



Original Research Article

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Species Composition of Fungi Participate in the Formation of Mycobiota of Some Essential Oil Plants Included in the Flora of Azerbaijan

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ABSTRACT

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In researches were investigate mycobiota of essential oil plants which spread the 7 economic regions of Azerbaijan and 161 species of fungi involved in their formation. It became clear that, among of recorded fungi widely is spread phytopathogens. Fungi which characterized as a true biotrophs causes diseases such as brown decay, white decay, rust, riding, floury dew, phytotor, plasmapore, peronospora and oth. on the studied essential oil plants. Fungi belongs to the polytrophyes also participates in the creating to the various pathologies on plants, to them belongs diseases such as fusariosis, stain, fading, septorios, different color of decay, mold, alternarioz and oth

Introduction

The fact that the Republic of Azerbaijan has extremely rich and colorful vegetation cover is one of the facts that have been confirmed. Thus, over 4700 plant species spread in this area, of which more than 1500 are medicinal (12). Therefore, the study of plant resources, analysis of their distribution laws, bioecological, phytocenology and ontogenetic properties, as well as the study of the microbiological, mycological, ecological and biotechnological bases of their use for practical purposes, is one of the most important issues and this is one of the priorities of a number of science fields, including microbiology.

It is known that in recent times bioecological balance in a global scale in the direction of disbalance undergoes fundamental changes. This is in turn creates real difficulties in the vital activities of the world of living beings including plant, animal and human organisms. In a disadvantaged environment needs of living things, including people to the products of natural origin is increasing, which have a healing-prophylactic effectes. According to these properties available plant products which this feature is realizes with their biological active ingredients that they have. Such substances an example can be cited alkaloids, essential oils, flavonoids, glycosides, coumarins, vaccines, resin, camellias, etc (1, 5, 16-18). Antifungal medicinal preparations within natural or

synthetic origins obtained from aromatic or medicinal plants are distinguished by low toxicity and high activity. Therefore, searching antifungal substances within the wild flora is more appropriate and leads to prospective researches.

As mentioned, more than 1500 species of plants included in the flora of Azerbaijan has medical important(12). Essential oils is as a biologically active matters among of composition elements which by the chemical nature they are mixture of various substances coordinated with each other and their component content is consisting at oxidized terpenes, phenols, aldehydes, esters, acetates, lactones and ketones(4, 6, 11). Essential oil plants containing these compounds is considered as the natural source of interest for clinical and folk medicine(1).

On the other side, plants currently used in folk medicine constitute a small part of all essential oils plants and at the same time, they are characterizes as one of the settlements of microorganisms, including those of their phytopathogenic, toxic, allergen species(2-3). Investigating this issue is among the problems waiting to be solved today, at least for the reason that from the activity of the phytopathogenic microorganisms, including the fungus, the biological productivity of the plants weakens, also the number of individuals in their populations decreases(15). The prevention of this is one of the urgent problems of the modern era, which beginning point is to identify of species composition of living things which specific to plant or plant groups and cause to decline biological productivity of plants.

For this reason, the purpose of this work was dedicated to characterization of species composition of fungi participate in the formation of mycobiota of some essential oil plants included in the flora of Azerbaijan and pathologies committed by them.

Materials and Methods

As an object of research was selected essential oil plants, their mycobiota included in the cultural and wild flora of Azerbaijan. For this purpose, were taken samples from vegetative or generativ organs of more than 100 species of essential oil plants that assumes had fungi, which spread in 7 economic regions of Azerbaijan (Aran, Absheron, Daghlig Shirvan, Ganja-Gazakh, Lankaran, Guba-Khashmaz and Shaki-Zagatala). At the same time, were used methods of planned route and choosing standing areas for stationary observations which is widely used in the course of mycological research. Taken of sampling was carried out by seasons. Overall, more than 3,000 samples were taken during the research and analyzed according to the purpose of the study.

Development of taken samples was carried out mainly in the laboratory of Microbiology of the Institute of Microbiology of ANAS.

In the analysis of collected samples were used modern mycology and phytopathology methods(13-14) that approached to the purpose of work.

As a nutrient medium for the taking to the pure culture of fungi found on studied plants were used medium such as at malt juice agar (MJA), rice agar(RA), starch agar (SA) and potatoes agar (PA),Chapek and Chapek-Doks agar. Preparation, sterilization and pouring of mediums to the Petri dishes were carried out according to known methods. The samples which alleged has fungi was heldes to nutrition mediums and for certain period (up to 10 days) puts to the thermostat (26⁰C) and kept until a colony is formed. After colony or mycelium is formed visualized and for the taking pure culture it moved to the new medium. The culture is monitored by means of a microscope. During the whole process,

colony forming date, forms, color, color of the back side (revision), smell, form of mycelium, the formation of conids and other derivatives and their forms, dimensions, etc. changes registered. Results acquired in laboratory conditions, as well as the results of the field observation performed identification of fungi or pathologies caused by fungi. During identification of fungi were used determiners having cultural, morphological, and biological signs (7, 10), as well as the base data of IMA(8).

Results and Discussion

From the result of analysis of samples taken from the essential oil plants included in the flora of Azerbaijan in 2013-2017 became clear that, in general, in the formation of their mycobiota participates 161 species of true and like-fungi organisms. So that, 93,2% of registered fungi species belong to real (Mycota), 6,8% to like fungi organisms (Chromista).

It was determined that 14 species of real fungi (*Absidia ramose*(Zopf) Lendn., *Actinomucor elegans* (Eidam) C.R. Benj. & Hesselt., *Mucor circinelloides* Tiegh., *M. corticola* Hagem, *M. hiemalis* Wehmer, *M. mucedo* (Tode) Spreng., *M. odoratus* Treschew, *M. pentrinularis* Naumov, *M. plumbeus* Bonord., *M. ramosissimus* Samouts, *M. racemosus* Fresen, *Rhizopus nicricans* Ehrenb., *Rh. oligosporus* Saito, *Rh. stolonifer* (Ehrenb.) Vuill.) are included in the department of Zygomycota, 109 species (*Aspergillus awamori* Nakaz, *A. flavus* Link, *A. fumigatus* Fresen, *A. mollis* Berk., *A. niger* Tiegh., *A. ochraceus* K. Wilh, *A. repens*(Corda) Sacc., *A. ustus* (Bainier) Thom & Church, *A. versicolor* (Vuill.) Tirab., *Penicillium chrysogenum* Thom, *P. citrinum* Thom, *P. cyclopium* Westling, *P. expansum* Link., *P. funiculosum* Thom, *P. janthinellum* Biourge, *P. lanosum* Westling, *P. notatum* Westling, *P. purpurogenum* Stoll, *P. rubrum* Stoll,

P. simplicissimum(Oudem.)Thom, *P. variabile* Sopp, *P. variotii* (Bainier) Sacc., *Botrytis cinerea* Pers, *Sclerotinia graminearum* Elenev ex Solkina., *S. sclerotiorum* (Lib.) de Barv, *S. libertiana* Fuskel, *Sphaerotheca pannosa* (Wallr.) Lév. *Podosphaera xanthii* (Castagne) U. Braun & Shishkoff, *Erysiphe cichoracearum* DC., *E. communis* (Wallr.) Schldl, *E. umbelliferarum* (Lév.) de Bary, *E. trifolii* Grev., *Cercospora anethi* Sacc., *Cladosporium cladosporioides*(Fresen.)G.A. de Vries, *C. herbarum* (Pers.) Link, *C. gossypii* Jacz., *C. transchelii* Pidopl. & Deniak, *Sphaceloma menthae* Jenkins, *Monilia sitophila* (Mont.) Sacc, *Pseudopeziza medicaginis* (Lib.) Sacc., *Aureobasidium pullulans* (de Bary) G. Arnaud, *Septoria carotae* Nagorny, *S. flagellifera* Ell. et Ev., *S. glycines* Hemmi, *S. lactucae* Pass, *S. menthae* (Thüm.) Oudem., *S. salviae-pratensis* Pass., *S. sojae* Syd. & E.J. Butler, *S. tanacetii* Niessl, *S. valerianae* Sacc. & Fautrey, *Heterosporium syringae* Oudem., *Phyllosticta thymi* Vasyag., *Ph. trifolii* Richon, *Ph. vulgaris* Desm. & Roberge, *Fuzarium dimerum* Penz., *F. gibbosum* Appel & Wollenw *F. moniliforme* J. Sheld., *F. oxysporum* Schecht, *F. semitectum* Berk. & Ravenel, *F. sporotrichiella* Bilai., *F. solani* (Mart.) Sacc., *Colletotrichum circinans* (Berk) Vogl, *C. higginsianum* Sacc., *C. kruegerianum* Vassiljevsky, *C. panacicola* Nakata & S. Takim., *C. ocimi* Damm, *C. valerianae* Kwash., *Sordaria fimicola* (Roberge ex Desm.) Ces. & De Not, *Nigrospora maydis* (Garov.) Jechová, *Trichoderma hamatum* (Bonord.) Bainier, *T. harzianum* Rifai, *T. koningii* Oudemans, *T. viride* Pers., *T. roseum* (Pers.) Link, *Thielaviopsis basicola*(Berk. & Broome) Ferraris, *Verticillium albo-atrum* Reinke & Berthold., *V. dahliae* Kleb., *V. lateritium* (Ehrenb.) Rabenh., *Alternaria alternata* Keissler, *A. chrysanthemii* E.G. Simmons & Crosier, *A. radicina* Meier, *A. tenuissima* (Nees) Wiltshire, *A. solani* (Ellis & G. Martin) L.R. Jones, *Pleospora herbarum* (Pers.)

Rabenh. ex Ces. & De Not., *Phoma achilleae* (Sacc.) Traverso, *Ph. anethi* (Pers.) Sacc., *Ph. betae* Frank, *Ph. capsici* Magnani, *Ph. destructiva* Plowr, *Ph. eupyrena* Sacc., *Ph. exigua* Desm., *Ph. lavandulae* Gabotto, *Ph. medicaginis* Malbr. & Roum, *Ph. pomorum* Thom., *Ph. dauci* Arx., *Macrosporium commune* Rabenh., *M. macrosporium* (Eliasson) Sawada, *Stemphylium botryosum* Wallr, *St. ilicis* Tenqwall, *St. macrosporoideum* (Berk.) Sacc., *Ascochyta anethicola* Sacc., *Asc. betae* Prill et. Delacr. *Asc. imperfecta* Peck, *Asc. iridis* Oudem, *Asc. leonuri* Ellis & Dearn., *Asc. sojikota sojicola* Nelen, *Asc. foeniculina* McAlpine, *Asc. vulgaris* Kabát & Bubák, *Phomopsis hyperici* Ascomycota, 27 (*Gymnosporangium clavariaeformae* (Wulfen) DC., *G. cornutum* Arthur ex F. Kern, *Puccinia anethi* Fuckel, *P. anthemidis* P. Syd. & Syd., *P. artemisiae* Fuckel, *P. iridis* Wallr., *P. matricariae* Syd., *P. menthae* Pers., *Puccinia nigrescens* L.A. Kirchn, *P. petroselini* (DC.) Lindr, *P. polygoni* (Pers.) J. Schröt., *P. porri* ((Sowerby) G. Winter, *Uromyces appendicutatus* (Pers.) Link, *U. erythronii* (DC.) Pass., *U. striatus* J. Schröt., *Aecidium foeniculi* Castagne, *Ustilago zae* (Beckm.) Unger. *Pleurotus ostreatus* (Jacq.) P. Kumm. *Typhula trifolii* Rostr. *Ganoderma applanatum* (Pers.) Pat. , *Inonotus hispidus* (Bull.) P. Karst., *Fomes fomentarius* (L.) Fr , *Fomitopsis pinicola* (Sw.) P. Karst. *Heteroporus biennis* (Bull.) Lázaro Ibiza, *Schizophyllum commune* Fr., *Phellinus igniarius* (L.) Quél., *Stereum hirsutum* (Willd.) Pers.) to the department of Bazidiomycota. Was determine that 11 species of fungi-like organisms (*Albugo candida* (Pers. ex J.F. Gmel.) Kuntze, *Phytophthora capsici* Leonian, *Ph. infestans* (Mont.) De Bary, *Ph. citrophthora* (R.E. Sm. & E.H. Sm.) Leonian. , *Ph. phaseoli* Thaxter, *Ph. melangenae* K.Sawade, *Ph. parazitica* Dastur, *P. destructor* Casp, *P. cubensis* Berk. & M.A. Curtis, *P. parazitica* (Pers.) Tul. and

Plasmopara dauci Savul. & O. Savul) belongs to the department of Oomycota.

It should be noted that mycological research in the territory of Azerbaijan is studying for a long time and the in the research undertaken so far was recorded thousands of fungi species. Comparing the fungi registered in the course of these studies to those which known to be spread in Azerbaijan, became clear that, the majority of recorded fungi, more precisely, 95,7% have been identified in Azerbaijan condition, that is most of them participating in the formation of mycobiot of Azerbaijan and this species is known by science. Despite this, among the recorded fungi is encountered species which spread in Azerbaijan were registeret in first time during research. The number of species suitable for this characteristic is equal to 7 (*Fusarium dimerum* Penz., *Exserohilum longirostratum* (Subram.) Sivan., *Mucor ramosissimus* Samouts, *Nigrospora maydis* (Garov.) Jechová, *Penicillium simplicissimum* (Oudem.) Thom, *Phoma medicaginis* Malbr. & Roum. and *Sclerotinia graminearum* Elenev ex Solkina).

Fungi, such as heterotrophic organisms participates in the formation of pathogenic or epiphythmic mycobiota of plants(15) and thereby exerts its effect on plants. The fungi that are involved in the formation of epiphitic mycobiota mainly are nourished by their exudates of plants and do not cause considerable changes in their biological activity.

But, species involved in the formation of pathogenic mycobiota is causes contrariwise, such as during using content components of plants causes at the change of their biological activity and in most cases its weakens. From the point of view to kept up their in the constant of attention, to identification of their species composition, development cycles, and

so on. is a necessary information for the preparation of preventive measures against them. From this research became clear that, in the formation of mycobiota of this studied essential oil plants also also actively participate pathogen species and at least 2/3 of the registered fungi are involved in the appearance of various pathologies in this or that extent.

It should be noted that, fungi that are involved in the creating of these or other pathologies are characterized as true biotrophs or polytrophs. Those are characterized as true biotrophs contains fungi as *Aecidium foeniculi* Castagne, *Gymnosporangium clavariaeformae* (Wulfen) DC., *Phytophthora capsici* Leonian, *Ph. citrophthora* (R.E. Sm. & E.H. Sm.) Leonian., *Plasmopara dauci* Savul. Tr. Et., *Puccinia artemisiae* Fuckel, *P.matricariae* Syd., *P.menthae* Pers., *Uromyces striatus* J. Schröt., *Ustilago zae*(Beckm.) Unger and oth. and they are cause diseases on plants such as brown decay, white decay, rust,antimony, flour dew, fitophtoroz, perinospora, plazmopar. As for the polytrophic they differ in both the number and the variety of pathologies cause by them. So that, about 75% of fungi which has the ability to commit to this or other pathology fall into the share of polytrophs. To the illnesses they are cause includes fusariosis, spotted, fade, septoria, different color decay, mold, alternarioz and so on. Among of disease-makers, fungi such as *Ascochyta anethicola* Sacc., *Asc.foeniculina* McAlpine, *Alternaria alternata* Keissler., *A.tenuissima* (Nees) Wiltshire, *F. gibbosum* Appel & Wollenw., *F.moniliforme* J. Sheld., *F.oxysporum* Schecht, *F.solani* (Mart.) Sacc., *Phoma lavandulae* Gabotto *Phomopsis achilleae* (Sacc.) Traverso, *Ph.dauci* Arx., *Phyllosticta trifolii* Richon, *Septoria menthae* (Thüm.) Oudem., *S. salviae-pratensis* Pass., *Trichothecium roseum* (Pers.) Link, *Verticillium albo-atrum* Reinke & Berthold.,

V.dahile Kleb and oth. are considered most widespread fungi on the essential oil plants.

Interestingly, among of fungi recorded in reseach and caused different pathologies toxigenic fungi is also takes enough part(2) and mycotoxins synthesized by them is considered serious sources of danger for human health(9). Therefore, preparation of security mycological principles during use of essential oils is one of the issues waiting its solve which confirms from obtained results .

Thus, from the carried out of research became clear that, although essential oil plants contain fungicidal compounds they ere characterized as one of the places where fungi are settles and feedings. In general, in the formation of their mycobiota are takes part 161 species of fungi and like-fungi organizms. The vast majority of registered fungi belong to biotrophs and polytrophs in terms of ecotrophic relationships, which also cause various pathologies in plants. Among these more frequently records diseases such as stain, rust, fusariosis, floury dew, fading, anthracnose and so on.

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