator of this were observed with respect to the fungus of C.herbarium. Thus, from the effect of 10% extract obtained from the plant the biomass yield of fungi compared to control decreases by 46%. Similar indicator for the fungi like as *Aspergillus niger, Aspergillus ochraceus, Fusarium oxysporum Penicillium citrinum* and *Penicillium cyclopium* are contain *34%, 39%, 36%, 43% və 40%.* Hence, the plant also takes attention as a carrier of fungicidal properties which limiting the growth of toxigenic fungi.

All of this, in turn, has a great likelihood that the component composition of the plant in separately has a higher fungicide feature effect. From the obtained result about the influence of a variety of environmental conditions to the fungicidal activity of AE such a tendency is observed that ie, substances which have fungicidal properties contained in plants with low moisture content has a relatively sharp effect.

In studies, the activity of essential oil obtained from the *A.mourorum* plant has been determined based both on the diameter of the lysis zone (mm) and the amount of produced biomass. From the results became clear that EO obtained from the plant has fungicidal properties (Table 4) and its use for this purpose is promising.

It should be noted that the results obtained with AE are generally compatible with EO that is the growth of *C.herbarium* fungus is more weakening from the effect of EO.

It should be noted that in some conducted studies the using of EO in the form of composition was proven to be more effective[14]. Taking this into consideration, at the end of the research was also investigated the fungicidal activity of the composition prepared from essential oils obtained from the camel's thorn and other plants. For this purpose was taken the composition of wormwood and camel's thorn in 1:1 ratio and was investigated the fungicidal activity of this composition prepared from two EO. The obtained results are given in Table 5. As seen, although the effect of the prepared composition is not felt on some fungi, but in many cases, it has been observed a rising effect.

The quantitative indicator of this rise is formed depending on the source of the component's content of composition and the biological properties of test cultures. This case demonstrated by the highest level in the composition prepared based on EO, which the main component is thymol. This finds its confirmation in the comparison of fungicidal activity of the compositions which compositional components are different. Thus, the composition of the *Artemisia absinthium/A.mourorum* thorn shows a higher result than the composition of the *Achillea millefolium/A.mourorum* thorn. Interestingly, none of the prepared compositions are observed a reduction in fungicidal activity compared initially. It was determined that the composition of *Nepeta cataria /A.mourorum* thorn shows a higher result than the composition of the *Achillea millefolium/A.mourorum* thorn.

Thus, from carried out of the research became clear that fungicidal activity of the essential oil of the camel's thorn included in the flora of Azerbaijan depends on its component composition and essential oil which major component is thymol both in separately and in the form of composition are characterized by higher quantitative indices. The difference of major and minor components of essential oils used in the preparation of compositions compared to the initial ones does not cause a decline of fungicide activity.

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How to cite this article:

Aytan Sh. Safarova. 2019. Fungicidal Activity of Component Composition of *Alhagi maurorum* Medik. *Int.J.Curr.Res.Aca.Rev.* 7(5), 65-70. **doi:** https://doi.org/10.20546/ijcrar.2019.705.009