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KAHRAMANMARAŞ SÜTÇÜ İMAM UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCE

CHARACTERIZATION OF VARIOUS IRAQI MEDICINAL PLANT ROOT EXTRACTS AND THEIR ANTIFUNGAL ACTIVITIES ON HUMAN PATHOGENIC FUNGI

BADR QADER ISMAEL ISMAEL

DOCTORATE THESIS

DEPARTMENT OF BIOENGINEERING AND SCIENCES

KAHRAMANMARAŞ - TURKEY 2018

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This thesis prepared at the

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IRAKTA YETİŞEN ÇEŞİTLİ TIBBİ BİTKİ KÖKÜ EKSTRAKTLARININ KARAKTERİZASYONU VE İNSAN PATOJEN MANTARLARI ÜZERİNDEKİ ANTİFUNGAL AKTİVİTELERİ

(DOKTORA TEZİ)

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ÖZET

Bu çalışmanın amacı Erbil şehrindeki Doğum Öğretmenliği Hastanesi Kadın Hastalıkları ve Doğum Anabilim Dalı'ndaki vajinal hastalardan patojenik mantar enfeksiyonunun izole edilmesi ve tanımlanması olmuştur. Daha sonra, on bir (11) farklı tıbbi bitkinin izole edilen mantarlara karşı bazı önemli antifungal aktiviteleri araştırılmıştır. Ekstraksiyon için etanol, asetonitril ve distile sudan oluşan üç solventin yanı sıra, mikrodalga destekli (MW), geleneksel (C) ve macerasyon (M) olmak üzere üç farklı ekstraksiyon yöntemi kullanılmıştır. Ayrıca, antifungal testleri için yedi adet *Candida* türü kullanılmıştır. Bitki köklerinin fitokimyasal analizleri LC-MS/MS kullanılarak yapılmıştır. Toplam ekstraksiyon verimi ve toplam kondanse tanen miktarları ayrıca belirlenmiştir. Kök ekstraktlarının antioksidan aktiviteleri ve toplam kondanse tanen miktarları UV-vis spektrofotometre cihazında sırasıyla 517 nm ve 580 nm'de ölçülmüştür. En yüksek verim oranı (CE10: % 28,85) geleneksel yöntem ve *Rubus sanctus* Schreb bitkisinin etanol ekstraktı için elde edilmiştir. Ayrıca, kondanse tanenin en yüksek miktarı (P10: 32,34 mg/kg) *Rubus sanctus* Schreb bitkisinde belirlenmiştir. Bitki ekstraktlarının antioksidan kapasitelerinin tespiti için serbest radikal olarak DPPH (1,1-difenil-2-pikrilhidrazil) kullanılmıştır. En yüksek DPPH giderme aktivitesi (P4 MWE: % 99,60) 0.2 mL ile *Quercus infectoria* Oliv. mikrodalga yöntemi ile elde edilen etanol ekstraktı için tespit edilmiştir. Aynı şekilde, en yüksek miktarda fitokimyasal madde (P3 MWE: 3572,22 µg / g) *Pyrus syriaca* Boiss'dan elde edilmiştir. Çalışmamız hastalardan izole edilen vajinal mantarların yaygınlığının 165 ile (% 70,81) *C. albicans* olduğunu göstermiştir. Antifungal etkinlik son derece iyi olmuştur ve *Quercus infectoria* Oliv. ve *Rubus sanctus* Schreb bitkilerinin mikrodalga ile elde edilen etanol ekstraklarından *C. guilliermondii'ye* karşı engelleme bölgesi çapı 24,47 mm ile çok iyi sonuç vermiştir. Aslında, yedi Candida türüne karşı MIC değerleri 7,8125-250 µg/ml arasında bulunmuştur. Sonuç olarak, bu biyolojik antifungal aktivitenin ve antioksidanın orijinal bir kaynağını verebilecek fitokimyasalların büyük kaynaklarını ortaya çıkarmıştır ve bu doğal ilaç olarak bu bitkinin ekstraktını kullanmak temelinde haklı gösterebilir.

Anahtar kelimeler: *Candida* spp, Antifungal, Antioksidan, fitokimyasal bileşikler, kondanse tanenler

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CHARACTERIZATION OF VARIOUS IRAQI MEDICINAL PLANT ROOT EXTRACTS AND THEIR ANTIFUNGAL ACTIVITIES ON HUMAN PATHOGENIC FUNGI

(Ph.D. THESIS)

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ABSTRACT

The aim of this study was to isolated and identify fungal pathogenic infection from vaginal patients in the Maternity Teaching Hospital obstetrics department in Erbil city. Then, some important antifungal activity of eleven (11) different medicinal plants was investigated against isolated fungi. Three methods were employed for extraction; microwave assisted (MW), conventional (C) and maceration (M) extractions methods along with three solvents including ethanol, acetonitrile and distilled water. Furthermore, seven *Candida* species were used for the antifungal test. Analyses of phytochemicals of plant roots were done by using LC-MS/MS. Total extract yields and total condensed tannin were also evaluated. The antioxidant activities of root extracts and total condensed tannin concentrations were measured by UV-vis spectrophotometer at 517 nm and 580 nm, respectively. The highest yield percentage was (CE10: 28.85%) by a conventional method and ethanol solvents of *Rubus sanctus* Schreb plant. Also, the highest amount of condensed tannin was (P10: 32.34 mg/kg) distinguished in *Rubus sanctus* Schreb plant. DPPH (2,2-diphenyl-1-picrylhydrazy) was used as a free radical to measure the antioxidant capacity of the plant extracts. The highest significant of DPPH scavenging activity (P4 MWE: 99.60%) with 0.2 mL was determined for the ethanol extract of *Quercus infectoria* Oliv. obtained via microwave method. Likewise, the highest quantity of phytochemicals (P3 MWE: 3572.22 µg/g) was obtained from *Pyrus syriaca* Boiss. Our study showed that the prevalence of vaginal yeast isolates from patients was 165 (70.81%) *C. albicans*. The antifungal activity was extremely good, and very good result inhibition zone diameter (24.47 mm) was obtained from ethanol extract of *Quercus infectoria* Oliv. and *Rubus sanctus* Schreb plants using microwave against *C. guilliermondii*. Actually, the MIC values against seven *Candida* species was between 7.8125-250 µg/ml. In a conclusion, the consequences exposed big sources of phytochemicals which might give an original source of this biological antifungal activity and antioxidant and which may be justified on the basis of using these plants' extract as a natural drug.

Keywords: *Candida* spp., antifungal, antioxidant, phytochemicals compounds, condensed tannin.

Kahramanmaraş Sütçü Imam University

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SYMBOLS AND ABBREVIATIONS

WHO:	World Health Organization
D.W	Distilled Water
ANOVA	Analysis of Variance
C:	*Candida*
ATCC:	American Type Culture Collection
SDB:	Sabouraud dextrose broth
SDA:	Sabouraud dextrose agar
ATCC:	American Type Culture Collection
MIC:	Minimum Inhibitory Concentration
BHT:	Butylated hydroxytoluene
DPPH:	1, 1-diphenyl-2 picrylhydrazyl
HPLC:	High Performance Liquid Chromatography
ROS:	Reactive Oxygen Species
LC:	Liquid Chromatography
MS:	Mass Spectrometry
MW:	Microwave assisted extraction
C:	Conventional Extraction
M:	Maceration Extraction
OD	Optical density
UV	Ultraviolet
L:	liter
ml:	Milliliter
µl:	Microliter
Kg:	Kilogram
g:	Gram
mg:	Milligram
µg:	Microgram
Cm:	Centimeter
nm	Nano meter
rpm	Round per minute
^{o}C	Celsius
GAE	Gallic Acid Equivalent

1. INTRODUCTION

Fungal infection is an increasing problem of conclusive unkind patients and these infections carry an attributable mortality that is higher than corresponding bacterial infections (Kerwat *et al.,* 2011). In the world, *Candida* infections predominate and much of this study concentrates on the risk factors, diagnosis and treatment of these infections.

The kingdom of fungi involves a separate group of eukaryotic organisms that absorb their food from dead or living organisms or organic matter. There is, however, a large group of fungi species that are parasitic on plants and a smaller group that are parasitic on animals, as well as on human beings. Fungi are different in size and form, nonetheless, they are divided into three main groups: unicellular (yeasts); multicellular filamentous (moulds) and dimorphic which are capable of changing shape to either a unicellular or multicellular form, depending on the environment growth (Campbell *et al.,* 2013). Fungi are a unique group of organisms, different from all others in their conduct and cellular organization. Fungi also have a vast range of activities as pathogens of plants or humans, as decomposer organisms (Deacon, 2013).

The dynamics of fungal activities are mutualistic, symbionts, pathogens and saprophytes, by mobilizing nutrients and affecting the physicochemical environment (Kavanagh, 2005). Most fungi are filamentous; several grow as unicellular yeasts and some primitive fungi, for example, the chytridomycetes live as separate rounded cells or dichotomous branched chains of cells with rootlike rhizoids for attachment to a nutrient resource (Kavanagh, 2005). Most of the yeasts are unicellular (Ascomycete, and Basidiomycete). Which are divided asexually by budding or fission and whose individual cell size can vary widely from 2–3 mm to 20–50 mm in length and 1–10 mm in width (Kavanagh, 2005).

Among the 50 000 to 250 000 species of fungi that have been described, fewer than 500 have been associated with human disease, and no more than 100 are capable of causing infection in otherwise typical individuals. In general, these organisms are free-living in nature and are in no way dependent on humans (or animals) for their survival (Richardson & Warnock, 2012; Kayser, *et al.,* 2005).

Candida species are the microorganisms of normal flora, which are isolated from the human body and to trimmer pathogens. Moreover, they are able to cause diverse clinical appearances of candidiasis (Abaci and Uztan, 2011).

Candida, which was found more than a 100 year before by way of a causative organism of oral thrush, can contaminate almost every tissue of the human body at the present time. Therefore, the *Candida* field and candidiasis have grown rapidly (Prasad, 1991).

Alongside the common of human pathogenic fungi, *C. albicans* displays dimorphism. An interesting feature related with the morphological alteration in the pathogenic fungus is that the morphology of the fungus is unlike that of the propagule which initiates the infection in the diseased tissue (Makwan, *et al.,* 2012; Prasad, 1991).

As a minimum 70% of all *Candida* infections of human are caused during *C. albicans* (Kayser *et al.,* 2005). *Candida* is a normal inhabitant of human and animal mucosa (commensal). Infections of *Candida* consequently are deemed endogenous. Skin is mainly infected on the moist and warm portions of the body. *Candida* can spread to cause secondary infections of the lungs, kidneys and other organs (Kayser *et al.,* 2005)

Mycotic vulvovaginitis (also known as vulvovaginal candidiasis or vaginal yeast infection) is caused by *C. albicans*. Indeed, Mycotic vulvovaginitis is the second greatest common reason of vaginitis (Chamberlain, 2009). The vaginal discharge often seems as a thick, curd-like discharge covering epithelial cells and masses of the pseudohypha. The patient regularly has had strong pruritus of the vulva and erythematous vagina and labia *C. albicans* cause 20-25% of vaginitis cases. The greatest number of mycotic vulvovaginitis cases result from *C. albicans* overgrowth, which is already existing in the mucosa of the vagina. Also, factors that can upset the balance of the standard flora include pregnancy, obesity, diabetes mellitus, oral contraceptives, corticosteroids, antibiotic therapy, prolonged exposure to moisture, and poor feminine hygiene (Chamberlain, 2009). When the delicate balance of organisms in the mucosa of the vagina is upset, *C. albicans* be able to overgrowth and affect vaginitis (Chamberlain, 2009). A Gram stain or wet mount of the discharge can be carried out to determine if yeast cells and pseudohyphae are present. Intravaginal agents such as butoconazole, clotrimazole, nystatin, or terconazole are available for treatment as over-the-counter drugs. Fluconazole, an oral antifungal agent, can similarly treat mycotic vulvovaginitis (Chamberlain, 2009).

Plants have been the main basis of drugs since olden times. Practically wholly humanoid cultures have been used not only as nutrition resources but besides as healing contrary to ailment and diseases (Alejandro & Jasiah, 2009).

The extracts of medicinal plants have been used indirectly or directly as a treatment for diverse ailments. Today, the most of developing countries use medicinal plant and traditional medicine for good health and life. In the world, nearly 30% of the therapeutic drugs are the preparations of medicinal plants (Hota, 2007).

It has been estimated that in modern countries, for example, the United States, drugs from plants constitute approximately 25% of all drugs, while in other countries, for instance, India and China, the contribution is nearly 80%. Therefore, the medicinal plant's economic importance is very much more to some countries, for example, India than to the rest of the world. These countries offer nearly 70 % of the medicinal plants used in the new system of drugs, and the healthcare schemes of rustic populations count on indigenous arrangements of medicine (Joy and Thomas, 1998).

Approximately 80,000 from 250,000 higher plants on the earth are medicinal plants. The generality of therapeutic plants, even currently, are collected from the wild (Joy, *et al.,* 1998). Consequently, farming of these plants is directly required to confirm their availability to the manufacturing in addition to individuals related to an old-style system of medicine. If timely steps are not taken for their maintenance, farming and mass promulgation, they may be missing from the normal vegetation evermore (Joy *et al.,* 1998).

Medicinal plants are used as raw resources for extraction of dynamic residents in clean form for example glycosides from digitalis leaves. Products, for example, valerian, ginseng and liquorice roots are divisions of the herbal and fitness food shop, besides the food, fragrance, cosmetic and flavours industries. A huge amount of medicinal plant substance is used in the formation of medicinal and herbal teas, for instance, chamomile plant. These herbal and food uses are of great importance, also to the exporters from improving countries. Hundreds of therapeutic plants are items of commerce, however, relatively small countries are used in formulated herbal remedies (Joy *et al.,* 1998).

Plants give a big varied collection of organic compounds that seem to have an indirect function in development and growth. These materials are called natural products, secondary products, or secondary metabolites. Secondary products also vary from primary products (protein, carbohydrate, nucleotides and lipids) in having a limited spreading in the kingdom of plants. That is, specific natural products are frequently found just in one plant species or correlated group of species, while primary products are found in the most plant kingdom (Taiz & Zeiger, 2010). These are structurally varied and several are dispersed between an actual restricted number of species inside the plant kingdom and thus can be investigative in chemotaxonomic studies. Though unnoticed for long, their occupation in plants is currently attracting consideration as some seem to have an important role in defensive plants from microorganism infection. Secondary metabolites are also of interest because of their use as fibers, oils, waxes, flavoring, dyes, agents, drugs and perfumes, and they are viewed as possible foundations of new natural drugs, antibiotics, insecticides and herbicides (Taiz & Zeiger, 2010). In recent years, the character of some natural metabolites as defensive nutritional ingredients has developed a more and more significant part of human food research (Crozier *et al.,* 2006). Plant natural metabolites can be classified into three main groups: (i) terpenoids, (ii) flavonoids, similar phenolic and polyphenolic compounds and (iii) Sulphur-containing and nitrogen-containing alkaloids compounds (Crozier *et al.,* 2006).

The fast increase of worsening illnesses universal is minatory financial and communal expansion in addition to the survival and fitness of millions of folks. It shows a chief healthiness challenge to worldwide development in the coming century. It is approximate that equal to 80% of cardiovascular ailment, 90% of Kind II diabetes, and one-third of tumors could be escaped by varying lifestyle, as well as diet (Fraga, 2010).

Since the 1990s a number of epidemiological reports have been approved out trying to compare high nutritional flavonoid and phenolic compounds intake, through the ingesting of fruits and vegetables, with the decreased danger of degenerative diseases. Most of these researchers have shown some grade of opposite relations among high nutritional phenolic/flavonoid intake and reduction of worsening illnesses (Fraga, 2010).

Subsequently oxidative pressure forced by Reactive Oxygen Species (ROS) is known to show a crucial role in the pathophysiology associated with neoplasia, atherosclerosis, and neurodegenerative diseases, the capacity technicality of the defensive influences of phenolic component and flavonoids were assumed to be by reason of the scavenging of free radicals (Heim *et al.,* 2002).

Phenolics are categorized by having a minimum of one aromatic ring with one or more hydroxyl groups adhered. In addition, 8000 phenolic structures have been testified and they are extensively scattered during the kingdom of plants. Phenolics array from unpretentious, low molecular-weight, only aromatic-ringed complexes with complex and large tannins and derived polyphenols. They can be arranged based on the amount and array of their carbon atoms and are usually found integrated with organic acids and sugars. Phenolics can be divided into two groups: the non-flavonoids and the flavonoids (Crozier *et al.,* 2006).

The main non-flavonoids of dietary significance are the C6-C1 phenolic acids, most notably gallic acid, which is the precursor of hydrolysable tannins, the C6-C3 hydroxycinammates and their conjugated derivatives, and the polyphenolic C6-C2-C6 stilbenes (Crozier *et al.,* 2006).

Plants such as antioxidant-rich phytochemicals and agronomic food crops have lately become an attractive substance for nutrition, biomedical and food scientists, and food producers. Antioxidant phytochemicals are natural plant products broadly existing in the kingdom of plants. Most of the allelochemicals are phenolic derivatives with polyhydric or monohydric phenols (Lim, 2014). Many medical reports have approved that antioxidant phytochemicals can avoid some oxidation-induced chronic and cholesterol-related illnesses. The antioxidant properties and fitness interest of phytochemicals in various farming nutrition plants have been intensively studied in recent years. Antioxidant phytochemicals usually have one or more phenolic rings or hydroxylated aromatic, which related to their antioxidant activity. They are extensively dispersed in plants and created by chorismite and shikimate biosynthesis from the essential forerunner L-phenylalanine (Fathabad *et al.,* 2015).

The synthesis reaction includes a deamination chain, enzymatic conversion, and enzymatic hydroxylation reactions and creates a variation of the phytochemicals with one or more phenolic rings (Herrmann, 1989)

1.1. The objectives of this study

The current investigation was intended to study the following issues:

1- Isolation and identification of fungal pathogenic infection from vaginal patients in the Maternity Teaching Hospital obstetrics department in Erbil city.
2- Extraction of the eleven-plant species by using different methods and different polarity of solvents in order to estimate the feasibility of each other.
3- Characterization of identified phytochemical compounds by using physical and chemical analyses with different analytical techniques.

4- Chemical tests of the extracts in order to determine the chemical groups existing in the plant extracts.

5- Isolation, purification and identification of phytochemicals, especially condensed tannin.

6- Calculation of the total extracts yields from different method.

7- Find out the DPPH free radical scavenging activity (i.e., antioxidant activity) of root extracts.

8. To identify and discover the biological activity of compounds characterized from the extracts on some human pathogenic fungi and compare with some antibiotics via the study of antifungal activity with MIC.

1.2. The important points of this investigation

The importance of this investigation was given below:

1. To explore the effectiveness of different extraction methods and comparisons were made to determine the best extraction method.
2. To do an opening study on the parameters that can impact on extraction efficiency to obtain a better yield.
3. To achieve the optimum financial benefits of the plant by the chance in a research study to produce a marketable product.
4. To open up chances for the investigation study that is related to the therapeutic value of these new plants in order to develop it commercially in the pharmacological interest.
5. To inform and provide adequate information to the growers of these plants on the actual potential and economic benefits from the plant especially on its various uses.

2. LITERATURE REVIEW

2.1. Pathogenic Fungi

2.1.1. Candidiasis

Candidiasis is a fungal infection caused via Candida types (Kavanagh, 2005). Candida species is a part of human microflora and it becomes pathogenic when certain conditions are present and cause some opportunistic infections (Vinet and Zhedanov, 2011).

2.1.2. Vaginal candidiasis

Vaginal candidiasis is a vaginal mycosis opportunistic contamination produced via species of the genus *Candida* in the female, in the impregnated time, and also the most frequent and important fungal disease of vaginal content (Rees, 2013). Women around the world get diagnosed with vaginal candidiasis. It is approximate that 75 % of the female through the fertile time have as a minimum one episode of vaginal candidiasis. Almost 40-50 % of female have recurrent contagion. Fewer than 5 % of mature lady inhabitants obtain replicated, common attacks of repeated vulvovaginal candidiasis. Point-prevalence investigation suggest that *Candida* species perhaps separated from the reproductive tract of nearly 20 % (range 10-50 %) of asymptomatic, healthy women in the child-bearing age 25-40 % of women who are culture positive for *Candida* species in the vaginal area are asymptomatic carriers (Rees, 2013). The genus *Candida* is comprised of approximately 200 yeast species, most of which have no known teleomorphic (i.e. sexual) phase (Suárez *et al.,* 2013; Kavanagh, 2005). The medically significant *Candida* species include *C. albicans, C. (Torulopsis) glabrata*, *C. tropicalis*, *C. tropicalis*, *C. krusei*, *C. kefyr*, *C. guilliermondii*, *C. lusitaniae*, *C. stellatoidea,* and *C. dubliniensis* (Howard 2002; Cihlar and Calderone, 2014). Usually, *C. albicans* is a member of the normal microbial flora colonizing human gastrointestinal and vaginal tracts (Scorzoni *et al.,* 2007; Cihlar & Calderone, 2009). In healthy human hosts, it may only reason a variety of mild superficial infections. But in immunocompromised patients, life-threatening systemic candidiasis may develop (Cihlar and Calderone, 2014).

2.1.3. Vulvovaginal candidiasis

Vulvovaginal candidiasis (VVC) is a mucosal infection affected by *Candida* types which is one of the most common clinical disorders in women of reproductive age. The Settlement and commitment of *Candida* species in epithelial cells are the initial stages in starting of contamination and producing vulvovaginal candidiasis (Roudbary *et al.,* 2013). An inflammation of the vagina is termed vulvovaginitis (Fornari *et al.,* 2016).

The phenotypic results showed that the isolation percent of *C. albicans* was 63%, while the other types, for instance, *C. tropicalis C. glabrata* and *C. krusei* were isolated with the ratios (7.6%, 14.2%, 8.69%) respectively. On the other hand, the percentage of yeasts such as *Trichosporon* sp. and the *Geotrichum* sp. were 5.43% and 1.08% respectively (Al-oebady, 2015). Vaginal swab cultures yielded *Candida* growth in 63 cases (50.4%). The predominant isolated species such as *C. albicans* was (60.3%) while the furthermost public non-albicans species, for example, *C. glabrata* was (12.7%) (ElFeky *et al.,* 2016). A total of 100 medical isolates of *Candida* from numerous clinical examples was treated throughout the investigation period. The amount of isolation of Candida was uppermost (31) in high vaginal swab pursued by urine (24). Six species of *Candida* were described: *C. albicans* was the preponderant species (46%). On the other hand, the following non-albicans species were segregated *C. tropicalis* (1%) *C. kefyr* (2%) *C. krusei* (3%), *C. tropicalis* (22%) and *C. glabrata* (26%). The total segregation of non- albicans species was 54%. *C. albicans* was more normally separated from high vaginal swabs (15/46, 33%) followed by urine (10/46, 22%) and phlegm (9/46, 19.5%), *C. glabrata* from urine test (12/26, 46%). *C. tropicalis* was found in high vaginal swab (11/22, 50%) (Madhumati & Rajendran, 2015). The outcome of this research presented that there were *Candida* species in the vagina of 110 (73%) of the sick persons and four kinds of *Candida* were recognized *C. tropicalis*. (1%), *C. tropicalis* (1.8%) *C. glabrata* (10%) and *C. albicans* (87.2%). However, as stated by Roudbary *et al.,*(2013) results *C. albicans* was the maximum commonly segregated species (82.2%), currently the appearance of the other non-albicans separates such as *C. glabrata* is rising in vaginal candidiasis.

2.1.4. Candida definition

Yeasts are opportunistic pathogens and popular memberships of the normal flora in individuals body. *C. albicans* is the mainly widespread yeast species in the human body. The transition from a commensal to a harmful pathogenic state eventually depends on a decrease in host resistance, changes in the local ecology or changes in intrinsic fungal virulence (Kavanagh, 2007).

Candida is a genus of yeasts. Numerous spp. of this genus is endosymbionts an organism living symbiotically inside the cells or body of another of animal hosts including humans. Whereas often living as commensals, a few *Candida* spp. have the possibility to cause ailment. Clinically, the very important member of the genus is *C. albicans*, which can reason to infections called thrush or candidiasis in animals and humans, particularly in immunocompromised patients (Ryan, 2004; Kavanagh, 2007).

2.1.5. Candida classification

For descriptions of species, keys to taxa and additional information see (Kurtzman *et al.,* 2011).

Kingdom: Fungi
Division: Ascomycota
Class: Saccharomycetes
Order: Saccharomycetales
Family: Saccharomycetaceae
Genus: *Candida*
Species: *C. albicans* (Binomial name)
C. albicans, C. glabrata , C. krusei, C. tropicalis, C. famata, C. parapsilosis and *C. guilliermondii* (C. P. Robin) Berkhout (1923) (Lachance and Scorzetti, 2011).

2.1.5.1. *Candida albicans* (Robin) Berkhout (1923)

To begin with, *C. albicans* colonies culture by (SDA) is cream to white-coloured smooth, glabrous yeast-similar. Also, the microscopic shape is spherical to subspherical budding ballistoconidia, size 2-7 x 3-8 µm (Ellis *et al.,* 2007).

A polymorphic species of *C. albicans* develops in numerous styles (Bastidas & Heitman, 2009; Baillie & Douglas, 1999). It can produce blastospores (daughter cells) through budding. Moreover, pseudohyphae form once the budding cells develop via elongation and do not separate. The hyphae (mycelia form) are the germ tubes that form as a result of filamentous growth. Both cell forms seem elongated but hyphal cells have no septal constrictions (Bastidas and Heitman, 2009). Under suboptimal conditions, *C.*

albicans can also form chlamydospores, round spores with thick walls as shown in Figure 2.1 (Chaffin *et al.,* 1998).

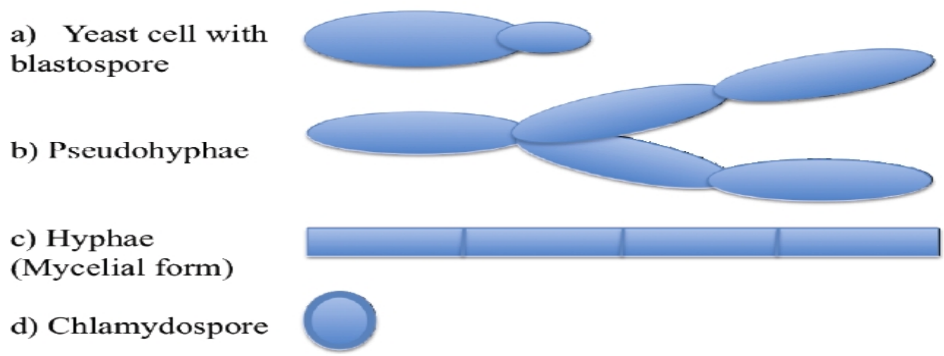

Figure 2.1. Morphological forms of C. albicans 1

2.1.5.2.*Candida glabrata* (H.W Anderson) S.A. Meyer & Yarrow (1978)

Synonyms: *Cryptococcus glabratus* Anderson, (1917) and *Torulopsis glabrata* (Anderson) Lodder & de Vries (1938) (Kutzman and Fell, 1998).

First of all, it has been colonies by (SDA) was cream to white-coloured soft, glabrous yeast-like. Moreover, it is ovoid to ellipsoidal budding blastoconidia, 3.4 x 2.0 µm in size. Also, there have been no pseudohyphae or chlamydospores produced and no capsules present (Rij, 1984). Dalmau Plate Culture was ovoid budding yeast cells only and no pseudohyphae formed (Ellis *et al.,* 2007). Last of all, germ tube is negative yeast and sugar assimilation pattern. Definitely, *C. glabrata* is one of the most common yeast species to be found on the body surface and is often isolated as an incidental finding from skin and urine. It has been concerned as an "opportunistic" reason of both superficial and systemic contaminations, especially in immunocompromised patients, and it has been isolated from patients with septicemia, pyelonephritis, pulmonary infections, endocarditis and hyperalimentation (Ellis *et al.,* 2007; Kurtzman, 2011).

2.1.5.3. *Candida krusei* (Castellani) Berkhout (1923)

Firstly, teleomorph of *C. krusei* was *Issatchenkia orientalis* by Kudryavtsev (1960) Ellis *et al.,* 2007). Secondly, Culture colonies by (SDA) is cream to white-coloured soft, glabrous yeast-similar. On the other hand, it was elongated to ovoid budding blastoconidia, 2.0-5.5 x 4.0-15.0 µm, predominantly small. While it is negative results and no capsules appear in India ink test (Rijm, 1984). After that, Dalmau plate culture indicates that plentiful long, wavy like branched pseudohyphae with elongated to ovoid blastoconidia, budding off in verticil-late branches. Finally, germ tube is negative yeast and sugar assimilation style. Indeed, *C. krusei* is frequently related to incidents of systemic and infant diarrhea sickness. It has also been reported to colonies the gastrointestinal, respiratory and urinary tracts of patients with granulocytopenia (Ellis *et al.,* 2007).

2.1.5.4. Candida tropicalis (Castellani)

Candida tropicalis was firstly separated from a sick with fungiform bronchitis in 1910 and named *Oidium tropical* (Castellani, 1912).

First of all, Berkhout culture colonies (SDA) of *C. tropicalis* is cream to white-colored soft, glabrous yeast-like. Likewise, it is globular to subglobular budding yeast-like cells or blastoconidia, 3-5.5 x 4-9 µm (Kutzman and Fell, 1998). It is also found as part of the normal human mucocutaneous flora (Zuza-Alves *et al.,* 2017).

2.1.5.5. *Candida famata* (Harrison) S.A. Meyer & Yarrow

Candida famata was originally isolated from air in Japan by Saito in 1922 and described as Torula *Candida* (Kutzman and Fell, 1998). Teleomorph: Debaryomyces hansenii (Zopf) Lodder & Kreger-van Rij (Rij 1984). The colony colour of *C. famata* appears as light pink at 37°C for 48 h on CaC (Nadeem *et al.,* 2010). Also, the colony color appears on (SDA) as a cream to white-coloured downy, glabrous and yeast-like. Microscopically of cells are ovoid to approximately ellipsoidal budding blastoconidia, the size is 3.5-5 x 2-3.5 µm, ascospores of walls is rough and ascus is spherical containing 1-2 spherical (Ellis *et al.,* 2007).

2.1.5.6. Candida parapsilosis Complex

Recently *Candida parapsilosis* has been recognized as 3 species: *C. parapsilosis, C. orthopsilosis* and *C. metapsilosis* (Tavanti *et al.,* 2005). These three species are phenotypically indistinguishable and are best distinguished by genetic analysis. Antifungal susceptibility data from the Australian Candidemia Study also shows no significant differences between the species (Tavanti *et al.,* 2005; Ellis *et al.,* 2007). At first, *C. tropicalis* has been presented colonies on (SDA) was cream to white-colored downy, glabrous yeast-similar. Then, it was predominantly small, spherical to egg-shaped budding blastoconidia, 2.0-3.5 x 3.0-4.5 µm, with a few bigger elongated forms show. Too, does not has capsules (Kurtzman, 2011a).

2.1.5.7. *Candida guilliermondii* (Castellani) Langeron & Guerra 1935

Teleomorph: *Pichia guilliermondii* by Wickerham and Burton, 1954; Wickerham, 1966 (Kurtzman, 2011a) .

Initially, *Candida guilliermondii* properties are white to cream-colored downy, glabrous yeast-like colonies. Furthermore, it has been globular to subglobular budding yeast-like cells or blastoconidia, 2.0- 4.0 x 3.0-6.5 µm (Dismukes *et al.,* 2003). It is not capsules (Kurtzman 2011). It has been branched pseudohyphae with dense verticils of blastoconidia be determined by Dalmau Plate Culture (Ellis *et al.,* 2007). To sum up, it is negative germ tube yeast and sugar assimilation design. *C. guilliermondii* has been separated from several person diseases, chiefly of cutaneous origin. It is likewise discovered from the ordinary membrane (Kutzman and Fell, 1998).

2.1.6. Yeasts infections of the reproductive tract and the susceptibility patterns

Yeast isolates to antifungal agents yeast infections of the vagina commonly identified as Candidal vulvovaginitis is a common female infection primarily through the pregnant interval (Sobel, 1992; Mohammed *et al.,* 2017). The prevalence of vulvovaginitis increases in groups, for instance, diabetic or pregnant women, those utilizing oral contraceptives or after antibiotic healing (Sobel, 1992). *C. albicans* is the very popular etiological cause of vulvovaginitis however other species, for example, *C. glabrata*, *C. krusei* and *C. tropicalis* are also encountered (Kennedy and Sobel, 2010).

2.1.6.1. Candida infections treatments

There are many effective antifungal drugs including both topical and oral drugs that are used in treating Candidal vulvovaginitis. Some of the topical antifungal drugs are clotrimazole, miconazole and nystatin. Oral alternatives include fluconazole, itraconazole and ketoconazole. Reduced susceptibility of some vaginal yeasts to a few antifungal agents has been reported by (Bignell, 1958; Gross *et al.,* 2007) in Costa Rica involving 57 yeasts secluded as of high vaginal swabs. They reported that 91% of the isolated were susceptible to ketoconazole, 96.5% were susceptible to fluconazole, 98% were susceptible to itraconazole and 63% were susceptible to 23 miconazole. One isolate each of *C. krusei* and *C. glabrata* was discovered to be resistant to fluconazole with a MIC of ≥ 64mg/l. A study was conducted in Italy by (Gross *et al.,* 2007) to establish the pathogen occurrence in vulvovaginal candidiasis and to estimate the in vitro antifungal susceptibility of the yeasts isolated from the high vaginal swabs of women over a 6 year period (2002 to 2007). They found that of 518 yeasts isolated, 61.2% were *C. albicans*, 28.8% were *C. glabrata*, 2.9 % were *C. parapsilosis*, 1.8 % each were *C. tropicalis* and *C. krusei* and 1.1% were *C. guilliermondii*. Other yeasts isolated were *Saccharomyces* and *Trichosporon*. The antifungal susceptibility of the 518 yeasts to fluconazole, flucytosine, amphotericin B, ketoconazole and voriconazole reported about 90 to 95% of all the isolates to be susceptible to all the antifungal agents tested. Ellabib & Eljariny (2001) conducted a study in Libya to determine the susceptibility of yeast isolates to miconazole, amphotericin B, ketoconazole, nystatin, clotrimazole and econazole. The yeasts were separated as of high vaginal swabs, nails, throat, hair and wound swabs. The isolated yeasts were *C. albicans*, *C. tropicalis*, *C. glabrata*, *C. krusei*, *C. guilliermondii* and *C. famata*.

They reported that all the isolates tested were highly susceptible to all the antifungal agents. In India, Mohanty *et al.,* (2007) determined the spread of Candida species affecting Candidal vulvovaginitis and tested the susceptibility of 30 Candida isolates to fluconazole. They reported that the prevalence of candidiasis vulvovaginitis was 18.5% and that 21 out of the 30 isolates tested were susceptible to fluconazole with MICs of ≤ 8 µg /ml and 9 were in the intermediate category 24 with MICs between 16 to 32 µg /ml. Of the 9 isolates found to be in the intermediate category, 7 were *C. glabrata* and one each was *C. albicans* and *C. tropicalis*. Indeed, the study conducted in Brazil by Falleiros De Pádua *et al.,* (2003) to determine the prevalence of yeast isolation as of great vaginal swabs and to determine the susceptibility of 83 yeast isolates to fluconazole, nystatin and amphotericin B reported that the prevalence of yeasts isolation by swabs from vaginal was 20.15%. They also reported that 96.4% of the yeast isolates were susceptible to fluconazole, 98.8% were sensitive to amphotericin B and 71% were susceptible to nystatin. Resistance to nystatin was not detected among the isolates but 29 % were found to be in the intermediate category. Also, A study conducted in Brazil to determine the prevalence and antifungal susceptibility of vaginal yeasts by Galle & Gianinni, (2004) reported that the prevalence of Candidal vulvovaginitis was 27.6% and that 11.8%, 23.5% and 9.8% of the 69 isolates tested were resistant to fluconazole, itraconazole and amphotericin B respectively. Likewise, in Italy Arzeni *et al.,* (1997) reported that the prevalence of Candidal vulvovaginitis among out patients was 19% and that *C. albicans* was the yeast species most frequently isolated from the by vaginal swabs followed by Saccharomyces cerevisiae and *C. glabrata*. The antifungal susceptibility investigating of the 42 yeasts isolated showed that maximum of the isolates was sensitive to fluconazole, flucytosine, itraconazole, ketoconazole and miconazole. They, however, reported that isolates of *C. glabrata* and *Saccharomyces cerevisiae* were a little susceptible to fluconazole. A clinical survey carried out in Nigeria southern part to conclude the spreading of genitourinary *Candida* species reported that 517 *Candida* was isolated from high vaginal swabs, endocervical swabs and urine (Okungbowa *et al.,* 2003). Yeasts isolated were *C. glabrata, C. albicans, C. tropicalis, C. guilliermondii, C. tropicalis* and *C. stellatoidea*. In Slovakia, Sojakova *et al.,* (2004) tested the in vitro activities of fluconazole and itraconazole against 227 vaginal yeasts isolates and described that 13% of the yeast strains were resistant to fluconazole with MICs of ≥ 64 µg /ml and 18.5% were resistant to itraconazole.

2.2. Medicinal Plants

Today gradually an increased interest and consume of aromatic and medicinal plants as natural sources in therapeutic, nutrition and ornamental manufacturing all over the world. Furthermore, Biological and natural compounds of therapeutic plants led them to be used in these industries as natural drugs, nutritional complements, useful foods and food packing, etc. (Lim, 2014; Littleton, *et al.,* 2005). Also, it has been used in ethnomedicine for numerous illnesses, for instance, cholesterol, hypertension, eczema and diarrhea for centuries and nowadays their scientific confirmation was offered by isolation and identification of bioactive phytochemicals (Littleton, *et al.,* 2005). To be sure, "Let your food be your first drug" (Hippocrates, 377 BC) was perhaps the first time that the connection made amongst food and happiness which emphasizes the significance of functional foods (Kamel, 2001). Furthermore, the practice of therapeutic plants is wonderfully recognized for healing the illnesses from the earliest times. Still now since of the confidence that plant medicine is a harmless and active maximum of the plant products are being consumed in native traditional medicine systems (WHO, 1999). As well, plant and herbal medicines have been used in Asia represents a long olden time with numerous applications against several sicknesses (Duraipandiyan *et al.,* 2006). The practice of traditional medicine is prevalent in Pakistan, China, Japan, India, Sri Lanka and Thailand. These countries have a large flora of medicinal plants such as China (30,000 species of higher plants), Indonesia (20,000), India (17,000), Myanmar (14,000), Malaysia (12,000) and Thailand (12,000) especially in China about 40% of the total medicinal consumption depends on traditional medicines (Ics-Unido, 2008).

2.2.1. *Acer monspessulanum* L.

The scientific name of Acer plant is *Acer monspessulanum* L. and Common Names Montpellier Maple (En).

Kingdom:	Plantae
Division:	Spermatophyta
Subdivision:	Angiospermae
Class:	Magnoliopsida (Dicotyledoneae)
Order:	Sapindales
Family:	Sapindaceae
	Acer monspessulanum L.
	(Ljubuncic *et al.,* 2005).

The *Acer monspessulanum* L. (Montpellier maple) is a maple species native from Portugal to Morocco in the west, to Turkey, Iraq, Syria, Lebanon, and Palestine in the east, and to the Jura Mountains in France and the Eifel in Germany in the north (Mitchell and More 1992). Besides, Acer can be deciduous large shrubs or tree with paired, frequently small flowers followed by characteristic winged fruits and palmately-lobed leaves (Petrides 1972; Biserkov *et al.,* 2015). It was flowering between March and April and fruiting from May to June (Petrides, 1972).

Ethnobotanically uses is able to treat eye disease, rheumatism, pain, hepatic disorders, etc. efficiently. Also, several suggestions from ethnomedicine have been confirmed by pharmacological actions, such as the hepatoprotective and anti-inflammatory activities of the species (Shahbaz, 2013).

More than 331 chemicals had been identified in *Acer* plants, including flavonoids (18.7%), tannins (12.4%), phenylpropanoids (22.4%), terpenoids and phytosterols (9.7%), diarylheptanoids (8.8%), and numerous extra kinds of compounds, for example simple phenolic compounds (9.7%), benzoic acid derivatives, (5.4%), alkaloids and phenylethanoid glycosides (Bi *et al.,* 2016). Based on this information, Yang *et al.,* (2016) conclude that flavonoids, phenylpropanoids, terpenoids, tannins, and diarylheptanoids are the most plentiful and major bioactive constituents in this genus.

The water extract of *Acer monspessulanum* L. plant exhibited good antioxidant activity. In the β-carotene- linoleic acid assay, ethyl acetate and ethanol extracts exhibited good lipid peroxidation inhibition activity (Ceylan *et al.,* 2016). Likewise, leaves methanol extract of *Acer ginnala* Max. indicated that have the greatest antioxidant activity (Han *et* *al.,* 2004). Moreover, *Acer truncatum* leaves extract was contained maximum levels of phenols and antioxidant capacity (Yang *et al.,* 2016).

2.2.2. *Prunus microcarpa* C.A. Mey (Yellow fruit)

The plant scientific name is *Prunus microcarpa* C.A. Mey. (Yellow fruit) and Common Names Little Cherry (En).

Kingdom: Plantae
Division: Spermatophyta
Subdivision: Angiospermae
Class: Magnoliopsida (Dicotyledoneae)
Order: Rosales
Family: Rosaceae
Prunus microcarpa C.A. Mey. (Yellow fruit)
(Victor *et al.,* 2004; Ljubuncic *et al.,* 2005; Shekha, 2010)

Prunus microcarpa C.A. Mey (Yellow fruit) is erect to sub-erect, spreading or prostrate, much-branched shrub, 0.5-3.5 m high. Twigs unarmed or sometimes sub-spinescent, rigid, often divaricate, at first brown and shortly pubescent, later glabrous or subglabrous with grayish or blackish bark (Petrides, 1972). Flowering is starting at March to April and fruiting at May to July (Nas *et al.,* 2010) (Ahmad and Askari, 2015)

It has been found that plant traditionally used as medicines for treating diabetes likewise have a significant antioxidant activity. It may be the potential that these extracts may perhaps decrease the influence of free radicals release throughout diabetes which might be one of the causative agents for the tissue distraction and insulin resistance (Nas *et al.,* 2011). Actually, other studies by Lachin and Reza, (2012) showed an important renoprotective and antidiabetic impacts with the cherries fruit ethanolic extract supported its traditional usage in the control of diabetes and its complications.

The Chemical constituents have been identified and quantified in *Prunus* species, as well as flavan-3-ols, hydroxycinnamic acids, anthocyanins and flavonol compound (Kelebek and Selli, 2011). Likewise, a phytochemical investigated by Yan *et al.,* (2014) of *P. mume* fruit showed that the separation of 23 compounds, as well as three new acylated sucroses, four benzyl glycosides, two cyanogenic glycosides, four caffeoyl quinic acid derivatives, four lignans, two organic acid and four additional compounds.

On the other hand, the results by Yan *et al.,* (2014) showed that the *P. mume* fruits are an outstanding antioxidant source. Likewise, the extraction of *Prunus spinosa* L. fruit shows a lot of phenolic content and a great amount of antioxidant activity, and can be utilized as an antioxidant in pharmaceutical industries and food (Velickovic *et al.,* 2014)

2.2.3. *Pyrus syriaca* Boiss.

The plant scientific name is *Pyrus syriaca* Boiss. and common names Wild Syrian Pear (En).

Kingdom: Plantae
Division: Spermatophyta
Subdivision: Angiospermae
Class: Magnoliopsida (Dicotyledoneae)
Order: Rosales
Family: Rosaceae
Pyrus syriaca Boiss
(Victor *et al.,* 2004; Shekha, 2010).

First of all, *Pyrus syriaca* Boiss. species is one of the most important pear species that is extensively spread in Turkey, Iraq, Syria, Lebanon, Palestine and Jordan (Muzher *et al.,* 2014). Then, it is a deciduous tree or shrub growing to 5-8 m high, twigs glabrous, spinose, dark-gray and spur shoots present (Petrides, 1972; El-Oglah, 2014). Finally, flowering happens between April and May and fruiting from September to November (Petrides, 1972; Haddad, 2008).

Traditionally, has been used for treating kidney, digestive system, circulatory system and urinary tract system (Mohammed *et al.,* 2013). Also, the fruit used for a healing cough and catarrhs stomach ache by infusion method (Baydoun *et al.,* 2015). Further, It is taken in the herbal form teas as medicines as prophylactics in contrast to bone, liver, kidney and cardiovascular diseases and for gastrointestinal problems (Carmona *et al.,* 2005). Finally, plant parts are used such as flowers, fruits, seeds for aromatherapy, medicinal, edible, cosmetics (Oran, 2015).

The chemical constituents of anatomical parts of pear (*Pyrus communis* L.) contained malic acid as the major organic acid, followed by shikimic acids and citric. The maximum condensation of triterpenoids (3460.5l mg/g dry matter) was determined in pear skin, and ursolic acid was predominant. Also, the leafy parts were distinguished by the uppermost quantity of phenolics (5326.7 mg/100 g DM). Pear leaves and seeds may be selected as potential sources of phytochemicals (Kolniak-Ostek, 2016). Then, the peels of *Pyrus pyrifolia* fruit contained extra phenolic compounds than the flesh. those include rutin, epicatechin and chlorogenic acid. Then again, the identified compounds from pear (*Pyrus ussuriensis* Maxim.) peels were identified as rutin, (−)-catechin, orobol , daidzein , tricin 4′-O-[threo-β-guaiacyl-(7″-O-methyl)-glyceryl] ether, tricin 4′-O-[threo-β-guaiacyl-(7″-O- methyl-9″-O-acetyl)-glyceryl] ether, 5,7,3′,5′-tetrahydroxyflavanone, artselaeroside A, trilobatin , 3-(2,4,6-trihydroxyphenyl)-1-(4-hydroxyphenyl)-propan-1-one, quercetin-3-O-(3″-O-galloyl)-α-L-rhamno- pyranoside, apigenin and quercetin (Qiu *et al.,* 2018).

The leaf parts of *Pyrus communis* L. were distinguished by the uppermost quantity DPPH and FRAP values (2027.9 and 3539.6l mol TE/100 g DM, respectively) (Kolniak-Ostek, 2016). Formerly, The results of a study by (Manzoor *et al.,* 2013).

2.2.4. ***Quercus infectoria*** Oliv.

The plant scientific name is *Quercus infectoria* Oliv. and common names Gall Oak, Aleppo Oak (En).

Kingdom: Plantae
Division: Spermatophyta
Subdivision: Angiospermae
Class: Magnoliopsida (Dicotyledoneae)
Order: Fagales
Family: Fagaceae
Quercus infectoria Oliv
(Ljubuncic *et al.,* 2005; Shekha, 2010).

Originally, The origin and distribution of *Q. infectoria* are indigenous to Iraq, Turkey, Greece, Cyprus, Syria, East Aegean, Islands, Greece, Lebanon and Iran (Petrides, 1972). Moreover, Sometimes, it has been cultivated for the manufacture of bark tannin and for dye wood production (Lim, 2012a). Furthermore, *Q. infectoria* is the small to medium-sized deciduous tree, 4-12 (-18) m tall, 4-8 m broad, branches spreading, twigs hairy or tomentose when young, later glabrous or nearly so; bark grayish, smooth on young stems, (Petrides, 1972). The flowering was between April and May, fruiting from August to October (Shahbaz, 2013).

The nut-galls traditionally have been used for treating illness and have a great medicinal value (Shahbaz, 2013). Also, it has been reported that it has been pharmacologically used for astringent, antidiabetic, anti-tremor, local anaesthetic, antipyretic and anti-Parkinson. Indeed, it has been utilized in the dealing of intertrigo, impetigo, eczema, haemorrhages, chronic diarrhoea, dysentery, etc. (Aroonrerk and Kamkaen, 2009). Also, in some Asian countries for centuries the galls have been used for the treatment of many diseases (Nur Syukriah *et al.,* 2014; Aroonrerk and Kamkaen, 2009).

It has been concluded that the chemical constituents of *Quercus infectoria* Oliv. contain the highest number of bioactive compounds of aqueous extract likened to other solvent kinds which are 51.14 mg/g example and 1332.88 mg/g example of gallic acid and tannic acid one-to-one. The maximum level of the phenolic compound was discovered in 100% acetone extract (121 mg/g of gallic acid equivalent) (Nur Syukriah *et al.,* 2014). Then, HPTLC analysis of the gall extract showed that include8.75% gallic acid (GA) and 19.925% tannic acid (TA) (Kaur *et al.,* 2008).

The antioxidant activity of plant extract gives the uppermost antioxidant activity nearly 94.55% (Nur Syukriah *et al.,* 2014). Another study determines that the *Q. infectoria* galls ethanolic extract has a powerful free radical scavenging and antioxidant activities (Kaur *et al.,* 2008). Further, the antioxidant activity shows moderate to potent antioxidant activity, with the E50 value i.e. 0.254 µg/ml (Rao *et al.,* 2013). Likewise, the results of *Quercus infectoria Oliv.* galls showed that between all galls extraction, the water extract had maximum antioxidant activities as calculated by DPPH scavenging (30/15±0.83 µg/ml) and β-carotene linolic acid (89/4±1.11/ml). These parameters for BHT were 5±0.25 and 7.4±0.3 µg/ml respectively (Fathabad *et al.,* 2015). Finally, it has been shown that two methods of extraction have antioxidant activity and similar to those got from industrial antioxidant (Hasmida *et al.,* 2014).

2.2.5. *Quercus aegilops* L.

The plant scientific name is *Quercus aegilops* L. and common names Valonia Oak, Great Prickly-cupped Oak, Aleppo Oak (En).

Kingdom:	Plantae
Division:	Spermatophyta
Subdivision:	Angiospermae
Class:	Magnoliopsida (Dicotyledoneae)
Order:	Fagales
Family:	Fagaceae

Quercus aegilops L.
(Victor *et al.,* 2004; Ljubuncic *et al.,* 2005).

It has been originated in the Balkans, and in the southern and eastern Mediterranean, including the north of Iraq, Turkey, Palestine, Italy, Greek Islands and Morocco (Petrides, 1972). *Quercus aegilops* L. is the small to medium-sized deciduous trees, 5-12 (20) m tall, 2-7 m broad with more or less rounded crown; the trunk diameter 15-80 (100) cm (Shahbaz, 2013). They are not a long-lived tree but living for up to 150-200 years (Petrides, 1972). Leaf blade ovate-oblong, obovate, grayish green, 4.6-12.5 cm long, 2.2-6.8 cm width, leaf length/leaf width 1.14-3.29. Flowering is between April and May and fruiting from August to October (El-Oglah, 2014).

The traditional and present uses of *Quercus aegilops* L. fruit has been presented have a very high curative rate utilized in the treatment of stomach pain (Shrestha *et al.,* 2014). Later, galls are strongly astringent and can be used in a treatment of hemorrhages, chronic diarrhea, dysentery etc. (Shahbaz, 2013). Finally, fruit and galls of oak (*Quercus aegilops* L.) promotes rodent pelage sacs in vivo suggesting they can be utilized to stimulate hair development in individual (Khidhir *et a l.,* 2016).

The chemical constituents of certain exact Quercus plant, for instance, *Q. myrsinaefolia Q. acuta, Q. salicina, Q. glauca,* and *Q. ilex* demonstrated to contain mainly high possibility as phenolic compounds sources (Vinha *et al.,* 2016). Then, other results displayed all the tested taxa contain aglycons, flavonoid sulphate, and flavon C & C-/O glycosides in their bark, gall and leaf. Myricetin, rutin, quercetin, apigenin, kaempferol and naringenin were closely presented in wholly of investigated taxa portions (Noori *et al.,* 2015). Following, the ethanol extract of *Q. brantii* plant had effective constituents (tannin = 8.2%) that accelerate ulcer curing and thus confirmed its traditional usage (Azizi *et al.,* 2014). Finally, introductory phytochemical screening of *Quercus infectoria* Oliv. presented the occurrence of phenols, steroids, triterpenes, alkaloids, flavonoids, tannins and saponins (Shrestha *et al.,* 2014).

The antioxidant and inhibitory activities of acorn fruits and leaves of *Q. suber* were studied by using 3 dissimilar solvents (methanol, water and hexane). The aqueous extracts displayed the maximum antioxidant activity as calculated by the DPPH and ABTS assays (Vinha *et al.,* 2016).

2.2.6. *Crataegus monogyna* Jacquin

The plant scientific name is *Crataegus monogyna* Jacquin and common names Hawthorn, Hedgerow Hawthorn, May tree or May, Whitethorn, Single-seed Hawthorn (En).

Kingdom:	Plantae
Division:	Spermatophyta
Subdivision:	Angiospermae
Class:	Magnoliopsida (Dicotyledoneae)
Order:	Rosales
Family:	Rosaceae
	Crataegus monogyna Jacquin
	(Ljubuncic *et al.,* 2005; Shekha, 2010)

Crataegus monogyna Jacquin as shrubs or trees is between 1.5-7 m tall, twigs glabrous or sparsely villous, dark or pale brown; bark of stem dark gray, with shallow longitudinal fissures; thorns stout, red-brown, 0.5-1.5 cm long; buds 0.13-0.31cm long, 0.09-0.26 cm thick (Khare, 2007). Flowering occurrs between March and April and fruiting from September to October (Petrides, 1972; Shahbaz, 2013).

The *Crataegus monogyna* Jacquin fruits are medicinally used for several illnesses such as cardiac nervous disorders, Cardiac disorder, analgesic, cicatrizing, respiratory, sole wounds and sedative (Tetik *et al.,* 2013). Similarly, it has been commonly utilized for the healing of respiratory system and circulatory disorders, insomnia and some nervous system disorders, such as irritability, confusion memory loss and migraines (Bechkri *et al.,* 2017; Camejo-Rodrigues *et al.,* 2003). Likewise, the bark is used for the treatment of prostatic hypertrophy, including urolithiasis, urinary disorders, urinary infections and neurogenic bladder; gastro-intestinal and uterine problems). Likewise, bark juice and extract of root bark provided to women after baby birth are utilized to scrofulous gland enlargements. Furthermore, *Crataegeus oxyacantha* plant used for antispasmodic, coronary vasodilator antihypertensive, diuretic and sedative to the nervous system (Khare, 2007).

It has been several clean compounds; specifically, epicatechin, hyperoside, isoquercitrin, ursolic acid, quercetin, rutin, protocatechuic acid and chlorogenic acid (Zhang *et al.,* 2001). Formerly, It contains several compounds such as proanthocyanidin (20.81 mg/g dry weight), total phenol, flavonoid, anthocyanin and chlorogenic acid (Bahorun *et al.,* 2003). In conclusion, plant extract proanthocyanidins (higher in unripe fruits) and flavonoids, mainly flavones and flavonols (greater in flower buds) were the major categories in the investigated examples. Phenolic acids (mostly derivatives of hydroxycinnamic acid) were also discovered in important quantities, particularly in the extract of flower bud (Nabavi *et al.,* 2015).

Originally, *C. monogyna* extracts by Jarzycka *et al.,* (2013) displayed strong antioxidant activity. Then, fruit methanol extract was investigated in vitro using the DPPH method. The results showed that high radical scavenger amount to 95.88%, this is due to the occurrence of a high percentage of polyphenol and reflected by the color change (from purple to yellow) (Djeddi and Boutalebm 2015). To finish, the highest antioxidant activity while C. monogyna had the biggest polyphenolic compound variety, with nine different compounds identified (Nunes *et al.,* 2017).

2.2.7. *Prunus argentea* (Lam.) Rehder

The plant scientific name is *Prunus argentea* (Lam.) Rehder and Common Names Silver Almond (En).

Kingdom:	Plantae
Division:	Spermatophyta
Subdivision:	Angiospermae
Class:	Magnoliopsida (Dicotyledoneae)
Order:	Rosales
Family:	Rosaceae
	Prunus argentea (Lam.) Rehder
	(Victor *et al.,* 2004; Ljubuncic *et al.,* 2005)

It grows in the Middle East in the central and eastern part of Turkey, interfering with Syria, Lebanon, northern Iraq, and western Iran (Petrides, 1972). It is described as a low, richly branched deciduous shrub, 0.5-3 m high, with young branches of thick white, lolly, later deciduous. The leaves are alternate, shortly petiolate or almost sessile, obovate to oblanceolate, 3-4 cm long and 1.5-2 cm wide, entire or crenate (Petrides, 1972). Flowers are single, on short stalks; Crown leaves 12-15 mm long, pale pink. Fruits are ovate, flattened, dirty white hairy, later drooping. Leaves obovate, ovate, lanceolate, oblong, or elliptic, margins entire to obscurely serrate. Flowering from March to April and fruiting between May and June (Yazbek, 2010).

The *Prunus africana* showed promising activity against bacteria and dermatophytes supporting its traditional uses and providing scientific proof of its claimed efficacy against dermatophytes and skin condition (Bii *et al.,* 2010). Additional old-style uses are allergies, diarrhea, stomach-ache, kidney disease and prostate gland disease (Kuete, 2014; Maurice, 2014) In a new drug, water extract of stem bark is utilized to produce products utilized for the remedy of prostate gland hypertrophy (expanded prostate glands) and additional serious situations of benign prostate hyperplasia (BPH) (Maurice, 2014). Finally, The extracts of bark of *P. africana* plant block bladder hyperactivity. The use of the bark in traditional medicine involves the healing of stomach aches, kidney disease, chest ache, bladder and urinary infections and malaria (Nyamai *et al.,* 2015).

The antioxidant activity investigation shows large variability between petioles of different sweet cherry cultivars in measured chemical attributes. Antioxidant activity of most cultivars are powerfully contingent on phenolics, and flavonoids, but is not in correlation with the content of tannins. *Prunus avium* L. fruit petioles are an important resource for different phenolic compounds and could be believed to be a good source of natural antioxidants (Prvulović *et al.,* 2011).

2.2.8. *Crataegus azarolus* var. aronia L.

The plant scientific name is *Crataegus azarolus* var. aronia L. and Common Names Little Cherry (En).

Kingdom:	Plantae
Division:	Spermatophyta
Subdivision:	Angiospermae
Class:	Magnoliopsida (Dicotyledoneae)
Order:	Rosales
Family:	Rosaceae
	Crataegus azarolus var. aronia L.
	(Ljubuncic *et al.,* 2005; Shekha, 2010)

It is native to Iraq, Turkey, Palestine, Jordan, Kazakhstan, Kyrgyzstan, Lebanon, Syria, Armenia, Cyprus, Egypt; Georgia, Greece, Iran, Tajikistan, Tunisia, Turkmenistan and Uzbekistan (Petrides 1972).

The *Crataegus azarolus* var. aronia L. is a medicinal plant belonging to the Rosaceae family, known as Hawthorns (Petrides, 1972). It has been described as shrubs or trees up to 8 m tall, twigs brownish grey, Leaf blades more or less coriaceous, more or less lustrous dark green above. Sub-terminal leaf blades of flowering shoots obovate. Inflorescence corymbose, Fruit 1-2.0 cm long, 1,14-2.42 cm in diameter, depressed globose to globose, yellowish or orange, often tinged with red. Flowering was between March and June and fruiting April to October (Shahbaz, 2013).

North of Iraq, like other nations in the area, is wealthy in its flora, and numerous of them have been utilized in a traditional drug for a long time (Petrides, 1972). Accordingly, it is extremely significant to estimate the herb and plant remedies on scientific bases to confirm their consumption (Shahbaz, 2013). Several ethnopharmacological investigations on the healing use of *Crataegus azarolus* var. aronia L., the main species which populate the highlands of the Mediterranean basin, discovered its use in the Islamic traditional therapy to remedy cardiac sicknesses, in addition to diabetes and cancer (Saad *et al.,* 2006). It has been traditionally utilized for the cure of sexual weakness, diabetes, cardiovascular diseases, hypotensive, insomnia, respiratory and circulatory system disorders and certain nervous system disorders, for instance irritability, memory loss, confusion and migraines (Al-Khazraji *et al.,* 1993; Camejo-Rodrigues *et al.,* 2003; Rastogi *et al.,* 2016). Finally, many academic types of research have shown that Crataegus flowers, leaves and volatile oils contain a high amount in phenolic compounds involving phenolic acids and flavonoids and triterpene acids which revealed significant biological influences, for example, antimicrobial activities, sexual weakness, anti-inflammatory, antiplatelet and/or anticoagulation agents and antioxidant (Kris-Etherton *et al.,* 2002; Svedström *et al.,* 2006; Shatoor *et al.,* 2012; Lakache *et al.,* 2016; Kmail *et al.,* 2017).

Fresh leaf extracts of *Crataegus azarolus* var. aronia L. presented several significant bioactive components such as terpenoids, saponins, phenols, and flavonoids cardiac resins, phlobatannins, and flavones and tannins, alkaloids, coumarin, quinone, sterols/steroids, diterpenes, anthocyanin, anthraquinones, lipids and fixed oils (Kallassy *et al.,* 2017). Extracts were contained a group of phenolic natural metabolites. Flavonoids, for example, the flavonol derivatives and flavone, procyanidins and (−)-epicatechin, are believed to be the key active ingredients (Kmail *et al.,* 2017). It was having dissimilar compositions of flavonoid, and there are also quantitative and qualitative variances in the flavonoid structure in the fruits, flowers and leaves of the similar plant (Belkhir *et al.,* 2013). Similarly, flavonoids appear in Crataegus species generally as flavonol-O-glycosides, for instance, hyperoside, and flavone-C- glycosides, for example, acetylvitexin-

2”-O-rhamnoside and vitexin-2”-O-rhamnoside, which are the chief flavonoids (Svedström *et al.,* 2006). Likewise, thirty- three diverse flavonoids, counting 13 flavonol derivatives and 20 flavones (Kuczkowiak *et al.,* 2014). In addition, condensed tannins or procyanidins, containing oligomers (OPs) and polymers (PPs) of flavan-3-ol parts, shape an unconnected flavonoids group (Svedström *et al.,* 2006).

To start with, the results by (Kallassy *et al.,* 2017) established that the diverse extracts showed significant antioxidant activities and their scavenging influences on DPPH radical were in the next order: water extract (IC50= 60±2.2 µg/ml) >methanolic extract (IC50= 55±2.8 µg/ml) > ethanolic extract (IC50= 50 ±5.2 µg/ml). Furthermore, *C. azarolus* has been demonstrating that the aqueous extract has the strong genoprotective and antioxidant activities, which might be resulting from flavonoids and phenols (Mustapha *et al.,* 2014). Finally, the information of the phenolic compounds in hawthorn fruit species, as well as anthocyanin, flavonoids, phenolic acids, tannins and their derivatives, will benefit to define their potential as a source of antioxidants (Mraihi *et al.,* 2015).

2.2.9. *Prunus microcarpa* C.A. Mey. (Red fruit)

The plant scientific name is *Prunus microcarpa* C.A. Mey. (Red fruit) and Common Names Little Cherry (En) while Synonyms: *Cerasus microcarpa* (C.A. Mey.) Bioss.

Kingdom:	Plantae
Division:	Spermatophyta
Subdivision:	Angiospermae
Class:	Magnoliopsida (Dicotyledoneae)
Order:	Rosales
Family:	Rosaceae
	Prunus microcarpa C.A. Mey. (Red fruit)
	(Ljubuncic *et al.,* 2005; Shekha, 2010).

The *Prunus microcarpa* C.A. Mey. stem is erect to sub-erect, spreading or prostrate, much-branched shrub, 0.5-3.5 m high. Also, twigs unarmed or sometimes sub-spinescent, rigid, often divaricate, at first brown and shortly pubescent, later glabrous or subglabrous with grayish or blackish bark. Then, leaves are oblong ovate-elliptic or obovate, on short shoots. The petiole is very short, 0.5-1.0 mm long. Stipules are subulate, glandular, 3-5 mm long (Petrides 1972; Nas *et al.,* 2011; Shahi-Gharahlar *et al.,* 2011). Flowers appear with the leaves; it produced in spring in clusters of two or three, from buds and spurs of older branches. Fruit is a drupe of 8-0 mm long, 7-10 mm wide, red. Flowering between March and April while fruiting from May to July (Lachin, 2014; Ahmad and Askari, 2015).

There are until now no medicinal uses listed for *Prunus microcarpa* C.A. Mey (Shahbaz, 2013). Although no exact indication has been seen for this kind, all associates of the genus present prunasin and amygdalin, constituents which analysis in water to produce hydrocyanic acid (cyanide or prussic acid). In slight quantities, this very toxic complex promotes breathing, ameliorate digestion and provides a sense of happiness (Green, 2007). Actually, they have the astringent, diaphoretic (inducing perspiration), antioxidant, febrifuge (reducing fever), laxative, stomachic, diuretic properties and depurative (removal of impurities) (Ahmad and Askari, 2015).

The aqueous methanol extracts of fruits of *Prunus virginiana* L. has been determined by HPLC-DAD to contain the highest concentration of these total phenolic compounds at 3,327 µg/g fruit, fresh weight basis (Green, 2007). The phenolic compounds identified by the fruit extract chlorogenic acid, rutin and quercetin in chokecherry. Similarly, phenolic compounds identified in the leaf extracts included chlorogenic acid, epicatechin, rutin and quercetin in chokecherry (Green, 2007). Also, the P. salicina and P. domestica were contains 41 phenolics were distinguished including p-coumaroylquinic acids, caffeoylshikimic acids, feruloylquinic acid, methyl caffeoylquinates, methyl p-coumaroylquinate, epicatechin, feruloyl-glucoside, caffeoylquinic acids, esculin, catechin, rutin, quercetin-3-O-hexosides, quercetin, caffeoyl-glucoside, dimeric proanthocyanidins, p-coumaroyl-glucoside, vanillic acid- glucosides, 3,4-dihydroxybenzoyl-glucoside, trimeric proanthocyanidins, 3-p-methoxycinnamoylquinic acid, quercetin-3-O-rhamnoside, quercetin-3-O-pentosides and quercetin-pentoside-rhamnosides (Jaiswal *et al.,* 2013).

Principally, the consequent display of *P. tomentosa* seeds can be observed as a probable basis of inflammation inhibitors and antioxidants (Liu *et al.,* 2014). Similarly, in last years, the *P. mume* seed was discovered as significant bases of antimicrobial agents and phenolic antioxidants (Xia *et al.,* 2011). The antioxidant analyses (ABTS, TPC and DPPH) also augmented significantly ($P \leq 0.05$) up to 40 min, though the firmness of the fruit was assumed and it presented a significant reduction beyond 20 min of ultrasound treatment (Muzaffar *et al.,* 2016).

2.2.10. *Rubus sanctus* Schreb

The plant scientific name is *Rubus sanctus* Schreb and Common Names Blackberry, bramble, Oriental Blackberry, Raspberry, Dewberry, Cloudberry (En).

Kingdom: Plantae
Division: Spermatophyta
Subdivision: Angiospermae
Class: Magnoliopsida (Dicotyledoneae)
Order: Rosales
Family: Rosaceae
Rubus sanctus Schreb
(Victor *et al.,* 2004; Ljubuncic *et al.,* 2005).

The *Rubus sanctus* Schreb has been described to grow wild in Egypt, north of Iraq and Turkey. It is shrub prostrate or arching, 1-2.5 m tall. Stems are robust or slender, distinctly angled, rooting at the tips, without suckering roots. Leaves are strong sterile shoots, 5-leaflets, leaflets oblong, obovate or orbicular,1.5-8 cm long, 1-6 cm wide, greenish. Stipules are linear-filiform. Inflorescence pyramidal or sub-cylindrical. Fruit is an aggregate of small, black (ripen from red to black) drupelets. Flowering is between April and June while Fruiting is between June and October (Shahbaz, 2013).

Originally, Egyptians traditionally used it to remedy infectious illnesses. Extracts of *Rubus sanctus* Schreb have been utilized in the old-style drug as the antimicrobial (Tosun *et al.,* 2004). It contained some different types of attracting antibacterial, antiviral, hepatoprotective, antituberculosis and antitumoral activities (Vântu, 2009). Additionally, it has been traditionally used for therapeutic purposes (Amira *et al.,* 2009). Moreover, it is used for anticonvulsant, muscle relaxant and radical scavenging agents. Young shoot for Diabetes Infusion (Bulut and Tuzlacı, 2015). Then again, leaves and roots extracts of it have been treated for the healing of rheumatism, haemorrhoid, sore throat, alleviate pain, diabetes mellitus, diarrhea and similar enteric disorders (Honda *et al.,* 1996; Jouad *et al.,* 2002). Moreover, dried and crushed young stem of it has been useful against diseased insect bites, wounds and pimples (Uncini Manganelli and Tomei, 1999).

Traditionally in Turkey used every day one glass of hot extract is drunk on an unfilled stomach for a Kidney stone, urinary infection, diabetes, stomachache (Akaydin *et al.,* 2013). Finally, it has been used for cardiac disorders, tonsillitis, prostate, Acne, astringent, diabetes mellitus, diuretic, hemorrhoids, infertility, stomach-ache, respiratory tract problem, cardiovascular disorders, colds, expectorant, hemorrhoids, constipation, diabetes, gastric diseases, urinary diseases, respiratory and throat diseases (Guarrera, 2005; Ahmed *et al.,* 2017).

The chemicals constituted of the aerial part of *R. fruticosus* by HPLC applied on flavonoids extract shows the presence of the protocatechuic acid, catechin, caffeic acid, gallocatechin, rutin, ellagic acid, gallic acid and myricetin (Chaouche Thanina *et al.,* 2015). Besides, anthocyanin content of *Rubus glaucus* Benth fruit was 45 ± 7.07 mg/100 g fresh weight. Also, Cyanidin 3-rutinoside was the main pigment demonstrating 45% of the whole pigment followed approximately 40% by cyanidin 3-glucoside (Garzón *et al.,* 2009). To finish, plant diverse cultivars of blackberries *Rubu*s sp. are comprised a dissimilar number of potent antioxidant properties and flavonoids (Wang Bowman *et al.,* 2008).

The antioxidant activity of the fruit extract *Rubus glaucus* Benth concluded as (mmoles Trolox equivalents) (TE)/100 mmol TE/100 g fresh weight by ABTS·+ and FRAP assays was 2.01± 0.12 and 4.50± 1.22, one-to-one (Garzón *et al.,* 2009). Similarly, numerous phytochemical components of berry fruits display a wide kind of biological influences, as well as antioxidant activities which are attributed to the phenolic compounds, for instance, phenolic acids, tannins and flavonoids (Velićanski *et al.,* 2012).

2.2.11. *Ficus carica* L.

The plant scientific name is *Ficus carica* L. and Common Names Common Fig, Fig tree Cultivated Fig, Edible Fig, Wild Fig (En).

Kingdom:	Plantae
Division:	Spermatophyta
Subdivision:	Angiospermae
Class:	Magnoliopsida (Dicotyledoneae)
Order:	Urticales
Family:	Moraceae
	Ficus carica L. (Victor *et al.,* 2004; Shekha, 2010).

It has been cultivated for a long period in several countries universal for its edible fruit. It is thought to originate from Western Asia and distributed to the Mediterranean by people (Petrides, 1972). It is also an imperative globe crop nowadays. Iraq, Turkey, Greece, California, Egypt, Morocco, Italy, Brazil, Spain, and further locations with usually hot dry summers and slight winters are the main producers of eatable fig (Mawa *et al.,* 2013; Khare, 2007).

The *Ficus carica L.* is shrubs or small tree, deciduous, 3-10 m tall and several branched. The bark is grayish, slightly roughened and distinctly lenticellate. Branchlets are straight, strong, pubescent, exuding a milky latex when broken. Leaf is blade obovate, nearly orbiculate, or ovate, or deeply palmately 3-5-lobed, 5-30 cm long, 3-15cm wide (Petrides, 1972). Stipules are lanceolate, 1-1.2 cm, brownish-membranous, caducous; petiole 8-1.5-12 cm long, glabrous to pubescent. The inflorescence is monoecious. Mature syconium is glabrous or shortly hairy. Achenes are lens like, yellow, 1.5 mm in diameter. Flowering and fruiting are between May and August (Frodin, 2004; Petrides 1972).

Firstly, in several countries, figs are a vital component of the Mediterranean diet, which is believed to be one of the healthiest and is connected with long life (Trichopoulou *et al.,* 2006). In addition, leaves, fruit and root parts are utilized to produce drugs for numerous complaints, for instance, inflammatory, respiratory (coughs, bronchial problems and sore throats,), gastrointestinal (colic, indigestion, diarrhea and loss of appetite), ulcerative diseases, cardiovascular disorders, and cancers (Mawa *et al.,* 2013). Furthermore, it has been traditionally utilized for its medicinal treatment antispasmodic, anti-inflammatory, cardiovascular and respiratory therapy (Guarrera, 2005). Completely, it has been used to remedy many diseases for example fruit for curing abscesses gum, swellings and tumours. Latex-analgesic and toxic utilized for healing stings, warts and insect bites. Leaf-used in leucoderma. Bark used for skin diseases and eczema (Khare, 2007).

Initially, results displayed that the uppermost antioxidant capacity was showed by the methanol extract of Azendjar variety with IC50 of 0.080 mg/mL (Debib *et al.,* 2014). Then, this study of figs showed that substantial variation occurs in several antioxidants and phytochemical properties (Çalişkan and Aytekin, 2011). Next, Mission fruits varieties comprised the highest levels of antioxidant capacity (Solomon *et al.,* 2006). After that, the bark of *Ficus microcarpa* L. contains the high amount antioxidant and antimicrobial influences and comprised a high quantity of total phenolics (436 GAE mg/g extract). EC50 values of bark extract were 1.62, 4.83 and 63.2 l g/ml in ABTS+, DPPH, superoxide radicals scavenging methods, one-to-one (Ao *et al.,* 2008).

2.3. Phytochemicals

Phytochemicals are the natural metabolites that have a number of subgroups having numerous bioactivities, for example, antibacterial, antifungal, antivirus, anticancer, antioxidant etc., (Duffy and Power, 2001). Today recurring joining among human health and plants particularly rest on their activity of antioxidant that may postpone or decrease the dangerous influences of free radicals (Alejandro & Jasiah, 2009).

2.3.1. Plant phytochemicals

Plants have their own capacity to synthesize a diverse array of chemical compounds, for instance, they can synthesize vitamin C which is different from humans and a number of animals (Lim, 2012b).

Phytochemicals, the bioactive non-nutrient compounds in fruit, vegetables and additional plant-based diets have been linked to a reduced danger of main chronic illnesses (Kris-Etherton *et al.,* 2002). It is estimated that more than 12,000 alkaloids, 25,000 terpenoids and 8,000 phenolics have been recognized in plants (Peter, 2012) but a very large number still remain unknown and need to be identified and quantified before their fitness benefits can be evaluated (Xu and Howard, 2012).

However, a new indication recommends that the benefits of phytochemicals in medicinal plants may be even greater than anticipated because oxidative stress induced by free radicals which are involved in the aetiology of a wide variety of chronic diseases can be stabilized by antioxidants (Fraga, 2010; Peter, 2012). To understand the contribution of the phytochemicals towards health effects, a few of the important phytochemicals will be discussed i.e. flavonoids, chlorogenic acids, alkaloids, carotenoids, vitamins and volatile compounds (Fraga, 2010; Peter, 2012).

2.3.2. Flavonoids phenolic compounds

Flavonoids phenolic compounds are extensively dispersed in plants and abundant in medicinal plants (Crozier *et al.,* 2006). One of the major groups of polyphenolic compounds, the flavonoids, are important in contributing to the flavours and colour of many fruits and vegetables (Balasundram *et al.,* 2006). Flavonoids are extensively disseminated in leaves, fruits and barks of the plants (Fraga 2010). Over 5000 types of flavonoids out of approximately 8000 types of phenolics have been identified (Kris-Etherton *et al.,* 2002; Xu & Howard, 2012), mainly as flavones, flavanones, flavan-3-ols, flavonols, anthocyanins, flavonones and isoflavones (Balasundram *et al.,* 2006; Koleckar *et al.,* 2008).

2.3.3. Plant drug

Plant medicines (also called phytopharmaceuticals or phytomedicines) are plant-derived remedies that comprise a chemical compound or extra typical mixes of chemical compounds that act independently or in a grouping on the human body to avoid ailments and to return or preserve health (Balunas and Kinghorn, 2005; Fraga, 2010). Chemical objects are clean chemical compounds (identified as of natural provenance, for instance, plants, or formed by chemical synthesis) that are utilized for medical aims (typically with an obviously defined and tested mode of action) Some phytopharmaceuticals may contain a single chemical compound extracted from a plant (Fraga, 2010). Several secondary metabolites have been consumed by the human for thousands of years as aromas, dyes, perfumes, stimulants, hallucinogens, insecticides, vertebrate and human poisons and most importantly as therapeutic agents as shown in Figure 2.2 (Fraga, 2010).

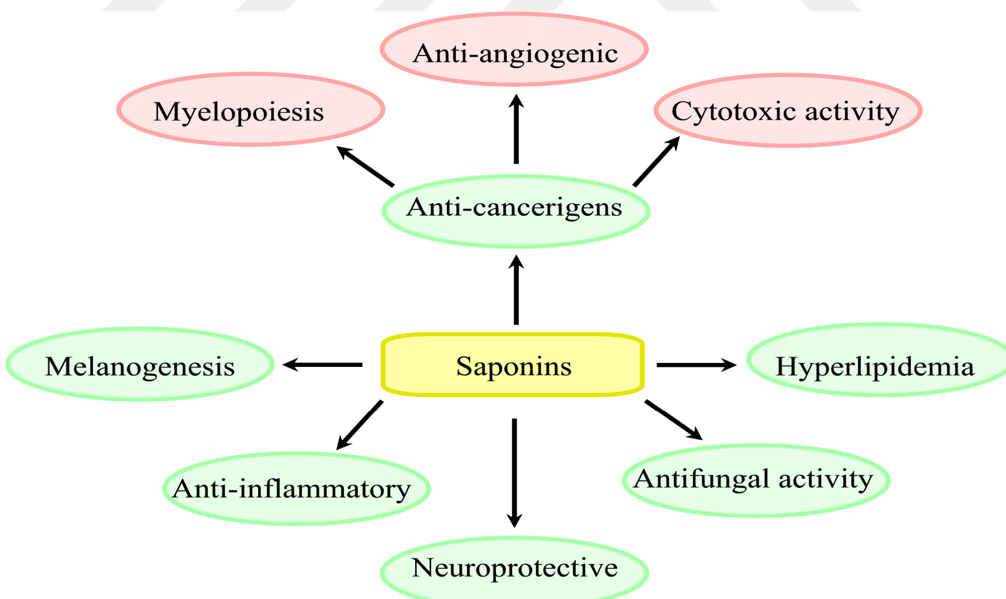

Figure 2.2. The diversity of natural products and their biological properties (Brielmann 2006)

2.3.4. The chief molecular targets that are modulated by plant medicines

The chief molecular targets that are modulated by plant medicines as exposed in Figure 2.3 the extract of a medicinal plant influences more than one molecular target and it is probable that numerous targets are influenced concomitantly when taking phytomedicines (Quave, 2014). In complex ailments, the application of these extracts increases the opportunity of "hitting" one or some related targets. Over-all, there have been discovered a several types of related compounds in a given plant species; frequently little main metabolites and numerous minor constituents, which vary in the location of their chemical groups. The profile typically differs among plant organs, in growing periods and occasionally even diurnally (Fraga, 2010). This aspect is important for quality control in phytotherapeutics (Fraga, 2010; Lim, 2013). Structures of allelochemicals appear to have been shaped during evolution in such a way that they can mimic the structures of endogenous substrates, hormones, neurotransmitters or other Hands; this process can be termed "evolutionary molecular modelling". Other metabolites intercalate or alkylate DNA, inhibit DNA and RN A related enzymes, protein biosynthesis, modulate metabolically active enzymes or they disturb membrane stability (Littleton *et al.,* 2005; Fraga, 2010). As a result of such interactions, plant drugs can inhibit with organ malfunctions (heart and circulation, and intestines and stomach, liver, lung, kidney, CNS disorders, gonads), inflammation and infections. To sum up, phytotherapy is an old-style method of using the correct plants in the correct concentrations to return healthiness or to relieve symptoms of sicknesses and turbulences (Fraga, 2010; Peter, 2012).

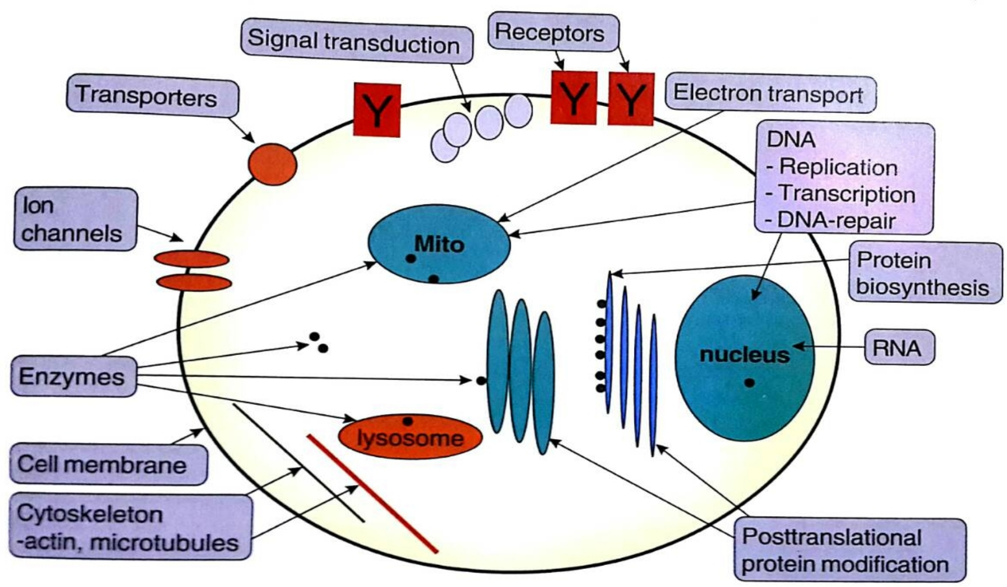

Figure 2.3. an overview of all the chief molecular targets that are modulated by plant medicines (Fraga, 2010)

3. MATERIALS AND METHODS

3.1. Materials

3.1.1. Apparatus and equipment

The laboratory apparatus and equipment used in the all experiment were listed in Table 3.1 along with company and country of origin.

Table 3.1. The list of laboratory apparatus and equipment

Apparatus and Equipment	Company	Country
UHPLC Nexera Shimadzu	Shimadzu	Germany
Microwave milestone NEOS system	Milestone	Italy
Autoclave	Lab Tech	Korea
Incubator	Memmert 2000	Germany
Electric Oven	Memmert 2000	Germany
Vitek 2 Compact	Bio Merieux	France
Densi Check (Turbidity meter)	Bio Merieux	France
Microscope (CH30)	Olympus	Japan
Water bath	Memmert	Germany
Water distilledatory	DLabTech	Korea
Centrifuge	Hettich	England
Magnetic stirrer hot	Labtech	India
Refrigerator	Revco (Thermo)	USA
Sensitive Balance	Mettler	Switzerland
pH meter	Gallen-Kamp	England
Digital Camera	SONY	Japan
Candle Jar	Merck	Germany
Micropipette different volumes	Gallen-Kamp	Germany
Rotary evaporator LABORATA 4000	Hyland	Germany
Micro tubes 1.5ml clear	Axygen, INC.	U.S.A
Sterile transport swabs	Capon S.P.A	Italia
Disposable Petri dishes (15 x100)	Sun	Jordan
Disposable plastic test tube	Barco pharma company	China
Glass Slide	Sail Brand	China
UV-vis spectrophotometer	SHIMADZU	Germany
Bunsen burner	Shenma	China
Nexera model Shimadzu UHPLC	HiMedia	India
Filter papers	Cito test	China
L shaped spreader	Citotest	China
Para film	Bemis	U.S.A.

3.1.2. Reagents, stains and solution

The chemicals and solvents used in the all experiment were listed in Table 3.2 along with company and country of origin.

Table 3. 2. Chemicals and solvents

Reagents	Company	Country
Universal-Indikatorpapier pH 1-14	Macherey-Nagel	Germany
Uripath 3 strip	Plasmatec LP	UK
Gram stain	Crescent diagnostic	KSA
N-butanol	Alpha- chemica	Germany
Glycerol	BDH	England
Ethanol	Alpha- chemica	Germany
NaOH	Merck	Germany
Na2HPO4	Himedia	India
DPPH	Himedia	India
HCl	Prolabo	England
EDTA (Ethylene diamine tetra acetic acid)	Fluka-chemika	Switzerland
BHT	Darmstad	Germany
Parafilm. Lab. Film	Menasha,WI 54952	Chicago

3.1.3. Antimicrobial susceptibility test discs

The antifungal susceptible test discs used in the all experiment were listed in Table 3.3 along with concentrations, company and country of origin.

Table 3.3. Antifungal susceptible test discs

Antifungal discs	Symbol	Concentration (µg/ ml)	Company/Country
Nystatin	NYS	100 unit	Bioanalyse/ Turkey
Clotrimazole	CLT	10	Bioanalyse/ Turkey
Fluconazole	FLU	25	Bioanalyse/ Turkey
Ketoconazole	KTZ	10	Bioanalyse/ Turkey
Fluconazole	FLC	10	Bioanalyse/ Turkey
Miconazole	MCZ	10	Bioanalyse/ Turkey

3.1.4. Culture media used in this study

The culture media used in the all experiments were listed in Table 3.4 along with company and country of origin.

Table 3.4. Culture media

Medium	Company	Country
Sabouraud dextrose agar	Hi media	India
Sabouraud dextrose broth	Hi media	India

3.1.5. Microorganism

All Candida species have been obtained from (Media Diagnostic Center) MDC Erbil accredited from America, CAP* (College of American Pathology) so these strains are external quality control material from CAP with the exception of *C. albicans* which is ATCC strain (ATCC 10231). However, to extend the spectrum of organisms investigated, laboratory strains were also included in the study. The strains of Candida spp. (C1) *C. albicans*; (C2) *C. glabrata*; (C3) *C. krusei*; (C4) *C. tropicalis*; (C5) *C. famata*; (C6) *C. parapsilosis*; (C7) *C. guilliermondii* utilized in this study are shown in Table 3.5 and Figure 3.1.

Table 3.5. List of microorganisms tested in this study

Organism code	Organisms	Source
C 1	*C. albicans* (ATCC 10231).	CAP*
C 2	*C. glabrata*	CAP
C 3	*C. krusei*	CAP
C 4	*C. tropicalis*	CAP
C 5	*C. famata*	CAP
C 6	*C. parapsilosis*	CAP
C 7	*C. guilliermondii*	CAP

CAP*: College of American Pathology

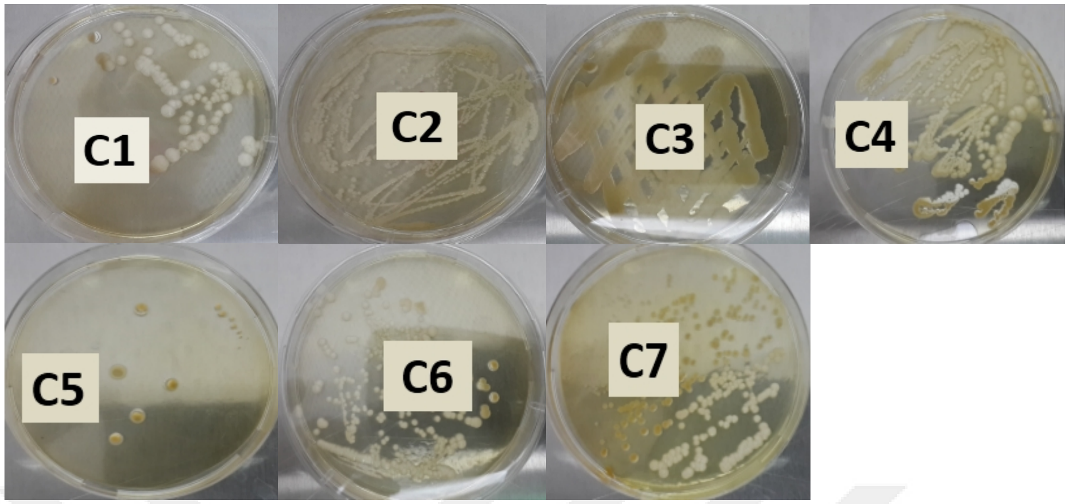

Figure 3.1. The strains of *Candida* spp. (C1) C. albicans; (C2) C. glabrata; (C3) C. krusei; (C4) C. tropicalis; (C5) C. famata; (C6) C. parapsilosis; C7) C. guilliermondii 4

3.2. Preparation of Plant Root Samples

This part of our study was carried out in Erbil city in the North of Iraq. It consists of survey, identification, collection, washing, cutting and powdering of plants as shown in diagram Figure 3.2.

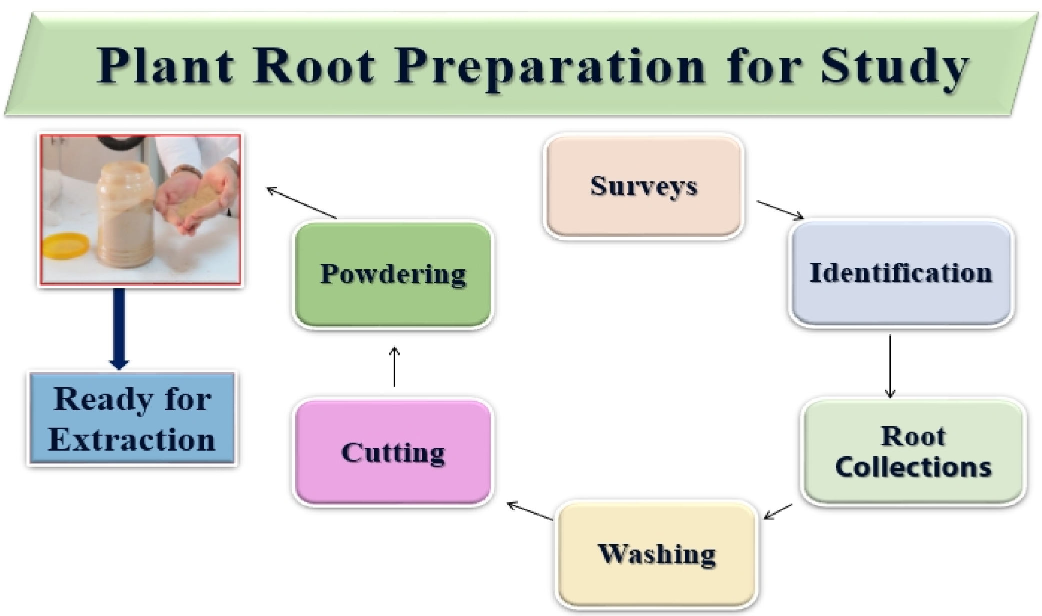

Figure 3.2. Preparation of plant root samples 5

3.2.1. Plant surveys

The plant survey was conducted in the Safin mountain of Shaqlawa district of Erbil city north of Iraq. The location of study area is observed by GIS (Geographic Information System) Map as shown in Figure 3.2. Two senior taxonomists (Dr. Abdullah Sh. Sardar and Dr. Yaseen A. Goran) at Salahaddin University helped to for identification of plants (Neldner *et al.,* 1995).

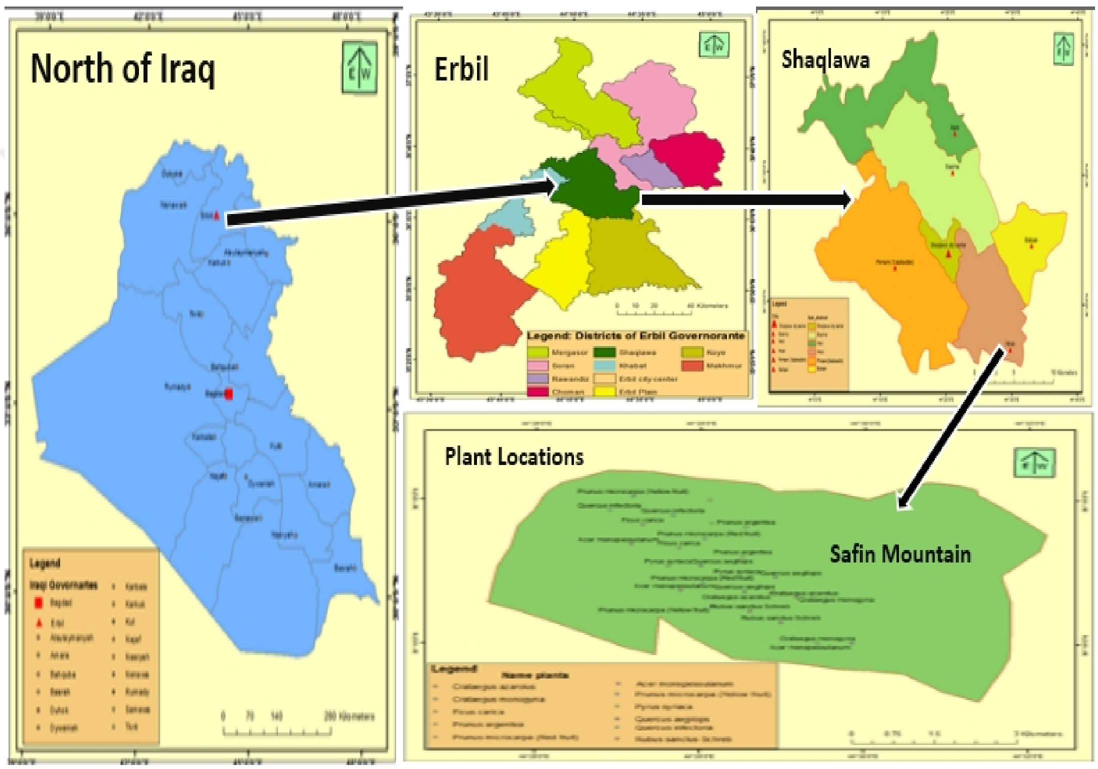

Figure 3.3. GIS Map of study area for plant surveys 6

3.2.2. Identification of Plant Taxa

First of all, the plant parts such as root, stem, leaf, flower, seed and fruit were collected for the identification process as shown in Table 3.6 and Figure 3.4. Further, the taxonomic identification was done by taxonomist Dr Abdullah Sh. Sardar.

Then, the plant samples were authenticated at the herbarium of the Department of Biology College of Sciences Salahaddin University - Erbil. Then, the plant samples were kept at the Biology Department Herbarium. Finally, voucher numbers were given for each species started from 7460 to 7470 code (Victor *et al.,* 2004; Rewald *et al.,* 2012).

Table 3.6. Plants identified

No.	Plants Binomial Names	Common Names	voucher numbers
1	*Acer monspessulanum* L.	Montpellier maple	7460
2	*Prunus microcarpa* C.A. Mey	Little Cherry (Yellow fruit)	7461
3	*Pyrus syriaca* Boiss.	Wild Syrian Pear	7462
4	*Quercus infectoria* Oliv.	Aleppo Oak	7463
5	*Quercus aegilops* L.	Valonia Oak	7464
6	*Crataegus monogyna* Jacquin	Single-seed Hawthorn Whitethorn	7465
7	*Prunus argentea* (Lam.) Rehder	Silver Almond	7466
8	*Crataegus azarolus* var. aronia L.	Azarole Hawthorn	7467
9	*Prunus microcarpa* C.A. Mey	Little Cherry (Red fruit)	7468
10	*Rubus sanctus* Schreb	Blackberry	7469
11	*Ficus carica* L.	Fig tree	7470

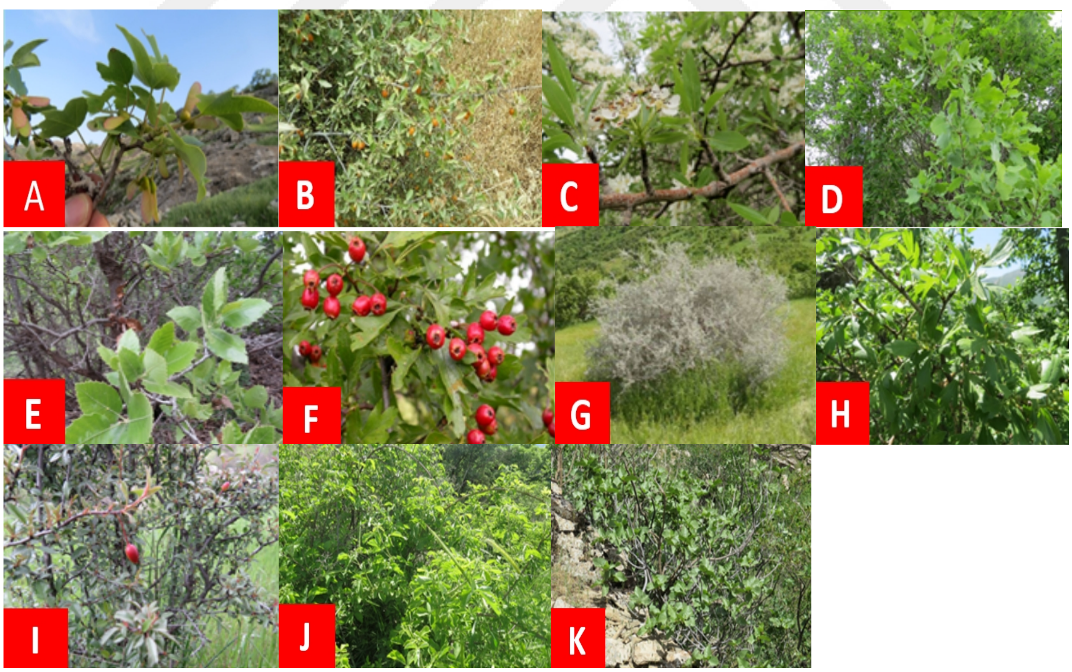

Figure 3.4. Plants identified (A) *Acer monspessulanum*; (B) *Prunus microcarpa* C.A. Mey. (Yellow fruit); (C) *Pyrus syriaca* Boiss.; (D) *Quercus infectoria* Oliv.; (E) *Quercus aegilops* L.; (F) *Crataegus monogyna* Jacquin; (G) *Prunus argentea* (Lam.) Rehder; (H) *Crataegus azarolus* var. aronia L.; (I) *Prunus microcarpa* C.A. Mey. (Red fruit); (J) *Rubus sanctus* Schreb; (K) *Ficus carica* L. 7

3.2.3. The plant root collections

After identification, the plant roots samples were collected in the Safin mountain, trees of Shaqlawa district, at Erbil city in north of Iraq. They have been collected carefully and scientifically at the same time, at a depth of 50 cm (Vranova *et al.,* 2013).

3.2.4. Washing of plant root samples

The root samples were washed with tap water for cleaning from soil particles. Then, they were cleaned again with distilled water. Afterwards, the roots were dried normally at room temperature. This step was done at a proper place (Baydoun *et al.,* 2015).

3.2.5. Plant roots cutting

The root samples were cut manually and very carefully, by a cutter tool.

3.2.6. Powdering of root samples

This step was carried out at Kahramanmaraş Sütçü Imam University, Faculty of Forestry department Forest Industrial Engineering laboratory. The root samples were ground by new modern grinder YAZICILAR (Model G1, Capacity 5 letter, Speed 13,000 rpm, Cycle 500 gr. and Capacity/ hour 15 kg). Finally, the root powders were kept in plastic bags in a dry, cool place (Olszewska and Kwapisz, 2011).

3.3. Chemical analysis

This part of our study consisted of extraction, extract yield percentage determination, determination of total condensed tannin and DPPH radical scavenging activity. It was done at Kahramanmaraş Sütçü Imam University, Faculty of Forestry Department of Forest Industrial Engineering laboratory. Also, phytochemical analyses were done at Dicle University.

3.3.1. Microwave assisted extraction method

This technique was described previously by Gallo *et al.,* (2010). The Microwave milestone NEOS system equipped with vessels and an automatic temperature control system was used for the microwave assisted extractions (MAE). 25 grams of sample powder was mixed with 250 mL of solvents and put in vessels. Additionally, a magnetic stirrer bar was applied to vessels at 400 rpm. The process was maintained for 30 min. The temperatures were standard for each solvent such as Ethanol at 68^{o}C, Acetonitrile at 92^{o}C and D.W at 100ºC. Also, the same power 200 Wat was used for all solvents. Finally, after extraction processes, the extracts were allowed to cool at room temperature. All samples were filtered and solvent was evaporated by using a rotary vacuum evaporator in order to obtain a purified extract (Laghari *et al.,* 2011).

3.3.2. Conventional extraction method

This technique was performed by some modifications that was described by Kiranmai *et al.,* (2011) and Ahmad *et al.,* (2013). Also, for conventional extraction, 25 grams of sample powder were mixed with 250 ml of solvents and put in the bottom flask. The ratio of plant material mass (g) to solvent volume (mL) was 1:10. Additionally, stirring was also applied. The extraction was performed at boiling point temperature for 60 min. Further, the temperatures were standard for each solvent such as Ethanol at 68ºC, Acetonitrile at 92ºC and D.W at 100ºC. Then, the mixtures were allowed to cool at room temperature. Finally, the mixtures were filtered and evaporated in a rotary vacuum evaporator in order to obtain a purified extract (Dhanani *et al.,* 2017).

3.3.3. Maceration extraction

In this method, 25 grams of plant root powder were added into a mortar. Then, a few solvents were added into a mortar and ground by a pestle. The final mixture was totally 250 mL and it was placed in a plug bottle. The plug bottle with the mixture was then waited at room temperature in a dark place for a period of at least 7 days. Furthermore, it was shaken 10 min. daily by a shaker. Next, the mixture of the extract was separated by the filtration processes from solid residue. Finally, the combined liquids are clarified by filtration once solvent was evaporated in a rotary vacuum evaporator (Kiranmai *et al.,* 2011).

3.3.4. Percentage yield of solvent extracts

0.5 g of powder roots were extracted with 5 mL of different solvents separately by using various extraction methods described above. The percentage yield of extract from plant roots samples were obtained by the following formula which was given below Equation 3.1 for each one of the extraction techniques mentioned (Ajibaye *et al.,* 2011).

$$\text{Yield percentage } \% = \frac{X}{Y} \times 100 \tag{3.1}$$

Where;

X: the oven dry weight of extract (g),

Y: the oven dry weight of the sample (g).

3.3.5. Determination of total condensed tannin

This analysis was carried out by using Shimadzu UV-vis spectrophotometer Figure 3.5. Firstly, an extraction solution was prepared by mixing 0.05 g of $FeSO_4$, 95 ml N-butanol and 5 mL hydrochloric acid (HCl) (35%). Then, for determining the condensed tannin, 0.01 g of both plant powder roots and mimosa tannin were put separately in a test tube and 10 ml of extraction solution was added and placed in a hot water bath 1 h. Finally, the absorbance was measured at 580 nm wavelength (Song *et al.,* 2017).

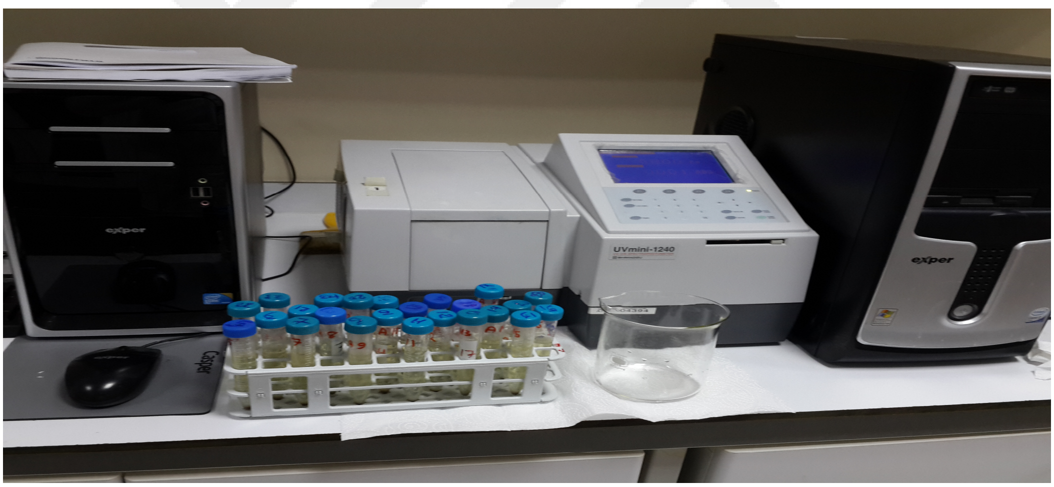

Figure 3.5. Shimadzu UV-vis spectrophotometer 8

3.3.6. Determination of antioxidant activity

The percentage of antioxidant activity (AA%) of each root powder was determined based on the radical scavenging effect for 2 2-diphenyl-1-picrylhydrazyl (DPPH) radical that presented previously by Blois (1958), with some modifications. The diluted working solutions from various parts of plant extracts along with controls (positive control was BHT (butylated hydroxytoluene) and the negative control was solvent alone) were prepared. Then, 0.1 mM DPPH was prepared for solvent extractions. Then 0.1, 0.2 and 0.3 mLof sample solutions mixed with solvents up to 3 ml in a test tube, separately and 1 mL of DPPH was added. The mixtures were kept in a dark place for 30 minutes. Finally, the absorbance was measured at 517 nms by UV/Visible spectrophotometer (Baba and Malik, 2015). The radical scavenging activity was given as the percentage of scavenged DPPH radical, which was calculated according to Lu *et al.,* (2014) by equation 3.2:

$$\text{Inhibition of DPPH radical scavenging activity (\%)} = \frac{A\text{-}B}{A} \times 100 \qquad (3.2)$$

Where;

A: the absorbance of DPPH,

B: the absorbance in the presence of sample and BHT.

3.3.7. Identification and quantification of phytochemical compounds

3.3.7.1. Preparation of plant extract for LC–MS/MS

The root extraction of above mentioned plants was done by using three different solvents and methods. Dry filtrated materials were diluted to 1000 mg/L and filtrated by 0.2 µm microfiber filter prior and used LC–MS/MS analysis.

3.3.7.2. LC–MS/MS instrumentation and chromatographic conditions

Nexera model (Shimadzu, Kyoto, Japan) of LC.MS/MS analyzes of the photochemical were used, and UHPLC attached to a tandem MS instrument Figure 3.6. The liquid chromatography machine has LC-30AD binary pumps, DGU-20A3R degasser, CTO-10ASvp column oven and SIL-30AC autosampler. A reversed-phase C18 typed Inertsil ODS-4 (150mm × 4.6mm, 3µm) analytical column was used in the chromatographically separation. The column temperature was fixed at 40◦C. The elution of gradient solvents of mobile phase A were (water, 5 mM ammonium formate and 0.1% formic acid) and mobile phase B were (methanol, 5 mM ammonium formate and 0.1%formic acid). The gradient program with the next extents of solvent B was applied t (min), B%: (0, 40), (20, 90), (23.99, 90), (24, 40), (29, 40). The solvent flow rate was preserved at 0.5 mL/min and injection volume was settled as 4 µL.

Figure 3.6. LC-MS/MS instrument 9

3.3.7.3. MS instrumentation

MS technique was performed using Shimadzu LCMS 8040 model triple quadrupole mass spectrometer equipped with an ESI source operating in both negative and positive ionization modes. LC–MS/MS data for extracted compounds were collected and treated by Lab. Solutions software (Shimadzu, Kyoto, Japan). The numerous reactions monitoring (MRM) mode was utilized to quantify the analyzer; the assay of investigated compounds was performed following two or three transitions per compound. The first attempt was for quantitative purposes and the second and/or the third one for confirmation. The optimum ESI conditions were determined as interface temperature; 350˚C, DL temperature; 250˚C, heat block temperature;400˚C, nebulizing gas flow (nitrogen); 3 L/min and drying gas flow(nitrogen); 15 L/min.

3.3.7.4. Method validation parameters for LC–MS/MS:

In this study, phytochemical process of ninety-nine root extracts were determined by a previously developed and validated LC-MS/MS method (Ertas *et al.,* 2014). Twenty-four phenolic compounds (flavonoid aglycones, flavonoid glycosides, phenolic acids, phenolic aldehyde and coumarin) and three non-phenolic organic acids which are widespread in plant materials were qualified and quantified. Quantification process is given by equation 3.3:

$$\text{Quantification of compound } (\mu\text{g analytic/g extract}) = \frac{R*U^f}{100} \qquad (3.3)$$

Where;

R: the result from LC–MS/MS (µg),

U^f: the percent relative uncertainty at 95% confidence level (%).

3.4. Biological assays

3.4.1. Pathogenic fungi samples collection and identification

Two hundred fifty of *Candida* species were collected 150 from non- pregnant (60%) and 100 from pregnant (40%) women patient by high vaginal swabs. Women patients with vaginal symptoms was selected from Maternity Teaching Hospital obstetrics department in Erbil city started from July to November 2016. The age range of these patients was between 20 and 50 years old (Masri *et al.,* 2015).

3.4.1.1. Important point of ethical rules sample collection from patient

When people are invited to participate in research, there is a strong belief that it should be their choice based on their understanding of what the study is about, and what the risks and benefits of the study (Kulynych, 2002). Individuals should be treated with respect from the time they are approached for possible participation even if they refuse enrollment in a study throughout their participation and after their participation ends. This includes: respecting their privacy and keeping their private information confidential respecting their right to change their mind, to decide that the research does not match their interests, and to withdraw without a penalty informing them of new information that might emerge in the course of research, which might change their assessment of the risks and benefits of participating monitoring their welfare and, if they experience adverse reactions, unexpected effects, or changes in clinical status, ensuring appropriate treatment and, when necessary, removal from the study informing them about what was learned from the research (Kapp, 2006).

3.4.1.2. Culture Media

Sabouraud dextrose agar medium was used for the isolation and cultivation of yeasts and other moulds requiring a rich substrate with a high content of organic nitrogen. Antibacterial antibiotics (in particular chloramphenicol) was added to control bacterial contamination and to inhibit the development of saprophytic fungi (Campbell *et al.,* 2013). SDA is the most repeatedly utilized primary isolation medium for *Candida* spp. (Odds and Bernaerts, 1994). For preparation of medium, 65 grams of it was dissolved in 1000 mL of distilled water supplemented with (0.5g/L) chloramphenicol (Abu-Elteen, 2006). Then the volume was adjusted to 1000 mL and sterilized in an autoclave (Nüve) at 15 psi pressure and 121°C for 15 min. At the end of that time, it was left to be cool to 50°C and, after cooling aseptically cycloheximide or chloramphenicol were added Finally, it was poured in to sterilized Petri dishes or stored in tubes. This medium was stored at 4ºC and was used for culturing, isolation and preservation of *Candida* isolates (Singh *et al.,* 2015).

Sabouraud dextrose broth (Sabouraud Liquid Medium) is utilized for culturing of moulds, yeasts and aciduria organisms. 30 grams of medium was put in 1L of deionized water. Then, heat was used to melt the medium totally. Next, it was sterilized by an autoclave at 15 lbs pressure and 121°C for 15 minutes. After it was mixed good and dispensed as wanted was used for MIC (minimum inhibitory concentration) testing and stored at 4°C prior to use (Contreras-Lynch *et al.,* 2017).

3.4.1.3. Sterilization of media and materials

All media were sterilized by autoclaving at 15 psi pressure and 121°C for 15 min. All glasswares, conical flask and L shaped spreader were washed using detergent and rinsed using tap water and allowed to dry. The glasswares were sterilized in a hot air oven at 200°C for 2 hours (Campbell *et al.,* 2013).

3.4.1.4. Stock cultures preservation

An isolated colony was routinely grown on Sabouraud dextrose agar slant and stored at 4ºC for daily use and it was subcultured every three weeks. Then, fungi isolates were preserved in the laboratory at – 20 ºC as frozen stock cultures in 15% glycerol with 85% Sabouraud dextrose broth (Asticcioli *et al.,* 2009).

3.4.1.5. Suspension preparation

A sterile loop was used to transfer a sufficient number of overnight incubated pure culture. The isolated *Candida* were suspended in 3 ml of sterile (0.45% NaCl) saline with pH (4.5 to 7.0) in a 12 x 75 mm of clear plastic polystyrene test tube. The turbidity was adjusted according to the tables provided by manufacturer recommendation McFarland turbidity range (1.80-2.20) and the turbidity was measured using a turbidity meter called the Densichek. The test tube containing the *Candida* suspension was placed into a special rack called (cassette), and the identification card was placed in the neighbouring slot while inserting the transfer into the corresponding suspension tube and the filled cassette was placed manually after reading the barcode of the cards (Pincus, 2010).

3.4.1.6. Isolation of microorganisms

For separation of fungi, the sample of the vaginal swab was immediately inoculated on Sabouraud dextrose agar culture media for cultivation of fungi. Which were incubated at 37ºC for 24-48 hours and examined after 48-72 hours suspected colonies were sub cultured on Sabouraud dextrose agar and incubated at 37ºC for 24-48 hours (Dismukes *et al.,* 2003; Cihlar, 2016)

3.4.1.7. Inoculation

Identification cards were injected with *Candida* suspensions utilizing a combined vacuum machine. A test tube having the suspension of microorganism was located hooked on a specific stand (cassette) and the discovery card was arranged in the bordering slot while adding the transfer tube into the paralleling suspension tube (the cassette can accommodate 10 cards). The filled cassette was located by hand into a vacuum cavity position. After the vacuum was applied and the air was restored to the position, the *Candida* suspension was forced during the transmit tube into micro-channels that fill all the analysis wells (Pincus, 2010).

3.4.1.8. Reagent cards

The reagent cards contain 64 wells that contain a separate test substrates mensuration numerous metabolic activity for example acidification, alkalinisation, enzyme hydrolysis, and growth in the occurrence of the inhibitory substance. An optically pure film existing on two sides of the card permits for the suitable level of oxygen broadcast whereas preserving a sealed vessel that avoids interaction with the microorganism-substrate admixtures (Nakasone *et al.,* 2007).

3.4.1.9. Yeast Identification by VITEK 2 compact system

The isolates of clean colony were diagnosed by utilizing antibiogram for pathogens were performed by using VITEK 2compact system (Nagaraja, 2008). The isolated Candida identified by VITEK 2 Compact System. The recently reshaped colorimetric VITEK 2 compact system as shown in Figure 3.7, with the updated advanced expert system (AES) (bioMerieux) was assessed for its precision and quickness to identify clinical separates and to detect several antimicrobial resistances (Nakasone *et al*., 2007). Throughout the study, which is used the VITEK 2 ID-YST card for the correct identification of significant yeasts microorganisms in a routine clinical laboratory of the hospital. Tests were performed from subcultures grown on SDA supplemented with chloramphenicol at 37°C for 24 h (Graf *et al.,* 2000). The VITEK 2 ID-YST card has the ability to identify the majority of the common and significant clinical yeast and Candida spp. correctly (Valenza *et al.,* 2008).

Figure 3.7. VITEK 2 compact system 10

3.4.2. Antifungal activity

3.4.2.1. Antifungal activity of root extracts and sensitivity

Agar disk-diffusion testing developed in 1940, is the official method used in many clinical microbiology laboratories for routine antimicrobial susceptibility testing. Nowadays, many accepted and approved standards are published by the Clinical and Laboratory Standards Institute (CLSI) for bacteria and yeasts testing (Wayne, 2016). Antifungal activity of the different extracts was determined by using disc diffusion method on Sabouraud Dextrose agar. Sabouraud dextrose agar was firstly sterilized. The medium was chilled to 45°C and teemed to sterilized Petri dish. Plates were prepared by pouring approximately 15 mL of media into the Petri dishes under aseptic conditions (Rao *et al.,* 2013). Suspensions of the test organisms were prepared in sterile saline to a density equivalent to a McFarland 0.5 (Deliorman Orhan *et al.,* 2012). The inoculum was spread evenly over the entire surface. Sterile paper disc having a diameter of 6 mms, impregnated with 50 µL of each sample extracts. After dried paper discs were placed on the agar plate with sterile forceps. Six filter paper discs were placed on each plate and placed at the same distance from each other and edge in order to prevent overlapping of inhibition zones. The discs were pressed with forceps to make complete contacts with the surface of the medium. six types of standard antifungal discs used such as Nystatin 100 unit (NYS), Clotrimazole 10 mcg CLT, Fluconazole 25 mcg (FLU), Ketoconazole 10 mcg (KTZ), Fluconazole 10mcg (FLC) and Miconazole 10 mcg (MCZ) for comparison with extract antifungals. These plates were incubated at 37 °C for 24 to 48 hrs. dependent on the strains being tested. After incubation, the diameter of the clear zones around each disc were measured in millimeters by a transparent ruler (ElFeky *et al.,* 2016).

3.4.2.2. Minimum inhibitory concentration (MIC)

First of all, one millilitre of extract concentration of 100 mg/ml for three extract solvents were mixed with nutrient agar in serial decimal dilutions diluted 1 ml in 9 ml of agar to get the concentration ranged 0.5 to 512 mcg/ml. The inoculum may also be standardized based on optical density [OD625 of 0.08-0.1 (1cm light path)] using a spectrophotometer. This is usually achieved after 18- 24 hours. All the *Candida* suspensions were prepared by suspending 24h *Candida* culture in sterile normal saline (0.89% NaCl wt/vol). The turbidity of the *Candida* suspension was adjusted to 1.0 McFarland standard (equivalent to 1.5 × 108 CFU/ml). The inoculation pins were sterilized in the Bunsen burner. Then, the tubes were incubated overnight at 37 ºC and the MIC of the extract was determined as the concentration which *Candida* growth (Asticcioli *et al.,* 2009; Kurtzman 2011a).

3.5. Statistical analysis

Data are expressed as means ± SD and SE (unless noted) with n equal to a number of treatments. Biological and chemicals measurements were compared using one-way ANOVA followed by a Bonferroni post hoc test where appropriate. GraphPad Prism version 7.0 (GraphPad Software, San Diego, CA) was used to analyze the data. A statistical analysis Probability value (P-value) less than (< 0.05) was considered as statistically significant (*), while P-value more than (> 0.05) was considered as statistically not significant. Histogram and pie-chart were used for the statistical analysis of the results.

4. RESULTS AND DISCUSSION

4.1. Determination of extraction yield

4.1.1. Determination of extraction yield of *Acer monspessulanum* L.

Biologically active compounds in plants usually occur in low concentrations. Extraction yield has been utilized as a pointer for the influences of the extraction conditions. A wide range of yields among extracts have been observed depending on the extraction methods and solvents.

The lowest extraction yield of *Acer monspessulanum* L. roots was (MWA: 3.335 %) in acetonitrile solvent by using microwave method, whereas the highest extraction yield was observed in ethanol solvent by conventional method (CE: 15.56 %) as shown in Table 4.1 and Figure 4.1.

Table 4.1. The percentage yield of *Acer monspessulanum* L. root extracts 7

	MW/E	C/E	M/E	MW/A	C/A	M/A	MW/W	C/W	M/W
Mean	6.673	15.560	13.330	3.335	5.556	6.670	3.337	3.337	3.337
SD	0.012	0.002	0.002	0.004	0.006	0.005	0.008	0.010	0.005
SE	0.005	0.001	0.001	0.002	0.003	0.002	0.003	0.004	0.002

Notes: MW; microwave assisted; C: conventional; M: maceration; E: ethanol; A: acetonitrile; W: water Note: P: plant; SD: standard division; SE: standard error

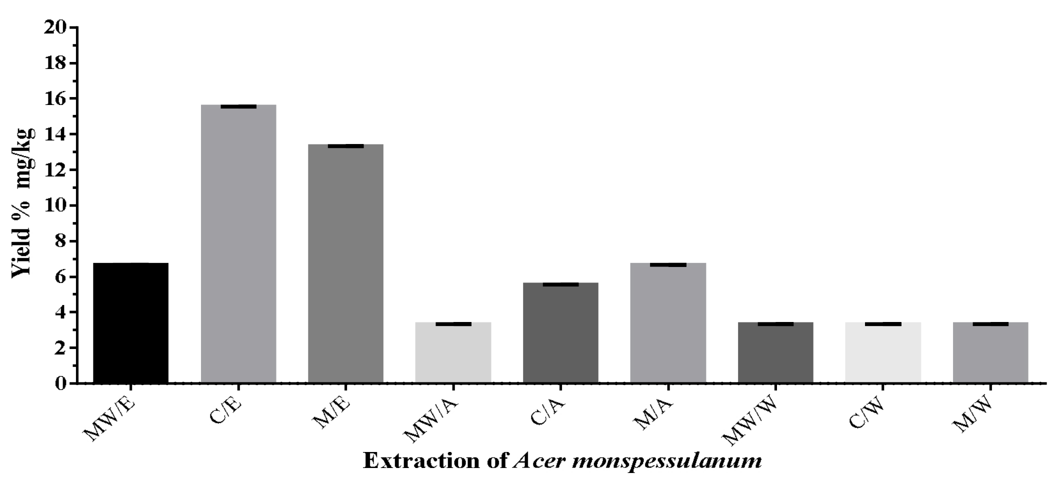

Figure 4.1. The percentage yield of *Acer monspessulanum* L. root extracts (Notes: MW; microwave assisted; C: conventional; M: maceration; E: ethanol; A: acetonitrile; W: water)11

4.1.2. Determination of extraction yield of *Prunus microcarpa* C.A. Mey. (yellow fruit)

Figure 4.2 and Table 4.1.2 show that the yield percentages of *Prunus microcarpa* C.A. Mey. (yellow fruit) extracts. Among the extraction methods, conventional extraction showed the highest yield percentages, followed by maceration and microwave extraction methods. The results showed that ethanol solvent has been was higher than acetonitrile and distilled water. The maximum amount of extraction yield was (CE: 25.74 %) and the minimum amount of extraction yield was (MWA and MW: 5.59%).

Table 4.2. The percentage yield of *Prunus microcarpa* C.A. Mey. (yellow fruit) root extracts 8

	MW/E	C/E	M/E	MW/A	C/A	M/A	MW/W	C/W	M/W
Mean	12.24	25.74	17.8	5.59	7.78	14.44	7.82	7.835	5.59
SD	0.032	0.286	0.045	0.056	0.006	0.006	0.089	0.095	0.057
SE	0.013	0.117	0.018	0.023	0.003	0.003	0.036	0.039	0.023

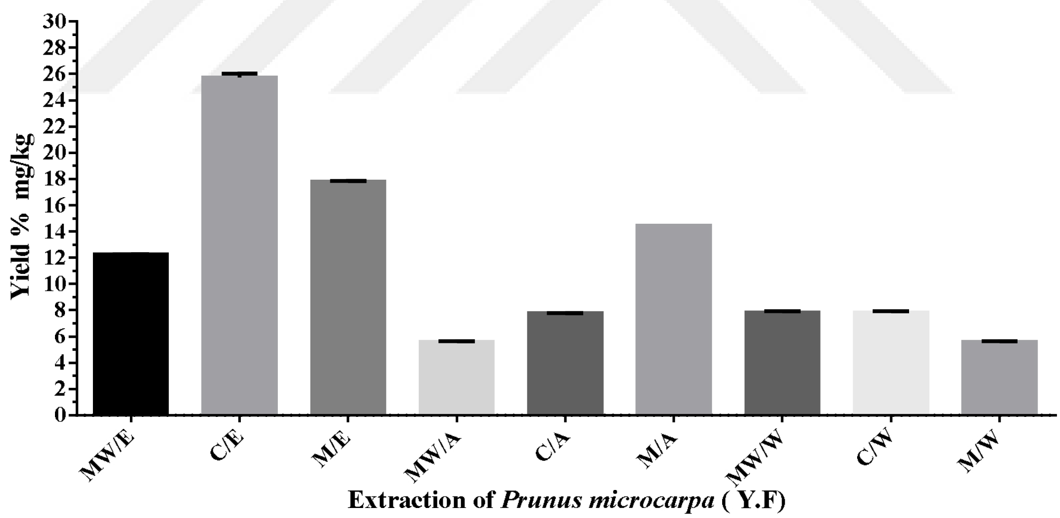

Figure 4.2. The percentage yield of *Prunus microcarpa* C.A. Mey (yellow fruit) root extracts 12

4.1.3. Determination of extraction yield of *Pyrus syriaca* Boiss.

The extraction yield in root extracts of *Pyrus syriaca* Boiss prepared by microwave, conventional, maceration methods with using ethanol, acetonitrile and distilled water solvents. The highest extraction yield was found in ethanol solution with microwave extraction technique (MWE: 16.69%). The lowest extraction yield was (MWW:4.471%)

observed in distilled water with microwave extraction method as shown in Table 4.3 and Figure 4.3.

Table 4.3. The percentage yield of *Pyrus syriaca* Boiss. root extracts 9

	MW/E	**C/E**	**M/E**	**MW/A**	**C/A**	**M/A**	**MW/W**	**C/W**	**M/W**
Mean	16.69	8.953	11.15	3.378	6.622	8.943	4.471	10.12	11.15
SD	0.0335	0.08504	0.04877	0.05175	0.07731	0.08923	0.03484	0.1347	0.04581
SE	0.01368	0.03472	0.01991	0.02113	0.03156	0.03643	0.01422	0.055	0.0187

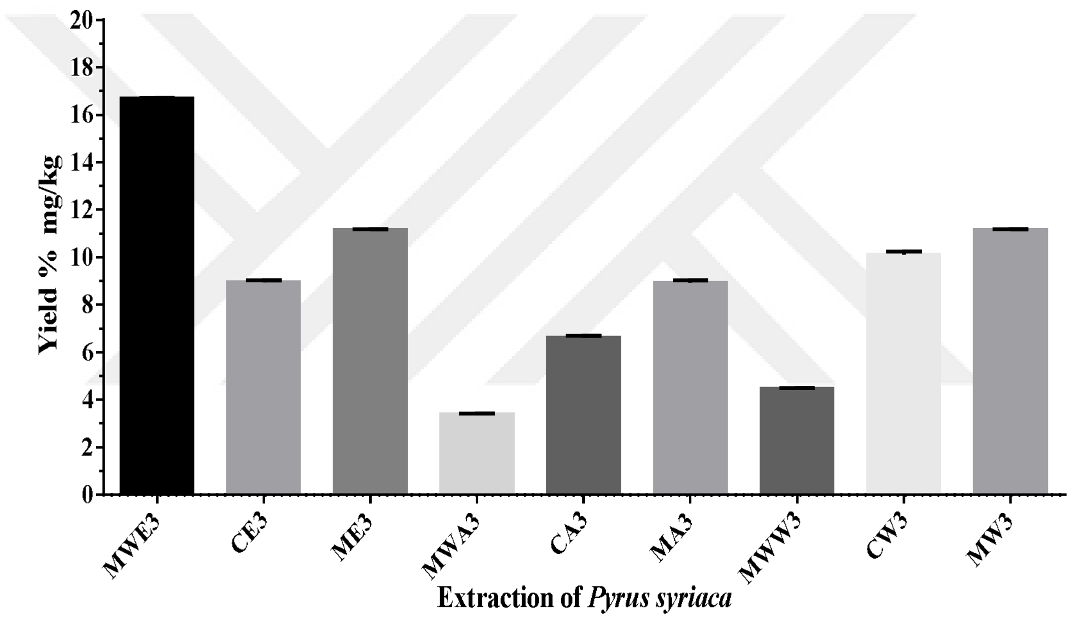

Figure 4.3. The percentage yield of *Pyrus syriaca* Boiss. root extracts 13

4.1.4. Determination of extraction yield of *Quercus infectoria* Oliv.

The uppermost extraction yield (17.3%) was found in conventional ethanol extract. The lowermost extraction yield (3.335%) was observed in acetonitrile solvent with microwave extraction method as shown in Table 4.4 and Figure 4.4.

Table 4.4. The percentage yield of *Quercus infectoria* Oliv. root extracts 10

	MW/E	**C/E**	**M/E**	**MW/A**	**C/A**	**M/A**	**MW/W**	**C/W**	**M/W**
Mean	18.89	23.34	15.55	3.335	6.667	6.667	21.11	13.33	20.00
SD	0.0076	0.0023	0.0084	0.0041	0.0064	0.0063	0.0063	0.0052	0.0052
SE	0.0031	0.0009	0.0034	0.0017	0.0026	0.0026	0.0026	0.0021	0.0021

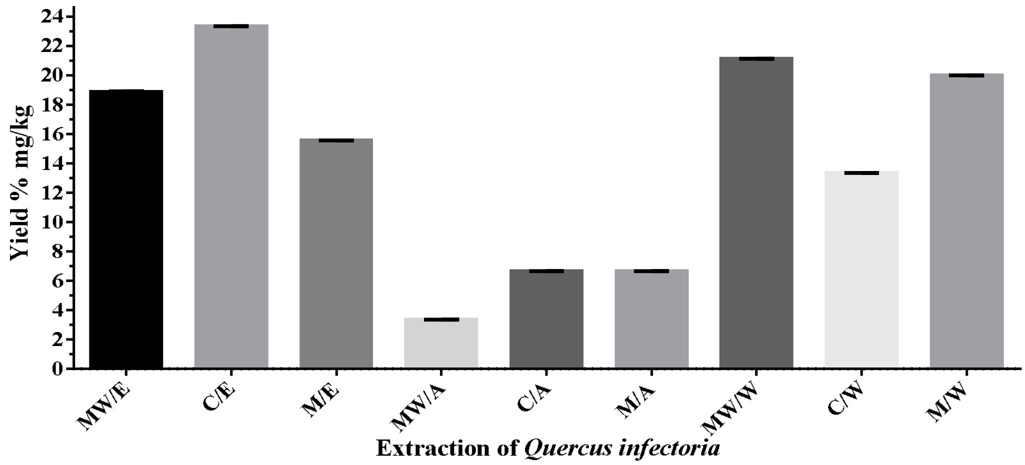

Figure 4.4. The percentage yield of *Quercus infectoria* Oliv. root extracts 14

4.1.5. Determination of extraction yield of *Quercus aegilops* L.

Three different methods such as microwave, conventional and maceration were used for yield determination of the *Quercus aegilops* L. root extracts with three solvents. The highest extraction yield was found in root extracts by water conventional method (CW5:19.1.%). The smallest extraction yield was found in root extracts by microwave acetonitrile (MWA5: 5.589 %) as shown in Table 4.5 and Figure 4.5.

Table 4.5. The percentage yield of *Quercus aegilops* L. root extracts 11

	MW/E	C/E	M/E	MW/A	C/A	M/A	MW/W	C/W	M/W
Mean	10.40	14.51	6.682	5.589	6.699	7.821	12.26	19.10	6.522
SD	0.8607	0.05941	0.02714	0.0274	0.04749	0.04766	0.04354	0.3791	0.08158
SE	0.3514	0.02426	0.01108	0.01118	0.01939	0.01946	0.01778	0.1548	0.0333

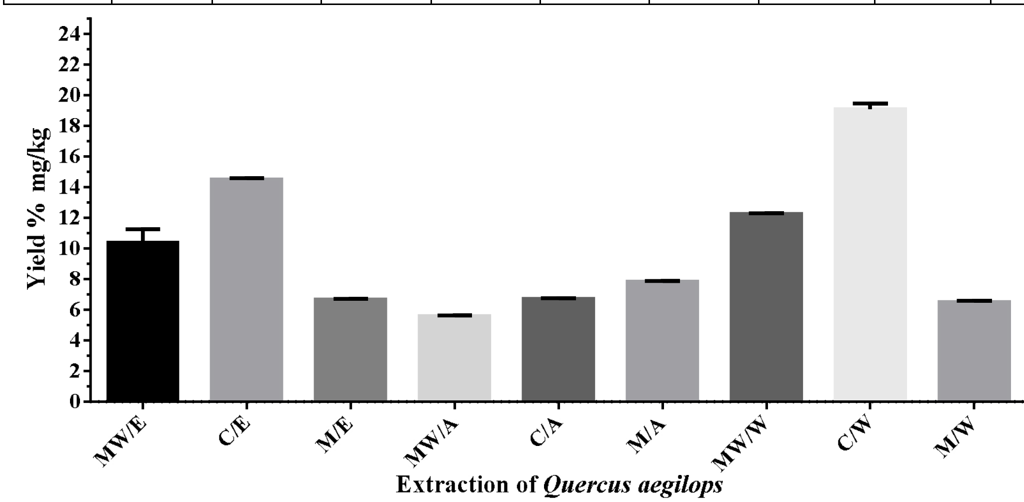

Figure 4.5. The percentage yield of *Quercus aegilops* L. root extracts 15

4.1.6. Determination of extraction yield of *Crataegus monogyna* Jacquin

The yield determinations in root extracts of *Crataegus monogyna* Jacquin by ethanol, acetonitrile and water solvents with three methods. A wide range of extraction yields were observed depending on the extraction methods and solvents. The lowest extraction yield was (MWA: 5.604%) in acetonitrile solvent by using microwave method, whereas the high amount of extraction yield was observed in distilled water solvent by using conventional method (12.06%) as shown in Table 4.6 and Figure 4.6.

Table 4.6. The percentage yield of *Crataegus monogyna* Jacquin root extracts 12

	MW/E	**C/E**	**M/E**	**MW/A**	**C/A**	**M/A**	**MW/W**	**C/W**	**M/W**
Mean	10.10	11.17	12.29	5.604	7.818	5.606	6.695	14.51	7.794
SD	0.08474	0.04934	0.1066	0.05713	0.04823	0.06052	0.0355	0.08462	0.05774
SE	0.0346	0.02014	0.04351	0.02332	0.01969	0.02471	0.0145	0.03455	0.02357

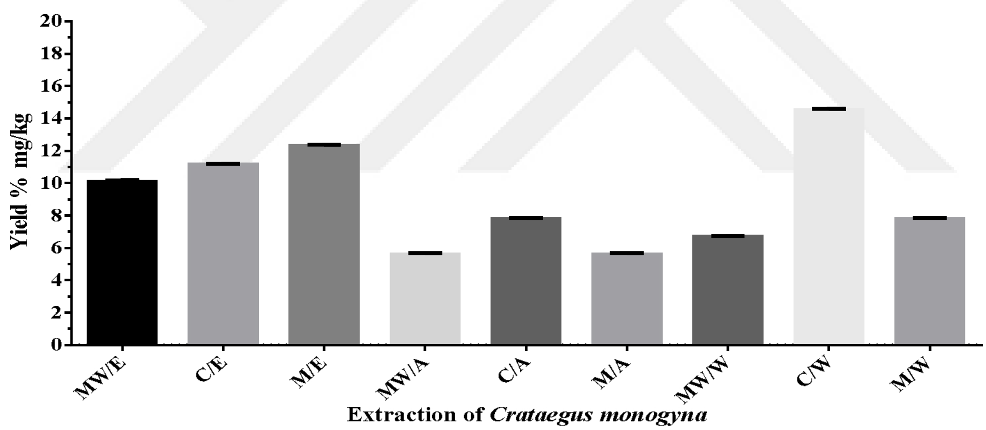

Figure 4.6. The percentage yield of *Crataegus monogyna* Jacquin 16

4.1.7. Determination of extraction yield of *Prunus argentea* (Lam.) Rehder

The highest yield percentages in root extract of *Prunus argentea* (Lam.) Rehder. was (MWE: 17.80%) by microwave method with ethanol solvent while, the minimum amount was (ME: 4.47%) by maceration method as shown in Table 4.7and Figure 4.7.

Table 4.7. The percentage yield of *Prunus argentea* (Lam.) Rehder root extracts 13

	MW/E	**C/E**	**M/E**	**MW/A**	**C/A**	**M/A**	**MW/W**	**C/W**	**M/W**
Mean	17.80	13.36	4.477	6.696	11.13	10.04	7.828	14.44	5.623
SD	0.03639	0.03887	0.04547	0.03891	0.04082	0.05523	0.03543	0.008366	0.03293
SE	0.01486	0.01587	0.01856	0.01589	0.01666	0.02255	0.01446	0.003416	0.01345

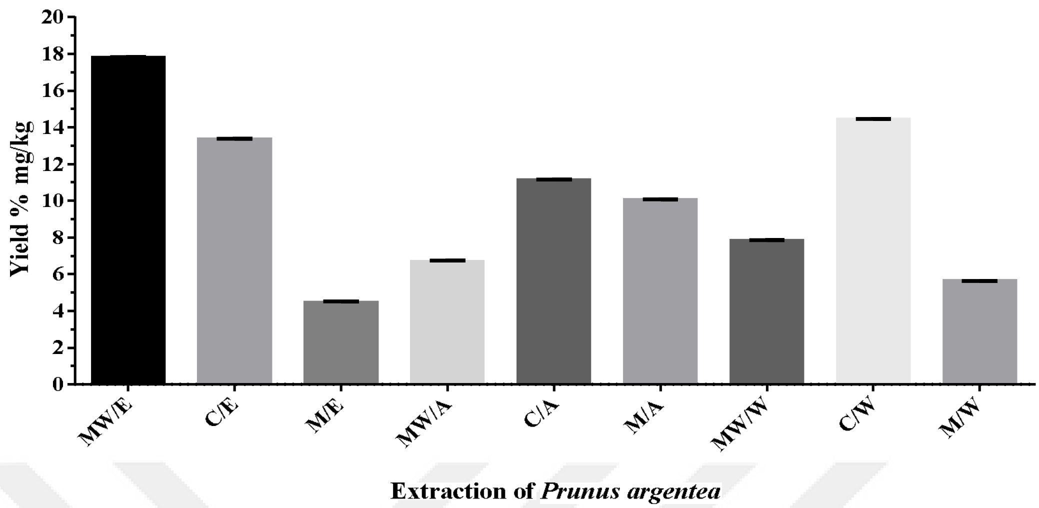

Figure 4.7. The percentage yield of *Prunus argentea* (Lam.) Rehder root extracts 17

4.1.8. Determination of extraction yield of *Crataegus azarolus* var. aronia L.

Extract yield in root part of *Crataegus azarolus* var. aronia L. was equipped by three different methods with usage of dissimilar solvents such as ethanol, acetonitrile and distilled water as shown in Table 4. And Figure 4.8.

Extraction yield (mass of extract/mass of dry matter) was utilized as a pointer for the influences of the extraction conditions. The maximum extract yield was (ME: 25.60 %) by maceration method with ethanol solvent. The minimum extract yield was (MW: 3.335 %) via maceration method with water solvent. Two maceration extracts (MWA; MWW) of acetonitrile and water solvent shows the same percentage was (15.59 %).

Table 4.8. The percentage yield of *Crataegus azarolus* var. aronia L. root extracts 14

	MW/E	C/E	M/E	MW/A	C/A	M/A	MW/W	C/W	M/W
Mean	14.47	23.38	25.6	15.59	22.26	14.51	15.59	6.689	5.599
SD	0.03229	0.05688	0.04885	0.04223	0.0416	0.07723	0.04245	0.02406	0.0459
SE	0.01318	0.02322	0.01994	0.01724	0.01698	0.03153	0.01733	0.009821	0.01874

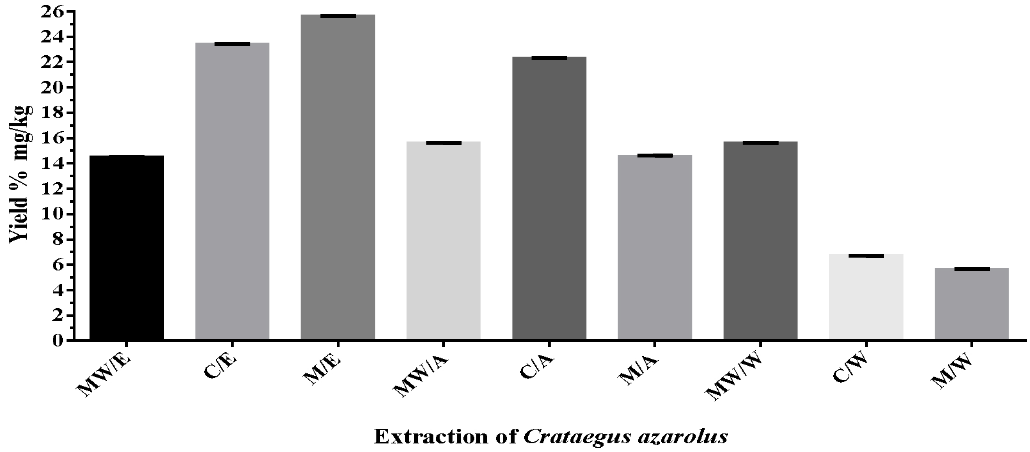

Figure 4.8. The percentage yield of *Crataegus azarolus* var. aronia L. root extracts 18

4.1.9. Determination of extraction yield of *Prunus microcarpa* C.A. Mey. (red fruit).

The highest extraction yield of the *Prunus microcarpa* C.A. Mey. (red fruit) root extract was exposed in acetonitrile solvent by conventional extraction methods (CA: 24.47%). The smallest yield percentage was (MWW: 4.477%) by microwave water extraction as shown in Table 4.9 and Figure 4.9.

Table 4.9. Extracts yield % determination of *Prunus microcarpa* C.A. Mey. (red fruit) root extracts 15

	MW/E	C/E	M/E	MW/A	C/A	M/A	MW/W	C/W	M/W
Mean	17.82	23.38	10.05	8.928	24.47	23.39	4.477	14.47	7.806
SD	0.05404	0.05549	0.05509	0.04917	0.03181	0.06079	0.0362	0.03486	0.02983
SE	0.02206	0.02266	0.02249	0.02007	0.01298	0.02482	0.0148	0.01423	0.01218

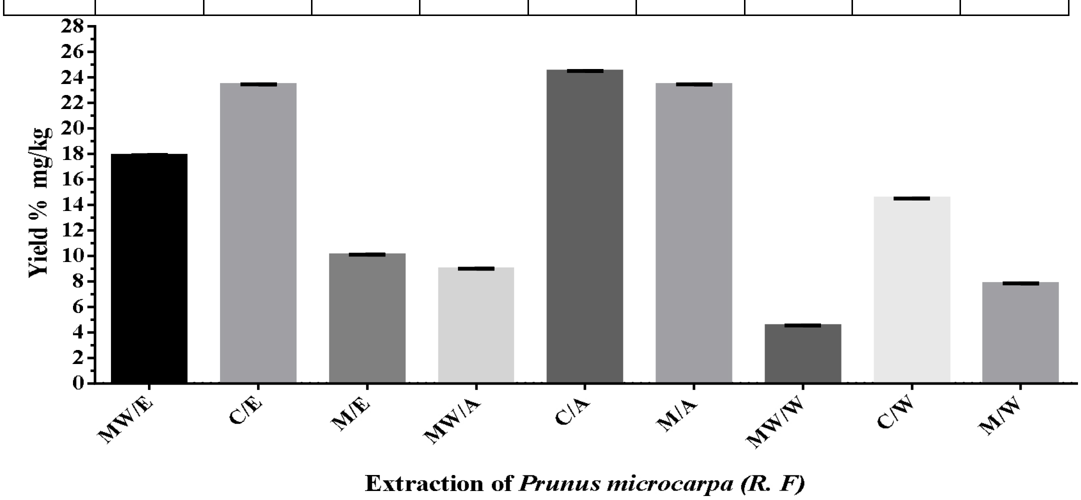

Figure 4.9. The percentage yield of *Prunus microcarpa* C.A. Mey. (red fruit) root extracts 19

4.1.10. Determination of extraction yield of *Rubus sanctus* Schreb

The yield determinations in root extracts of *Rubus sanctus* Schreb in ethanol, acetonitrile and distilled water are presented in Table 4.10 and Figure 4.10. The minimum extraction yield of *Rubus sanctus* Schreb roots was (CW: 5.601%) in acetonitrile by using microwave extraction, whereas the maximum extraction yield was observed in ethanol with the conventional method (CE: 28.76%).

Table 4.10. The percentage yield of *Rubus sanctus* Schreb root extracts 16

	MW/E	C/E	M/E	MW/A	C/A	M/A	MW/W	C/W	M/W
Mean	14.46	28.76	25.62	13.39	18.93	8.951	17.81	5.601	8.966
SD	0.04453	0.3733	0.07092	0.04774	0.0527	0.06884	0.04005	0.04739	0.0608
SE	0.01818	0.1524	0.02895	0.01949	0.02152	0.0281	0.01635	0.01935	0.0248

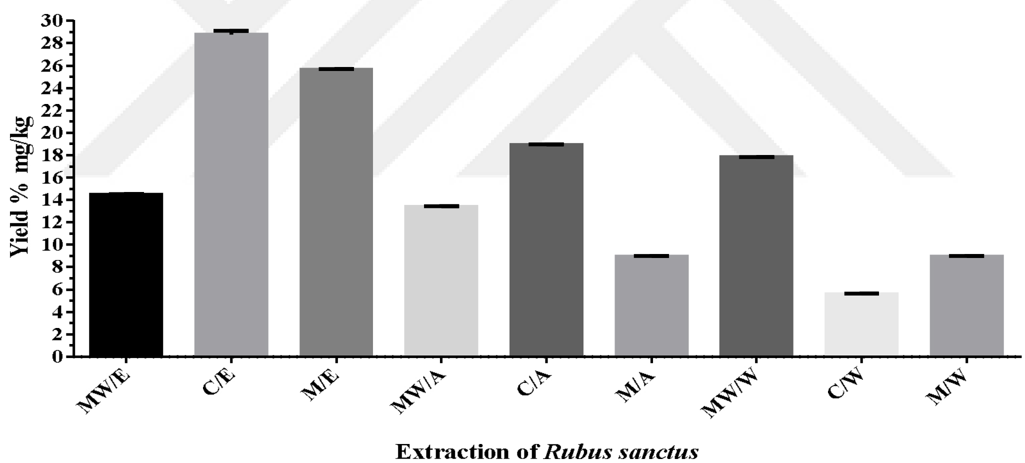

Figure 4.10. The percentage yield of *Rubus sanctus* Schreb root extracts 20

4.1.11. Determination of extraction yield of *Ficus carica* L.

The highest extraction yield in root extract of *Ficus carica* L. was found by ethanol microwave method (MWE:19.1%). The smallest extraction yield was observed for root extracts by maceration acetonitrile (MWA: 2.32%) as shown in Table 4.11and Figure 4.11.

Table 4.11. The percentage yield of *Ficus carica* L. root extracts 17

	MW/E	C/E	M/E	MW/A	C/A	M/A	MW/W	C/W	M/W
Mean	12.28	5.636	11.16	8.93	5.593	2.323	7.809	10.13	4.513
SD	0.04848	0.05519	0.05077	0.07318	0.04055	0.05989	0.05563	0.07688	0.0764
SE	0.01979	0.02253	0.02073	0.02988	0.01655	0.02445	0.02271	0.03138	0.0312

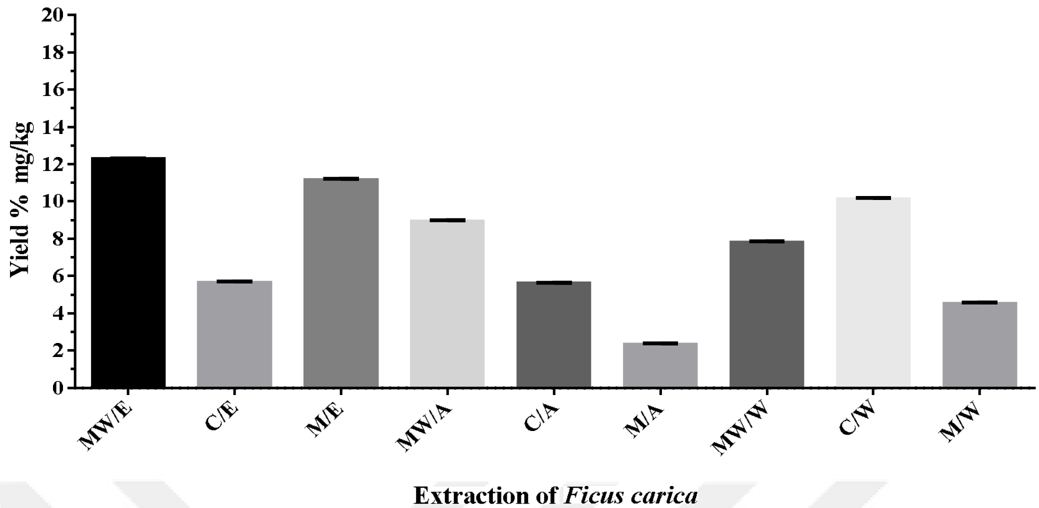

Figure 4.11. The percentage yield of *Ficus carica* L. root extracts 21

There are many researches on plant parts extraction yield, but no research has been conducted on root extract. These results are in agreement with Ho *et al.,*(2012) who studied on *Acer oliverianum* methanolic leaf extract yield was (10.5%). Chemical constitutions and extraction yields of red maple (*Acer rubrum* L.) crude extracts were (23.7 %). Generally, advanced yields have been obtained by warm water extraction from all tissues. Indeed, extraction yields with warm water are 2–3 times higher than those obtained by ethanol (Royer *et al.,* 2011). Likewise, maximum percentage extraction yield has been obtained for aqueous fraction (21.88 ± 2.56 %) followed by n-butanol, ethyl acetate and hexane fraction respectively. Ethyl acetate fraction of *Prunus domestica* has had the highest amount of polyphenol (33.88 ± 0.18 mg GAE/g), while the lowest has been observed in hexane fraction (6.28 ± 0.12 mg GAE/g) (Dhingra *et al.* 2014). The extraction yield of *Pyrus boissieriana* leaf extract was 21.6% Polyphenol (Khalilpour *et al.* 2013). The extract yield was 105 ±8.4 mg dry ethanolic extract/g dry weight of *Prunus mume* seeds (Xia *et al.,* 2011). The difference in the results of extraction yields might be as a result of the dissimilar availability of extractable components, resulting from the diverse chemical structure and the polarity of the solvents (Sultana *et al.,* 2009; Ozusaglam and Karakoca, 2013). Also, the effects of solvents polarity on extraction yield both qualitatively and quantitatively are confirmed by (Franco *et al.,* 2008; Qader *et al.,* 2011). This difference could be explained by a higher mass transfer due to the higher temperature of water extraction (Royer *et al.,* 2011). The variations in extract yields with different solvents might be explained by the polarity of extracted components and solvents applied (Hsu *et al.,* 2006; Shabir *et al.,* 2011).

4.2. Determination Total Condensed Tannin

Tannin was quantified by the *n*-butanol-HCl-iron method. The usage of this evaluation for measuring tannin has been quantitatively released from the sample through the evaluation. Commonly mimosa-tannin used as standard for *n*-butanol/HCl assay is under normal reaction/condition, which was calculated by using the regression equation ($y = 66.357_x + 0.4117$), got earlier from the linear calibration curve as shown in Figure 4.12. Comparison quantity of tannins found in all root plants species by percentage of tannin was determined, Calculation: % = A/3m, A = absorbance value, m = mass weight (Song *et al.,* 2017). In this study, tannin-content is diverse decidedly and significantly so that the result is expressed as absorbance unit at 580 nm_s per 1 mg of extract (A_{580}/mg). The lowest amount of total condensed tannin was (P 11: 0.7133 mg/kg) in root of *Ficus carica* L. while, the highest was (P 10: 32.34 mg/kg) in root of *Rubus sanctus*as Schreb as shown in Table 4.12 and Figure 4.13.

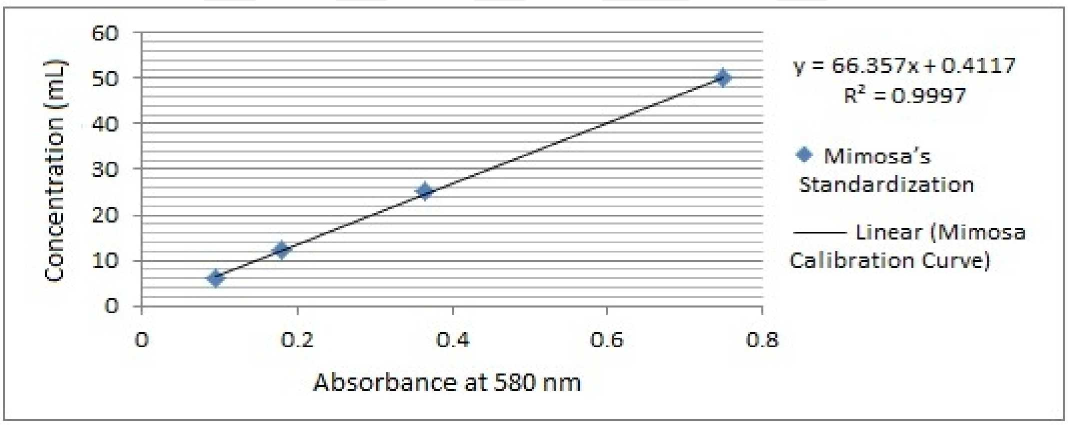

Figure 4.12. Mimosa tannin standard calibration curve 22

Table 4.12. The amount of total condensed tannin concentration in all root plants by acid-butanol method 18

	P 1	**P 2**	**P 3**	**P 4**	**P 5**	**P 6**	**P 7**	**P 8**	**P 9**	**P 10**	**P 11**
Mean mg/kg	3.788	6.993	15.87	1.258	1.392	5.233	12.5	14.55	19.7	32.34	0.7133
SD	0.15	0.12	0.09	0.05	0.05	0.10	0.05	0.07	0.07	0.05	0.10
SE	0.06	0.05	0.03	0.02	0.02	0.04	0.02	0.03	0.03	0.02	0.04

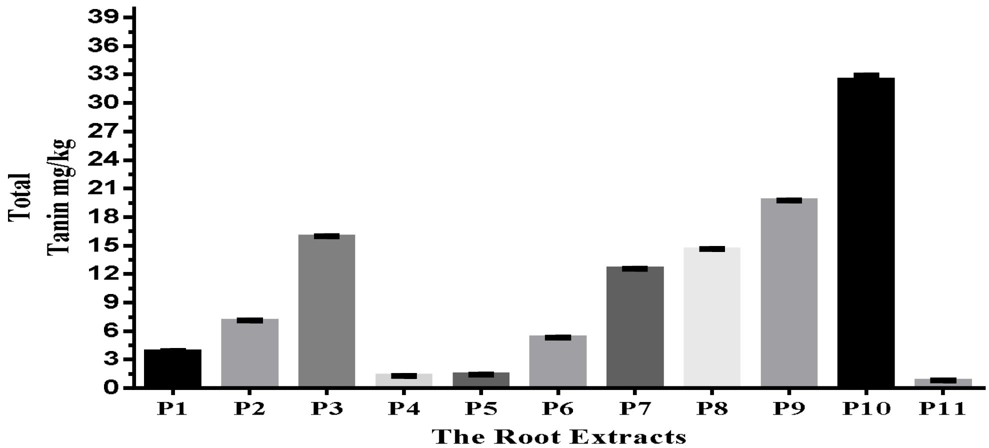

Figure 4.13. The amount of total condensed tannin concentration in all root plants 23

These results are agreed with the previous studies conducted on total condensed tannin contains in different parts and plant without roots. These results were agreed by Amarowicz and Pegg (2006) who evaluated the condensed tannin in three different parts of oak collected from Estonia; oak apple-gall (47.2%), oak nut-gall (81.4%) and oak bark (9.1%) and identified by using the standard procedures of classic $FeCl_3$ and Gelatin test methods. Many authors supported the presence of tannin in gall of *Quercus infectoria* by (Hassan, 2011; Hasmida *et al.,* 2014; Shrestha *et al.,* 2014; Baharuddin *et al.,* 2015; Vinha *et al.,* 2016). In addition, Ma *et al.,* (2012) reported high concentration of tannin in ethanol extract of *Pyrus pyrifolia* fruits. Many scientists intended to investigate the total tannin content in different plants on *Crataegus azarolus* leaves and flowers by Lakache *et al.,* (2016), on bark of *Acer rubrum* L. by Royer *et al.,* (2011), on leaves of *Acer truncatum* by Yang *et al.,* (2016), on dried fruit of *Ficus carica* L. by Debib *et al.,* (2014). Also, they were on fruit of *Prunus spinosa* L. by (Velickovic *et al.,* 2014) and on leaves and Branches of *Prunus cerasifera* by (Song *et al.* 2017).

4.3. Determine the antioxidant activity

In this study, the effect of free radicals scavenging ability has been determined through the DPPH assay because it has been one of most effective, reactive, reliable, simple and reproducible *in vitro* method for evaluating this important activity of a single compound as well as a plant extract (Hassan, 2011). The role of an antioxidant is removing free radicals (Wang, *et al.,* 2008).

4.3.1. Measurement of antioxidant activities of *Acer monspessulanum* L.

All the extraction tests of *Acer monspessulanum* L. root are highly, significantly effects of DPPH scavenging activity with compared to control (standard BHT). The highest DPPH scavenging activity value for root extracts with 0.1 mL was detected (M: 95.44%) by ethanol solvent with maceration method. The lowest value was (MW: 79.37%), which was obtained by using microwave extraction with ethanol solvent as shown in Table 4.13 and Figure 4.14.

Table 4.13. DPPH radical scavenging (%) of root extracts of *Acer monspessulanum* L. compared with the standard BHT 19

	MW 0.1ml	MW 0.2ml	MW 0.3ml	C 0.1ml	C 0.2ml	C 0.3ml	M 0.1ml	M 0.2ml	M 0.3ml	BHT 0.1ml	BHT 0.2ml	BHT 0.3ml
Mean %	79.37	88.85	86.70	87.82	92.29	88.96	95.44	82.95	86.22	65.39	65.11	71.97
SD	0.11	0.50	0.20	0.12	0.24	0.54	0.57	0.68	0.36	0.24	0.32	0.39
SE	0.05	0.20	0.08	0.05	0.10	0.22	0.23	0.28	0.15	0.10	0.13	0.16

Note: MW; microwave assisted; C: conventional; M: maceration; BHT: Butylated hydroxytoluene; SD: standard division; SE: standard error

Note: MW; microwave assisted; C: conventional; M: maceration; BHT: Butylated hydroxytoluene

Figure 4.14. DPPH radical scavenging (%) of root extracts of *Acer monspessulanum* L. compared with the standard BHT 24

Our study is agreement with several works about antioxidant activity of *Acer monspessulanum* L. tissue extracts have been used. It has been revealed that the ethanol extract has antioxidant activity 0.5 mg/mL; 94.62 ± 0.01, 1.0 mg/mL; 94.70 ± 0.01 and 2.5 mg/mL; 96.95 ± 0.03 (Ceylan *et al.,* 2016). On the other hand, many authors supported the presence of antioxidant in leaves of *Acer ginnala* Max by Han *et al.,* (2004), Similarly, in leaves of *Acer ginnala* var. aidzuense by Watanabe and Devkota, (2017), in leaves of *Acer ginnala* by Yong *et al.,* (2005) and in leaves and twigs of *Acer okamotoanum* (Jin *et al.,* 2007).

4.3.2. Measurement of antioxidant activities of *Prunus microcarpa* C.A. Mey. (Yellow fruit)

Table 4.14 and Figure 4.15 describes that total ethanol root extracts of *Prunus microcarpa* C.A. Mey. (Yellow fruit) has significant effects on DPPH scavenging activity with compared to control (standard BHT). The highest value with 0.1 mL was detected for the ethanol extract by maceration method (M: 97.74 %). While the lowest value was (MW: 78.58 %), which was obtained by using microwave extraction with ethanol.

Table 4.14. DPPH radical scavenging (%) of root extracts of *Prunus microcarpa* C.A. Mey. (Yellow fruit) compared with the standard BHT 20

	MW 0.1ml	MW 0.2ml	MW 0.3ml	C 0.1ml	C 0.2ml	C 0.3ml	M 0.1ml	M 0.2ml	M 0.3ml	BHT 0.1ml	BHT 0.2ml	BHT 0.3ml
Mean %	89.48	78.58	94.71	96.48	97.52	96.56	97.74	98.50	91.85	65.39	67.99	71.97
SD	0.29	0.15	0.52	0.14	0.07	0.19	0.35	0.32	0.47	0.24	0.31	0.39
SE	0.12	0.06	0.21	0.06	0.03	0.08	0.14	0.13	0.19	0.10	2.92	0.16

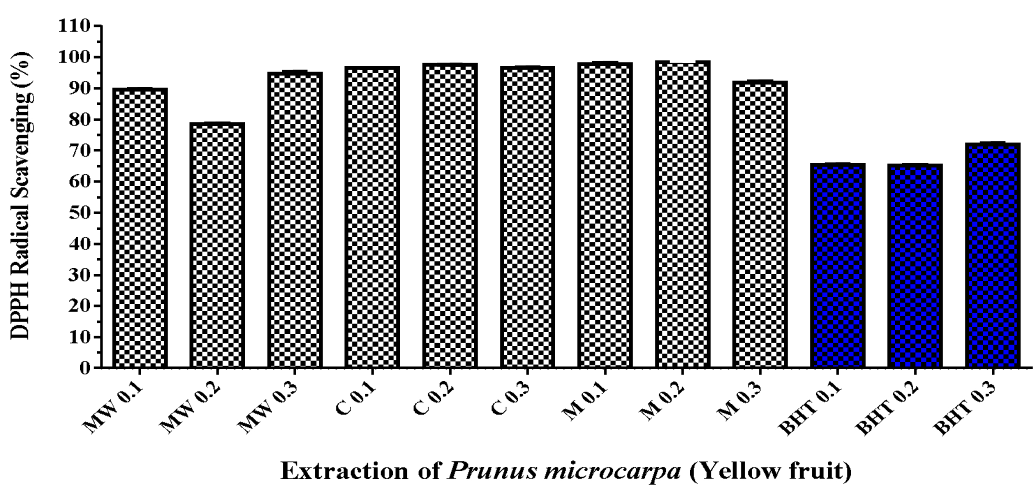

Figure 4.15. DPPH radical scavenging (%) of root extracts of *Prunus microcarpa* C.A. Mey. (Yellow fruit) compared with the standard BHT 25

The results and presences of these antioxidant are in agreement with other studies by Usenik *et al.,* (2008) was found the antioxidant activity ranged from 8.0 to 17.2 mg ascorbic acid equivalent antioxidant capacity mg/100 g fresh weight of sweet cherry *Prunus avium* L. Likewise, the DPPH scavenging activity of methanolic extracts fruit of

Blackthorn *Prunus spinosa* L. expressed in terms of SC_{50}, was 1.573± 0.025 mg/ml (Aliyazicioglu *et al.,* 2015). Similarly, many authors supported the presence of antioxidant in stems, flowers, leaves and seeds of *Prunus* spp. by (Jo *et al.,* 2006; Ahn *et al.,* 2009; Xia *et al.,* 2011; Olszewska and Kwapisz, 2011; Prvulović *et al.,* 2011; Dhingra *et al.,* 2014; Malsawmtluangi *et al.,* 2014; Liu *et al.,* 2014; Pinacho *et al.,* 2015; Blando *et al.,* 2016; Powar and Gaikwad, 2017; Song *et al.,* 2017).

4.3.3. Measurement of antioxidant activities of *Pyrus syriaca* Boiss.

The maximum value at 0.3 mL DPPH free radical scavenging activity of *Pyrus syriaca* Boiss. was observed from the conventional ethanol extract (C: 86.35 %). The minimum value at 0.2 mLwas (MW: 75.77%), which was obtained by using maceration ethanol extract. All results statistically significant compared with control (standard BHT) as shown in Table 4.15 and Figure 4.16.

Table 4.15. DPPH radical scavenging (%) of root extracts of *Pyrus syriaca* Boiss. compared with the standard BHT 21

	MW 0.1ml	**MW 0.2ml**	**MW 0.3ml**	**C 0.1ml**	**C 0.2ml**	**C 0.3ml**	**M 0.1ml**	**M 0.2ml**	**M 0.3ml**	**BHT 0.1ml**	**BHT 0.2ml**	**BHT 0.3ml**
Mean%	83.68	87.71	81.02	86.28	85.42	86.35	82.53	75.77	79.45	65.39	65.10	71.97
SD	0.43	0.35	2.24	0.43	0.14	0.26	0.15	0.42	0.33	0.24	0.31	0.39
SE	0.18	0.14	0.91	0.17	0.06	0.11	0.06	0.17	0.13	0.10	0.13	0.16

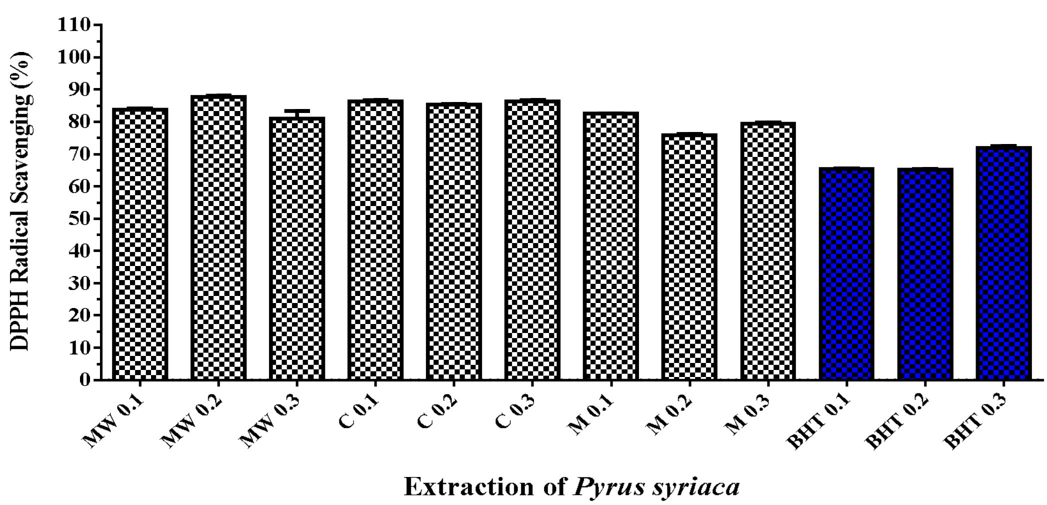

Figure 4.16. DPPH radical scavenging (%) of root extracts of *Pyrus syriaca* Boiss. compared with the standard BHT 26

These results are in agreement with the study by Liaudanskas *et al.,*(2017) the strongest antioxidant activity has been detected in pear extracts of the "Grabova" cultivar (resp., 36.86 ± 0.59 and 58.75 ± 2.23 µmol/g). The ABTS method shows that the highest DPPH and FRAP values (2027.9 and 3539.6 lmol TE/100 g DM, respectively in different anatomical parts of *Pyrus communis* L. (Kolniak-Ostek, 2016). Also, several studies published by many different specialist scientists supported that the presence of antioxidant in fruit of *Pyrus* spp. by (Ma *et al.,* 2012; Chinnasamy and bhargava, 2014; Dwivedi and Prakash, 2015).

4.3.4. Measurement of antioxidant activities of *Quercus infectoria* Oliv.

The results of antioxidant activity of *Quercus infectoria* Oliv. is presented in Table 4.16 and Figure 4.17. The results are displayed according to root parts of the plant with ethanol and three extraction methods. The highest scavenging activity microwave 0.1 mL was (MW: 99.60 %). While the minimum amount conventional at 0.2 mL concertation was (C: 85.13). The antioxidant of root extracts has high amount than controls: BHT (synthetic antioxidant as a positive control) under the same conditions.

Table 4.16. DPPH radical scavenging (%) of root extracts of Quercus infectoria Oliv. compared with the standard BHT 22

	MW 0.1ml	MW 0.2ml	MW 0.3ml	C 0.1ml	C 0.2ml	C 0.3ml	M 0.1ml	M 0.2ml	M 0.3ml	BHT 0.1ml	BHT 0.2ml	BHT 0.3ml
Mean %	99.60±	99.57	96.35	99.57	85.13	93.84	98.34	99.04	91.07	65.39	65.10	71.97
SD	0.14	0.19	0.22	0.17	0.50	0.41	0.21	0.42	0.56	0.24	0.31	0.39
SE	0.06	0.08	0.09	0.07	0.20	0.17	0.09	0.17	0.23	0.10	0.13	0.16

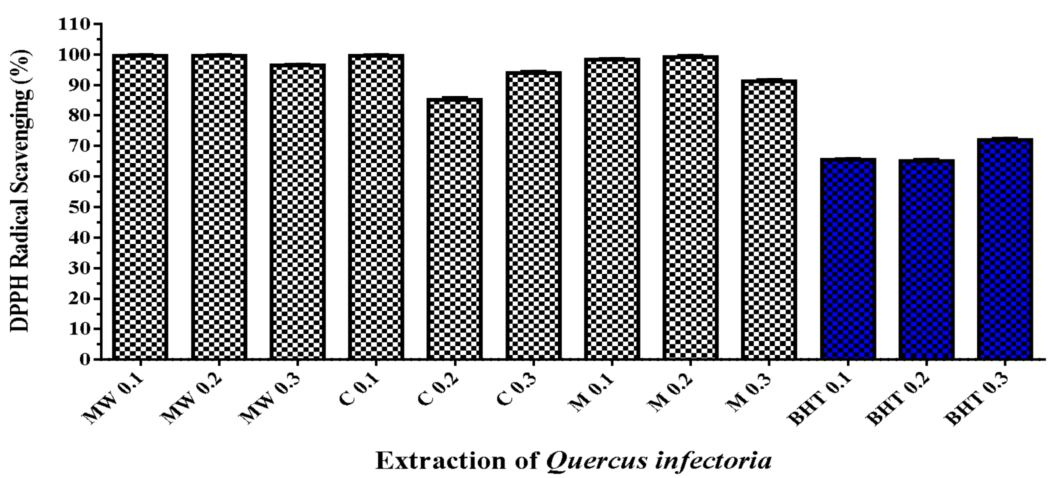

Figure 4.17. DPPH radical scavenging (%) of root extracts of Quercus infectoria Oliv. compared with the standard BHT 27

The present finding is similar to the results that observed by Salleh *et al.,* (2014) who showed that the extracts of *Q. infectoria* was obtained (96.97 %) at the same condition gave higher activity (%) than BHT (95.24 %). In addition, the gall aqueous extract of *Q. infectoria* gives the highest antioxidant activity nearly 94.55% (Nur Syukriah *et al.,* 2014). Also, the IC_{50} values for extract and BHT were 30.78 mg/mL and 31.50 mg/mL, respectively of Oak *Q. infectoria* fruit (Kheirandish *et al.,* 2016).

4.3.5. Measurement of antioxidant activities of *Quercus aegilops* L.

DPPH free radicals scavenging activity in Table 4.17 and Figure 4.18 presents that microwave ethanol extract 0.2 mL was (MW: 99.57%) gives the highest DPPH free radicals scavenging activity. Conversely, the minimum of DPPH free radicals scavenging activity by maceration at concentration 0.3 mL was (M: 92.60%). The current information's antioxidant extracts are better than controls result BHT (synthetic antioxidant as a positive control).

Table 4.17. DPPH radical scavenging (%) of root extracts of *Quercus aegilops* L. compared with the standard BHT 23

	MW 0.1ml	**MW 0.2ml**	**MW 0.3ml**	**C 0.1ml**	**C 0.2ml**	**C 0.3ml**	**M 0.1ml**	**M 0.2ml**	**M 0.3ml**	**BHT 0.1ml**	**BHT 0.2ml**	**BHT 0.3ml**
Mean %	99.28	99.57	96.67	99.40	99.04	98.34	98.67	99.04	91.73	65.39	65.10	71.97
SD	0.74	0.19	0.92	0.44	0.42	0.21	0.43	0.42	0.45	0.24	0.31	0.39
SE	0.30	0.08	0.37	0.18	0.17	0.09	0.18	0.17	0.18	0.10	0.13	0.16

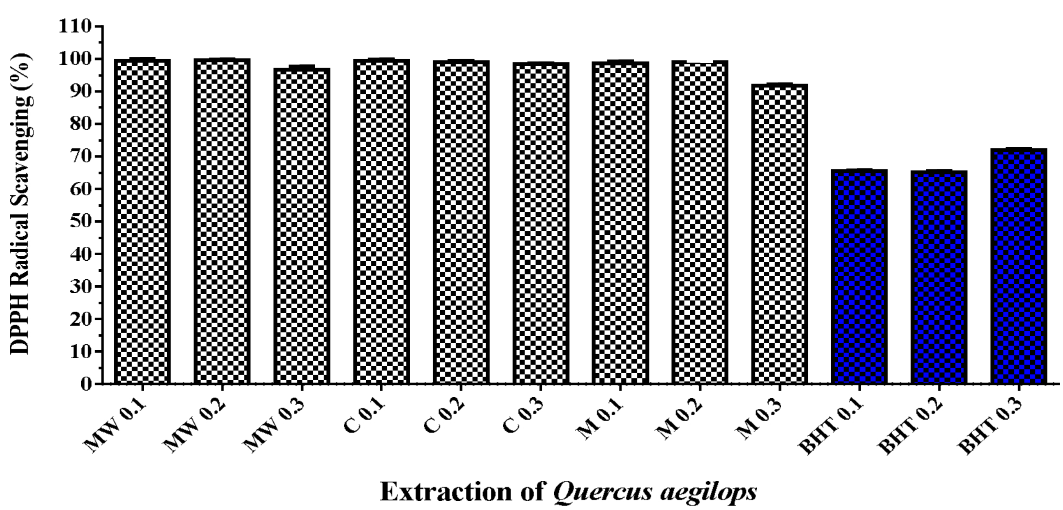

Figure 4.18. DPPH radical scavenging (%) of root extracts of *Quercus aegilops* L. compared with the standard BHT 28

These results were agreed with the previous literature by Nur Syukriah *et al.,* (2014) who evaluated the antioxidant activity of *Quercus aegilops* L. galls extracts by using different types of solvents did not gave a significant differences towards the scavenging of free radicals. Also, Salleh *et al.,*(2014) reported that the extracts of *Q. infectoria* has been obtained (96.97 %) at the same condition gave higher activity (%) than BHT (95.24 %). Likewise, many authors determined the antioxidant activity in acorn fruit oils, leaf and bark extracted of *Quercus* species by (Al-Rousan *et al.,* 2013; Baharum *et al.,* 2014; Vinha *et al.,* 2016).

4.3.6. Measurement of antioxidant activities of *Crataegus monogyna* Jacquin

The antioxidant activity in ethanolic extract of *Crataegus monogyna* Jacquin by using DPPH assay method shows appreciable activity, comparable to standard BHT. The antioxidant capacity for each extract at three concentrations 0.1, 0.2 and 0.3 mL was shown below. The maximum of antioxidant activities at the concentration 0.3 mL was (MW: 99.54 %) by microwave method and the smallest at the concentration 0.3 mL by maceration method was (M: 87.19%) as shown in Table 4.18 and Figure 4.19.

Table 4.18. DPPH radical scavenging (%) of root extracts of *Crataegus monogyna* Jacquin compared with the standard BHT 24

	MW 0.1ml	**MW 0.2ml**	**MW 0.3ml**	**C 0.1ml**	**C 0.2ml**	**C 0.3ml**	**M 0.1ml**	**M 0.2ml**	**M 0.3ml**	**BHT 0.1ml**	**BHT 0.2ml**	**BHT 0.3ml**
Mean %	86.57	94.58	99.52	91.72	91.23	90.13	87.48	94.85	87.19	65.39	65.10	71.97
SD	0.12	0.12	0.16	0.46	1.03	0.13	0.11	0.30	0.27	0.24	0.31	0.39
SE	0.05	0.05	0.06	0.19	0.42	0.05	0.05	0.12	0.11	0.10	0.13	0.16

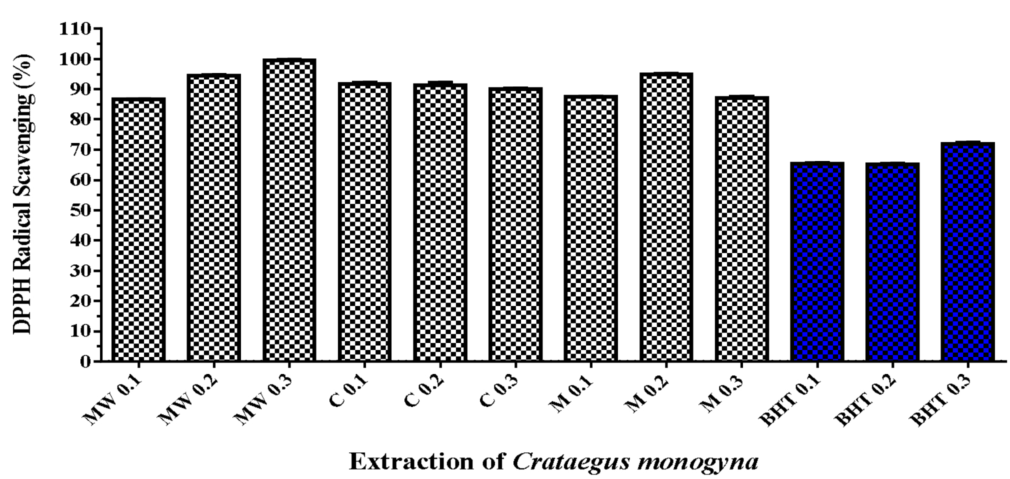

Figure 4.19. DPPH radical scavenging (%) of root extracts of *Crataegus monogyna* Jacquin compared with the standard BHT 29

These results are in agreement with investigated by Djeddi and Boutaleb, (2015), showed that the antioxidant activity of the methanol extract has been studied in vitro by utilizing the DPPH technique. The results present that the tested extract of the plant can perform as a high radical scavenger reaching 95.88%. Similarly, the phenolic extracts prepared from leaf, fruit, and syrup of *C. monogyna* extracts was contains a high antioxidant (Nabavi *et al.,* 2015). The confirmative studies have been presented by various studies on the antioxidant capacities in callus extracts of *Crataegus monogyna* (Hawthorn) by (Bahorun *et al.,* 2003), in the fruit of Hawthorn (*Crataegus oxyacantha* L.) showed that the high antioxidant activity with DPPH radical transformation value as high as 89.9 % in the methanol-water (50/50, v/v%) extract (Kostić *et al.,* 2012).

4.3.7. Measurement of antioxidant activities of *Prunus argentea* (Lam.) Rehder

All extraction test of *Prunus argentea* (Lam.) Rehder root produces significant effects of DPPH scavenging activity compared to control (standard BHT). The highest value with 0.2 mL was detected by microwave method (MA: 94.53%). On the other hand, the lowest value was (M: 84.44%), which has been obtained by using maceration at 0.3mL concentration as shown in Table 4.19 and Figure 4.20.

Table 4.19. DPPH radical scavenging (%) of root extracts of *Prunus argentea* (Lam.) Rehder. compared with the standard BHT 25

	MW 0.1ml	MW 0.2ml	MW 0.3ml	C 0.1ml	C 0.2ml	C 0.3ml	M 0.1ml	M 0.2ml	M 0.3ml	BHT 0.1ml	BHT 0.2ml	BHT 0.3ml
Mean %	88.19	94.53	94.40	91.90	93.30	92.33	92.47	93.38	84.44	65.39	65.10	71.97
SD	1.01	0.33	0.17	0.56	0.21	0.15	0.41	0.17	0.21	0.24	0.31	0.39
SE	0.41	0.14	0.07	0.23	0.08	0.06	0.17	0.07	0.09	0.10	0.13	0.16

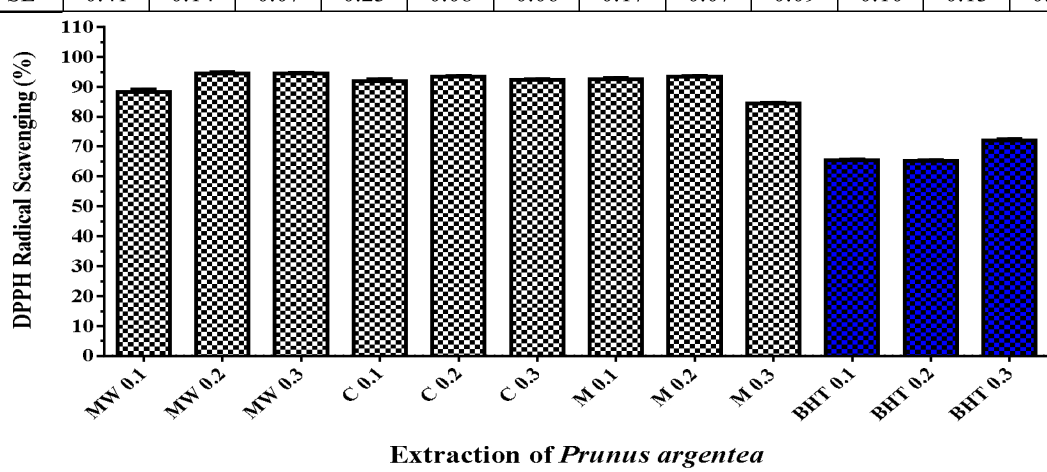

Figure 4.20. DPPH radical scavenging (%) of root extracts of *Prunus argentea* (Lam.) Rehder compared with the standard BHT 30

These results are agreement with some other studies by Pinelo *et al.,* (2004) reported the highest values for the DPPH were associated to ethanolic extracts of the dried sample which presented statistically significant differences. Also, Najafabad and Jamei (2014) intended to investigate the antioxidant in ethanol extract of in hulls of *Prunus amygdalus* were lignocellulosic residues that contain antioxidant compounds. Likewise, other studies on *Prunus africana* in stem bark by (Nyamai, *et al.,* 2015).

4.3.8. Measurement of antioxidant activities of *Crataegus azarolus* var. aronia L.

The highest content of dried root was recorded in 0.1 mL concentration extract (M: 92.62%) by maceration method, and the lowest was noted in the microwave method with 0.2 mL concentration extract (MW: 81.73%) as shown in Table 4.20 and Figure 4.21.

Table4.20. DPPH radical scavenging (%) in root extracts of *Crataegus azarolus* var. aronia L. compared with the standard BHT 26

	MW 0.1ml	**MW 0.2ml**	**MW 0.3ml**	**C 0.1ml**	**C 0.2ml**	**C 0.3ml**	**M 0.1ml**	**M 0.2ml**	**M 0.3ml**	**BHT 0.1ml**	**BHT 0.2ml**	**BHT 0.3ml**
Mean %	90.03	81.73	82.49	91.65	86.96	83.47	92.62	88.19	87.65	65.39	65.10	71.97
SD	0.25	0.24	0.29	0.52	0.58	0.32	0.12	1.01	0.45	0.24	0.31	0.39
SE	0.10	0.10	0.12	0.21	0.24	0.13	0.05	0.41	0.19	0.10	0.13	0.16

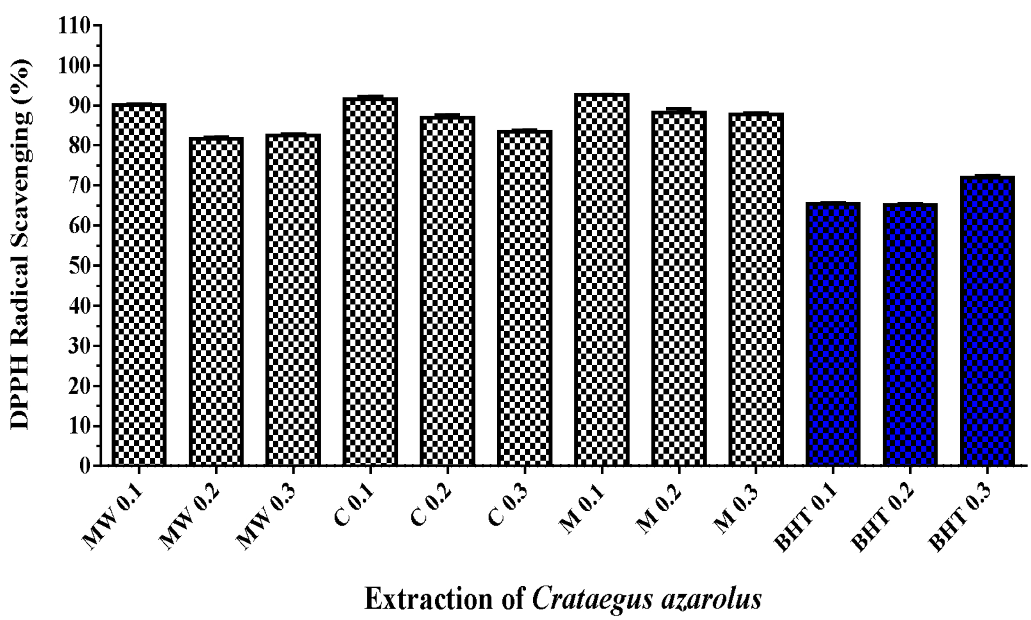

Figure 4.21. DPPH radical scavenging (%) of root extracts of *Crataegus azarolus* var. aronia L. compared with the standard BHT 31

These results are in agreement with study produced by Hamahameen and Jamal, (2013) on leaves of Hawthorn (*Crataegus azarolus*). Indeed, Bahri-Sahloul *et al.,* (2014) worked to determine the content of the antioxidant capacity were value (3326.02 ±1.17µmole/100g DW of $TEAC_{DPPH}$ and 6741±1.14µmole/100g DW of $TEAC_{ABTS}$) in leaves of Hawthorn (*Crataegus azarolus*). Similarly, the free DPPH radicals scavenging ability of (*Crataegus azarolus* L.) in leaves and fruit pulp/peel polyphenolic aqueous-acetone extract. The greatest antioxidant effects have been observed with the extracts of leaves (89.07% of inhibition), followed by those of fruit peel (70.66% of inhibition), then fruit pulp extracts (38.92% of inhibition) (Belkhir *et al.,* 2013). On the other hand, many investigators supported the presence of antioxidant in different parts Hawthorn (*Crataegus azarolus*) by (Rakotoarison *et al.,* 1997; Zhang *et al.,* 200; Mustapha *et al.,* 2014).

4.3.9. Measurement of antioxidant activities of *Prunus microcarpa* C.A. Mey. (Red Fruit)

In our study on antioxidant activity of *Prunus microcarpa* C.A. Mey. (Red Fruit) displayed in Table 4.21 and Figure 4.22, the antioxidant activity in ethanolic extract by using DPPH assay method showed considerable activity compared to standard BHT.

In the present study, the highest amount of antioxidant activity at the concentration 0.2 mL was (MW: 98.40 %) by microwave method and the lowest at the concentration 0.1 mL by microwave method was (MW: 88.24%).

Table 4.21. DPPH radical scavenging (%) of root extracts of *Prunus microcarpa* C.A. Mey. (Red Fruit) compared with the standard BHT 27

	MW 0.1ml	**MW 0.2ml**	**MW 0.3ml**	**C 0.1ml**	**C 0.2ml**	**C 0.3ml**	**M 0.1ml**	**M 0.2ml**	**M 0.3ml**	**BHT 0.1ml**	**BHT 0.2ml**	**BHT 0.3ml**
Mean %	88.24	98.40	94.45	95.78	96.38	95.04	96.51	93.47	92.29	65.39	65.10	71.97
SD	1.05	0.26	0.18	0.14	0.45	0.43	0.24	0.31	0.38	0.24	0.31	0.39
SE	0.43	0.11	0.07	0.06	0.18	0.18	0.10	0.13	0.16	0.10	0.13	0.16

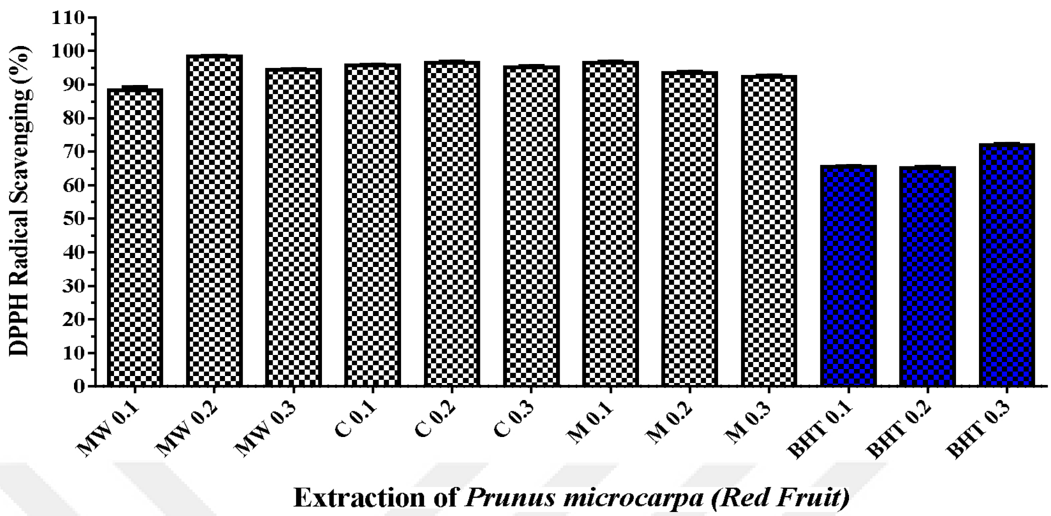

Figure 4.22. DPPH radical scavenging (%) of root extracts of *Prunus microcarpa* C.A. Mey. (Red Fruit) compared with the standard BHT 32

These results are in agreement with many results reported by several researchers concerning *Prunus* spp. The seeds of *Prunus tomentosa* extract show moderate DPPH radical scavenging activities with IC50 values 59.5 ± 3.5 µM, respectively, whereas the other compounds (IC50 > 100 µM) do not display significant DPPH radical scavenging activity (Liu *et al.,* 2014). Indeed, the largest antioxidant response peaks of *Prunus salicina* Lindl in fruit part (Venter *et al.,* 2013). Certainly, the n-hexane extract of *Prunus domestica* shoots has been analyzed by GC and GC–MS. It has been a good antioxidant DPPH radical scavenging activity (Mahmood *et al.,* 2009). Also, the antioxidant activity of apricot has been studied extensively and the plant displayed a high antioxidant effect in both in vitro and in vivo test systems (Yiğit *et al.,* 2009).

4.3.10. Measurement of antioxidant activities of *Rubus sanctus* Schreb

The results are given conferring to root parts of the plant three extraction ways. The root of *Rubus sanctus* extract indicates a DPPH radical scavenging activity. The highest scavenging activity of *Rubus sanctus* Schreb root extract by maceration method at concentration 0.1 mL was (M: 95.84 %). Meanwhile, the minimum amount by maceration method at concentration 0.3 mL was (C: 72.52%). The present data indicated that all exrtracts caused significant effect on antioxidant activities in compare to controls: BHT (synthetic antioxidant as a positive control) under the same conditions was obtainable in Table 4.22 and Figure 4.23.

Table 4.22. DPPH radical scavenging (%) of root extracts of *Rubus sanctus* Schreb compared with the standard BHT 28

	MW 0.1ml	**MW 0.2ml**	**MW 0.3ml**	**C 0.1ml**	**C 0.2ml**	**C 0.3ml**	**M 0.1ml**	**M 0.2ml**	**M 0.3ml**	**BHT 0.1ml**	**BHT 0.2ml**	**BHT 0.3ml**
Mean %	93.55	86.88	81.28	94.98	83.50	80.29	95.84	82.98	72.52	65.39	65.10	71.97
SD	0.49	0.17	0.40	0.88	0.51	0.48	0.88	0.51	0.67	0.24	0.31	0.39
SE	0.20	0.07	0.16	0.36	0.21	0.19	0.36	0.21	0.27	0.10	0.13	0.16

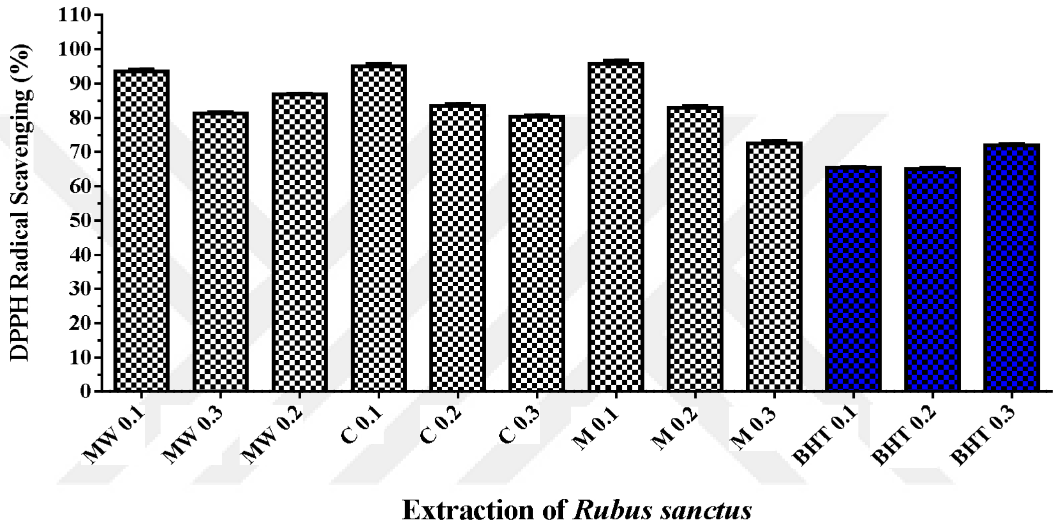

Figure 4.23. DPPH radical scavenging (%) of root extracts of *Rubus sanctus* Schreb compared with the standard BHT 33

These results are in agreement with various reported outlined by different schools of research. Our results is similar to the results observed by Martini *et al.,* (2009) who evaluated the antioxidant capacity in blackberry leaves of *Rubus ulmifolius* extract was mainly due to ellagic acid and gallic acid, which were presented in high concentrations. Furthermore, the antioxidant activity in the fruit of *Rubus glaucus* extract determined (Trolox equivalents) TE/100 g FW using the ABTS+ and FRAP assays was 2.01± 0.12 and 4.50± 1.22, respectively (Garzón *et al.,* 2009). Likewise, various phytochemical constituents in the fruit of *Rubus idaeus* L. exhibit a wide range of biological effects such as including antioxidant activities (Velićanski *et al.,* 2012).

4.3.11. Measurement of antioxidant activities of *Ficus carica* L.

The findings are shown in Table 4.23 and Figure 4.24. The results show that there is a considerable diversity of the capacity to scavenge free radicals depending on the variety of method extraction. It was showed that maceration ethanol extract at concentration at 0.3

mL was (M: 89.80%) provides the highest DPPH scavenging activity. Equally, the minimum of free radicals scavenging was by microwave method at 0.2 mL (MW: 69.08%). The extracts of present information are better antioxidants than the controls: BHT (synthetic antioxidant as a positive control).

Table 4.23. DPPH radical scavenging (%) of root extracts of *Ficus carica* L. compared with the standard BHT 29

	MW 0.1ml	**MW 0.2ml**	**MW 0.3ml**	**C 0.1ml**	**C 0.2ml**	**C 0.3ml**	**M 0.1ml**	**M 0.2ml**	**M 0.3ml**	**BHT 0.1ml**	**BHT 0.2ml**	**BHT 0.3ml**
Mean %	75.05	69.08	87.65	81.39	88.37	82.68	82.41	85.98	89.80	65.39	65.10	71.97
SD	0.54	0.61	0.37	0.43	0.29	0.23	0.23	0.34	0.37	0.24	0.31	0.39
SE	0.22	0.25	0.15	0.18	0.12	0.09	0.09	0.14	0.15	0.10	0.13	0.16

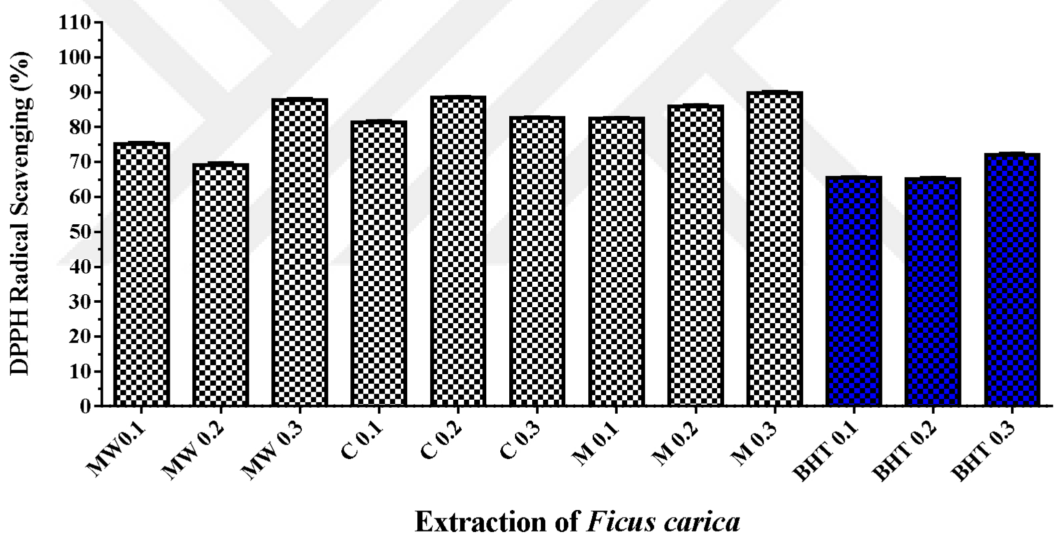

Figure 4.24. DPPH radical scavenging (%) of root extracts of *Ficus carica* L. compared with the standard BHT 34

These results are in agreement with study by Debib *et al.,*(2014) the methanolic extract of this variety exhibits the highest antioxidant properties among the tested extracts with IC50 of 0.08 mg/mL and comparable with that of the reference sub- stance (ascorbic acid) with IC50 of 0.068 mg/mL. The aqueous extract showed that a noticeable antioxidant activity with IC50 of 0.11 mg/mL. Also, antioxidant capacity correlated well with the amounts of polyphenols and anthocyanins (R 2= 0.985 and 0.992, respectively) and other species of *Ficus microcarpa* L. (Solomon *et al.* 2006). Indeed, the antioxidant capacity vary from 358 µmol/100 g of FW for Mission to 21 µmol/100 g of FW for Kadota in fresh fruits of *Ficus carica* L. (Ao *et al.,* 2008; Debib *et al.,* 2014).

The DPPH free radical scavenging power of the total extracts studied here were higher than that of BHT, which indicates a powerful free radical scavenging activity of the plant. Actually, Andarwulan *et al.,*(1999) have been found a parallel increase in phenol content and antioxidant activity (Fathabad *et al.,* 2015). The mechanism of radical scavenging activity could be due to the presence of polyphenolic compounds. Polyphenolic compounds are considered as responsible for radical scavenging activity, due to the ability of their hydrogen atom donation to active free radicals (Thomas *et al.,*1994; Ho *et al.,*1994 Peter, 2000; Cantín *et al.,* 2009). However, comparison or judgement could not be made because the samples measured in the studies reported on the correlation between total phenolic content and antioxidant activity are different to that of traditional vegetables used in the present study (Puupponen-Pimiä *et al.,* 2001). Nevertheless, there are reports with the low association between radical scavenging capacity and total phenolic contents. The high free radical scavenging capacity of the wild plants might be attributed not only to phenolic composition, but also to the presence of other bioactive compounds, such as vitamins (ascorbic acid, tocopherols) and pigments (anthocyanins), as well as the structural interaction among these compounds (Yu *et al.,* 2002). Also, flavonoids have been knowen to reduce oxidative stress in biological systems due to their antioxidant capacities (Kim *et al.,* 2005; Cuyckens and Claeys, 2005).

4.4. Identification and quantitative analysis of phytochemical compounds in the root extracts by LC-MS/MS.

In recent literature, there are several studies about LC-MS/MS-based quantitative analysis (Cavaliere *et al.,* 2005; Ertas *et al.,* 2014). In addition, numerous studies have been provided the evidence for the fundamental role of phenolic glycosides with the interactions of plant species family against their natural herbivore enemies. Hence, an accurate LC-MS/MS method was used the analysis of 27 compounds in quantitative purpose. An accurate method on a mass spectrometer equipped by a triple quadrupole analyzer was developed for the analyses of twenty-four phenolic compounds (10 flavonoid aglycones, 3 flavonoid glycosides, 9 phenolic acids, 1 phenolic aldehyde and coumarin) and three non-phenolic organic acids in the root extracts. Ethanol, acetonitrile and distilled water solvents were used in three different methods by using microwave, conventional and maceration, respectively. In the present study, negative ionization modes were used for analyzing compounds. The LOD/LOQ techniques were used for phenolic compounds and the quantified results for all plant extraction. These compounds were monitored by the transition from the specific de-protonated molecular ions [M-H+] to the corresponding fragment ions [M-H+-X]. The molecular ions and fragments have been observed in MS/MS based on the collision energies for these fragments and the quantified results. Furthermore, the LC-MS/MS chromatograms for 27 of phenolic reference compounds have been used for calibration and validation as shown in Tables 4.24 and Figure 4.25.

Table 4.24. Analytical parameters of the LC-MS/MS method 30

No	Analytes	RT[a]	Parent ion (m/z)[b]	Ionization Mode	R^{2c}	RSD%[d]	Linearity Range (mg/L)	LOD/LOQ (µg/L)[e]	Recovery (%)	U[f]
1	Quinic acid	3.32	190.95	Neg	0.993	0.0388	250-10000	22.3 / 74.5	103.3	5
2	Malic acid	3.54	133.05	Neg	0.998	0.1214	250-10000	19.2 / 64.1	101.4	5
3	tr-Aconitic acid	4.13	172.85	Neg	0.993	0.3908	250-10000	15.6 / 51.9	102.8	5
4	Gallic acid	4.29	169.05	Neg	0.99	0.4734	25-1000	4.8 / 15.9	102.3	5
5	Chlorogenic acid	5.43	353	Neg	0.993	0.1882	250-10000	7.3 / 24.3	99.7	5
6	Protocatechuic acid	5.63	152.95	Neg	0.999	0.5958	100-4000	25.8 / 85.9	100.2	5
7	Tannic acid	6.46	182.95	Neg	0.996	0.9075	100-4000	10.2 / 34.2	97.8	5
8	tr- caffeic acid	7.37	178.95	Neg	0.994	1.008	25-1000	4.4 / 14.7	98.6	5
9	Vanillin	8.77	151.05	Neg	1	0.4094	250-10000	10.1 / 33.7	99.2	5
10	p-Coumaric acid	9.53	162.95	Neg	0.991	1.1358	100-4000	15.2 / 50.8	98.4	5
11	Rosmarinic acid	9.57	358.9	Neg	0.999	0.522	250-10000	10.4 / 34.8	101.7	5
12	Rutin	10.2	609.1	Neg	0.997	0.8146	250-10000	17.0 / 56.6	102.2	5
13	Hesperidin	9.69	611.1	Poz	0.997	0.1363	250-10000	21.6 / 71.9	100.2	5
14	Hyperoside	10.4	463.1	Neg	0.955	0.2135	100-4000	12.4 / 41.4	98.5	5
15	4-OH Benzoic acid	11.7	136.95	Neg	0.993	1.4013	25-1000	3.0 / 10.0	106.2	5
16	Salicylic acid	11.7	136.95	Neg	0.99	0.6619	25-1000	4 / 13.3	106.2	5
17	Myricetin	11.9	317	Neg	0.999	2.8247	100-4000	9.9 / 32.9	106	6
18	Fisetin	12.6	284.95	Neg	0.999	2.4262	100-4000	10.7 / 35.6	96.9	6
19	Coumarin	12.5	146.95	Poz	0.992	0.4203	100-4000	9.1 / 30.4	104.4	5
20	Quercetin	14.5	300.9	Neg	1	4.3149	25-1000	2.0 / 6.8	98.9	7
21	Naringenin	14.7	270.95	Neg	0.996	2.02	25-1000	2.6 / 8.8	97	6
22	Hesperetin	15.3	300.95	Neg	0.996	1.0164	25-1000	3.3/ 11.0	102.4	5
23	Luteolin	15.4	284.95	Neg	0.999	3.9487	25-1000	5.8 / 19.4	105.4	7
24	Kaempferol	15.4	284.95	Neg	0.992	0.5885	25-1000	2.0 / 6.6	99.1	5
25	Apigenin	17.3	268.95	Neg	0.995	0.6782	25-1000	0.1 / 0.3	98.9	5
26	Rhamnetin	18.9	314.95	Neg	0.999	2.5678	25-1000	0.2 / 0.7	100.8	6
27	Chrysin	21.2	253	Neg	0.997	1.553	25-1000	0.05 / 0.17	102.2	5

aRT: Retention time; bParent ion (m/z): Molecular ions of the standard compounds (mass to charge ratio); cR2: coefficient of determination; dRSD: relative standard deviation; eLOD/LOQ (µg/L): Limit of deteection/Limit of quantification; f U (%): Percent relative uncertainty at 95% confidence level (k=2); g Values in µg/g; (w/w) of plant methanol extract

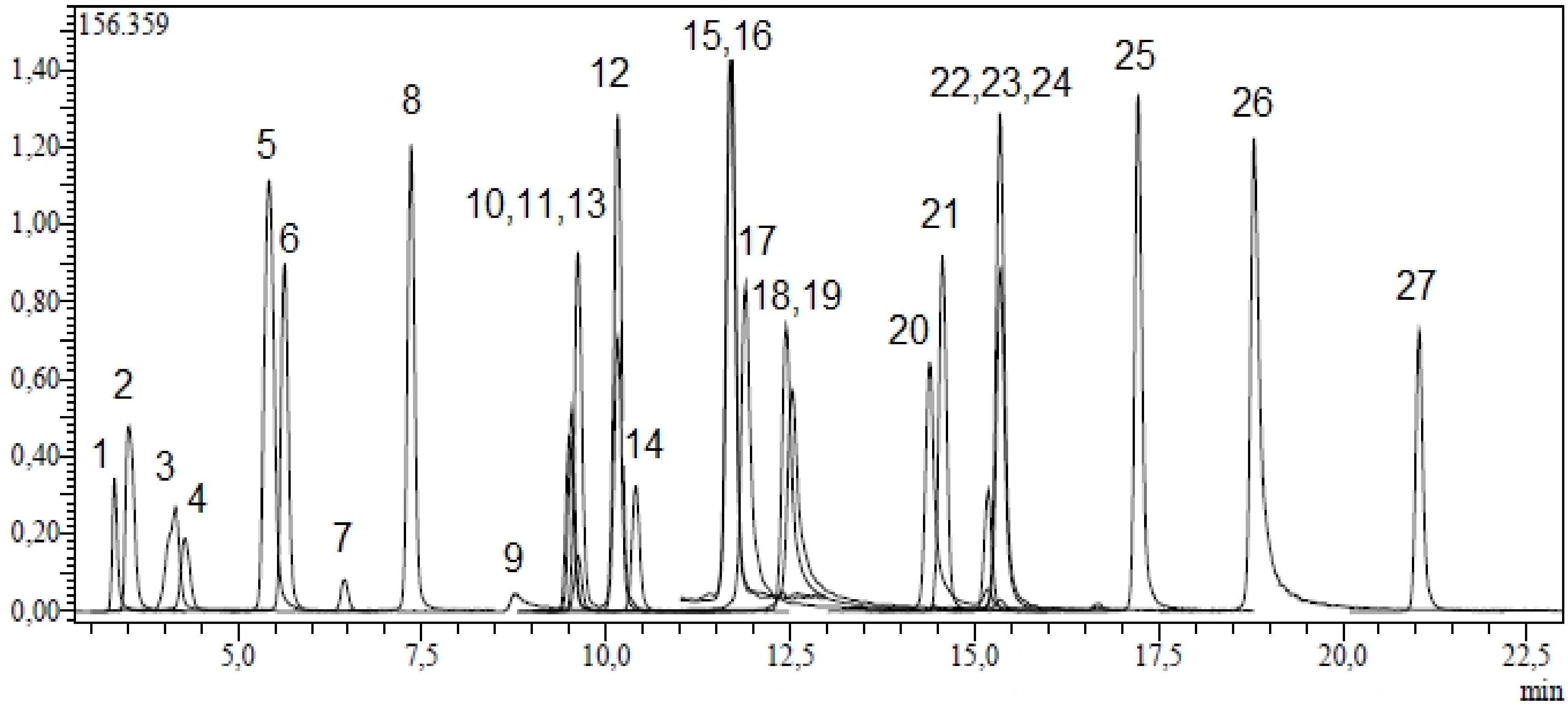

Figure 4.25. LC-MS/MS chromatogram for reference phytochemical compounds: 35

1) quinic acid, 2) malic acid, 3) tr-aconitic acid, 4) gallic acid, 5) chlorogenic acid, 6) protocatechuic acid, 7) tannic acid, 8) tr-caffeic acid, 9) vanillin, 10) p-coumaric acid, 11) rosmarinic acid, 12) rutin, 13) hesperidin, 14) hyperoside, 15) 4-OH benzoic acid, 16) salicylic acid, 17) myricetin, 18) fisetin, 19) coumarin, 20) quercetin, 21) naringenin, 22) hesperetin, 23) luteolin, 24) kaempferol, 25) apigenin, 26) rhamnetin, and 27) chrysin.

4.4.1. Identification and quantification of phytochemical compounds in root extracts of *Acer monspessulanum* L.

The overall results in the root extracts by LC–MS/MS analysis were rich in terms of phenolic and non-phenolic compounds. Firstly, the results indicated that non-phenolic organic acids compounds were rich in roots extract of *Acer monspessulanum* L. by LC-MS/MS analysis. It contained a high amount of quinic acid by ethanol conventional method (CE1: 16950.77 µg/g). While the minimum amount of it was tr-aconitic acid (MWA1: 0.91 µg/g) by microwave method with acetonitrile solvent. Secondly, the high amount of phenolic acids was protocatechuic acid (MWW1: 1297.05 µg/g) by a microwave method. Whereas, it a low amount chlorogenic acid was detected in it (MA1: 0.23µg/g). Thirdly, the maximum and the minimum of flavonoids compounds were hesperidin (CE1: 90.02 µg/g) by conventional method with ethanol solvent and hesperetin (ME 1 0.04 µg/g) by maceration method with ethanol solvent. On the other hand, in many of the phenolic compounds, there was detected no rosmarinic acid, coumarin, hyperoside and chrysin in the root extract by three methods with solvents as presented in Table 4.25.

There are no analytical studies on the root part of *Acer monspessulanum* L. These results are in agreement with study by Zhang *et al.,* (2016) on leaves of two *Acer palmatum* cultivars, Atropurpureum and Thunb. Also, other study was identified phytochemical compounds in leaves and stem of *Acer* plants by (Bi *et al.,* 2016).

Table 4.25. Identification and quantification of phytochemical compounds in root extracts of *Acer monspessulanum* L. 31

No.	Phenolic Compounds	Quantification µg/g (w/w)								
		MWE 1	**CE 1**	**ME 1**	**MWA1**	**CA 1**	**MA 1**	**MWW1**	**CW 1**	**MW 1**
1	Quinic acid	13946.37	**16950.77**	15480.84	13.50	15.60	22.07	869.02	3248.88	64.77
2	Malic acid	304.66	535.40	1038.96	0.00	0.00	0.00	21.55	524.12	931.33
3	tr-Aconitic acid	10.61	14.32	35.61	0.91	1.55	1.42	14.22	71.23	3.64
4	Gallic acid	18.53	45.94	28.24	4.78	6.00	4.67	86.20	455.71	2534.37
5	Chlorogenic acid	15.74	27.40	17.77	0.00	0.00	**0.23**	1.78	4.28	6.66
6	Protocatechuic acid	266.67	353.02	294.83	119.94	161.16	70.19	**1297.05**	1015.62	1211.69
7	Tannic acid	0.00	24.38	24.45	3.99	13.69	0.00	0.00	0.00	0.00
8	tr- caffeic acid	2.78	4.02	2.92	1.02	1.07	0.00	0.00	1.46	1.14
9	Vanillin	571.15	905.17	903.21	488.33	611.65	560.22	0.00	0.00	0.00
10	p-Coumaric acid	50.32	85.41	57.28	23.03	47.83	19.64	30.40	0.00	0.00
11	Rosmarinic acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	49.08	82.46	39.06	11.97	19.30	4.92	13.00	0.24	0.92
16	Salicylic acid	39.06	73.37	30.53	9.35	15.59	4.01	10.51	0.31	0.67
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	44.95	53.79	37.78	6.68	5.06	5.34	0.00	3.51	4.52
13	Hesperidin	77.64	**90.02**	89.41	15.32	9.38	13.62	0.00	11.68	0.00
14	Hyperoside	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Myricetin	0.43	0.54	0.30	0.12	0.27	0.00	0.00	0.21	0.10
18	Fisetin	0.00	0.17	0.21	0.00	0.00	0.00	0.00	0.00	0.00
20	Quercetin	0.00	0.00	5.02	0.00	3.52	0.00	0.00	0.00	0.00
21	Naringenin	24.78	47.65	32.93	14.02	20.38	11.70	0.00	0.00	0.00
22	Hesperetin	0.14	0.15	0.06	0.04	0.48	0.08	0.00	0.00	0.08
23	Luteolin	1.74	18.77	0.34	0.41	3.16	0.49	0.00	0.00	0.00
24	Kaempferol	8.04	26.38	14.01	0.00	7.18	0.00	0.00	0.00	0.00
25	Apigenin	5.69	18.17	13.61	2.95	6.27	3.61	0.10	0.06	0.00
26	Rhamnetin	0.32	0.27	0.41	0.32	0.13	0.15	0.18	0.07	0.40
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Not: MW: microwave methods; C: Conventional method; M: maceration method; E: ethanol solvent; A: acetonitrile; W: distilled water

4.4.2. Identification and quantification of phytochemical compounds in root extracts of *Prunus microcarpa* C.A. Mey. (Yellow fruit)

Principally, the results indicated that non-phenolic compounds are abundant in root ethanol extract of *Prunus microcarpa* C.A. Mey. by LC-MS/MS analysis. It contained a high amount was quinic acid (MWE2: 3644.43 µg/g) by microwave method with ethanol solvent. Also, the lowest amount was tr-aconitic acid (MA2: 1.24µg/g) by microwave. On the other hand, the high amount of phenolic acid was protocatechuic acid (MW2: 1830.64 µg/g) by distilled water with microwave method. Whereas it contained a low amount of 4-OH Benzoic acid was (MW2: 0.51µg/g). The maximum compound of flavonoid was hyperoside (CE2: 2528.16 µg/g) and the minimum flavonoid compound was apigenin (MWW2; CW2; MW2: 0.02µg/g) at three methods with distilled water. Nonetheless, rosmarinic acid, coumarin and chrysin was not sensed by all three methods and solvents summarized in Table 4.26.

There is no any investigation on root extracts of *Prunus microcarpa* C.A. Mey. for phytochemical analysis but there is some other research on fruit, flowers, leaves and branches of other species. There are various studies regarding the phenolic and flavonoid constituents in the *Prunus microcarpa* C.A. Mey. root extracts which were determined by LC–MS/MS techniques, for example, Milbury *et al.,* (2006) found the large amount of total phenols, flavonoids, and phenolic acids analyses in *Prunus dulcis* skins and kernels. Likewise, the study by Dulf *et al.,* (2017) who worked on qualified and quantitated the active compounds of the phenolic compounds and flavonoids in *Prunus armeniaca* L. analysis. Indeed, Song *et al.,* (2017) was isolated phytochemicals in leaves and branches of *Prunus cerasifera* and identified by using HPLC. Certainly, six phenolics were identified in the leaves of *Prunus padus* L. by using HPLC (Olszewska and Kwapisz, 2011). Finally, isolated and identification phenolic compound from *Prunus mume* fruits extracts (Yan *et al.,* 2014). Donovan *et al.,* (1998) found the large amount of total phenols and flavonoids from the Prunes and Prune Juice of *Prunus domestica* by LC–MS/MS techniques.

Table 4.26. Identification and quantification of phytochemical compounds in *Prunus microcarpa* C.A. Mey. (Yellow fruit) root extract 32

No.	Phenolic Compounds	Quantification µg/g (w/w)								
		MWE 2	**CE 2**	**ME 2**	**MWA 2**	**CA 2**	**MA 2**	**MWW 2**	**CW 2**	**MW 2**
1	Quinic acid	**3644.43**	2371.49	1780.78	17.96	9.93	10.85	836.61	41.21	581.26
2	Malic acid	745.48	364.32	428.19	12.13	0.00	0.00	30.60	30.08	720.19
3	tr-Aconitic acid	30.23	17.59	30.55	45.37	1.62	**1.24**	8.68	1.67	32.20
4	Gallic acid	12.84	24.27	16.92	8.61	5.86	2.84	21.44	33.90	60.50
5	Chlorogenic acid	328.39	230.79	184.91	109.03	11.46	3.66	58.10	30.56	48.97
6	Protocatechuic acid	399.83	343.95	280.78	240.23	161.76	93.91	378.58	753.42	**1830.64**
7	Tannic acid	20.37	39.84	26.91	0.00	26.15	0.00	0.00	0.00	0.00
8	tr- caffeic acid	1.52	1.56	1.37	0.82	0.00	0.00	0.00	0.94	6.25
9	Vanillin	272.86	221.53	190.98	248.84	313.70	256.85	0.00	0.00	41.89
10	p-Coumaric acid	56.85	47.51	54.89	35.73	33.58	28.34	46.26	0.00	149.93
11	Rosmarinic acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	47.55	46.93	33.14	25.59	17.45	7.21	10.97	0.91	0.51
16	Salicylic acid	43.09	36.68	26.91	20.51	14.81	0.63	9.93	0.89	1.34
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	10.60	12.34	4.90	0.00	0.00	2.42	0.00	0.00	0.00
13	Hesperidin	9.80	14.30	10.97	0.00	3.59	5.49	0.00	0.00	0.00
14	Hyperoside	**2528.16**	2193.60	2144.52	1532.68	0.00	108.87	28.57	35.42	31.19
17	Myricetin	20.69	19.87	15.62	18.50	15.21	9.68	0.10	0.09	0.12
18	Fisetin	14.48	11.91	11.99	14.75	12.60	12.26	0.00	0.00	0.00
20	Quercetin	159.69	167.77	139.08	152.56	34.89	23.05	0.00	3.79	0.00
21	Naringenin	410.59	392.42	331.49	368.51	326.04	174.64	3.72	5.80	9.08
22	Hesperetin	35.39	34.78	32.65	32.36	33.18	23.99	0.95	1.04	2.69
23	Luteolin	1.60	2.51	2.49	1.73	0.77	1.13	0.00	0.00	0.00
24	Kaempferol	4.95	7.85	4.54	3.22	0.00	2.10	0.00	0.00	0.00
25	Apigenin	5.76	7.13	4.34	3.36	3.54	2.52	**0.02**	**0.02**	**0.02**
26	Rhamnetin	26.09	30.51	26.40	25.54	16.32	24.64	0.12	0.77	0.14
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.4.3. Identification and quantification of phytochemical compounds in root extracts of *Pyrus syriaca* Boiss.

In this research, twenty-seven standard classes of phenolic compounds were consumed with root extract of *Pyrus syriaca* Boiss.

The general consequences in the root extracts by LC–MS/MS analysis were rich based on phenolic and non-phenolic compounds. Mainly, Table 4.27 shows non-phenolic organic acid compounds that abundant in root extracts of *Pyrus syriaca Boiss.* by LC-MS/MS analysis. High amounts of quinic acid (MWE3: 37017.96 µg/g) were extracted by microwave method by using ethanol solvent. In addition, tr-aconitic acid was extracted as fewer amounts in conventional method by using acetonitrile (CA3: 1.00 µg/g). chlorogenic acid was a high volume of phenolic acids (MWE3: 7038.89 µg/g) by using microwave technique. Whereas, phenolic acids contain low volume of salicylic acid a (MW3: 0.40 µg/g) dissolved in distilled water by maceration method. The maximum and the minimum amount of flavonoid compounds were hesperidin (MWE3: 111.45 µg/g) by using microwave method in ethanol and apigenin (MW3: 0.01 µg/g) by using maceration in distilled water, respectively. No rosmarinic acid, coumarin, hyperoside, fisetin and chrysin were detected from all nine-root extraction by using all techniques and solvents as shown in Table 4.27.

There are many studies about phenolic and flavonoid constituents in different aerial plant parts and no studies in root extracts on *Pyrus syriaca* Boiss. Our results are in agreement with study by Liaudanskas *et al.,* (2017) determined eight phenolic compounds in the pear fruit samples of *Pyrus syriaca* Boiss. Similarly, the chlorogenic acid was the major component in the samples of all the tested cultivars. Six major components were identified and quantified in the peels and flesh of fruits of *Pyrus syriaca* Boiss. by using Ultra Performance Liquid Chromatography–Electrospray Ionization Mass Spectrometry (Ma *et al.,* 2012). Thirteen phenolic compounds were recognized from pear peels and leaves of *P. ussuriensis* (Qiu *et al.,* 2018).

Table 4.27. Identification and quantification of phytochemical compounds in root extracts of *Pyrus syriaca* Boiss. 33

No.	Phenolic Compounds	Quantification µg/g (w/w)								
		MWE3	**CE3**	**ME3**	**MWA3**	**CA3**	**MA3**	**MWW3**	**CW3**	**MW3**
1	Quinic acid	37017.96	23704.52	24678.11	40.51	8.67	20.57	2080.13	2527.38	324.26
2	Malic acid	4578.00	1956.11	2826.65	16.89	0.00	0.00	373.20	1143.10	556.75
3	tr-Aconitic acid	94.73	39.97	75.85	34.54	1.00	14.28	32.40	24.81	6099.18
4	Gallic acid	96.44	92.24	62.05	36.90	12.60	7.95	187.58	184.85	1343.45
5	Chlorogenic acid	**7037.89**	4828.81	4965.68	1403.41	209.34	730.80	1429.44	942.09	2170.11
6	Protocatechuic acid	719.32	681.15	595.67	471.84	311.05	175.80	1371.19	5732.89	992.03
7	Tannic acid	131.66	151.35	92.15	91.62	104.76	24.36	0.00	27.69	0.00
8	tr- caffeic acid	8.08	9.35	7.88	7.04	3.97	2.71	9.03	17.54	53.35
9	Vanillin	137.03	147.12	158.11	129.91	154.87	115.71	0.00	0.00	0.00
10	p-Coumaric acid	194.68	196.39	178.56	157.80	135.84	90.23	146.57	39.23	51.36
11	Rosmarinic acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	12.48	10.38	6.77	6.23	3.73	1.00	3.01	0.47	10.70
16	Salicylic acid	11.85	8.93	6.40	5.53	3.32	0.74	**0.40**	1.02	0.80
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	66.90	50.90	43.12	11.73	7.82	5.95	2.90	2.45	8.03
13	Hesperidin	**111.45**	90.71	75.89	17.80	15.69	11.44	7.13	0.00	0.00
14	Hyperoside	43.20	37.46	31.33	17.78	0.00	0.00	0.00	0.00	0.00
17	Myricetin	0.51	0.72	0.70	0.18	0.22	0.24	0.00	0.16	0.00
18	Fisetin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Quercetin	0.00	9.70	7.54	0.00	0.00	0.00	0.00	0.00	0.00
21	Naringenin	17.83	18.98	16.64	13.27	10.77	6.52	0.00	0.00	0.38
22	Hesperetin	0.46	0.68	0.34	1.09	0.26	0.21	0.00	0.05	0.00
23	Luteolin	1.86	1.22	3.26	2.69	0.96	0.57	0.00	0.00	0.23
24	Kaempferol	7.03	8.29	7.74	4.56	3.55	0.00	0.00	0.00	0.00
25	Apigenin	0.16	0.05	0.27	0.04	0.04	0.04	0.00	0.02	**0.01**
26	Rhamnetin	0.43	0.17	0.14	0.18	0.22	0.07	0.00	0.00	0.00
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.4.4. Identification and quantification of phytochemical compounds in root extract of *Quercus infectoria* Oliv.

All results were extracted based on phenolic acids and non-phenolic compounds. Table 4.28 shows a high concentration of phenolic compounds, including phenolic acids and flavonoids in root extracts. While, all extracts for herein determined higher concentrations of non-phenolic and phenolic acids compared with those of flavonoids. The root extracts comprised, mainly, of tannic, quinic, gallic, malic and protocatechuic acids, respectively. Moreover, small amounts of various flavonoids such as rutin, myricetin, naringenin, hesperetin, luteolin, apigenin, rhamnetin as well as some other flavonoids were detected. However, the root extracts were found to consist, essentially, of non-phenolic acids such as quinic, malic and gallic acids, consequently, along with small quantities of numerous flavonoids. The analysis determined that phenolic acids were a foremost phytochemical in the whole extracts got herein. This investigation showed that the quantification and identification of phenolic compounds of *Quercus infectoria* Oliv. were carried out by UHPLC-ESI-MS/MS. Many phenolic compounds in root extract were detected and the quantified results in ethanol extracts root.

The amount of plant has widespread non-phenolic organic acids were qualified and quantified in root extract of *Quercus infectoria* Oliv. Three non-phenolic organic acids were identified which were quinic acid, malic acid and trans-aconitic acid, the root extract showed the highest quinic acid among all methods and solvents with concentration (MWE4: 13,830.85μg/g) by microwave method with ethanol solvent. The tr-aconitic acid showed the lowest concentration among non-phenolic acids for all methods and solvents with concentration (MA4: 2.52μg/g) by maceration method with acetonitrile solvent. In addition, eleven types of phenolic acids were used for the study of *Quercus infectoria* Oliv. root. The high amount of phenolic acids was gallic acid (CW4: 2,236.08μg/g) by a conventional method with distilled water. On the other hand, chlorogenic acid extracted in low concentration (MWW4: 0.12μg/g). No detection any rosmarinic acid and coumarin in all root extracts by three methods were detected in root extracted by using all techniques and solvents. through our study thirteen types of the flavonoids standard were identified by using LC–MS/MS instrument. The maximum and the minimum amounts of flavonoid compounds of all root extracts were rutin (CE4: 41.70μg/g) by conventional method by ethanol solvent and apigenin (MWW4: 0.01 μg/g) in distilled water by using microwave method, respectively. No detections of hesperidin, hyperoside, fisetin, quercetin, luteolin, kaempferol and chrysin were detected from all nine-root extraction by using all techniques and solvents as shown in Table 4.28.

Our results are in agreement with several studies published about *Quercus infectoria* Oliv. The presence of phenolic compounds in *Quercus infectoria* Oliv. root extracts were confirmed by Hamad *et al.,* (2017) the nutgall extracts were found to have higher concentration of phenolic acid contents, and to some extent flavonoids in comparison with the root extracts. A microwave extraction method was established to be much more effective than conventional one in view of extraction yield for both plant portions utilized. However, there are various studies about phenolic and flavonoid constituents in the *Q. infectoria* on leaf, flower, fruit, bark, gall and branch which were Identified and quantified by HPLC, TLC and GC–MS techniques. Firstly, the results of *Q. infectoria* gall extract by Kaur *et al.,* (2008) who found that a large amount of tannic acid (19.925%) and gallic acid (8.75%) were quantified by using HPLC instruments. Also, these results are in agreement with (Rao *et al.,* 2013; Nur Syukriah *et al.,* 2014 ; Fathabad *et al.,* 2015; Kheirandish *et al.,* 2016) on *Q. infectoria* gall extract phytochemicals identification and quantification by HPLC, TLC and LC–MS techniques. Moreover, Hashim, (2013) qualified and quantitated the active compounds in the gall-extract of *Q. infectoria* by using active compounds tannic acid, isoquercetin, coumaric acid, quercetin, ferulic acid, rutin, kaempferol, vanillic acid, sinapic acid and genstic acid.

Table 4.28. Identification and quantification of phytochemical compounds in root extract of *Quercus infectoria* Oliv. 34

No.	Phenolic Compounds	Quantification µg/g (w/w)								
		MWE4	**CE4**	**ME4**	**MWA4**	**CA 4**	**MA 4**	**MWW4**	**CW4**	**MW4**
1	Quinic acid	**13830.85**	10110.50	6441.00	146.77	20.30	19.51	7580.49	5125.39	936.60
2	Malic acid	7389.22	5530.25	4695.28	1276.53	43.47	49.09	9084.13	7787.40	3081.71
3	tr-Aconitic acid	112.17	43.25	56.77	14.40	1.86	2.52	521.68	57.85	1087.58
4	Gallic acid	1285.04	1182.93	993.06	773.42	517.85	272.25	1677.61	**2236.08**	686.57
5	Chlorogenic acid	72.88	86.18	48.06	25.11	12.74	11.57	**0.12**	0.24	8.66
6	Protocatechuic acid	59.98	59.21	48.26	51.29	37.63	22.69	32.26	1180.35	1641.52
7	Tannic acid	115.41	161.35	361.77	250.05	1035.20	154.24	16.15	72.89	178.73
8	tr- caffeic acid	6.35	6.51	5.05	5.30	1.89	1.66	0.00	1.05	2.30
9	Vanillin	230.29	182.35	162.41	157.39	189.39	154.67	0.00	0.00	0.00
10	p-Coumaric acid	90.46	72.46	67.18	78.61	59.94	39.35	10.56	23.30	11.03
11	Rosmarinic acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	23.89	22.66	18.13	14.51	9.04	4.35	7.57	2.47	1.26
16	Salicylic acid	21.98	18.28	15.72	12.51	7.59	0.89	6.10	1.61	0.74
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	33.41	**41.70**	39.75	0.00	0.00	0.00	14.98	4.15	0.00
13	Hesperidin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	Hyperoside	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Myricetin	4.20	2.35	0.17	0.61	0.28	0.00	0.10	0.15	0.12
18	Fisetin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Quercetin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	Naringenin	24.47	19.01	18.68	16.06	4.65	3.28	0.00	0.00	0.00
22	Hesperetin	0.23	0.23	0.23	0.08	0.04	0.27	0.00	0.08	0.00
23	Luteolin	0.46	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	Kaempferol	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	Apigenin	0.03	0.09	0.05	0.05	0.05	0.11	0.01	0.00	0.00
26	Rhamnetin	2.14	14.97	1.13	0.21	0.13	0.27	0.18	0.24	0.17
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.4.5. Identification and quantification of phytochemical compounds in root extracts of *Quercus aegilops* L.

This investigation showed that the quantification and identification of phenolic compounds of *Quercus aegilops* L. were carried out by UHPLC-ESI-MS/MS. Several phenolic compounds in root extracts were detected and determined their results in ethanol, extract root (Table 4.29).

Overall results in the root extracts by LC–MS/MS analysis were high amount of phenolic and non-phenolic compounds. The root extract of *Quercus aegilops* L. showed the uppermost quinic acid among methods and solvents through concentration (MWE5: 10,279.91µg/g) via microwave method by ethanol solvent. The tr-aconitic acid showed the lowest concentration among non-phenolic acids for all approaches and solvents with concentration (MA5: 0.26µg/g) by maceration technique by acetonitrile solvent. In addition, many types of phenolic acids standard have been utilized for the study root extracts of *Quercus aegilops* L. The high amount of phenolic acids was tannic acid (MWW5: 10,388.48µg/g) by a microwave technique in ethanol solvent. The low amount of root extracts of salicylic acid was detected (CW5: 0.32µg/g) by concentration. There was not determined any phenolic acids such as rosmarinic acid and coumarin in all root extracts at all three approaches. Through our study, many types of the flavonoids reference were used for identification. The maximum and the minimum of flavonoids compounds of all root extracts were naringenin (ME5: 12.54µg/g) by maceration technique in ethanol solvent and apigenin (CW5: 0.01 µg/g) with distilled water and conventional method. Instead, hesperidin, hyperoside, fisetin, kaempferol and chrysin of flavonoids in root extract for all three methods were not detected as shown in Table 4.29.

There are other studies based on phenolic and flavonoid ingredients in the other species and other parts with no studies on *Quercus aegilops* L. root extracts. These results are in agreement with those investigated by Bahabri *et al.,* (2016) who found, vescalagin, castalagin (with linkages to flavogallonic acid) and vescalin/castalin; ellagic acid and vescavaloneic/castavaloneic acid; and free gallic acid and catechin gallate in the Valonia oak acorn (*Quercus aegilops L.*). Other studies indicated that the apigenin, kaempferol, myricetin, naringenin, quercetin and rutin which were found nearly in all parts leaf, gall and bark flavonoids in collected *Quercus brantii* Lindl. by (Noori *et al.,* 2015) and *Quercus* spp. fruits by (Vinha *et al.,* 2016).

Table 4.29. Identification and quantification of phytochemical compounds in root extracts of *Quercus aegilops* L. 35

No.	Phenolic Compounds	Quantification µg/g (w/w)								
		MWE5	**CE5**	**ME5**	**MWA5**	**CA5**	**MA5**	**MWW5**	**CW5**	**MW5**
1	Quinic acid	**10279.91**	7399.18	7196.32	12.24	23.89	9.04	6053.52	7920.58	79.10
2	Malic acid	4261.22	2843.29	2948.94	2.38	6.87	0.00	5281.31	6405.54	303.71
3	tr-Aconitic acid	84.25	54.34	83.19	5.40	0.97	**0.26**	97.82	93.81	21.45
4	Gallic acid	950.56	901.67	880.39	429.31	306.43	180.70	1343.39	1125.01	1624.91
5	Chlorogenic acid	36.74	60.52	36.10	5.67	5.67	2.88	12.91	5.15	1.29
6	Protocatechuic acid	104.37	98.75	102.47	57.35	49.24	29.56	66.35	125.71	2212.84
7	Tannic acid	**10388.48**	7840.44	8434.23	5937.17	5034.60	1769.49	883.74	3137.21	1122.21
8	tr- caffeic acid	6.49	6.61	6.73	4.56	3.23	3.53	3.37	2.70	2.23
9	Vanillin	610.38	407.03	559.75	467.61	424.49	364.76	0.00	105.84	0.00
10	p-Coumaric acid	46.49	42.56	49.52	31.28	30.24	27.73	15.08	25.10	11.34
11	Rosmarinic acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	3.93	3.99	3.37	1.18	0.67	0.97	0.42	0.48	0.63
16	Salicylic acid	4.49	3.05	0.64	0.77	0.77	0.48	0.39	**0.32**	1.91
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	0.00	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	Hesperidin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	Hyperoside	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Myricetin	1.15	0.23	0.87	0.10	0.15	0.00	0.39	0.00	0.00
18	Fisetin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Quercetin	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00
21	Naringenin	12.08	11.74	**12.54**	7.88	6.13	3.88	0.00	0.00	0.00
22	Hesperetin	0.19	0.20	0.42	0.15	0.12	0.26	0.00	0.04	0.00
23	Luteolin	0.00	0.67	1.01	0.00	0.32	0.41	0.00	0.00	0.00
24	Kaempferol	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	Apigenin	0.08	0.34	0.93	0.02	0.18	0.02	0.00	**0.01**	0.02
26	Rhamnetin	0.40	0.31	0.14	0.20	0.24	0.13	0.07	0.13	0.08
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.4.6. Identification and quantification of phytochemical compounds in root extracts of *Crataegus monogyna* Jacquin.

The quantification and determination of phenolic acids in root extracts of *Crataegus monogyna* Jacquin were carried out by UHPLC-ESI-MS/MS (Table 4.30). Various amounts of phenolic compounds in ethanol root extract were extracted. In this research, twenty-seven types of standard have been using including three non-phenolic, eleven non-flavonoids and thirteen flavonoid compounds of root ethanol extract. Three methods have been used for analysis by UHPLC-ESI-MS/MS.

All results indicated that non-phenolic compounds are abundant in root extract of *Crataegus monogyna*. High quantity amounts by microwave technique with distilled water solvent were malic acid (MWE6: 14,247.79µg/g). The lowest amount was tr-aconitic acid (MA6: 0.70µg/g) by microwave method and acetonitrile solvent. The high amount of phenolic acid was protocatechuic acid (MW6: 1,609.74µg/g) by distilled water with microwave technique. Whereas the low amount of phenolic acid was a salicylic acid with concentration (CA6: 0.59µg/g) by conventional method with distilled water. However, rosmarinic acid and coumarin were not extracted by all three approaches and solvents of phenolic acids. Finally, throughout our research thirteen types of flavonoid references were used for flavonoids identification from root extract by LC-MS/MS instrument. The maximum flavonoids were naringenin (ME6: 118.46 µg/g) and the minimum flavonoid compound was apigenin (MWW6: 0.01µg/g) at three methods with distilled water. Nonetheless, hyperoside, fisetin and chrysin were not identified by all three methods and solvents of flavonoid compounds as shown in Table 4.30.

There are no investigations on root extracts of *Crataegus monogyna* Jacquin, but there are different investigations on phenolic compounds of flower, buds and fruits of *Crataegus monogyna*. Our results are in agreement with Zhang *et al.,* (2001) who studied on Hawthorn fruits (Crateagus *pinnatifida*) which were in the column chromatographic separation led to isolation of seven antioxidants (namely, hyperoside, isoquercitrin, epicatechin, chlorogenic acid, quercetin, rutin and pro-tocatechuic acid). Other researches published about leaves and sprouts of *Crataegus monogyna* Jacquin by (Urbonavičiute *et al.,* 2006) and other investigations, found the flavanol-type substance [(-)- epicatechin] and flavonoid (vitexin 2″-O -rhamnoside, acetylvitexin 2″- O -rhamnoside, and hyperoside) in the Leave of *C. laevigata* and *C. monogyna* (Kirakosyan *et al.,* 2003).

There were many studies about buds and fruits of *Crataegus monogyna* Jacquin by (Rodrigues *et al.,* 2012), the fruits of *C. aronia* var. aronia *C. pseudoheterophylla C. monogyna* ssp. monogyna by (Orhan *et al.,* 2007). Other researches were published about leaves, flowers, and berries of *Crataegus monogyna* Jacquin and *Crataegus oxyacantha* L by (Tadi *et al.,* 2008), on the leaves and berries of *Crataegus oxyacantha* ssp. *monogyna* by (Benmalek *et al.,* 2013) and on the fruit of *Crataegus monogyna* Jacquin by (Nabavi *et al.,* 2015).

Table 4.30. Identification and quantification of phytochemical compounds in root extracts of *Crataegus monogyna* Jacquin 36

No.	Phenolic Compounds	Quantification µg/g (w/w)								
		MWE6	**CE6**	**ME6**	**MWA6**	**CA6**	**MA6**	**MWW6**	**CW6**	**MW6**
1	Quinic acid	7210.50	6302.75	5908.34	7.85	2.81	7.53	6719.25	1893.33	86.44
2	Malic acid	4364.94	3299.18	5403.87	0.00	12.54	0.00	**14247.79**	5880.09	30.66
3	tr-Aconitic acid	50.49	35.19	95.45	9.19	8.01	0.70	242.92	12.62	1.66
4	Gallic acid	57.25	74.80	38.10	11.49	9.86	3.40	67.20	250.45	460.06
5	Chlorogenic acid	1387.72	1161.58	970.54	86.93	110.42	27.94	851.13	372.36	11.96
6	Protocatechuic acid	230.97	238.02	226.43	100.53	123.43	55.92	401.85	726.61	**1609.74**
7	Tannic acid	83.88	121.19	27.67	40.88	32.19	0.00	0.00	5.67	0.00
8	tr- caffeic acid	7.13	7.93	7.19	3.97	4.22	2.82	9.53	5.24	0.00
9	Vanillin	155.30	188.84	112.15	106.92	223.28	119.44	0.00	0.00	0.00
10	p-Coumaric acid	85.01	85.55	78.72	50.11	71.00	48.69	54.80	35.06	11.08
11	Rosmarinic acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	14.22	11.63	8.86	5.46	6.25	4.35	0.00	7.24	0.00
16	Salicylic acid	10.84	10.17	7.22	4.30	**0.59**	0.92	15.46	6.10	0.00
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	63.14	62.58	48.30	13.18	0.00	0.00	5.74	0.30	0.47
13	Hesperidin	102.25	91.09	88.74	16.16	8.71	11.71	5.50	0.61	0.49
14	Hyperoside	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Myricetin	0.15	0.11	0.42	0.00	0.25	0.12	0.00	0.00	0.00
18	Fisetin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Quercetin	7.36	0.00	7.25	0.00	0.00	0.00	0.00	0.00	0.00
21	Naringenin	117.62	96.58	**118.46**	63.19	42.60	33.83	0.00	0.00	2.39
22	Hesperetin	4.18	4.03	3.22	2.70	3.30	2.10	0.00	0.00	0.04
23	Luteolin	11.16	13.77	10.75	1.37	6.27	2.07	0.00	0.00	0.00
24	Kaempferol	13.93	16.27	16.05	5.78	7.91	0.00	0.00	0.00	0.00
25	Apigenin	1.56	2.43	2.09	0.40	1.41	0.43	0.01	0.00	0.05
26	Rhamnetin	0.30	0.20	0.23	0.08	0.29	0.07	0.00	0.00	0.00
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.4.7. Identification and quantification of phytochemical compounds in root extracts of *Prunus argentea* (Lam.) Rehder

Among twenty-seven compounds, there were twenty-four non-phenolic, phenolic acids and flavonoid compounds detected in all root extracts of *Prunus argentea* (Lam.) Rehder. phenolic compounds in root extract was carried out by UHPLC-ESI-MS/MS. Many phenolics in root extract were detected including twenty-seven standard types have been using three non-phenolic, eleven phenolic acids and thirteen flavonoid compounds of root extracts. Three methods and three solvents were used for analyzing by LC-MS/MS.

The non-phenolic organic acid compounds quinic acid are abundant in root extracts and contains high quantity by microwave technique with ethanol solvent (MWE7: 11,610.62µg/g). The minimum quantity was tr-aconitic acid by conventional technique with acetonitrile solvent (MWA7: 0.45µg/g). The high volume of phenolic acids was protocatechuic acid (CW7: 2,068.71µg/g) by microwave way and ethanol solvent. Low volume chlorogenic acid was noticed (MA7: 0.09µg/g) by maceration method with acetonitrile solvent. Maximum and minimum of flavonoids compounds were naringenin (MWE7: 8023.62µg/g) by microwave method with ethanol and apigenin (MW7: 0.03µg/g) by maceration technique with distilled water. Rosmarinic acid, coumarin and chrysin were not determined from all root extract and all three methods with three solvents as shown in Table 4.31.

There were no studies about phenolic compounds identification of *Prunus argentea* (Lam.) Rehder root extracts. Our study is agreement with several works about phenolic constituents by (Usenik *et al.,* 2008) on fruit of sweet cherry (*Prunus avium* L.) which found that organic acids (malic, citric, shikimic and fumaric) ranged from 3.67 to 8.66 g/kg FW. Likewise, other study on the fruit of Peach (*Prunus persica* L.) by (Zhao *et al.,* 2015). Fruit almond hulls (*Prunus amygdalus*) researched by (Pinelo *et al.,* 2004) and supported by (Najafabad and Jamei, 2014) study on plum (*Prunus domestica* L.) in both fresh and dried samples. Finally, there was investigation on the fruit of peach (*Prunus persica* L) by (Carbonaro *et al.,* 2002).

Table 4.31. Identification and quantification of phytochemical compounds in root extracts of *Prunus argentea* (Lam.) Rehder 37

No.	Phenolic Compounds	Quantification µg/g (w/w)								
		MWE7	CE7	ME7	MWA7	CA7	MA7	MWW7	CW7	MW7
1	Quinic acid	**11610.62**	7777.38	6472.53	31.91	32.98	32.03	4677.76	94.87	5080.08
2	Malic acid	1669.99	1148.93	1308.97	0.00	0.00	0.00	4042.94	793.52	581.42
3	tr-Aconitic acid	40.59	32.27	51.41	**0.45**	1.69	10.52	38.36	94.76	93.55
4	Gallic acid	34.18	34.77	21.44	8.23	5.68	4.14	10.16	162.66	237.31
5	Chlorogenic acid	42.58	43.96	22.71	3.64	0.34	**0.09**	3.89	1.69	6.34
6	Protocatechuic acid	474.66	442.58	337.40	162.53	145.08	100.38	234.01	**2068.71**	1285.91
7	Tannic acid	23.07	26.16	11.95	12.37	0.00	0.00	0.00	0.00	0.00
8	tr- caffeic acid	2.17	2.18	1.66	1.09	0.00	0.00	0.00	2.87	3.48
9	Vanillin	246.17	250.46	205.57	169.08	274.85	156.36	0.00	0.00	0.00
10	p-Coumaric acid	46.46	46.12	38.72	33.67	40.22	29.38	46.46	29.58	125.49
11	Rosmarinic acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	10.75	10.16	6.50	3.01	3.53	0.26	4.23	0.75	0.43
16	Salicylic acid	9.69	8.70	6.40	1.63	0.37	0.25	2.86	30.73	0.71
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	28.32	24.94	15.04	4.62	5.95	6.35	0.00	4.58	4.10
13	Hesperidin	35.21	31.32	29.34	10.46	11.06	12.28	0.00	6.15	5.28
14	Hyperoside	123.65	114.51	92.62	37.39	34.13	0.00	0.00	28.84	0.00
17	Myricetin	0.79	0.17	0.19	1.44	0.30	0.31	0.00	0.10	0.05
18	Fisetin	70.48	71.93	45.79	45.07	46.90	20.57	0.00	0.00	0.00
20	Quercetin	319.16	314.74	192.95	142.96	147.55	61.90	0.00	0.00	10.74
21	Naringenin	**8023.62**	7733.34	5869.45	5923.01	6717.44	3406.32	91.77	18.57	455.87
22	Hesperetin	24.36	27.45	16.81	14.89	16.32	0.43	0.00	0.09	0.07
23	Luteolin	20.09	23.25	11.32	2.26	9.41	0.88	0.00	0.18	0.00
24	Kaempferol	29.59	25.86	19.48	11.76	13.00	5.57	0.00	0.00	0.00
25	Apigenin	25.30	23.11	18.15	15.37	16.90	8.60	0.03	0.04	0.04
26	Rhamnetin	102.89	107.62	95.93	88.82	100.60	56.37	0.09	0.07	0.09
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.4.8. Identification and quantification of phytochemical compounds in *Crataegus azarolus* var. aronia L. root extract

It is clear from Table 4.32 that the root extracts had high concentration of phenolic contents, including phenolic acids and flavonoids. All extracts studied herein presented contains higher concentrations of non-phenolic and phenolic acids compared with those of flavonoids. However, the root extracts were found to consist, essentially, of non-phenolic acids such as quinic, malic and gallic acids, consequently, along with small quantities of numerous flavonoids. The analysis exposed that phenolic acids were a foremost phytochemical in the whole extracts contain herein.

In this investigation, the quantification and identification of phenolic compounds of *Crataegus azarolus* var. aronia L. were carried out by UHPLC-ESI-MS/MS technique. Many phenolics in root extract were detected. The quantified results in ethanol extracts root were summarized in Table 4.32. The results illustrate that the amount of plant non-phenolic organic acids which are widespread in plant materials and qualified and quantified in root extract of *Crataegus azarolus* var. aronia L. Three non-phenolic organic acids were identified which were quinic acid, malic ac-id and trans-aconitic acid. The root extract showed the highest amount of malic acid among all methods and solvents with concentration (MWW8: 7098.12µg/g) by microwave method with distilled water solvent. While the tr-aconitic acid showed the lowest concentration among non-phenolic acids for all methods and solvents with concentration (CA8: 1.07µg/g) by conventional method with acetonitrile solvent. Furthermore, eleven kinds standard of the phenolic acids have been used for identified phenolic acids in root extracts. From nine components quantified, chlorogenic acid has showed the highest (MWE8: 708.44µg/g) by microwave method with ethanol solvent. Also, chlorogenic acid showed the lowest concentration (MW8: 0.22 µg/g) by maceration way and distilled water solvent. Instead, there was not noticed any rosmarinic acid and coumarin in all root extracts at all three approaches. Then, through our study thirteen classes of the flavonoids standard were used for identification of flavonoids in root extracts by using LC–MS/MS instrument. The maximum and the minimum of flavonoids compounds of all root extracts were naringenin (CE8: 99.35 µg/g) by conventional method with ethanol solvent and apigenin (MWW8: 0.01 µg/g) with distilled water and microwave method. fisetin and chrysin in the root extract by three approaches with three solvents were not noticed Table 4.32.

These results were in agreement with our results, although there are no investigations on root extracts of *Crataegus azarolus* var. aronia L. Nonetheless, there are other studies based on the phenolic constituents in another parts of *Crataegus azarolus* var. aronia L. and other Crataegus species such as by Bahri-Sahloul *et al.,* (2014) on floral buds of *Crataegus azarolus* var. aronia L. var. which contains shikimic acid, gallic acid, and phenylalanine. The dried flowers and leaves of hawthorn (*C. laevigata* or *C. oxyacantha*) contains some phenolic compound such as (−) epicatechin, hyperoside and chlorogenic acid (Svedström *et al.,* 2006). The leaves of Hawthorn (*Crataegus azarolus* var. aronia L.) was a rich source of hypersoide and vitexin- rahmnose identified by (Hamahameen and Jamal, 2013). Two species of hawthorn fruit, *Crataegus monogyna* Jacquin and *Crataegus azarolus* var. aronia L. were analysed by HPLC–DAD–MS in which twenty phenolics compounds distributed into four subclasses were identified (Mraihi *et al.,* 2015). other study of *Crataegus azarolus* var. aronia L. leaves were agreed with (Abu-Gharbieh and Shehab, 2017).

Table 4.32. Identification and quantification of phytochemical compounds in root extract of *Crataegus azarolus* var. aronia L. 38

No.	Phenolic Compounds	Quantification µg/g (w/w)								
		MWE8	CE8	ME8	MWA8	CA8	MA8	MWW8	CW8	MW8
1	Quinic acid	4824.27	1287.36	925.64	8.03	8.37	4.42	1581.96	721.62	38.24
2	Malic acid	6346.18	1206.71	1051.97	0.00	0.00	0.00	**7098.12**	403.13	0.00
3	tr-Aconitic acid	76.34	9.46	11.70	2.12	**1.07**	1.28	66.02	3.92	2.26
4	Gallic acid	17.91	17.34	11.23	2.95	0.49	2.28	17.80	20.36	10.60
5	Chlorogenic acid	**708.44**	307.18	226.45	4.39	13.28	8.08	206.73	166.88	0.22
6	Protocatechuic acid	444.28	414.61	298.94	129.21	56.62	113.57	328.16	541.41	152.67
7	Tannic acid	16.33	16.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	tr- caffeic acid	8.68	9.19	7.72	4.77	0.00	3.31	2.95	6.92	1.53
9	Vanillin	149.96	185.45	163.54	136.13	142.60	105.29	0.00	0.00	1.88
10	p-Coumaric acid	113.06	115.35	92.70	77.83	47.12	57.94	36.07	14.44	6.77
11	Rosmarinic acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	28.13	19.01	10.70	6.91	3.96	4.89	5.49	1.64	9.80
16	Salicylic acid	24.18	14.60	9.58	6.54	4.08	3.58	5.33	0.61	0.52
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	6.14	6.23	3.65	0.00	0.00	0.00	0.00	0.00	0.00
13	Hesperidin	9.07	9.39	7.89	0.00	0.00	0.00	0.00	0.00	0.00
14	Hyperoside	0.00	18.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Myricetin	1.18	0.10	0.17	0.40	0.00	0.17	0.00	0.00	0.00
18	Fisetin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Quercetin	7.95	8.03	4.43	0.00	0.00	0.00	0.00	0.00	0.00
21	Naringenin	44.74	**99.35**	26.89	23.99	10.95	19.73	0.00	0.00	0.00
22	Hesperetin	2.52	1.95	2.39	0.15	0.04	0.04	0.00	0.10	0.04
23	Luteolin	1.30	0.77	0.83	1.28	0.00	0.18	0.00	0.91	0.32
24	Kaempferol	0.00	3.96	2.66	1.66	0.00	0.00	0.00	0.00	0.00
25	Apigenin	0.06	0.33	0.10	0.06	0.21	0.79	**0.01**	0.00	0.02
26	Rhamnetin	5.90	8.07	0.28	5.13	5.70	4.93	0.00	0.00	0.00
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.4.9. Identification and quantification of phytochemical compounds in root extracts of *Prunus microcarpa* C.A. Mey. (Red fruit)

It is obvious from Table 4.33 that all quantification and determination of phenolic compound treatments of *Prunus microcarpa* C.A. Mey. (Red fruit) were carried out by UHPLC-ESI-MS/MS instrument. Many instances of phenolic and non-phenolic compounds in root extract were detected. In this research, twenty-seven standard classes have been using three non-phenolic organic acids, eleven phenolic acids and thirteen flavonoid compounds in root extract of *Prunus microcarpa* C.A. Mey. Three solvents and three methods were used for analysing by mass spectrometer equipped with the triple-quadruple analyzer. As a consequence of this, its sensitivity and selectivity for phenolics and flavonoids, negative ionization mode was preferred in the current study.

The total outcomes in the root extracts by LC–MS/MS analysis were containing a high concentration of non-phenolic and phenolic compounds. In *Prunus microcarpa* C.A. Mey. (Red fruit), 25 phytochemical components were also identified (Table 4.33) with quinic acid and contains major components (MWE9: 6,224.88 µg/g) by microwave method with ethanol solvent and tr-aconitic acid and showed the lowest at (MA9: 3.23µg/g) Identified components by microwave way and acetonitrile solvents.

High amount of phenolic acid was protocatechuic acid (MW9: 1,610.02µg/g) by distilled water with microwave technique. Whereas the smallest quantity was detected chlorogenic acid (CW9: 0.15µg/g) by conventional method with distillated water. Nonetheless, coumarin was not sensed by all three methods and solvents. Finally, from the thirteen classes of the flavonoids references have been using with LC-MS/MS. The extreme amount was hyperoside (MWE9: 1298.64µg/g) and the smallest amount of flavonoid compound was apigenin (MWW9: 0.02µg/g) by microwave method with distilled water. Nonetheless, chrysin was not determined by all three methods and solvents as shown in Table 4.33.

There were no studies on *Prunus microcarpa* C.A. Mey (Red fruit) root extract. But there are several reserch instances at different schools agreed by Xia *et al.,* (2011). three chlorogenic acid isomers were identified, namely, 3-O-caffeoylquinic acid, 5-O-caffeoylquinic acid and 4-O-caffeoylquinic acid from *P. mume* seed. Also, other reports found that neochlorogenic acid and cyanidin-3-O-glucoside were the major compounds in most of *Prunus salicina* Lindl. flesh fruit by (Venter *et al.,* 2013). Also, phenolic compounds were identified from Plum fruits (*Prunus salicina* L. and *Prunus domestica* L.) by (Jaiswal *et al.,* 2013). phenolic compounds were determined from the fruits of *Prunus mume* (Yan *et al.,* 2014). Other study by Muzaffar *et al.,* (2016) on the fruits of cherry (*Prunus avium*). Finally, phenolics from the seeds of *Prunus tomentosa* were extracted (Liu *et al.,* 2014).

Table 4.33. Identification and quantification of phytochemical compounds in root extracts of *Prunus microcarpa* C.A. Mey. (Red fruit) 39

No.	**Phenolic Compounds**	**Quantification µg/g (w/w)**								
		MWE9	**CE9**	**ME9**	**MWA9**	**CA9**	**MA9**	**MWW9**	**CW9**	**MW9**
1	Quinic acid	**6224.88**	6104.89	3145.53	15.78	66.30	16.43	3937.16	147.36	4273.85
2	Malic acid	1662.48	1308.34	1012.30	0.00	0.00	0.00	151.42	14.54	157.87
3	tr-Aconitic acid	59.45	37.42	51.52	7.50	14.86	**3.32**	60.15	4.31	76.16
4	Gallic acid	84.82	79.89	50.57	37.22	14.81	16.21	109.64	27.25	140.87
5	Chlorogenic acid	85.68	61.11	24.71	2.98	9.38	2.32	9.71	**0.15**	0.22
6	Protocatechuic acid	657.42	629.19	370.84	348.53	182.13	211.52	554.24	433.58	**1610.02**
7	Tannic acid	49.47	52.51	72.01	52.71	0.00	0.00	0.00	0.00	12.38
8	tr- caffeic acid	2.16	1.96	1.74	0.88	0.00	0.00	0.00	1.09	4.06
9	Vanillin	346.19	288.58	233.48	217.24	246.74	245.55	0.00	0.00	0.00
10	p-Coumaric acid	91.34	99.99	83.37	68.48	44.70	62.53	93.64	24.49	134.94
11	Rosmarinic acid	33.21	32.00	17.74	16.11	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	64.08	69.05	37.46	0.36	13.66	20.35	21.98	0.29	0.73
16	Salicylic acid	53.65	56.53	33.94	0.87	12.34	18.06	17.44	0.47	0.53
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	24.68	21.09	13.11	7.21	2.47	2.76	0.00	0.00	9.08
13	Hesperidin	32.55	30.40	19.97	7.60	8.18	6.48	10.33	0.00	4.68
14	Hyperoside	**1298.64**	1289.15	881.81	758.83	53.69	44.64	17.85	0.00	27.26
17	Myricetin	28.61	28.85	21.69	0.32	13.78	23.41	0.88	0.08	0.13
18	Fisetin	31.59	24.64	16.24	0.00	17.40	20.74	0.00	0.00	0.00
20	Quercetin	308.16	317.90	193.58	99.82	49.99	74.65	4.49	0.00	10.33
21	Naringenin	1178.79	1224.66	779.36	876.14	472.38	855.17	33.09	165.28	46.02
22	Hesperetin	40.53	42.03	31.61	36.99	24.77	33.55	2.21	0.04	0.20
23	Luteolin	7.55	11.14	1.62	4.77	1.96	3.53	0.00	0.35	0.23
24	Kaempferol	13.76	13.83	5.98	6.15	2.22	4.19	0.00	0.00	0.00
25	Apigenin	8.96	8.36	5.72	5.73	2.99	5.04	**0.02**	0.14	0.03
26	Rhamnetin	78.91	74.52	57.24	63.21	59.60	68.94	0.09	0.00	0.16
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.4.10. Identification and quantification of phytochemical compounds in root extracts of *Rubus sanctus* Schreb

The results in this study presented that of all quantification and determination treatments of phenolic compounds in *Rubus sanctus* Schreb *was* carried out by UHPLC-ESI-MS/MS. Many phenolics in root extract were detected. Around research, twenty-seven standard types have been using three non-phenolic, eleven phenolic acids and thirteen flavonoid compounds of root extracts.

Results of the phytochemical compounds in *Rubus sanctus Schreb* are shown in Table 4.34. Twenty-one types of phytochemical compounds were identified and quantified. The main component was malic acid (MWE10: 6,194.52µg/g) by microwave technique with ethanol solvent. While the lowest component was tr-aconitic acid (CA7: 1.51µg/g) microwave technique with ethanol solvent which represents the class of non-phenolic organic acid compounds. The high volume of phenolic acids was gallic acid (CE10: 2,630.86µg/g) by conventional way and ethanol solvent. Whereas, the low volume was sensed chlorogenic acid (CW10: 0.17µg/g) by conventional method with distilled water solvent. On the other hand, from all root extract and all three methods with three solvents were no detected any rosmarinic acid and coumarin. The maximum and the minimum of flavonoids compounds were naringenin (CE10: 98.81 µg/g) by conventional method with ethanol and apigenin (MW10: 0.02µg/g) by maceration technique with distilled water. In contrast, from all root extract by three methods with three solvents were not sensed any rutin, hesperidin, fisetin and chrysin as shown in Table 4.34.

There are no studies on root extracts of *Rubus sanctus* Schreb. But there are some studies regarding the phenolic and flavonoid constituents on other parts and other species. These results were agreed by Gharaghania *et al.,* (2015) on total phenols from the fruit of Wild Blackberry (*Rubus sanctus* Schreb). Likewise, identification of phytochemical compound in the blackberry (*Rubus ulmifolius*) leaves contain 44.88 (gallic acid) to 1.60 (kaempferol) by (Martini *et al.,* 2009). Also, other results on the aerial part extract of *Rubus sanctus* Schreb were contained caffeoyl esters; 3,6-di-O-caffeoyl-(a/b)-glucose; 1-O-caffeoyl-b-xylose; Tannin; 2,3-O-hexahydroxydiphenoyl (Hussein *et al.,* 2003). Moreover, three galloyated flavonoids, namely: kaempferol, quercetin and myricetin were identified from fresh leaves of *Rubus sanctus* Schreb (Amira *et al.,* 2009) and the young branches of *Rubus ulmifolius* Schott (Sisti *et al.,* 2008).

Table 4.34. Identification and quantification of phytochemical compounds in root extracts of *Rubus sanctus* Schreb 40

No.	Phenolic Compounds	Quantification µg/g (w/w)								
		MWE10	**CE10**	**ME10**	**MWA10**	**CA10**	**MA10**	**MWW10**	**CW10**	**MW10**
1	Quinic acid	5142.93	3570.88	2254.18	25.33	25.53	28.70	2946.68	806.60	360.25
2	Malic acid	**6194.52**	3457.68	2946.76	0.00	0.00	42.78	800.97	432.88	1453.34
3	tr-Aconitic acid	414.21	214.66	207.93	9.93	**1.51**	29.78	1050.16	524.31	1152.46
4	Gallic acid	2387.29	**2630.86**	1705.29	472.65	480.67	351.91	2433.29	1979.57	775.13
5	Chlorogenic acid	27.14	24.78	1.21	0.20	0.95	0.41	3.31	**0.17**	0.28
6	Protocatechuic acid	385.18	415.23	288.95	110.77	126.11	88.00	676.98	671.33	288.55
7	Tannic acid	57.64	58.50	87.44	76.86	0.00	32.13	46.51	182.27	244.28
8	tr- caffeic acid	9.68	12.01	7.77	4.79	5.33	3.47	5.84	11.41	3.84
9	Vanillin	234.42	281.00	202.14	234.76	304.31	217.34	0.00	21.71	0.00
10	p-Coumaric acid	88.84	83.64	69.47	58.81	69.76	38.73	12.96	64.85	0.00
11	Rosmarinic acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	55.47	57.23	37.07	14.90	13.00	10.04	17.42	0.88	53.27
16	Salicylic acid	41.84	49.69	32.60	12.44	13.63	7.92	14.06	1.18	0.92
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	Hesperidin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	Hyperoside	40.25	47.62	31.96	0.00	0.00	0.00	0.00	0.00	0.00
17	Myricetin	0.22	0.15	0.77	0.43	0.82	0.12	0.12	0.16	0.27
18	Fisetin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Quercetin	26.38	29.47	17.38	6.20	7.33	5.20	0.00	0.00	0.00
21	Naringenin	91.65	**98.81**	63.68	44.52	47.15	30.72	3.16	3.43	6.18
22	Hesperetin	1.86	2.24	0.13	0.08	0.19	0.15	0.04	0.08	0.08
23	Luteolin	9.40	9.85	5.07	0.68	1.07	0.37	0.00	0.00	0.00
24	Kaempferol	11.08	14.85	6.87	1.61	2.93	1.14	0.00	0.00	0.00
25	Apigenin	0.99	1.40	0.31	0.36	0.33	0.20	0.00	0.00	0.02
26	Rhamnetin	0.00	0.00	0.00	0.00	1.60	0.71	0.51	0.32	0.23
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.4.11. Identification and quantification of phytochemical compounds in *Ficus carica* L. root extract

Through research, *Ficus carica* L. root extract was screened for twenty-seven phytochemical compounds including three non-phenolic organic acids, nine phenolic acids, one phenolic aldehyde, coumarin and thirteen flavonoid compounds. Three solvents with three methods were used to analyzing by LC–MS/MS. As a consequence of its sensitivity and selectivity for phenolic and flavonoids, negative ionization mode was preferred in the current study. The quantified results in root extracts were summarized in (Table 4.35). All root extracts studied herein presented higher concentrations of non-phenolic organic acids and phenolic acids compared with those of flavonoids. The analysis revealed that phenolic acids were a major phytochemical in the whole extracts obtained herein.

The results are indicated that non-phenolic organic acids compounds were contains high amount in roots extract of *Ficus carica L.* by LC-MS/MS analysis. High amounts of quinic acid were detected at ethanol microwave method (MWE11: 1,332.12µg/g), while the minimum amount of non-phenolic organic acids was tr-Aconitic acid microwave (MA11: 0.29µg/g). The high amount of phenolic acids was p-Coumaric acid (CE11: 1,301.67µg/g) by a conventional method with ethanol solvent. Whereas, a low amount of chlorogenic acid was sensed (CW11: 0.17µg/g) using the conventional method with distilled water solvent. The greatest and the slightest of flavonoids compounds were naringenin (MWE11: 2449.15µg/g) by microwave method with ethanol solvent and apigenin (MWW11: 0.01 µg/g) by maceration method with distilled water solvent.

On the other hand, no rosmarinic acid, coumarin and chrysin were detected in the root extract of all three approaches and solvents as shown in Table 4.35.

There are no investigations on root extracts of *Ficus carica* L. However, there were many studies regarding the phenolic compound on other parts and other species. of *Ficus carica* L. These results are in agreement with many other results. Most species of *F. carica* fruit contain phenolic compounds, organic acids, and volatile compounds (Gibernau *et al.,* 1997; Oliveira *et al.,* 2009). The latex extracts of *Ficus carica* L. contained the caffeic acid, 3.4-dihydroxybenzoic acid, p-OH-phenylacetic acid, p-coumaric acid luteolin, n-argenine, ferulic acid (Lazreg *et al.,* 2011). Also, fresh fruits of common Fig (*Ficus carica L.*) by (Solomon *et al.,* 2006). The Coumarin has been isolated from the leaves of *F. carica* L. (Liu *et al.,* 2011). There were many other studies on the fig (*Ficus carica* L. Linn.)

leaves by (Ali *et al.,* 2012), the fig (*Ficus carica* Linn.) leaf and latex extract by (Rashid *et al.,* 2014) and the green fruit latex fig (*Ficus carica* Linn.) by (Aref *et al.* 2010). Finally, the green, yellow, brown, purple and black-fruited fig (*Ficus carica* L.) phenolic acids; 3-O-and 5-O-caffeoylquinic acids, ferulic acid, quercetin-3-O-glucoside, quercetin-3-O-rutinoside, psoralen, and bergapten, and organic acids (oxalic, citric, malic, shikimic, and fumaric acids) were isolated from the pulps and peels of fig (Çalişkan and Aytekin Polat, 2011).

Table 4.35. Identification and quantification of phytochemical compounds in *Ficus carica* L. root extract 41

No.	Phenolic Compounds	Quantification µg/g (w/w)								
		MWE11	**CE11**	**ME11**	**MWA11**	**CA11**	**MA11**	**MWW11**	**CW11**	**MW11**
1	Quinic acid	**1332.12**	542.89	521.21	0.00	0.00	0.82	946.19	232.31	629.34
2	Malic acid	1189.67	515.74	1130.52	0.00	0.00	0.00	1033.41	553.79	705.19
3	tr-Aconitic acid	1.46	1.70	1.52	0.56	0.37	**0.29**	2272.98	27.26	132.37
4	Gallic acid	15.67	12.63	32.47	0.14	0.63	0.64	0.95	3.61	117.06
5	Chlorogenic acid	779.59	520.92	550.65	5.70	1.42	1.72	8.23	**0.17**	22.57
6	Protocatechuic acid	130.45	110.74	89.16	34.30	20.42	12.43	335.69	34.03	1113.62
7	Tannic acid	93.39	41.87	47.56	26.49	20.57	0.00	0.00	0.00	42.73
8	tr- caffeic acid	5.84	5.73	5.39	1.83	0.00	0.00	0.00	0.00	2.50
9	Vanillin	213.36	159.48	155.78	193.85	211.22	174.01	0.00	0.00	0.00
10	p-Coumaric acid	1104.58	**1301.67**	912.25	610.89	644.60	290.60	86.60	151.39	91.40
11	Rosmarinic acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4-OH Benzoic acid	28.68	22.72	14.40	8.23	4.90	1.90	0.41	0.48	0.60
16	Salicylic acid	24.48	18.72	11.71	8.36	0.38	0.50	0.40	0.52	0.67
19	Coumarin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Rutin	5.92	2.70	3.06	0.25	0.00	0.00	0.00	0.00	0.00
13	Hesperidin	14.96	7.18	7.07	0.00	0.00	0.00	0.00	0.00	0.00
14	Hyperoside	16.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Myricetin	0.29	0.18	1.22	0.58	0.91	0.58	0.00	0.10	0.00
18	Fisetin	69.11	59.90	48.31	17.03	5.51	4.82	0.00	0.00	0.00
20	Quercetin	11.47	17.81	12.20	3.25	0.00	0.00	0.00	0.00	0.00
21	Naringenin	**2449.15**	2061.87	2111.59	1421.31	1456.77	970.25	0.00	0.00	12.98
22	Hesperetin	39.03	32.93	29.40	24.34	26.68	13.82	0.00	0.00	0.08
23	Luteolin	1141.41	1081.37	968.34	496.87	442.67	230.61	0.00	0.32	2.61
24	Kaempferol	1543.31	1455.60	1228.55	700.48	588.67	323.63	0.00	0.00	9.20
25	Apigenin	1076.79	1035.24	1033.20	628.40	635.32	381.54	**0.02**	0.00	18.03
26	Rhamnetin	0.52	0.53	0.18	0.28	0.41	0.06	0.10	0.04	0.00
27	Chrysin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Based on vide supra results, there are many differences between our results of phenolic compounds by using three methods and three solvents. The variance in amount levels of phenolic compounds could be due to differing methods of extraction (Garzón *et al.,* 2009). Indeed, it could be due to the polyphenolic content of the roots being greatly affected by environmental factors as well as edaphic factors like soil type, sun exposure, rainfall, altitude and hightide, soil nutrients. etc. (Manach *et al.,* 2004). Oloumi and Hassibi, (2011) also indicated that the variation of phytochemical concentrations might be due to several environmental factors, they studied the correlation between some climate parameters and the content of phenolic compounds in roots of the content of flavonoids, anthocyanins and sugar in roots was correlated to soil pH. Total phenolic compounds and sugar content showed the direct correlation with soil texture. Based on the results, it seems that tannins content is correlated with mean annual temperature (Oloumi and Hassibi, 2011). A high variation on the phenolic composition inter- and intraspecies is due to the differences in the composition of roots(Zielinski *et al.,* 2014). Moreover, the phenolic compounds and antioxidant capacity of the plant from the same species may be discrepant because of differences in the environmental conditions, physiopathological conditions of the plant, water stress, and soil composition, among others (Zielinski *et al.,* 2014). Some studies suggest that the polyphenolic content of plant fruits is influenced by genotype, habitat conditions and ripeness of the fruits (Deliorman Orhan *et al.,* 2007). Other factors, such as altitude, light, temperature, and content of nutritive matter in the soil, can influence phenylpropanoid metabolism (Dixon and Paiva, 1995).

4.5. Distribution of women patients with vaginitis in relation to pregnant and non-pregnant

Throughout our study totally has been two hundred and fifty (250) high vaginal swabs collected from women patients attending in Erbil city at Maternity Teaching Hospital suspected of having vaginitis (patients who are married). The consequences presented that among 250 high vaginal swabs only 228 (91.2%) showed culture positive, 135 equal (90%) were non- pregnant and 93 equal (93%) pregnant, while 22 (8.8%) samples showed culture negative, 15 equal (10%) were non- pregnant and 7 equal (7%) pregnant. The statistical analysis showed no significant differences of infection among non- pregnant and pregnant as shown in the Table 4.36.

Table 4.36. Distribution of women patients with vaginitis in relation to pregnant and non-pregnant 42

Culture results	Non- pregnant		Pregnant		Total	
	No.	%	No.	%	No.	%
Positive culture	135	90 %	93	93 %	228	91.2 %
Negative culture	15	10 %	7	7 %	22	8.8 %
Total	150	60%	100	40 %	250	100 %

Also, the frequency of microorganisms isolated from women with vaginitis as shown in Table 4.37 and Figure 4.26 out of the 228 culture positive samples, 203 (89.03%) showed single culture growth and 25 (10.97%) isolates showed mixed culture growth. A total of 233 *Candida* species were isolated. Also, as contained in this Table 4.37, the incidence of *Candida* was isolated from vaginal infections. The results showed that the occurrence of *Candida* isolated from single culture growth 203 (87.1%) was significantly higher compared to that from mixed culture growth 30 (10.97%). ($P < 0.05$)

Table 4.37. The incidence of all Candida isolated in single and mixed culture from vaginal infections 43

Candida code.	*Candida* species	Isolated	Percentage (%)
C 1	*C. albicans*	165	70.81
C 2	*C. glabrata*	33	14.16
C 3	*C. krusei*	17	7.29
C 4	*C. tropicalis*	8	3.43
C 5	*C. famata*	4	1.71
C 6	*C. parapsilosis*	3	1.28
C 7	*C. guilliermondii*	3	1.28
C 8	*Candida kefyr*	1	0.42
C 9	*Candida lusitaniae*	1	0.42
C 10	*Candida dubliniensis*	1	0.42
Total	Total *Candida* species were isolated	228	

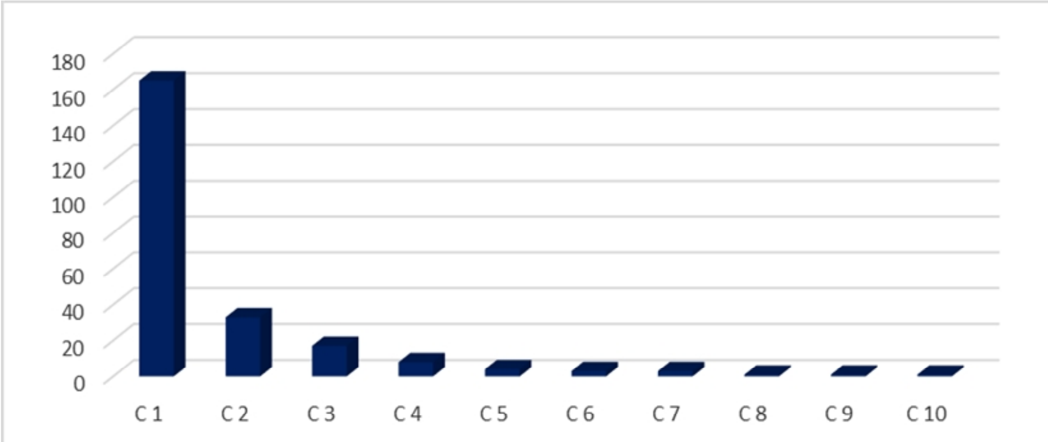

Figure 4.26. The incidence of all *Candida* isolated in single and mixed from vaginal infections 36

These results are in agreement with various reported outlined by different schools of research published by Abu-Elteen (2001) 44.9% the separation amount in women with uncharacteristic vaginal discharge. Nonetheless, higher than those by Mendoza *et al.,* (1999) cited the isolation rate was (24%), Bauters *et al.,* (2002) isolation rate was (21.7%), and Lopes Consolaro *et al.,* (2004) stated that the isolation rate in women with vaginal discharge was (20.1%). Further investigators have informed isolation rates up to 79.3% of *Candida* spp. from illnesses (Parazzini *et al.,* 2000; Ribeiro *et al.,* 2001). These consequences were in conformity with consequences of Cetin *et al.,* (2007) hat *Candida* spp. were discovered in 44.2% had an isolation rate of 37.9 %. It has been reported that reproductive age, pregnancy, diabetes, contraception and antibiotic use correlated positively with both *C. albicans* and *non albicans* spp. isolates Grigoriou *et al.,* (2006). Some investigates have exposed that there were no significant differences of *Candida* infection (Erdem *et al.,* 2003), and that agree with the current study.

4.6. In Vitro Comparison of Antifungal Activity of Eleven Root Extracts and Six Synthetic Antifungal Against Seven Pathogenic *Candida* spp.

The antifungal activity of root extracts of *Acer monspessulanum* L. were studied in 50µL concentrations per disk paper against seven pathogenic strains of *Candida* species: *C. albicans* (ATCC 10231), *C. glabrata, C. krusei, C. tropicalis, C. famata, C. parapsilosis* and *C. guilliermondii*. After that, they were compared with six synthetic antifungal discs including Nystatin, Clotrimazole, Fluconazole, ketoconazole, Fluconazole and Miconazole used as positive controls. Then, calculated the minimum inhibitory concentration (MIC) values of root extracts against all Candida species was ranged from 0.5 to 512 mcg/ml. The

Candida species was inhibited by different root extract. The significant inhibitions were seen with a concentration of 50µL/disk of *Acer monspessulanum* L. root extracts. Most root extracts by three methods and three solvents were statically significant by the different diameters of inhibition zones of most the activities against all *Candida* species tested.

4.6.1. Comparison of Antifungal activity of *Acer monspessulanum* L. root extracts and synthetic antifungal against pathogenic *Candida* spp.

As presented in Table 4.38, Table 4.39 and Table 4.40, indicated that most treatments of root extracts of *Acer monspessulanum* L. caused significantly affected on antifungal activity against all *Candida* tested at concentration 50µL/disc in compression to positive control. Some isolates *Candida* species were found sensitive to root extract that was expressed by growth inhibition zones ranged from 8.263 to 14.45 mm in diameter of inhibition zone. Results of the antifungal activity of different root extracts and methods of *Acer monspessulanum* L. against tested *Candida* species showed that ethanol extracts have maximum antifungal activity against *C. guilliermondii* with values (CE1: 14.45 mm) by conventional method. While distilled water extract showed that less inhibitory effect against *C. tropicalis* with values (MWW1: 8.263 mm). Indeed, the MIC values regarding the antifungal activity of root extraction were against *Candida* species. Furthermore, the extract exhibited an effect against the *Candida* species. In fact, the minimum inhibitory concentration (MIC) values against all *Candida* test was between 31.25-125µg/ml. On the other hand, six synthetic antifungal discs were statically significant by the diverse widths of inhibition zones of maximum activities against the organisms tested were given in all Tables. The growth inhibition zones ranged from 10.5–38.40mm in diameter of inhibition zone. The lowermost inhibitory zone 10.5 mm of FLU/25 was against *C. albicans.* Also, the uppermost inhibitory zone of FLU/25 38.40 mm was against *C. guilliermondii*.

These results are supported by Zhang *et al.,* (2008) who reported that Gram-positive and Gram-negative bacteria and some fungi were used to assess the antibacterial abilities of different extract samples. The experiments showed that a higher polyphenol content of the extracts led to a more potent antibacterial effectiveness. Extracts got from the dropped leaves of the Shantung maple (*Acer truncatum* Bunge). Moreover, other studies on the leaves of *Acer* plant Anti-quorum sensing activity and violacein inhibition activity determined that anti-swarming activity was carried out with *Pseudomonas aeruginosa* PA01 (Ceylan *et al.,* 2016).

Table 4.38. Antifungal activity of ethanol root extracts of *Acer monspessulanum* L. against tested *Candida* species 44

***Candida* spp.**		**MWE1 (I.Z. mm)**	**MIC (µg/ml)**	**CE1 (I.Z.mm)**	**MIC (µg/ml)**	**ME1 (I.Z.mm)**	**MIC (µg/mm)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	9.85	62.50	10.29	62.50	11.02	62.50	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.04		0.01		0.02		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.02		0.00		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	9.745	62.50	**8.275**	62.50	11.36	31.25	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.05		0.04		0.04		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.02		0.02		0.02		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	8.727	62.50	0.00	125	0.00	125	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.05		0.00		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.02		0.00		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	0.00	125	0.00	250	0.00	125	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.00		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	125	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	11.31	31.25	9.338	62.50	9.838	62.50	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.05		0.01		0.03		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.02		0.00		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	12.22	31.25	**14.45**	31.25	13.33	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.02		0.03		0.02		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Notes: MW: microwave assisted; C: conventional; M: maceration; E: ethanol; A: acetonitrile; W: distilled water; I.Z: inhibition zone; MIC: minimum inhibitory concentration; NY: Nystatin; CLT: Clotrimazole; FLU: Fluconazole; KTZ: ketoconazole; MCZ: Miconazole; SD: standard division; SE: standard error

Table 4.39. Antifungal activity of acetonitrile root extracts of *Acer monspessulanum* L. against tested *Candida* species 45

***Candida* spp.**		**MWA1 (I.Z.mm)**	**MIC (µg/ml)**	**CA1 (I.Z.mm)**	**MIC (µg/ml)**	**MA1 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	0.00	125	0.00	125	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.00		0.00		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.00		0.00		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	0.00	125	0.00	250	0.00	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.00		0.00		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.00		0.00		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	0.00	125	0.00	125	0.00	125	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.00		0.00		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.00		0.00		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	0.00	125	0.00	125	0.00	125	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.00		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	125	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	9.998	62.50	8.44	62.50	0.00	125	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.02		0.01		0.00		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.00		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	**10.23**	62.50	9.965	62.50	8.938	62.50	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.02		0.02		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.40. Antifungal activity of distilled water root extracts of *Acer monspessulanum* L. against tested *Candida* species 46

***Candida* spp.**		**MWW1 (I.Z.mm)**	**MIC (µg/ml)**	**CW1 (I.Z.mm)**	**MIC (µg/ml)**	**MW1 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	9.085	62.50	9.825	62.50	10.21	62.50	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.41		0.05		0.03		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.17		0.02		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	8.322	62.50	8.854	62.50	9.825	62.50	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.02		0.07		0.05		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.03		0.02		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	9.085	62.50	9.085	62.50	11.43	31.25	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.41		0.41		0.02		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.17		0.17		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	8.263	62.50	8.86	62.50	9.863	62.50	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.08		0.03		0.04		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.03		0.01		0.02		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	125	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	0.00	250	12.23	31.25	8.86	62.50	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.00		0.02		0.03		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.00		0.01		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	11.36	31.25	13.12	31.25	10.24	62.50	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.02		0.02		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

4.6.2. Comparison of Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) root extracts and synthetic antifungal against pathogenic *Candida* spp.

The ethanol, acetonitrile and distilled water root extracts of *Prunus microcarpa* C.A. Mey. (Yellow fruit) showed significantly the inhibition zones with a concentration of 50 µL/disk of extracts against all clinical isolates of *Candida* species, with inhibition zone ranging from 8.23 to 12.32 mm. The results confirmed that distilled ware extract with maceration method are potentially rich source of antifungal activity. In this investigation, the antifungal activities of the root extract were compared with those of six synthetic antifungal discs used as positive controls. The root extracts of *Prunus microcarpa* C.A. Mey. (Yellow fruit) by three methods and three solvents were statically significant by the different diameters of inhibition zones of most activities against the organisms tested. The lowest inhibitory zone 8.23 mm by (MWW) microwave method with distilled water root extract was against *C. albicans.* Whereas, the highest significant inhibitory zone 12.32 mm by (MW) distilled ware extract with maceration method was against *C. guilliermondii.* In this study, the MIC values regarding the antifungal activity of root extraction were against *Candida* species. The root extracts showed that an effect against the *Candida* species. Actually, the MIC values against all *Candida* tested were between 31.25-250 µg/ml. Alternatively, six artificial antifungal discs were statically significant by the diverse diameter of inhibition zones of maximum activities against the organisms tested. All clinical isolates of Candida species, with inhibition zone ranging from 10.5–38.40 mm in diameter of inhibition zone. The lowermost inhibitory zone 10.5 mm of FLU/25 was against *C. albicans.* Also, the uppermost inhibitory zone of FLU/25 38.40 mm was against *C. guilliermondii* as shown in Table 4.41, Table 4.42 and Table 4.43.

It has been previously reported that fungi are resistant to plant extracts by Ahn *et al.,* (2009). The results suggest that the fruit of *P. avium* L. has high potentials with anti-*Candida* with 0.5~1.0 mg/mL of the MIC. Also, significant anti-*Candida* activity was also observed with the methanol extract of apricot (*Prunus armeniaca* L.) kernels against the diameter of inhibition zone and a 0.625 mg/mL MIC value (Yiğit *et al.,* 2009). Likewise, the bark of *Prunus cornuta* was observed for their antimicrobial activity against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Aspergillus niger* and *C. albicans*. Thus, the MIC of resulting extract was also checked. The sensitivity of the pathogens was also checked with standard antibiotics erythromycin, Fluconazole, and N-saline The (Powar and Gaikwad 2017).

Table 4.41. Antifungal activity of ethanol root extracts of *Prunus microcarpa* C.A. Mey. (Yellow fruit) against tested *Candida* species 47

***Candida* spp.**		**MWE2 (I.Z.mm)**	**MIC (µg/ml)**	**CE2 (I.Z.mm)**	**MIC (µg/ml)**	**ME2 (I.Z. mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	9.29	62.5	9.35	62.5	10.47	62.5	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.22		0.04		0.40		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.09		0.01		0.16		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	10.11	62.5	8.77	62.5	11.43	31.25	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.01		0.02		0.02		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.00		0.01		0.01		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	9.88	62.5	0.00	125	9.24	62.5	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.01		0.00		0.04		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.00		0.00		0.02		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	0.00	125	7.80	125	0.00	125	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.00		0.03		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.01		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	250	0.00	250	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	9.46	62.5	9.90	62.5	9.67	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.01		0.04		0.02		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.02		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	9.33	62.5	9.90	62.5	9.98	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.02		0.04		0.04		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.02		0.02		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.42. Antifungal activity of acetonitrile root extracts of Prunus microcarpa C.A. Mey. (Yellow fruit) against tested Candida species 48

***Candida* spp.**		**MWA2 (I.Z.mm)**	**MIC (µg/ml)**	**CA2 (I.Z.mm)**	**MIC (µg/ml)**	**MA2 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	9.092	62.5	0.00	125	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.01		0.00		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.00		0.00		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	9.33	62.5	0.00	250	0.00	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.02		0.00		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.00		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	8.25	62.5	0.00	125	0.00	125	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.02		0.00		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.01		0.00		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	8.87	125	0.00	125	0.00	250	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.02		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.01		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	250	0.00	500	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	9.99	62.5	0.00	125	0.00	250	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.02		0.00		0.00		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.00		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	11.53	31.25	8.337	62.5	0.00	125	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.17		0.02		0.00		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.07		0.01		0.00		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.43. Antifungal activity of distilled water root extracts of Prunus microcarpa C.A. Mey. (Yellow fruit) against tested Candida species 49

***Candida* spp.**		**MWW2 (I.Z.mm)**	**MIC (µg/ml)**	**CW2 (I.Z.mm)**	**MIC (µg/ml)**	**MW2 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	8.23	62.5	0.00	125	11.61	31.25	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.02		0.00		0.01		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.00		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	9.83	62.5	0.00	125	0.00	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.05		0.00		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.02		0.00		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	8.24	62.5	0.00	125	11.43	31.25	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.02		0.00		0.02		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.01		0.00		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	9.09	62.5	0.00	125	11.26	31.25	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.41		0.00		0.03		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.17		0.00		0.01		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	8.42	62.5	0.00	125	11.43	31.25	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.01		0.00		0.02		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.01		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	8.24	62.5	0.00	125	12.00	31.25	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.02		0.00		0.04		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.00		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	11.43	31.25	8.24	31.5	**12.32**	31.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.02		0.02		0.02		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

4.6.3. Comparison of Antifungal activity of *Pyrus syriaca* Boiss. root extracts and synthetic antifungal against pathogenic *Candida* spp.

Seven *Candida* species were inhibited by *Pyrus syriaca* Boiss. root extracts by three different method and solvents. The inhibition zones significantly were seen with a concentration of 50 µL/disk of extracts. The antifungal activities of the root extract were compared with those of six synthetic antifungal discs used as positive controls as shown in Table 4.44, Table 4.45 and Table 4.46. The root extracts were statically significant by the different diameters of inhibition zones of most the activities against the organisms tested. Some isolates Candida species were found sensitive to root extract that was expressed by growth inhibition zones ranged from 7.58 –14.46 mm in diameter of inhibition zone. The lowest inhibitory zone 7.58 mm by (CA) of extract at was against *C. krusei.* While the highest inhibitory zone 14.46 mm by (MWE) was against *C. tropicalis.* In this study, the MIC values regarding the antifungal activity of root extraction were against *Candida* species. Besides, the extract showed an effect against the *Candida* species. Actually, the MIC values against all *Candida* tested were between 31.25-250µg/ml. Alternatively, six artificial antifungal discs were statically significant by the diverse diameter of inhibition zones of maximum the activities against the organisms tested were given in all Tables. The mean inhibition zones against all *Candida* test ranged from 10.5–38.40mm in diameter of inhibition zone. The lowermost inhibitory zone 10.5 mm of FLU/25 was against *C. albicans.* Also, the uppermost inhibitory zone of FLU/25 38.40 mm was against *C. guilliermondii*.

There is no study on root extracts of *Pyrus syriaca* Boiss. on *Candida*. Although, the above results were supported by some results obtained from other studies by Sharma *et al.,* (2015) the obtained compounds by *Pyrus communis* L. fruit have potent antimicrobial & antioxidant properties. The antioxidant, antibacterial, antifungal, antilarval and anticholinesterase activities of a methanolic Leaf extract from this plant have been studied in vitro and the antioxidant, antihyperglycaemic and antihyperlipidemic effects of *Pyrus biossieriana* buhse extract were studied in vivo (Khalilpour *et al.,* 2013).

Table 4.44. Antifungal activity of ethanol root extracts of *Pyrus syriaca* Boiss. against tested *Candida* species 50

***Candida* spp.**		**MWE3 (I.Z.mm)**	**MIC (µg/ml)**	**CE3 (I.Z.mm)**	**MIC (µg/ml)**	**ME3 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	MCZ 10mcg
C. albicans	Mean	11.32	31.25	11.30	31.25	12.28	31.25	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.03		0.01		0.07		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.00		0.03		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	12.4	31.25	10.26	62.5	11.24	62.5	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.02		0.03		0.03		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.01		0.01		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	14.36	31.25	9.80	62.5	10.42	62.5	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.05		0.04		0.03		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.02		0.02		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	11.52	31.5	8.44	62.5	9.85	62.5	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.03		0.01		0.03		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.01		0.00		0.01		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	12.23	31.25	0.00	125	13.37	31.25	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.02		0.00		0.03		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.01		0.00		0.01		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	14.46	31.25	10.62	62.5	12.24	31.25	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.03		0.02		0.01		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.01		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	14.45	31.25	12.24	31.25	13.33	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.03		0.01		0.02		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.00		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.45. Antifungal activity of acetonitrile root extracts of *Pyrus syriaca* Boiss. against tested *Candida* species 51

***Candida* spp.**		**MWA3 (I.Z.mm)**	**MIC (µg/ml)**	**CA3(I.Z. mm)**	**MIC (µg/ml)**	**MA3(I.Z. mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	9.91	62.5	0.00	250	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.02		0.00		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.00		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	10.35	62.5	0.00	125	0.00	250	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.03		0.00		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.00		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	9.33	62.5	7.58	125	0.00	250	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.02		0.06		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.01		0.02		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	8.53	125	0.00	250	0.00	250	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.02		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.01		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	250	0.00	250	0.00	500	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	9.87	62.5	9.96	62.5	0.00	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.02		0.02		0.00		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.01		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	10.23	62.5	10.08	62.5	9.36	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.02		0.02		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.46. Antifungal activity of distilled water root extracts of *Pyrus syriaca* Boiss. against tested *Candida* species 52

***Candida* spp.**		**MWW3 (I.Z.mm)**	**MIC (µg/ml)**	**CW3 (I.Z.mm)**	**MIC (µg/ml)**	**MW3 (I.Z. mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	11.28	31.25	12.88	31.25	9.825	31.25	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.02		0.01		0.05		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.00		0.02		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	9.83	62.5	11.43	31.25	8.854	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.05		0.02		0.07		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.02		0.01		0.03		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	8.322	62.5	10.21	31.25	8.86	62.5	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.02		0.01		0.03		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.01		0.00		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	9.085	62.5	9.813	62.5	0.00	250	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.41		0.06		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.17		0.03		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	9.863	62.5	8.418	62.5	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.04		0.01		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.02		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	8.86	62.5	11.43	31.25	9.863	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.03		0.02		0.04		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.01		0.02		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	11.26	31.25	13.44	31.25	10.24	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.05		0.04		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.02		0.02		0.01		0.07	0.08	0.49	0.13	0.11	0.06

4.6.4. Comparison of Antifungal activity of *Quercus infectoria* Oliv. root extracts and synthetic antifungal against pathogenic *Candida* spp.

According to Table 4.47, Table 4.48 and Table 4.49 in this study, there are numerous *Candida* species the growth of which were stopped by the *Quercus infectoria* Oliv. root extracts by three different methods and solvents. The inhibition zones were significantly seen with a concentration of 50µL/disk of extracts. In this study, the antifungal activities of the root extract were compared with those of six synthetic antifungal discs used as positive controls. The root extracts were statically significant by the different diameters of inhibition zones of most the activities against the organisms tested. All isolates Candida species were found sensitive to root extract that was expressed by growth inhibition zones ranged from 7.585–24.47mm in diameter of inhibition zone. The lowest inhibitory zone 7.585 mm by (MA) of extract at was against *C. glabatra.* While the highest inhibitory zone 24.47mm by (MWE) was against *C. guilliermondii.* In this study, the MIC values regarding the antifungal activity of root extraction were against *Candida* species. Besides, the extract showed an effect against the *Candida* species. In fact, the MIC values against all *Candida* tested were between 7.8125-125µg/ml. Alternatively, six artificial antifungal discs were statically significant by the diverse diameter of inhibition zones of maximum activities against the organisms tested. The mean inhibition zones against all *Candida* test ranged from 10.5–38.40mm in diameter of inhibition zone. The lowermost inhibitory zone 10.5 mm of FLU/25 was against *C. albicans.* Also, the uppermost inhibitory zone of FLU/25 38.40 mm was against *C. guilliermondii*.

These results are in agreement with several studies on total tannin contains on gall of *Quercus infectoria* Oliv. by many researches carried out, and thus studied and reported the importance of tannin and its variation (Hassan 2011; Shrestha *et al.,* 2014; Baharuddin *et al.,* 2015; Barrett *et al.,* 2018). Their activity is possible because of their capability to connect with extracellular and soluble proteins or combine with the cell wall of fungi. The character of these compounds may disrupt fungal membranes (Hasmida *et al.,* 2014). Likewise, Tannins are found in fruits, leaves, roots and seeds. The function of tannins is the defence system of plants antimicrobial and against animal infects by reason of their harsh ability and the ability to produce complexes with polysaccharides and proteins (Aguilera-Carbo *et al.,* 2008; Tsuchiya *et al.,* 1996).

Table 4.47. Antifungal activity of ethanol root extracts of *Quercus infectoria* Oliv. against tested *Candida* species 53

***Candida* spp.**		**MWE4 (I.Z.mm)**	**MIC (µg/ml)**	**CE4 (I.Z.mm)**	**MIC (µg/ml)**	**ME4 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	20.3	7.8125	19.4	15.62	17.31	15.625	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.14		0.02		0.02		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.06		0.01		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	16.18	15.625	21.26	7.8125	18.74	15.625	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.01		0.04		0.03		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.00		0.02		0.01		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	16.38	15.625	15.3	15.625	14.36	31.25	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.04		0.02		0.02		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.02		0.01		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	15.33	15.625	16.42	15.625	16.42	15.625	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.01		0.01		0.02		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.00		0.01		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	16.12	15.625	15.06	15.625	15.26	15.625	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.01		0.04		0.03		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.01		0.01		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	19.24	15.625	17.88	15.625	16.73	15.625	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.02		0.02		0.10		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.01		0.04		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	24.47	7.8125	20.51	7.8125	18.75	15.625	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.15		0.05		0.04		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.06		0.02		0.02		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.48. Antifungal activity of acetonitrile root extracts of *Quercus infectoria* Oliv. against tested *Candida* species 54

***Candida* spp.**		**MWA4 (I.Z.mm)**	**MIC (µg/ml)**	**CA4 (I.Z.mm)**	**MIC (µg/ml)**	**MA4 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	11.45	31.25	9.883	62.5	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.03		0.02		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.01		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	11.19	31.25	13.38	31.25	7.585	62.5	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.09		0.04		0.06		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.04		0.02		0.02		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	11.45	31.25	10.23	62.5	0.00	125	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.03		0.01		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.01		0.00		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	12.35	31.25	11.43	31.25	0.00	125	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.01		0.02		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.01		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	10.33	62.5	0.00	125	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.01		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	11.44	31.25	11.43	31.25	0.00	125	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.01		0.02		0.00		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.00		0.01		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	15.5	15.62	12.46	31.25	11.44	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.05		0.27		0.01		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.02		0.11		0.00		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.49. Antifungal activity of distilled water root extracts of *Quercus infectoria* Oliv. against tested *Candida* species 55

***Candida* spp.**		**MWW4 (I.Z.mm)**	**MIC (µg/ml)**	**CW4 (I.Z.mm)**	**MIC (µg/ml)**	**MW4 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	18.38	7.8125	14.8	31.25	11.28	31.25	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.02		0.04		0.02		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.02		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	17.81	15.625	16.51	7.8125	10.21	62.5	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.06		0.04		0.01		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.03		0.02		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	18.10	15.625	14.49	31.25	11.43	31.25	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.74		0.17		0.02		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.30		0.07		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	14.8	31.25	11.43	31.25	10.21	62.5	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.04		0.02		0.01		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.02		0.01		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	11.43	31.25	9.813	62.5	8.418	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.02		0.06		0.01		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.01		0.03		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	15.94	15.625	13.23	31.25	10.21	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.03		0.03		0.01		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.01		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	22.44	7.8125	20.38	7.8125	10.24	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.02		0.01		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.00		0.01		0.07	0.08	0.49	0.13	0.11	0.06

4.6.5. Comparison of Antifungal activity of *Quercus aegilops* L. root extracts and synthetic antifungal against pathogenic *Candida* spp.

In this research, there are numerous *Candida* species the growth of which were stopped by the *Quercus aegilops L.* root extracts by three different method and solvents as shown in Tables below. The inhibition zones were significantly seen with a concentration 50µL/disk of extracts. In this study, the antifungal activities of the root extract were compared with artificial antifungal used as positive controls. The root extracts were statically high significant by the different diameters of inhibition zones of most the activities against the organisms tested. Most isolates *Candida* species were found sensitive to root extract that was expressed by growth inhibition zones ranged from 8.09–20.43 mm in diameter of inhibition zone. The lowest inhibitory zone 8.09 mm by (CA) of extract at was *C. krusei.* While The root extract by conventional method demonstrated the highest growth inhibitory activity against all the tested *Candida*. The highest inhibitory zone 20.43 mm was against *C. glabatra.* In this study, the MIC values regarding the antifungal activity of root extraction were against *Candida* species. Besides, the extract showed an effect against the *Candida* species. Actually, the MIC values against all *Candida* tested were between 7.8125-125µg/ml. On the other hand, six artificial antifungal discs were statically significant by the diverse diameter of inhibition zones of maximum the activities against the organisms tested. The mean inhibition zones against all *Candida* test ranged from 10.5 to 38.40 mm in diameter of inhibition zone. The lowermost inhibitory zone 10.5 mm of FLU/25 was against *C. albicans.* Also, the uppermost inhibitory zone of FLU/25 38.40 mm was against *C. guilliermondii* were given in Table 4.50, Table 4.51 and Table 4.52.

These results are in agreement with various reported outlines on other plant parts by different schools of research on *Quercus aegilops* L. such as by Baharuddin *et al.,* (2015) recommended that *Q. infectoria* gall extracts are a potential basis to be established as anti-Candidiasis. Also, in vitro antifungal activities of ethanolic and aqueous (hot and cold distilled water) extracts of *Quercus infectoria* Oliv. galls were assessed against development of *C. albicans* and *C. glabrata* in dissimilar concentration, presented that ethanolic extracts of *Quercus infectoria* Oliv. was more active against *C. albicans* at concentration of 700 mg/ml whereas the aqueous (hot and cold distilled water) extracts were more effective against *C. glabrata* compared with development of *C. albicans* at the same extracts (Hassan 2011).

Table 4.50. Antifungal activity of ethanol root extracts of *Quercus aegilops* L. against tested *Candida* species 56

***Candida* spp.**		**MWE5 (I.Z.mm)**	**MIC (µg/ml)**	**CE2 (I.Z.mm)**	**MIC (µg/ml)**	**ME2 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	20.32	15.625	18.36	7.8125	16.21	31.25	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.02		0.41		0.02		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.17		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	19.31	15.625	20.13	7.8125	17.21	15.625	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.02		0.07		0.01		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.03		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	17.26	31.25	14.47	31.25	14.47	31.25	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.04		0.03		0.01		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.02		0.01		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	20.32	7.8125	16.43	31.25	16.46	31.25	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.01		0.02		0.02		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.01		0.01		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	15.32	31.25	14.45	31.25	14.53	31.25	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.01		0.03		0.05		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.01		0.02		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	18.35	7.8125	19.52	15.625	17.44	31.25	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.01		0.03		0.04		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.00		0.01		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	18.33	15.625	17.55	7.8125	17.97	15.625	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.02		0.04		0.02		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.02		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.51. Antifungal activity of acetonitrile root extracts of *Quercus aegilops* L. against tested *Candida* species 57

***Candida* spp.**		**MWA5 (I.Z.mm)**	**MIC (µg/ml)**	**CA5 (I.Z.mm)**	**MIC (µg/ml)**	**MA5 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	10.29	62.5	10.14	62.5	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.01		0.01		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.00		0.00		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	11.51	31.25	10.29	62.5	8.093	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.02		0.01		0.01		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.00		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	9.977	62.5	8.09	62.5	0.00	250	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.04		0.01		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.01		0.00		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	10.14	62.5	10.16	31.3	0.00	125	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.01		0.04		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.02		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	11.44	31.25	0.00	125	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.01		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	11.52	31.25	11.44	31.3	9.433	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.03		0.01		0.02		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.00		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	14.49	31.25	12.46	31.3	10.20	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.17		0.27		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.07		0.11		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.52. Antifungal activity of distilled water root extracts of *Quercus aegilops* L. against tested *Candida* species 58

Candida spp.		MWW5 (I.Z.mm)	MIC (µg/ml)	CW5 (I.Z. mm)	MIC (µg/ml)	MW5 (I.Z. mm)	MIC (µg/ml)	NY 100U	CLT 10mcg	FLU 25mcg	KTC 10mcg	FLU 10mcg	MCZ 10mcg
C. albicans	Mean	17.81	15.63	20.15	7.81	10.21	62.5	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.06		0.02		0.01		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.03		0.01		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	14.8	31.25	20.43	7.81	11.43	31.3	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.04		0.43		0.02		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.02		0.17		0.01		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	14.49	31.25	16.74	15.6	19.57	15.6	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.17		0.02		0.04		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.07		0.01		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	17.09	15.63	19.98	15.6	11.43	31.3	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.06		0.06		0.02		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.02		0.02		0.01		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	11.26	31.25	12.35	31.3	10.21	62.5	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.03		0.03		0.01		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.01		0.01		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	16.51	15.63	19.34	15.6	11.43	31.3	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.04		0.03		0.02		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.02		0.01		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	17.81	15.63	20.11	7.81	15.35	15.6	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.06		0.01		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.03		0.00		0.01		0.07	0.08	0.49	0.13	0.11	0.06

4.6.6. Comparison of Antifungal activity of *Crataegus monogyna* Jacquin root extracts and synthetic antifungal against pathogenic *Candida* spp.

Our results indicated that most treatments of root extracts significantly affected the *Candida* species the growth of which were stopped by the *Crataegus monogyna* via three different methods with three solvents. The extract exhibited significant antifungal activity at 50µL/disk of extracts. The root extract activities were compared with synthetic antifungal discs used as positive controls as shown in Table 4.53, Table 4.54 and Table 4.55. The root extracts were statically significantly affected by the different diameters of inhibition zones. Some isolates Candida species were found sensitive to root extract that was expressed by growth inhibition zones ranged from 8.045 to16.13 mm in diameter of inhibition zone. The plant extract showed highest activity inhibitory zone 16.13 mm by the conventional method with acetonitrile solvent against *C. tropicalis*; while the lowest inhibitory zone 8.045 mm by (CE) of extract at was against *C. guilliermondii.* In this study, the MIC values regarding the antifungal activity of root extraction were against seven *Candida* species. Besides, the extract showed an effect against the *Candida* species. Essentially, the MIC values against all *Candida* tested were ranging from 15.63 to 250 µg/ml. Otherwise, six unnatural antifungal discs were caused significant effect on Candida species by the various diameter of inhibition zones of maximum the activities. The mean inhibition zones against all *Candida* test ranged from 10.5–38.40 mm. The lowermost inhibitory zone 10.5 mm of FLU/25 was against *C. albicans.* Also, the uppermost inhibitory zone of FLU/25 38.40 mm was against *C. guilliermondii*. These results are in agreement with several studies by Tadić *et al.,* (2008) on Hawthorn [*Crataegus monogyna* Jacquin. and *Crataegus oxyacantha* L.] leaves, flowers, and berries extract were antimicrobial testing. Its moderate bactericidal activity, especially against Gram-positive bacteria *Micrococcus flavus*, *Bacillus subtilis*, and *Lysteria monocytogenes*, with no effect on *C. albicans*. Also, According to obtained data, the extracts of leaves and berries of three Crataegus species including *C. aronia* var. aronia, *C. monogyna* ssp. Monogyna and *C. pseudoheterophylla* have been verified to be highly effective against *C. albicans* and *Herpes simplex* virus (Orhan *et al.,* 2007). The ethanol extracts the fruit of *Crataegus oxyacantha* L. exhibited antimicrobial activity against all test microorganisms except two, *Bacillus subtilis* and *Staphylococcus aureus*, and one species of fungi, *Aspergillus niger*. Flavonoid structure influenced the extract's selectivity towards Gram-positive and Gram negative bacteria (Kostić *et al.* 2012).

Table 4.53. Antifungal activity of ethanol root extracts of *Crataegus monogyna* Jacquin against tested *Candida* species 59

***Candida* spp.**		**MWE6 (I.Z.mm)**	**MIC (µg/ml)**	**CE6 (I.Z.mm)**	**MIC (µg/ml)**	**ME6 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	0.00	125	0.00	125	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.00		0.00		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.00		0.00		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	0.00	125	0.00	125	0.00	250	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.00		0.00		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.00		0.00		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	0.00	125	0.00	125	0.00	250	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.00		0.00		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.00		0.00		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	0.00	250	0.00	250	0.00	250	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.00		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	250	0.00	250	0.00	250	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	0.00	250	0.00	250	0.00	250	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.00		0.00		0.00		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.00		0.00		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	9.155	62.5	8.045	62.5	0.00	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.04		0.04		0.00		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.02		0.02		0.00		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.54. Antifungal activity of acetonitrile root extracts of *Crataegus monogyna* Jacquin against tested *Candida* species 60

***Candida* spp.**		**MWA6 (I.Z.mm)**	**MIC (µg/ml)**	**CA6 (I.Z.mm)**	**MIC (µg/ml)**	**MA6 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	9.883	62.5	11.51	31.25	14.82	31.25	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.02		0.02		0.03		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.01		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	10.14	62.5	7.217	62.5	0.00	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.01		0.02		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.00		0.01		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	0.00	125	8.06	62.5	0.00	125	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.00		0.03		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.00		0.01		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	0.00	125	9.11	62.5	9.46	62.5	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.00		0.01		0.04		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.01		0.02		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	9.43	62.5	14.24	31.25	14.87	31.25	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.03		0.01		0.01		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.01		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	9.433	62.5	16.13	15.63	10.2	31.25	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.02		0.02		0.03		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.01		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	0.00	62.5	14.94	31.25	11.52	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.00		0.03		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.00		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.55. Antifungal activity of distilled water root extracts of *Crataegus monogyna* Jacquin against tested *Candida* species 61

***Candida* spp.**		**MWW6 (I.Z.mm)**	**MIC (µg/ml)**	**CW6 (I.Z.mm)**	**MIC (µg/ml)**	**MW6 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	12.41	31.3	10.21	31.25	8.854	62.5	20.21	18.1	10.55	14.05	0.00	14.61
	SD	0.02		0.02		0.07		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.01		0.03		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	14.8	31.3	11.43	31.25	8.86	62.5	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.04		0.02		0.03		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.02		0.01		0.01		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	13.35	31.3	12.12	31.25	11.15	62.5	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.04		0.02		0.04		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.02		0.01		0.02		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	11.43	31.3	11.26	31.25	8.775	62.5	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.02		0.03		0.06		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.01		0.01		0.02		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	10.21	62.5	8.41	62.5	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.01		0.01		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	12.35	31.3	11.26	31.25	9.363	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.03		0.03		0.04		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.01		0.02		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	16.51	15.6	12.12	31.25	9.665	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.04		0.02		0.01		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.02		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

4.6.7. Comparison of Antifungal activity of *Prunus argentea* (Lam.) Rehder root extracts and synthetic antifungal against pathogenic *Candida* spp.

It is obvious from Table 4.56, Table 4.57 and Table 4.58 the significant effect of some treatments of *Prunus argentea* (Lam.) Rehder root extracts by three solvents and methods on seven types of *Candida* species. In comparison to six standard reference, the root extract exhibited significant antifungal activity at concentration of 50µL/disk of extracts. In this study, the antifungal activities of the root extract were compared with those of six synthetic antifungal discs used as positive controls as shown in Tables below. The root extracts were statically significant by the different diameters of inhibition zones of most the activities against the organisms tested. Some of isolates *Candida* species were found sensitive to root extract that was expressed by growth inhibition zones ranged from 7.42 to 21.45 mm in diameter of inhibition zone. The lowest inhibitory zone 7.42 mm by (CW) of extract at was *C. tropicalis.* Whereas, the highest inhibitory zone 21.45mm by (MW) was against *C. guilliermondii.*

The MIC values of root extracts against all test organisms are shown in Table 4.56, Table 4.57 and Table 4.58. The MIC values of all root extracts were ranged from 7.8125 to125µg/ml. Then, six artificial antifungal discs as positive controls have significant effect by the diverse diameter of inhibition zones of maximum the activities against the candida tested.

The results showed that seven *Candida* species had synergistic effect with most of the tested antifungals. It was showed that the highest resistance among all antifungals ranged from 10.5–38.40 mm in diameter of inhibition zone. The highest synergistic inhibitory effect was observed with FLU/25 was against *C. guilliermondii* with inhibition zone 38.40 mm. Also, the lowest inhibitory zone 10.5 mm of FLU/25 was against *C. albicans*.

There is no result support our results on *Prunus argentea* (Lam.) Rehder root extracts. Other results are in agreement with our results, such as study by Bii *et al.,* (2010) that showed the methanol stem bark extracts were active against *Trichopyton mentagrophyte*, *Staphylococcus aureus* ATCC 25923, Methicillin resistant *Staphylococcus aureus* and *Streptococcus pneumoniae* at concentrations of 0.039, 0.073, 0.156 and 2.5 mg/ml, respectively. The extract of the above plant had no activity against *Cryptococcus neoformans* ATCC 66031 and *C. albicans* ATCC 90028.

Table 4.56. Antifungal activity of ethanol root extracts of *Prunus argentea* (Lam.) Rehder against tested *Candida* species 62

***Candida* spp.**		**MWE7 (I.Z.mm)**	**MIC (µg/ml)**	**CE7(I.Z. mm)**	**MIC (µg/ml)**	**ME7(I.Z. mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	11.33	31.25	12.11	31.25	11.31	31.25	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.03		0.01		0.03		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.00		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	10.67	62.5	12.51	31.25	12.35	31.25	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.02		0.04		0.03		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.02		0.01		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	13.52	31.25	12.29	31.25	11.44	31.25	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.20		0.22		0.03		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.08		0.09		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	8.978	62.5	9.223	62.5	9.927	62.5	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.01		0.02		0.07		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.01		0.03		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	250	0.00	250	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	10.05	62.5	10.22	62.5	10.44	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.04		0.01		0.02		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.02		0.01		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	12.35	31.25	11.34	31.25	11.39	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.04		0.03		0.01		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.02		0.01		0.00		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.57. Antifungal activity of acetonitrile root extracts of *Prunus argentea* (Lam.) Rehder against tested *Candida* species 63

***Candida* spp.**		**MWA7 (I.Z.mm)**	**MIC (µg/ml)**	**CA7 (I.Z.mm)**	**MIC (µg/ml)**	**MA7 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	8.093	62.5	0.00	125	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.01		0.00		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.00		0.00		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	8.368	62.5	0.00	125	0.00	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.03		0.00		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.00		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	0.00	125	0.00	125	0.00	250	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.00		0.00		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.00		0.00		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	9.34	62.5	0.00	125	0.00	125	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.03		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.01		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	250	0.00	250	0.00	500	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	8.865	62.5	0.00	125	0.00	125	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.01		0.00		0.00		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.00		0.00		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	9.155	62.5	8.045	62.5	0.00	125	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.04		0.04		0.00		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.02		0.02		0.00		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.58. Antifungal activity of distilled water root extracts of *Prunus argentea* (Lam.) Rehder against tested *Candida* species 64

<table>
<tr><th>Candida spp.</th><th></th><th>MWW7 (I.Z.mm)</th><th>MIC (µg/ml)</th><th>CW7(I.Z. mm)</th><th>MIC (µg/ml)</th><th>MW7 (I.Z.mm)</th><th>MIC (µg/ml)</th><th>NY 100U</th><th>CLT 10mcg</th><th>FLU 25mcg</th><th>KTC 10mcg</th><th>FLU 10mcg</th><th>MCZ 10mcg</th></tr>
<tr><td rowspan="3">C. albicans</td><td>Mean</td><td>10.21</td><td>62.5</td><td>8.948</td><td>62.5</td><td>9.025</td><td>62.5</td><td>20.21</td><td>18.15</td><td>10.55</td><td>14.05</td><td>0.00</td><td>14.61</td></tr>
<tr><td>SD</td><td>0.02</td><td></td><td>0.04</td><td></td><td>0.08</td><td></td><td>0.24</td><td>0.18</td><td>0.13</td><td>0.10</td><td>0.00</td><td>0.10</td></tr>
<tr><td>SE</td><td>0.01</td><td></td><td>0.02</td><td></td><td>0.03</td><td></td><td>0.10</td><td>0.07</td><td>0.05</td><td>0.04</td><td>0.00</td><td>0.04</td></tr>
<tr><td rowspan="3">C. glabatra</td><td>Mean</td><td>11.00</td><td>31.25</td><td>8.575</td><td>62.5</td><td>9.353</td><td>62.5</td><td>24.72</td><td>12.29</td><td>15.68</td><td>13.33</td><td>16.71</td><td>14.54</td></tr>
<tr><td>SD</td><td>0.40</td><td></td><td>0.06</td><td></td><td>0.01</td><td></td><td>0.31</td><td>0.22</td><td>0.21</td><td>0.11</td><td>0.16</td><td>0.20</td></tr>
<tr><td>SE</td><td>0.16</td><td></td><td>0.02</td><td></td><td>0.00</td><td></td><td>0.12</td><td>0.09</td><td>0.09</td><td>0.04</td><td>0.06</td><td>0.08</td></tr>
<tr><td rowspan="3">C. krusei</td><td>Mean</td><td>9.353</td><td>62.5</td><td>8.595</td><td>62.5</td><td>8.948</td><td>62.5</td><td>14.49</td><td>25.91</td><td>24.63</td><td>18.79</td><td>15.32</td><td>13.52</td></tr>
<tr><td>SD</td><td>0.01</td><td></td><td>0.07</td><td></td><td>0.04</td><td></td><td>0.17</td><td>0.22</td><td>0.66</td><td>0.09</td><td>0.15</td><td>0.20</td></tr>
<tr><td>SE</td><td>0.00</td><td></td><td>0.03</td><td></td><td>0.02</td><td></td><td>0.07</td><td>0.09</td><td>0.27</td><td>0.04</td><td>0.06</td><td>0.08</td></tr>
<tr><td rowspan="3">C. tropicalis</td><td>Mean</td><td>9.025</td><td>62.5</td><td>7.42</td><td>62.5</td><td>0.00</td><td>125</td><td>21.23</td><td>19.95</td><td>27.67</td><td>23.96</td><td>20.52</td><td>12.46</td></tr>
<tr><td>SD</td><td>0.08</td><td></td><td>0.01</td><td></td><td>0.00</td><td></td><td>0.15</td><td>0.14</td><td>0.17</td><td>0.10</td><td>0.08</td><td>0.27</td></tr>
<tr><td>SE</td><td>0.03</td><td></td><td>0.01</td><td></td><td>0.00</td><td></td><td>0.06</td><td>0.06</td><td>0.07</td><td>0.04</td><td>0.03</td><td>0.11</td></tr>
<tr><td rowspan="3">C. famata</td><td>Mean</td><td>9.873</td><td>62.5</td><td>0.00</td><td>500</td><td>0.00</td><td>125</td><td>24.75</td><td>20.26</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.00</td></tr>
<tr><td>SD</td><td>0.02</td><td></td><td>0.00</td><td></td><td>0.00</td><td></td><td>0.13</td><td>0.16</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.00</td></tr>
<tr><td>SE</td><td>0.01</td><td></td><td>0.00</td><td></td><td>0.00</td><td></td><td>0.05</td><td>0.07</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.00</td></tr>
<tr><td rowspan="3">C. parapsilosis</td><td>Mean</td><td>10.13</td><td>31.25</td><td>7.42</td><td>62.5</td><td>8.575</td><td>62.5</td><td>24.47</td><td>22.42</td><td>26.36</td><td>27.48</td><td>21.43</td><td>11.53</td></tr>
<tr><td>SD</td><td>0.01</td><td></td><td>0.01</td><td></td><td>0.06</td><td></td><td>0.15</td><td>0.28</td><td>0.17</td><td>0.32</td><td>0.16</td><td>0.17</td></tr>
<tr><td>SE</td><td>0.01</td><td></td><td>0.01</td><td></td><td>0.02</td><td></td><td>0.06</td><td>0.11</td><td>0.07</td><td>0.13</td><td>0.07</td><td>0.07</td></tr>
<tr><td rowspan="3">C. guilliermondii</td><td>Mean</td><td>11.75</td><td>31.25</td><td>8.575</td><td>62.5</td><td>21.45</td><td>7.8125</td><td>21.45</td><td>31.26</td><td>38.07</td><td>37.61</td><td>37.48</td><td>24.19</td></tr>
<tr><td>SD</td><td>0.01</td><td></td><td>0.06</td><td></td><td>0.18</td><td></td><td>0.18</td><td>0.19</td><td>1.21</td><td>0.32</td><td>0.26</td><td>0.15</td></tr>
<tr><td>SE</td><td>0.00</td><td></td><td>0.02</td><td></td><td>0.07</td><td></td><td>0.07</td><td>0.08</td><td>0.49</td><td>0.13</td><td>0.11</td><td>0.06</td></tr>
</table>

4.6.8. Comparison of Antifungal activity of *Crataegus azarolus* var. aronia L. root extracts and synthetic antifungal against pathogenic *Candida* spp.

It is inferred that there are numerous *Candida* species were inhibited by the *Crataegus azarolus* var. aronia L. root extracts by three different method and solvents. The inhibition zones significantly were seen with a concentration 50µL/disk of extracts. The inhibitory effects of the nine extracts were evaluated against seven pathogenic fungi. The results obtained from assays significant antifungal activity at different method and solvents are reported in Table 4.59, Table 4.60 and Table 4.61. The results indicate that the inhibition of the Candida growth of each strain was significantly influenced by different extraction methods and solvents.

In this study, the significant antifungal activity of the root extracts was compared with synthetic antifungal discs controls. Some isolates *Candida* species were found sensitive to root extract that was expressed by growth inhibition zones ranged from 7.42 to 12.09 mm in diameter of inhibition zone. The lowest inhibitory zone of *C. parapsilosis* was 7.42 mm. Whereas, the highest inhibitory zone was 12.09 mm in diameter of inhibition zone by (MWE) against *C. albicans.* All the test fungal were sensitive to the root extracts with MIC values of 31.25 to 250 µg/ml.

The inhibition zones of antifungal discs against all *Candida* species ranged from 10.5 to 38.40 mm. The lowest inhibitory zone 10.5 mm in diameter of inhibition zone of FLU/25 was against *C. albicans.* Also, the uppermost inhibitory zone of FLU/25 38.40 mm in diameter of inhibition zone was against *C. guilliermondii*.

These results are in agreement with the study by Bahri-Sahloul *et al.,* (2014) antimicrobial activities were strongly correlated with total phenols and total flavonoids. *Crataegus azarolus* var. aronia L. cells culture represents an important alternative source of natural antioxidants and antimicrobials. The *Crataegus azarolus* leaves extract showed variable antimicrobial activity against E. coli, P. aeruginosa, S. aureus, and C. albicans. (Abu-Gharbieh and Shehabm 2017).

Table 4.59. Antifungal activity of ethanol root extracts of *Crataegus azarolus* var. aronia L. against tested *Candida* species 65

***Candida* spp.**		**MWE8 (I.Z.mm)**	**MIC (µg/ml)**	**CE8 (I.Z.mm)**	**MIC (µg/ml)**	**ME8 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	12.09	62.5	9.108	62.5	9.782	62.5	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.05		0.01		0.11		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.02		0.00		0.04		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	11.44	31.25	8.935	62.5	9.84	62.5	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.03		0.05		0.05		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.02		0.02		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	8.978	62.5	9.223	62.5	9.927	62.5	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.01		0.02		0.07		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.00		0.01		0.03		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	0.00	125	0.00	250	0.00	250	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.00		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	250	9.927	250	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	9.118	62.5	9.228	62.5	10.34	31.25	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.01		0.02		0.01		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.00		0.01		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	12.10	31.25	9.108	62.5	9.782	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.05		0.01		0.11		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.02		0.00		0.04		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.60. Antifungal activity of acetonitrile root extracts of *Crataegus azarolus* var. aronia L. against tested *Candida* species 6667

***Candida* spp.**		**MWA8 (I.Z.mm)**	**MIC (µg/ml)**	**CA8 (I.Z.mm)**	**MIC (µg/ml)**	**MA8 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	0.00	125	0.00	250	0.00	250	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.00		0.00		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.00		0.00		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	11.28	31.25	0.00	125	0.00	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.02		0.00		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.00		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	7.34	62.5	0.00	125	0.00	125	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.23		0.00		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.09		0.00		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	0.00	125	0.00	125	0.00	250	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.00		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	250	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	7.347	62.5	0.00	125	0.00	125	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.23		0.00		0.00		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.09		0.00		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	9.013	62.5	7.347	62.5	9.008	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.03		0.23		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.09		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.61. Antifungal activity of distilled water root extracts of *Crataegus azarolus* var. aronia L. against tested *Candida* species 68

***Candida* spp.**		**MWW8 (I.Z.mm)**	**MIC (µg/ml)**	**CW8 (I.Z.mm)**	**MIC (µg/ml)**	**MW8 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	10.75	62.5	7.802	62.5	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.03		0.03		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.01		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	9.863	62.5	8.595	62.5	8.469	62.5	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.04		0.07		0.04		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.02		0.03		0.02		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	9.013	62.5	7.802	62.5	0.00	62.5	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.03		0.03		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.01		0.01		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	8.499	62.5	8.575	62.5	0.00	125	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.07		0.06		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.03		0.02		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	125	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	9.013	62.5	7.802	62.5	7.42	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.03		0.03		0.01		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.01		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	10.75	31.25	9.902	62.5	8.469	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.03		0.04		0.04		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.02		0.02		0.07	0.08	0.49	0.13	0.11	0.06

4.6.9. Comparison of Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) root extracts and synthetic antifungal against pathogenic *Candida* spp.

The root extracts used in this study showed variable significant antifungal activities against with a concentration *Candida* species at 50µL/disk of extracts. There are some *Candida* species that were inhibited by the *Prunus microcarpa* C.A. Mey. root extracts after using three different methods and solvents. The sizes of the zone of inhibition are listed in Table 4.62, Table 4.63 and Table 4.64.

The root extracts were statically significant by the different diameters of inhibition zones of most activities against *Candida* species. Some isolates *Candida* species were found sensitive to root extract that was expressed by growth inhibition zones ranged from 7.42 to 12.35 mm compared with those of six synthetic antifungal discs used as positive controls. The largest zone of inhibition was observed for nine root extracts with inhibition zone diameter of 12.35 mm against *C. famata* by microwave method with ethanol solvent. Whereas the lowest inhibitory zone 7.42 mm in diameter of inhibition zone by (CW) of extract at was *C. guilliermondii.* Really, the MIC values of nine root extract against seven *Candida* tested were between 31.25-250 µg/ml. The maximum activities artificial antifungal discs against the organisms tested were given in Table 4.62, Table 4.63 and Table 4.64.The results in showed that seven *Candida* species had synergistic effect with most of the tested antifungals. It is shown that the highest resistance among all antifungals ranged from 10.5–38.40 mm in diameter of inhibition zone. The highest synergistic inhibitory effect was observed with FLU/25 was against *C. guilliermondii* with inhibition zone 38.40 mm. Also, the lowest inhibitory zone 10.5 mm of FLU/25 was against *C. albicans*.

These results are promised with some other study. The seeds extract of *P. mume* showed the strongest activity on S. aureus at MIC of 25 mg/mL. The MICs of this extract on *E. coli*, *S. enterica* and *V. parahaemolyticus* was 50 mg/mL, 100 mg/mL and 100 mg/mL, respectively. It may be anticipated that *P. mume* seeds extract has potent antibacterial and antifungal activities.(Xia *et al.,* 2011). The shoots hexan extract of *P. domestica* showed moderate antibacterial activity against *Salmonella* group, moderate antifungal activity against *Microsporum canis* (Mahmood *et al.,* 2009).

Table 4.62. Antifungal activity of ethanol root extracts of *Prunus microcarpa* C.A. Mey. against tested *Candida* species 69

***Candida* spp.**		**MWE9 (I.Z.mm)**	**MIC (µg/ml)**	**CE9 (I.Z. mm)**	**MIC (µg/ml)**	**ME9 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	12.31	31.25	0.00	125	10.31	62.5	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.01		0.00		0.02		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.00		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	11.3	31.25	12.22	31.25	10.17	62.5	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.03		0.07		0.03		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.03		0.01		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	0.00	125	0.00	250	0.00	125	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.00		0.00		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.00		0.00		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	0.00	250	0.00	250	0.00	250	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.00		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	12.35	62.5	10.12	62.5	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.04		0.02		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.02		0.01		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	0.00	125	11.33	31.25	9.89	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.00		0.02		0.01		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.00		0.01		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	11.3	31.25	12.22	31.25	10.17	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.03386		0.06716		0.03391		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01382		0.02742		0.01384		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.63. Antifungal activity of acetonitrile root extracts of *Prunus microcarpa* C.A. Mey against tested *Candida* species 70

***Candida* spp.**		**MWA9 (I.Z.mm)**	**MIC (µg/ml)**	**CA9 (I.Z.mm)**	**MIC (µg/ml)**	**MA9 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	9.118	62.5	0.00	125	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.014		0.00		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.006		0.00		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	9.218	62.5	0.00	125	0.00	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.01		0.00		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.00		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	0.00	125	0.00	125	8.183	62.5	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.00		0.00		0.02		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.00		0.00		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	0.00	250	0.00	125	0.00	250	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.00		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	125	0.00	250	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	8.469	62.5	0.00	125	8.59	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.04		0.00		0.03		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.02		0.00		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	9.013	62.5	7.822	62.5	9.013	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.03		0.03		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.64. Antifungal activity of distilled water root extracts of *Prunus microcarpa* C.A. Mey against tested *Candida* species 71

***Candida* spp.**		**MWW9 (I.Z.mm)**	**MIC (µg/ml)**	**CW9 (I.Z.mm)**	**MIC (µg/ml)**	**MW9 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	9.02	62.5	0.00	125	8.948	62.5	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.08		0.00		0.04		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.03		0.00		0.02		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	9.353	62.5	0.00	125	8.575	62.5	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.01		0.00		0.06		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.00		0.00		0.02		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	8.575	62.5	0.00	125	8.948	62.5	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.06		0.00		0.04		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.02		0.00		0.02		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	9.353	62.5	0.00	125	8.948	62.5	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.01		0.00		0.04		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.00		0.00		0.02		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	125	0.00	250	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	9.873	62.5	0.00	125	8.575	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.02		0.00		0.06		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.00		0.02		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	11.00	31.25	7.42	62.5	10.32	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.40		0.01		0.02		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.16		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

4.6.10. Comparison of Antifungal activity of *Rubus sanctus* Schreb root extracts and synthetic antifungal against pathogenic *Candida spp.*

The root extracts of *Rubus sanctus* Schreb showed high degrees of significant antifungal activities against seven *Candida* species ranged from 7.405–24.47 mm in diameter of inhibition zones. They also exhibited variable synergistic activities when tested with six commercially available antibiotics used as positive controls to inhibit the growth of *Candida* species. The inhibition zones significantly were seen with a concentration of 50µL/disk of extracts root with using three different methods and solvents. The lowest inhibitory zone 7.405 mm in diameter of inhibition zone was *C. glabatra* by maceration methods with distillated water. Whereas, the highest significant inhibitory zone 24.47 mm in diameter of inhibition zone by (MWE) microwave method with ethanol solvent was against *C. guilliermondii.* In this study, the MIC values regarding the antifungal activity of root extraction were against *Candida* species. In addition, the extract showed an effect against the *Candida* species. In fact, the MIC values against all *Candida* tested were between 7.81-125µg/ml. The results in Table 4.65, Table 4.66 and Table 4.67 showed that seven *Candida* species had synergistic effect with most of the tested antifungals. It showed that the highest resistance among all antifungals ranged from 10.5–38.40 mm in diameter of inhibition zone. The highest synergistic inhibitory effect was observed with FLU/25 was against *C. guilliermondii* with inhibition zone 38.40 mm. Also, the lowest inhibitory zone 10.5 mm of FLU/25 was against *C. albicans.* These results are promised with some other study the results obtained by Han *et al.,* (2016) Although neither *R. chingii* leaves extract nor Fluconazole alone showed obvious antifungal activity, the two drugs together showed significant synergy. The MIC 80 for FLC alone was 256mg/mL and for *R. chingii* extract alone 5000mg/mL. However, the MIC80 was 4.88–312.5mg/mL for *R. chingii* extract. Likewise, the study of aerial part of *Rubus sanctus* Schreb could be potential sources for new antimicrobial agents. Additionally, antimicrobial activity results support the traditional uses of the plants (Deliorman Orhan *et al.,* 2012). Also, other result showed that the extract *Rubus imperialis* roots were and some fractions exhibited antimicrobial action, particularly against the Gram-positive bacteria tested, with MIC values between 0.5 and 2.0 mg/mL (Bella Cruz *et al.,* 2006). Moreover, other research indicates that the aerial part of *R. fruticosus* L. has an important antimicrobial effect, which justifies its potential use in infectious diseases (Chaouche Thanina *et al.,* 2015).

Table 4.65. Antifungal activity of ethanol root extracts of *Rubus sanctus* Schreb. against tested *Candida* species 72

***Candida* spp.**		**MWE10 (I.Z.mm)**	**MIC (µg/ml)**	**CE10 (I.Z.mm)**	**MIC (µg/ml)**	**ME10 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	21.33	7.81	20.43	7.81	18.30	15.625	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.07		0.48		0.02		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.03		0.20		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	21.97	7.81	22.87	7.81	21.32	7.81	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.08		0.38		0.02		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.03		0.16		0.01		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	19.91	15.625	15.37	15.625	14.49	15.625	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.08		0.06		0.17		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.03		0.02		0.07		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	18.32	15.625	17.33	15.625	15.54	15.625	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.01		0.02		0.02		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.01		0.01		0.01		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	13.30	31.25	13.43	31.25	14.46	31.25	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.42		0.02		0.04		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.17		0.01		0.01		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	17.86	15.625	19.84	7.81	19.43	7.81	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.03		0.04		0.02		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.02		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	24.47	7.81	21.15	7.81	20.23	7.81	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.15		0.06		0.02		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.06		0.02		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.66. Antifungal activity of acetonitrile root extracts of *Rubus sanctus* Schreb against tested *Candida* species 73

***Candida* spp.**		**MWA10 (I.Z.mm)**	**MIC (µg/ml)**	**CA10 (I.Z.mm)**	**MIC (µg/ml)**	**MA10 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	9.825	62.5	10.10	31.25	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.05		0.03		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.02		0.01		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	10.1	62.5	10.14	31.25	0.00	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.03		0.03		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.01		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	11.43	31.25	8.469	62.5	0.00	125	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.02		0.04		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.01		0.02		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	11.43	31.25	8.469	62.5	0.00	62.5	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.02		0.04		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.01		0.02		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	125	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	11.94	31.25	9.013	62.5	8.499	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.02		0.03		0.07		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.01		0.03		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	13.49	31.25	11.94	31.25	9.013	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.02		0.02		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.67. Antifungal activity of distilled water root extracts of *Rubus sanctus* Schreb against tested *Candida* species 74

***Candida* spp.**		**MWW10 (I.Z.mm)**	**MIC (µg/ml)**	**CW10 (I.Z.mm)**	**MIC (µg/ml)**	**MW10 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	12.63	31.25	9.025	62.5	7.42	62.5	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.49		0.08		0.01		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.20		0.03		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	11.09	31.25	9.123	62.5	7.405	62.5	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.04		0.02		0.03		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.01		0.01		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	9.353	62.5	8.575	62.5	0.00	125	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.01		0.06		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.00		0.02		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	8.948	62.5	9.025	62.5	0.00	125	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.04		0.08		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.02		0.03		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	8.948	62.5	0.00	125	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.04		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.02		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	11.12	31.25	8.575	62.5	8.42	62.5	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.01		0.06		0.02		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.02		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	14.49	31.25	9.873	62.5	8.575	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.17		0.02		0.06		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.07		0.01		0.02		0.07	0.08	0.49	0.13	0.11	0.06

4.6.11. Comparison of Antifungal activity of *Ficus carica* L. root extracts and synthetic antifungal against pathogenic *Candida* spp.

The results of antifungal activities of the nine extracts in agar diffusion method. Some extracts showed variable degrees of activity against the tested *Candida* strains. The inhibition zones significantly were seen with a concentration of 50µL/disk of extracts. It was observed that the *C. parapsilosis* strain manifested more sensitivity to the investigated extracts than the other *Candida* species. For the most part, among the investigated extracts, the acetonitrile extracts exhibited the highest antimicrobial effect. The root extracts of *Ficus carica* L. showed significant antifungal activities against seven *Candida* species ranged from 7.41 to 18.44 mm in diameter of inhibition zones It was interesting to note that the most remarkable antimicrobial activity with inhibition zones higher than 18.44 mm was noticed for the acetonitrile extracts against *C. parapsilosis*. On the other hand, the lowest antimicrobial activity was observed for the distillated water extracts 7.41 mm in diameter of inhibition zone by (CW) of extract at was *C. krusei*. The antifungal activities of the root extract were compared with those of six synthetic antifungal discs used as positive controls. In this study, the MIC values regarding the antifungal activity of root extraction were against *Candida* species. In addition, the extract showed an effect against the *Candida* species. In fact, the MIC values against all *Candida* tested were between 31.25-125 µg/ml. Then, six artificial antifungal discs statically significant effected by the various diameter of inhibition zones. The maximum the activities against the organisms tested were given in Tables below. The mean value of inhibition zones against all *Candida* test ranged from 10.5–38.40 mm in diameter of inhibition zone. The lowermost inhibitory zone 10.5 mm of FLU/25 was against *C. albicans.* Also, the highest inhibitory zone of FLU/25 38.40 mm was against *C. guilliermondii* as observed in Table 4.68, Table 4.69 and Table 4.70.These results are in agreement with some other study the results obtained by Ahmad and Beg, (2001) was observed between susceptibility of test strains with *Ficus carica L.* leaves extracts and antibiotic resistance behaviour of the microbial strains (*Staphylococcus aureus, Salmonella paratyphi, Shigella dysenteriae, Escherichia coli, Bacillus subtilis, C. albicans*). Similarly, the ethanolic extract had strong antimicrobial activity, the maximum zone of inhibition was noted for Fez extract against *Staphylococcus epidermidis* (21mm) with MIC 25µg/ml and for Al, Jadida extract against *C. famata* (14.7mm) with MIC 50µg/ml. These results indicate some benefits of fig leaves which can use to treatment the microbial infection. (Askari *et al.,* 2012).

Table 4.68. Antifungal activity of ethanol root extracts of *Ficus carica* L. against tested *Candida* species 75

***Candida* spp.**		**MWE11 (I.Z.mm)**	**MIC (µg/ml)**	**CE11 (I.Z.mm)**	**MIC (µg/ml)**	**ME11 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	9.693	62.5	11.11	31.25	10.09	31.25	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.04		0.02		0.02		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.02		0.01		0.01		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	8.903	62.5	11.15	31.25	11.28	31.25	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.07		0.04		0.02		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.03		0.02		0.01		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	9.91	62.5	8.95	62.5	0.00	125	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.04		0.02		0.00		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.02		0.01		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	9.383	62.5	9.125	62.5	9.857	62.5	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.05		0.02		0.03		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.02		0.01		0.01		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	8.032	62.5	0.00	125	8.925	62.5	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.41		0.00		0.04		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.17		0.00		0.01		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	10.32	31.25	10.34	31.25	12.2	31.25	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.01		0.03		0.02		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.01		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	11.15	31.25	11.28	31.25	10.34	31.25	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.04		0.02		0.03		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.02		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.69. Antifungal activity of acetonitrile root extracts of *Ficus carica* L. against tested *Candida* species 76

***Candida* spp.**		**MWA11 (I.Z.mm)**	**MIC (µg/ml)**	**CA11 (I.Z.mm)**	**MIC (µg/ml)**	**MA11 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	8.499	62.5	0.00	125	0.00	125	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.07		0.00		0.00		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.03		0.00		0.00		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	9.825	62.5	0.00	125	0.00	125	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.05		0.00		0.00		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.02		0.00		0.00		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	8.499	62.5	8.469	62.5	9.213	62.5	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.07		0.04		0.01		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.03		0.02		0.00		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	9.278	62.5	0.00	62.5	0.00	125	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.02		0.00		0.00		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.01		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	9.857	62.5	0.00	125	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.07		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.03		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. parapsilosis	Mean	9.013	62.5	8.441	31.25	18.44	15.625	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.03		0.07		0.01		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.01		0.03		0.00		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	11.26	31.25	10.08	31.25	0.00	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.02		0.01		0.00		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.01		0.01		0.00		0.07	0.08	0.49	0.13	0.11	0.06

Table 4.70. Antifungal activity of distilled water root extracts of *Ficus carica* L. against tested *Candida* species 77

***Candida* spp.**		**MWW11 (I.Z.mm)**	**MIC (µg/ml)**	**CW11 (I.Z.mm)**	**MIC (µg/ml)**	**MW11 (I.Z.mm)**	**MIC (µg/ml)**	**NY 100U**	**CLT 10mcg**	**FLU 25mcg**	**KTC 10mcg**	**FLU 10mcg**	**MCZ 10mcg**
C. albicans	Mean	11.09	31.25	0.00	125	8.948	62.5	20.21	18.15	10.55	14.05	0.00	14.61
	SD	0.04		0.00		0.04		0.24	0.18	0.13	0.10	0.00	0.10
	SE	0.01		0.00		0.02		0.10	0.07	0.05	0.04	0.00	0.04
C. glabatra	Mean	9.873	62.5	0.00	125	8.575	62.5	24.72	12.29	15.68	13.33	16.71	14.54
	SD	0.02		0.00		0.06		0.31	0.22	0.21	0.11	0.16	0.20
	SE	0.01		0.00		0.02		0.12	0.09	0.09	0.04	0.06	0.08
C. krusei	Mean	9.123	62.5	0.00	125	7.41	62.5	14.49	25.91	24.63	18.79	15.32	13.52
	SD	0.02		0.00		0.01		0.17	0.22	0.66	0.09	0.15	0.20
	SE	0.01		0.00		0.01		0.07	0.09	0.27	0.04	0.06	0.08
C. tropicalis	Mean	8.948	62.5	0.00	125	9.353	62.5	21.23	19.95	27.67	23.96	20.52	12.46
	SD	0.04		0.00		0.01		0.15	0.14	0.17	0.10	0.08	0.27
	SE	0.02		0.00		0.00		0.06	0.06	0.07	0.04	0.03	0.11
C. famata	Mean	0.00	125	0.00	125	0.00	125	24.75	20.26	0.00	0.00	0.00	0.00
	SD	0.00		0.00		0.00		0.13	0.16	0.00	0.00	0.00	0.00
	SE	0.00		0.00		0.00		0.05	0.07	0.00	0.00	0.00	0.00
C. tropicalis	Mean	9.353	62.5	0.00	125	12.8 ±	31.25	24.47	22.42	26.36	27.48	21.43	11.53
	SD	0.01		0.00		0.02		0.15	0.28	0.17	0.32	0.16	0.17
	SE	0.00		0.00		0.01		0.06	0.11	0.07	0.13	0.07	0.07
C. guilliermondii	Mean	8.948	62.5	7.42	62.5	9.873	62.5	21.45	31.26	38.07	37.61	37.48	24.19
	SD	0.04		0.01		0.02		0.18	0.19	1.21	0.32	0.26	0.15
	SE	0.02		0.01		0.01		0.07	0.08	0.49	0.13	0.11	0.06

Phytochemical compounds have been widely studied since the past 30 years. It is well known that phytochemical compounds contribute to quality and nutritional value in terms of changing color, taste, aroma and flavor. These substances are existing in a variety of plants utilized in the Mediterranean diet. Moreover, the health benefits associated with the consumption of fruits and vegetables have been partly attributed to the phenolic content (Debib *et al.,* 2014)(Lampila *et al.,* 2009).

Many natural products are produced normally by plants which establish a significant source of microbicides, pesticides and numerous pharmacological medicines. Plant products still remain the major basis of pharmaceutical agents used in old-style medicine (Askari *et al.,* 2012). It is observed that the antimicrobial effect of plant extract varies from different researchers carried out in various regions of the world. This may be due to many factors such as the influence of climate, age and vegetation cycle stage, quality, quantity and composition of the extracted product, different microorganism strains (Angioni *et al.,* 2003; Ababutain, 2011). It has been conducted to elucidate the components responsible for the antimicrobial activity as well as any pharmacological or toxicological properties that such extracts might have (Deliorman Orhan *et al.,* 2012). The root extract added to culture media inoculated with *Candida* spp. inhibited the development of *Candida*. The inhibition zone was greater in *C. albicans* than *C. tropicalis* which might be due to their difference in the cell wall. These discoveries are extremely similar to those demonstrated by other researchers working on the antimicrobial activity of an essential extract of Anti-*Candida* activity of *Quercus infectoria Oliv.* gall extracts against *Candida* species by (Hassan 2011; Baharuddin *et al.,* 2015). The growth of tested *Candida* spp. in the presence of high concentrations of essential root extract was extremely inhibited. Thus, it was assured that some species were sensitive to the extract. In fact, the chemical compound of extract leads to growth inhibition of *Candida*. This characteristic of extract needs further investigations in terms of constituents and antimicrobial contents. There was variation in the degrees of antimicrobial activities of the extracts against selected of microbes. This in discrepancy is presumed to be due to differences in responses of the microbe to active compounds that presented in the extracts. The activity of plant extracts may be due to parts of plant and harvesting time, extracting solvent, and method of extraction (Okigbo and Ogbonnaya 2006; (Okwu1 *et al.,* 2014) (Anyanwu and Nwosu 2014) (Alo *et al.,* 2012). According to Nweke and Ibiam (2012), who explained that the presence of inhibitors for toxicity may contribute to differences observed in the antimicrobial activity of the plant extracts. Subsequently, Chukwuka *et al.,* (2011) noted that the medicinal plants with no antimicrobial activity may be due to astringent properties possessed by extracts of the plant. Though, the less resistance of fungal species due to their morphological structure, fungi has thicker cell walls and contains a higher percentage of chitin (Lim *et al.,* 2006). The control did not produce inhibition haloes against the tested of microorganisms. This is indicating that the solvent does not interfere with the antimicrobial activity results from the extracts.

5. CONCLUSION

All treatments of plant root extracts recorded significant in chemical analysis characteristics, such as extraction yield, total condensed tannin, antioxidant activity and phytochemical identification and quantification. Similarly, the significant pharmacological antifungal potencies of the studied plant extracts on seven *Candida* species were compared to with six artificial antifungals using agar disk diffusion methods and MIC value.

Depending on all results above the high significant extraction yield in *Rubus sanctus Schreb* plant was (CE10: 28.85 %) by conventional method with ethanol solvents. On the other hand, the minimum extraction yield was (MW1: 3.325 %) by maceration method with a distilled water solvent.

Among all plant root results, the lowermost amount of total condense tannin was (P 11: 0.7133 mg/kg) found in root extracts of *Ficus carica L.* plant. On the other hand, the uppermost amount was (P 10: 32.34 mg/kg) distinguished in root of *Rubus sanctus Schreb* plant.

In this study, the use of LC-MS/MS has led to the identification and quantification of plant phytochemical compounds. The total antioxidant activity of the studied extracts determined by DPPH assay. All results have high significances compared with control standard (BHT). It can be concluded that all plant roots are considered as rich sources of beneficial phytochemicals and antioxidants.

The important test schemes, totally DPPH free radical scavenging following with reducing influence, were used for the chemical investigation. Additionally, in the current investigation designates that the flavonoids are exists. The existence of flavonoids in enormous amount is rationally relative to the antioxidant activity so it is obviously shown that incidence of flavonoids will demonstrate the antioxidant activity and indorse the antifungal for dealing with a various infectious ailment. The uppermost value with 0.2 mL was detected for the *Quercus infectoria Oliv.* ethanol extract by microwave method (P4 MW: 99.60%). On the other hand, the lowest value was 0.2 ml (P11 MW: 69.08%), which was obtained by using microwave method and distilled water solvent.

The twenty-seven phytochemical compounds (three non-phenolic, eleven non-flavonoids and thirteen flavonoids) compounds were identified and quantified by LC-MS/MS. The highest amount of these total twenty-seven phytochemicals was (3572.22 µg/g) from *Pyrus syriaca Boiss.* ethanol root extract by microwave method. Whereas the minimum amount was (15.05 µg/g) *Crataegus azarolus var. aronia L. water* root extract by maceration method.

Our study showed that the prevalence of vaginal yeast isolates from patients was 165 (70.81%) *C. albicans*. It was the most commonly isolated species. Whereas *Candida* kefyr, *Candida* lusitaniae and *Candida* dubliniensis the minimum abounded were 1(0.4%) from Total 233 *Candida* species isolated from two hundred and twenty-eight (228) high vaginal positive swabs collected from women patients.

Furthermore, the results of antifungal activity showed very good results the inhibition zone diameter was (P10 MWE: 24.47 mm) by using microwave ethanol extraction from plants *Quercus infectoria Oliv.* and *Rubus sanctus Schreb* against *C. guilliermondii*. On the other hand, the minimum effect was (P10 MW: 7.405mm) inhibition zone diameter by maceration distilled water method of *Rubus sanctus Schreb* against *C. glabatra*. Also, the minimum inhibitory concentration (MIC) values against all *Candida* test was between 7.8125-250µg/ml. While six synthetic antifungal discs were statistically significant with diverse widths of inhibition zones against the organisms tested. The mean inhibition zones against all *Candida* test were ranged from 10.5–38.40mm in diameter of inhibition zone. The lowermost inhibitory zone 10.5 mm of FLU/25 was against *C. albicans*. Also, the uppermost inhibitory zone of FLU/25 38.40 mm was against *Candida guillier mmondii.*

Depending on all results, the microwave extraction method was established to be much more effective than conventional and maceration methods. Likewise, the root plant extracts of *Rubus sanctus* Schreb recorded high significant antifungal effects than other plant root extracts. Also, the maximum phytochemical of 27 chemical compound in root of *Pyrus syriaca Boiss.* Boiss was (P3: MWE: 3572.22 µg/g) and lowest in root of *Crataegus azarolus* var. aronia L. (P8: MW: 15.05 µg/g).

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APPENDIXES

Figure A1. LC-MS/MS chromatogram of ethanol root extract of *Acer monspessulanum* L. by microwave assisted method

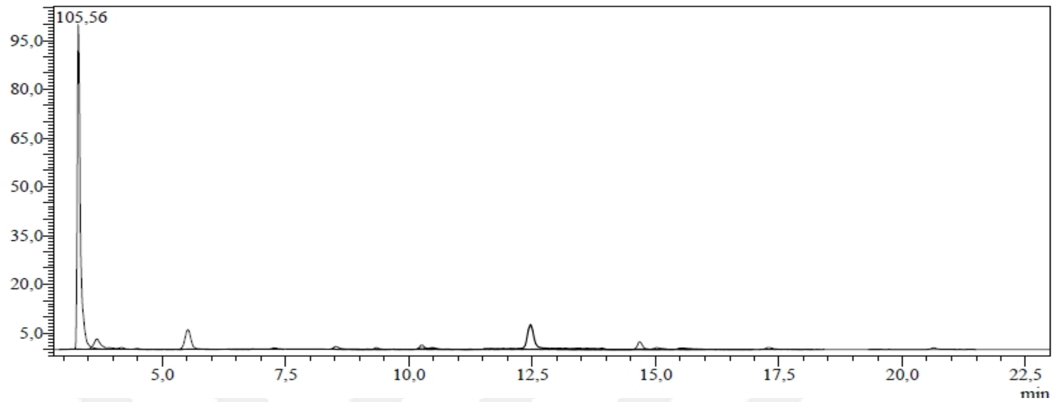


Figure A2. LC-MS/MS chromatogram of ethanol root extract of *Prunus microcarpa* C.A. Mey. (Yellow fruit) by microwave assisted method

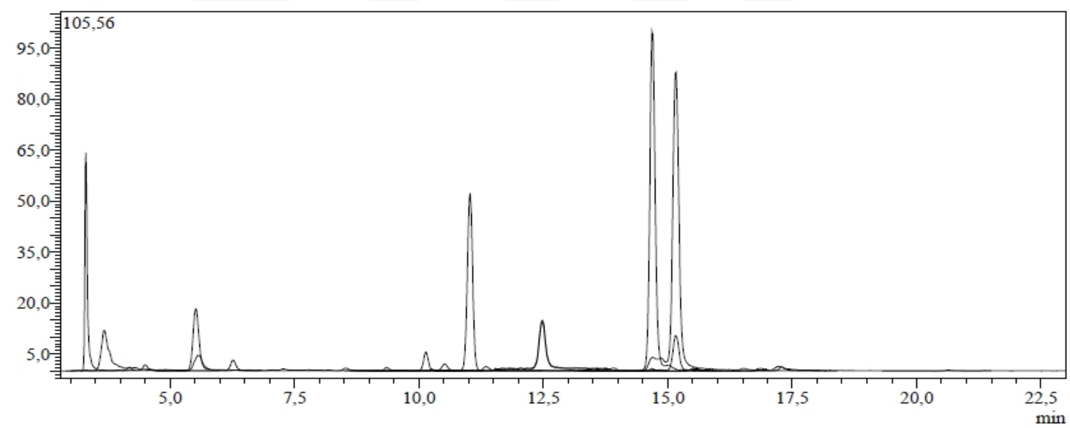


Figure A3. LC-MS/MS chromatogram of ethanol root extract of *Pyrus syriaca* Boiss. by microwave assisted method

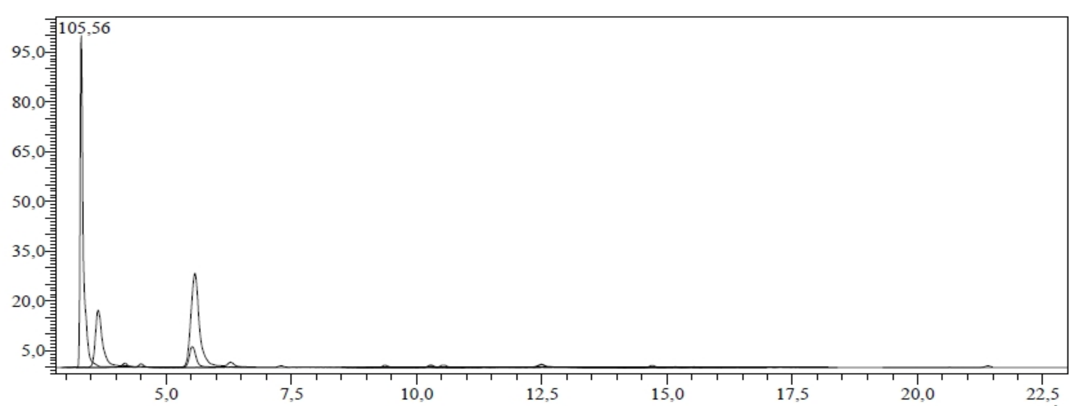


Figure A4. LC-MS/MS chromatogram of ethanol root extract of *Quercus infectoria* Oliv. by microwave assisted method

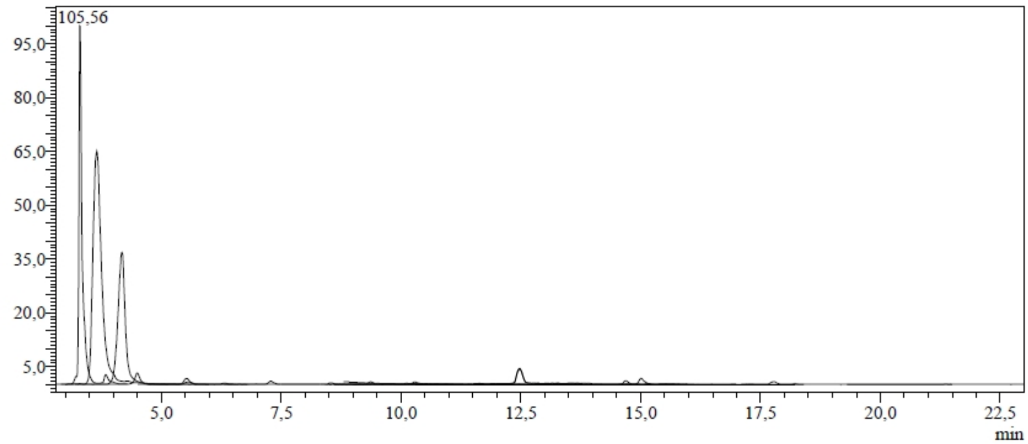


Figure A5. LC-MS/MS chromatogram of ethanol root extract of *Quercus aegilops* L. by microwave assisted method

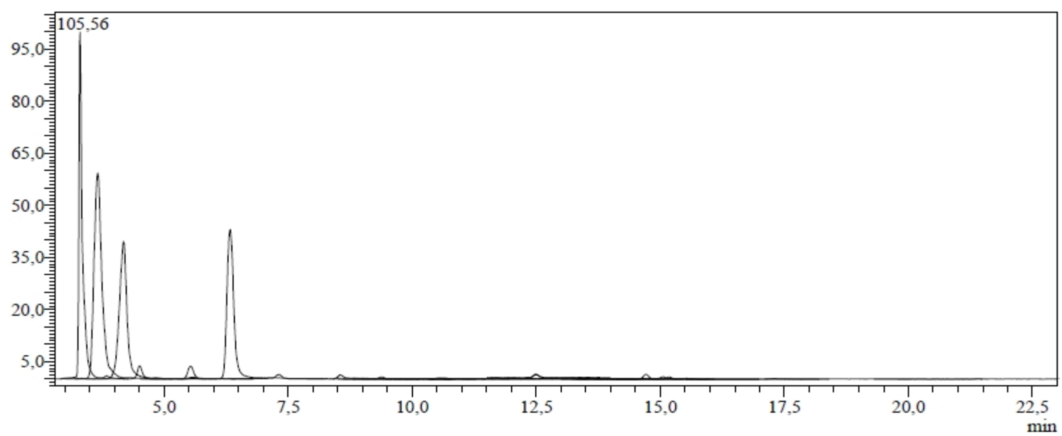


Figure A6. LC-MS/MS chromatogram of ethanol root extract of *Crataegus monogyna* Jacquin. by microwave assisted method

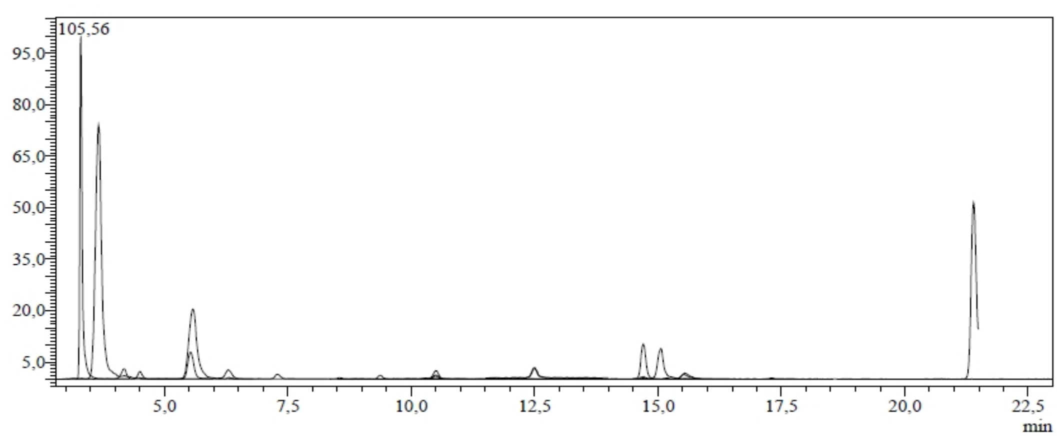


Figure A7. LC-MS/MS chromatogram of ethanol root extract of *Prunus argentea* (Lam.) Rehder. by microwave assisted method

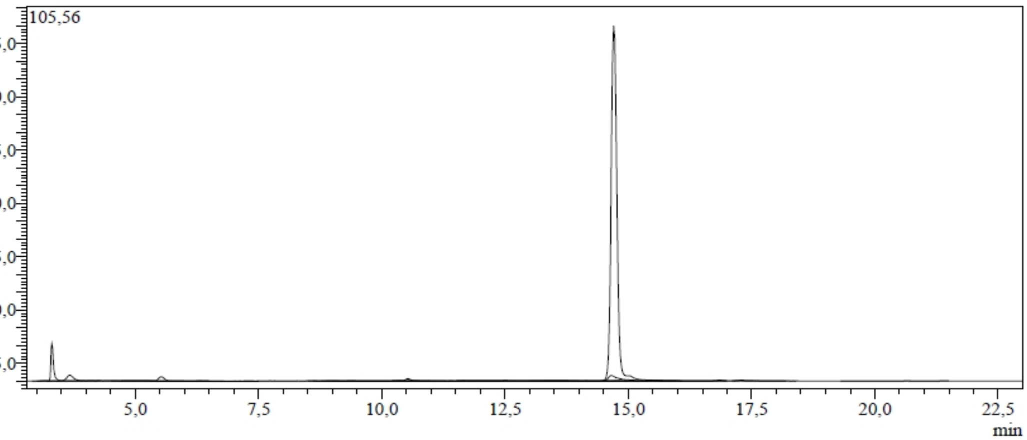


Figure A8. LC-MS/MS chromatogram of ethanol root extract of *Crataegus azarolus* var. aronia L. by microwave assisted method.

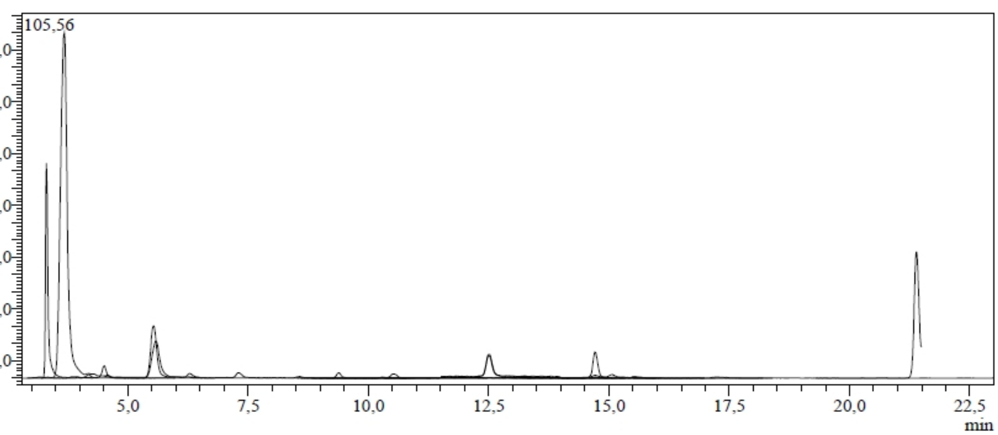


Figure A9. LC-MS/MS chromatogram of ethanol root extract of *Prunus microcarpa* C.A. Mey. (Red fruit) by microwave assisted method.

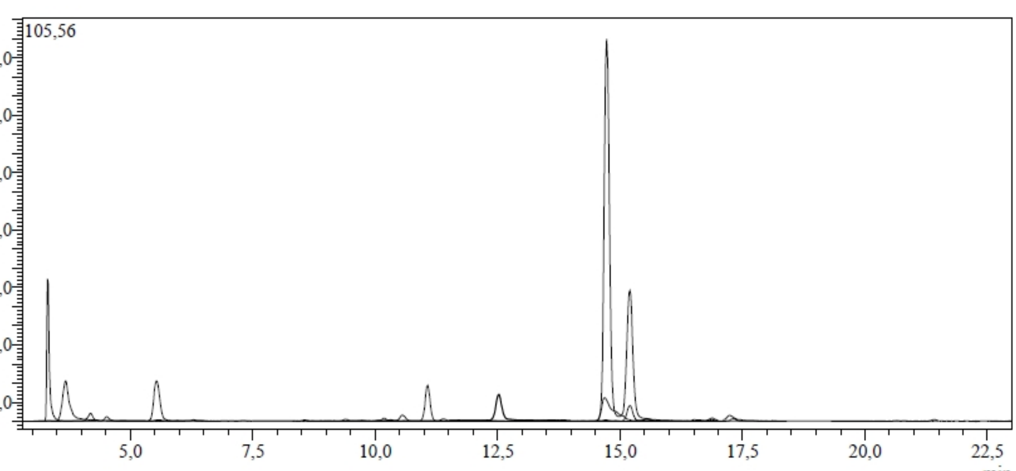


Figure A10. LC-MS/MS chromatogram of ethanol root extract of P *Rubus sanctus* Schreb by microwave assisted method.

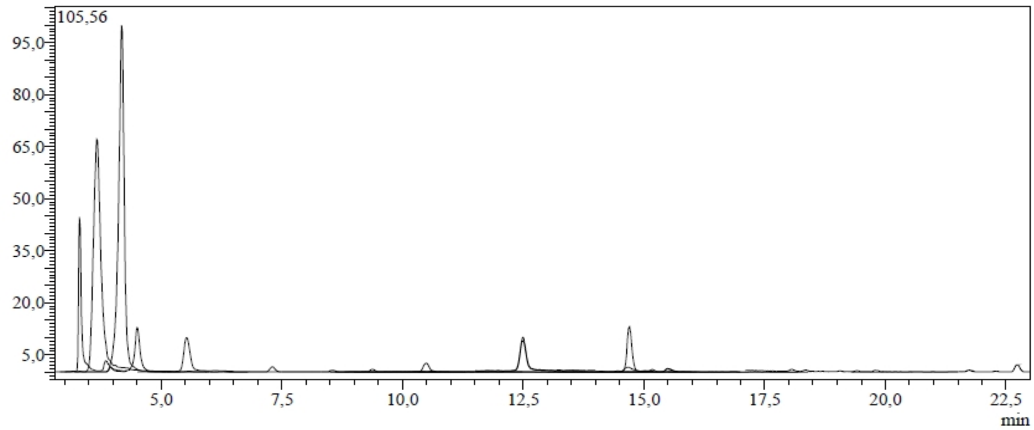


Figure A11. LC-MS/MS chromatogram of ethanol root extract of *Ficus carica* L. by microwave assisted method.

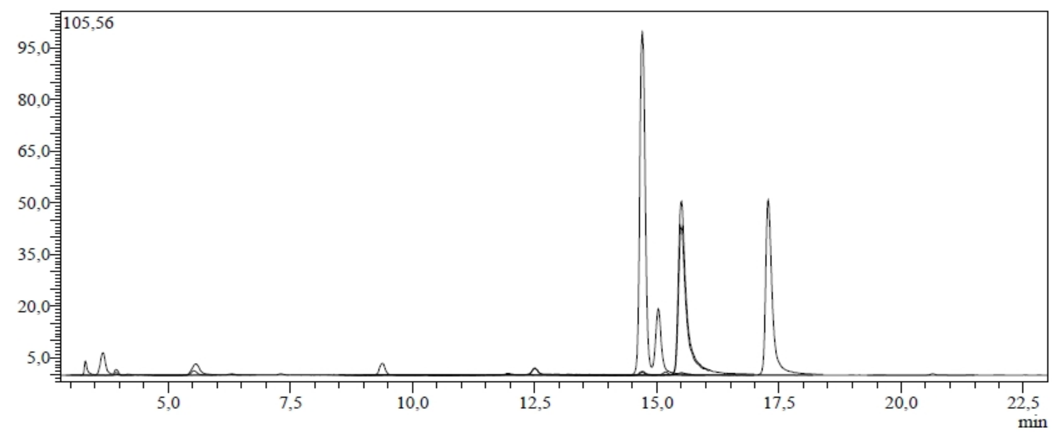


Figure A12. LC-MS/MS chromatogram of ethanol root extract of *Acer monspessulanum* L. by conventional method.

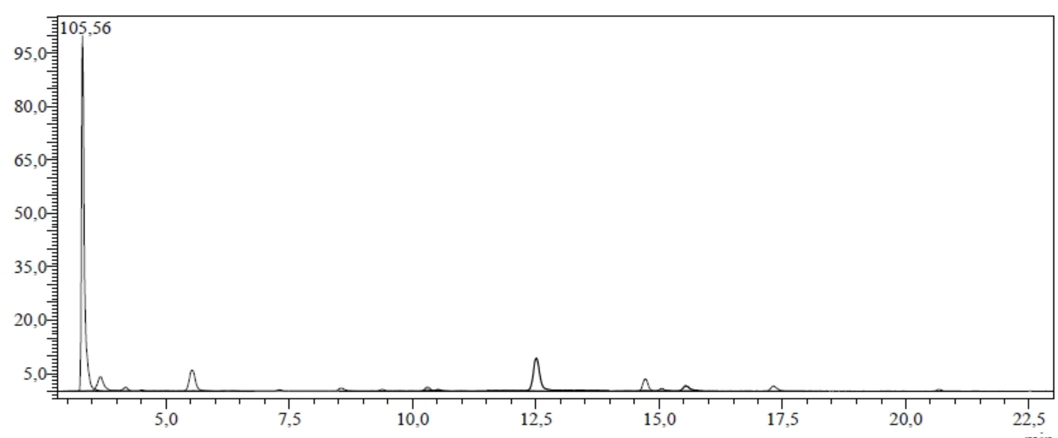


Figure A13. LC-MS/MS chromatogram of ethanol root extract of *Prunus microcarpa* C.A. Mey. (Yellow fruit) by conventional method

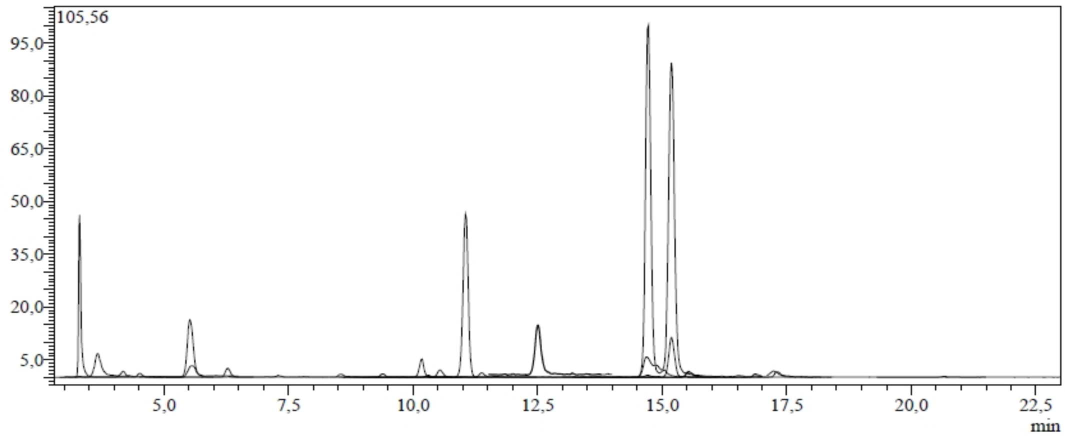


Figure A14. Illustration LC-MS/MS ethanol root extraction calibration by the conventional method of *Pyrus syriaca* Boiss.

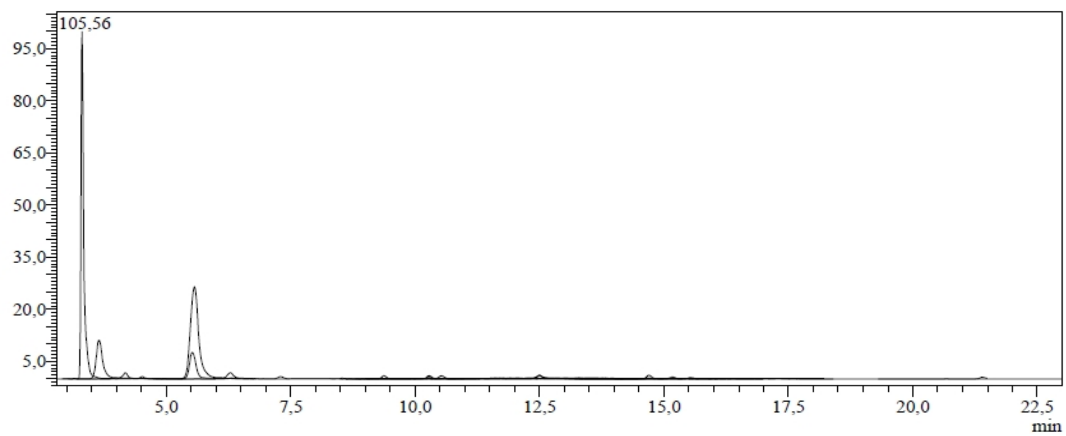


Figure A15. LC-MS/MS chromatogram of ethanol root extract of *Quercus infectoria* Oliv. by conventional method.

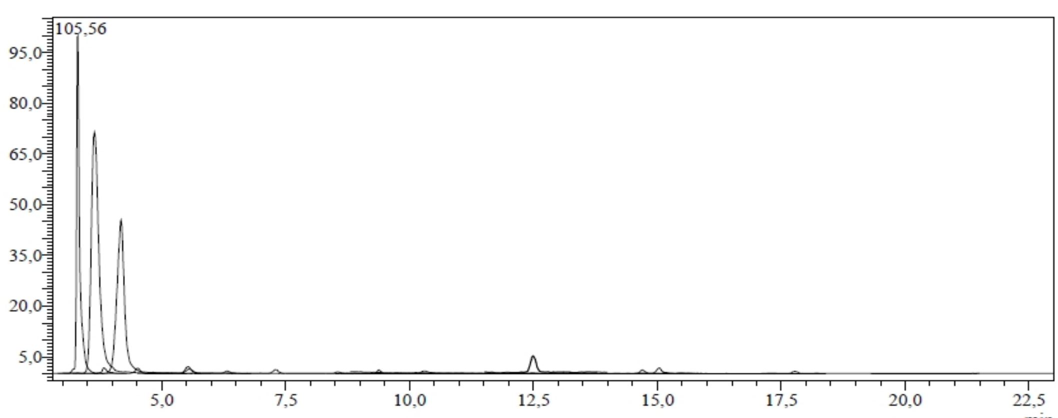


Figure A16. LC-MS/MS chromatogram of ethanol root extract of *Quercus aegilops* L. by conventional method

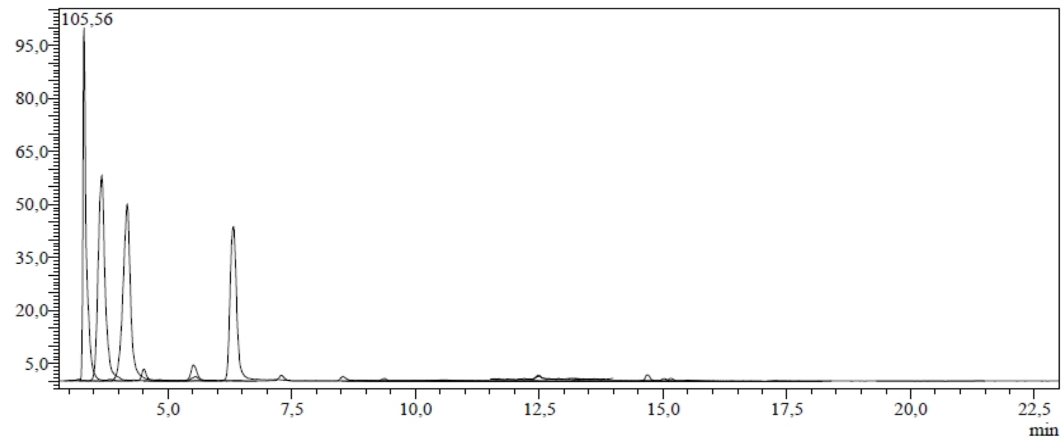


Figure A17. LC-MS/MS chromatogram of ethanol root extract of *Crataegus monogyna* Jacquin. by conventional method.

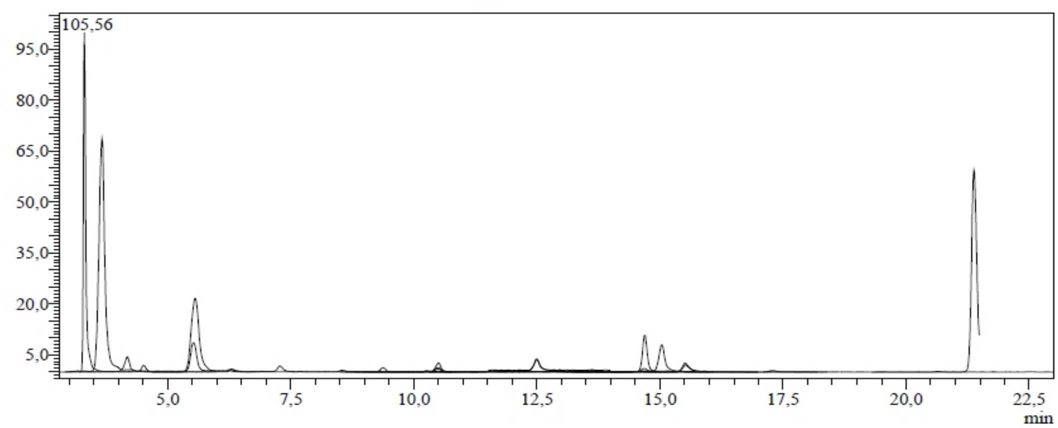


Figure A18. LC-MS/MS chromatogram of ethanol root extract of *Prunus argentea* (Lam.) Rehder. by conventional method.

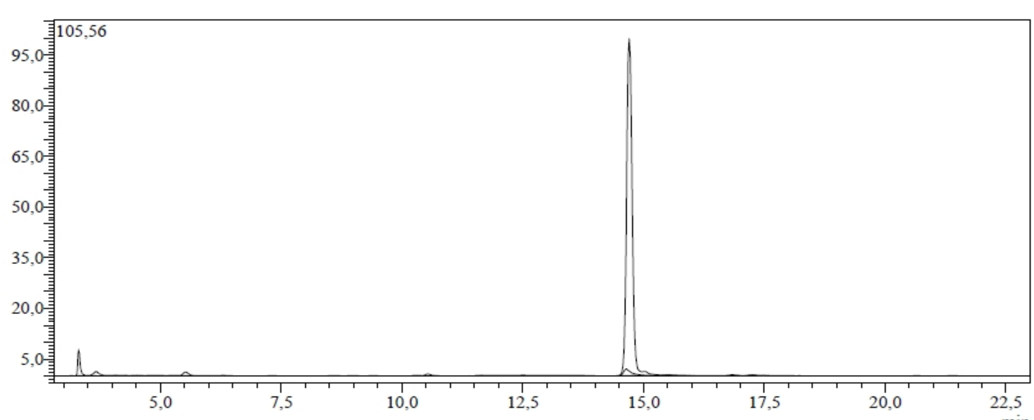


Figure A19. LC-MS/MS chromatogram of ethanol root extract of *Crataegus azarolus* var. aronia L. by conventional method.

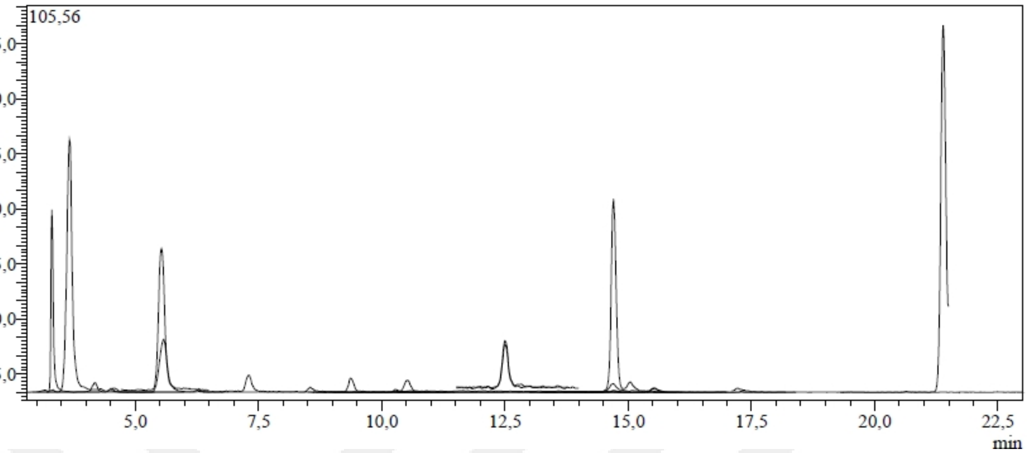


Figure A20. LC-MS/MS chromatogram of ethanol root extract of *Prunus microcarpa* C.A. Mey. (Red fruit). by conventional method.

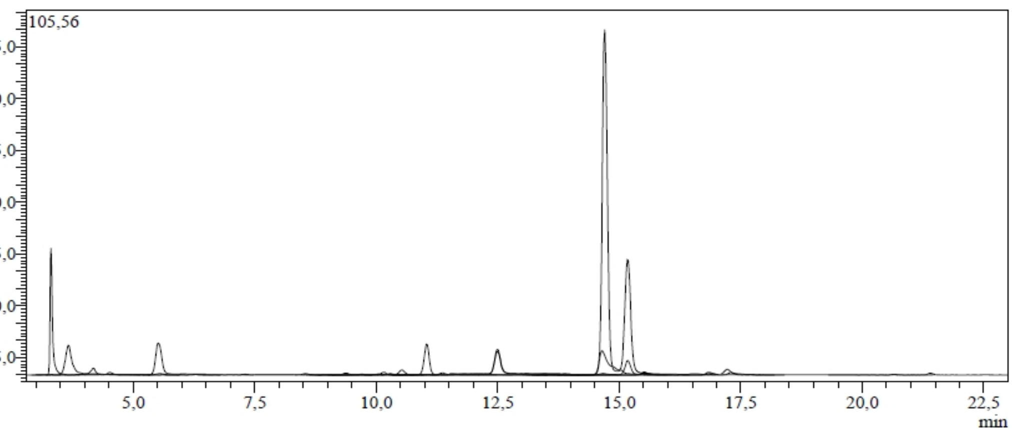


Figure A21. LC-MS/MS chromatogram of ethanol root extract of *Rubus sanctus* Schreb. by conventional method.

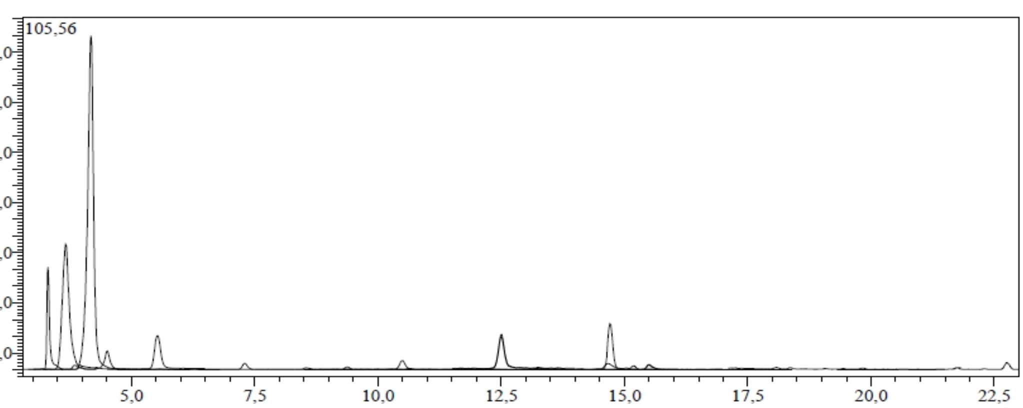


Figure A22. LC-MS/MS chromatogram of ethanol root extract of *Ficus carica* L. by conventional method.

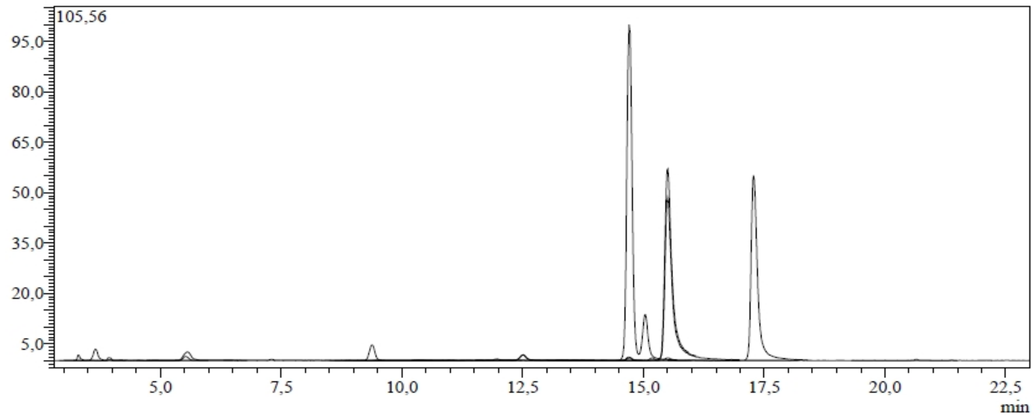


Figure A23. LC-MS/MS chromatogram of ethanol root extract of *Acer monspessulanum* L. by maceration method.

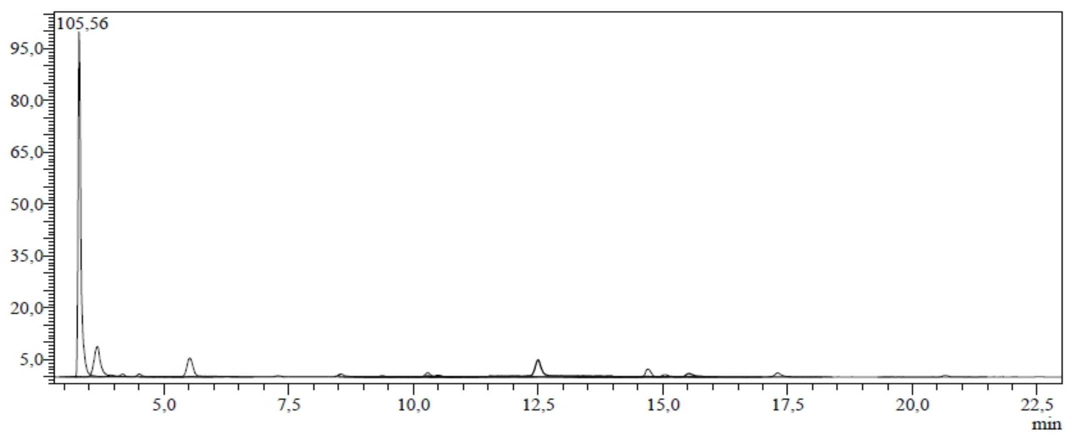


Figure A24. LC-MS/MS chromatogram of ethanol root extract of *Prunus microcarpa* C.A. Mey. (Yellow fruit). by maceration method

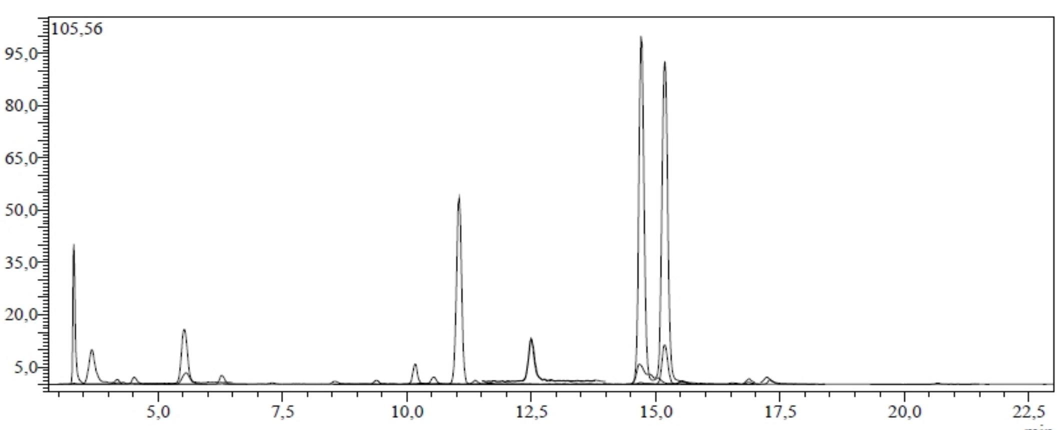


Figure A25. LC-MS/MS chromatogram of ethanol root extract of *Pyrus syriaca* Boiss. by maceration method

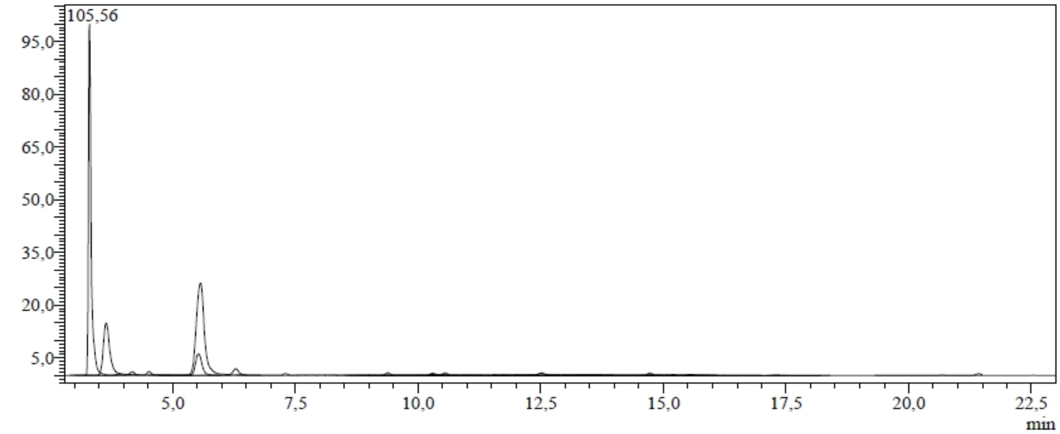


Figure A26. LC-MS/MS chromatogram of ethanol root extract of *Quercus infectoria* Oliv. by maceration method.

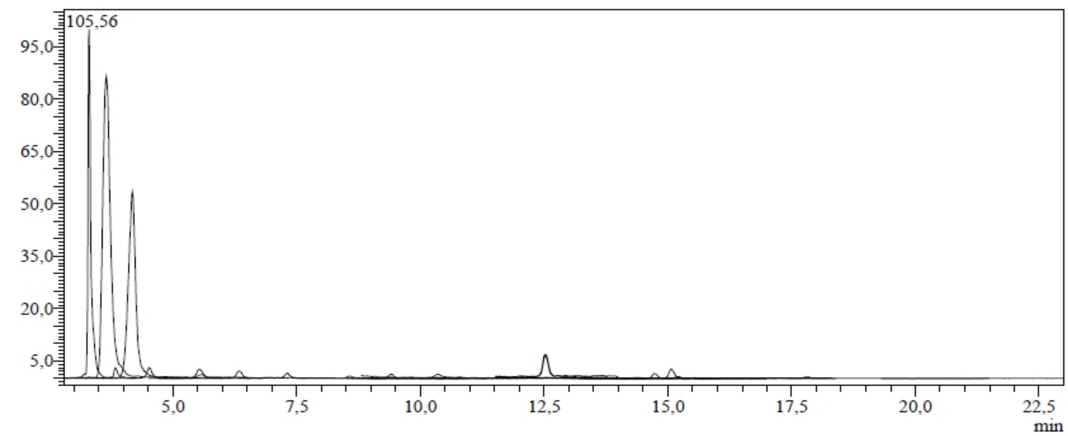


Figure A27. LC-MS/MS chromatogram of ethanol root extract of *Quercus aegilops* L. by maceration method

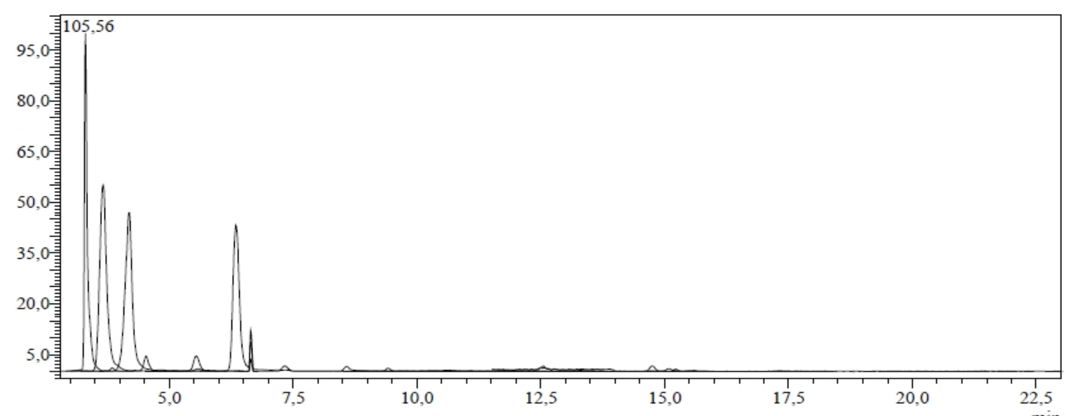


Figure A28. LC-MS/MS chromatogram of ethanol root extract of *Crataegus monogyna* Jacquin. by maceration method.

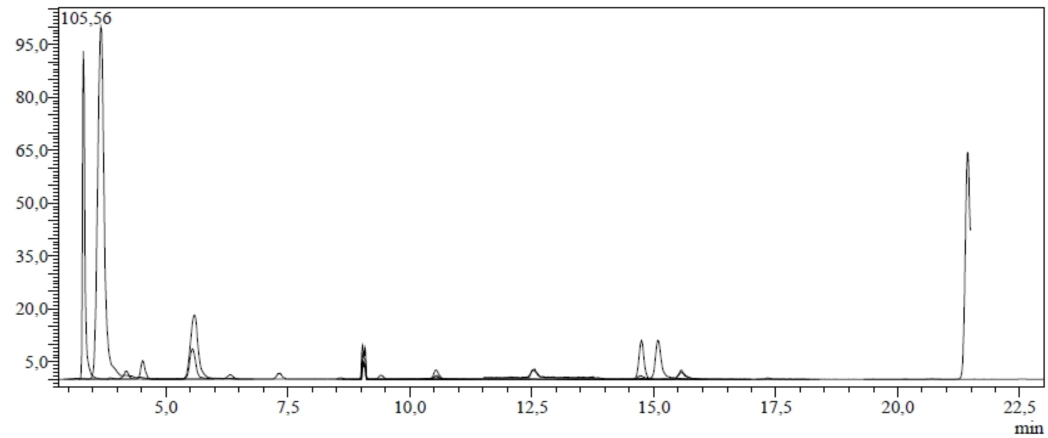


Figure A29. LC-MS/MS chromatogram of ethanol root extract of *Prunus argentea* (Lam.) Rehder. by maceration method.

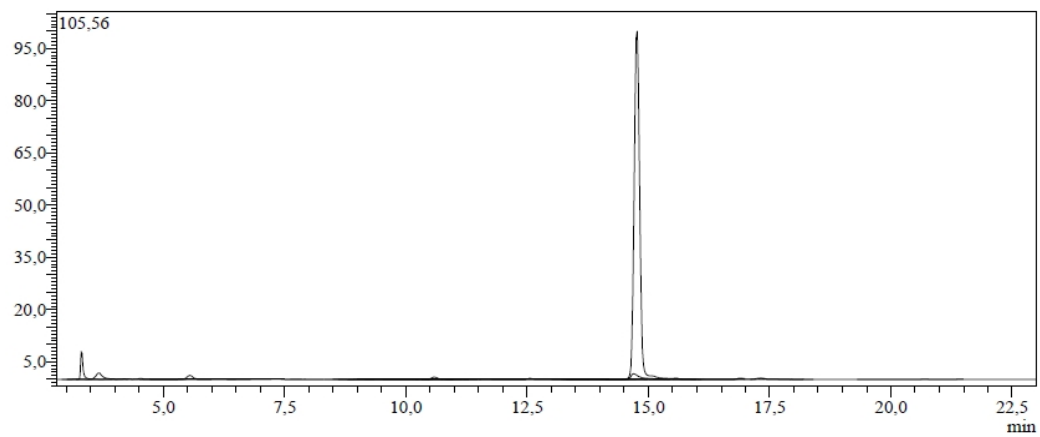


Figure A30. LC-MS/MS chromatogram of ethanol root extract of *Crataegus azarolus* var. aronia L. by maceration method.

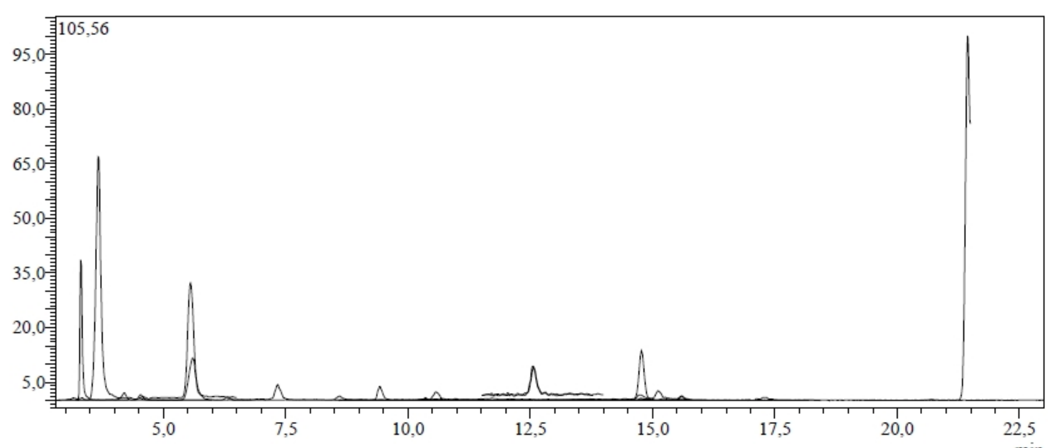


Figure A31. LC-MS/MS chromatogram of ethanol root extract of *Prunus microcarpa* C.A. Mey. (Red fruit). by maceration method

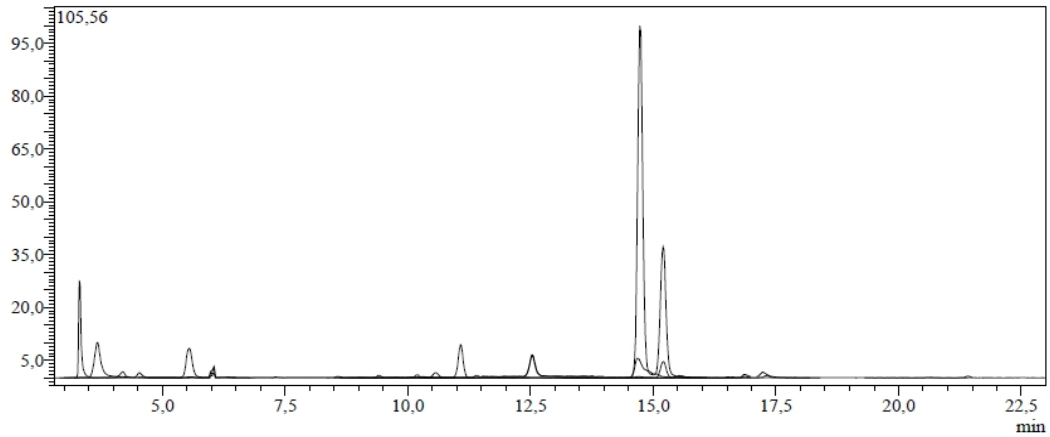


Figure A32. LC-MS/MS chromatogram of ethanol root extract of *Rubus sanctus* Schreb. by maceration method

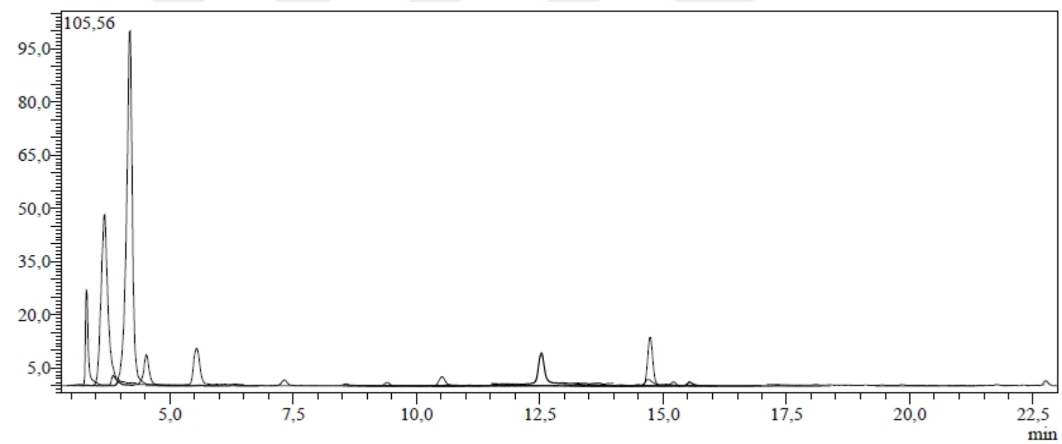


Figure A33. LC-MS/MS chromatogram of ethanol root extract of *Ficus carica* L. by maceration method.

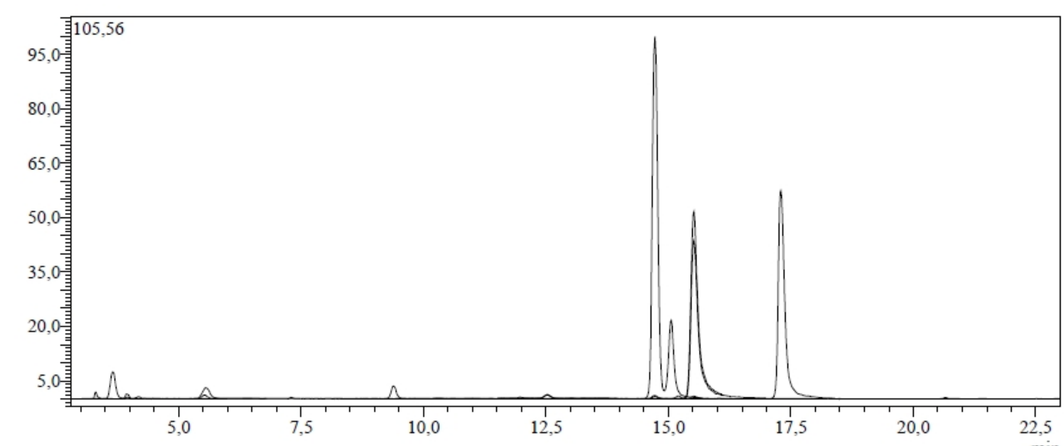


Figure A34. LC-MS/MS chromatogram of acetonitrile root extraction calibration of *Acer monspessulanum* L. by microwave assisted method.

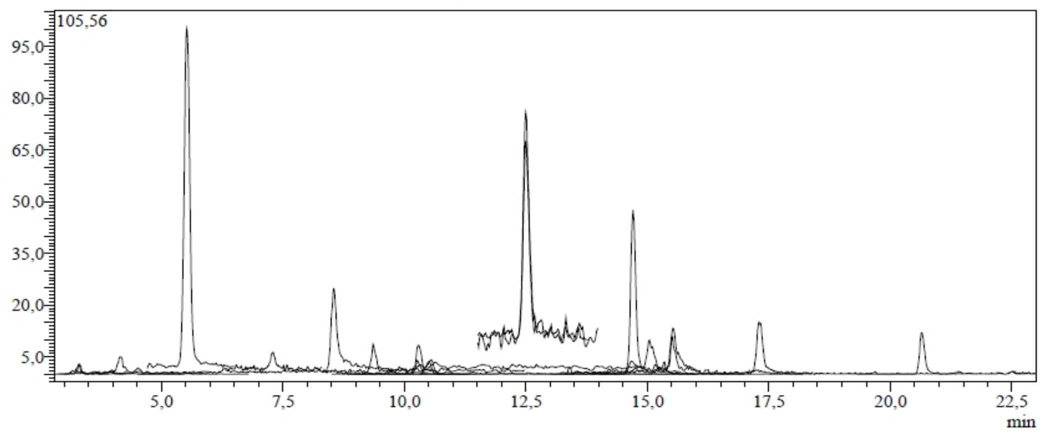


Figure A35. LC-MS/MS chromatogram of acetonitrile root extract of *Prunus microcarpa* C.A. Mey. (Yellow fruit). by microwave assisted method.

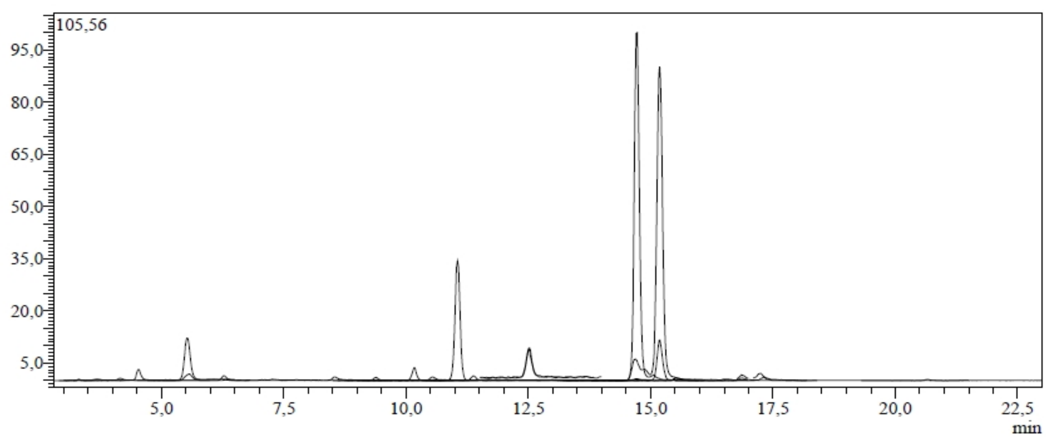


Figure A36. LC-MS/MS chromatogram of acetonitrile root extract of *Pyrus syriaca* Boiss. by microwave assisted method.

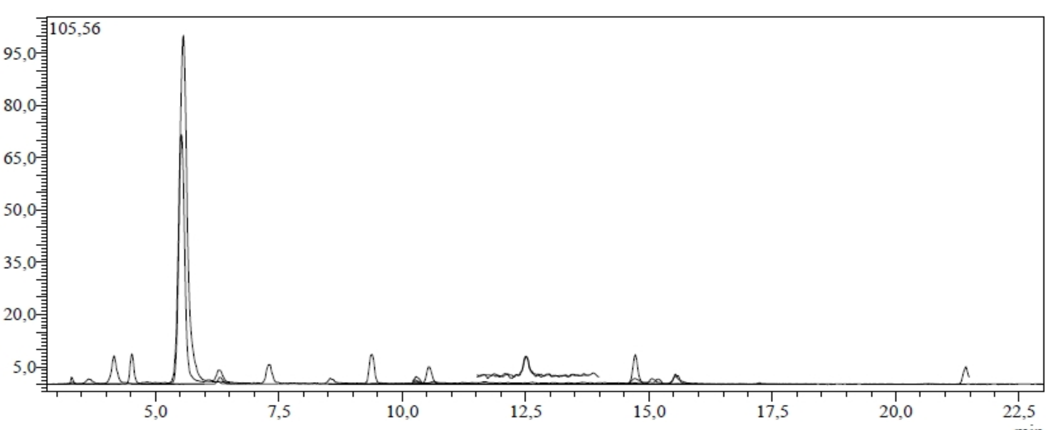


Figure A37. LC-MS/MS chromatogram of acetonitrile root extract of *Quercus infectoria* Oliv. by microwave assisted method

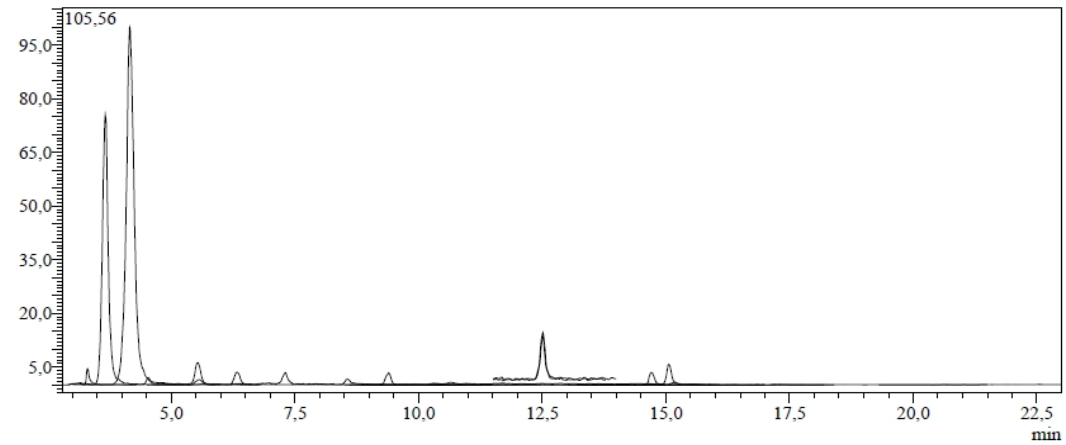
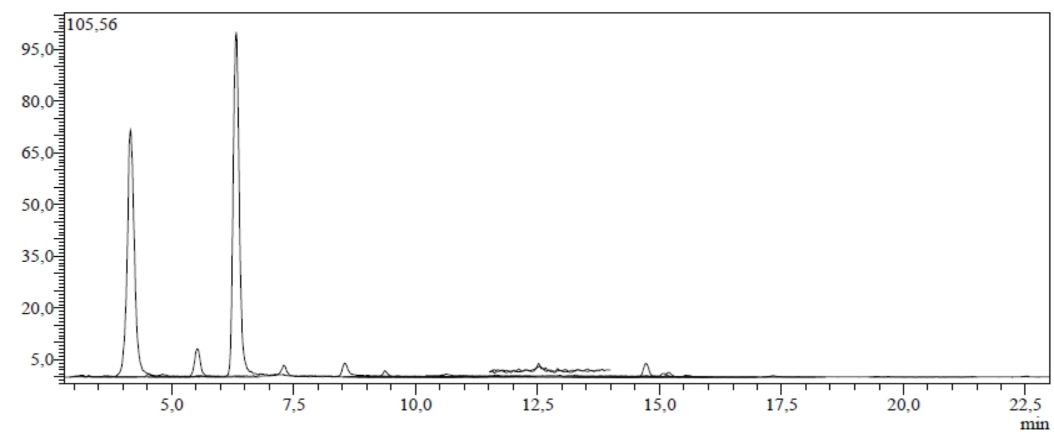
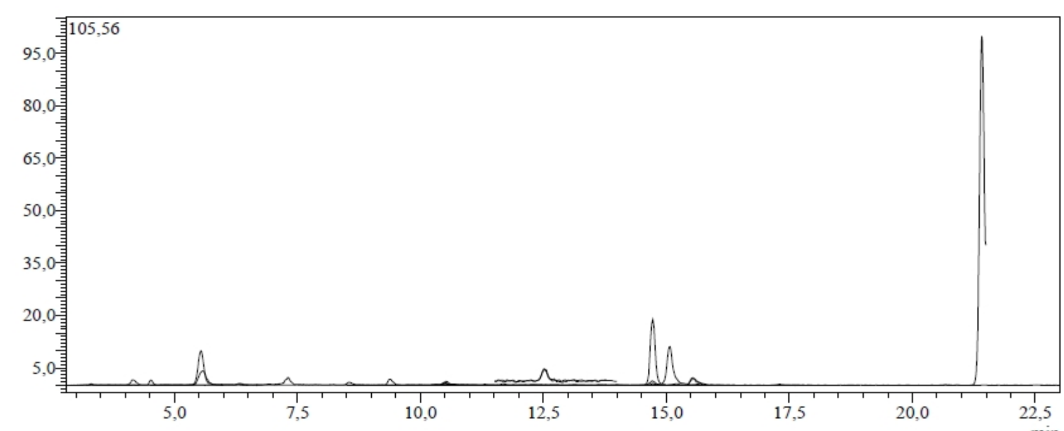


Figure A38. LC-MS/MS chromatogram of acetonitrile root extract of *Quercus aegilops* L. by microwave assisted method.



A39. LC-MS/MS chromatogram of acetonitrile root extract of *Crataegus monogyna* Jacquin. by microwave assisted method.



A40. LC-MS/MS chromatogram of acetonitrile root extract of *Prunus argentea* (Lam.) Rehder. by microwave assisted method.

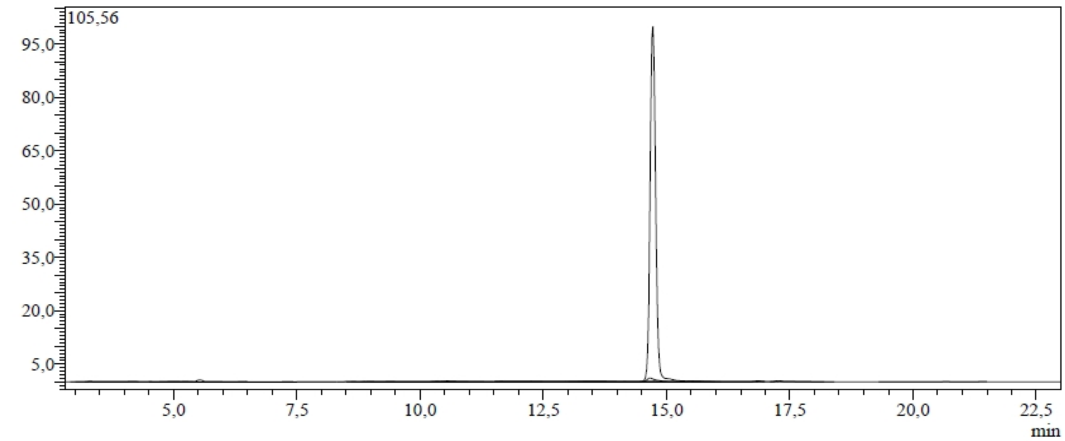


Figure A41. LC-MS/MS chromatogram of acetonitrile root extract of *Crataegus azarolus* var. aronia L. by microwave assisted method.

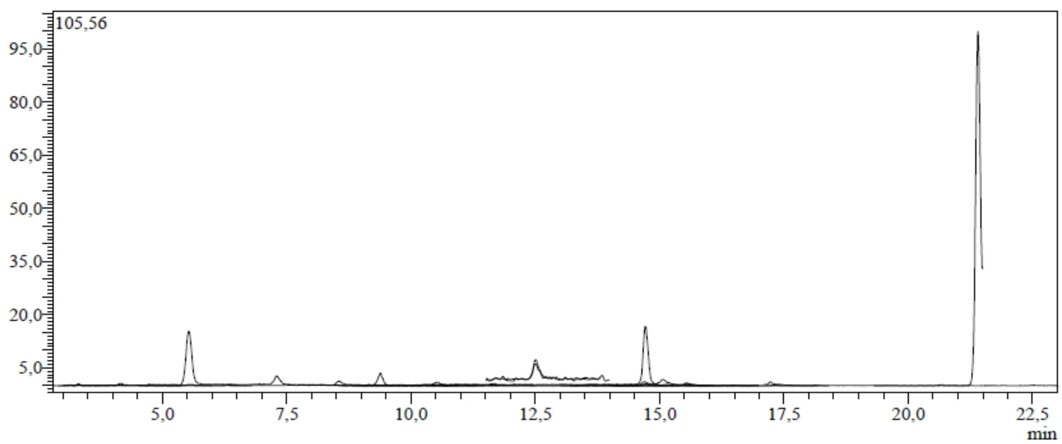


Figure A42. LC-MS/MS chromatogram of acetonitrile root extract of *Prunus microcarpa* C.A. Mey. (Red fruit) by microwave assisted method.

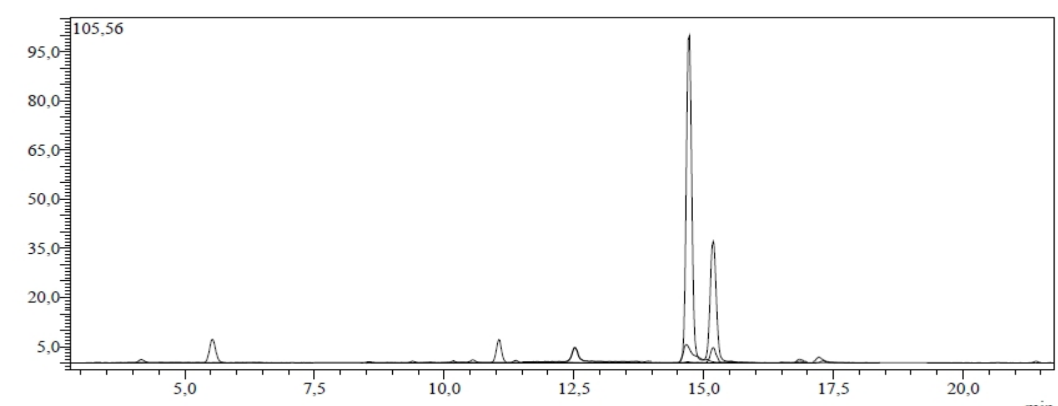


Figure A43. LC-MS/MS chromatogram of acetonitrile root extract of *Rubus sanctus* Schreb. by microwave assisted method.

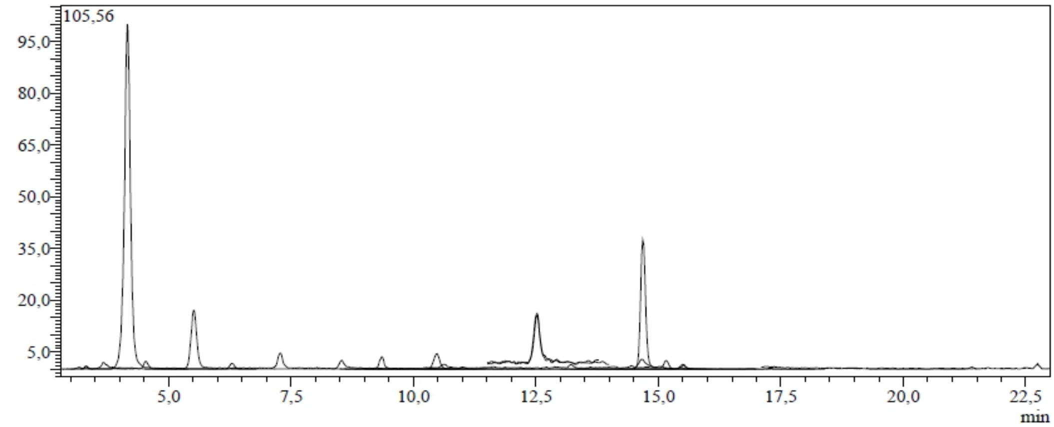


Figure A44. LC-MS/MS chromatogram of acetonitrile root extract of *Ficus carica* L. by microwave assisted method.

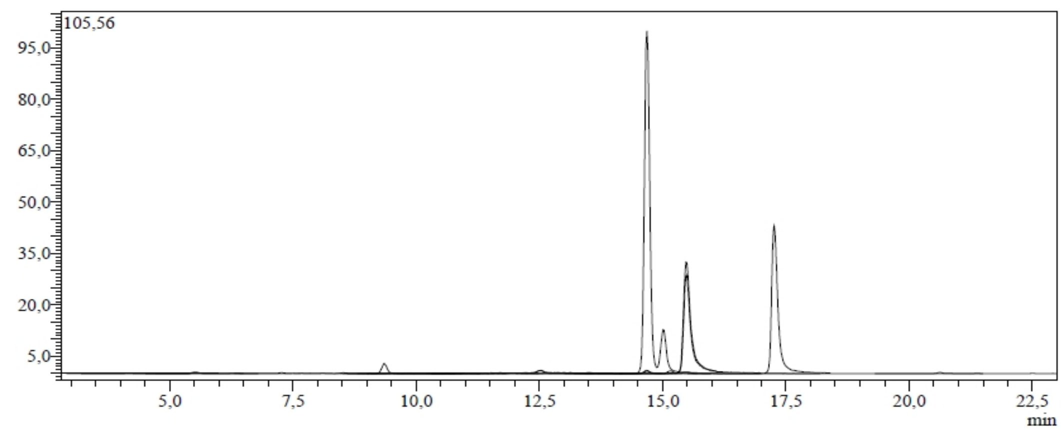
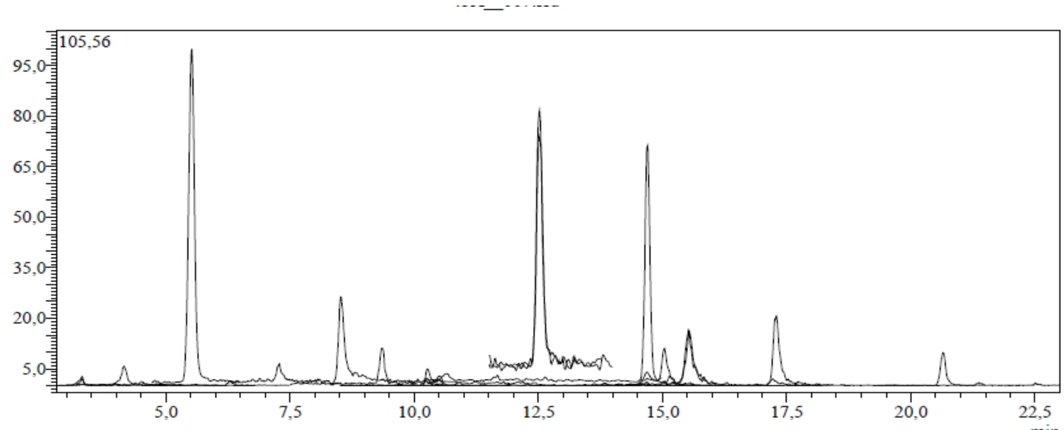


Figure A45. LC-MS/MS chromatogram of acetonitrile root extract of *Acer* monspessulanum L. by conventional method.



A46. LC-MS/MS chromatogram of acetonitrile root extract of *Prunus microcarpa* C.A. Mey. (Yellow fruit) by conventional method.

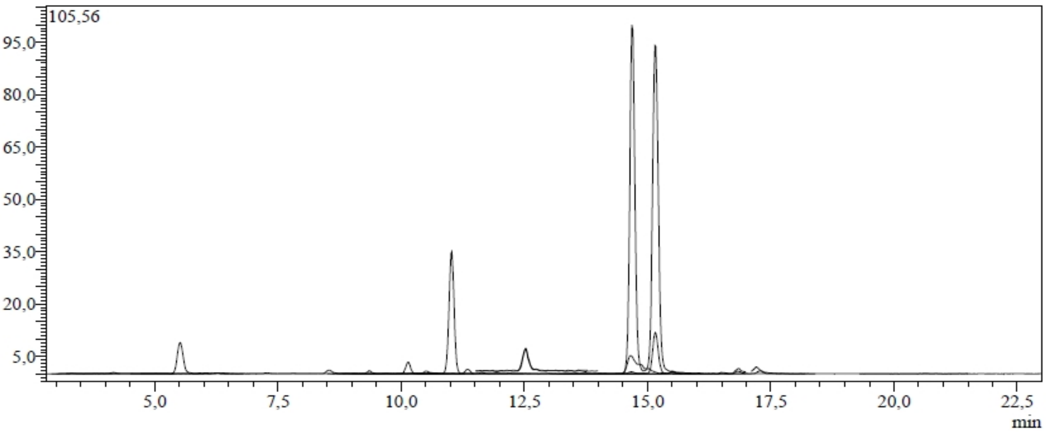


Figure A47. LC-MS/MS chromatogram of acetonitrile root extract of *Pyrus syriaca* Boiss. by conventional method.

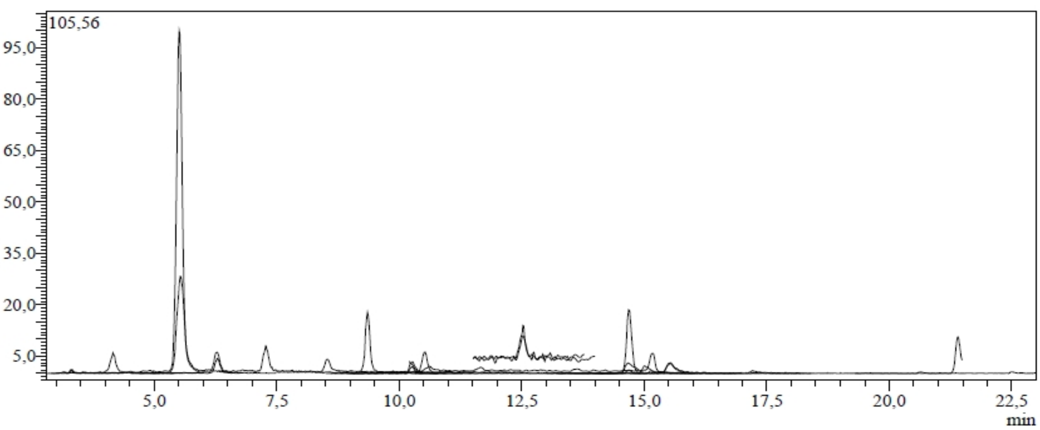


Figure A48. LC-MS/MS chromatogram of acetonitrile root extract of *Quercus infectoria* Oliv. by conventional method

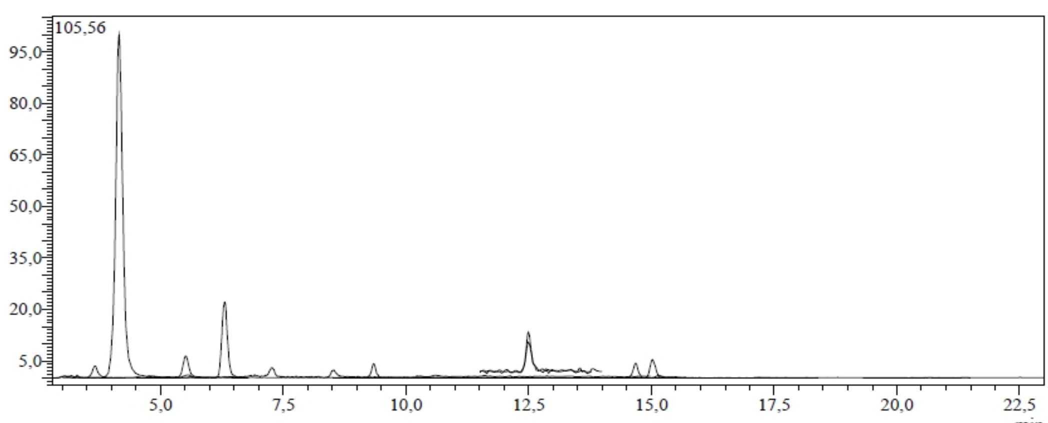


Figure A49. LC-MS/MS chromatogram of acetonitrile root extract of *Quercus aegilops* L. by conventional method

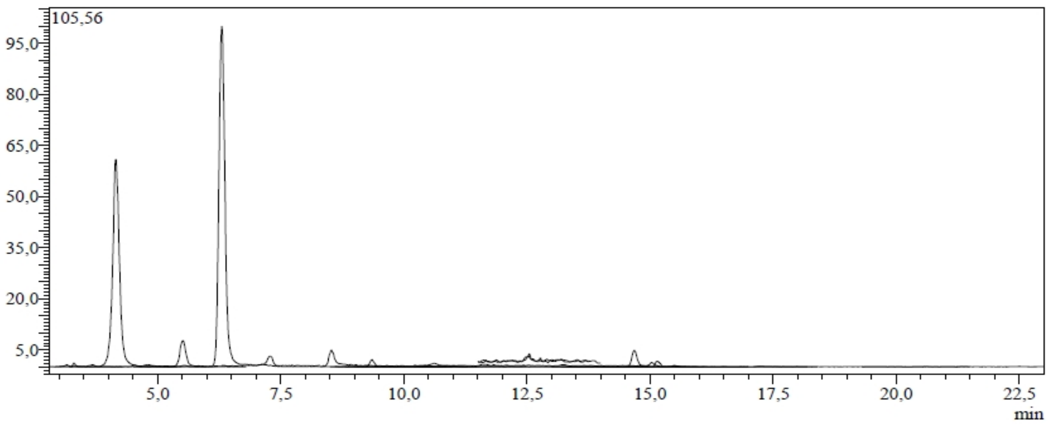


Figure A50. LC-MS/MS chromatogram of acetonitrile root extract of *Crataegus monogyna* Jacquin. by conventional method.

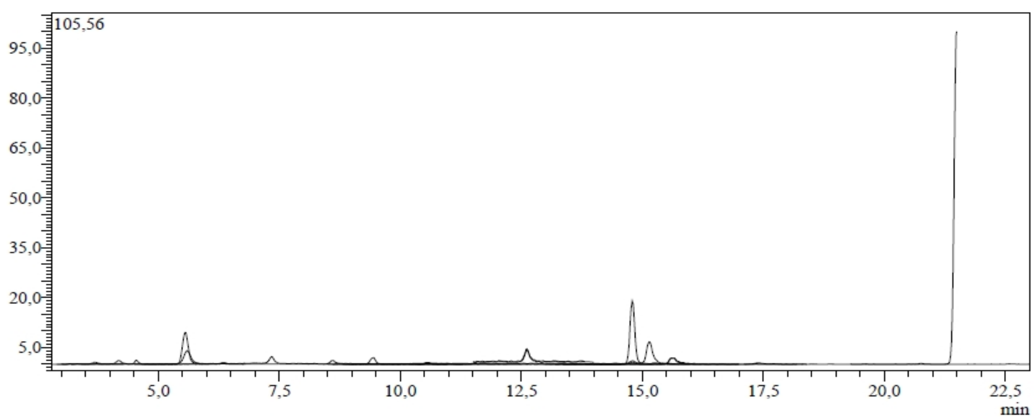


Figure A51. LC-MS/MS chromatogram of acetonitrile root extract of *Prunus argentea* (Lam.) Rehder. by conventional method.

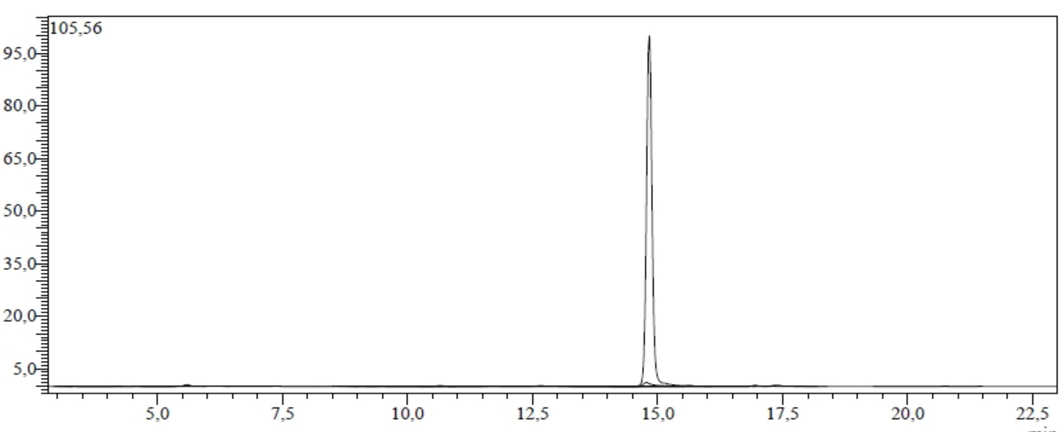


Figure A52. LC-MS/MS chromatogram of acetonitrile root extract of *Crataegus azarolus var. aronia* L. by conventional method.

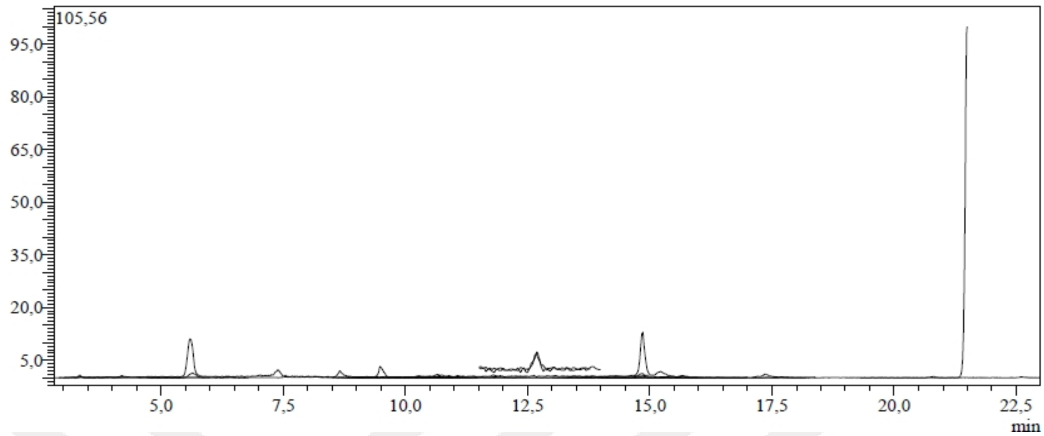


Figure A53. LC-MS/MS chromatogram of acetonitrile root extract of *Prunus microcarpa* C.A. Mey. (Red fruit). by conventional method

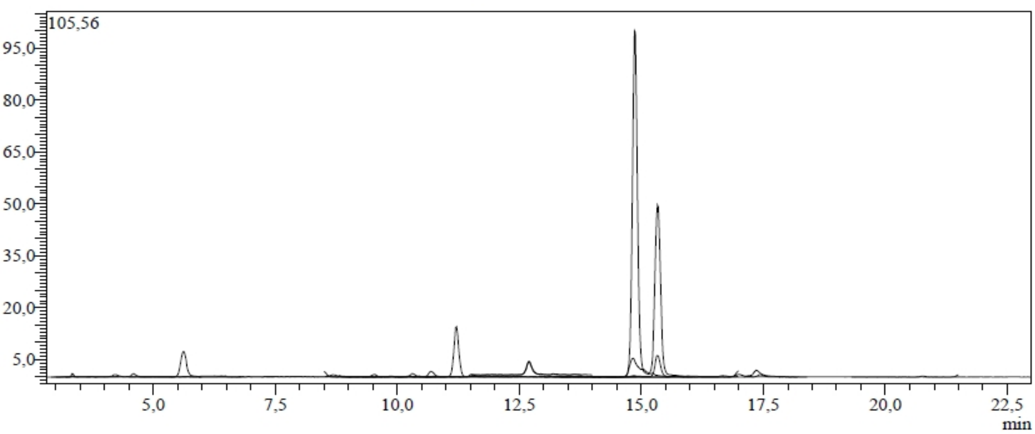


Figure A54. LC-MS/MS chromatogram of acetonitrile root extract of *Rubus sanctus* Schreb. by conventional method.

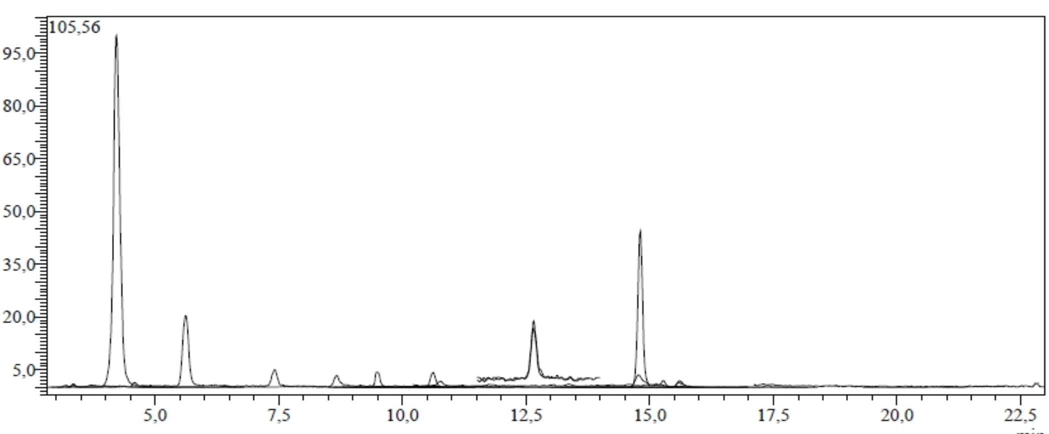


Figure A55. LC-MS/MS chromatogram of acetonitrile root extract of *Ficus carica* L. by conventional method.

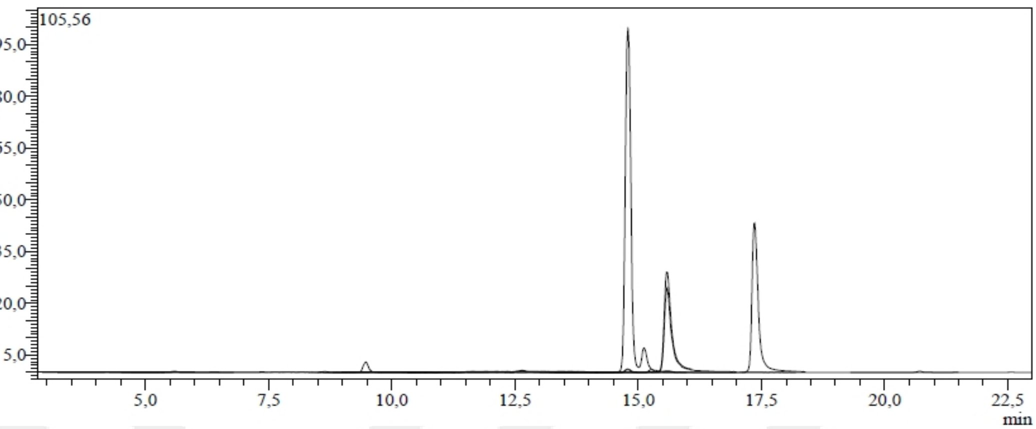


Figure A56. LC-MS/MS chromatogram of acetonitrile root extract of *Acer monspessulanum* L. by maceration method.

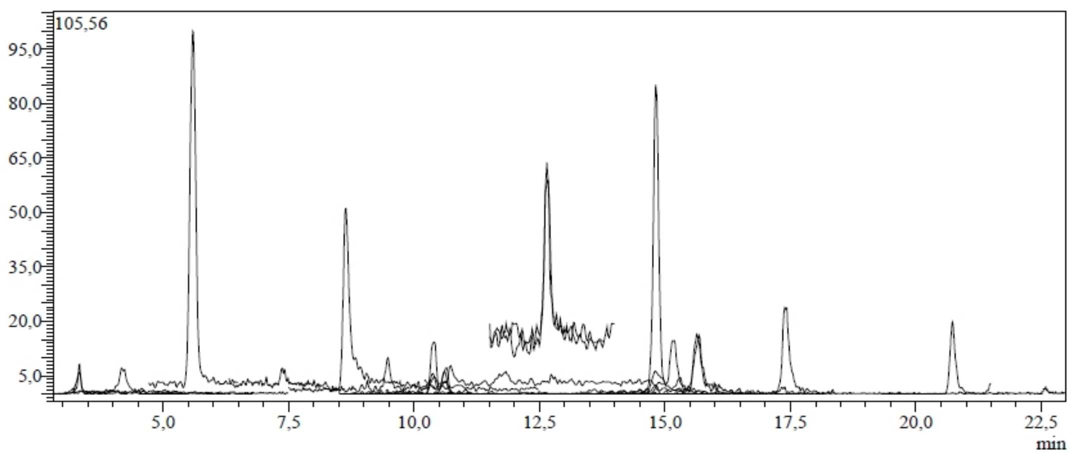


Figure A57. LC-MS/MS chromatogram of acetonitrile root extract of *Prunus microcarpa* C.A. Mey. (Yellow fruit). by maceration method.

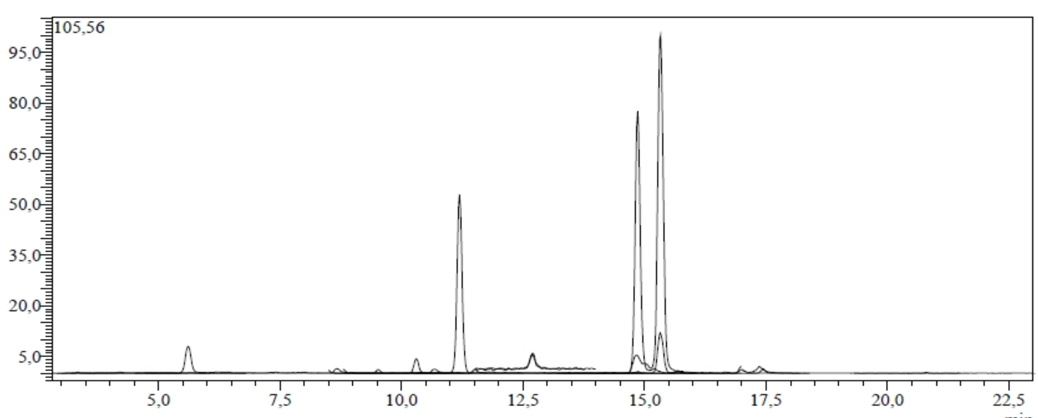


Figure A58. LC-MS/MS chromatogram of acetonitrile root extract of *Pyrus syriaca* Boiss. by maceration method.

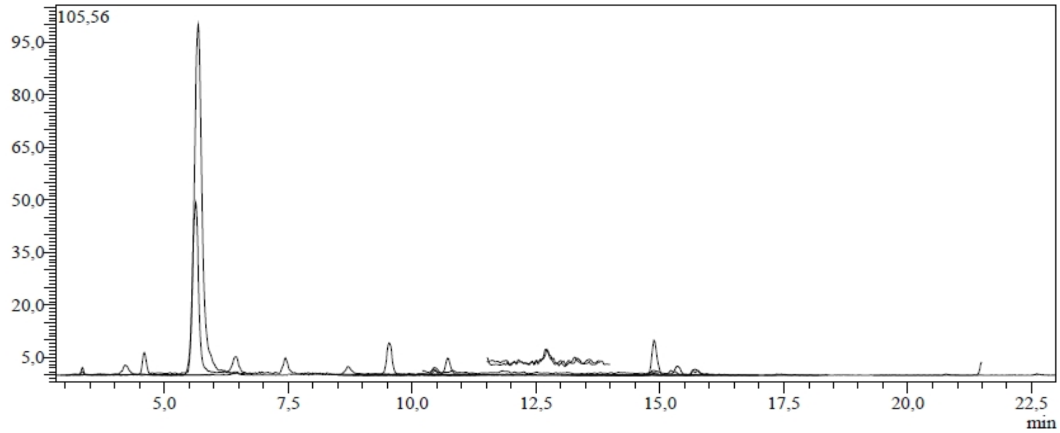


Figure A59. LC-MS/MS chromatogram of acetonitrile root extract of *Quercus infectoria* Oliv. by maceration method

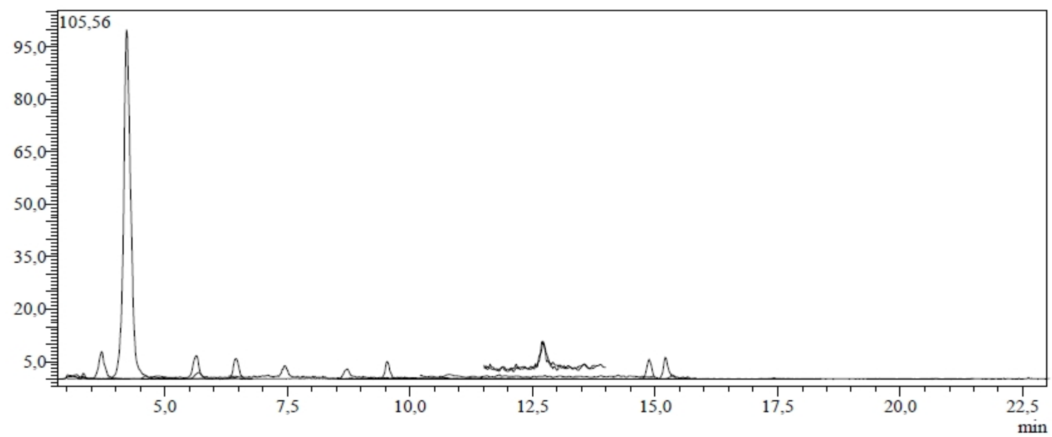


Figure A60. LC-MS/MS chromatogram of acetonitrile root extract of *Quercus aegilops* L. by maceration method.

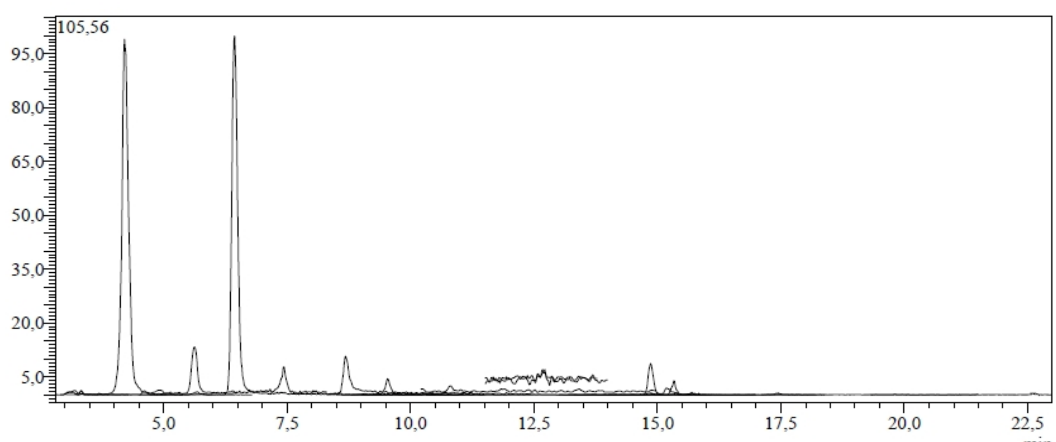


Figure A61. LC-MS/MS chromatogram of acetonitrile root extract of *Crataegus monogyna* Jacquin. by maceration method.

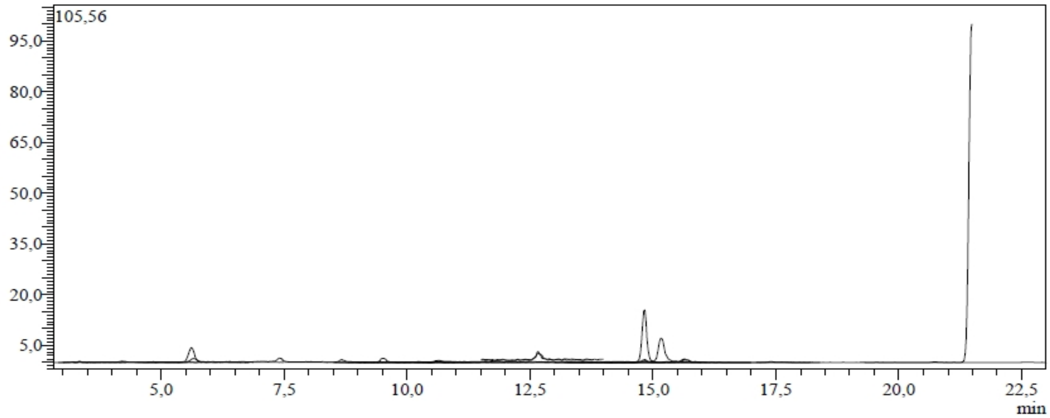


Figure A62. LC-MS/MS chromatogram of acetonitrile root extract of *Prunus argentea* (Lam.) Rehder. by maceration method.

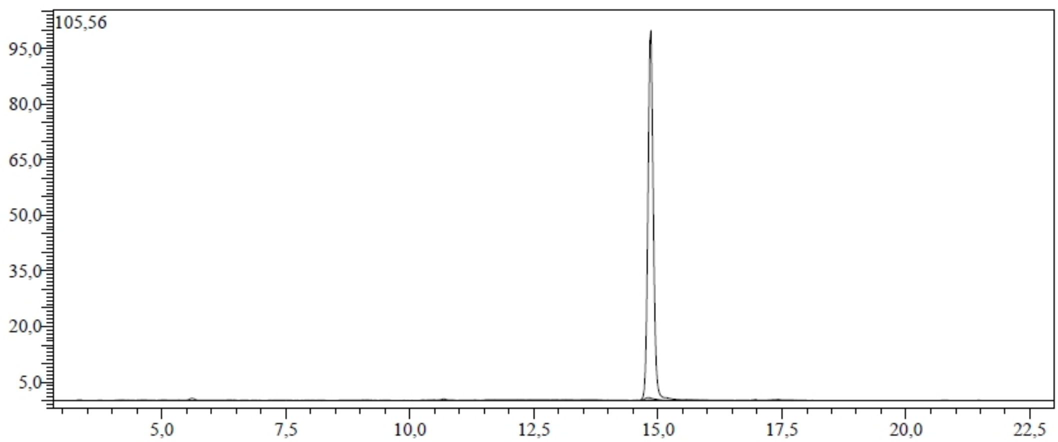


Figure A63. LC-MS/MS chromatogram of acetonitrile root extract of *Crataegus azarolus* var. aronia L. by maceration method.

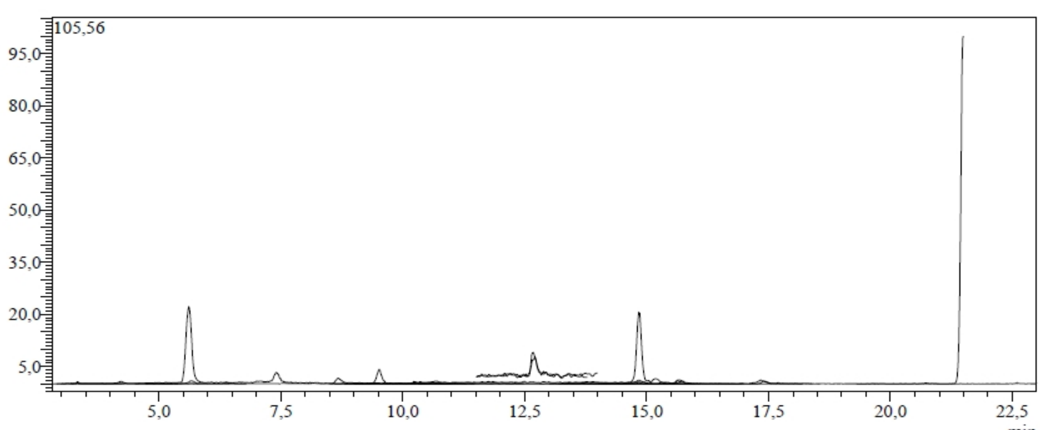


Figure A64. LC-MS/MS chromatogram of acetonitrile root extract of *Prunus microcarpa* C.A. Mey. (Red fruit). by maceration method

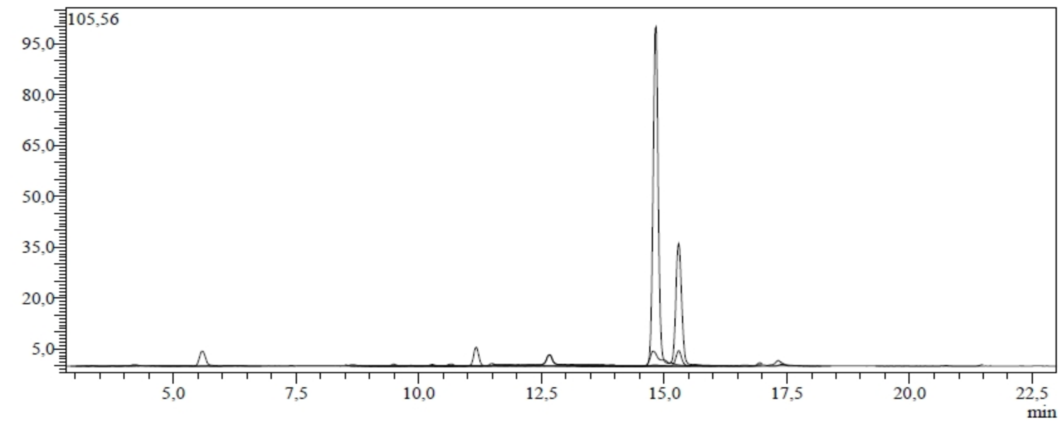


Figure A65. LC-MS/MS chromatogram of acetonitrile root extract of *Rubus sanctus* Schreb. by maceration method.

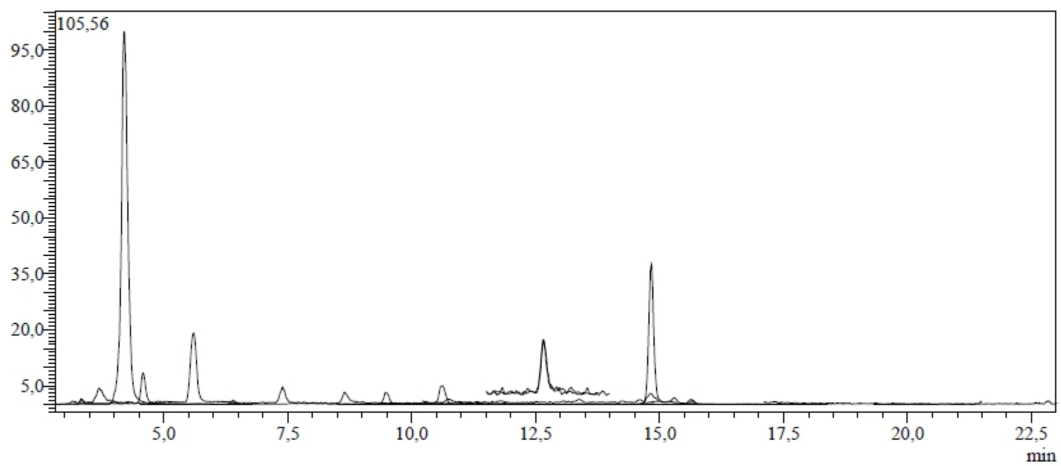


Figure A66. LC-MS/MS chromatogram of acetonitrile root extract of *Ficus carica* L. by maceration method.

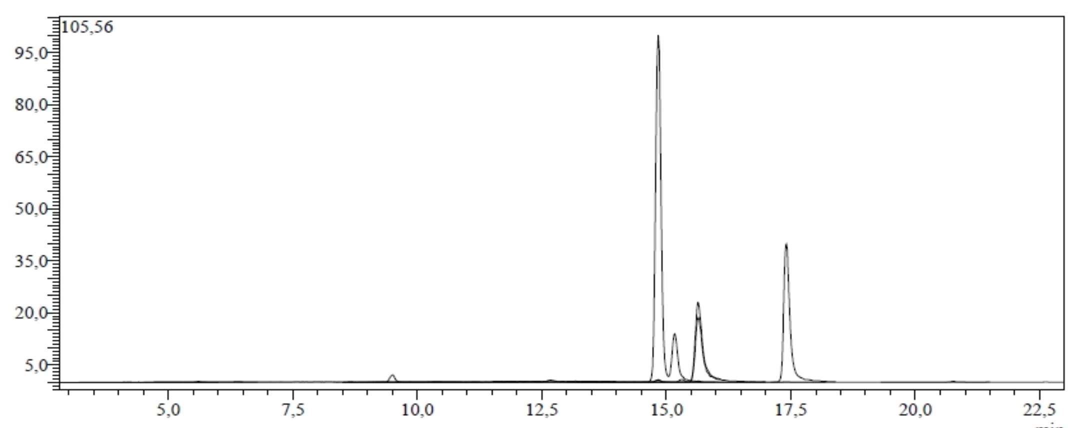


Figure A67. LC-MS/MS chromatogram of distilled water root extract of *Acer monspessulanum* L. by microwave assisted method.

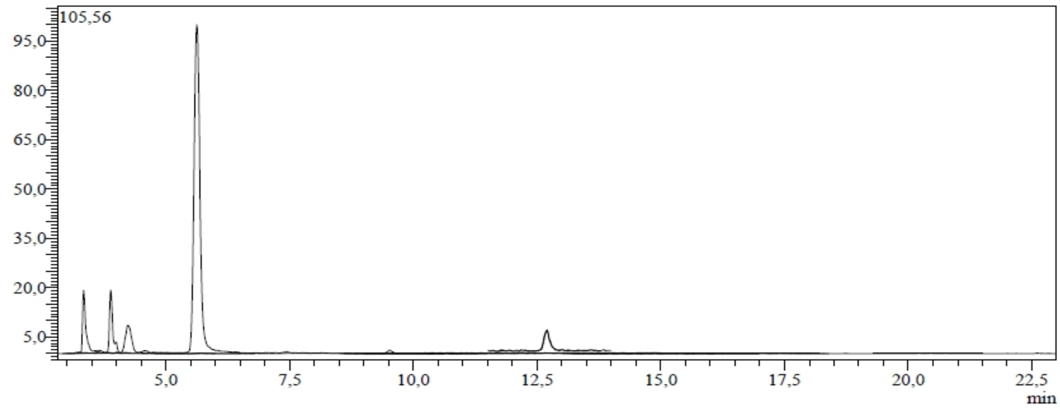


Figure A68. LC-MS/MS chromatogram of distilled water root extract of *Prunus microcarpa* C.A. Mey. (Yellow fruit) by microwave assisted method.

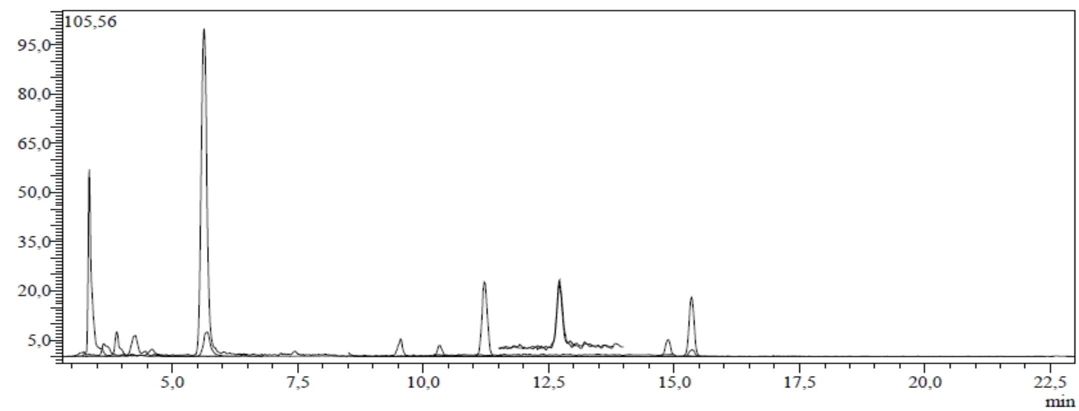


Figure A69. LC-MS/MS chromatogram of distilled water root extract of *Pyrus syriaca* Boiss. by microwave assisted method.

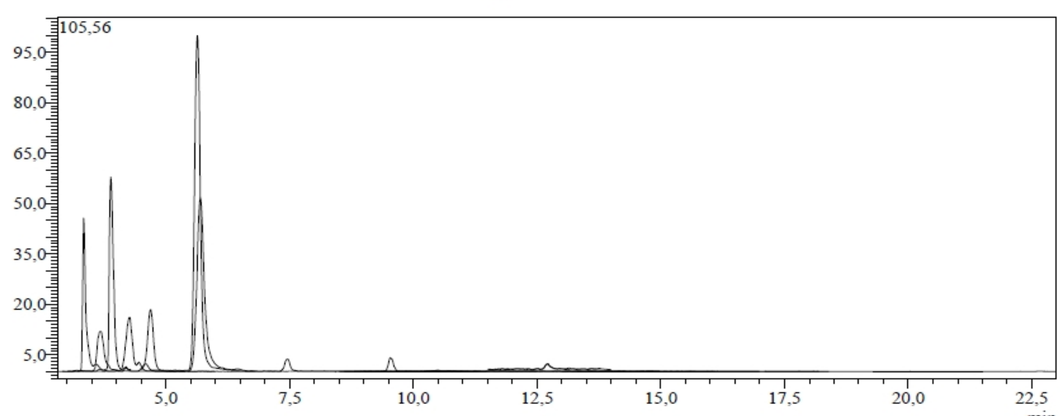


Figure A70. LC-MS/MS chromatogram of distilled water root extract of *Quercus infectoria* Oliv. by microwave assisted method.

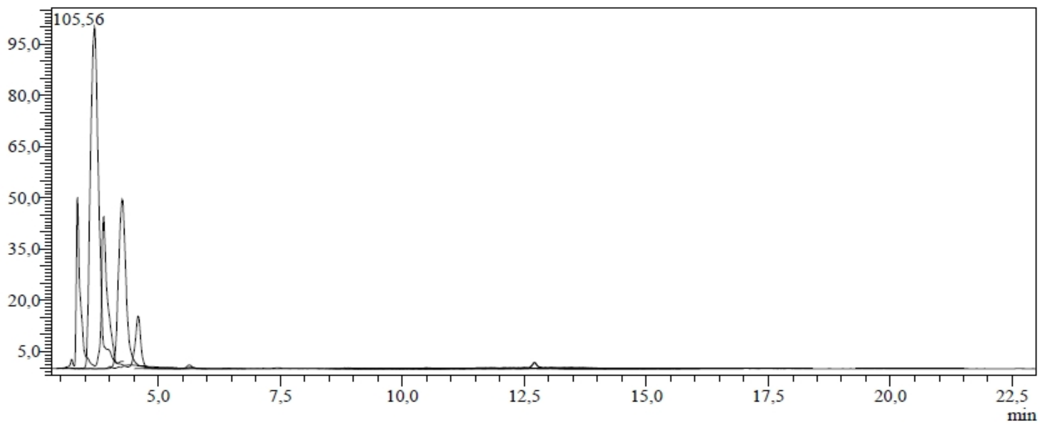


Figure A71. LC-MS/MS chromatogram of distilled water root extract of *Quercus aegilops* L. by microwave assisted method.

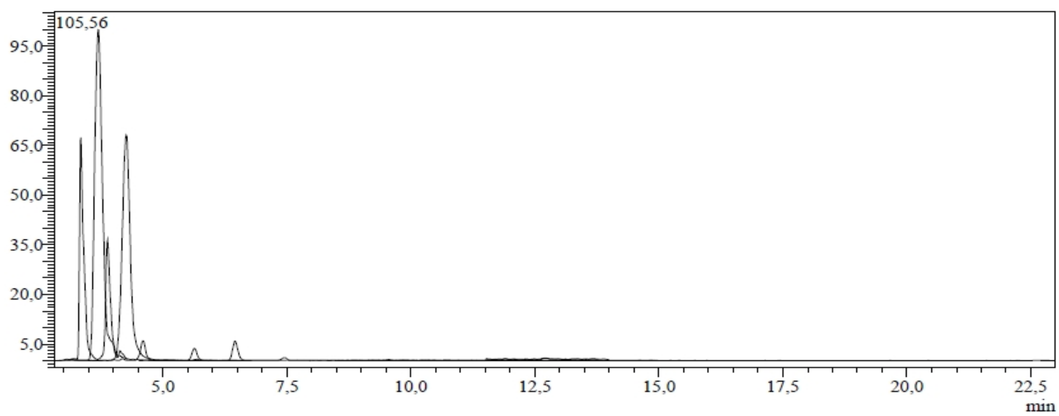


Figure A72. LC-MS/MS chromatogram of distilled water root extract of *Crataegus monogyna* Jacquin. by microwave assisted method.

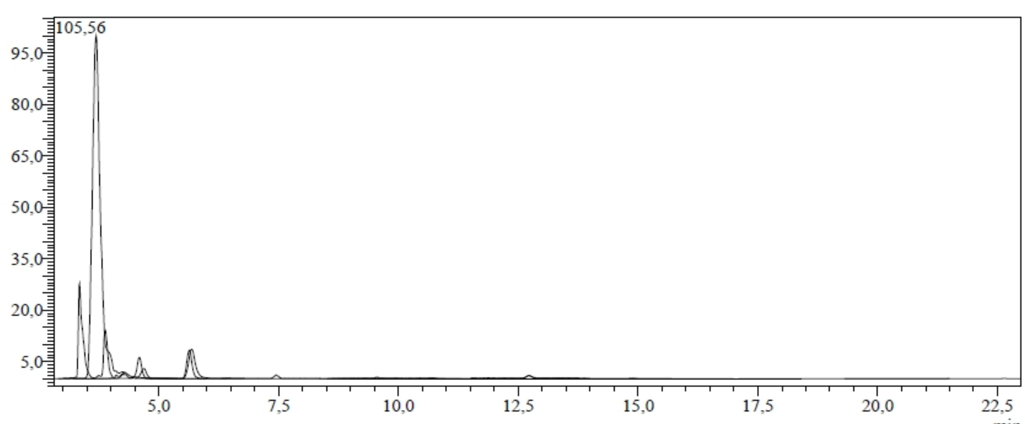


Figure A73. LC-MS/MS chromatogram of distilled water root extract of *Prunus argentea* (Lam.) Rehder. by microwave assisted method.

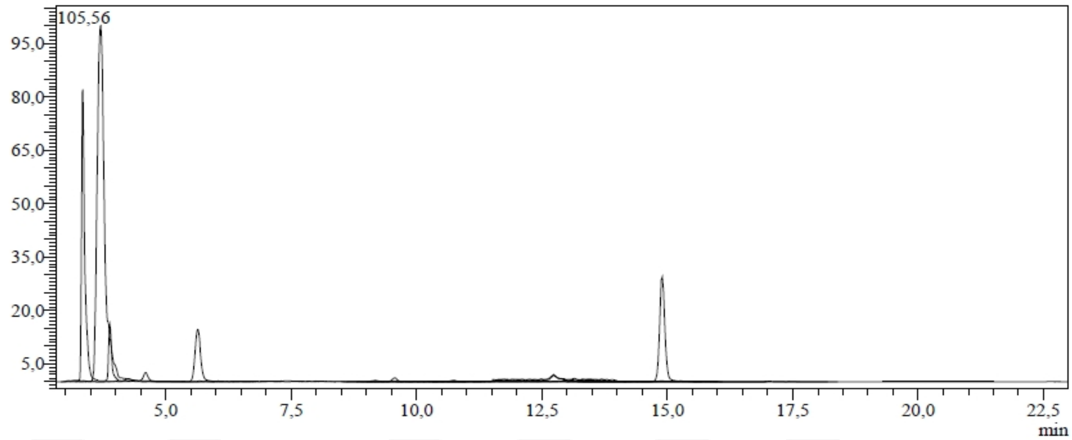


Figure A74. LC-MS/MS chromatogram of distilled water root extract of *Crataegus azarolus* var. aronia L. by microwave assisted method.

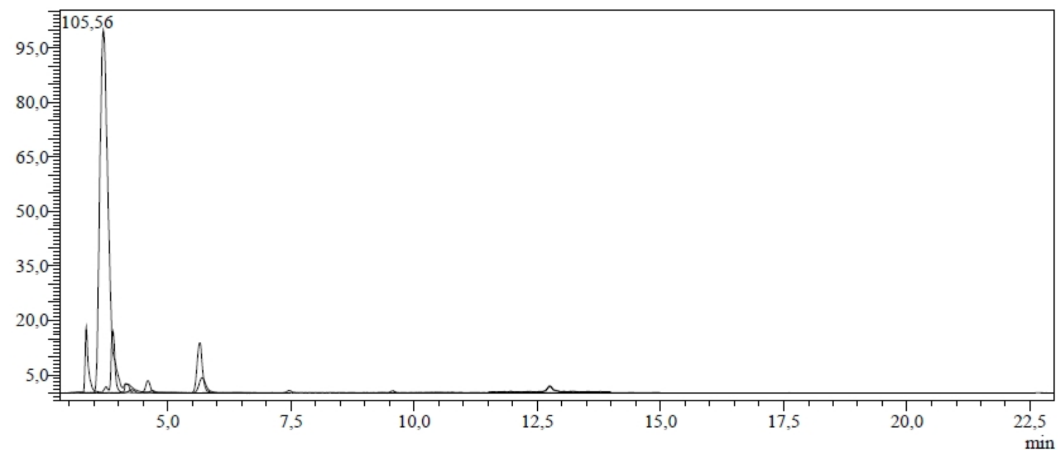


Figure A75. LC-MS/MS chromatogram of distilled water root extract of *Prunus microcarpa* C.A. Mey. (Red fruit). by microwave assisted method.

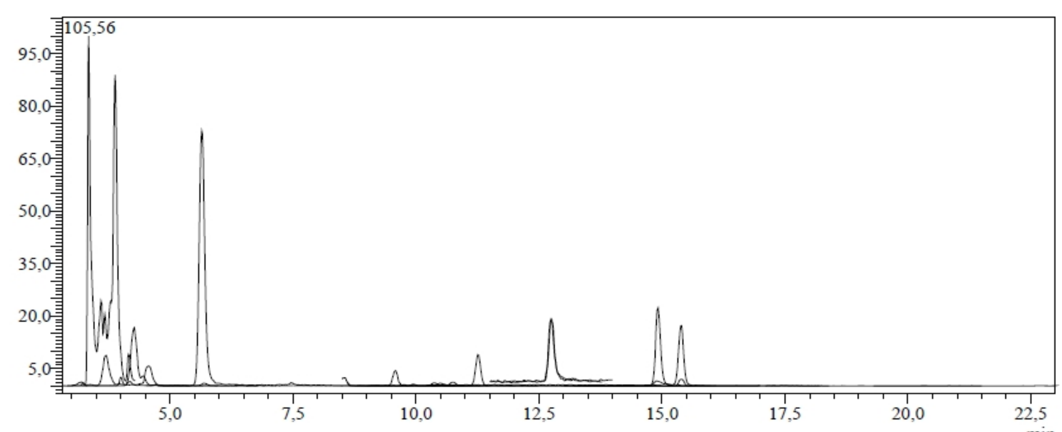


Figure A76. LC-MS/MS chromatogram of distilled water root extract of *Rubus sanctus* Schreb. by microwave assisted method.

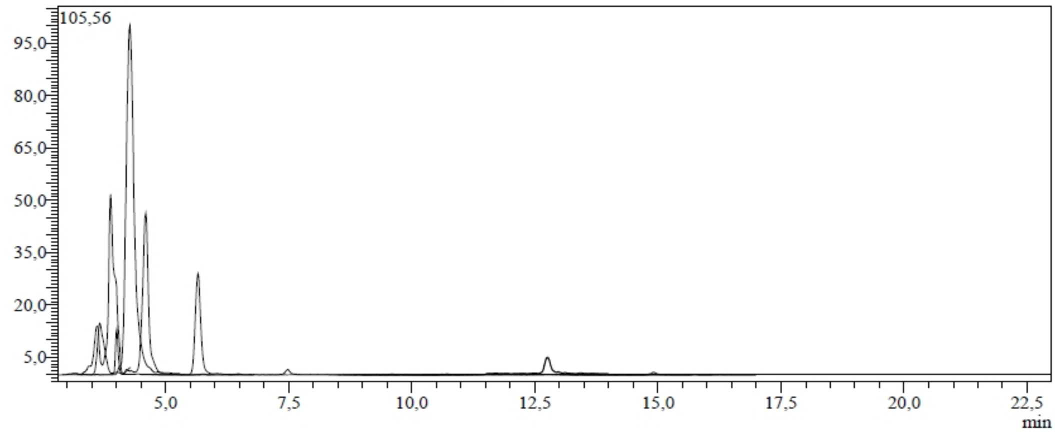


Figure A77. LC-MS/MS chromatogram of distilled water root extract of *Ficus carica* L. by microwave assisted method.

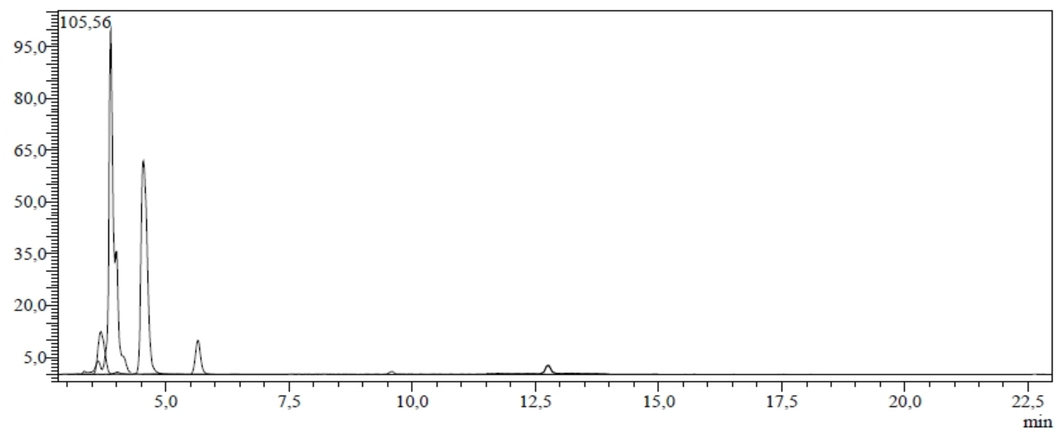


Figure A78. LC-MS/MS chromatogram of distilled water root extract of *Acer monspessulanum* L. by conventional method.

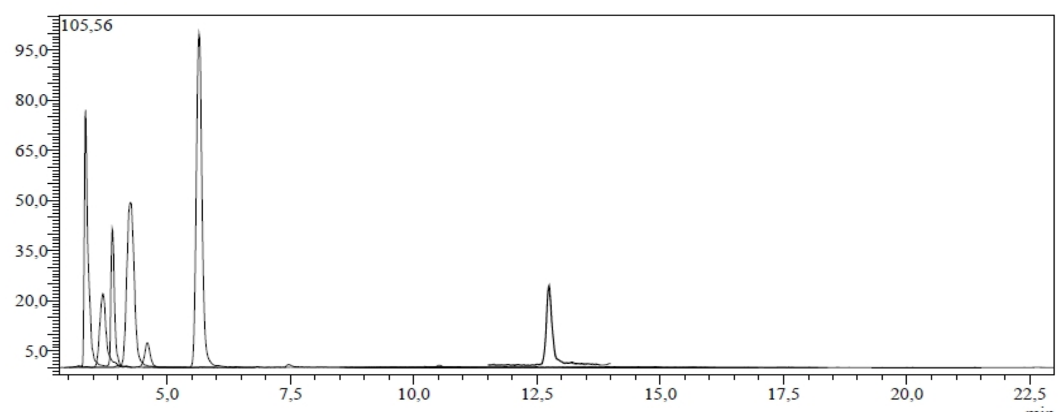


Figure A79. LC-MS/MS chromatogram of distilled water root extract of *Prunus microcarpa* C.A. Mey. (Yellow fruit) by conventional method.

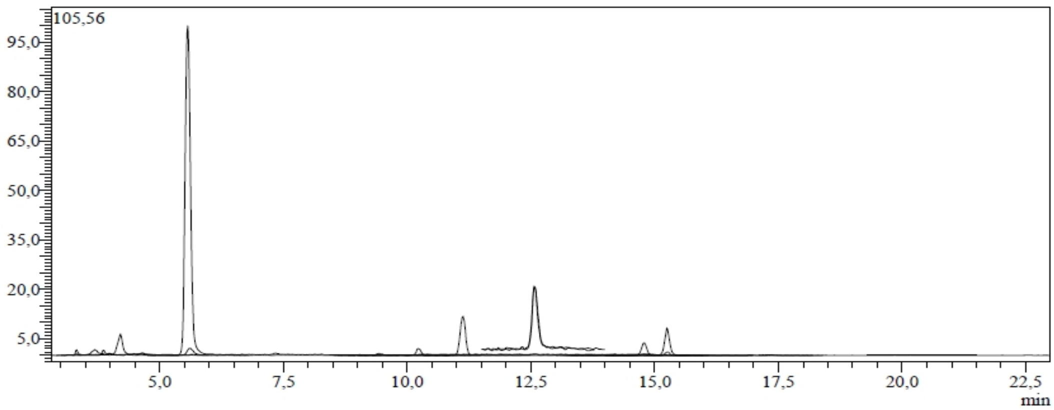


Figure A80. LC-MS/MS chromatogram of distilled water root extract of *Pyrus syriaca* Boiss. by conventional method.

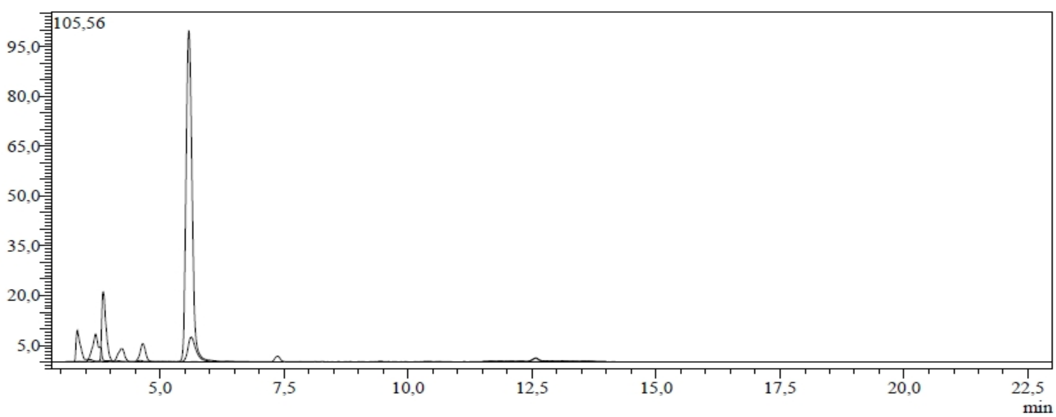


Figure A81. LC-MS/MS chromatogram of distilled water root extract of *Quercus infectoria* Oliv. by conventional method.

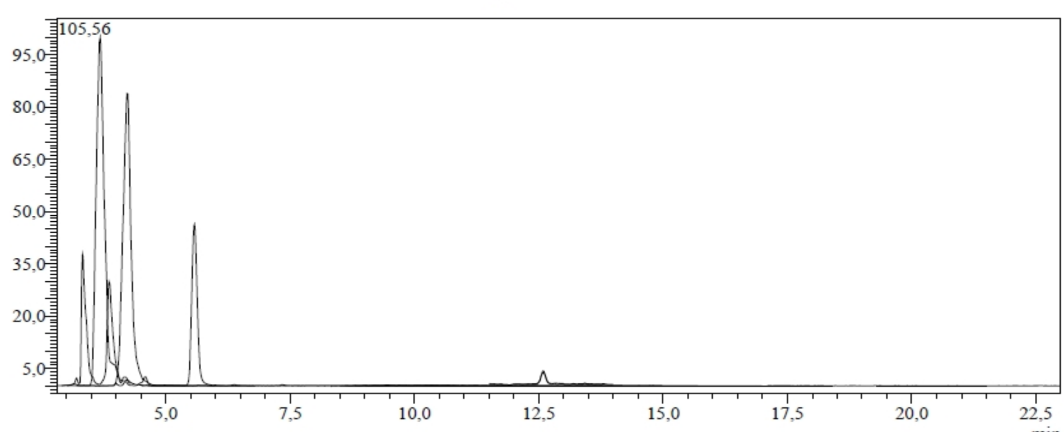


Figure A82. LC-MS/MS chromatogram of distilled water root extract of *Quercus aegilops* L. by conventional method.

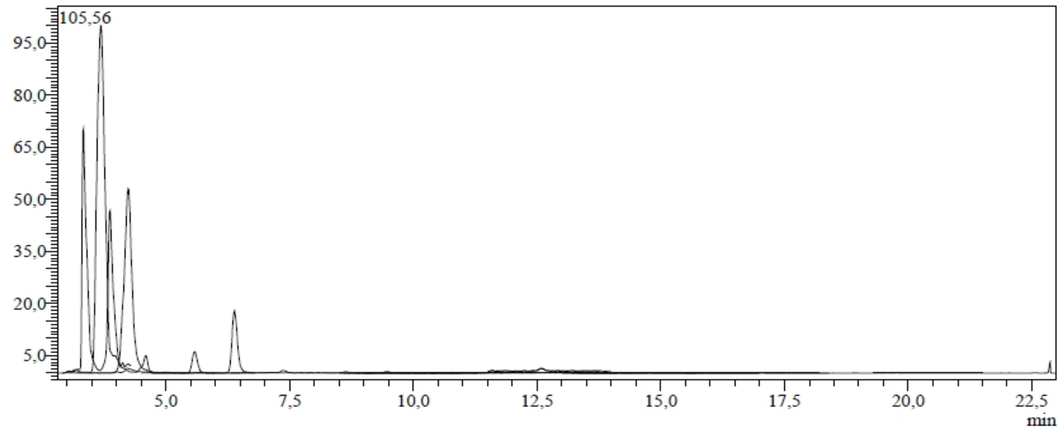


Figure A83. LC-MS/MS chromatogram of distilled water root extract of *Crataegus monogyna* Jacquin. by conventional method.

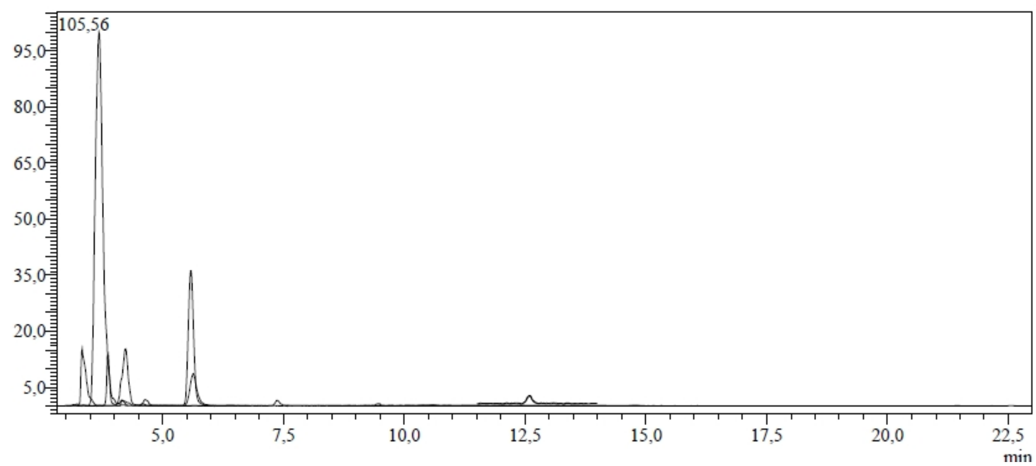


Figure A84. LC-MS/MS chromatogram of distilled water root extract of *Prunus argentea* (Lam.) Rehder. by conventional method.

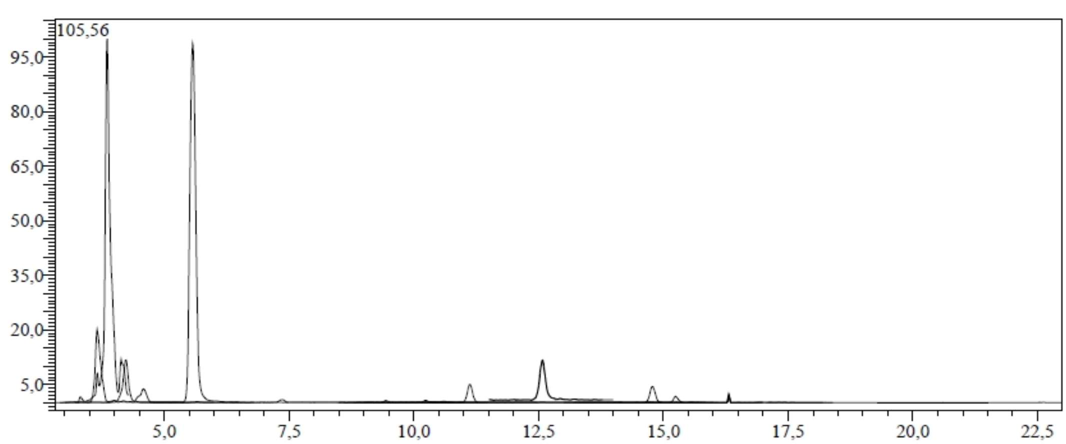


Figure A85. LC-MS/MS chromatogram of distilled water root extract of *Crataegus azarolus* var. aronia L. by conventional method.

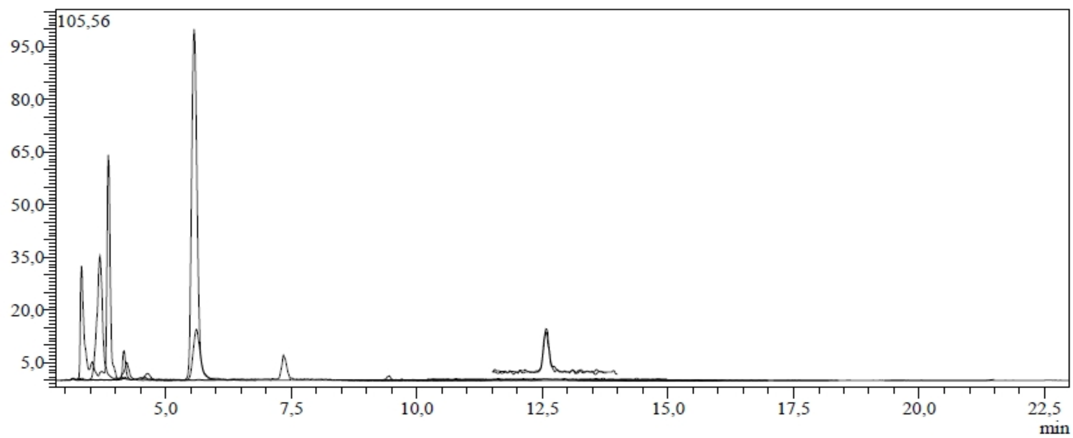


Figure A86. LC-MS/MS chromatogram of distilled water root extract of *Prunus microcarpa* C.A. Mey. (Red fruit). by conventional method.

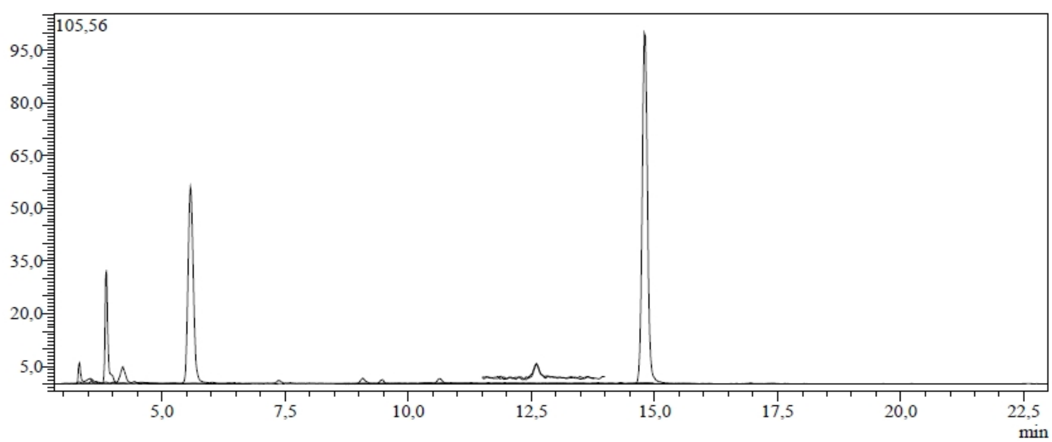
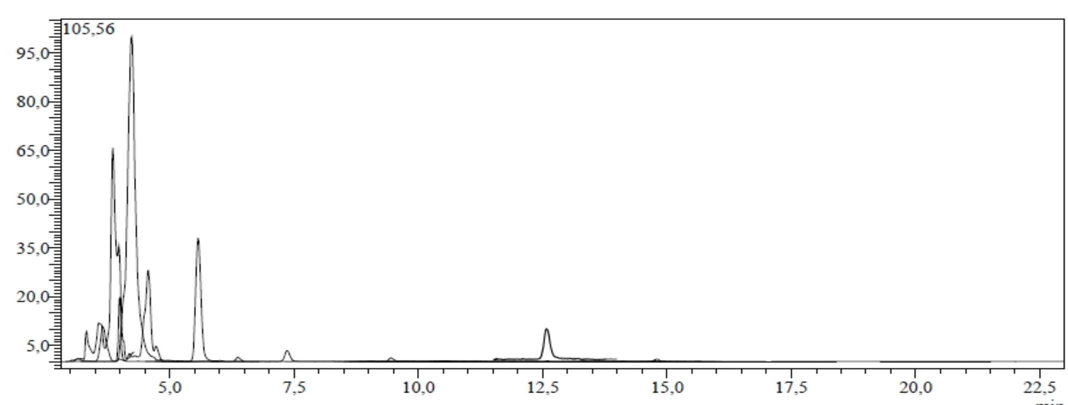


Figure A87. LC-MS/MS chromatogram of distilled water root extract of *Rubus sanctus* Schreb. by conventional method.



A88. LC-MS/MS chromatogram of distilled water root extract of *Ficus carica* L. by conventional method.

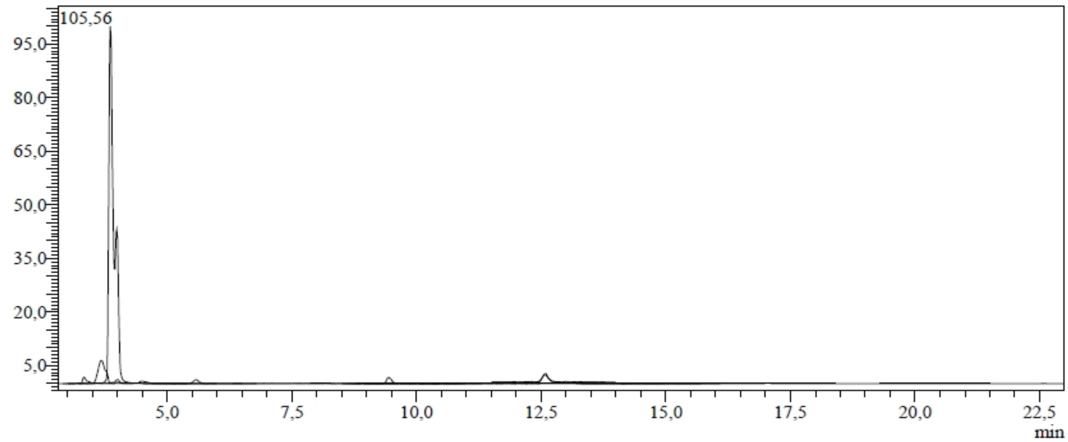


Figure A89. LC-MS/MS chromatogram of distilled water root extract of *Acer monspessulanum* L. by maceration method.

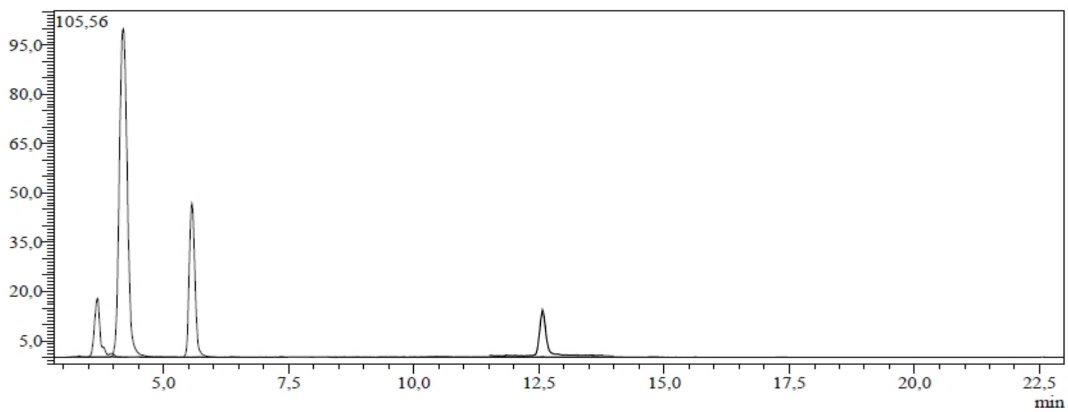


Figure A90. LC-MS/MS chromatogram of distilled water root extract of *Prunus microcarpa* C.A. Mey. (Yellow fruit) by maceration method

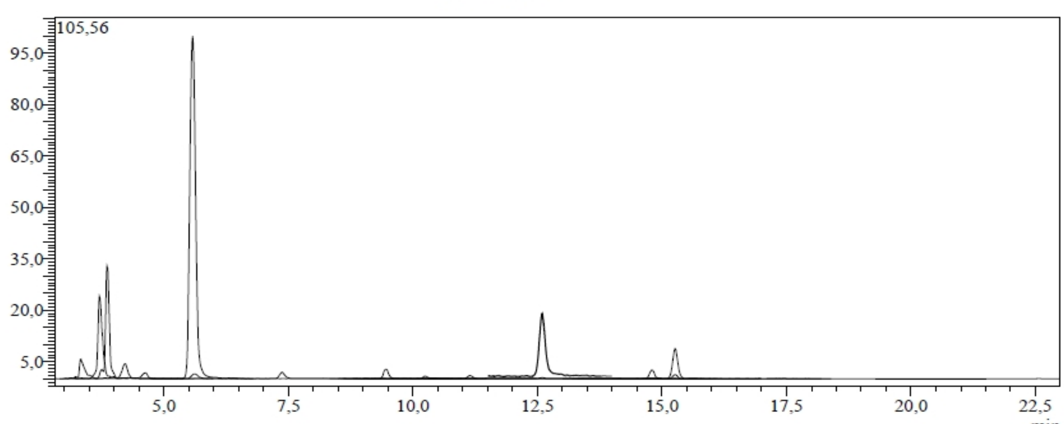


Figure A91. LC-MS/MS chromatogram of distilled water root extract of *Pyrus syriaca* Boiss. by maceration method.

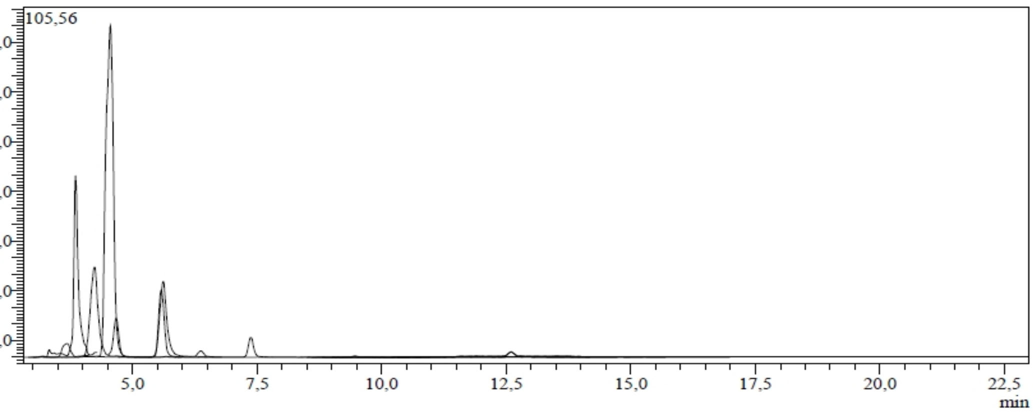


Figure A92. LC-MS/MS chromatogram of distilled water root extract of *Quercus infectoria* Oliv. by maceration method.

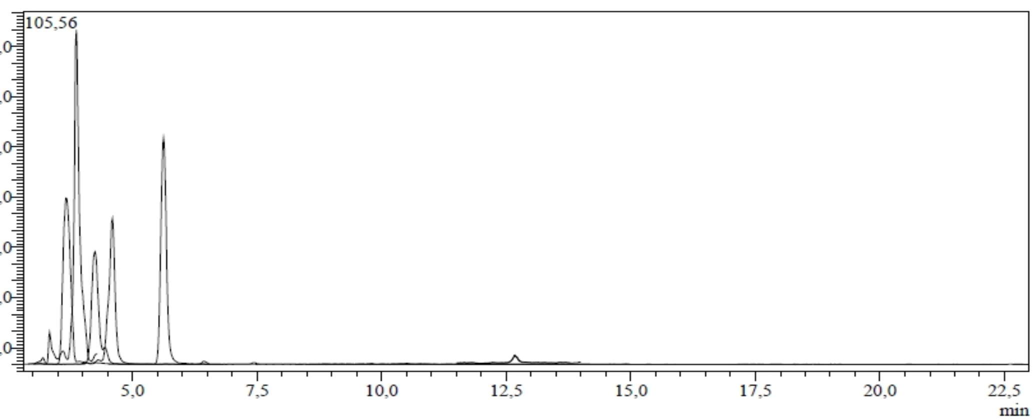


Figure A93. LC-MS/MS chromatogram of distilled water root extract of *Quercus aegilops* L. by maceration method.

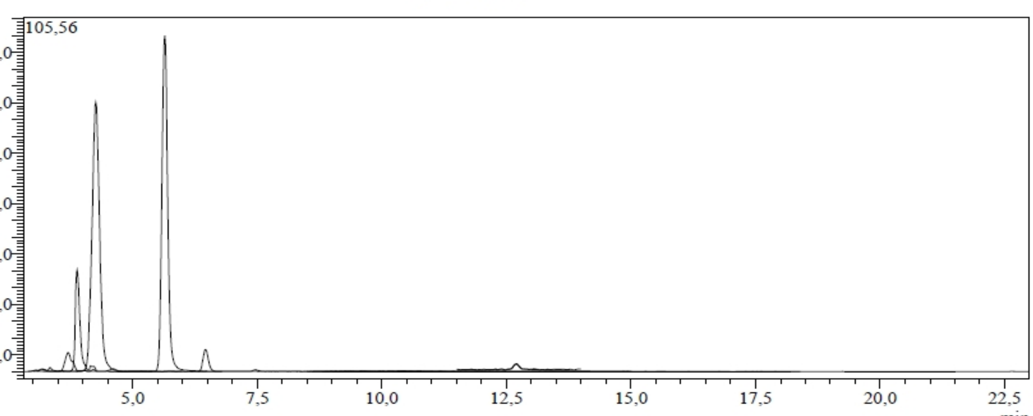


Figure A94. LC-MS/MS chromatogram of distilled water root extract of *Crataegus monogyna* Jacquin. by maceration method.

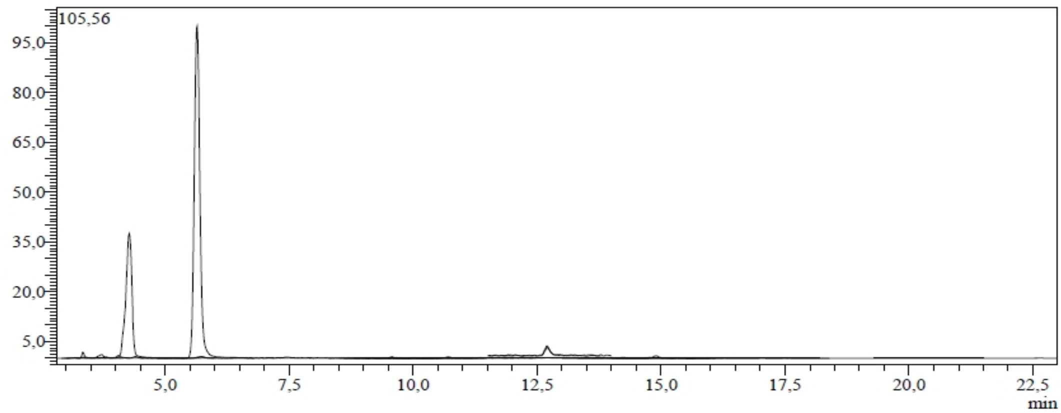


Figure A95. LC-MS/MS chromatogram of distilled water root extract of *Prunus argentea* (Lam.) Rehder. by maceration method.

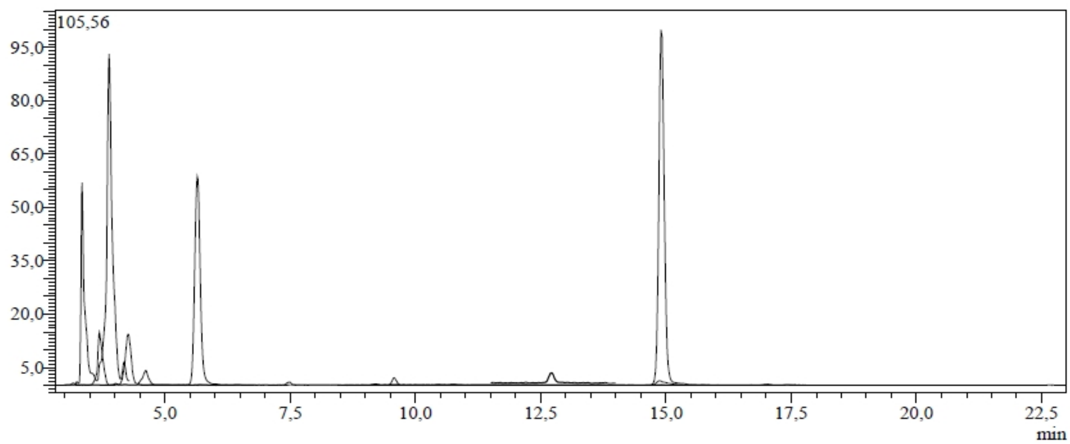


Figure A96. LC-MS/MS chromatogram of distilled water root extract of *Crataegus azarolus* var. aronia L. by maceration method.

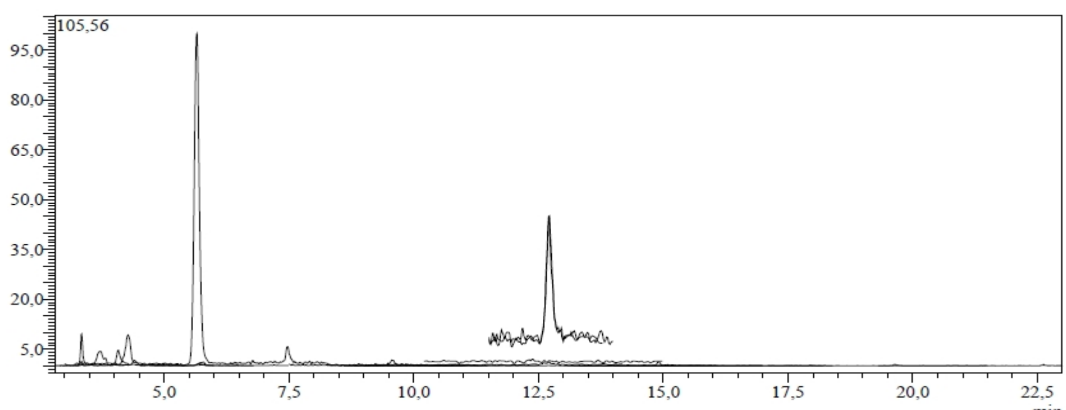


Figure A97. LC-MS/MS chromatogram of distilled water root extract of *Prunus microcarpa* C.A. Mey. (Red fruit). by maceration method.

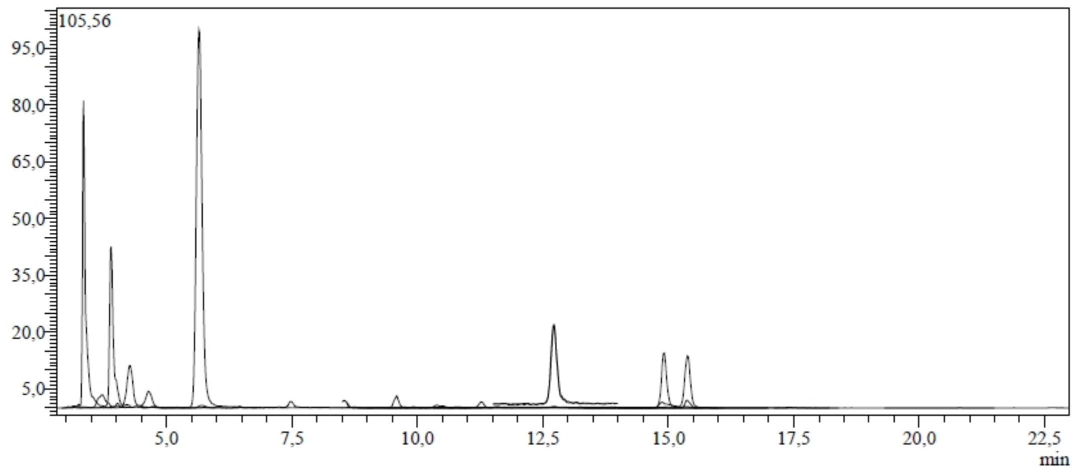


Figure A98. LC-MS/MS chromatogram of distilled water root extract of *Rubus sanctus* Schreb. by maceration method

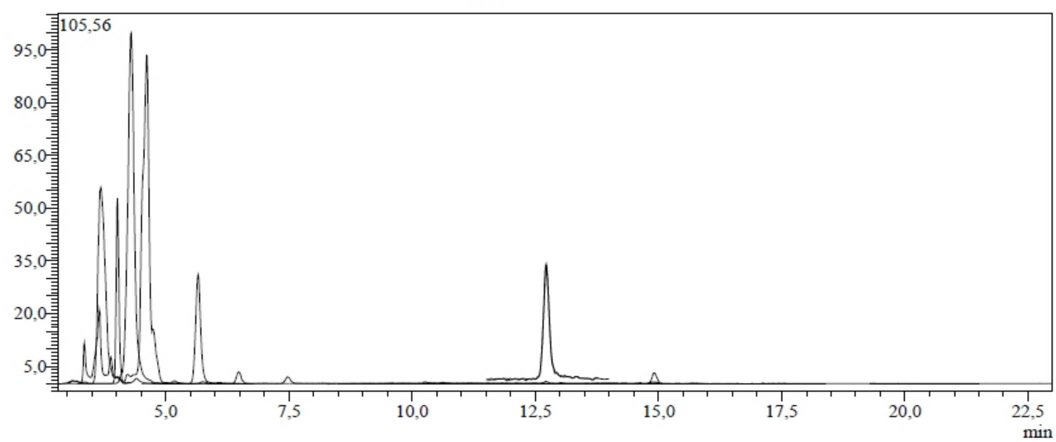


Figure A99. LC-MS/MS chromatogram of distilled water root extract of *Ficus carica* L. by maceration method

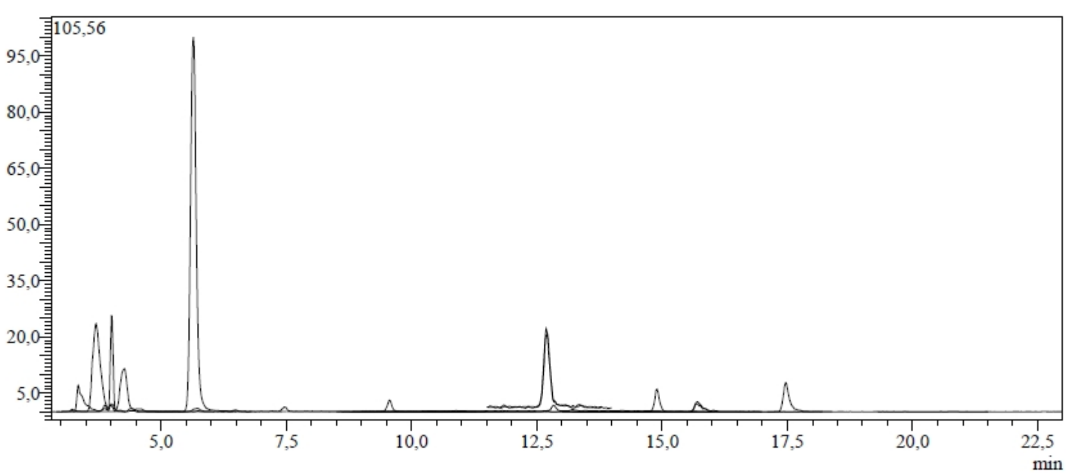
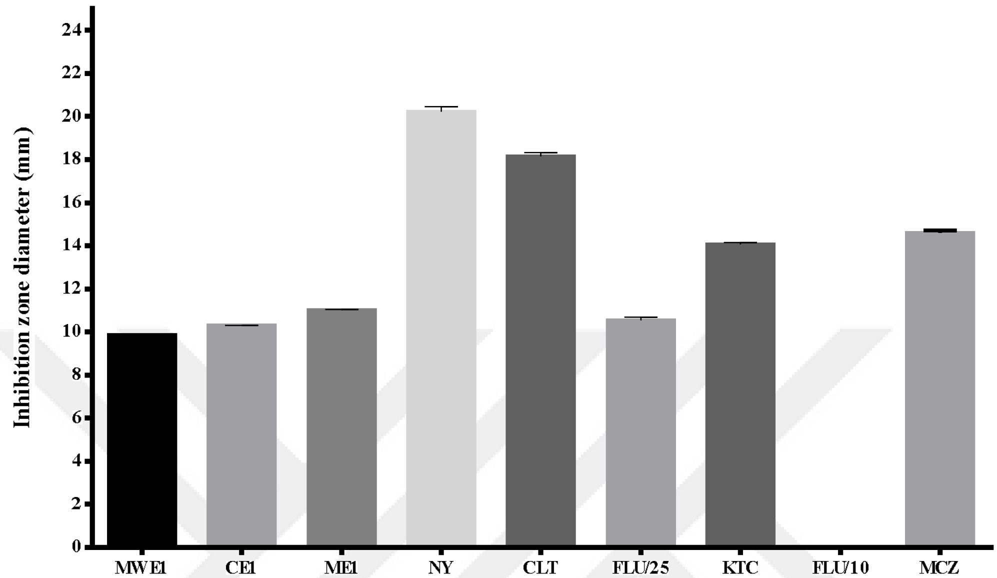


Figure A 100. Antifungal activity of *Acer monspessulanum* L. ethanolic extracts and antifungal discs against *C. albicans.*

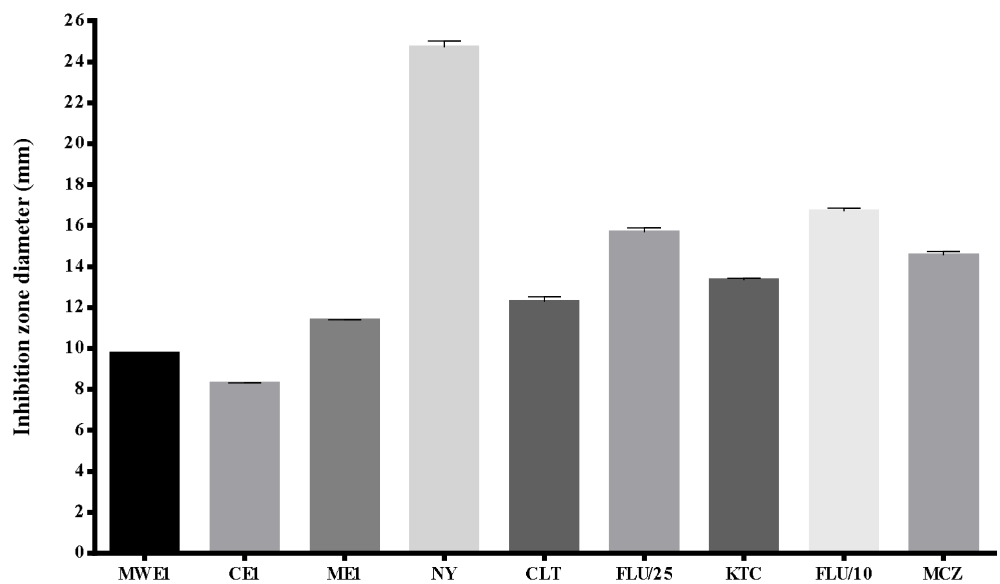
1- *Candida albican*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida albicans*

Figure A 101. Antifungal activity of *Acer monspessulanum* L. ethanolic extracts and antifungal discs against *C. glabatra.*

2- *Candida glabatra*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida glabatra*

Figure A 102. Antifungal activity of *Acer monspessulanum* L. ethanolic extracts and antifungal discs against *C. krusei*

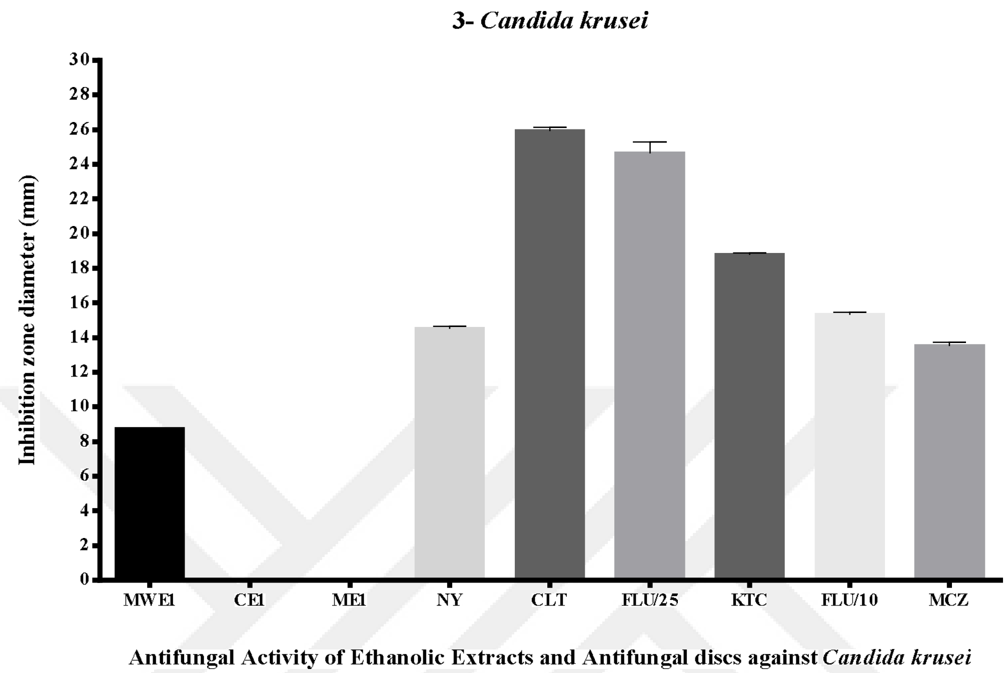


Figure A 103. Antifungal activity of Acer *monspessulanum* L. ethanolic extracts and antifungal discs against *C. tropicalis.*

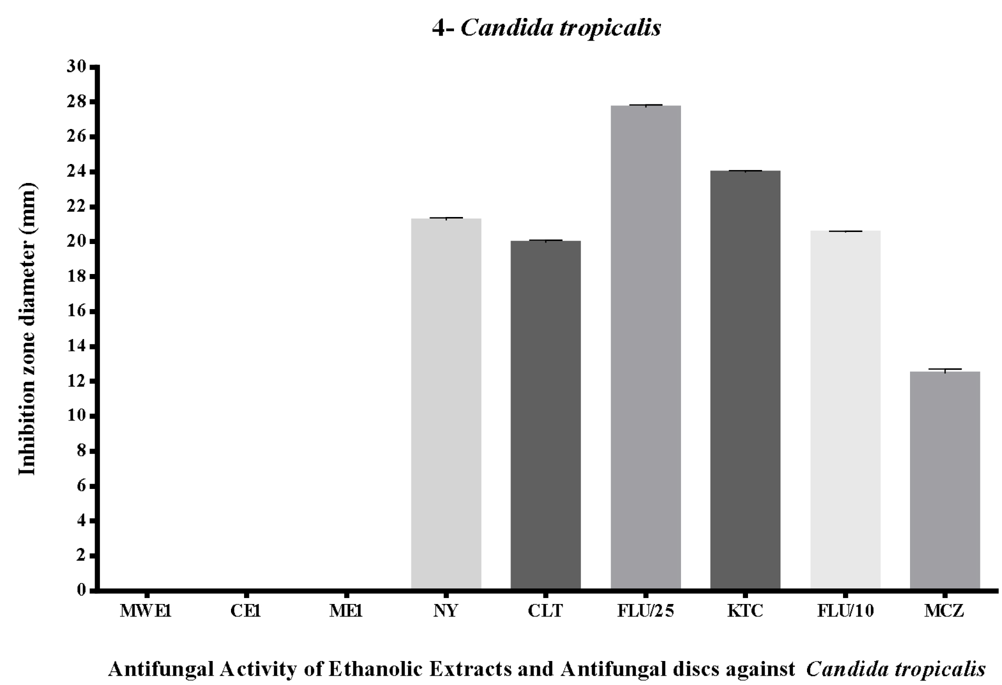


Figure A 104. Antifungal activity of *Acer monspessulanum* L. ethanolic extracts and antifungal discs against *C. famata.*

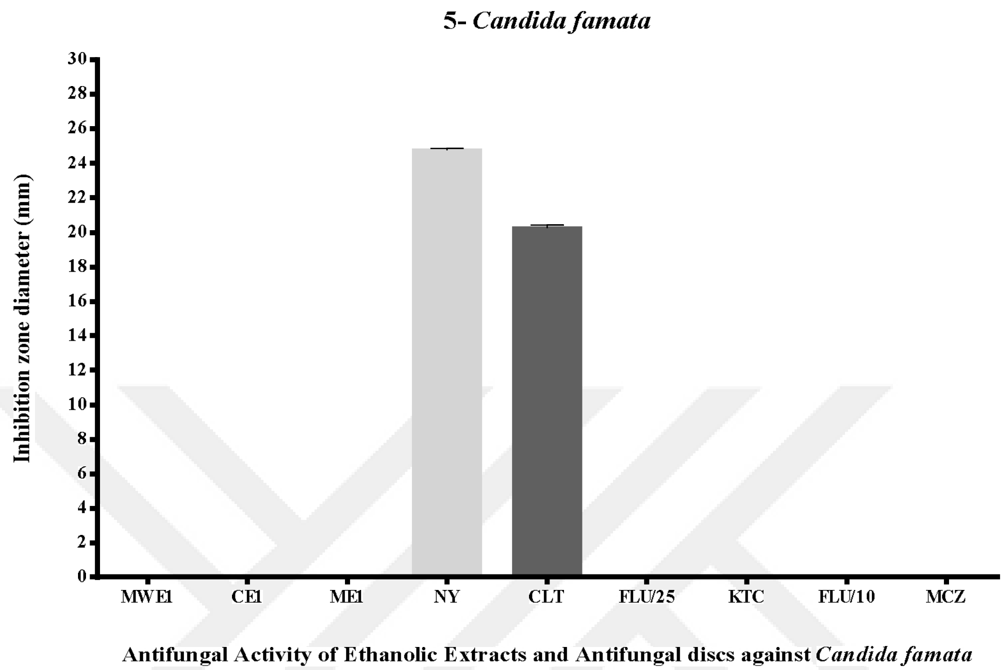


Figure A 105. Antifungal activity of *Acer monspessulanum* L. ethanolic extracts and antifungal discs against *C. parapsilosis.*

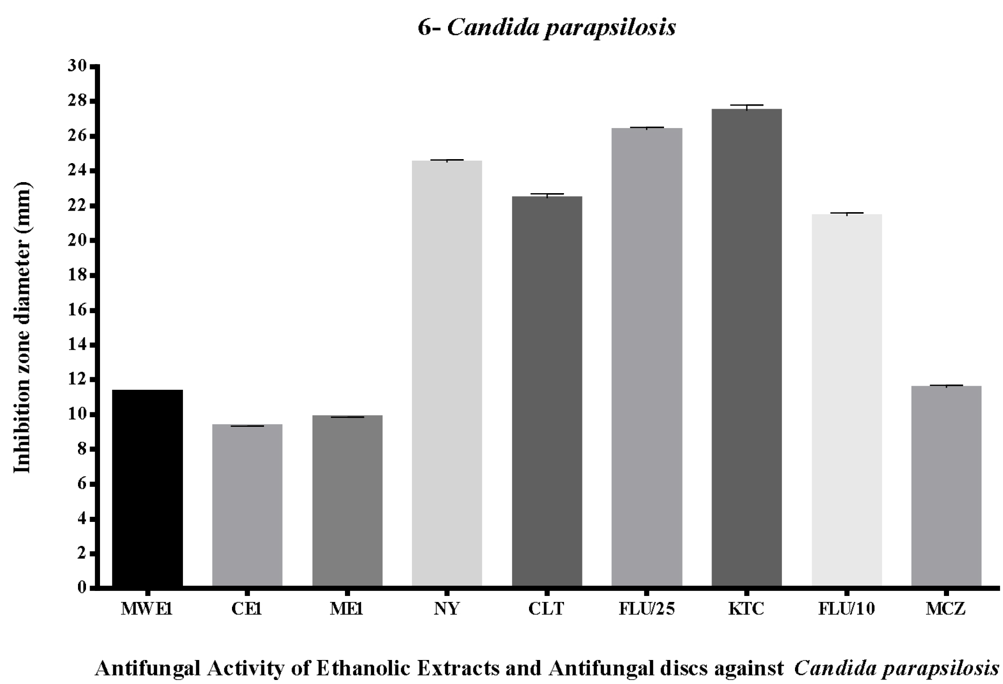


Figure A 106. Antifungal activity of *Acer monspessulanum* L. ethanolic extracts and antifungal discs against *C. guilliermondii.*

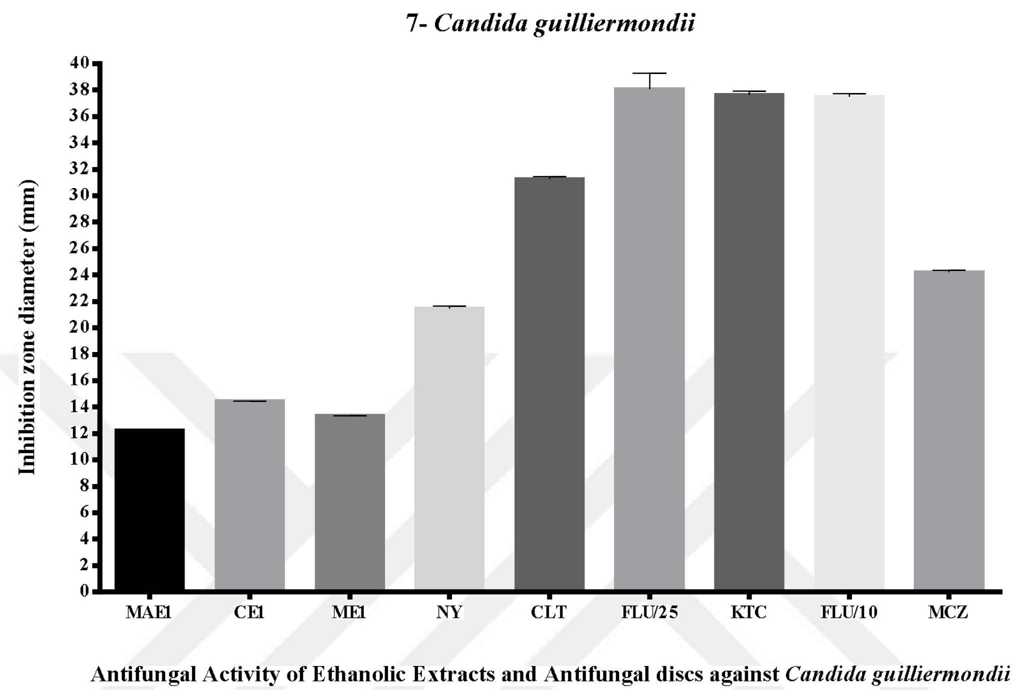


Figure A 107. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) ethanolic extracts and antifungal discs against *C. albicans*

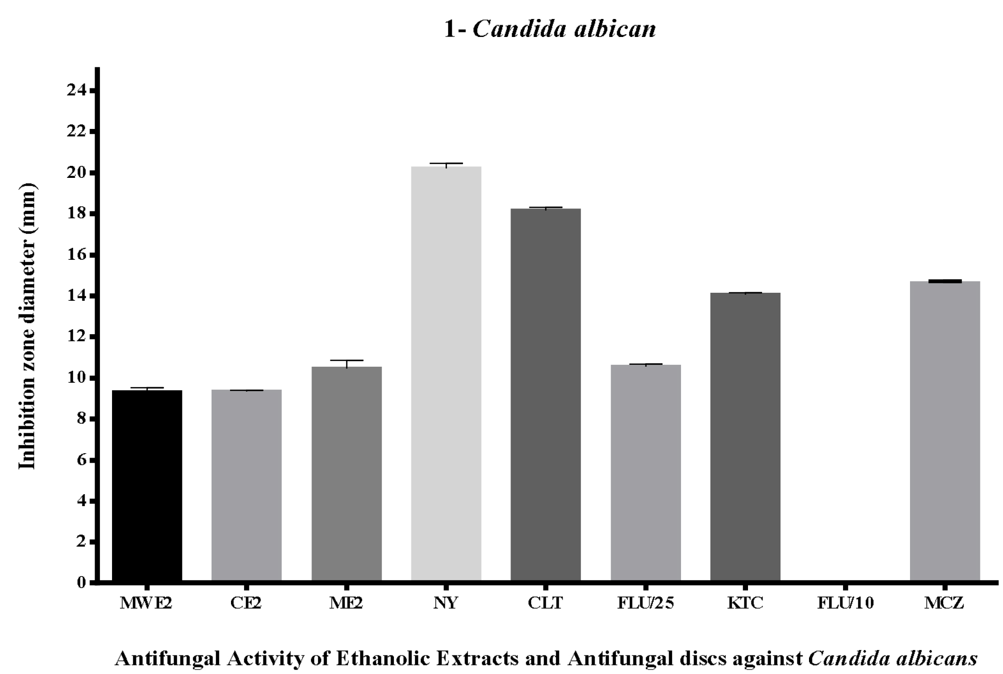
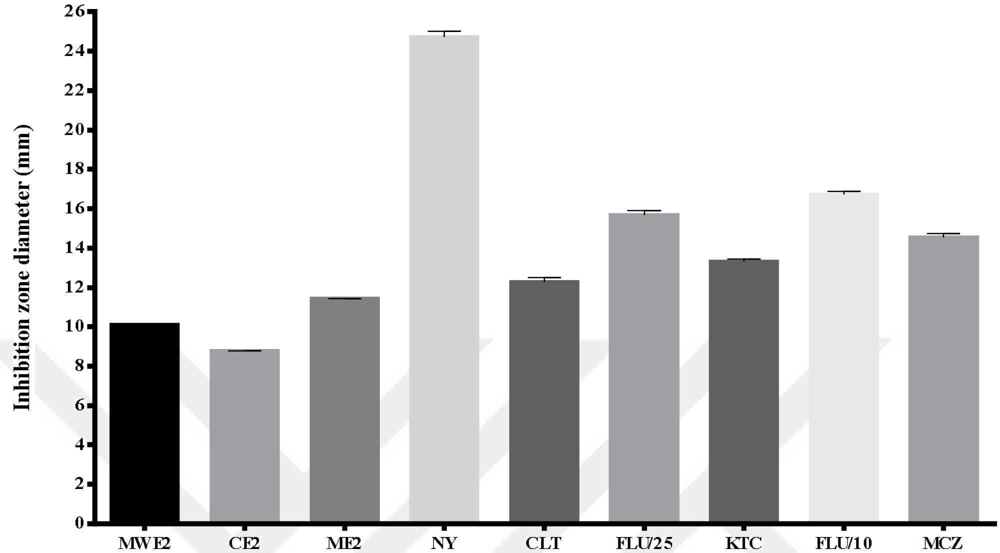


Figure A 108. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) ethanolic extracts and antifungal discs against *C. glabatra*.

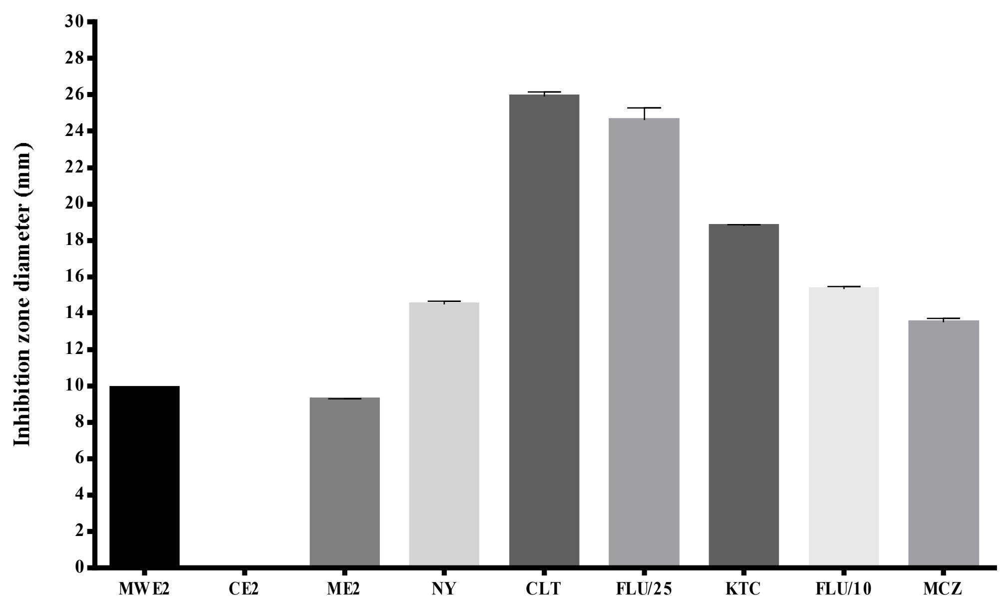
2- *Candida glabatra*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida glabatra*

Figure A 109. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) ethanolic extracts and antifungal discs against *C. krusei*.

3- *Candida krusei*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida krusei*

Figure A 110. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) ethanolic extracts and antifungal discs against *C. tropicalis.*

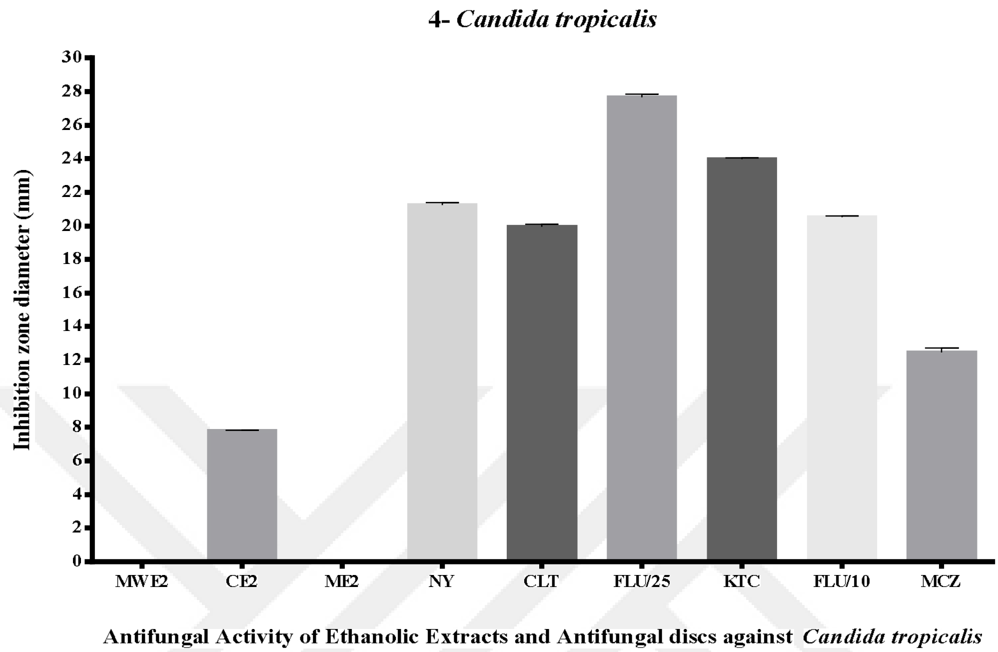


Figure A 111. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) ethanolic extracts and antifungal discs against *C. famata.*

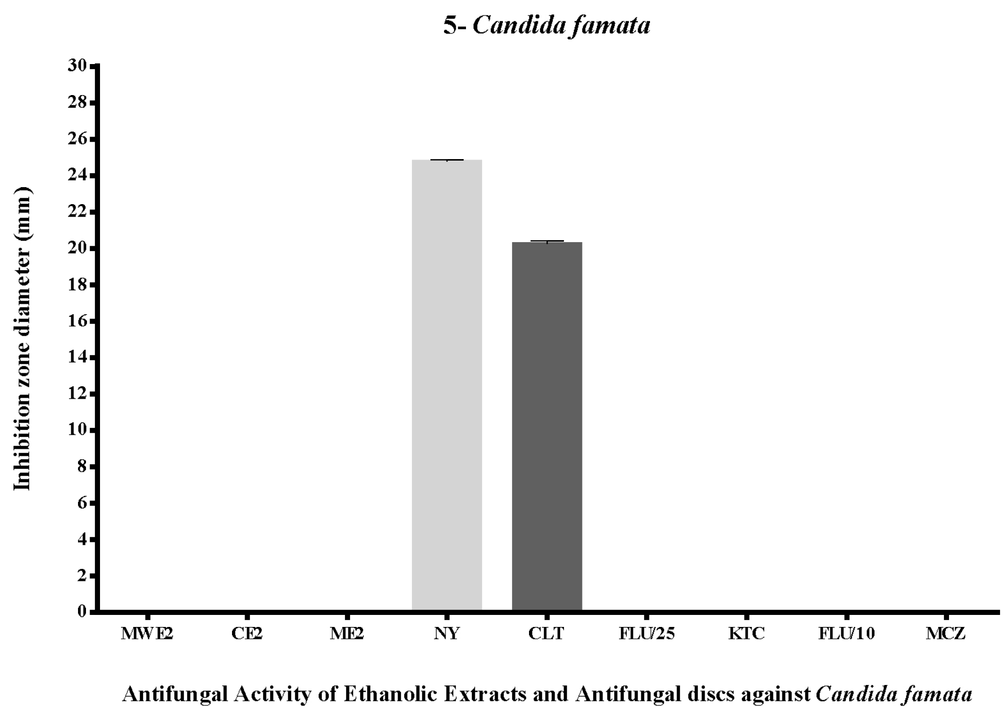


Figure A 112. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) ethanolic extracts and antifungal discs against *C. parapsilosis.*

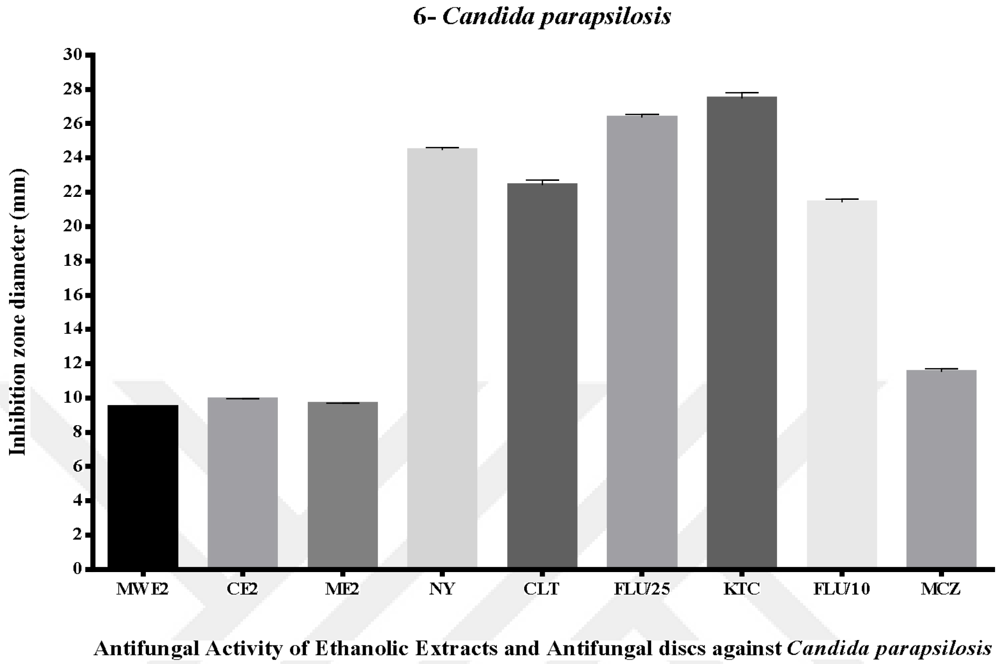


Figure A 113. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) ethanolic extracts and antifungal discs against *C. guilliermondii.*

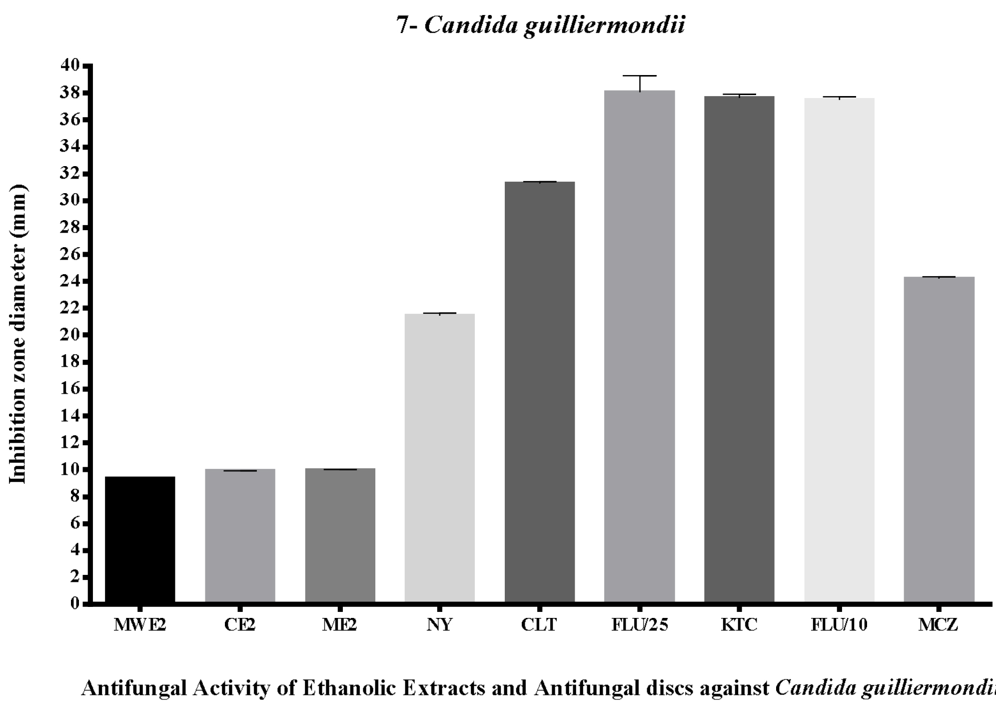


Figure A 114. Antifungal activity of *Pyrus syriaca* Boiss. ethanolic extracts and antifungal discs against *C. albicans*.

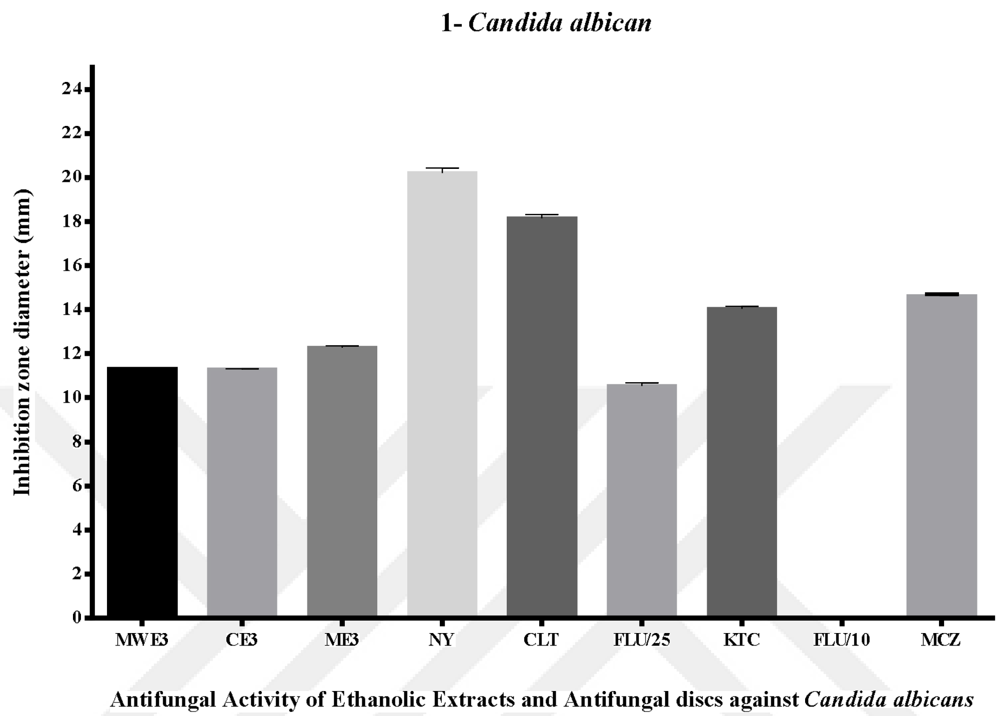


Figure A 115. Antifungal activity of *Pyrus syriaca* Boiss. ethanolic extracts and antifungal discs against *C. glabatra*.

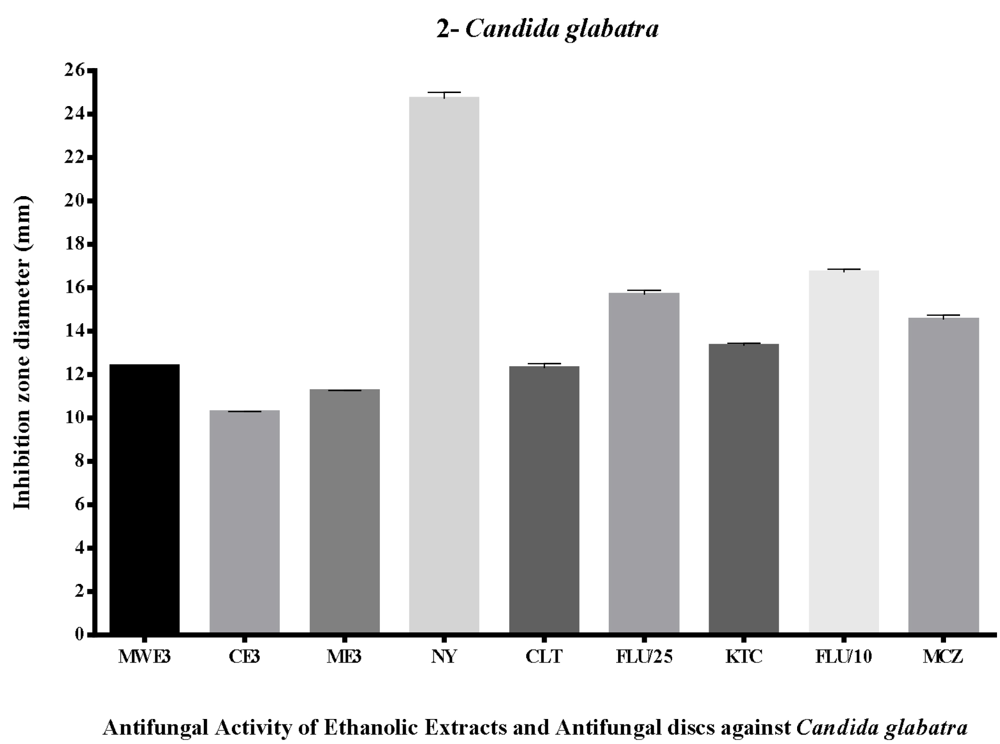


Figure A 116. Antifungal activity of *Pyrus syriaca* Boiss. ethanolic extracts and antifungal discs against *C. krusei.*

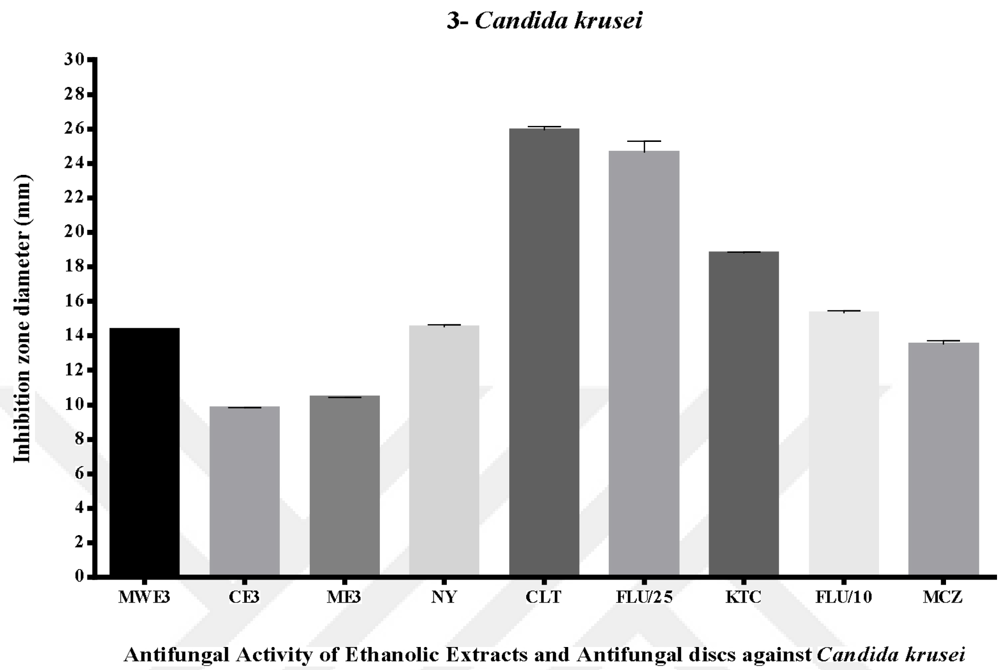


Figure A 117. Antifungal activity of *Pyrus syriaca* Boiss. ethanolic extracts and antifungal discs against *C. tropicalis.*

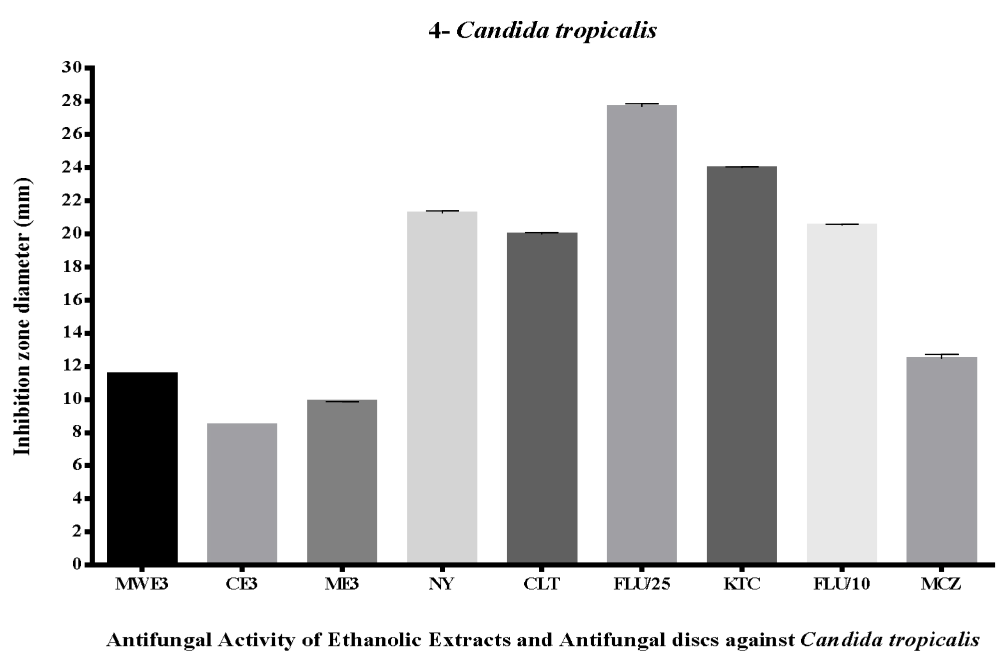
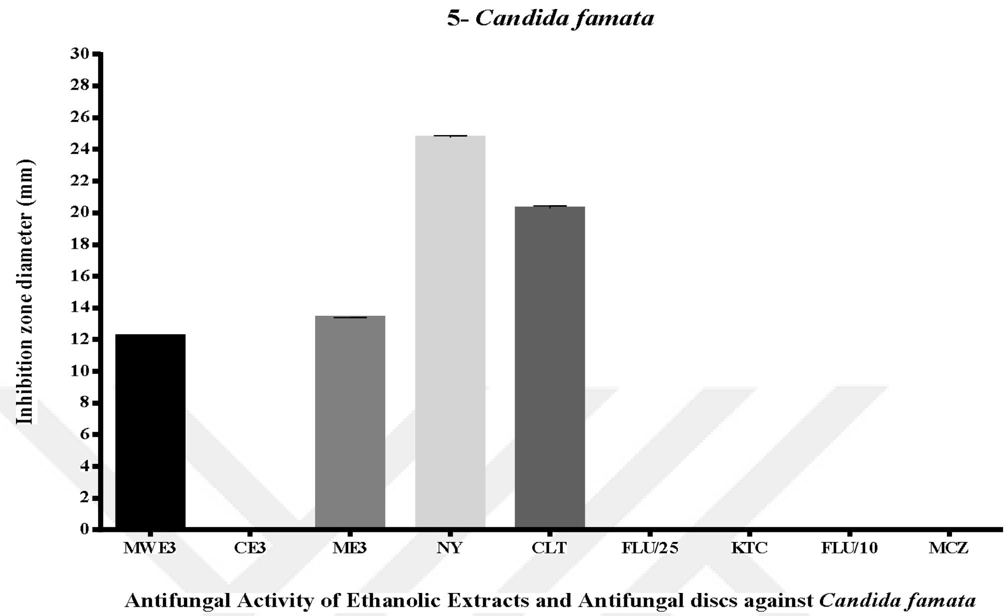


Figure A 118. Antifungal activity of *Pyrus syriaca* Boiss. ethanolic extracts and antifungal discs against *C. famata*



A Figure A 119. Antifungal activity of *Pyrus syriaca* Boiss. ethanolic extracts and antifungal discs against *C. parapsilosis.*

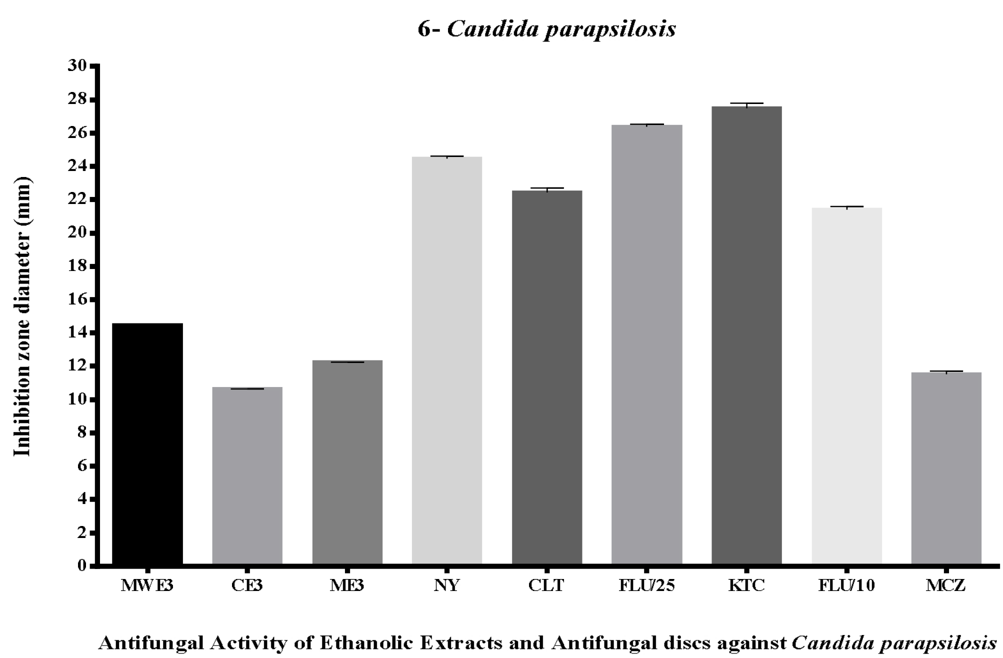
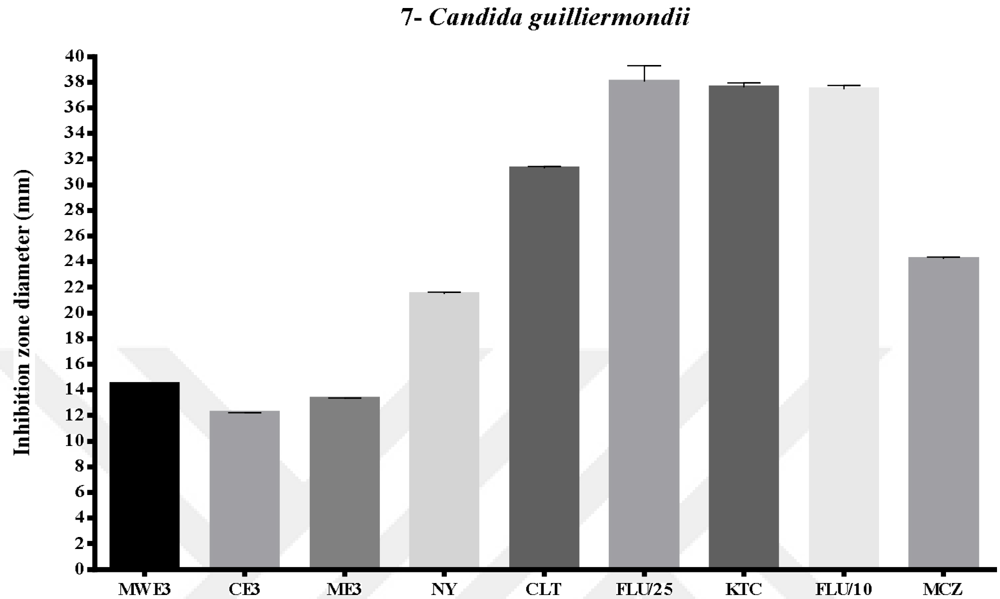
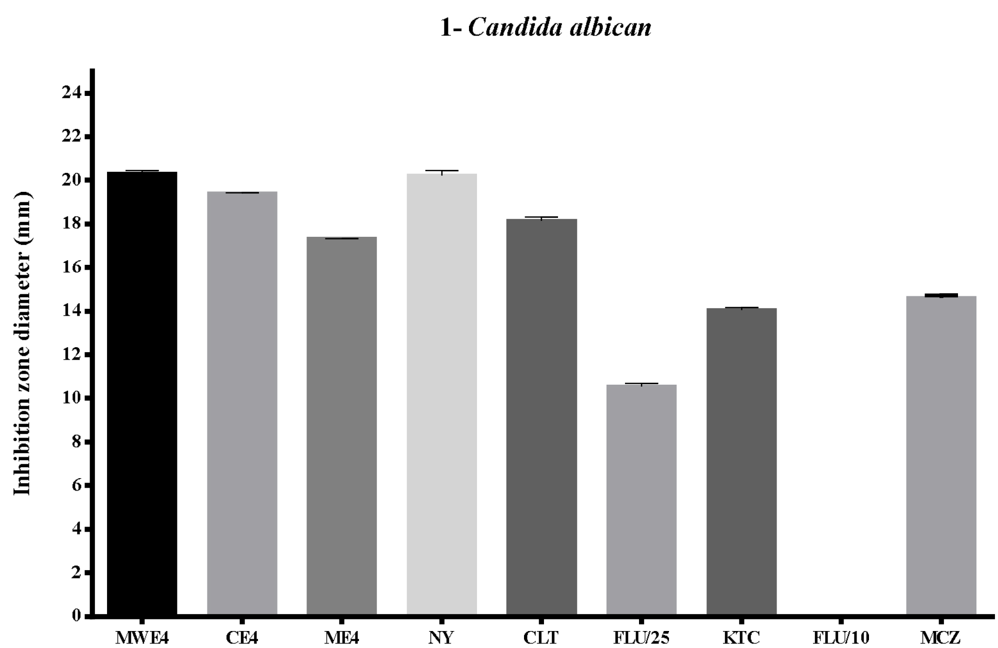


Figure A 120. Antifungal activity of *Pyrus syriaca* Boiss. ethanolic extracts and antifungal discs against *C. guilliermondii.*



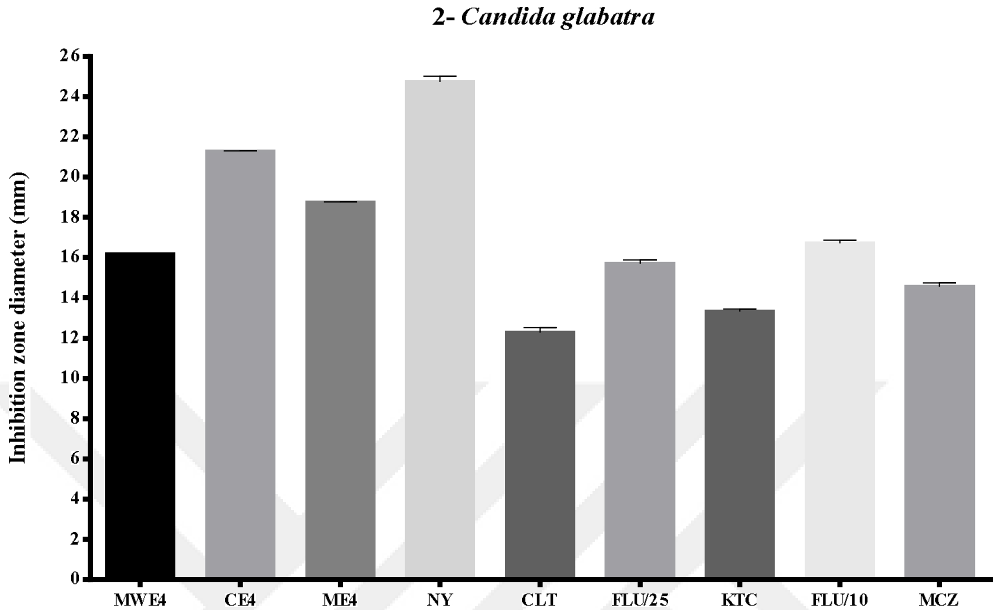
Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 121. Antifungal activity of *Quercus infectoria* Oliv. ethanolic extracts and antifungal discs against *C. albicans*.



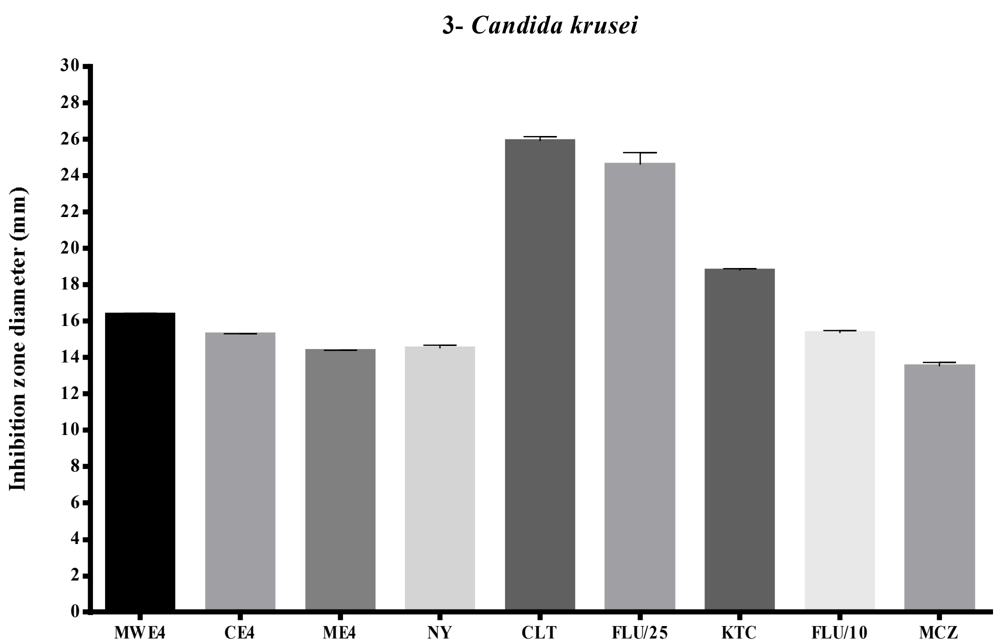
Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida albicans*

Figure A 122. Antifungal activity of *Quercus infectoria* Oliv. ethanolic extracts and antifungal discs against *C. glabatra*.



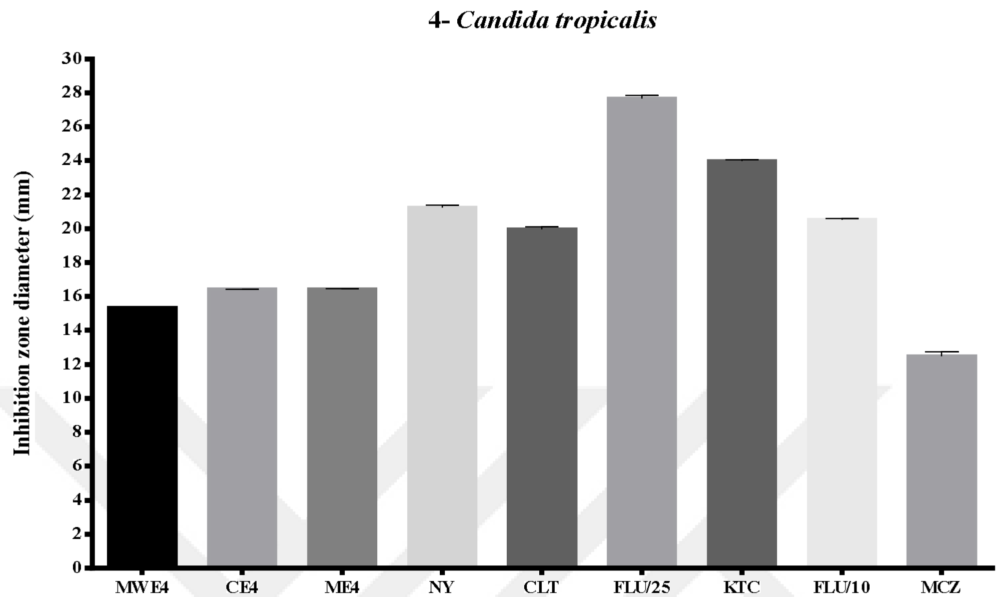
Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida glabatra*

Figure A 123. Antifungal activity of *Quercus infectoria* Oliv. ethanolic extracts and antifungal discs against *C. krusei*.



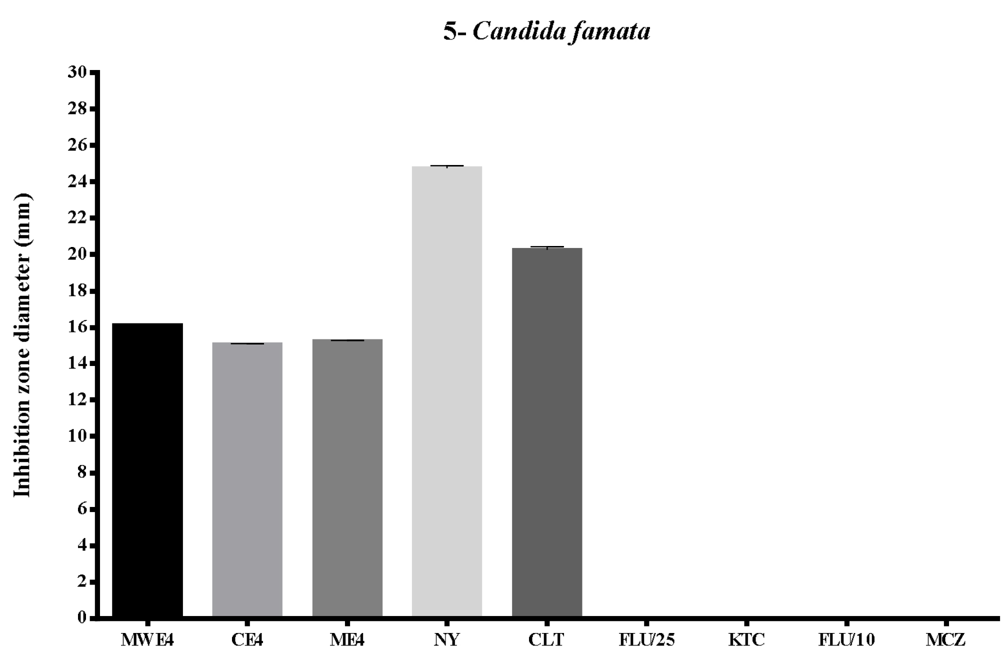
Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida krusei*

Figure A 124. Antifungal activity of *Quercus infectoria* Oliv. ethanolic extracts and antifungal discs against *C. tropicalis.*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida tropicalis*

Figure A 125. Antifungal activity of *Quercus infectoria* Oliv. ethanolic extracts and antifungal discs against *C. famata.*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida famata*

Figure A 126. Antifungal activity of *Quercus infectoria* Oliv. ethanolic extracts and antifungal discs against *C. parapsilosis.*

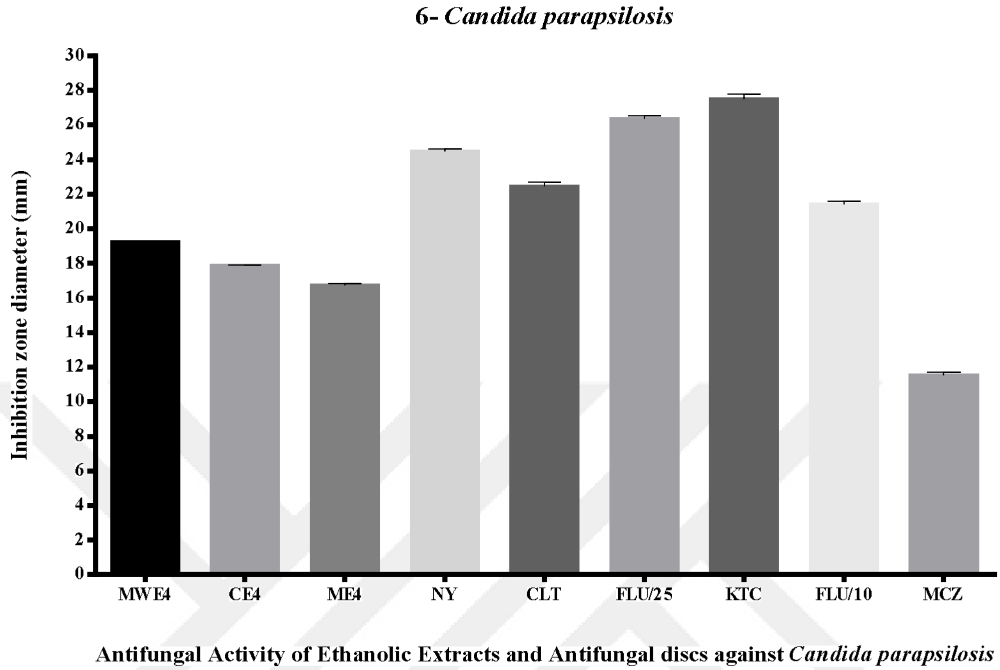


Figure A 127. Antifungal activity of *Quercus infectoria* Oliv. ethanolic extracts and antifungal discs against *C. guilliermondii.*

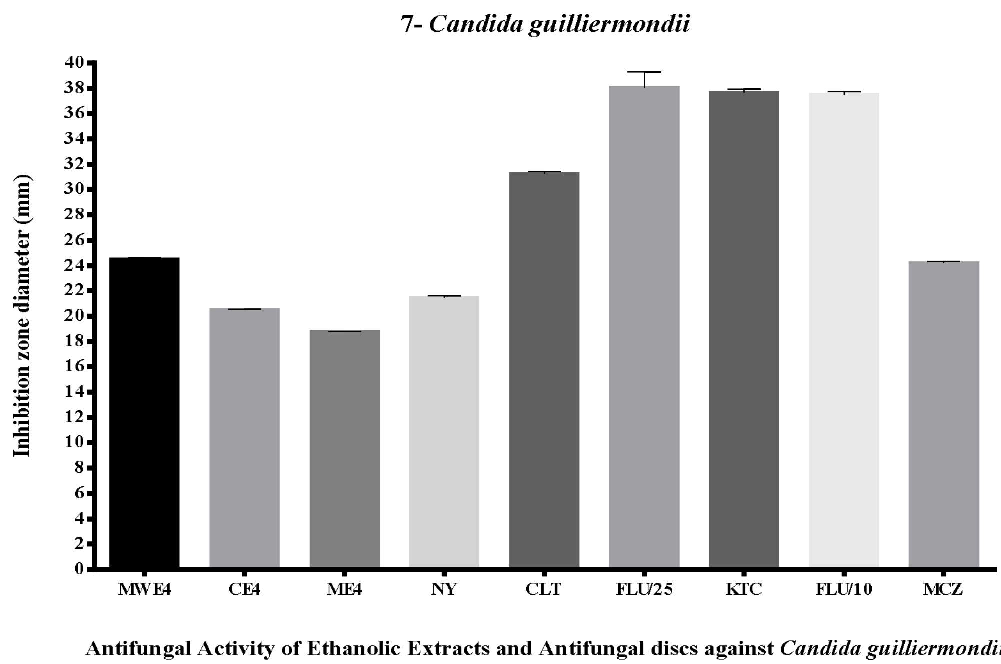


Figure A 128. Antifungal activity of *Quercus aegilops* L. ethanolic extracts and antifungal discs against *C. albicans.*

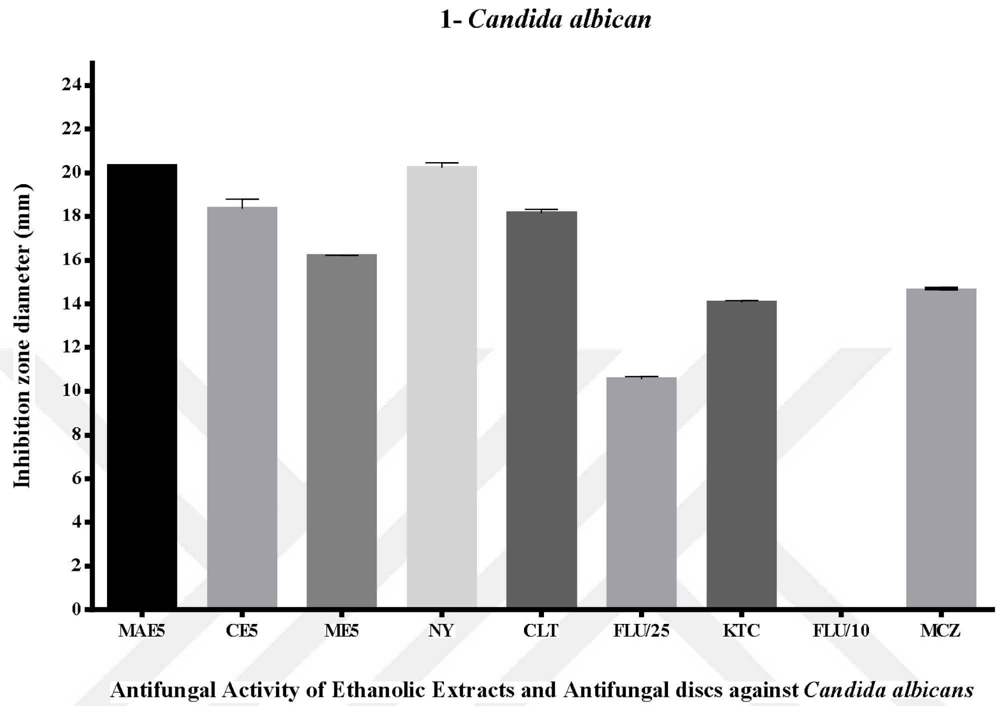


Figure A 129. Antifungal activity of *Quercus aegilops* L. ethanolic extracts and antifungal discs against *C. glabatra.*

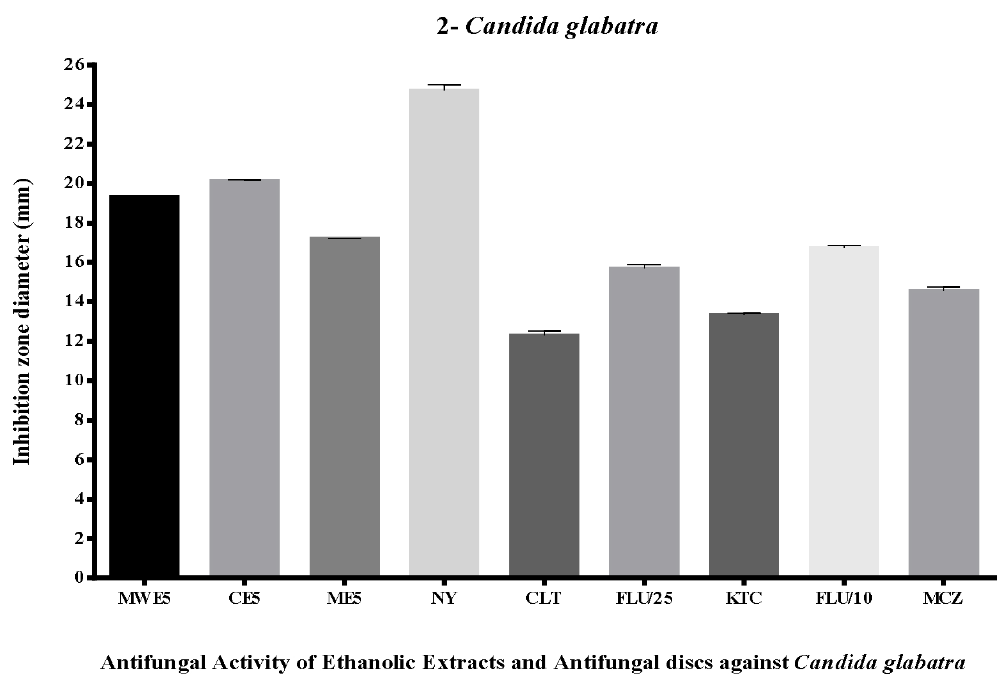
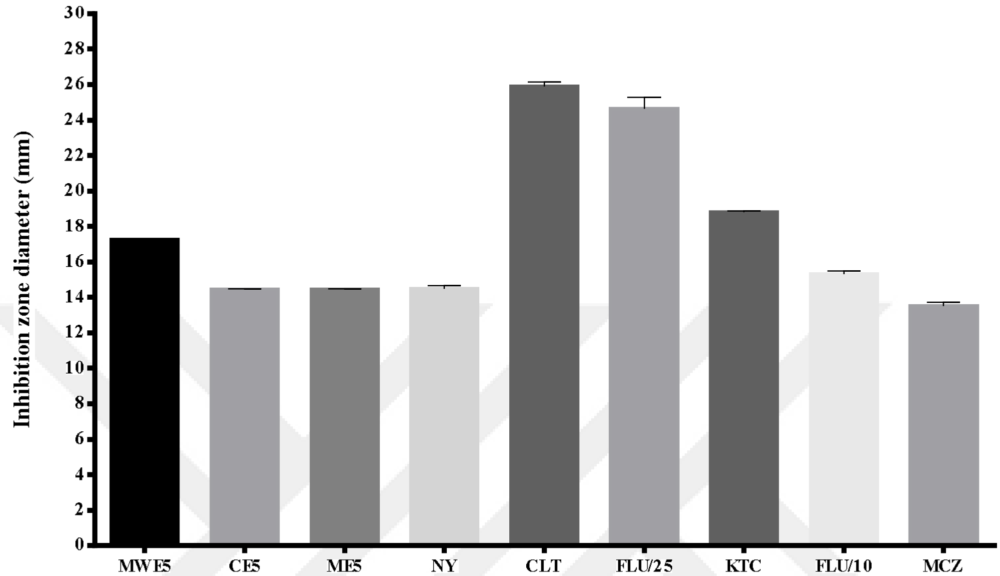


Figure A 130. Antifungal activity of *Quercus aegilops* L. ethanolic extracts and antifungal discs against *C. krusei.*

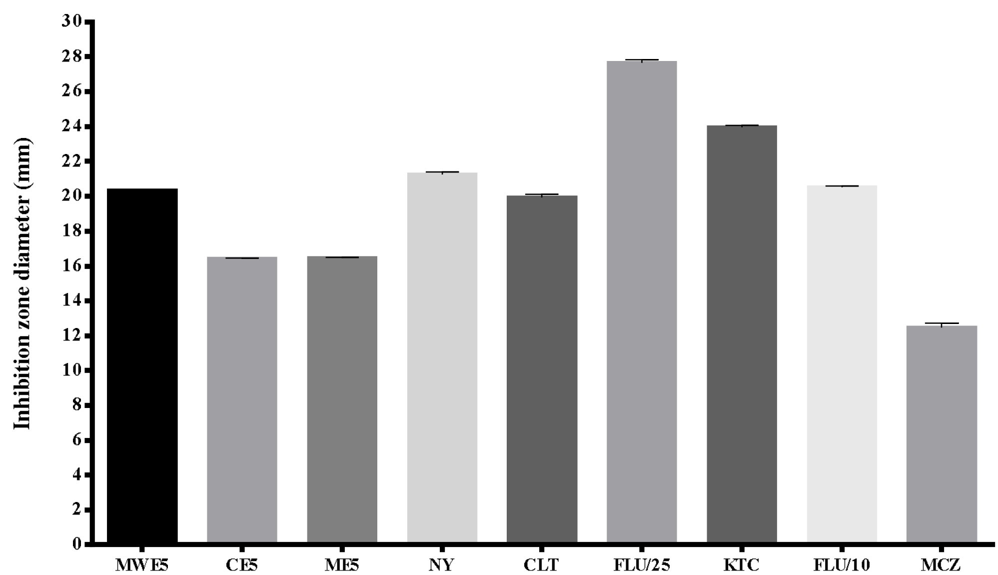
3- *Candida krusei*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida krusei*

Figure A 131. Antifungal activity of *Quercus aegilops* L. ethanolic extracts and antifungal discs against *C. tropicalis.*

4- *Candida tropicalis*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida tropicalis*

Figure A 132. Antifungal activity of *Quercus aegilops* L. ethanolic extracts and antifungal discs against *C. famata.*

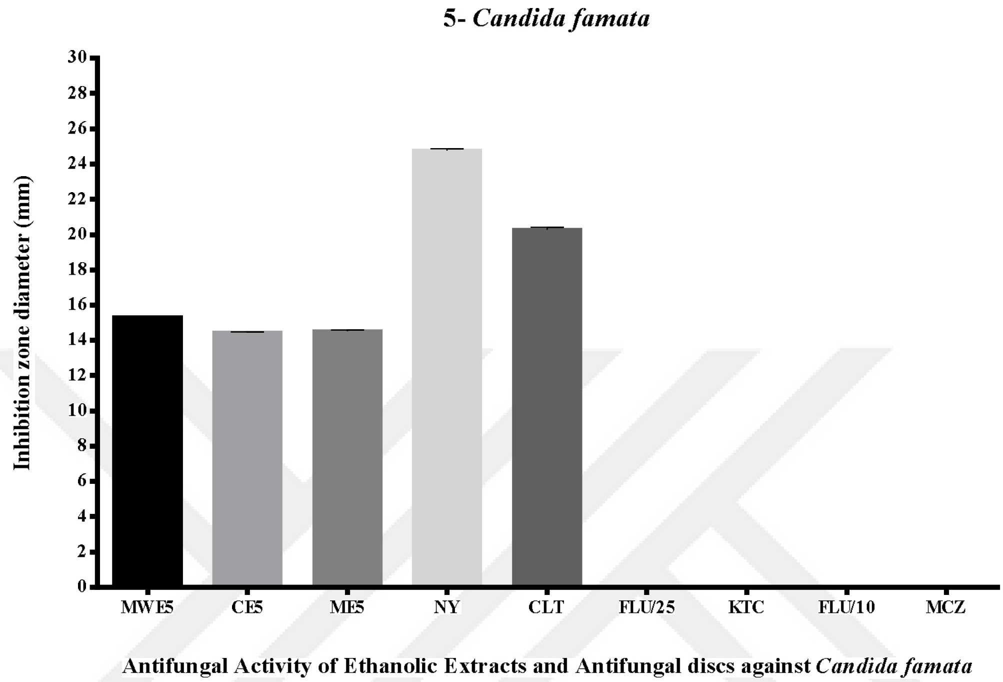


Figure A 133. Antifungal activity of *Quercus aegilops* L. ethanolic extracts and antifungal discs against *C. parapsilosis.*

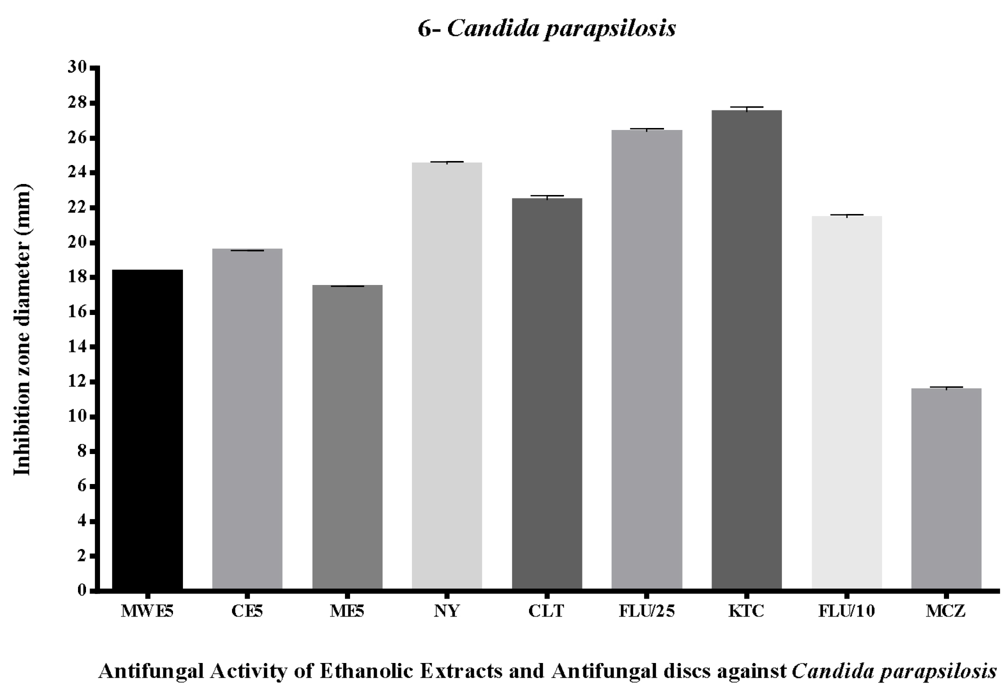
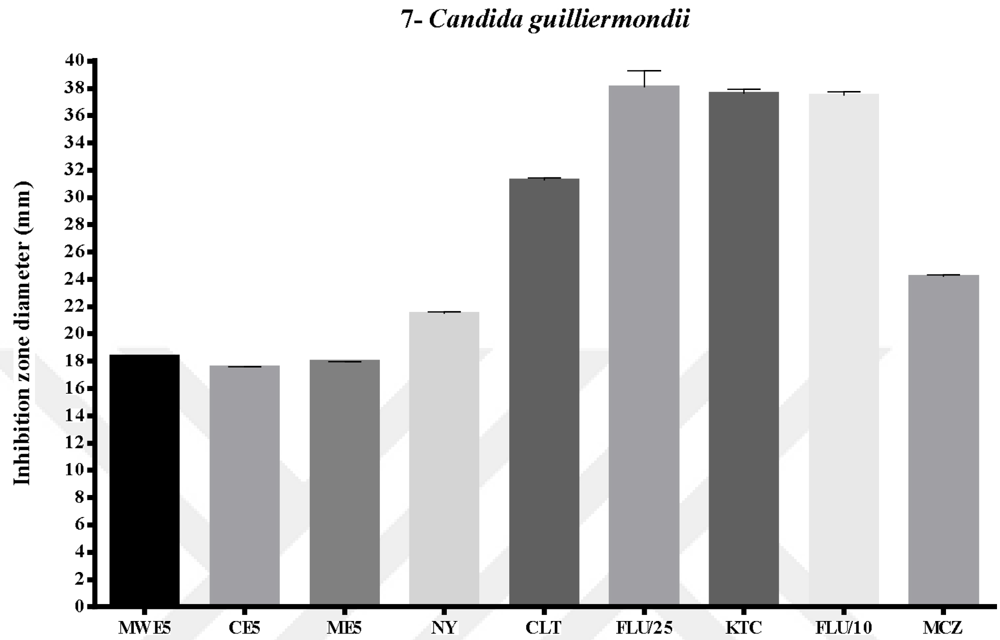
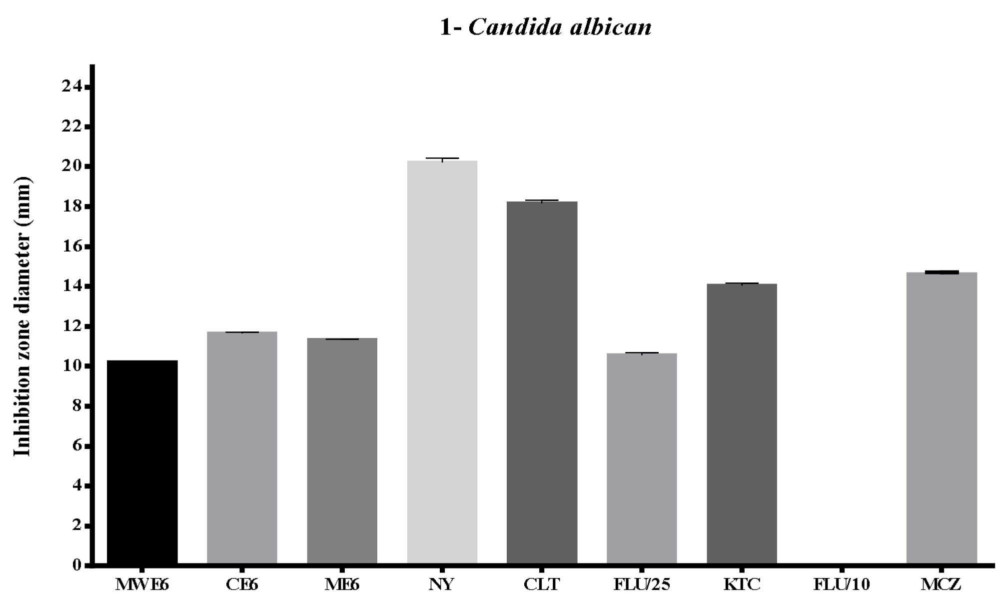


Figure A 134. Antifungal activity of *Quercus aegilops* L. ethanolic extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 135. Antifungal activity of *Crataegus monogyna* Jacquin ethanolic extracts and antifungal discs against *C. albicans.*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida albicans*

Figure A 136. Antifungal activity of *Crataegus monogyna* Jacquin ethanolic extracts and antifungal discs against *C. glabatra*.

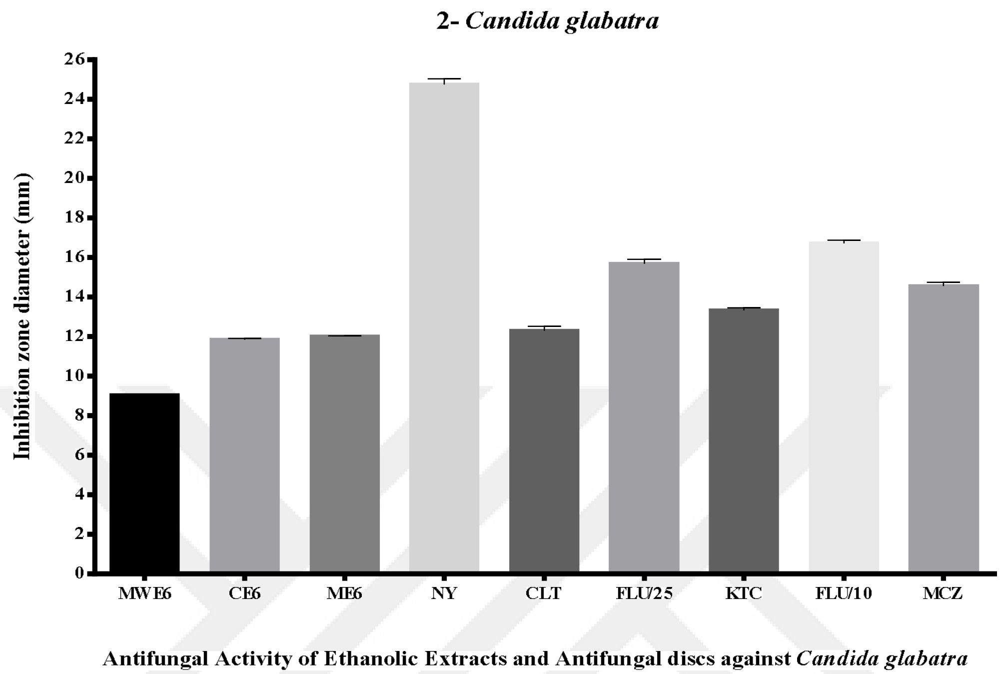


Figure A 137. Antifungal activity of *Crataegus monogyna* Jacquin ethanolic extracts and antifungal discs against *C. krusei.*

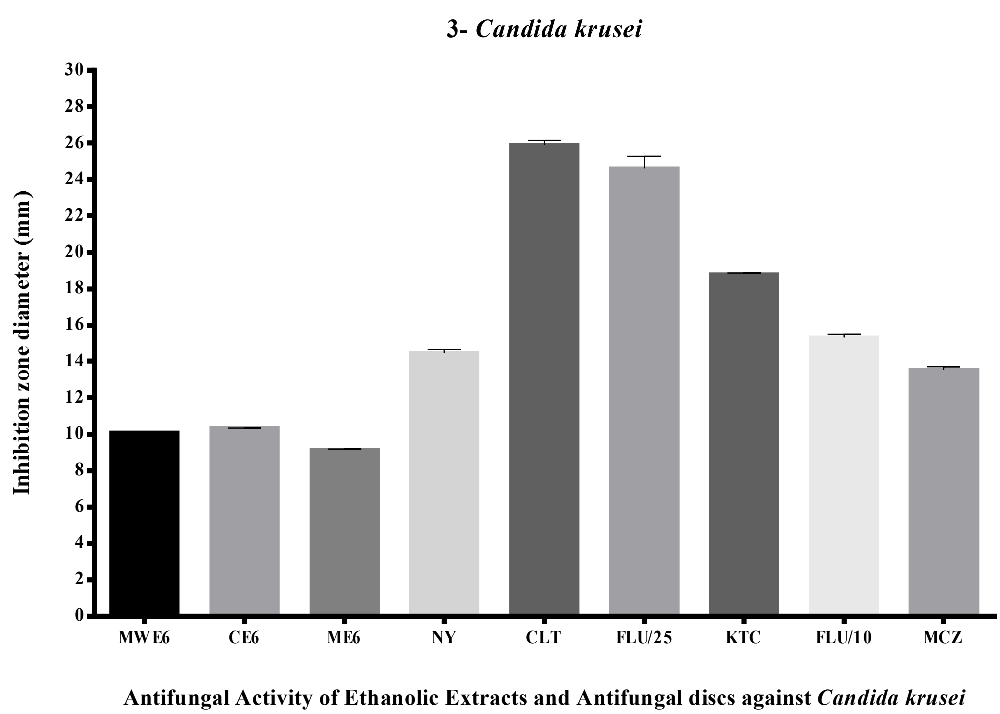


Figure A 138. Antifungal activity of *Crataegus monogyna* Jacquin ethanolic extracts and antifungal discs against *C. tropicalis.*

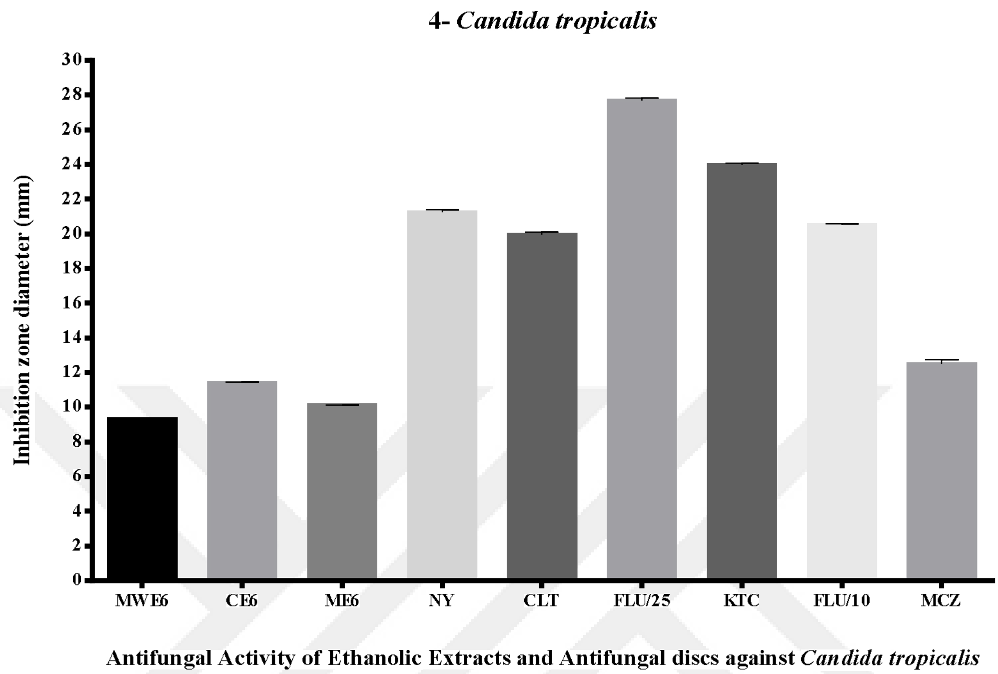


Figure A 139. Antifungal activity of *Crataegus monogyna* Jacquin ethanolic extracts and antifungal discs against *C. famata.*

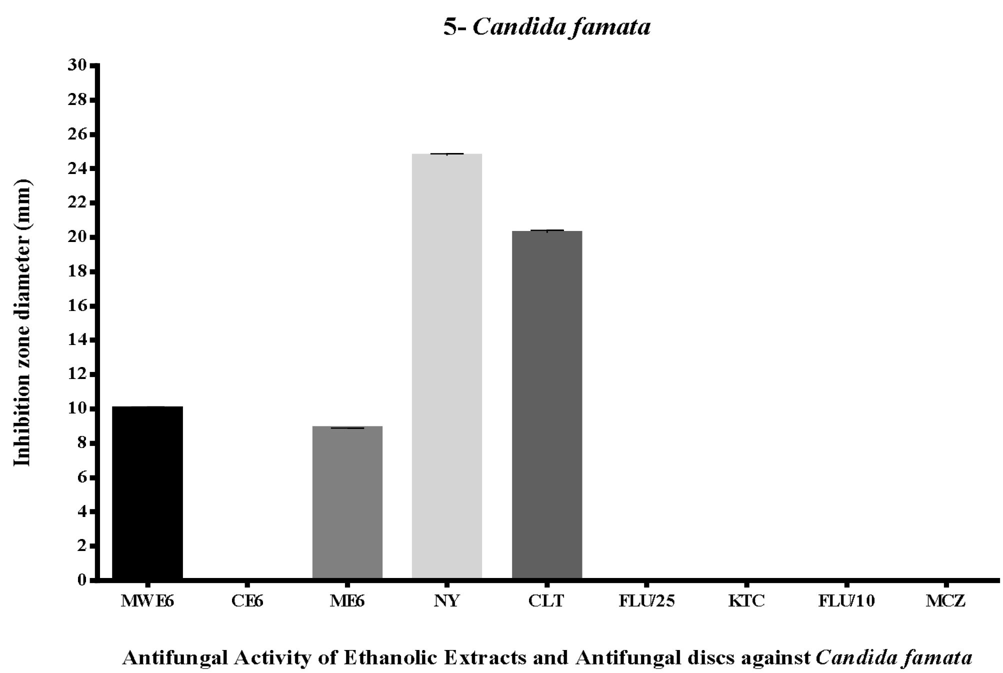


Figure A 140. Antifungal activity of *Crataegus monogyna* Jacquin ethanolic extracts and antifungal discs against *C. parapsilosis.*

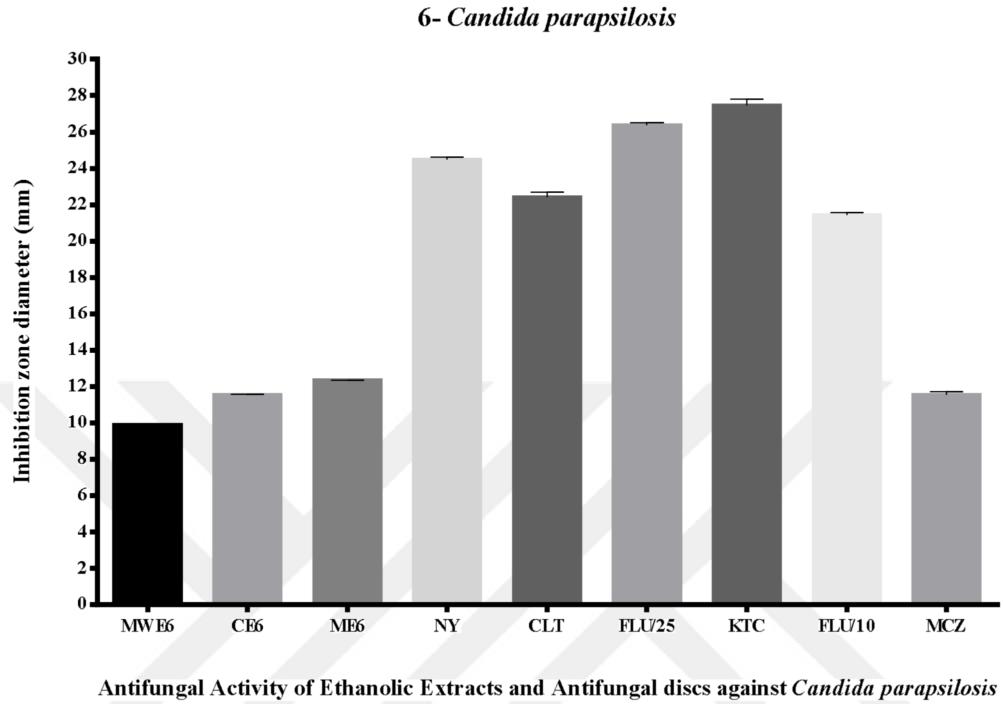


Figure A 141. Antifungal activity of *Crataegus monogyna* Jacquin ethanolic extracts and antifungal discs against *C. guilliermondii.*

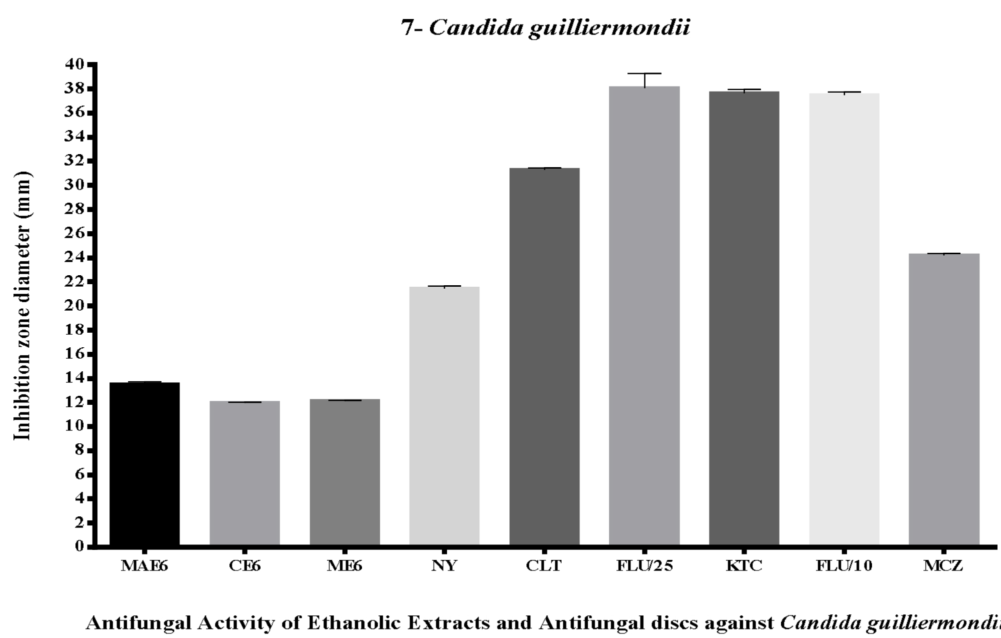


Figure A 142. Antifungal activity of *Prunus argentea* (Lam.) Rehder ethanolic extracts and antifungal discs against *C. albicans.*

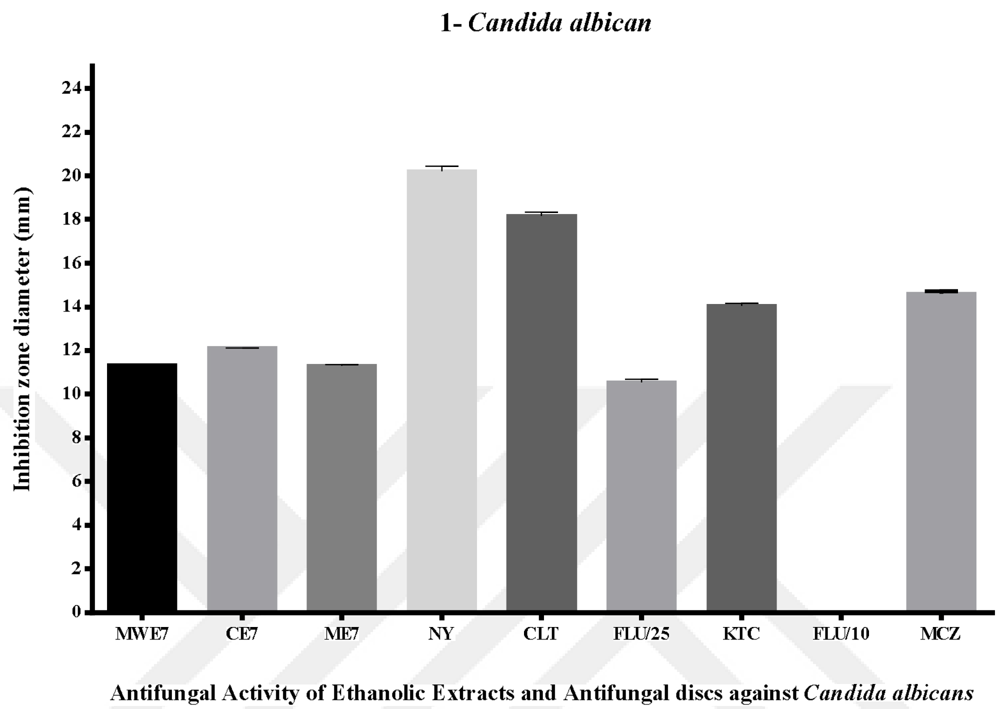


Figure A 143. Antifungal activity of *Prunus argentea* (Lam.) Rehder ethanolic extracts and antifungal discs against *C. glabatra.*

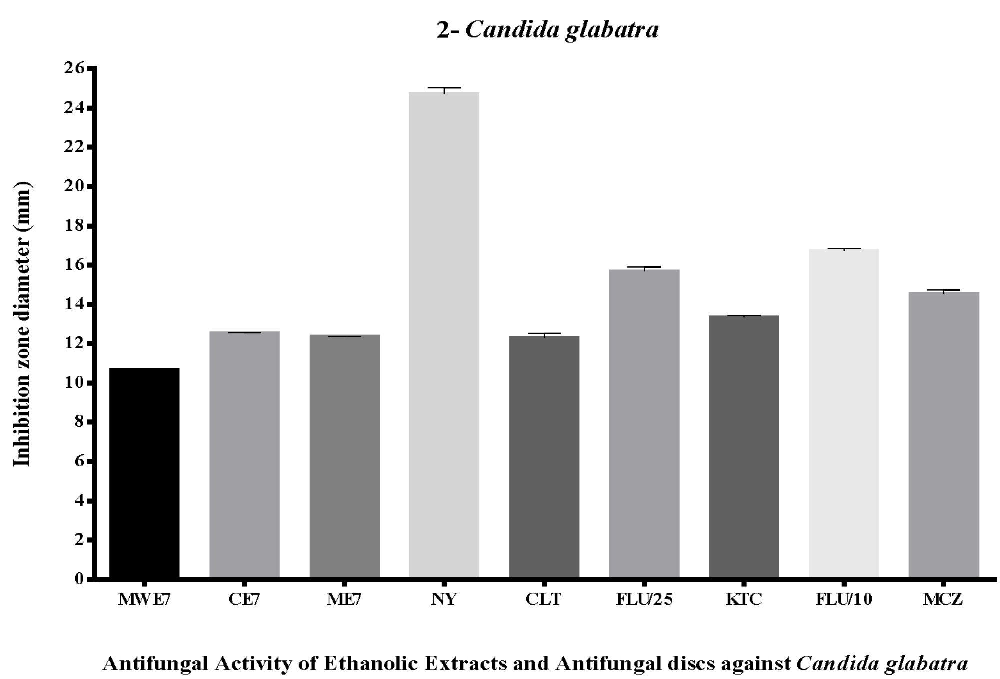


Figure A 144. Antifungal activity of *Prunus argentea* (Lam.) Rehder ethanolic extracts and antifungal discs against *C. krusei.*

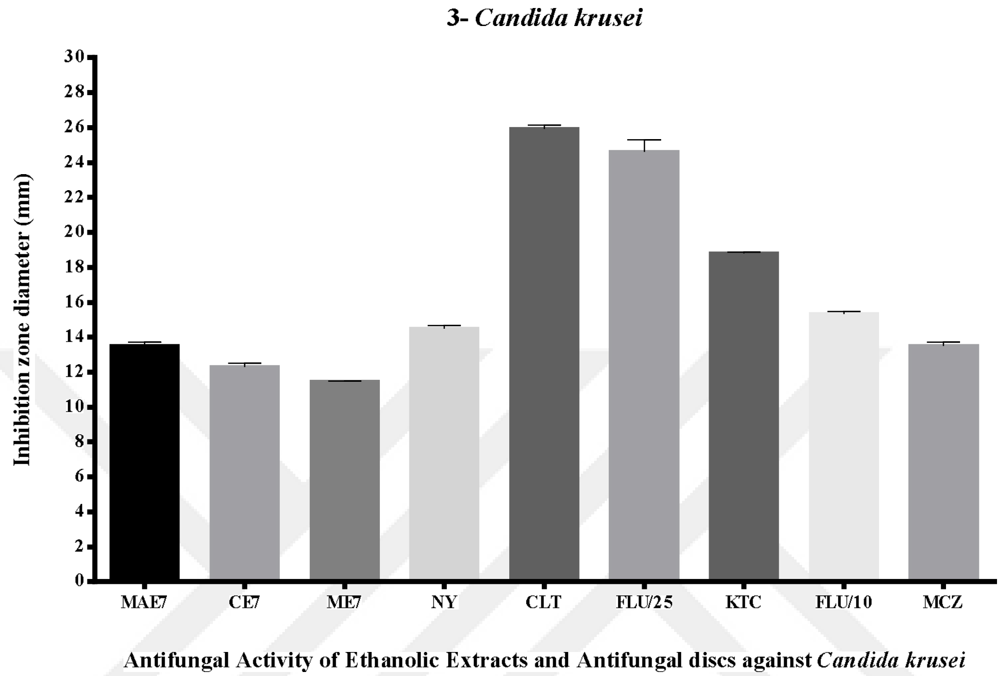


Figure A 145. Antifungal activity of *Prunus argentea* (Lam.) Rehder ethanolic extracts and antifungal discs against *C. tropicalis.*

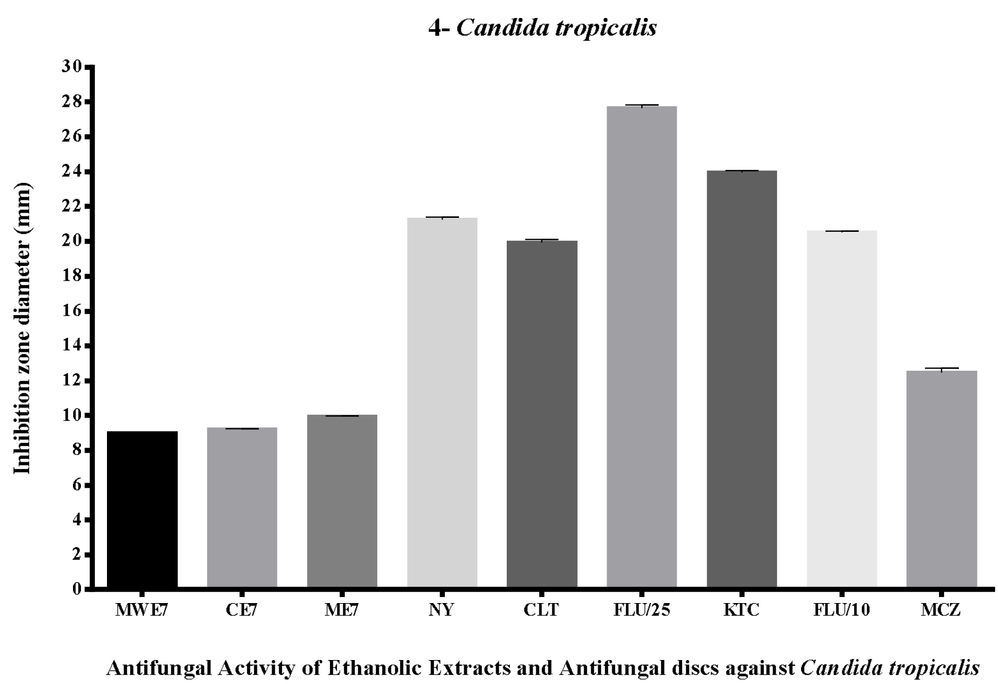


Figure A 146. Antifungal activity of *Prunus argentea* (Lam.) Rehder ethanolic extracts and antifungal discs against *C. famata.*

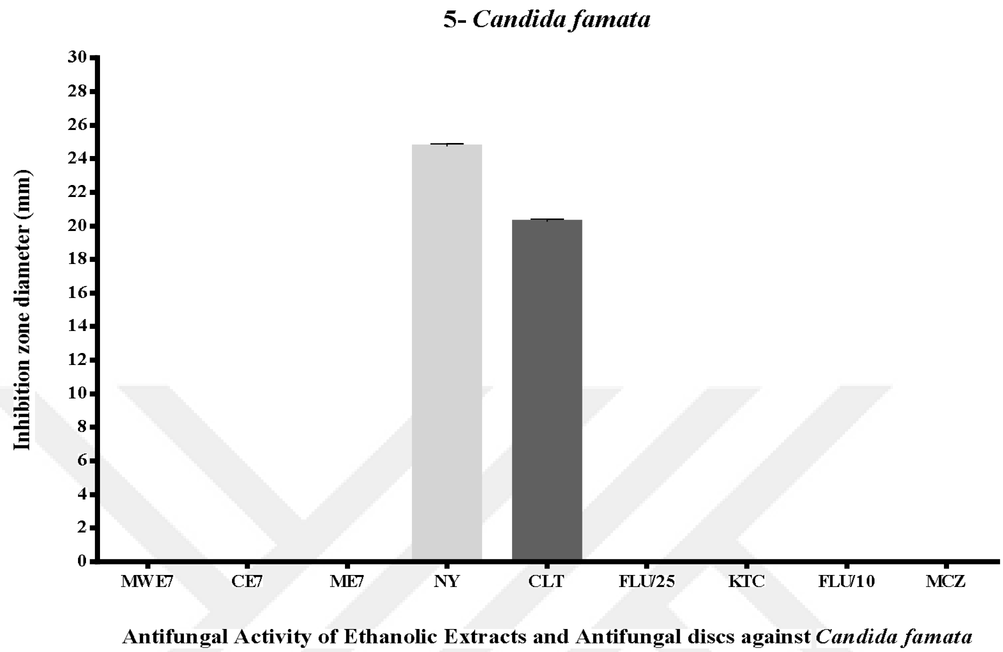


Figure A 147. Antifungal activity of *Prunus argentea* (Lam.) Rehder ethanolic extracts and antifungal discs against *C. parapsilosis.*

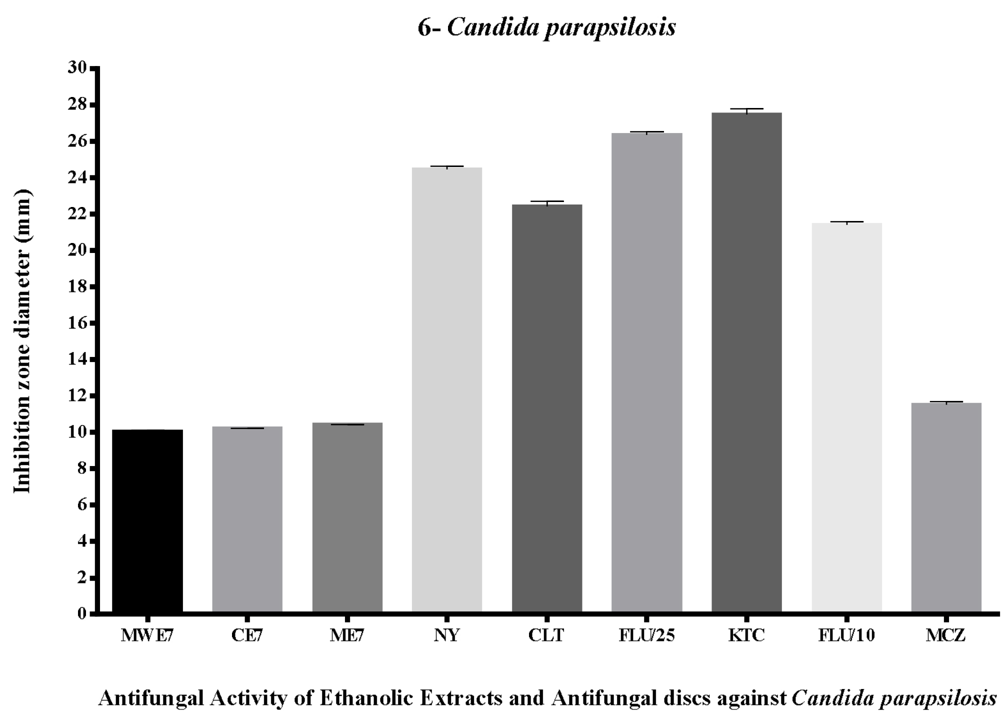
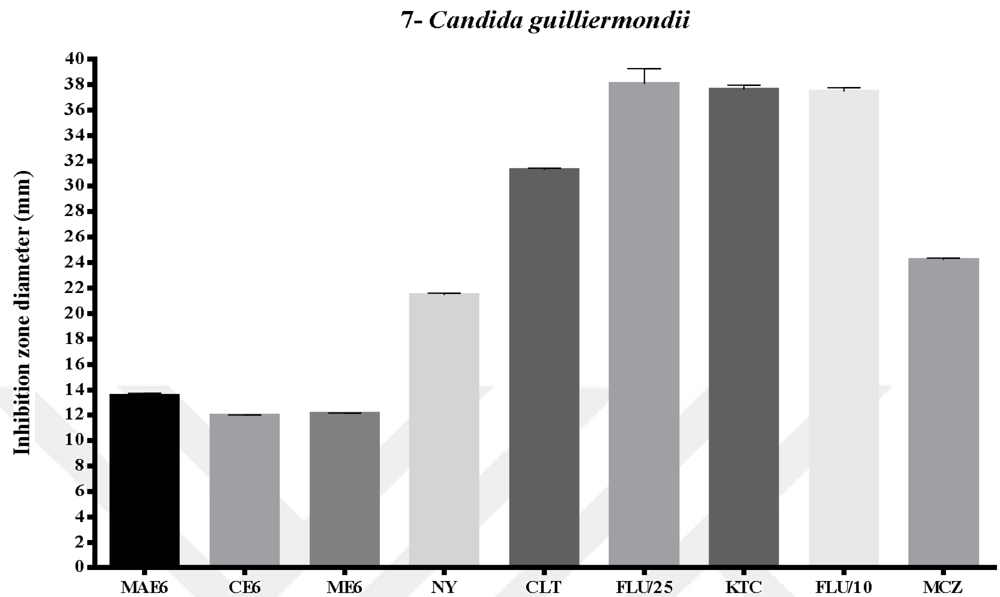
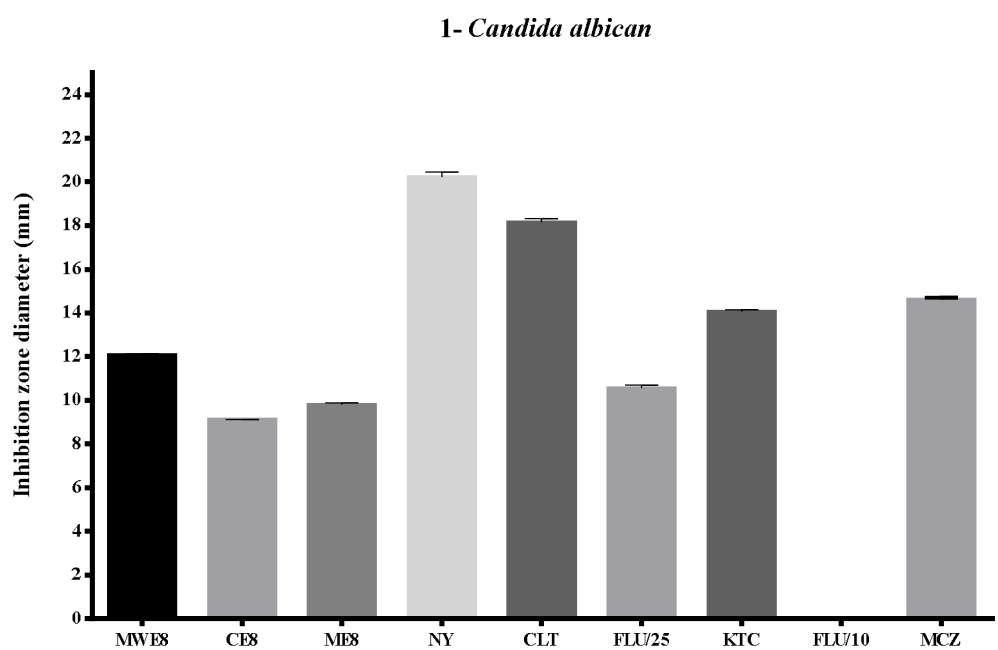


Figure A 148. Antifungal activity of *Prunus argentea* (Lam.) Rehder ethanolic extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 149. Antifungal activity of *Crataegus azarolus* var. aronia L. ethanolic extracts and antifungal discs against *C. albicans.*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida albicans*

Figure A 150. Antifungal activity of *Crataegus azarolus* var. aronia L. ethanolic extracts and antifungal discs against *C. glabatra.*

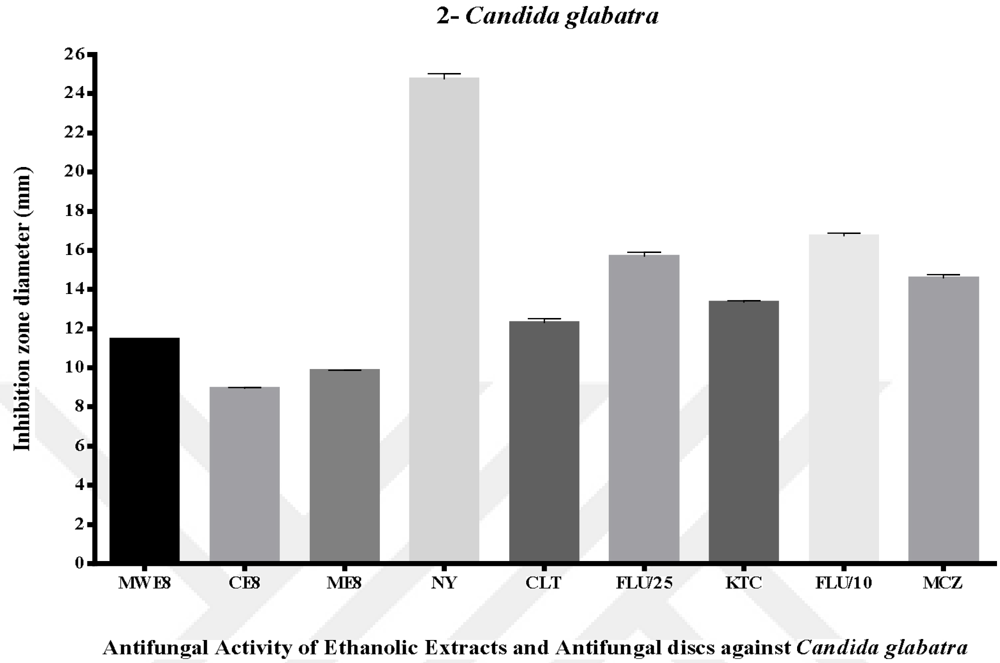


Figure A 151. Antifungal activity of *Crataegus azarolus* var. aronia L. ethanolic extracts and antifungal discs against *C. krusei.*

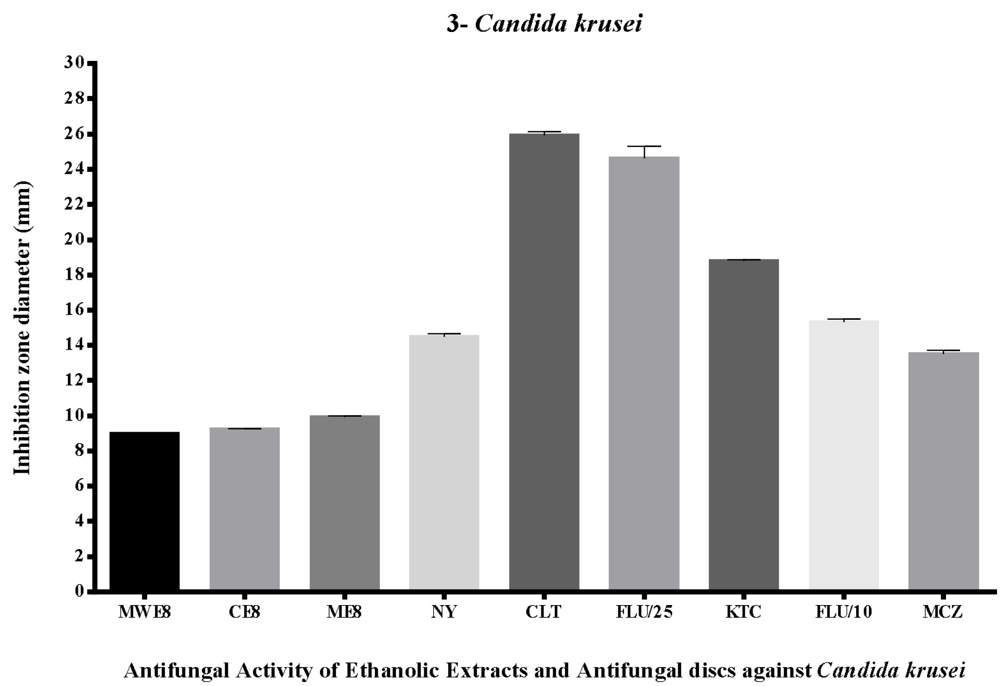


Figure A 152. Antifungal activity of *Crataegus azarolus* var. aronia L. ethanolic extracts and antifungal discs against *C. tropicalis.*

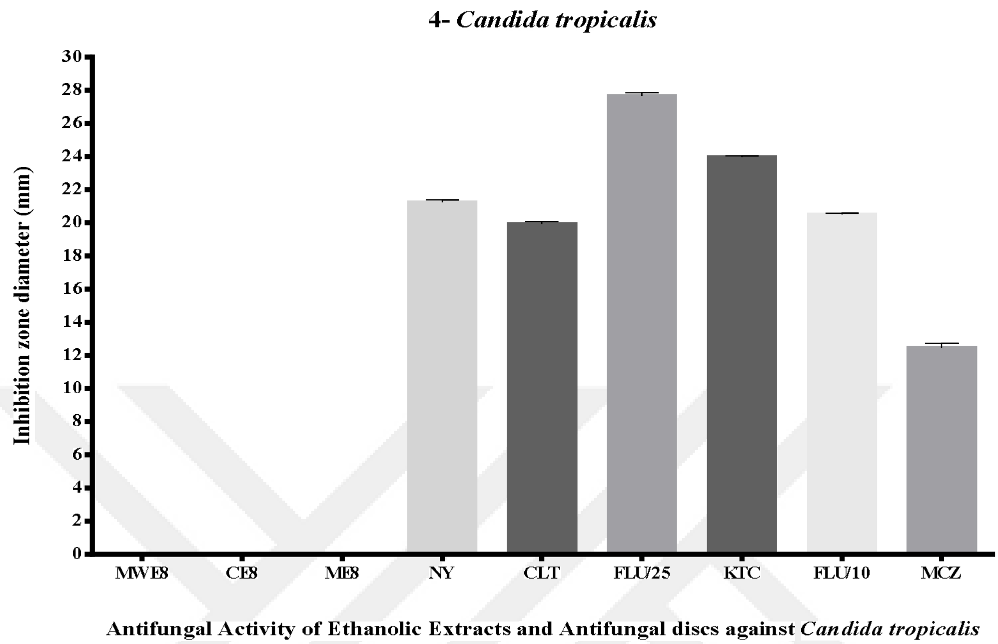


Figure A 153. Antifungal activity of *Crataegus azarolus* var. aronia L. ethanolic extracts and antifungal discs against *C. famata.*

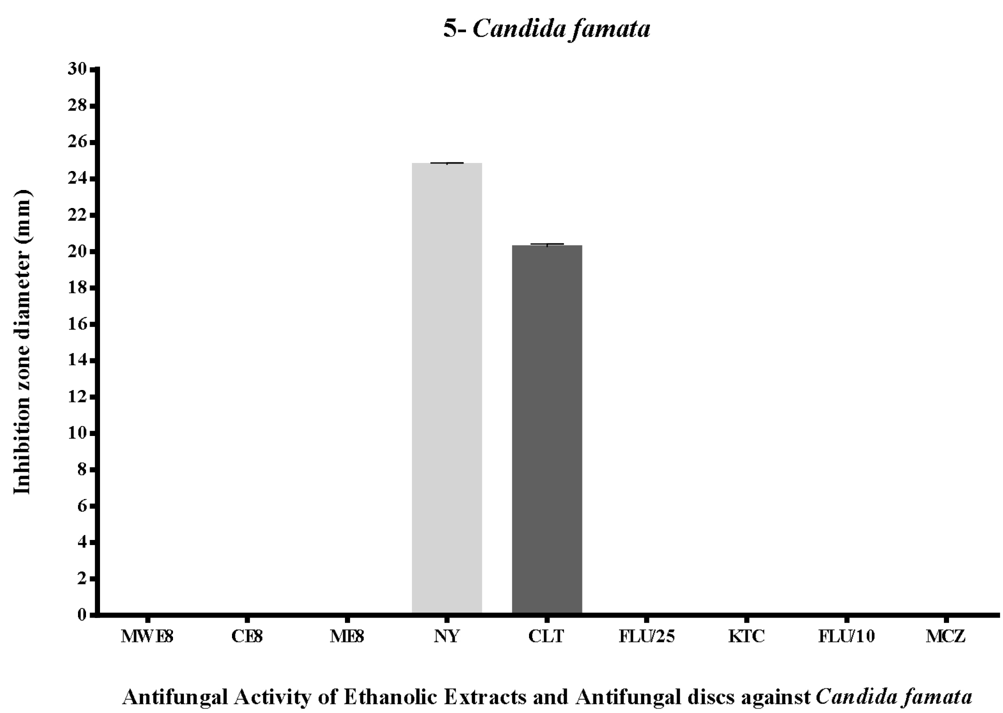
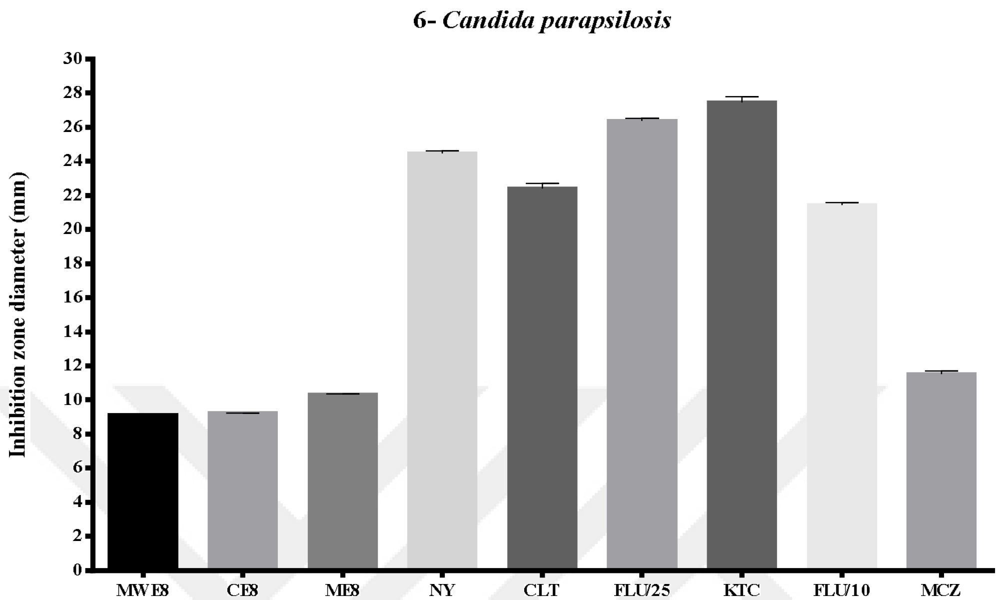
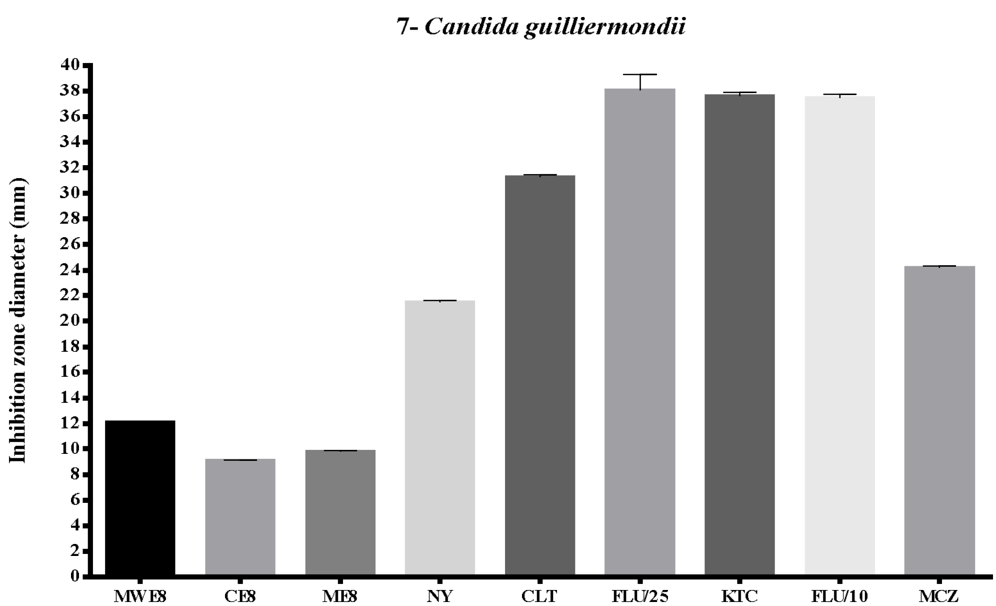


Figure A 154. Antifungal activity of *Crataegus azarolus* var. aronia L. ethanolic extracts and antifungal discs against *C. parapsilosis.*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida parapsilosis*

Figure A 155. Antifungal activity of *Crataegus azarolus* var. aronia L. ethanolic extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 156. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) ethanolic extracts and antifungal discs against *C. albicans.*

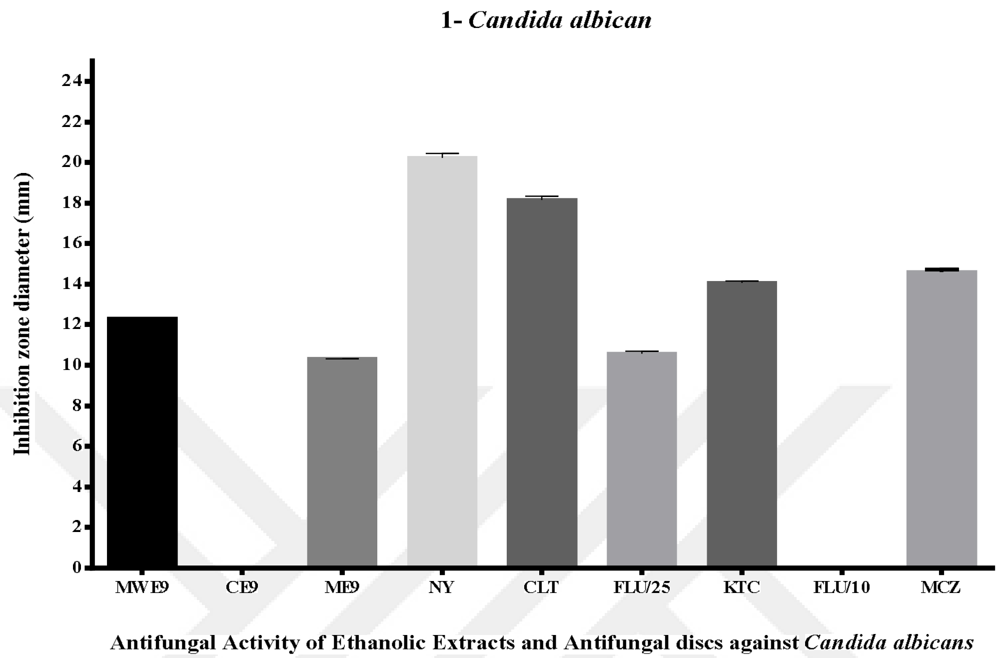


Figure A 157. Antifungal Activity of *Prunus microcarpa* C.A. Mey. (Red fruit) ethanolic extracts and antifungal discs against *C. glabatra.*

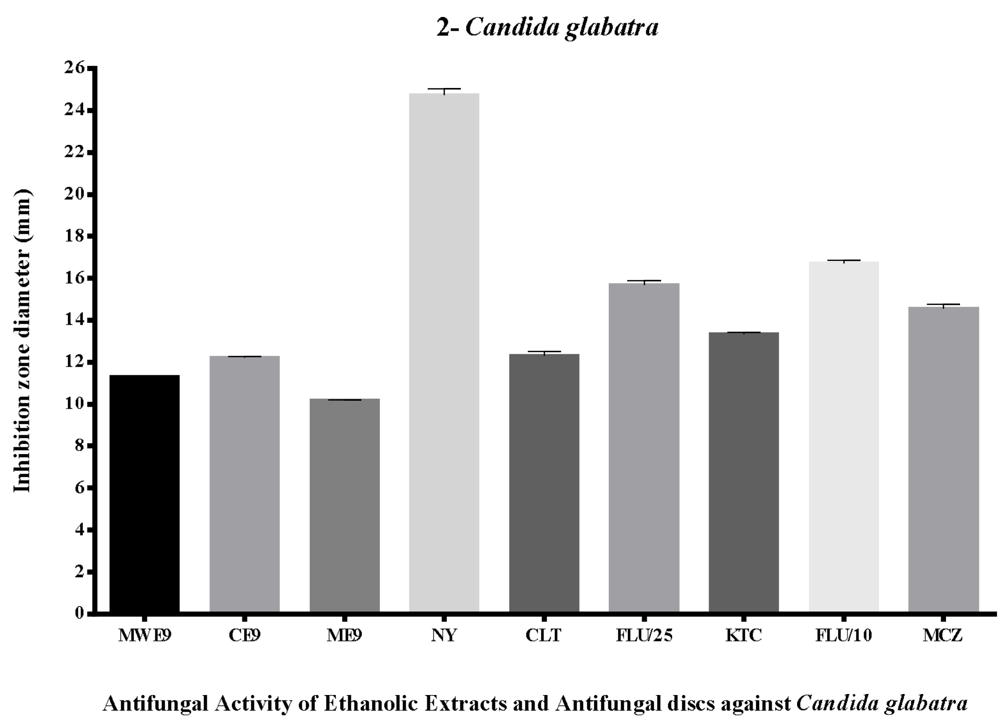


Figure A 158. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) ethanolic extracts and antifungal discs against *C. krusei.*

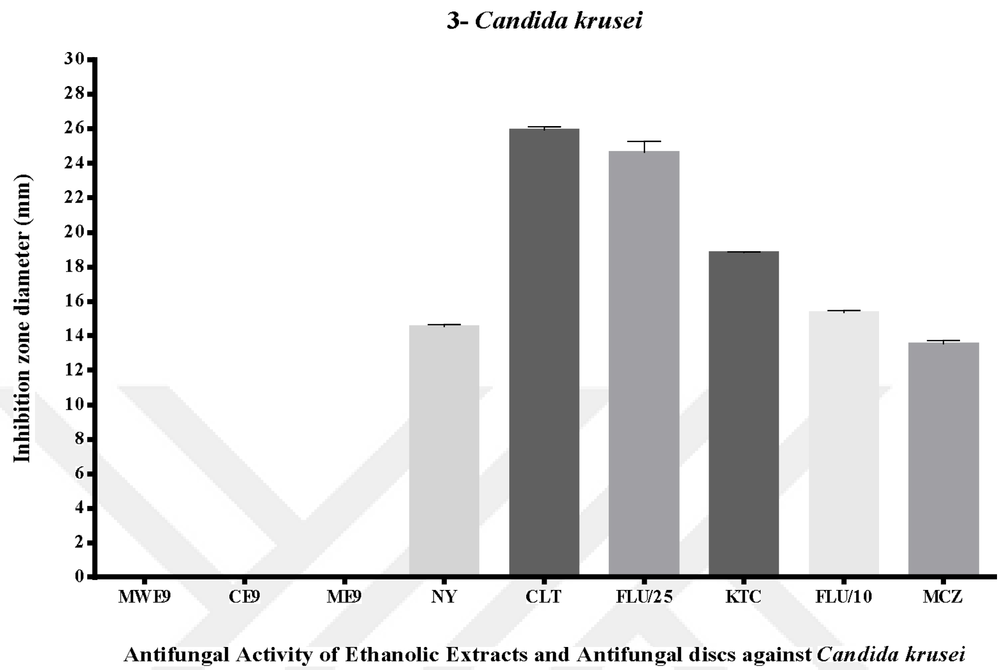


Figure A 159. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) ethanolic extracts and antifungal discs against *C. tropicalis.*

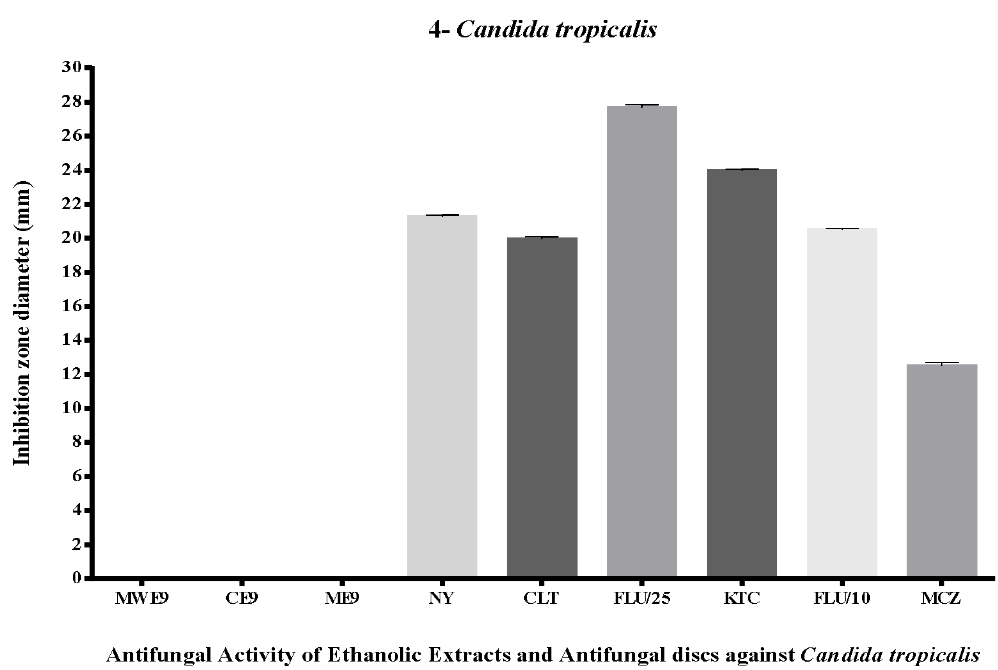


Figure A 160. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) ethanolic extracts and antifungal discs against *C. famata.*

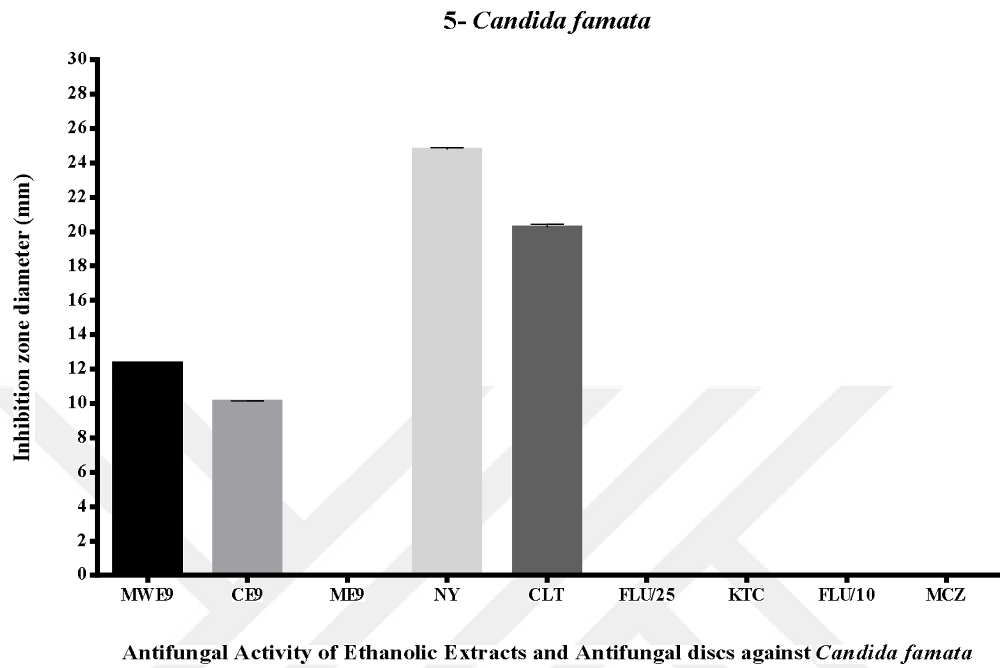


Figure A 161. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) ethanolic extracts and antifungal discs against *C. parapsilosis.*

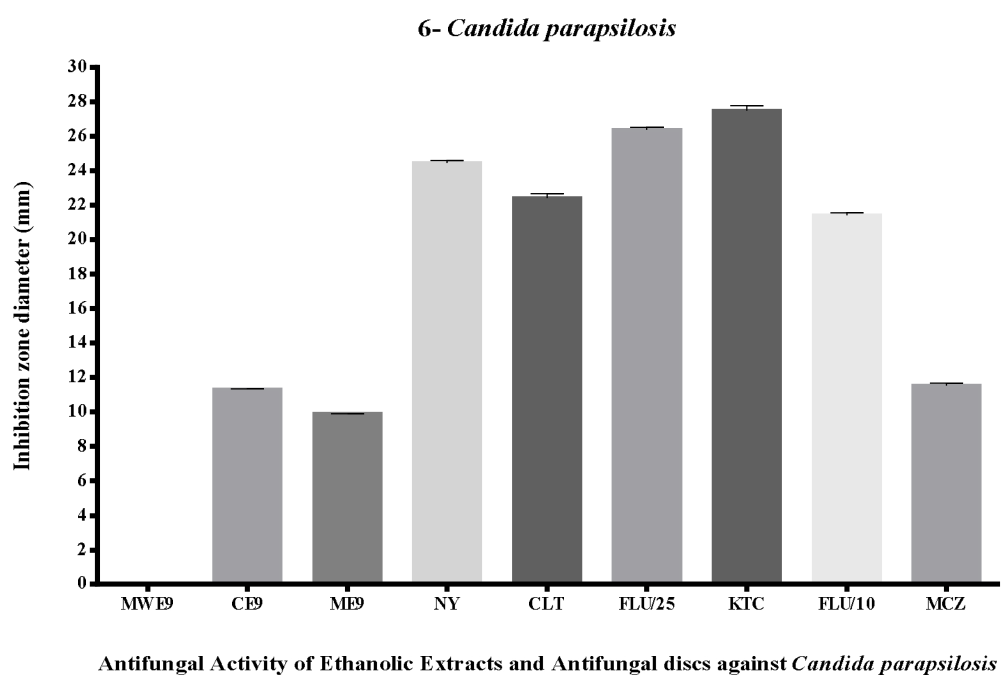


Figure A 162. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) ethanolic extracts and antifungal discs against *C. guilliermondii.*

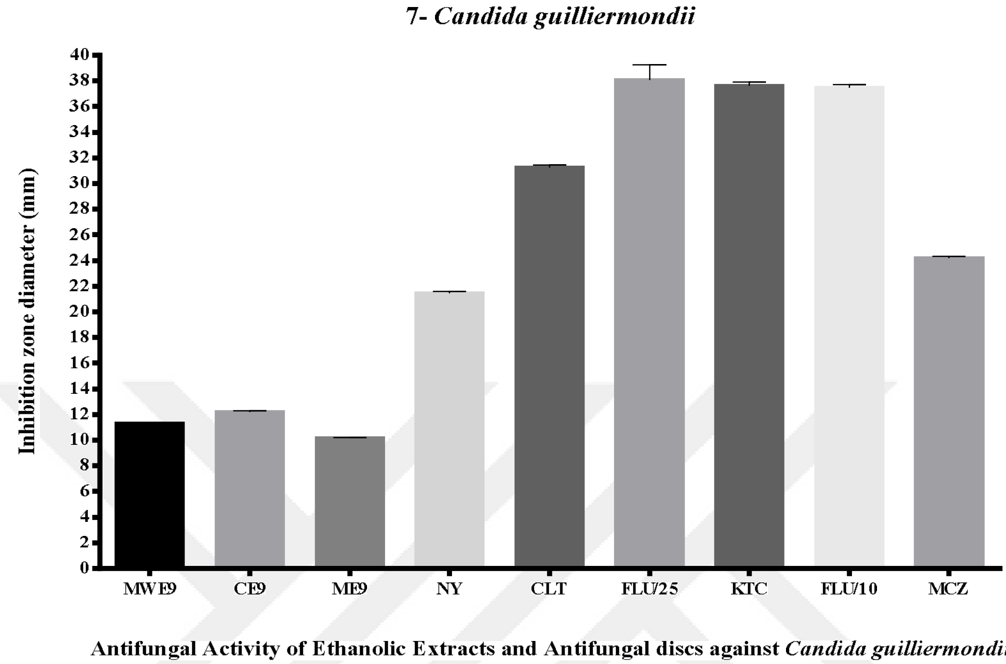


Figure A 163. Antifungal activity of *Rubus sanctus* Schreb ethanolic extracts and antifungal discs against *C. albicans.*

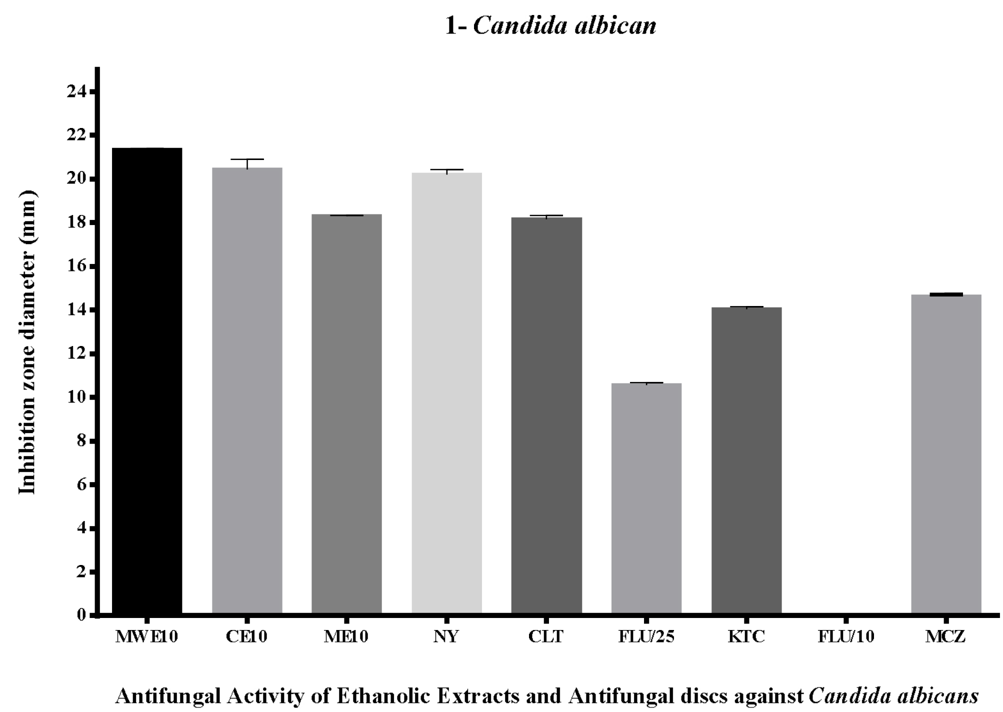
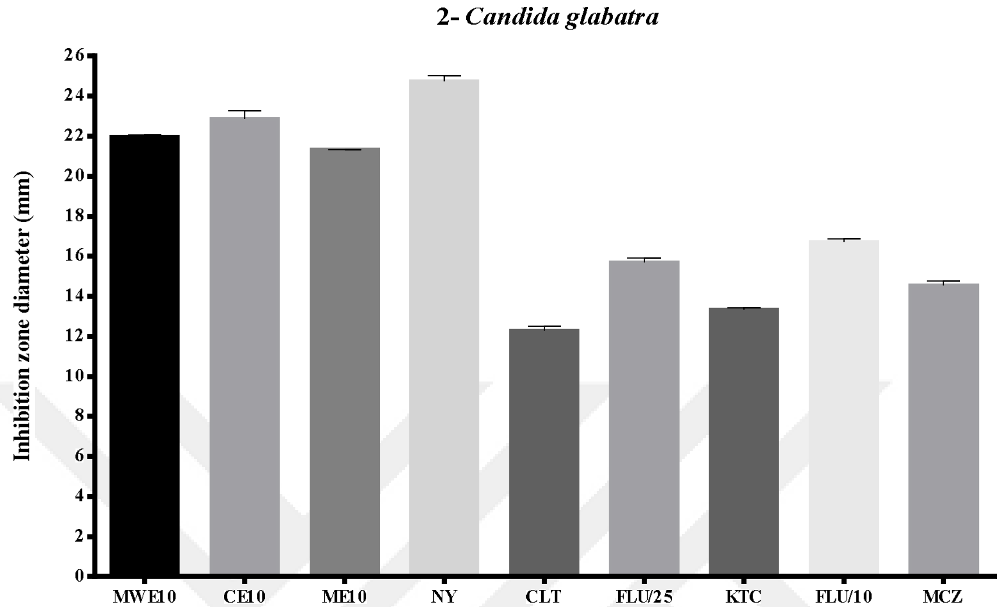
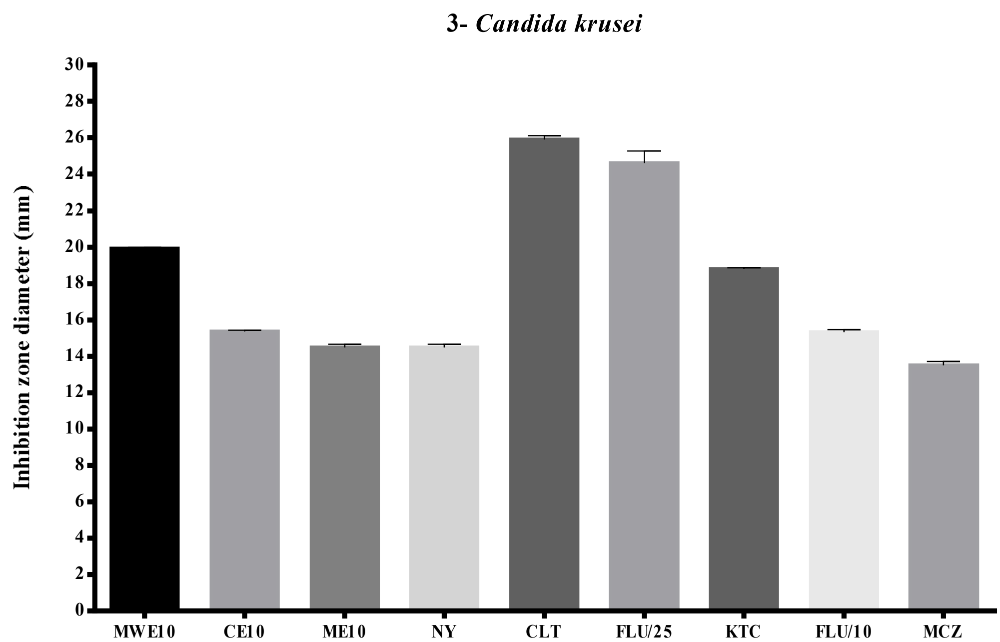


Figure A 164. Antifungal activity of *Rubus sanctus* Schreb ethanolic extracts and antifungal discs against *C. glabatra*.



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida glabatra*

Figure A 165. Antifungal activity of *Rubus sanctus* Schreb ethanolic extracts and antifungal discs against *C. krusei*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida krusei*

Figure A 166. Antifungal activity of *Rubus sanctus* Schreb ethanolic extracts and antifungal discs against *C. tropicalis*

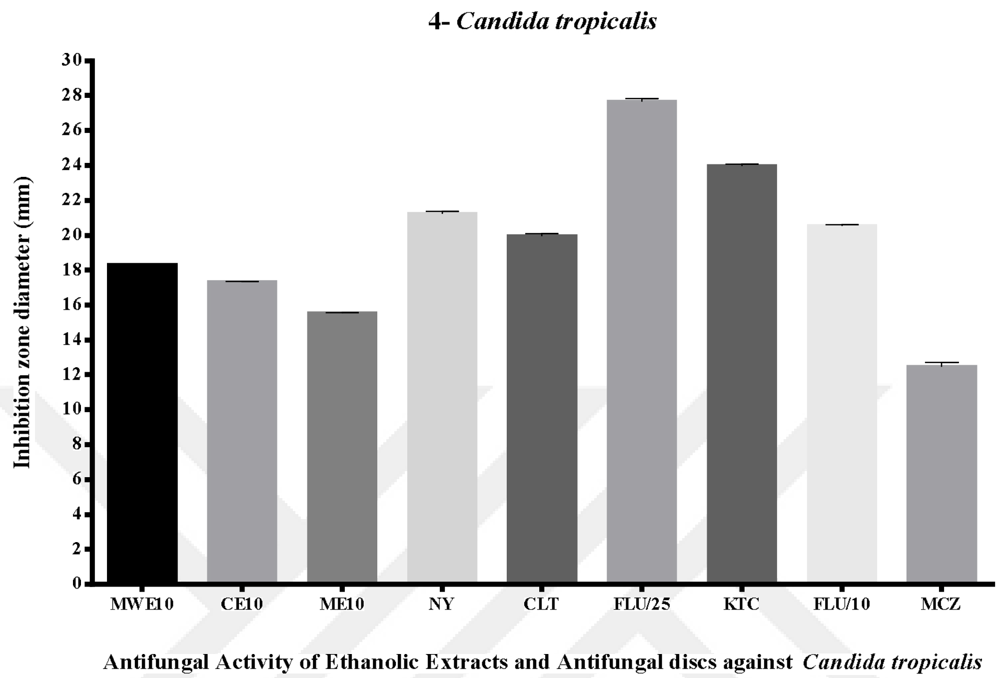


Figure A 167 Antifungal activity of *Rubus sanctus* Schreb ethanolic extracts and antifungal discs against *C. famata.*

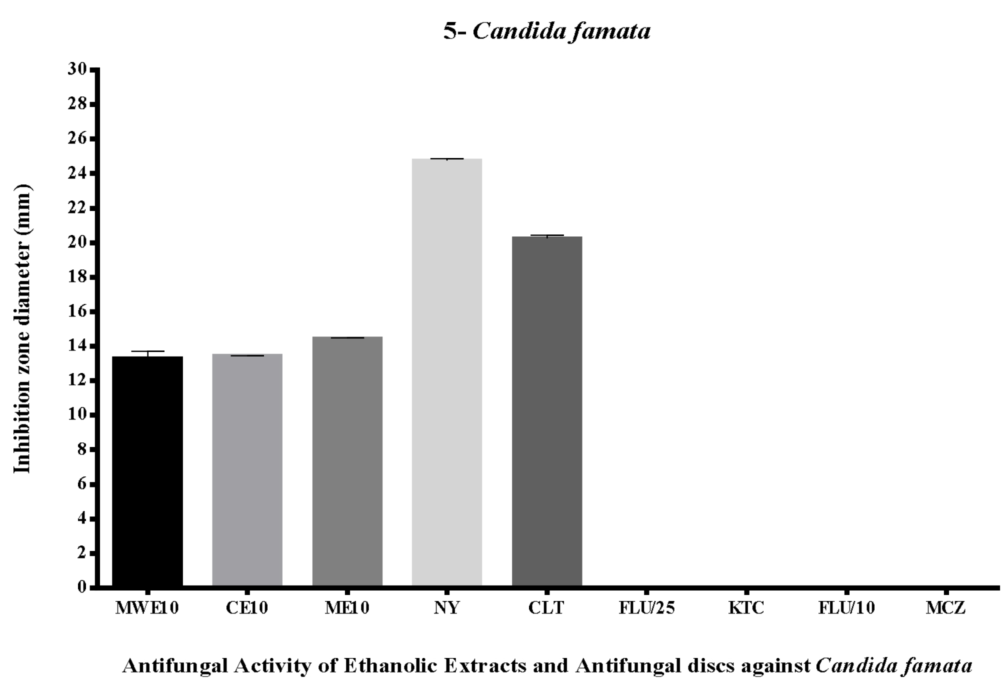


Figure A 168. Antifungal activity of *Rubus sanctus* Schreb ethanolic extracts and antifungal discs against *C. parapsilosis*.

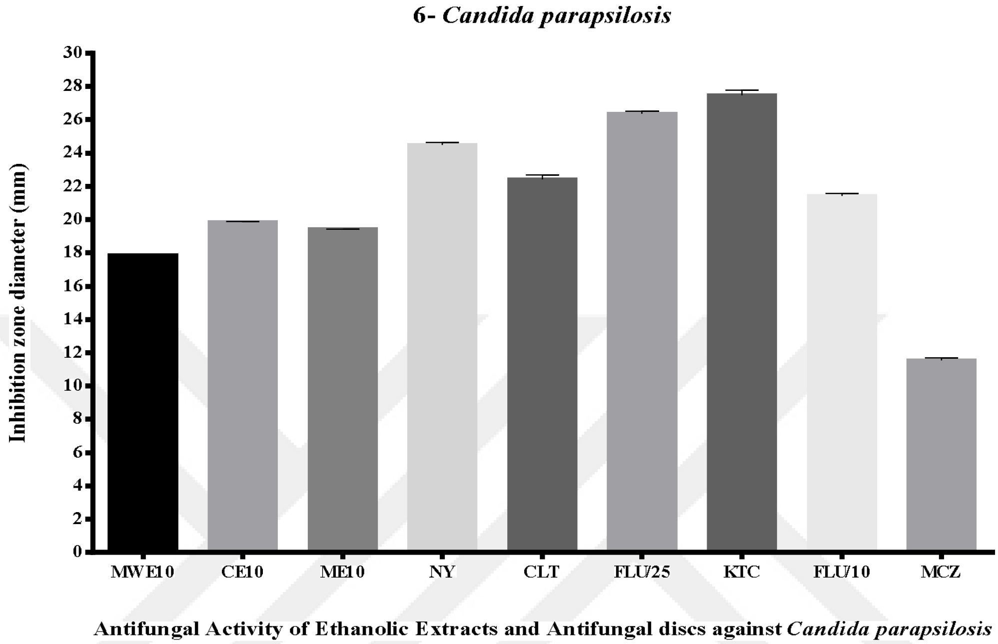


Figure A 169. Antifungal activity of *Rubus sanctus* Schreb ethanolic extracts and antifungal discs against *C. guilliermondii.*

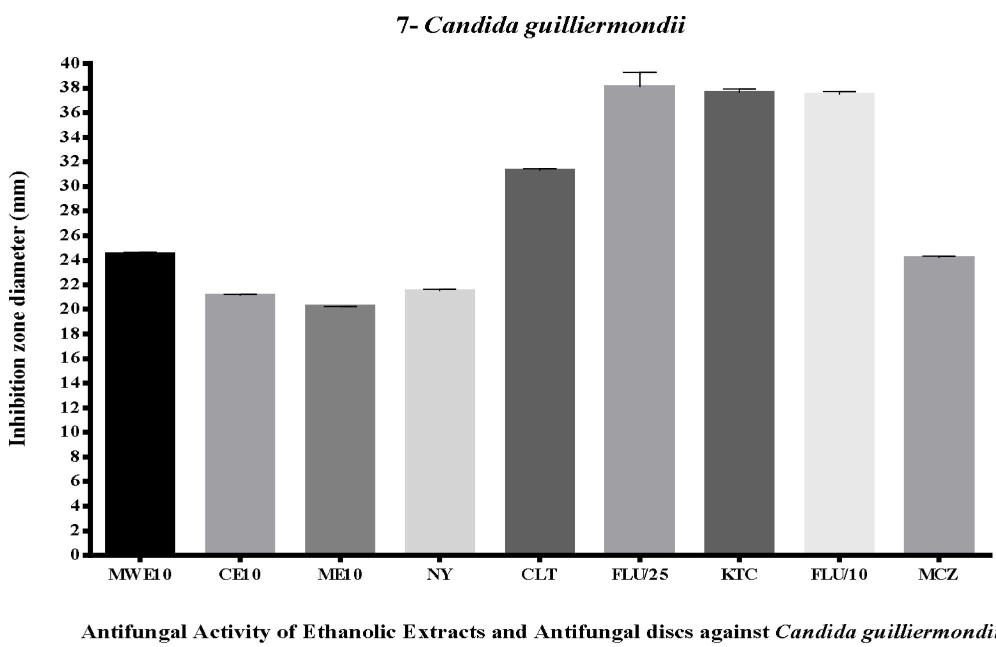


Figure A 170. Antifungal activity of *Ficus carica* L. ethanolic extracts and antifungal discs against *C. albicans.*

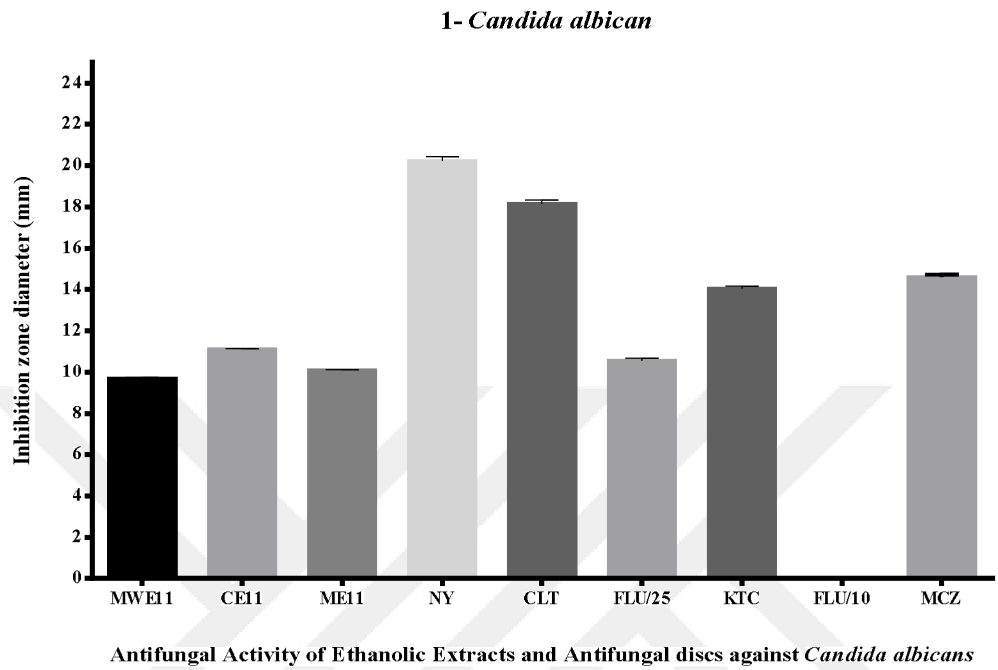


Figure A 171. Antifungal activity of *Ficus carica* L. ethanolic extracts and antifungal discs against *C. glabatra.*

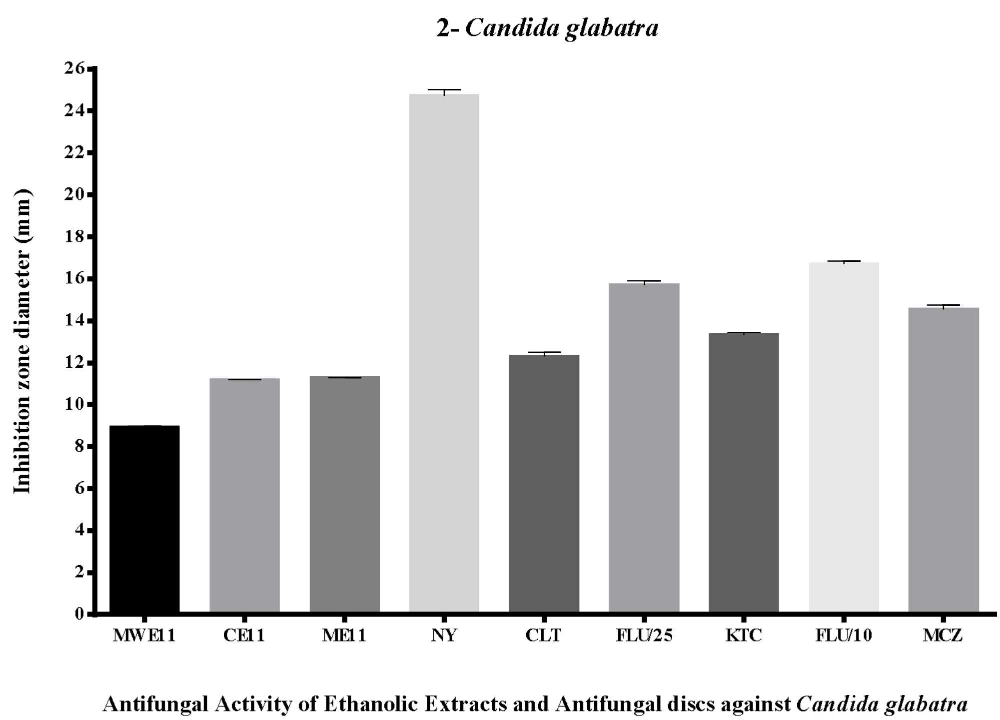


Figure A 172. Antifungal activity of ethanolic *Ficus carica* L. extracts and antifungal discs against *C. krusei.*

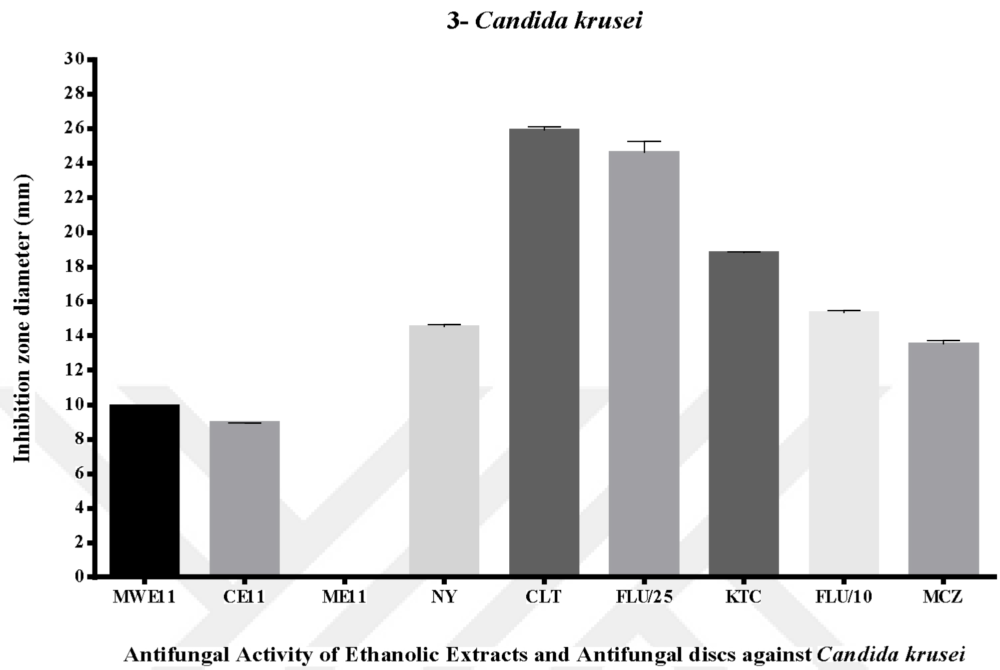


Figure A 173. Antifungal activity of *Ficus carica* L. ethanolic extracts and antifungal discs against *C. tropicalis.*

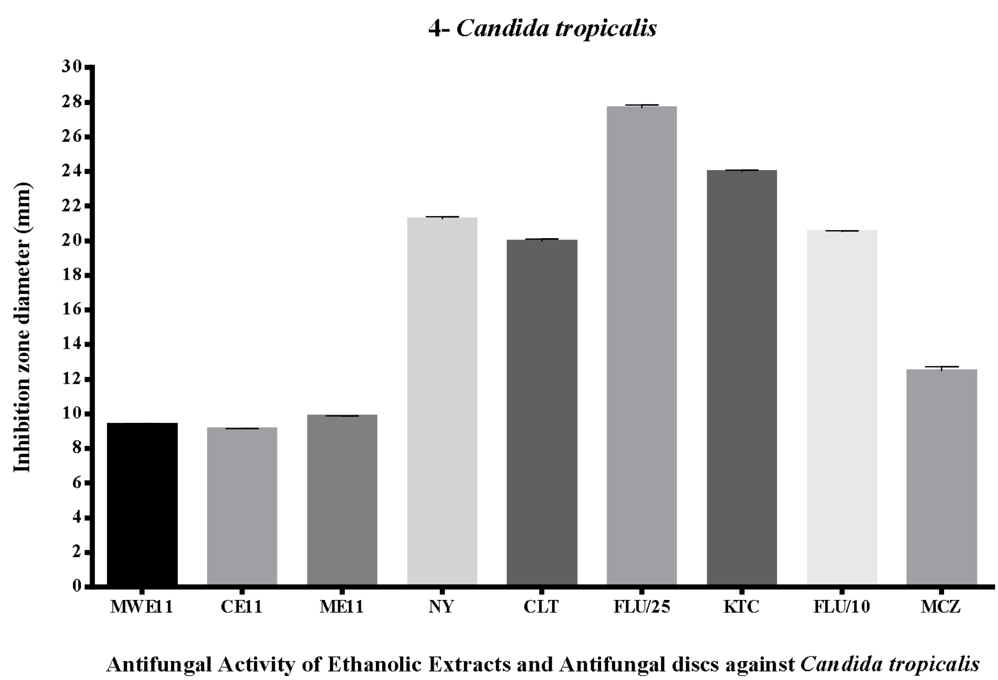


Figure A 174. Antifungal activity of *Ficus carica* L. ethanolic extracts and antifungal discs against *C. famata.*

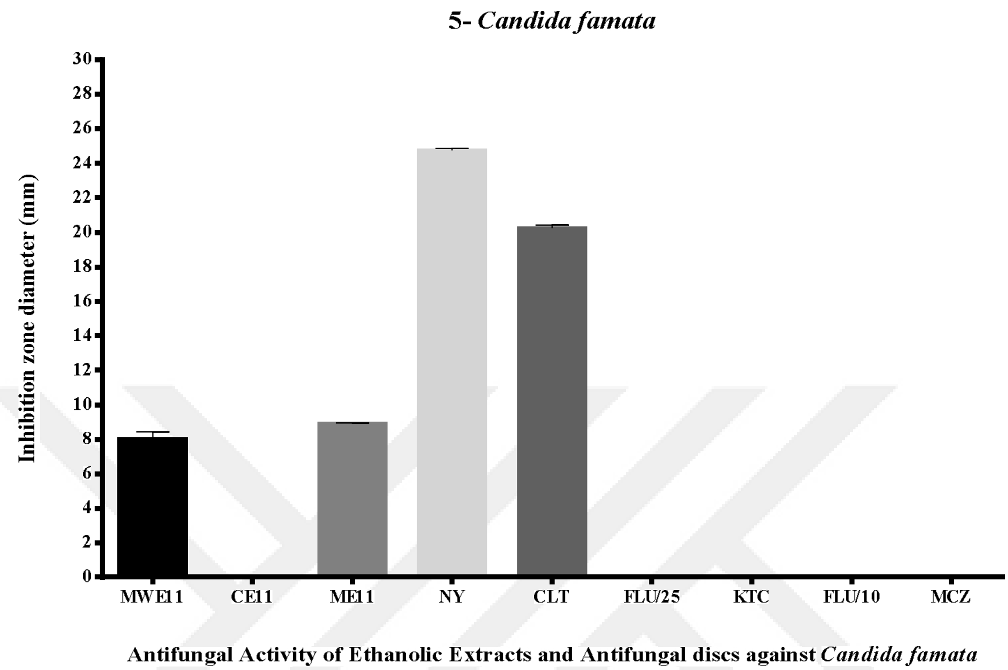


Figure A 175. Antifungal activity of *Ficus carica* L. ethanolic extracts and antifungal discs against *C. parapsilosis.*

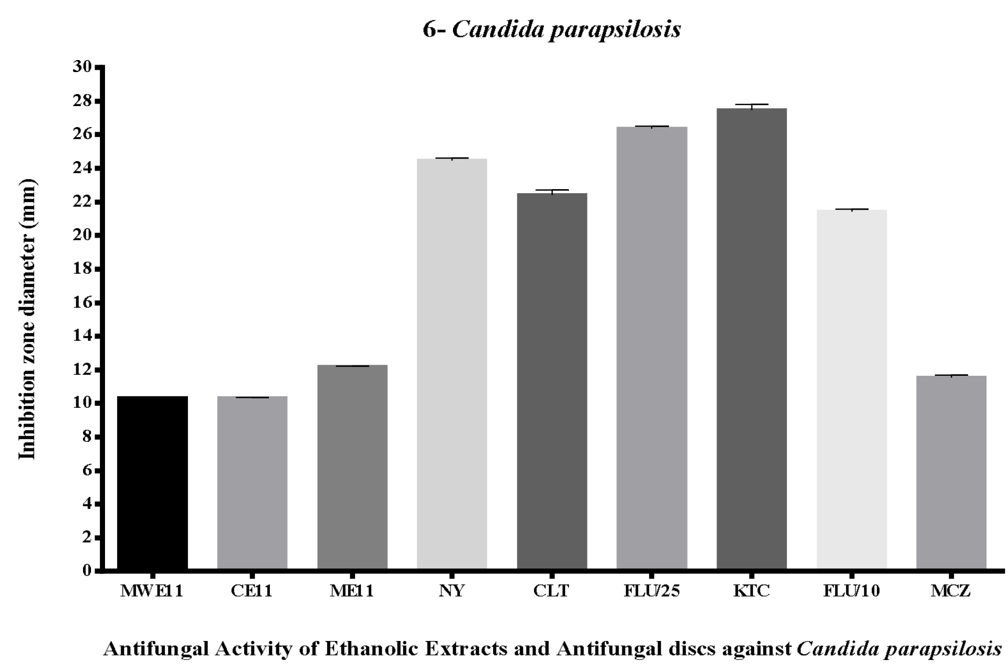
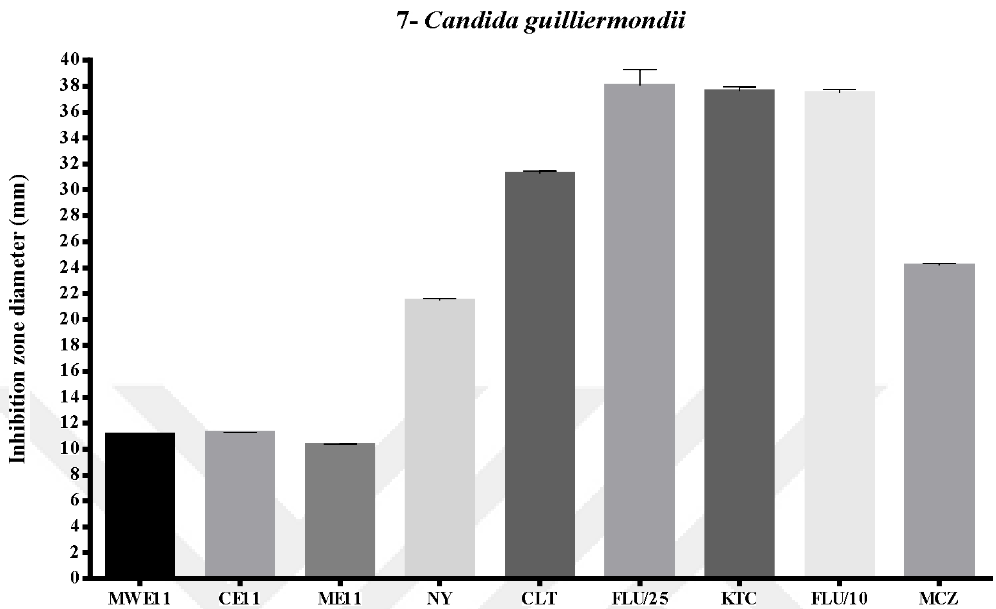
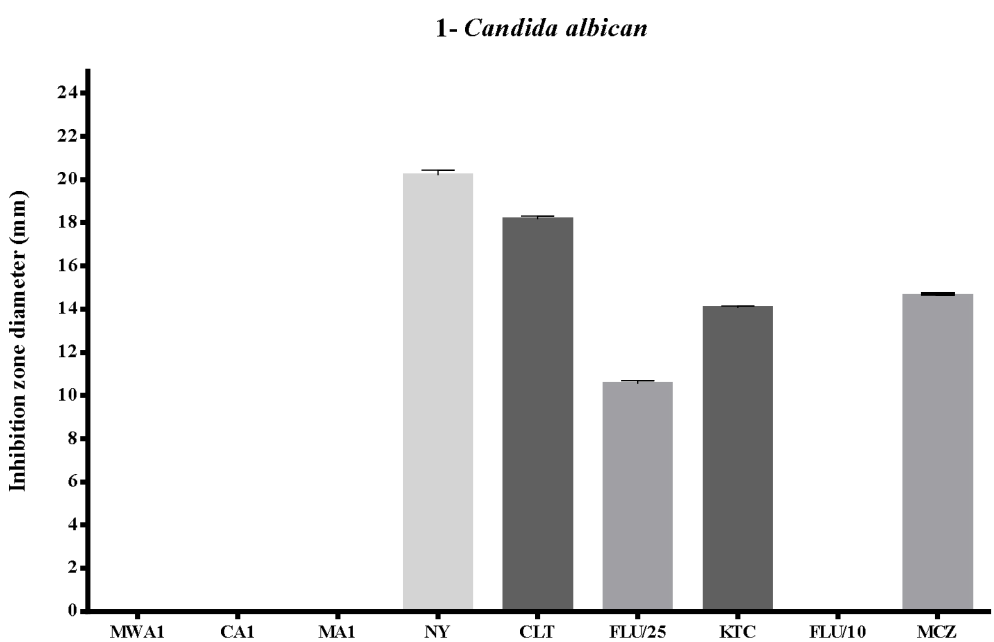


Figure A 176. Antifungal activity of *Ficus carica* L. ethanolic extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Ethanolic Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 177. Antifungal activity of *Acer monspessulanum* L. acetonitrile and antifungal discs against *C. albicans.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida albicans*

Figure A 178. Antifungal activity of *Acer monspessulanum* L. acetonitrile extracts and antifungal discs against *C. glabatra*

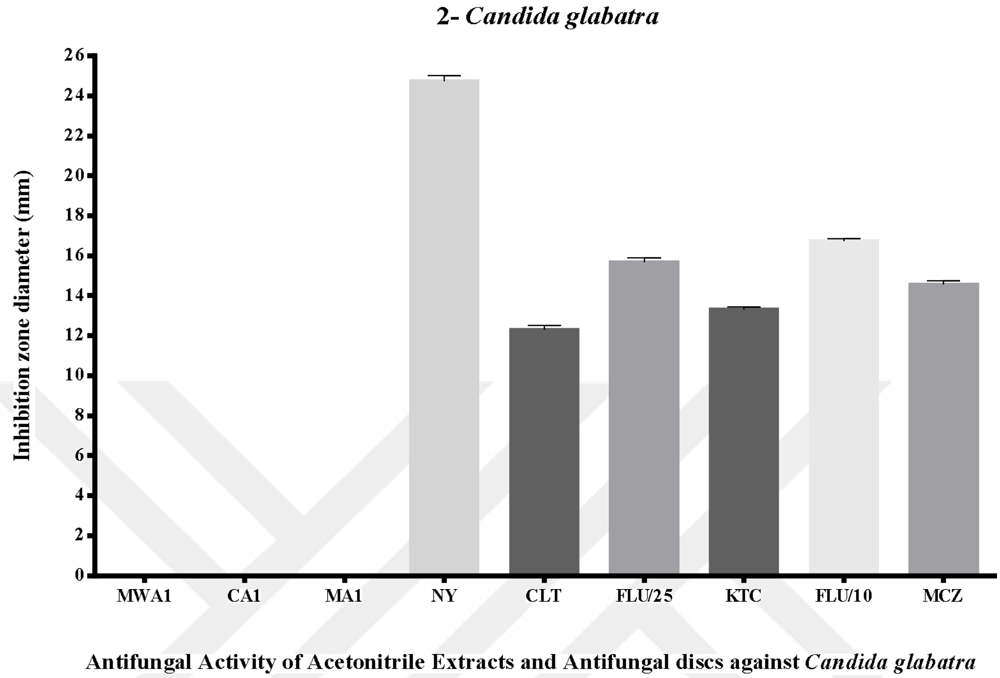


Figure A 179. Antifungal activity of *Acer monspessulanum* L. acetonitrile extracts and antifungal discs against *C. krusei.*

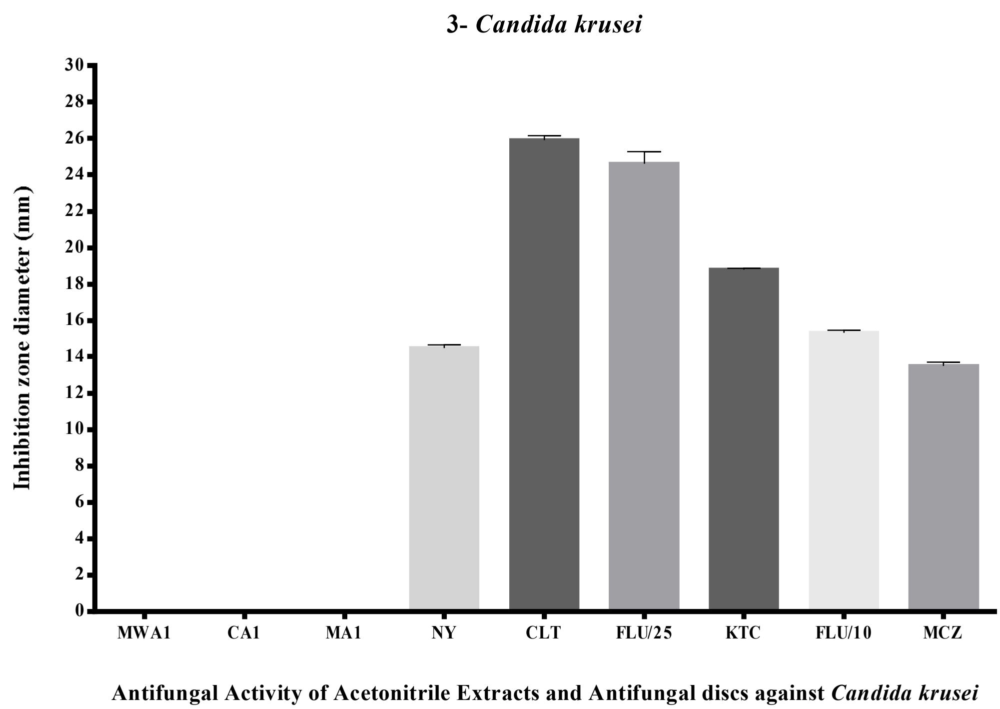


Figure A 180. Antifungal activity of *Acer monspessulanum* L. acetonitrile extracts and antifungal discs against *C. tropicalis.*

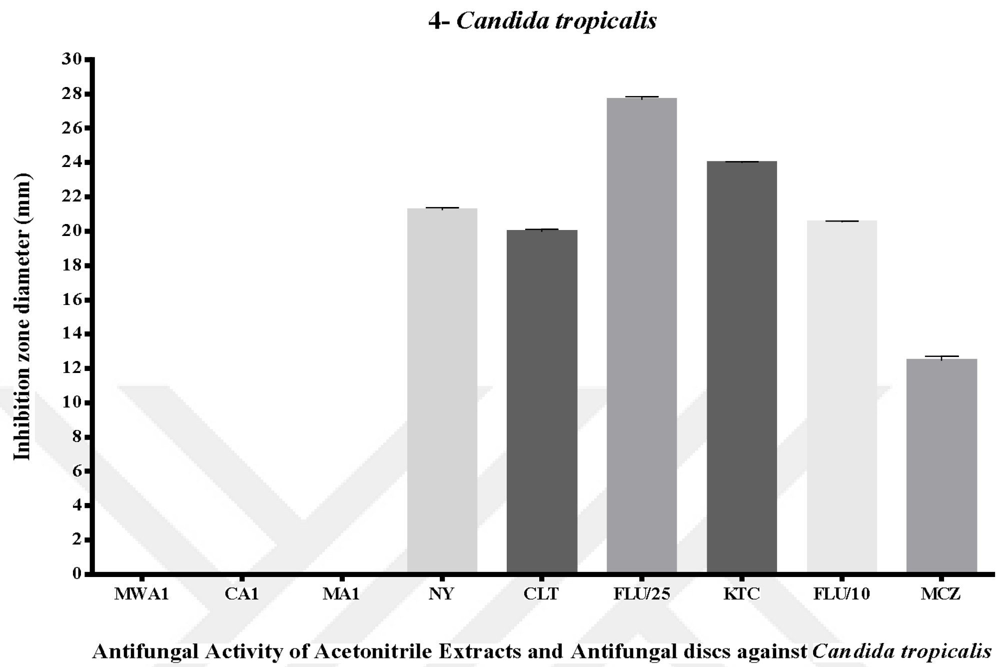


Figure A 181. Antifungal activity of *Acer monspessulanum* L. acetonitrile extracts and antifungal discs against *C. famata.*

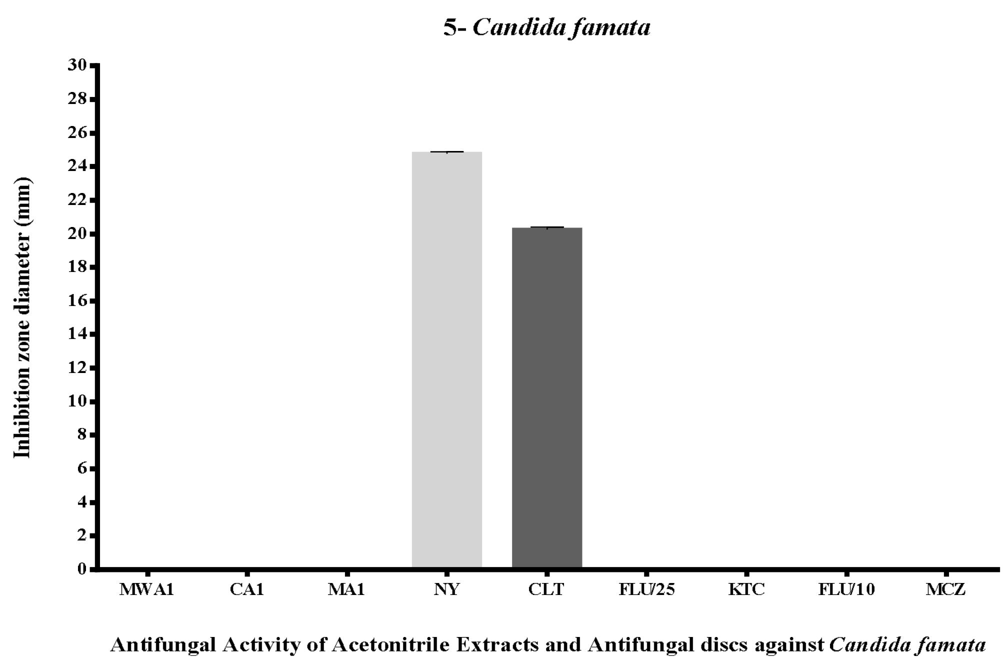


Figure A 182. Antifungal activity of *Acer monspessulanum* L. acetonitrile extracts and antifungal discs against *C. parapsilosis.*

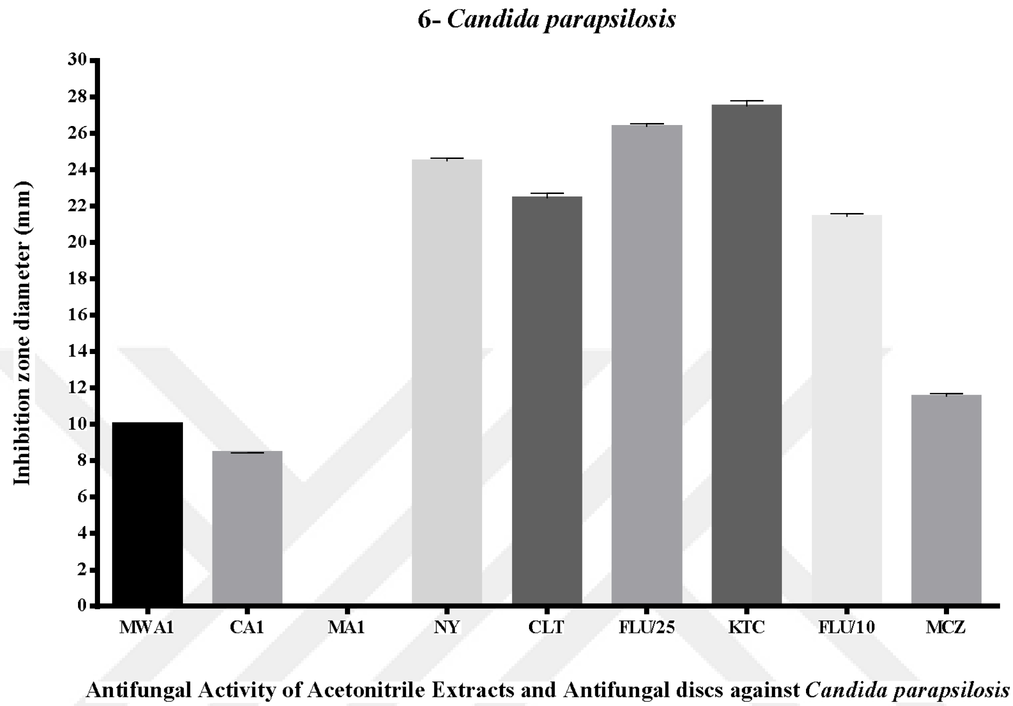


Figure A 183. Antifungal activity of *Acer monspessulanum* L. acetonitrile extracts and antifungal discs against *C. guilliermondii.*

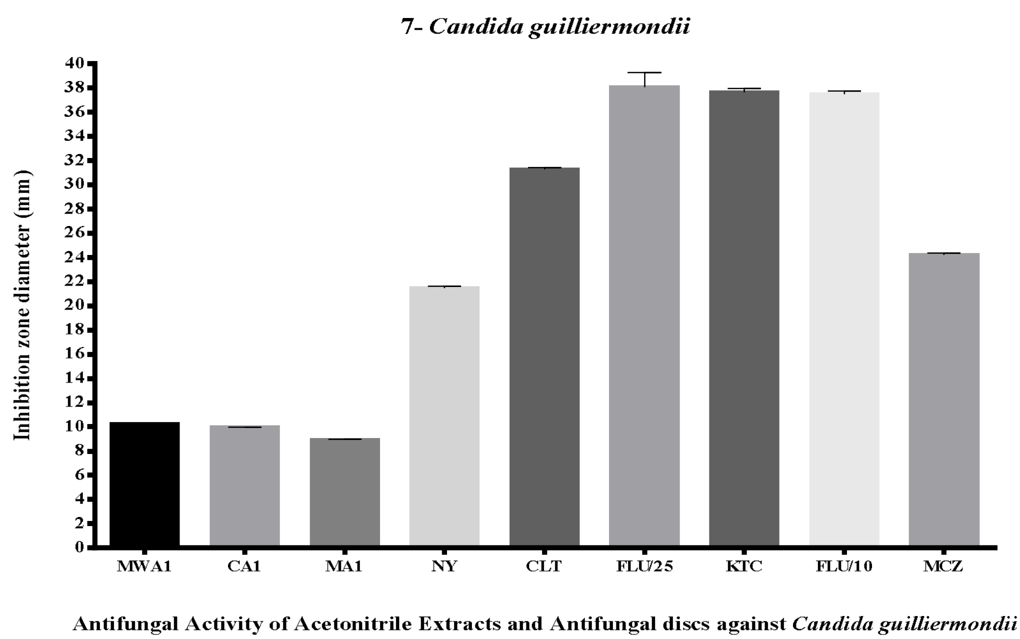


Figure A 184. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) acetonitrile extracts and antifungal discs against *C. albicans.*

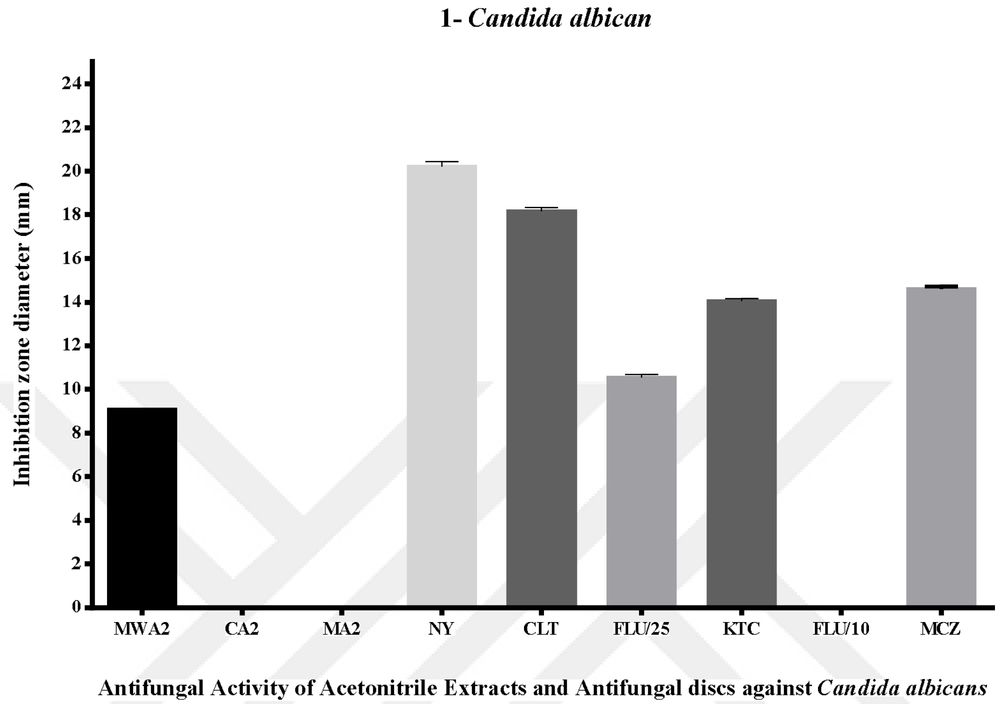


Figure A 185. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) acetonitrile extracts and antifungal discs against *C. glabatra.*

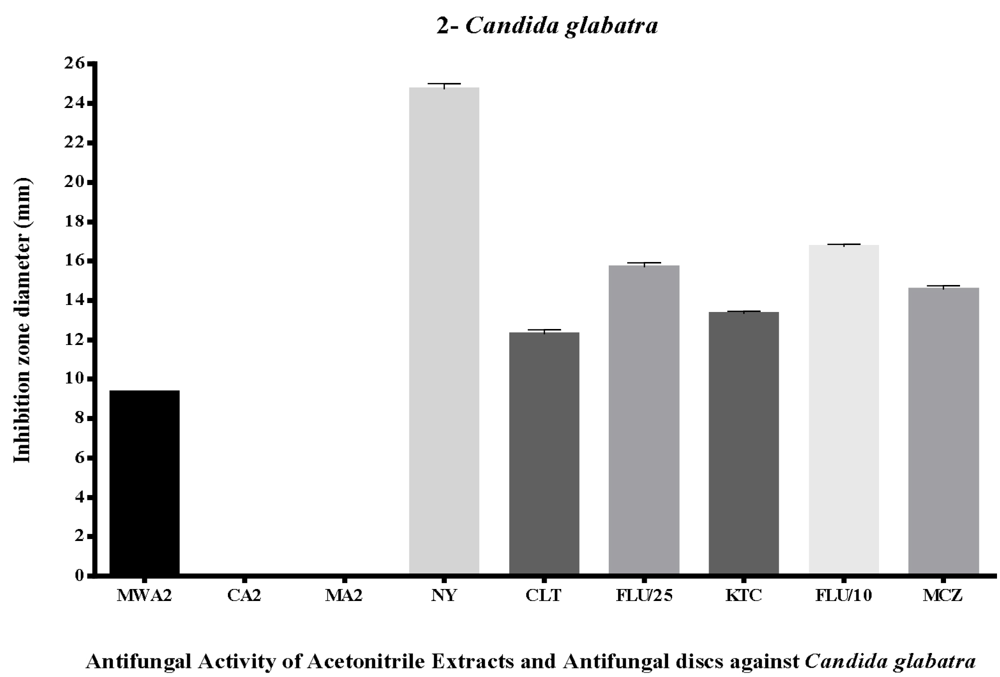


Figure A 186. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) acetonitrile extracts and antifungal discs against *C. krusei.*

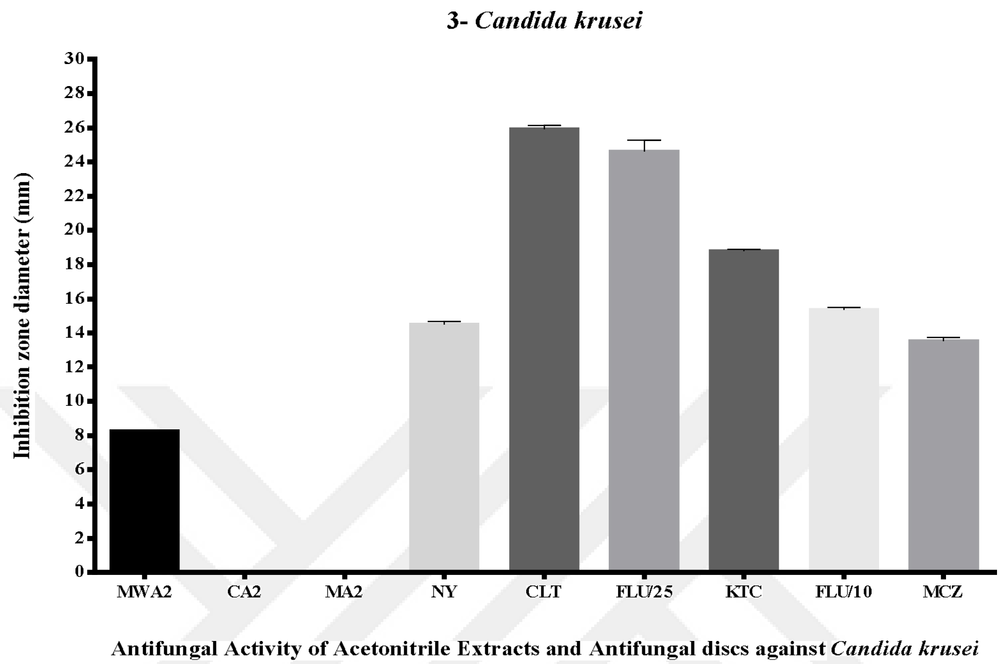


Figure A 187. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) acetonitrile extracts and antifungal discs against *C. tropicalis.*

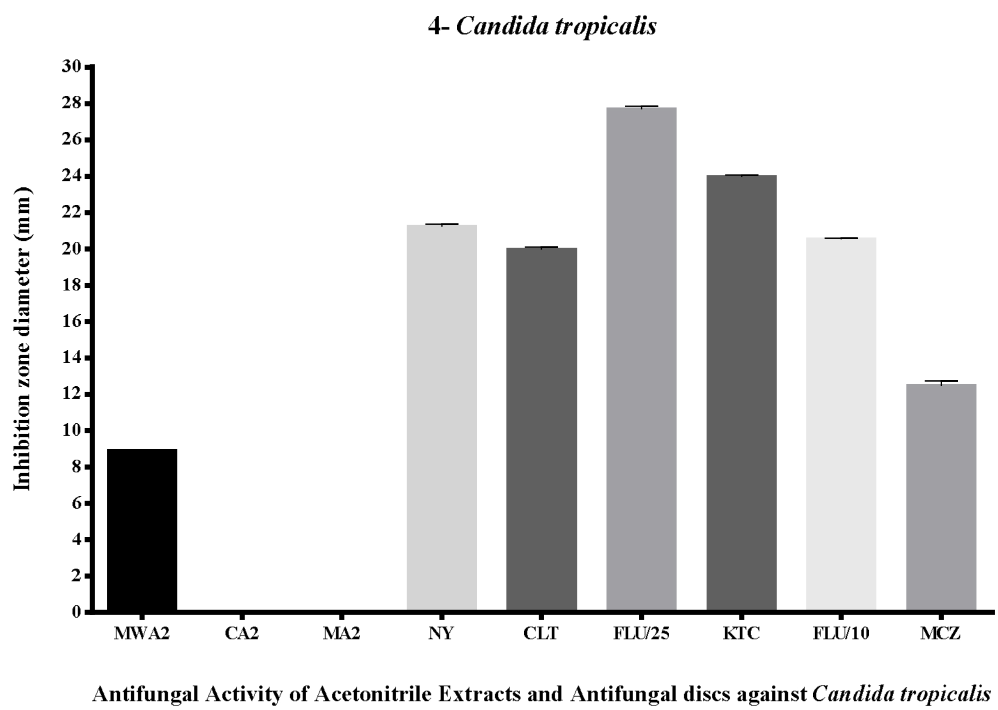


Figure A 188. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) acetonitrile extracts and antifungal discs against *C. famata*.

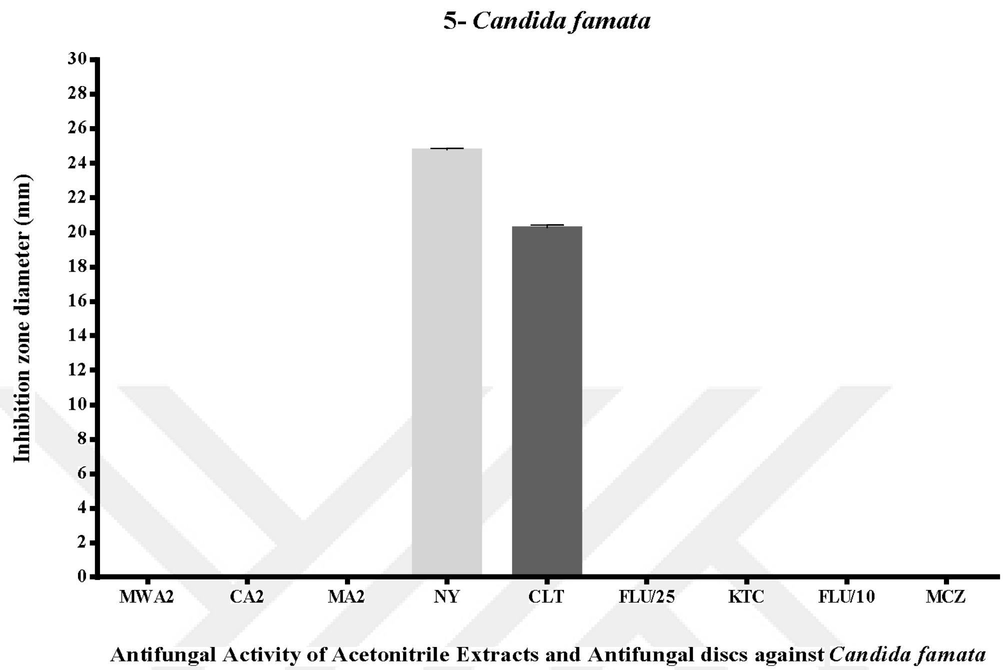


Figure A 189. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) acetonitrile extracts and antifungal discs against *C. parapsilosis*.

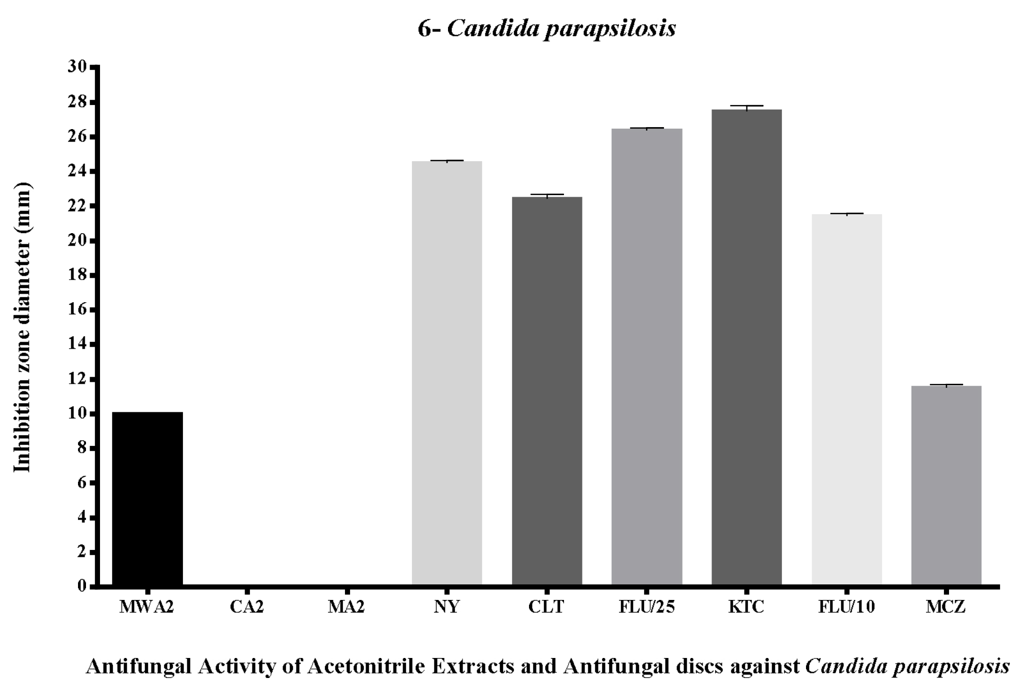


Figure A 190. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) acetonitrile extracts and antifungal discs against *C. guilliermondii.*

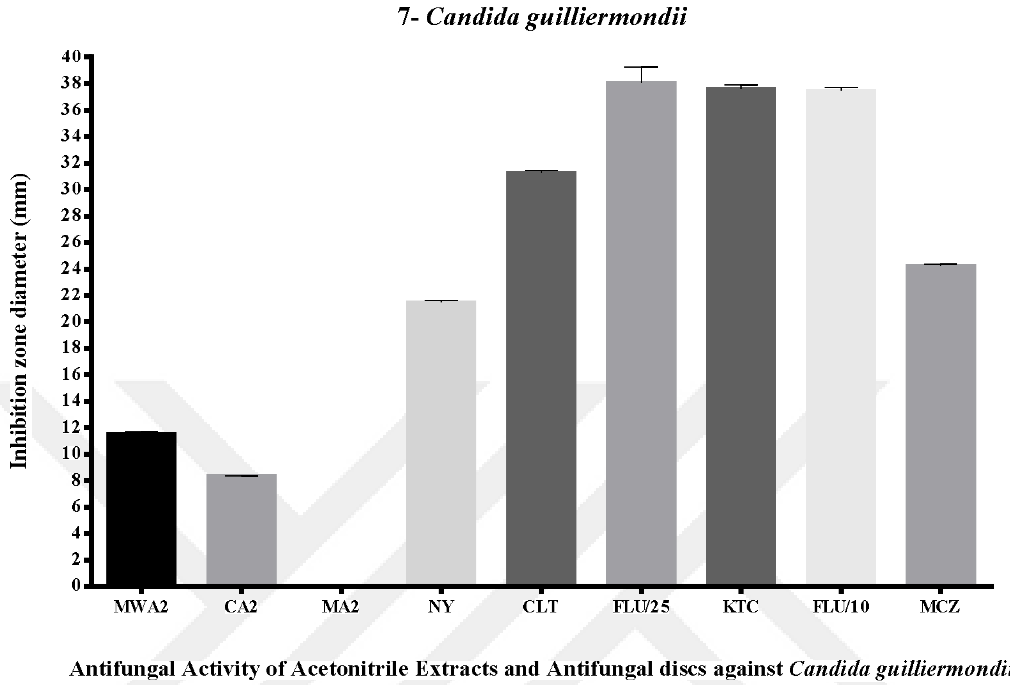


Figure A 191. Antifungal activity of *Ficus carica* L. acetonitrile extracts and antifungal discs against *C. albicans.*

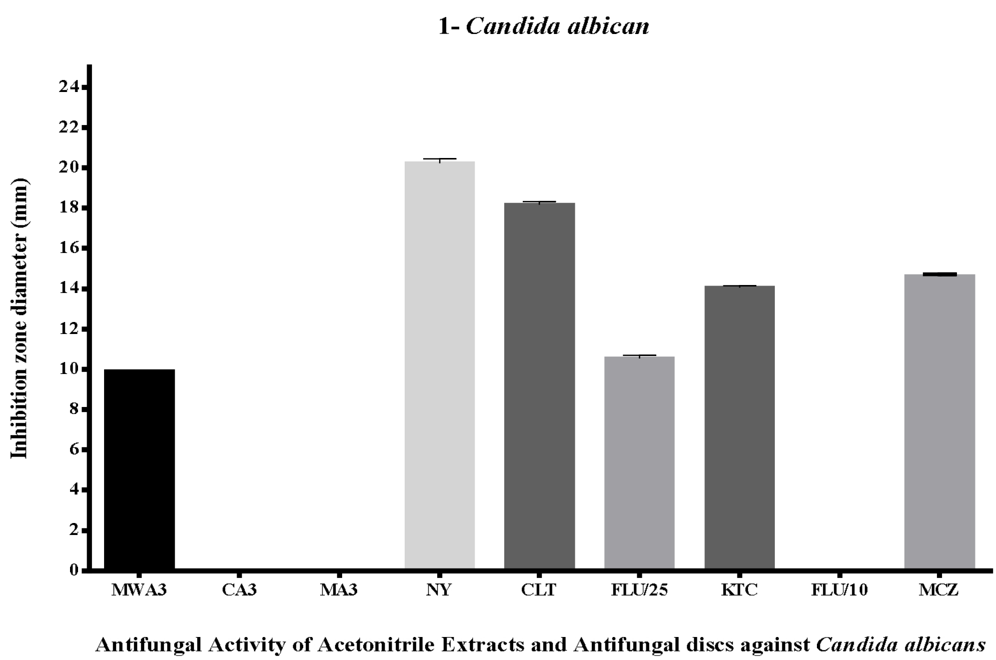


Figure A 192. Antifungal activity of *Ficus carica* L. acetonitrile extracts and antifungal discs against *C. glabatra*.

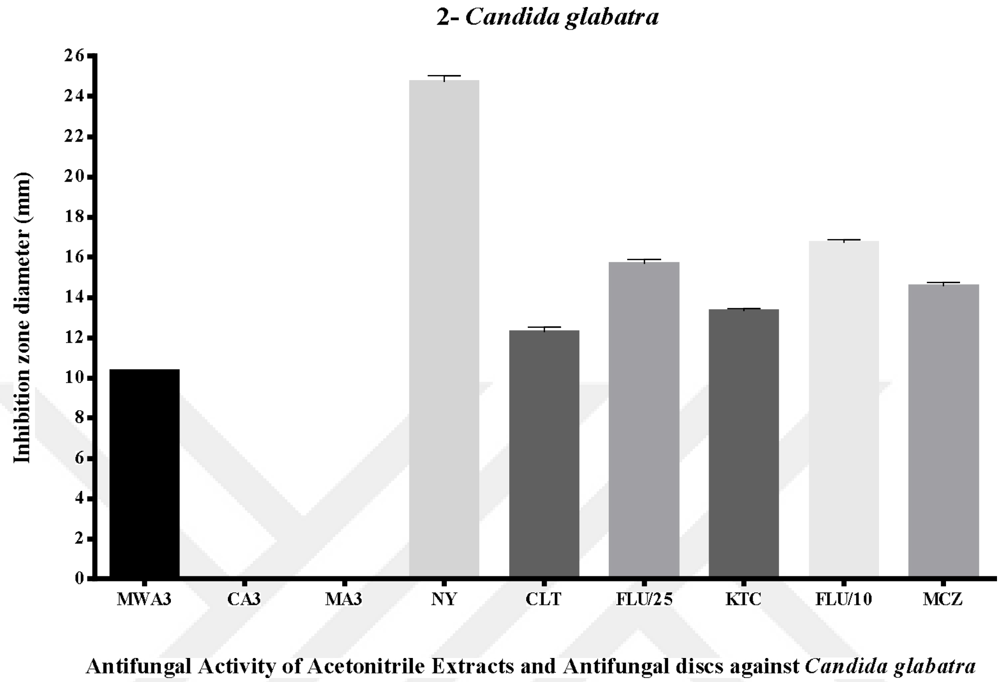


Figure A 193. Antifungal activity of *Pyrus syriaca* Boiss. acetonitrile extracts and antifungal discs against *C. krusei*.

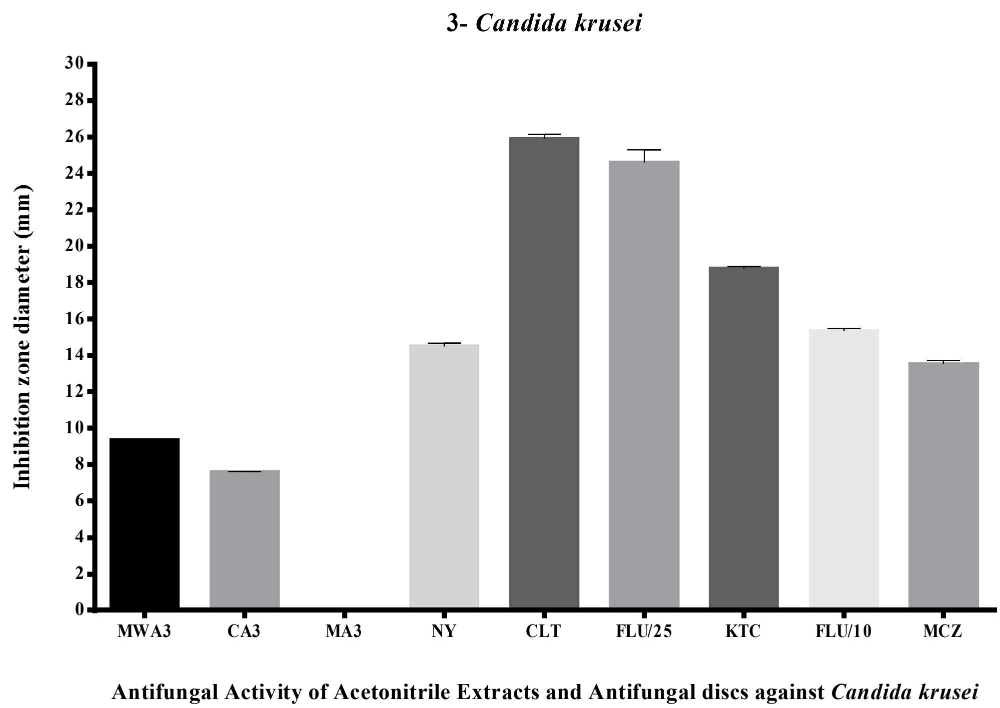


Figure A 194. Antifungal activity of *Pyrus syriaca* Boiss. acetonitrile extracts and antifungal discs against *C. tropicalis.*

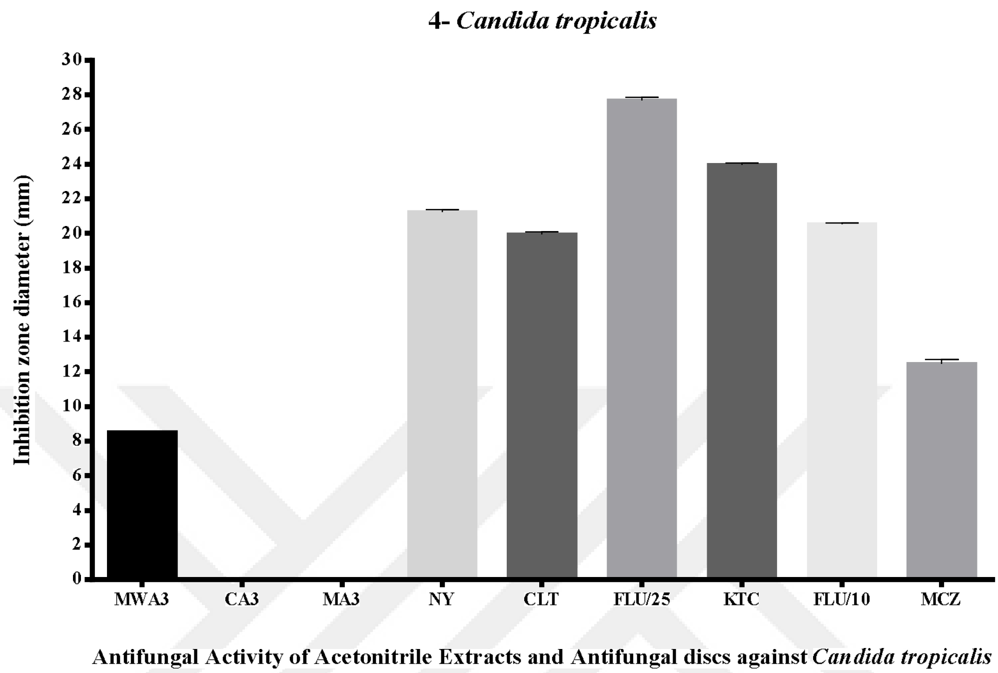


Figure A 195. Antifungal activity of *Pyrus syriaca* Boiss. acetonitrile extracts and antifungal discs against *C. famata.*

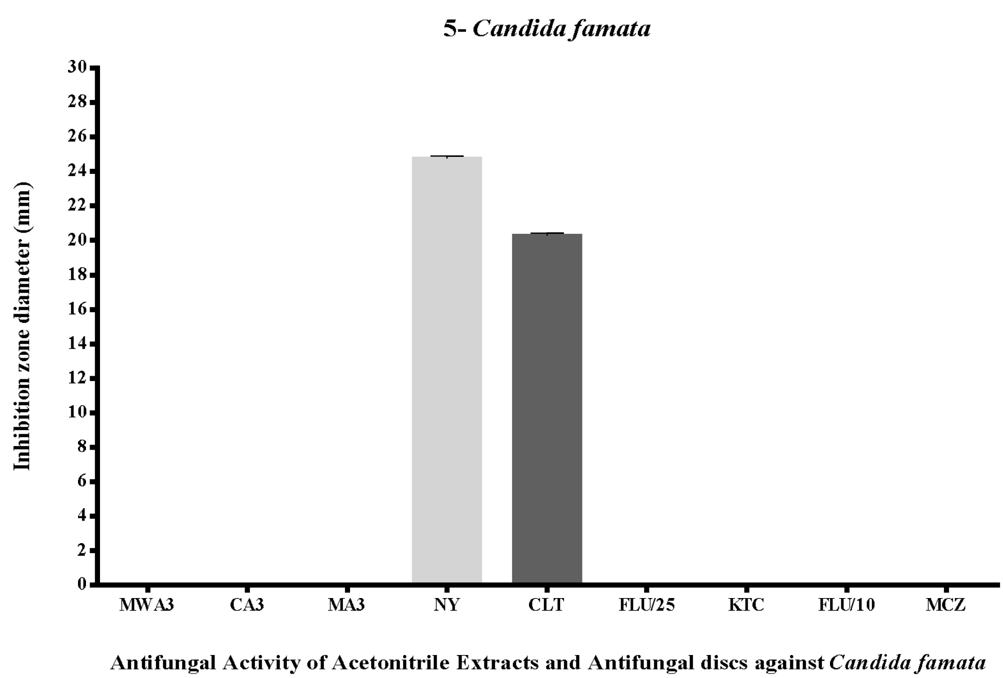
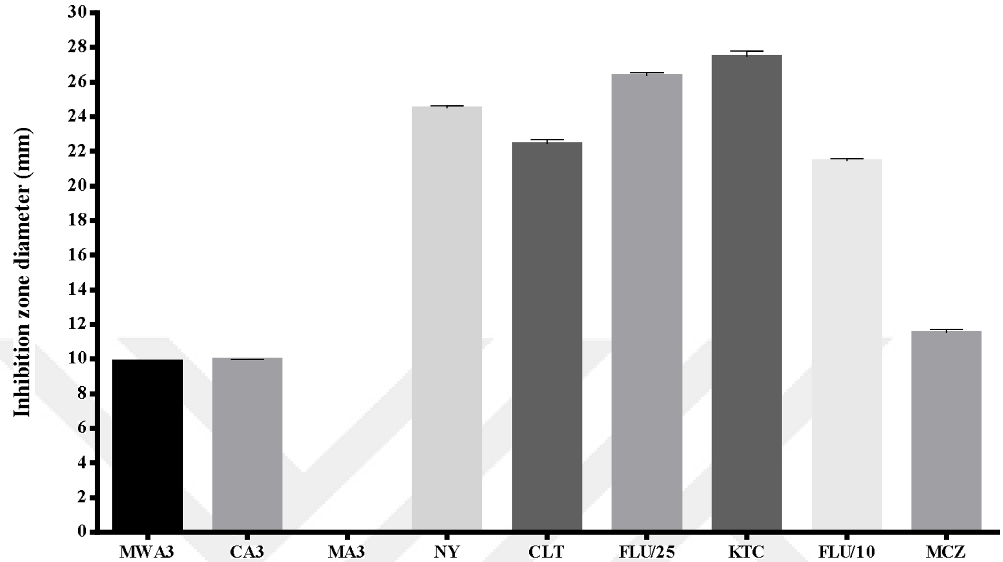


Figure A 196. Antifungal activity of *Pyrus syriaca* Boiss. acetonitrile extracts and antifungal discs against *C. parapsilosis.*

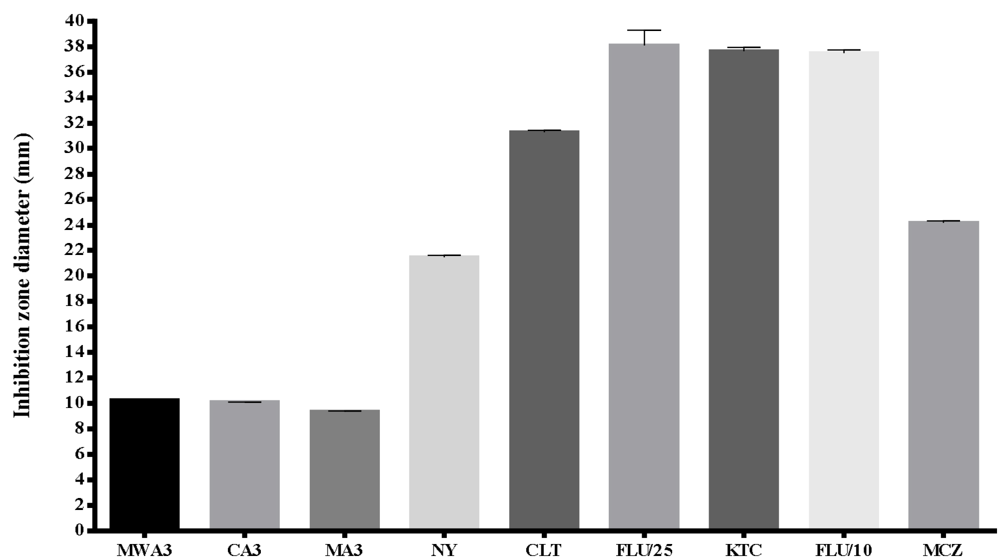
6- *Candida parapsilosis*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida parapsilosis*

Figure A 197. Antifungal activity of *Pyrus syriaca* Boiss. acetonitrile extracts and antifungal discs against *C. guilliermondii.*

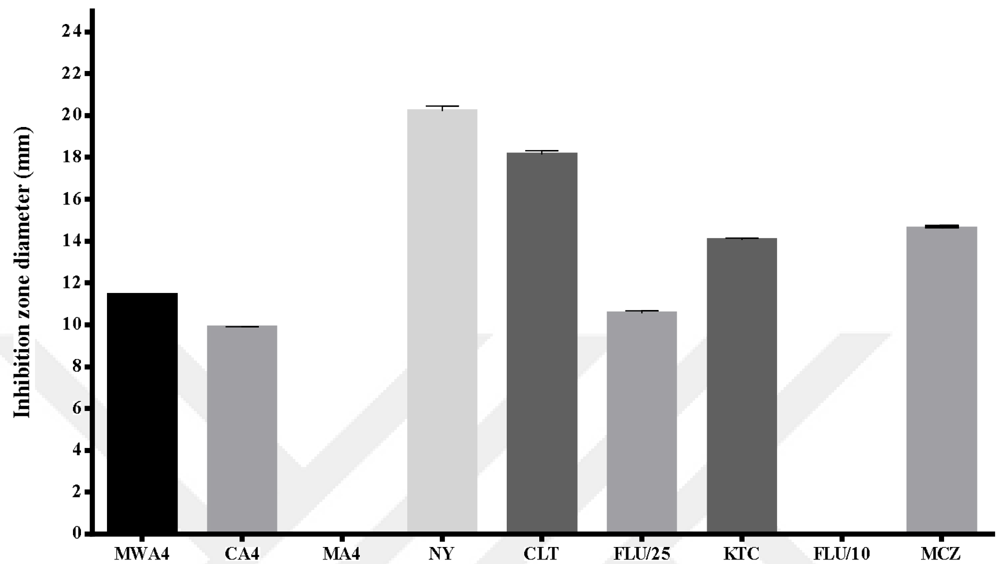
7- *Candida guilliermondii*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 198. Antifungal activity of *Quercus infectoria* Oliv. acetonitrile extracts and antifungal discs against *C. albicans*.

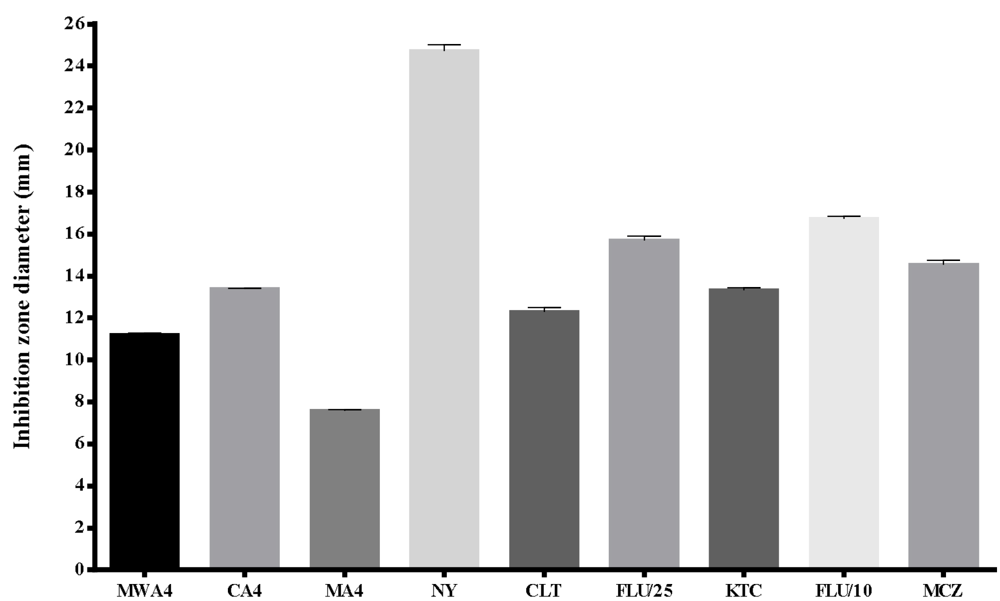
1- *Candida albican*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida albicans*

Figure A 199. Antifungal activity of *Quercus infectoria* Oliv. acetonitrile extracts and antifungal discs against *C. glabatra*.

2- *Candida glabatra*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida glabatra*

Figure A 200. Antifungal activity of *Quercus infectoria* Oliv. acetonitrile extracts and antifungal discs against *C. krusei.*

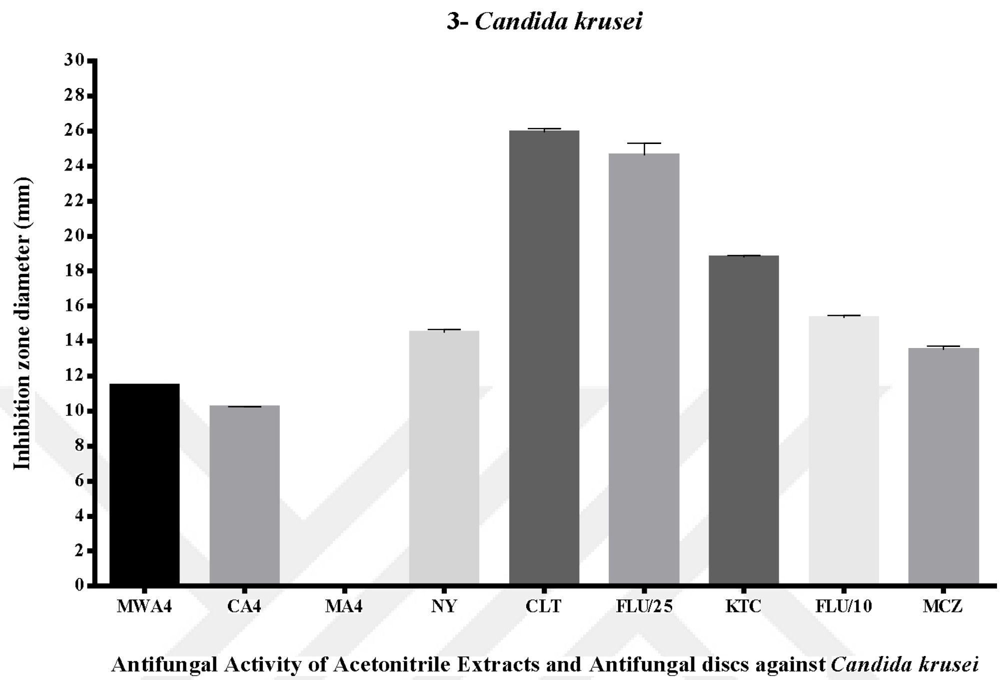


Figure A 201. Antifungal activity of *Quercus infectoria* Oliv. acetonitrile extracts and antifungal discs against *C. tropicalis.*

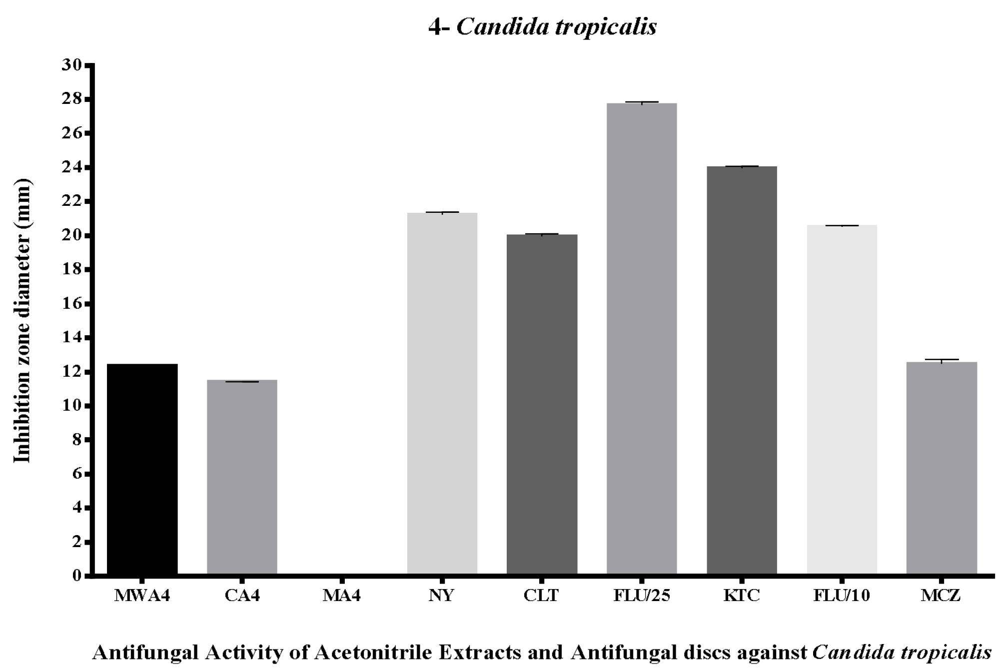


Figure A 202. Antifungal activity of *Quercus infectoria* Oliv. acetonitrile extracts and antifungal discs against *C. famata.*

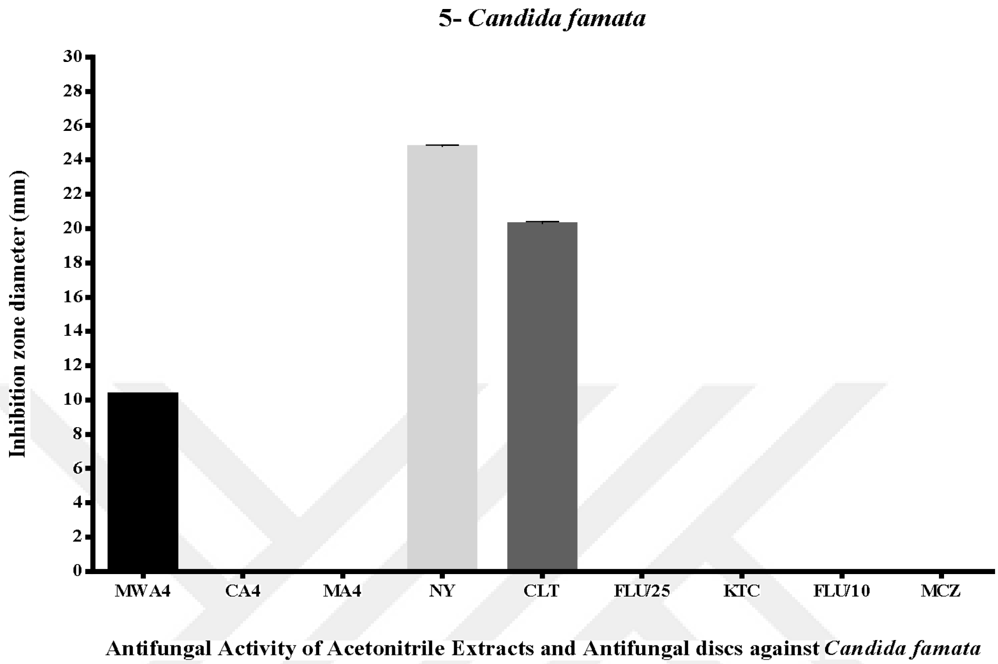


Figure A 203. Antifungal activity of *Quercus infectoria* Oliv. acetonitrile extracts and antifungal discs against *C. parapsilosis.*

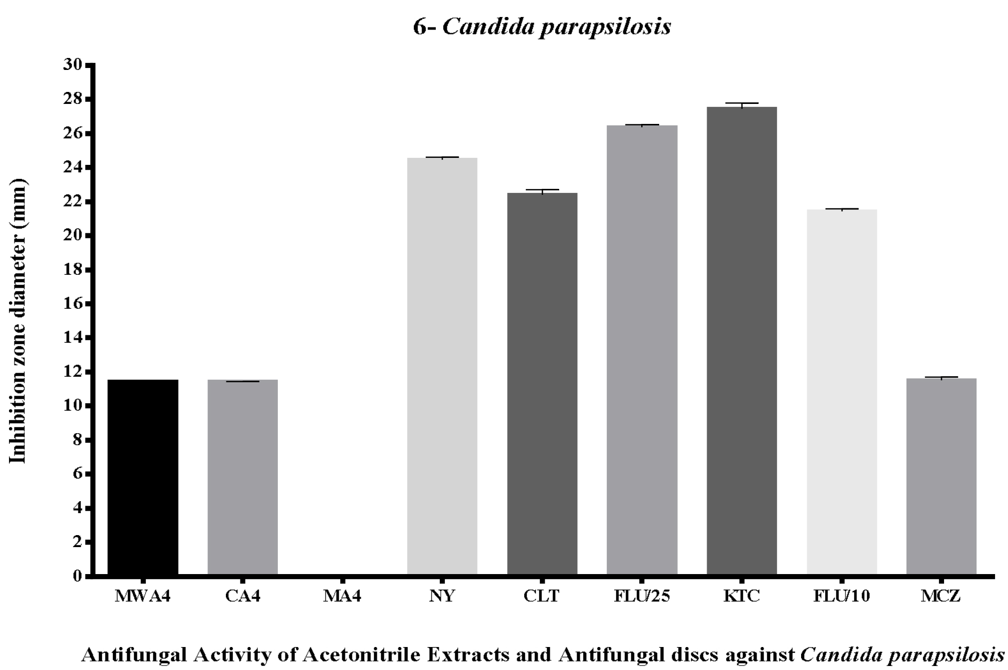
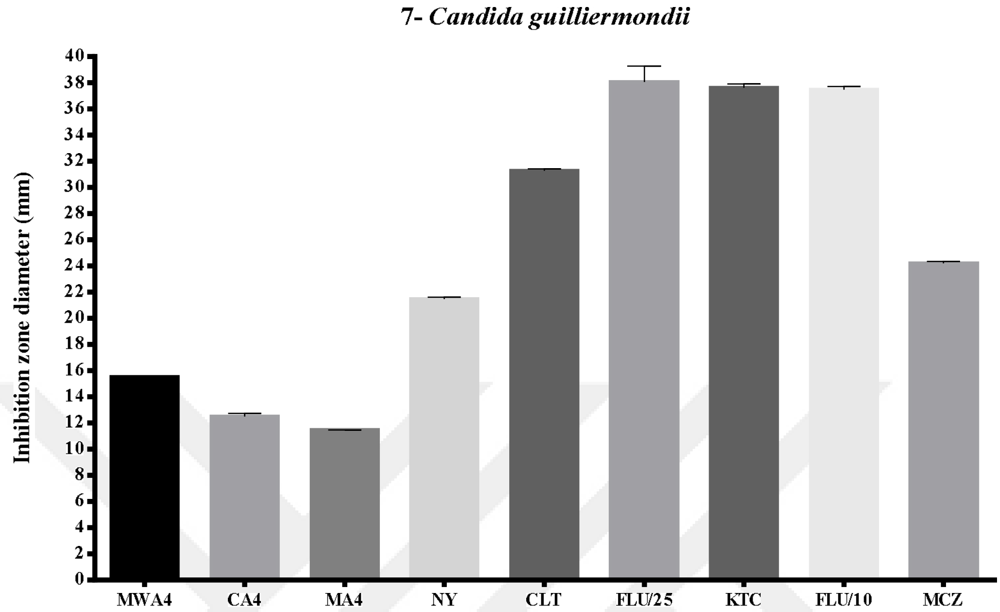
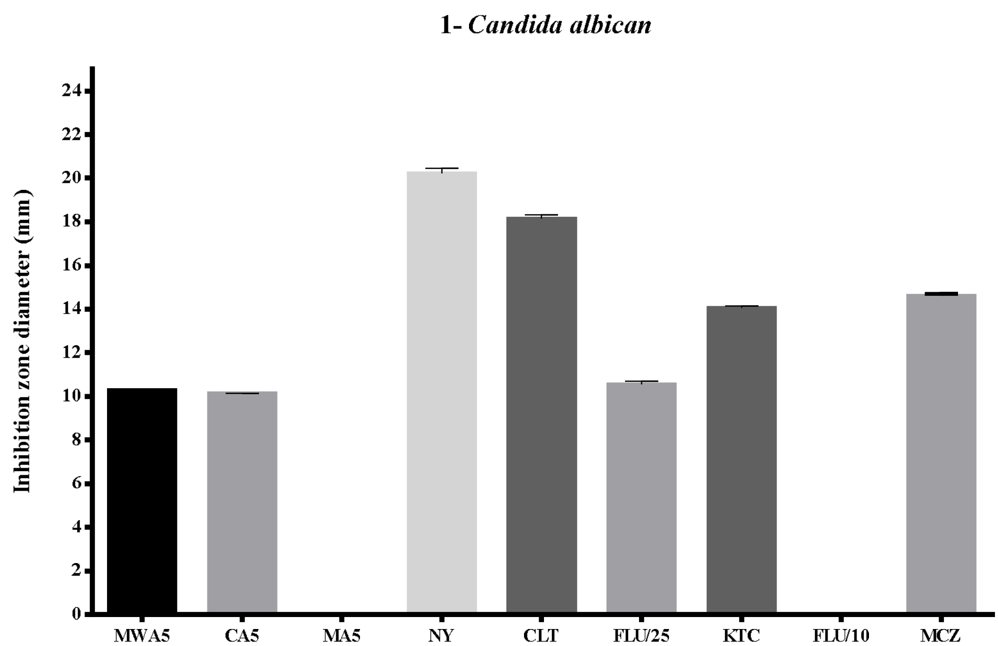


Figure A 204. Antifungal activity of *Quercus infectoria* Oliv. acetonitrile extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 205. Antifungal activity of *Quercus aegilops* L. acetonitrile extracts and antifungal discs against *C. albicans*.



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida albicans*

Figure A 206. Antifungal activity of *Quercus aegilops* L. acetonitrile extracts and antifungal discs against *C. glabatra*.

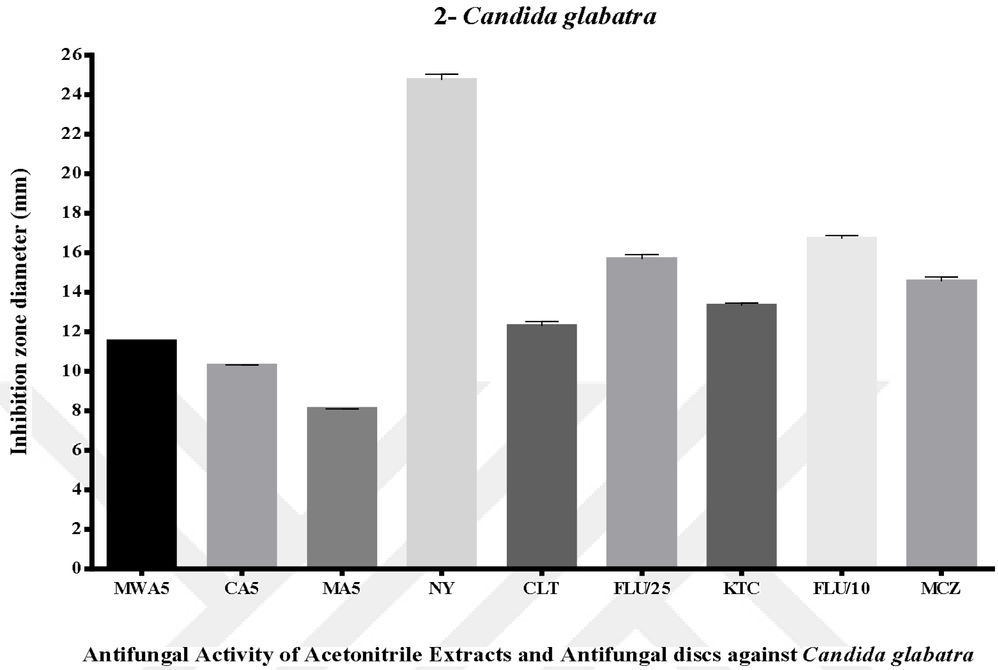


Figure A 207. Antifungal activity of *Quercus aegilops* L. acetonitrile extracts and antifungal discs against *C. krusei.*

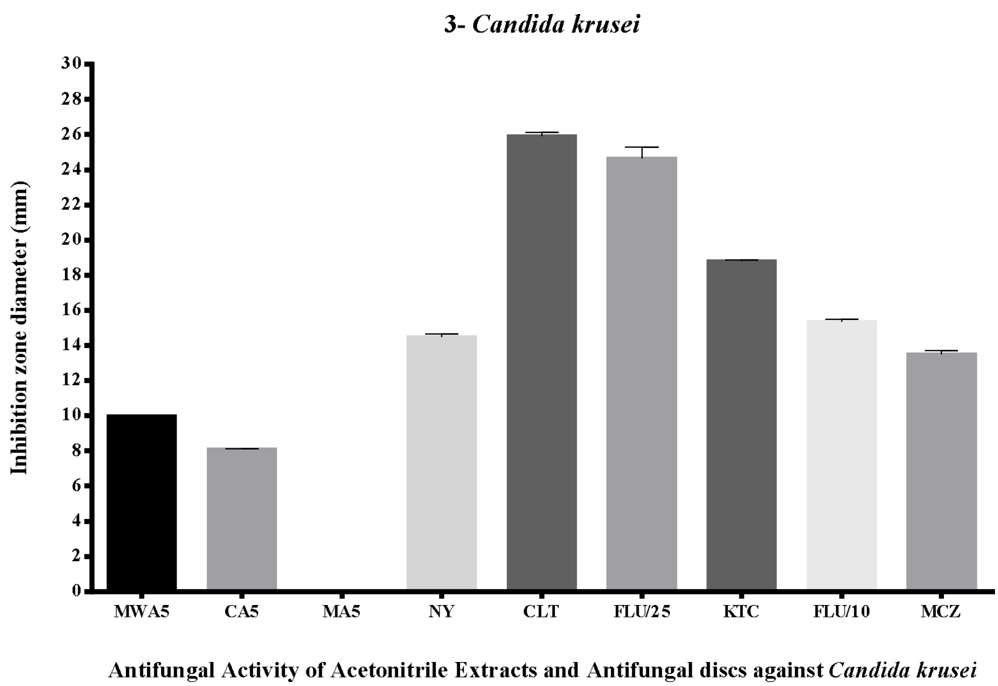
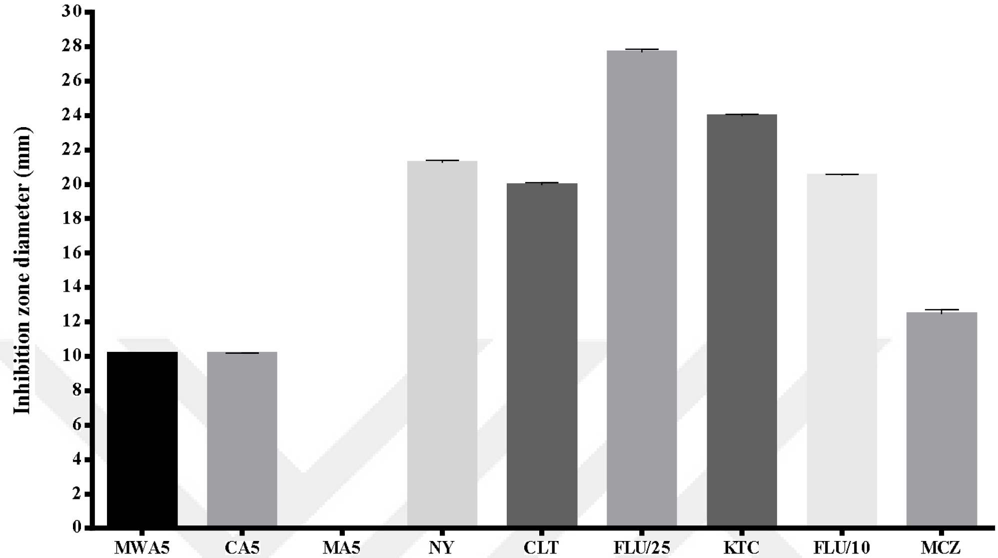


Figure A 208. Antifungal activity of *Quercus aegilops* L. acetonitrile extracts and antifungal discs against *C. tropicalis.*

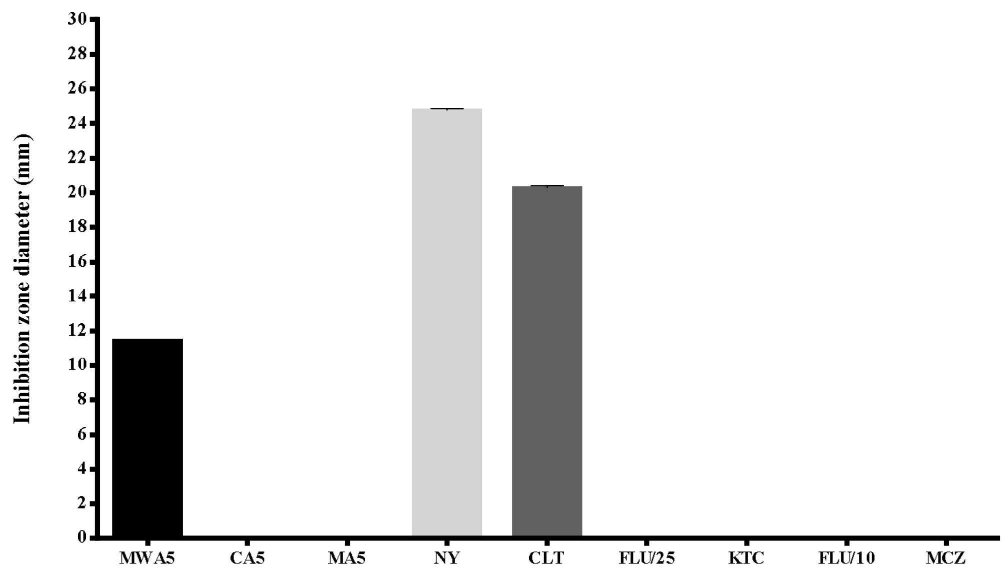
4- *Candida tropicalis*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida tropicalis*

Figure A 209. Antifungal activity of *Quercus aegilops* L. acetonitrile extracts and antifungal discs against *C. famata.*

5- *Candida famata*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida famata*

Figure A 210. Antifungal activity of *Quercus aegilops* L. acetonitrile extracts and antifungal discs against *C. parapsilosis.*

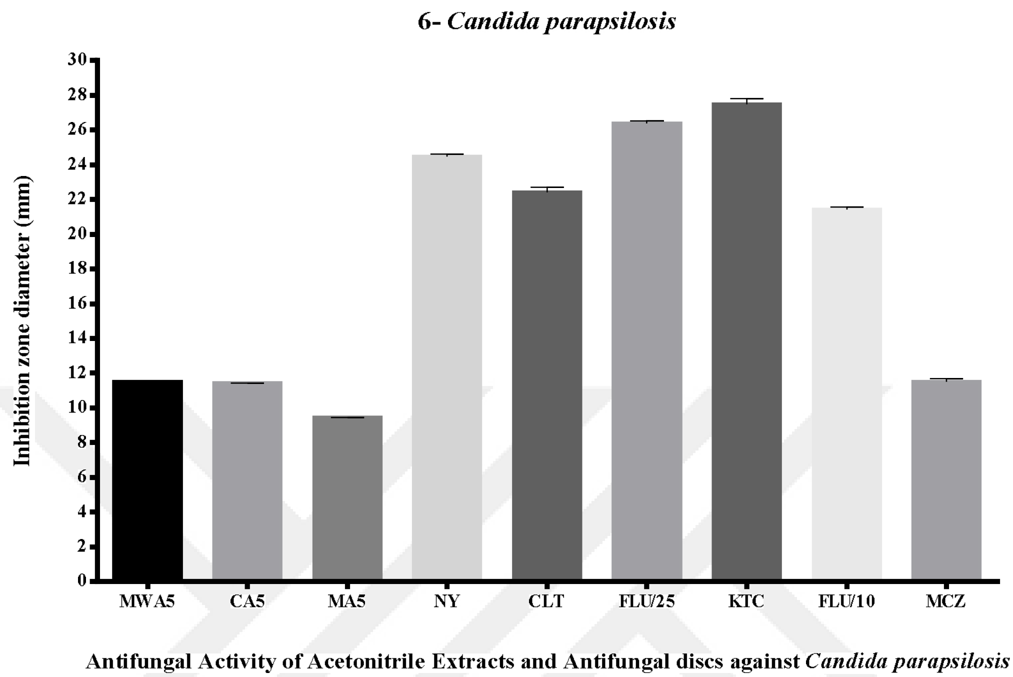


Figure A 211. Antifungal activity of *Quercus aegilops* L. acetonitrile extracts and antifungal discs against *C. guilliermondii.*

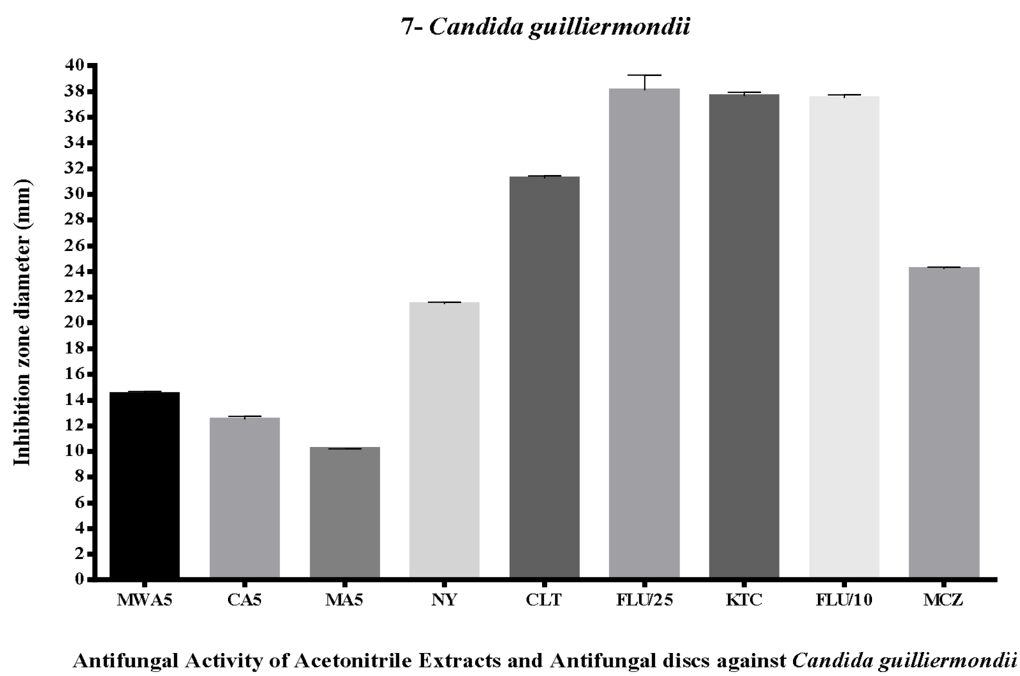


Figure A 212. Antifungal activity of *Crataegus monogyna* Jacquin acetonitrile extracts and antifungal discs against *C. albicans.*

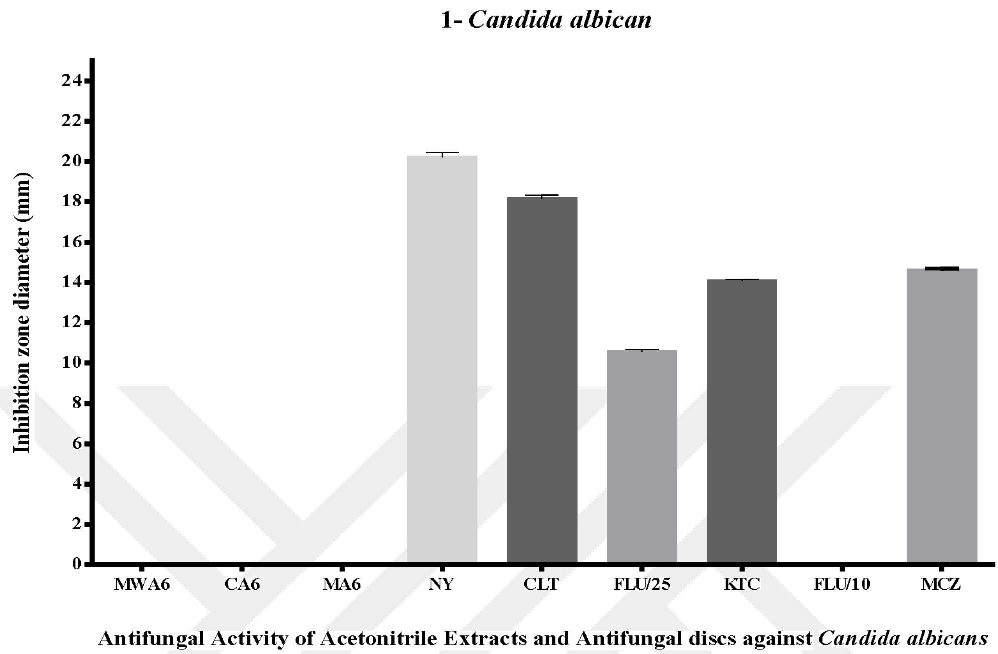


Figure A 213. Antifungal activity of *Crataegus monogyna* Jacquin acetonitrile extracts and antifungal discs against *C. glabatra.*

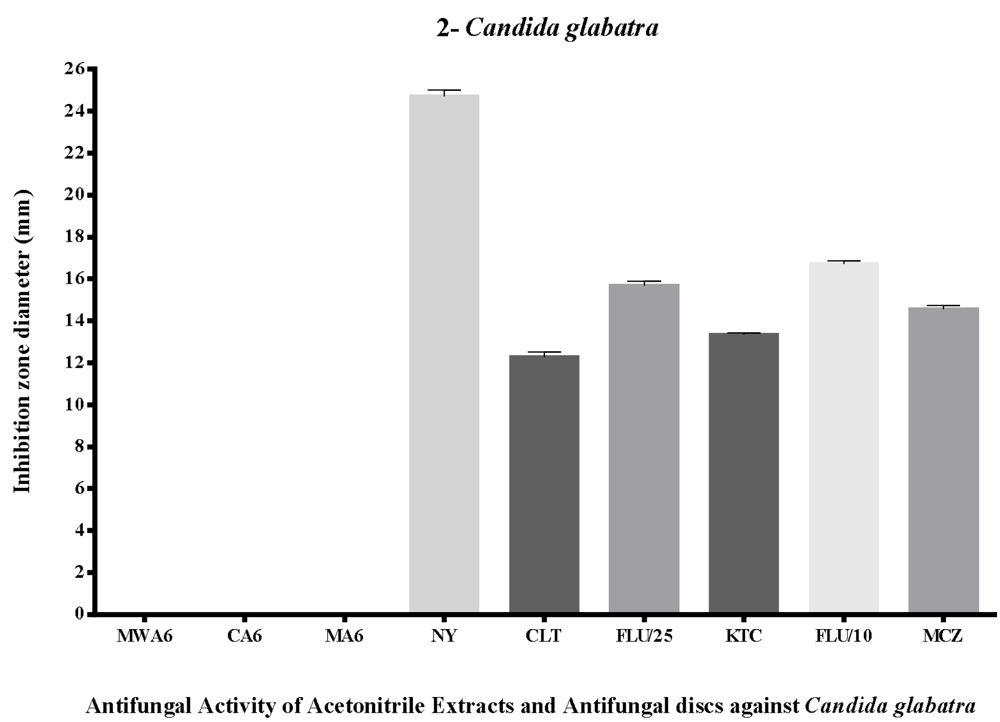


Figure A 214. Antifungal activity of *Crataegus monogyna* Jacquin acetonitrile extracts and antifungal discs against *C. krusei.*

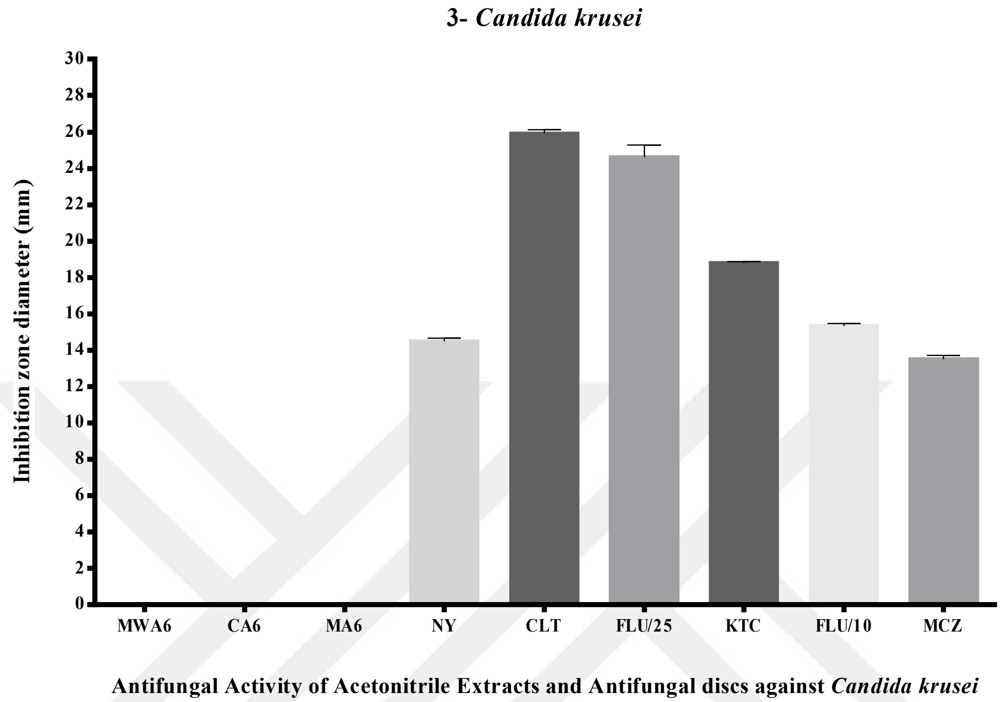


Figure A 215. Antifungal activity of *Crataegus monogyna* Jacquin acetonitrile extracts and antifungal discs against *C. tropicalis.*

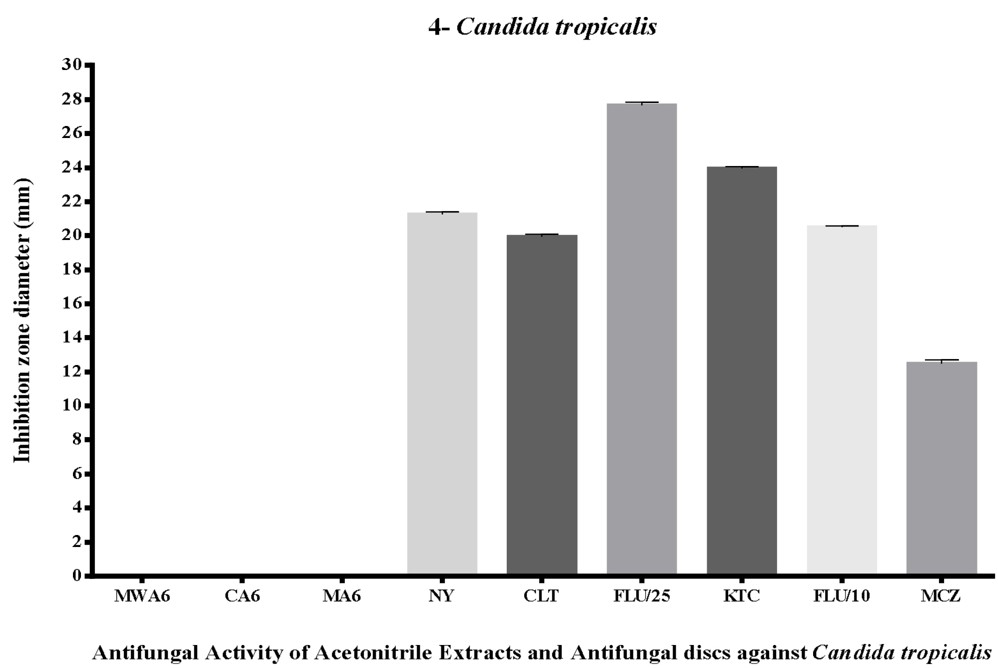


Figure A 216. Antifungal activity of *Crataegus monogyna* Jacquin acetonitrile extracts and antifungal discs against *C. famata.*

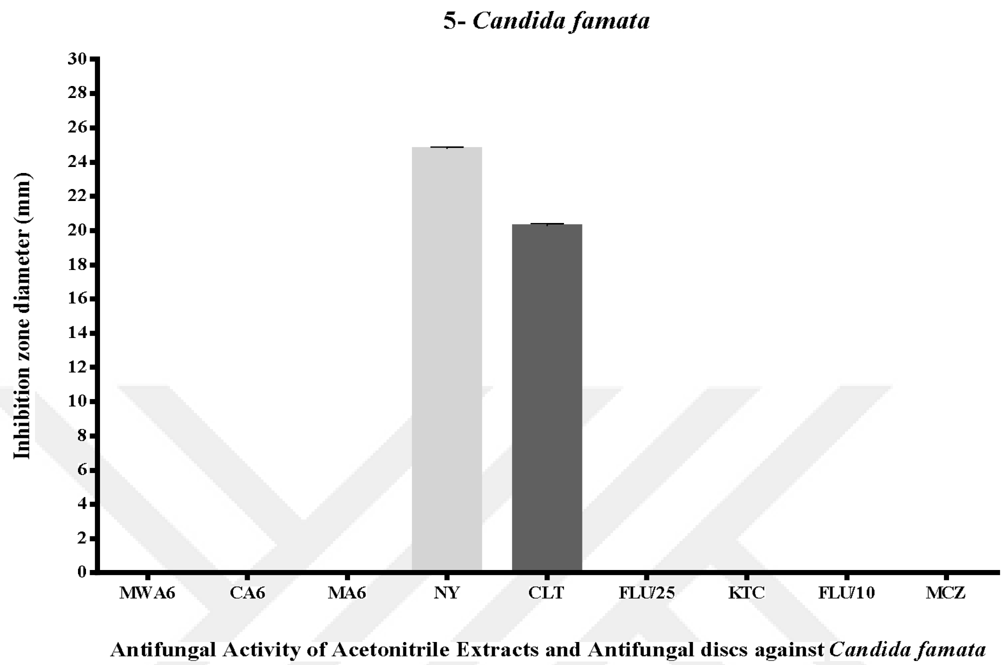


Figure A 217. Antifungal activity of *Crataegus monogyna* Jacquin acetonitrile extracts and antifungal discs against *C. parapsilosis.*

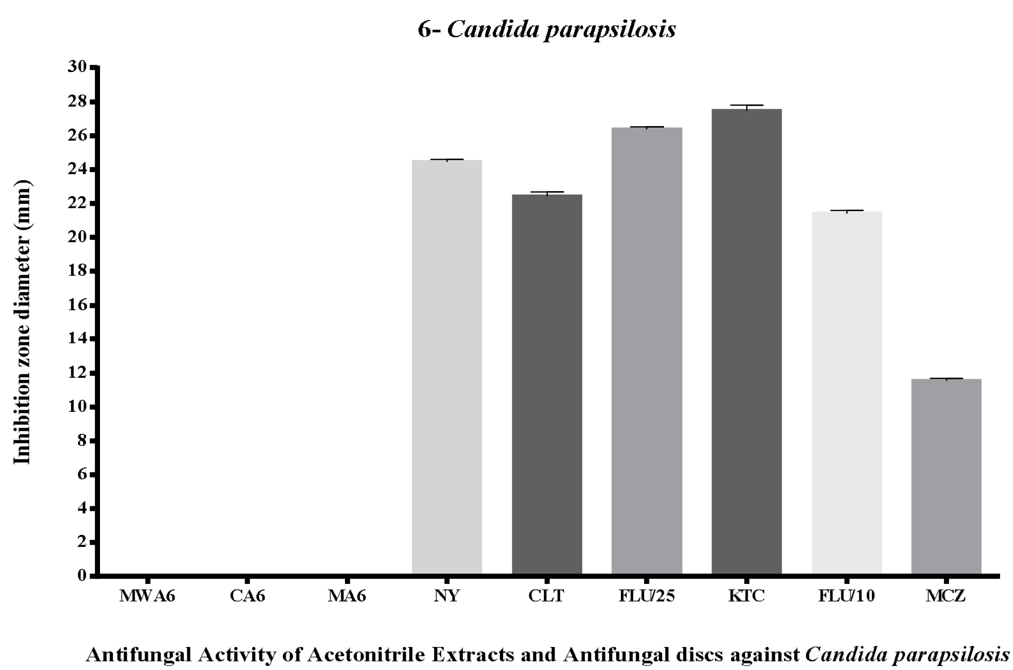
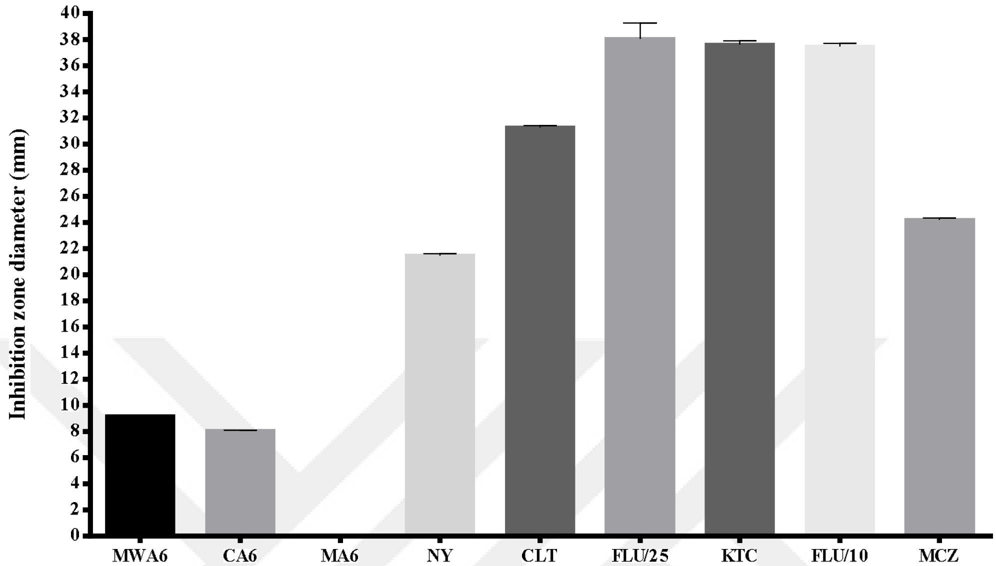


Figure A 218. Antifungal activity of *Crataegus monogyna* Jacquin acetonitrile extracts and antifungal discs against *C. guilliermondii.*

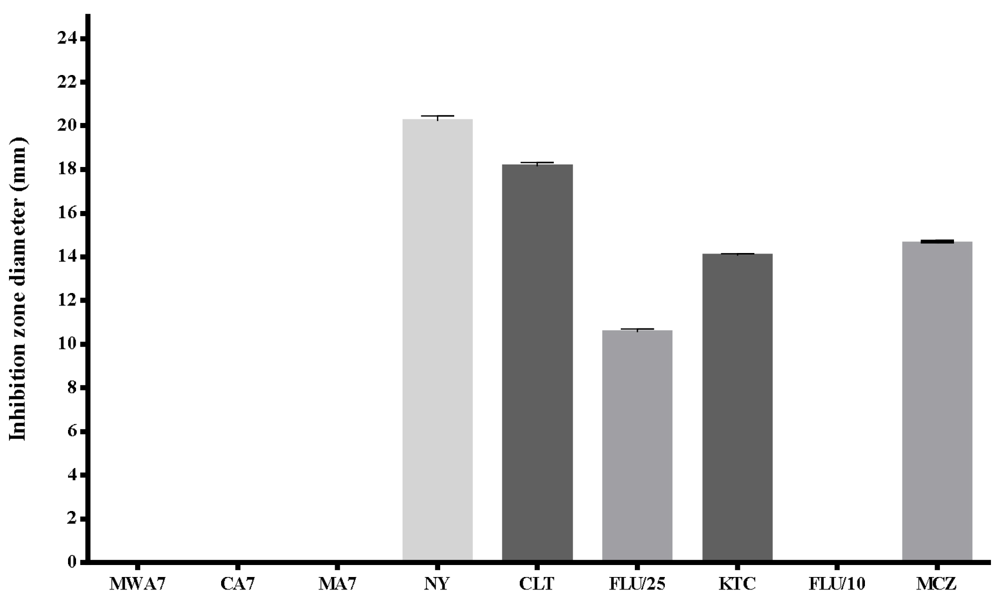
7- *Candida guilliermondii*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida guilliermondii*

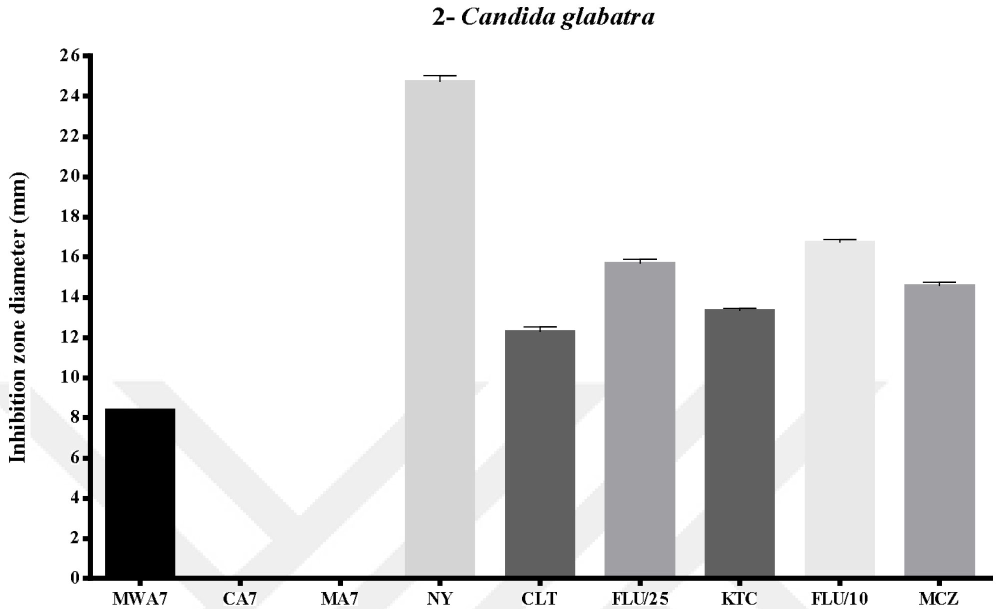
Figure A 219. Antifungal activity of *Prunus argentea* (Lam.) Rehder acetonitrile extracts and antifungal discs against *C. albicans.*

1- *Candida albican*



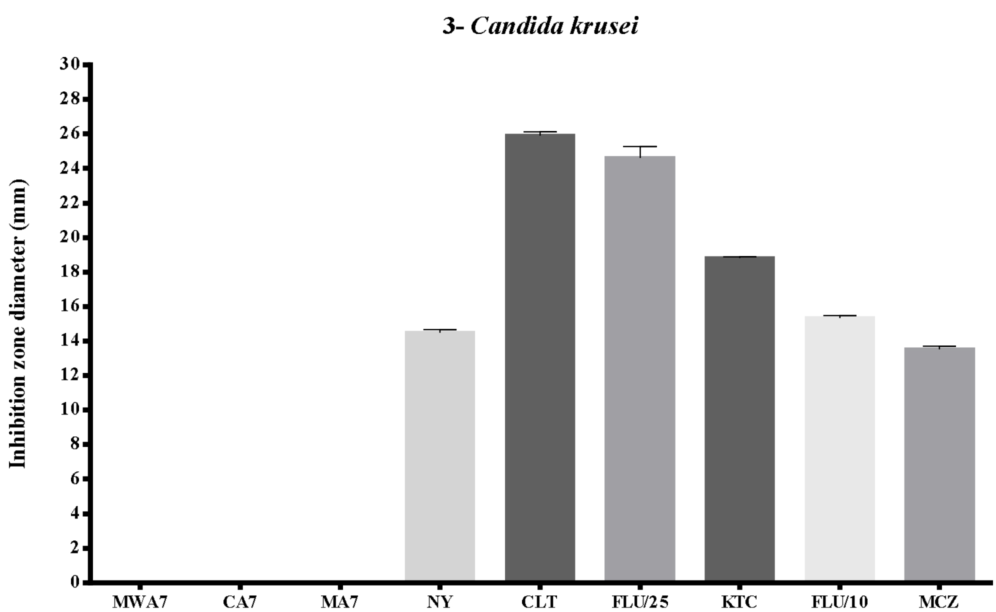
Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida albicans*

Figure A 220. Antifungal activity of *Prunus argentea* (Lam.) Rehder acetonitrile extracts and antifungal discs against *C. glabatra.*



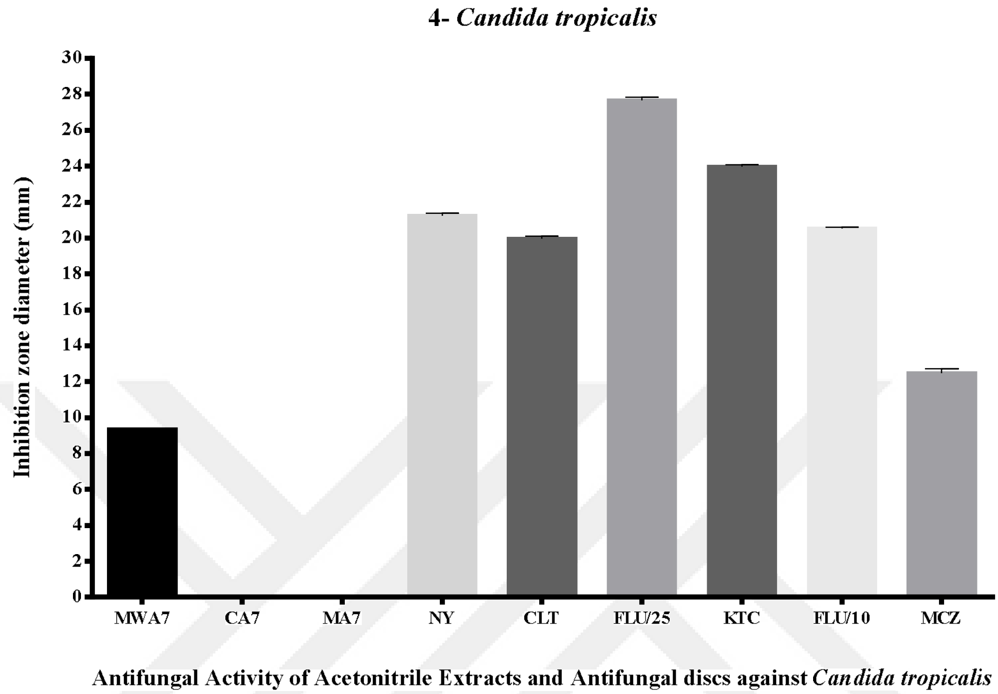
Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida glabatra*

Figure A 221. Antifungal activity of *Prunus argentea* (Lam.) Rehder acetonitrile extracts and antifungal discs against *C. krusei.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida krusei*

Figure A 222. Antifungal activity of *Prunus argentea* (Lam.) Rehder acetonitrile extracts and antifungal discs against *C. tropicalis.*



A Figure A 223. Antifungal activity of *Prunus argentea* (Lam.) Rehder acetonitrile extracts and antifungal discs against *C. famata.*

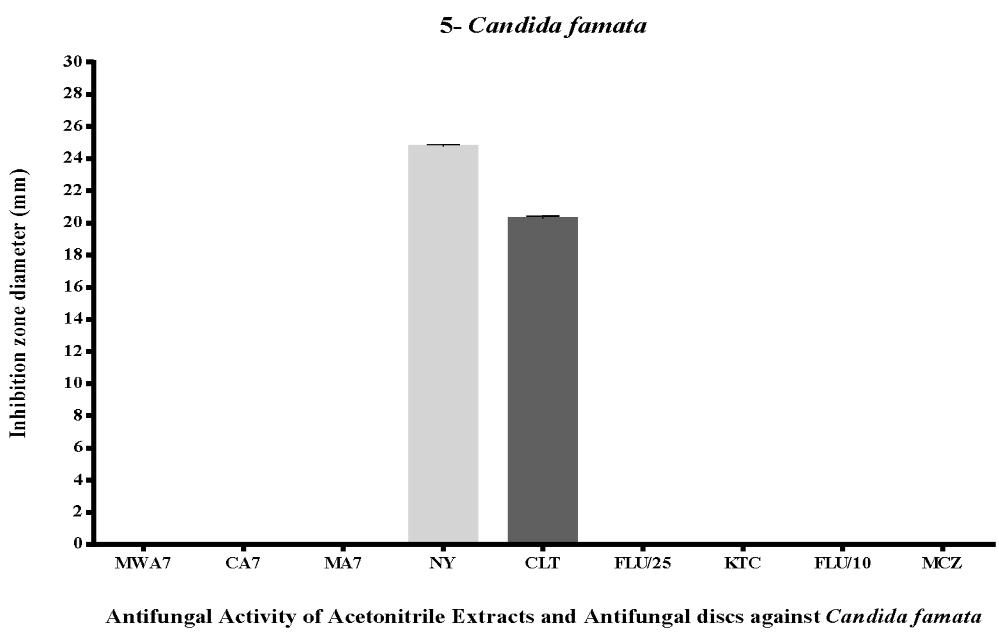
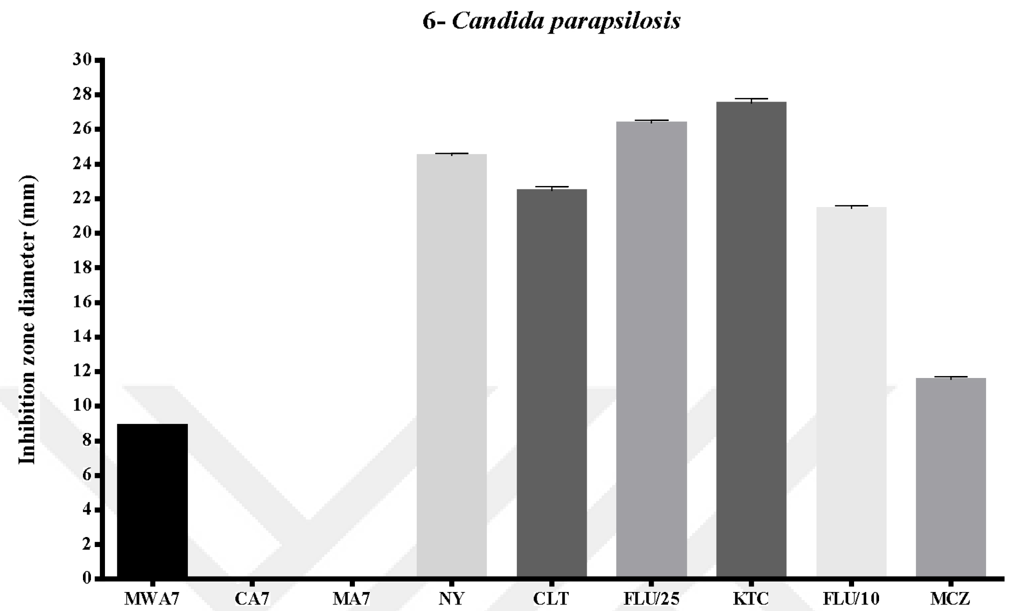
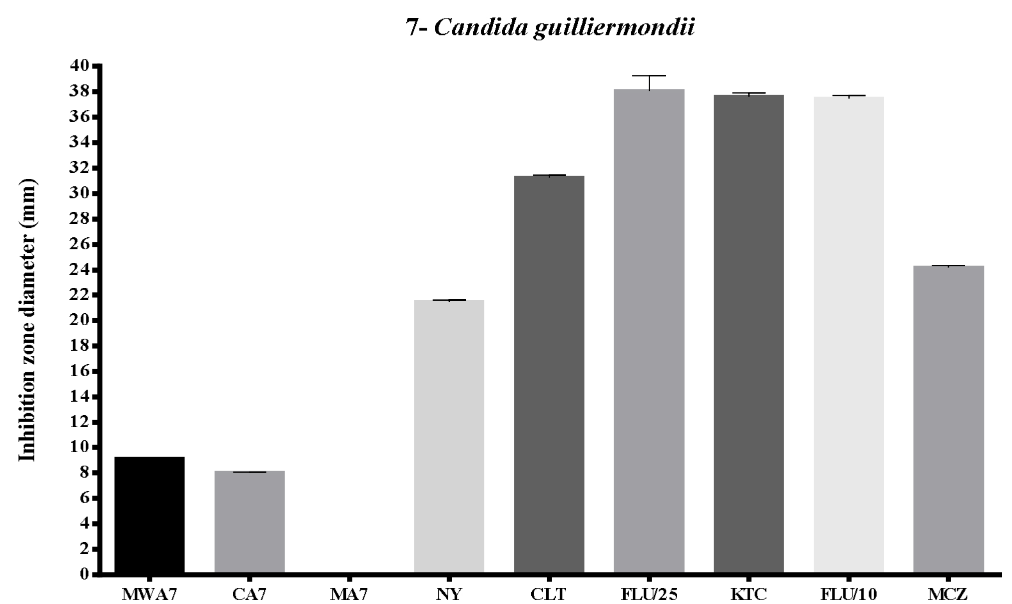


Figure A 224. Antifungal activity of *Prunus argentea* (Lam.) Rehder acetonitrile extracts and antifungal discs against *C. parapsilosis.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida parapsilosis*

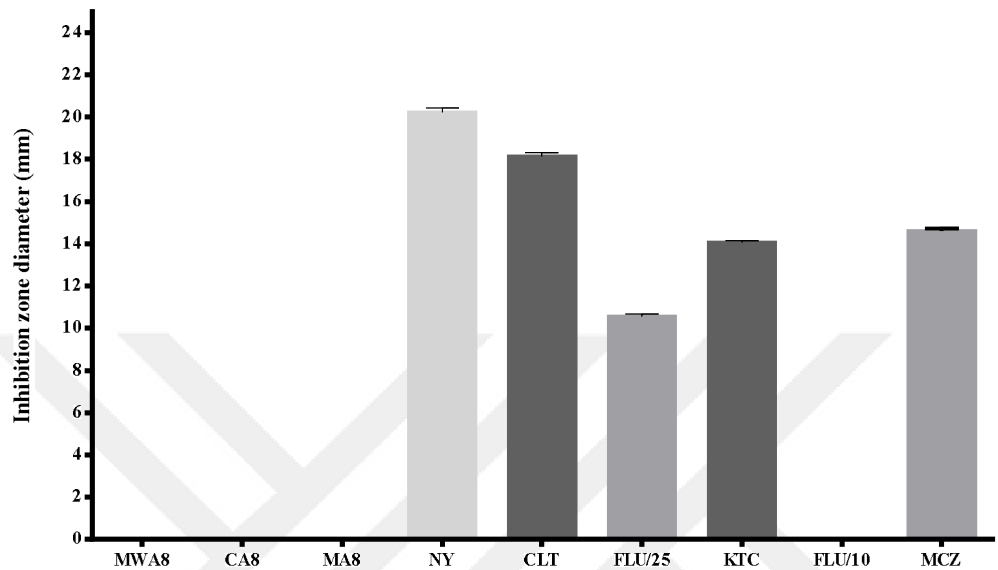
Figure A 225. Antifungal activity of *Prunus argentea* (Lam.) Rehder acetonitrile extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 226. Antifungal activity of *Crataegus azarolus* var. aronia L. acetonitrile extracts and antifungal discs against *C. albicans.*

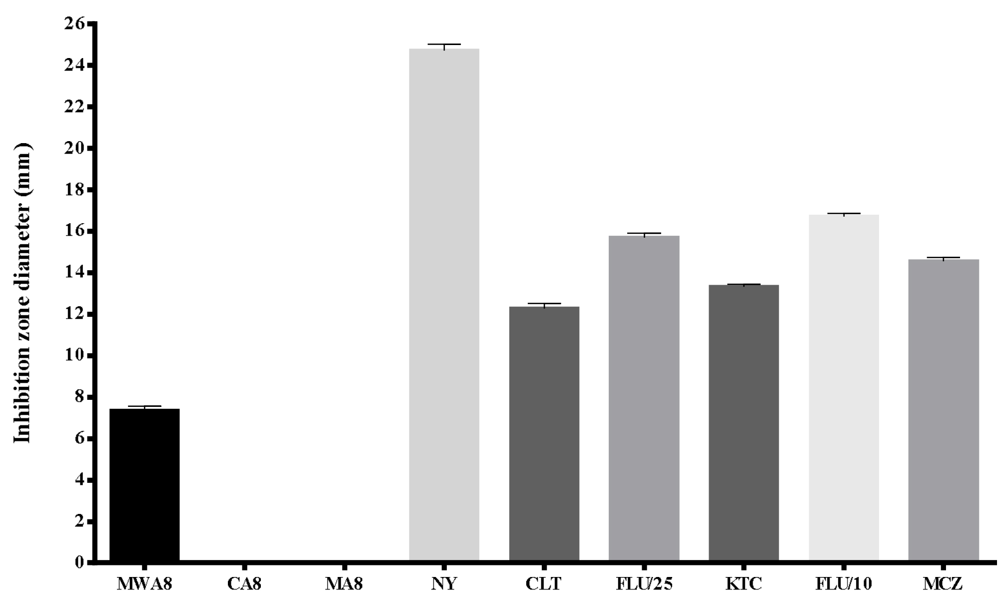
1- *Candida albican*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida albicans*

Figure A 227. Antifungal activity of *Crataegus azarolus* var. aronia L. acetonitrile extracts and antifungal discs against *C. glabatra.*

2- *Candida glabatra*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida glabatra*

Figure A 228. Antifungal activity of *Crataegus azarolus* var. aronia L. acetonitrile extracts and antifungal discs against *C. krusei.*

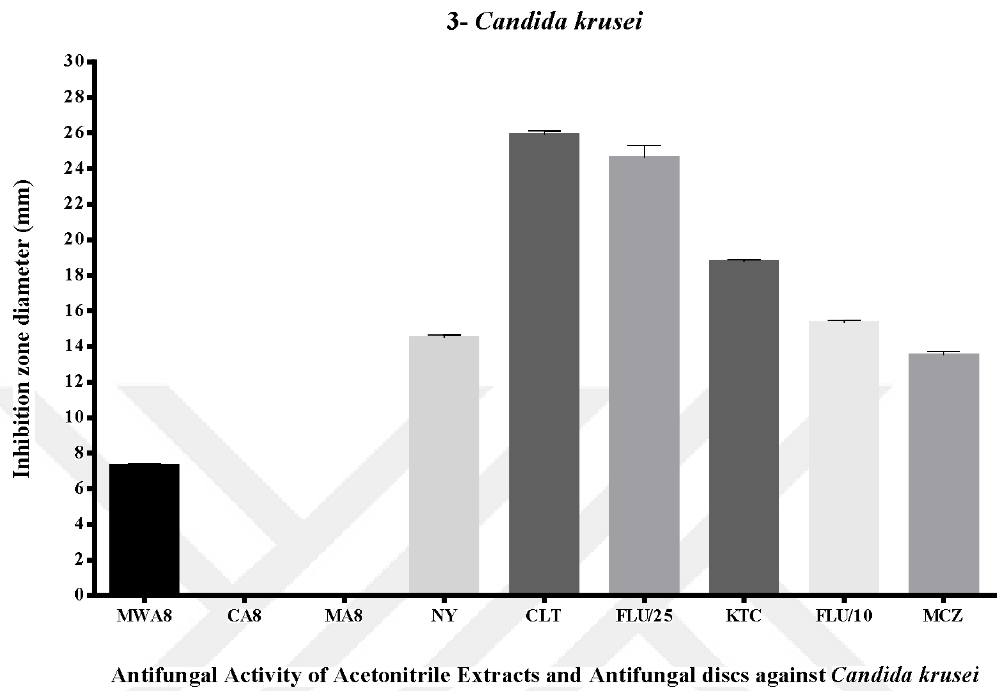


Figure A 229. Antifungal activity of *Crataegus azarolus* var. aronia L. acetonitrile extracts and antifungal discs against *C. tropicalis.*

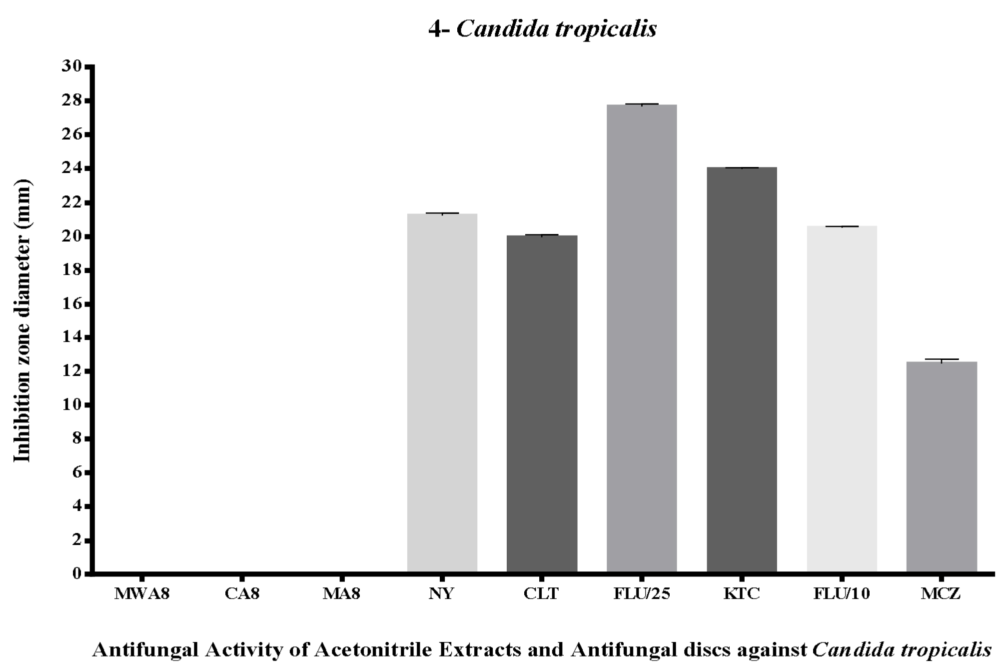
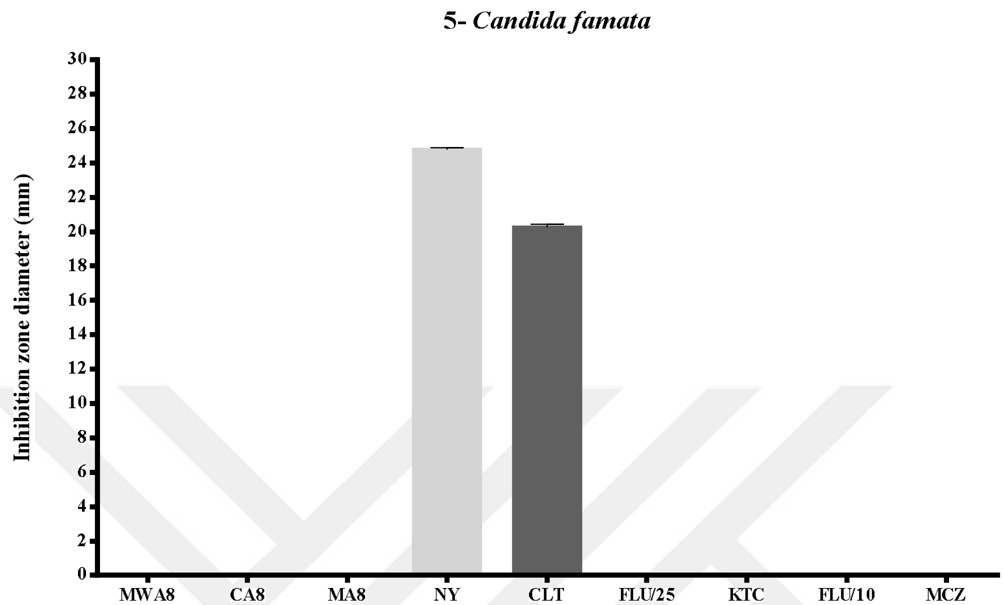
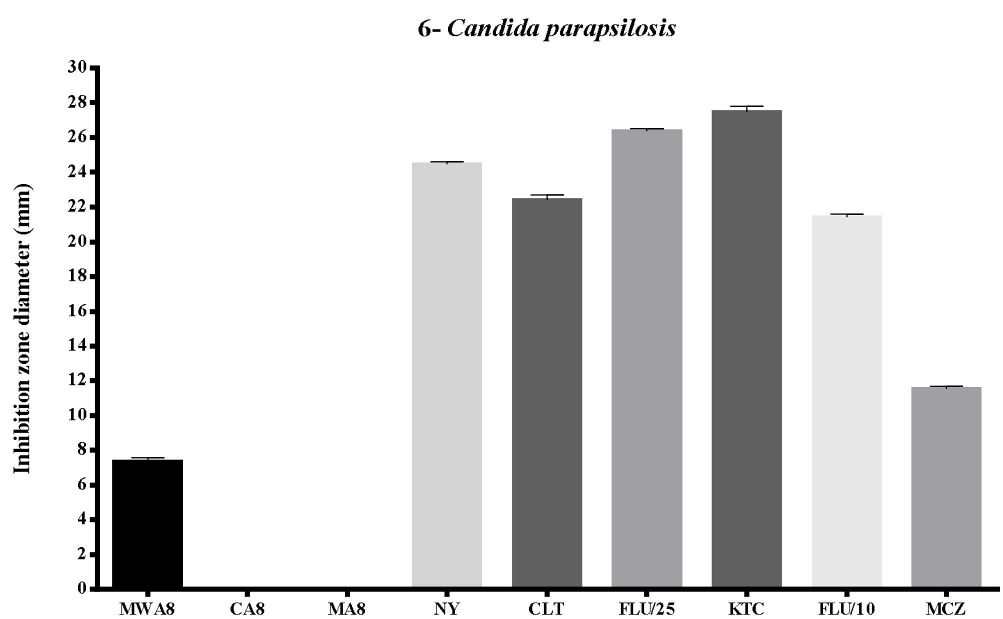


Figure A 230. Antifungal activity of *Crataegus azarolus* var. aronia L. acetonitrile extracts and antifungal discs against *C. famata.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida famata*

Figure A 231. Antifungal activity of *Crataegus azarolus* var. aronia L. acetonitrile extracts and antifungal discs against *C. parapsilosis.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida parapsilosis*

Figure A 232. Antifungal activity of *Crataegus azarolus* var. aronia L. acetonitrile extracts and antifungal discs against *C. guilliermondii.*

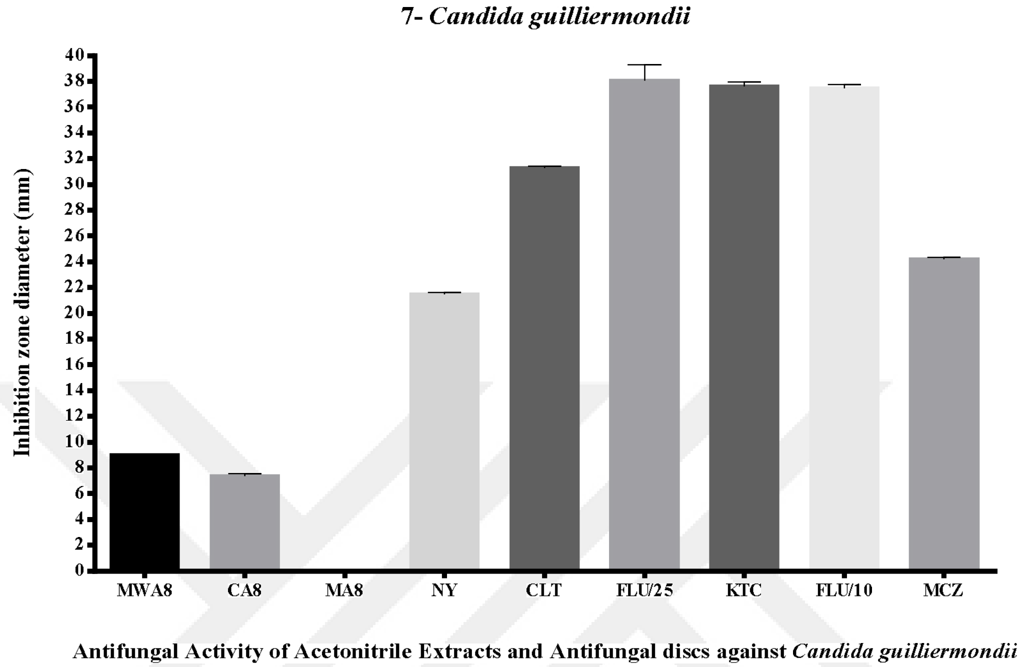


Figure A 233. Antifungal activity of acetonitrile extracts and antifungal discs against *C. albicans.*

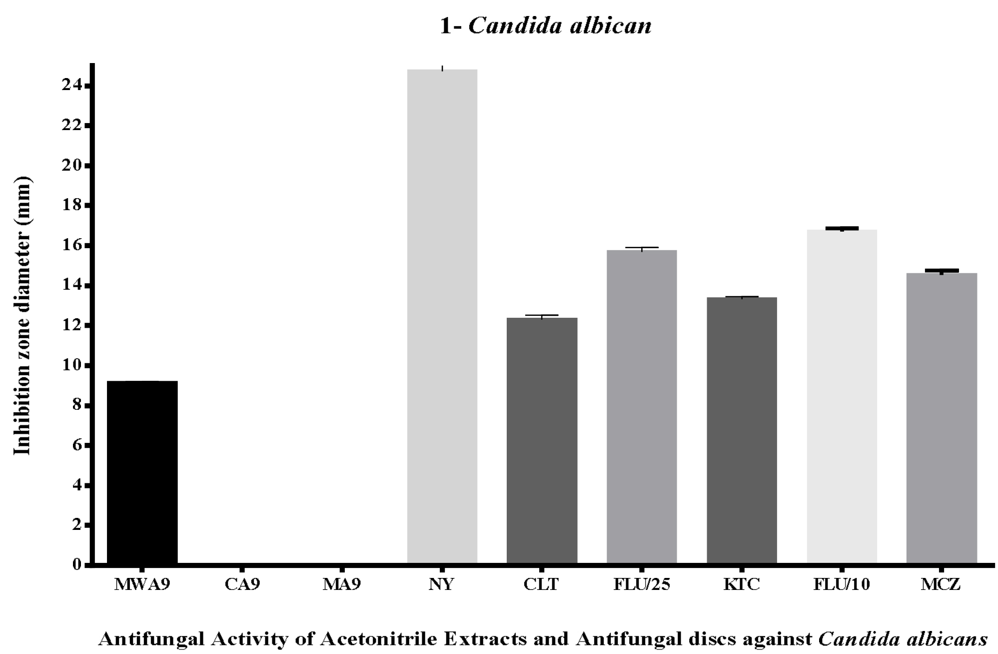
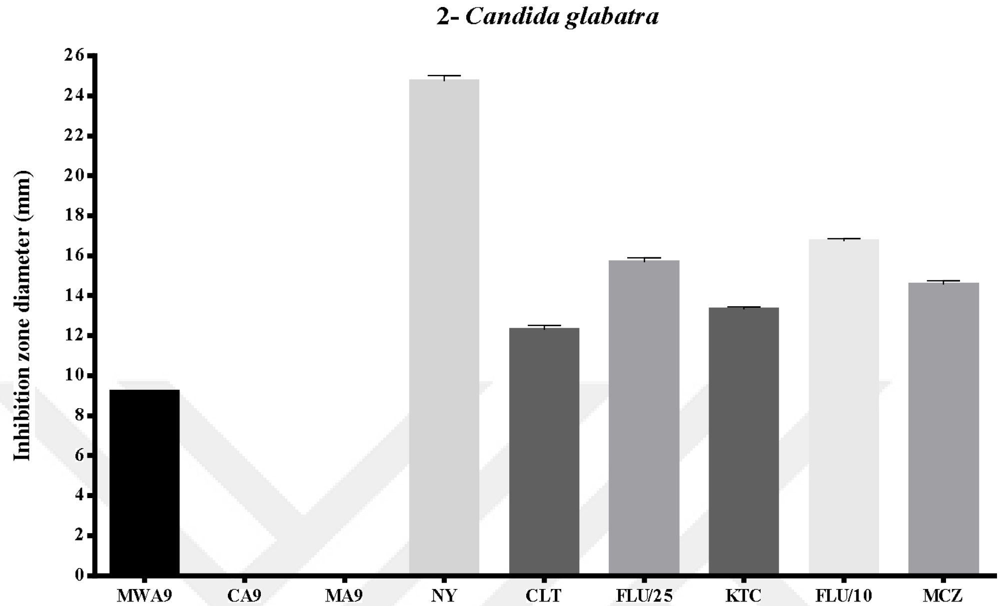
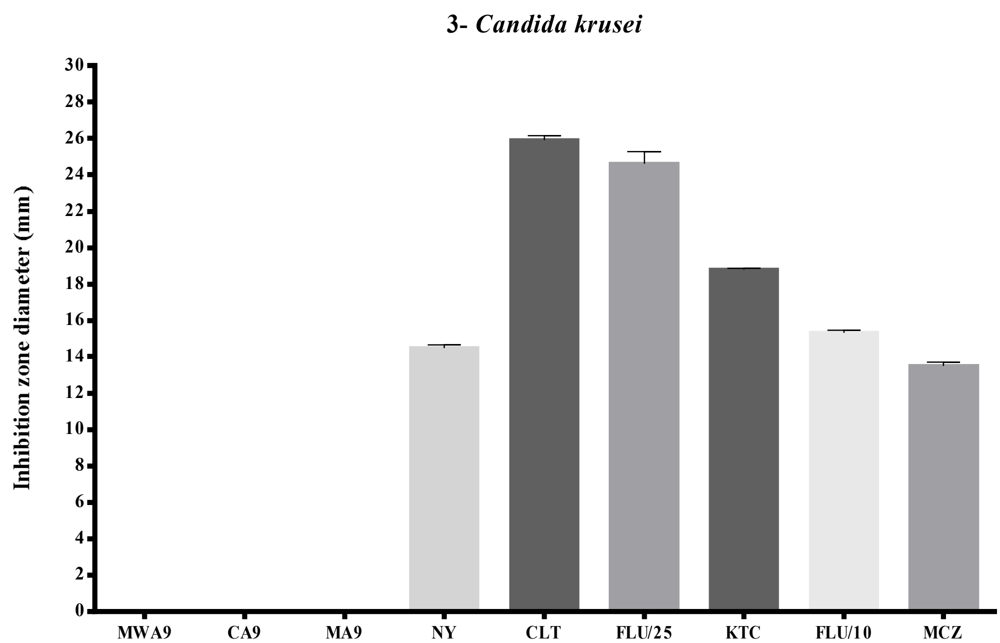


Figure A 234. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) acetonitrile extracts and antifungal discs against *C. glabatra.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida glabatra*

Figure A 235. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) acetonitrile extracts and antifungal discs against *C. krusei.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida krusei*

Figure A 236. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) acetonitrile extracts and antifungal discs against *C. tropicalis.*

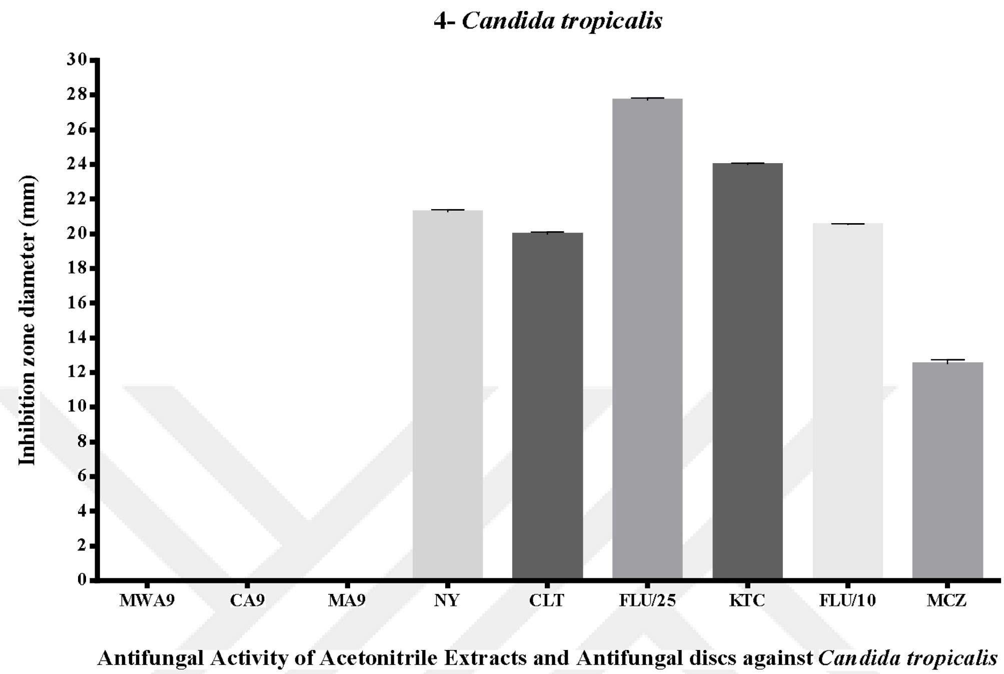


Figure A 237. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) acetonitrile extracts and antifungal discs against *C. famata*.

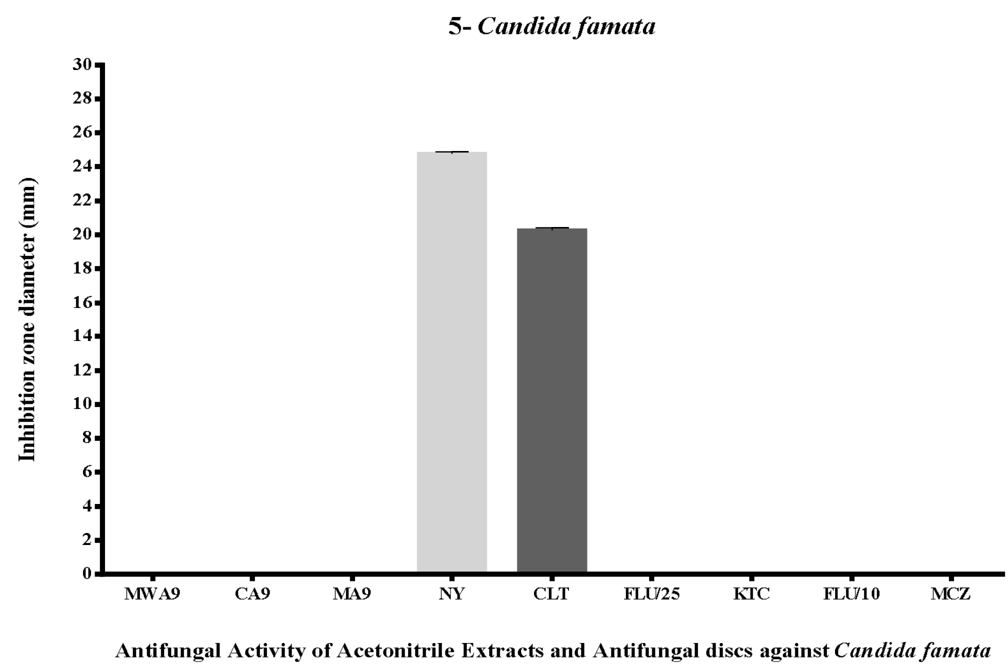
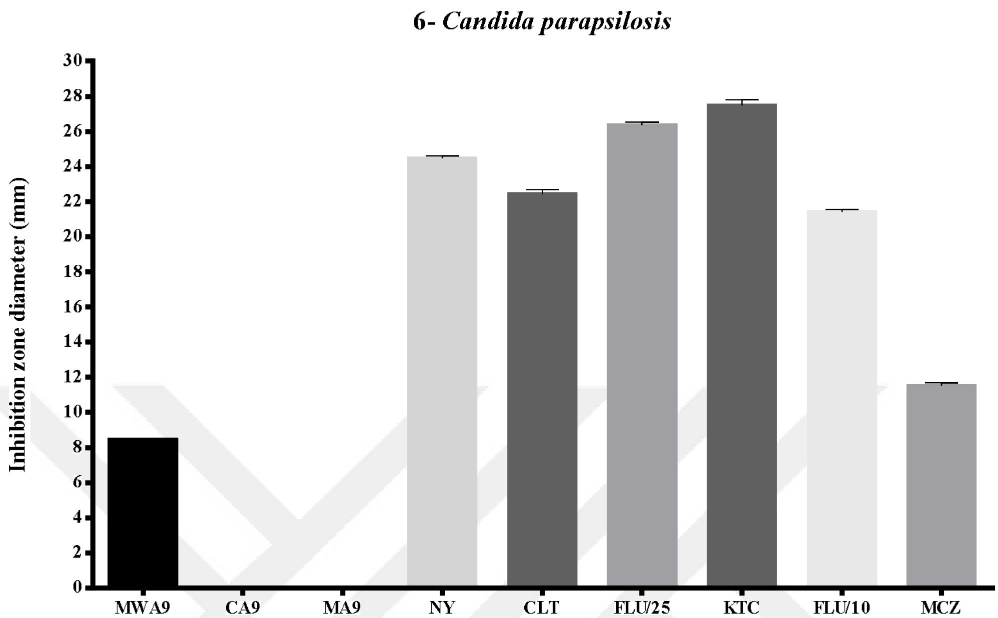
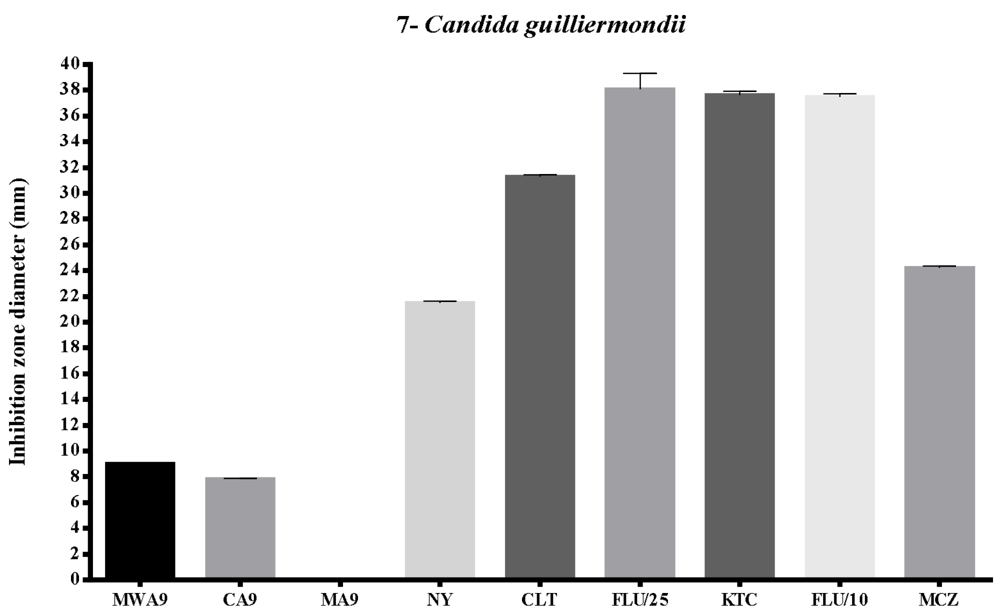


Figure A 238. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) acetonitrile extracts and antifungal discs against *C. parapsilosis.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida parapsilosis*

Figure A 239. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) acetonitrile extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 240. Antifungal activity of *Rubus sanctus* Schreb acetonitrile extracts and antifungal discs against *C. albicans*

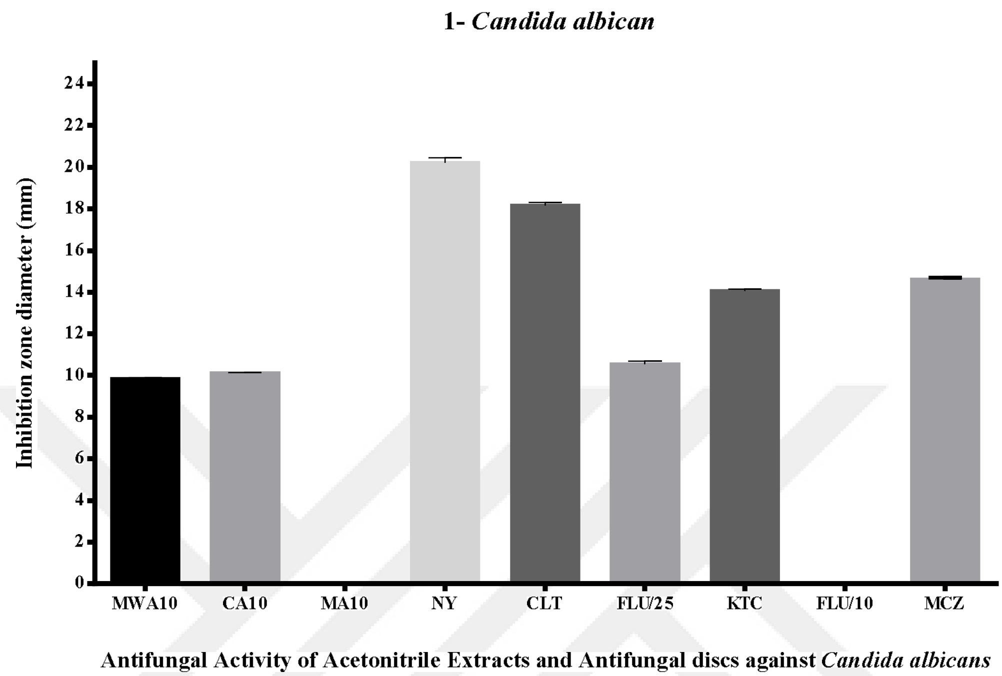


Figure A 241. Antifungal activity of *Rubus sanctus* Schreb acetonitrile extracts and antifungal discs against *C. glabatra.*

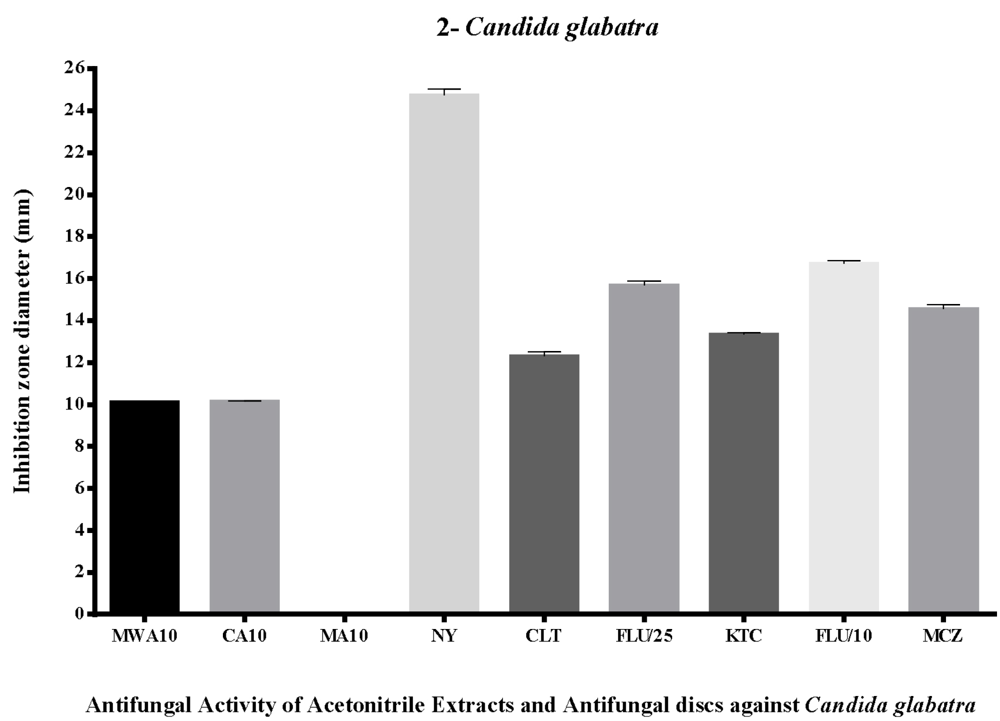
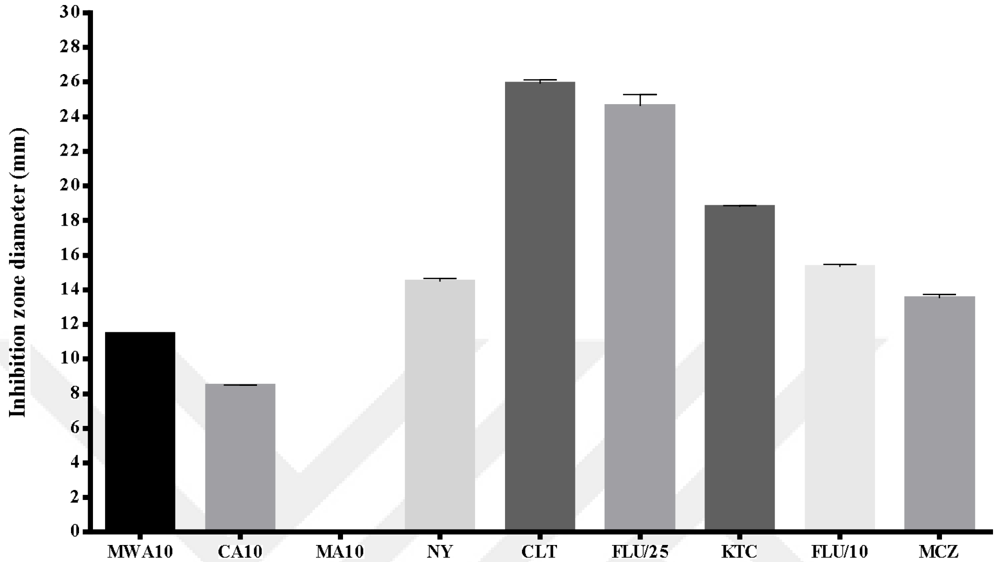


Figure A 242. Antifungal activity of *Rubus sanctus* Schreb acetonitrile extracts and antifungal discs against *C. krusei.*

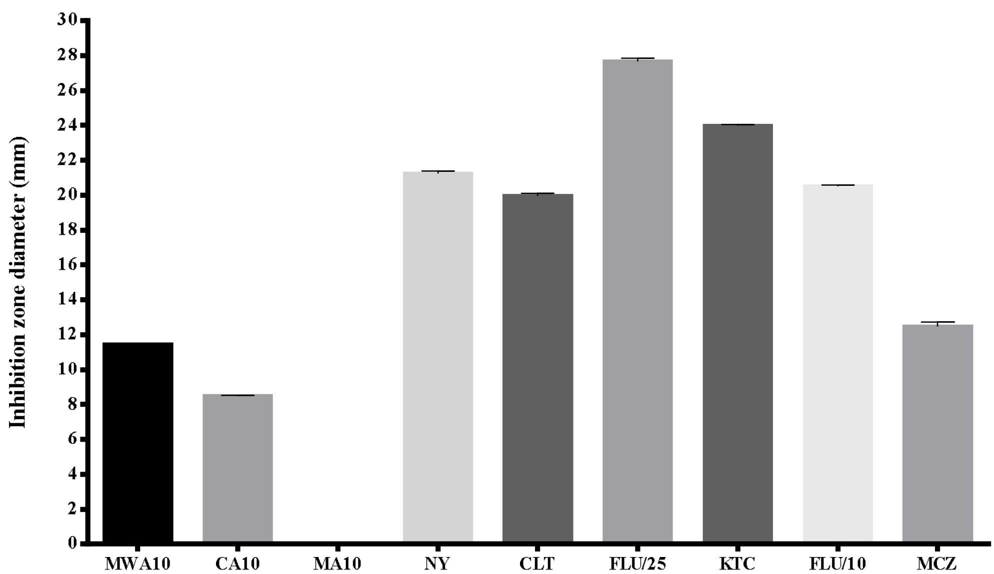
3- *Candida krusei*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida krusei*

Figure A 243. Antifungal activity of *Rubus sanctus* Schreb acetonitrile extracts and antifungal discs against *C. tropicalis.*

4- *Candida tropicalis*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida tropicalis*

Figure A 244. Antifungal activity of *Rubus sanctus* Schreb acetonitrile extracts and antifungal discs against *C. famata.*

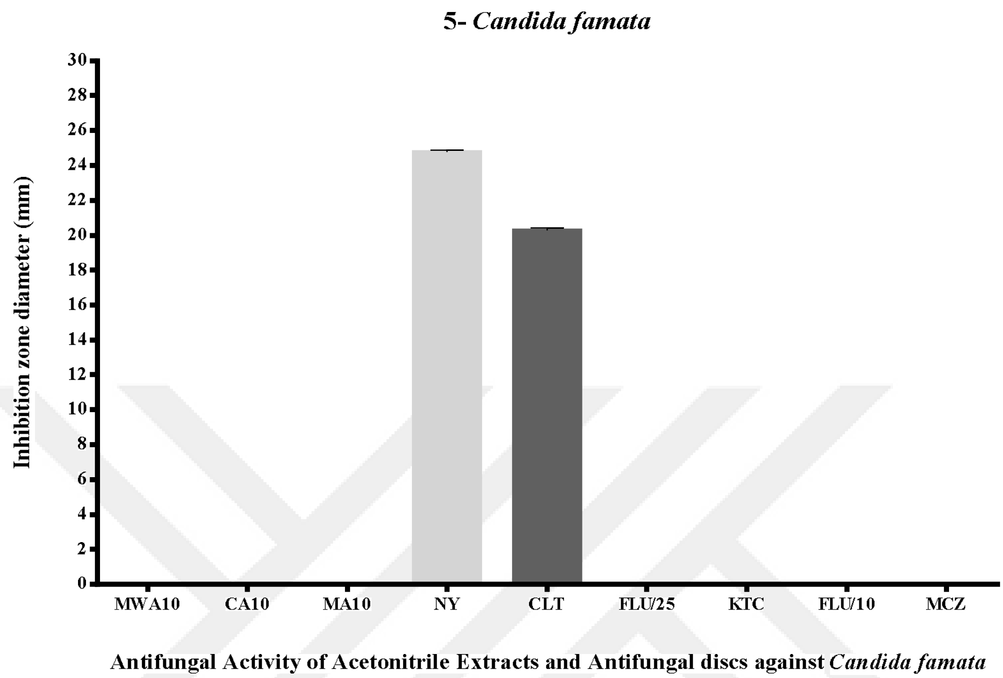


Figure A 245. Antifungal activity of *Rubus sanctus* Schreb acetonitrile extracts and antifungal discs against *C. parapsilosis.*

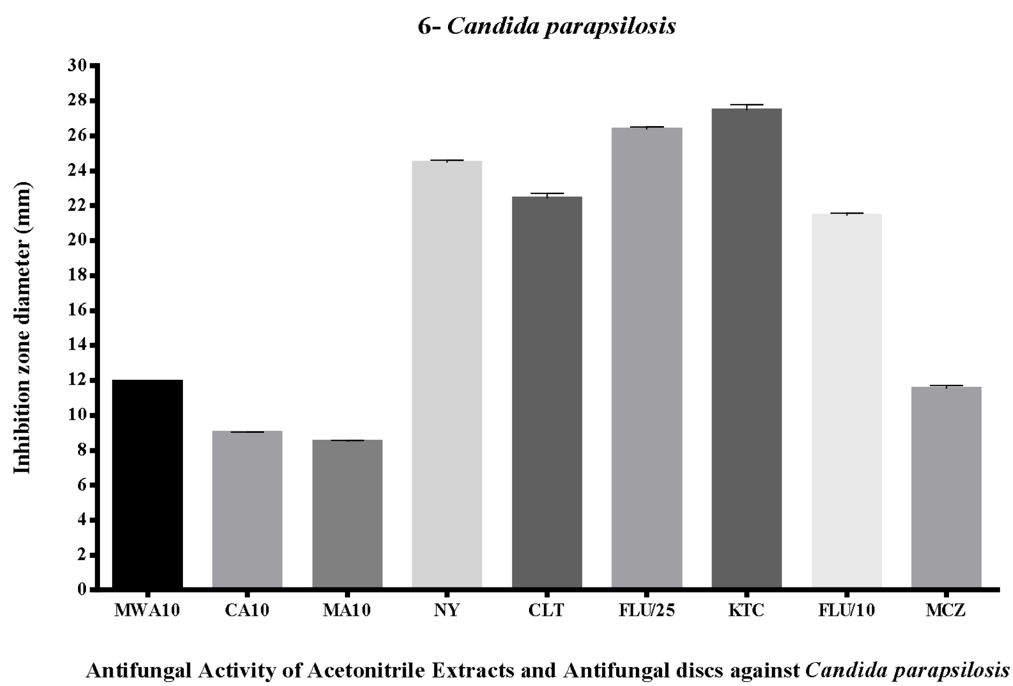
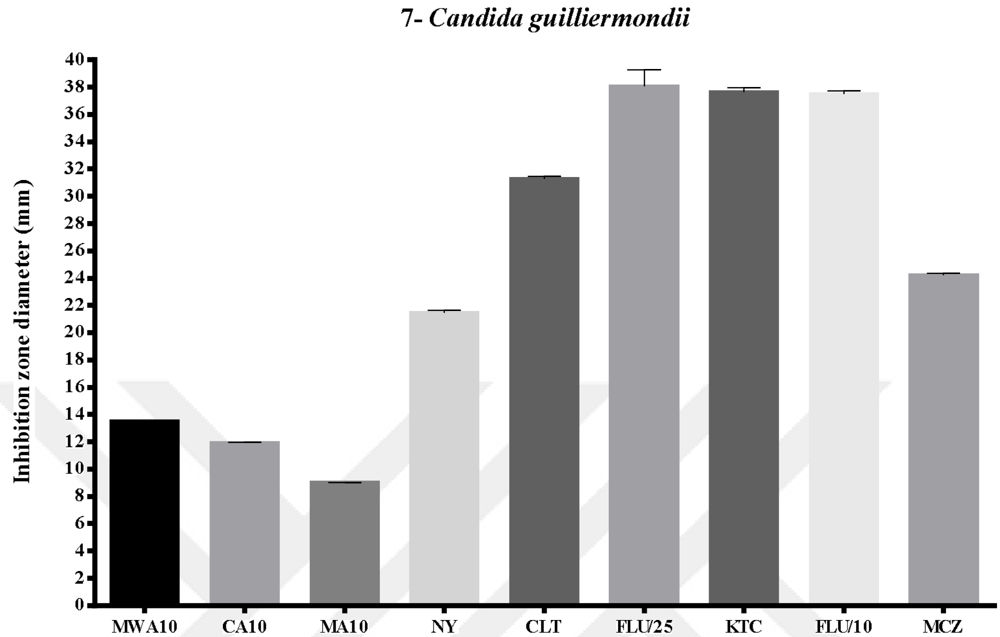
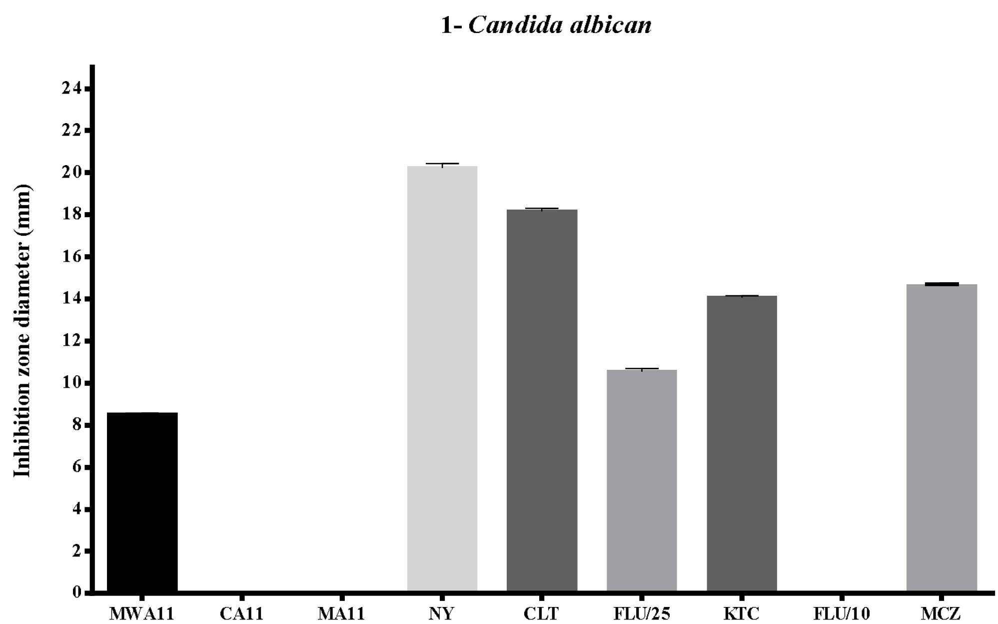


Figure A 246. Antifungal activity of *Rubus sanctus* Schreb acetonitrile extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 247. Antifungal activity of *Ficus carica* L. acetonitrile extracts and antifungal discs against *C. albicans.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida albicans*

Figure A 248. Antifungal activity of *Ficus carica* L. acetonitrile extracts and antifungal discs against *C. glabatra.*

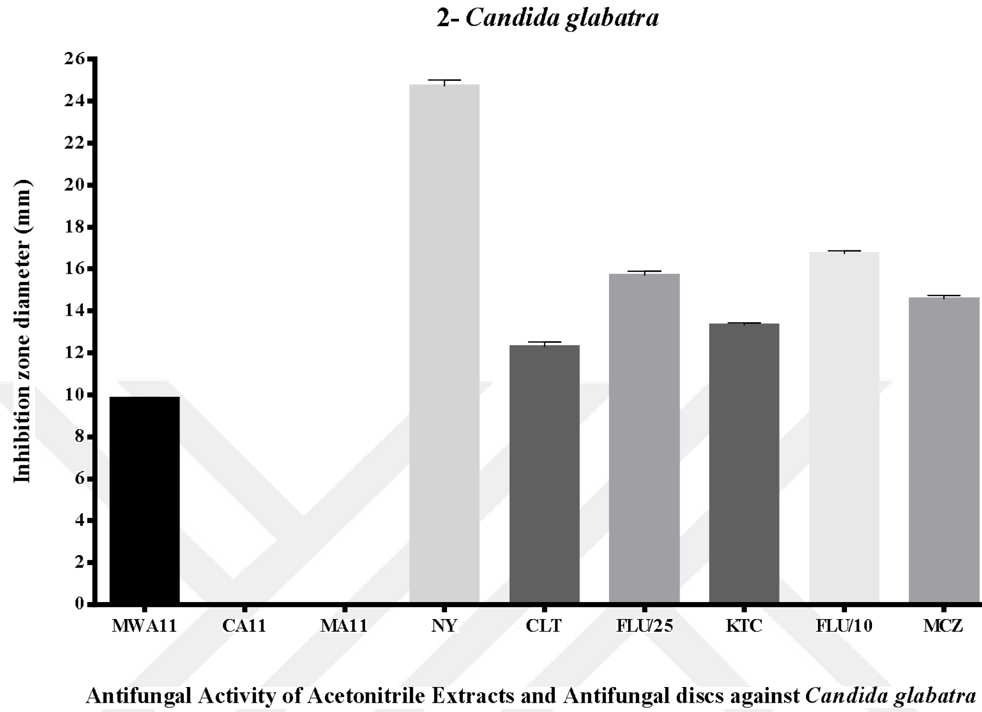


Figure A 249. Antifungal activity of *Ficus carica* L. acetonitrile extracts and antifungal discs against *C. krusei*

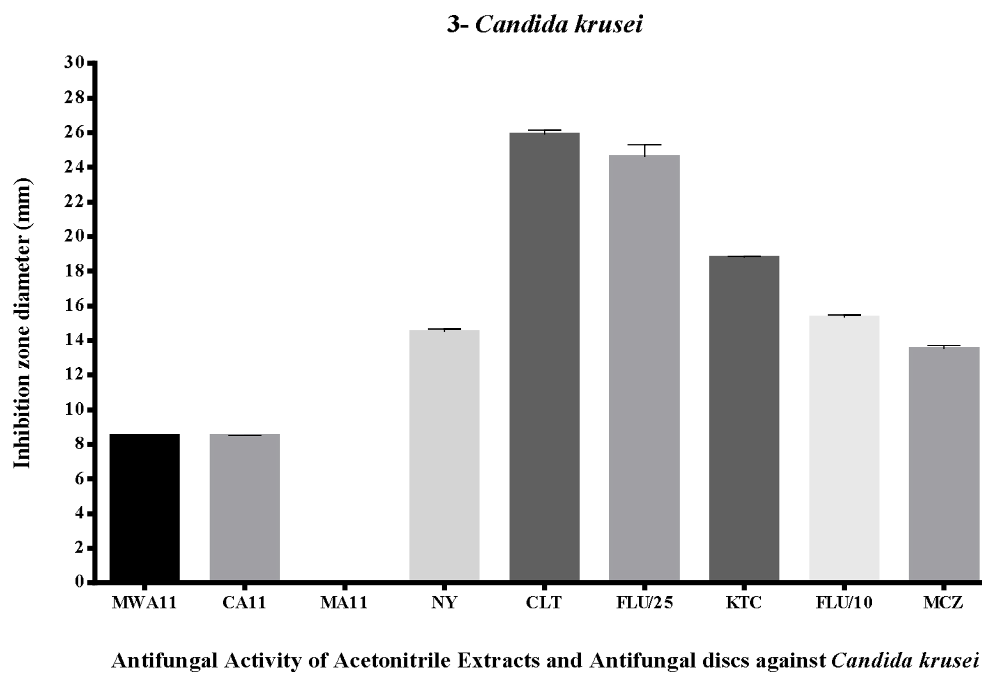


Figure A 250. Antifungal activity of *Ficus carica* L. acetonitrile extracts and antifungal discs against *C. tropicalis*

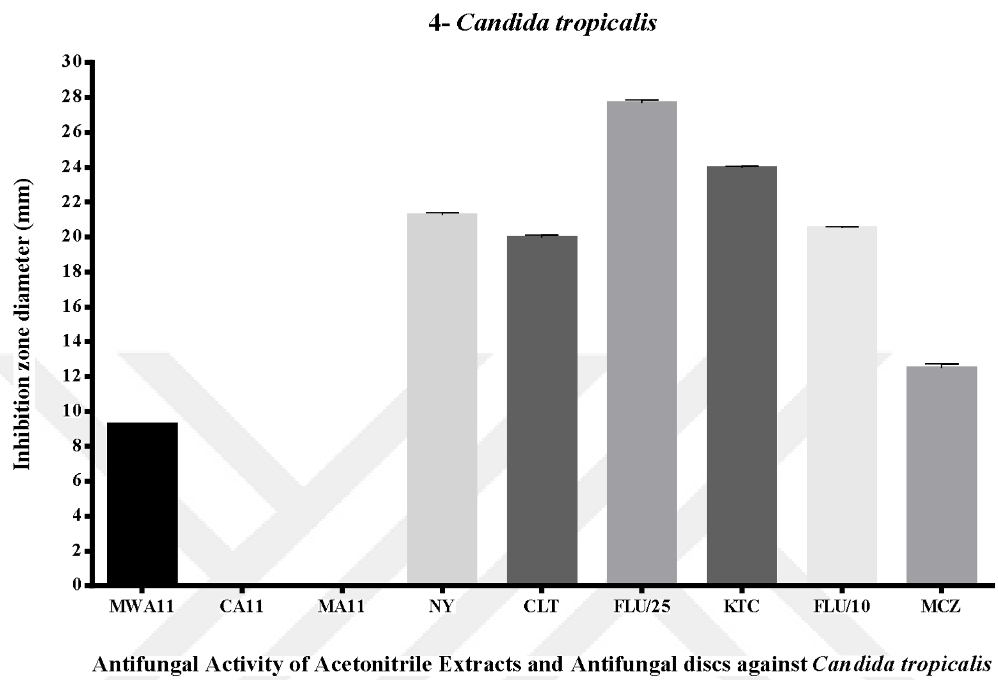


Figure A 251. Antifungal activity of *Ficus carica* L. acetonitrile extracts and antifungal discs against *C. famata.*

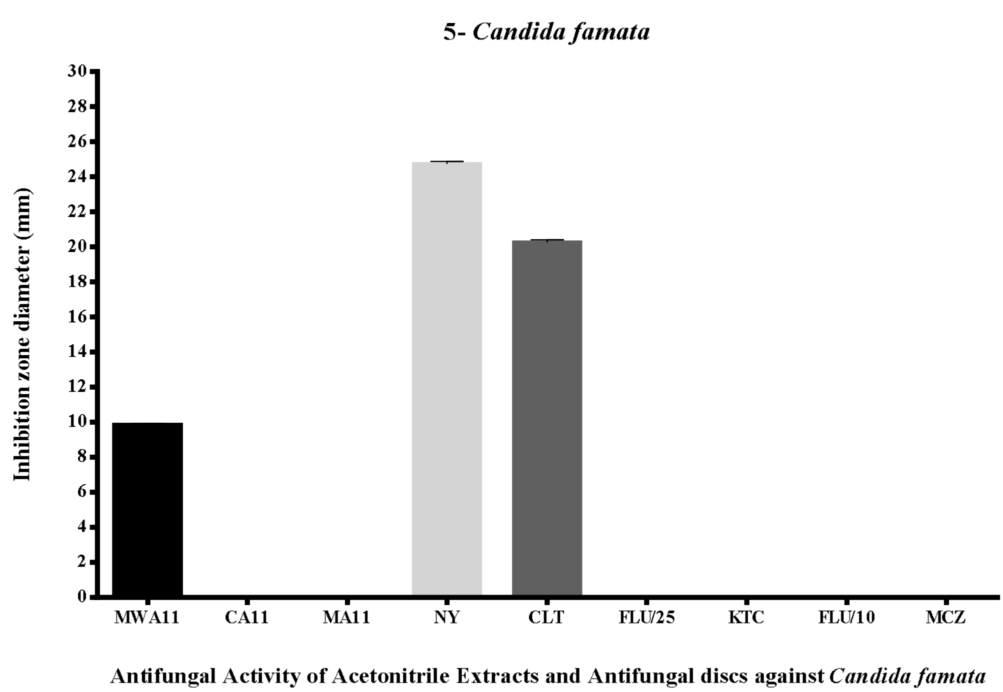
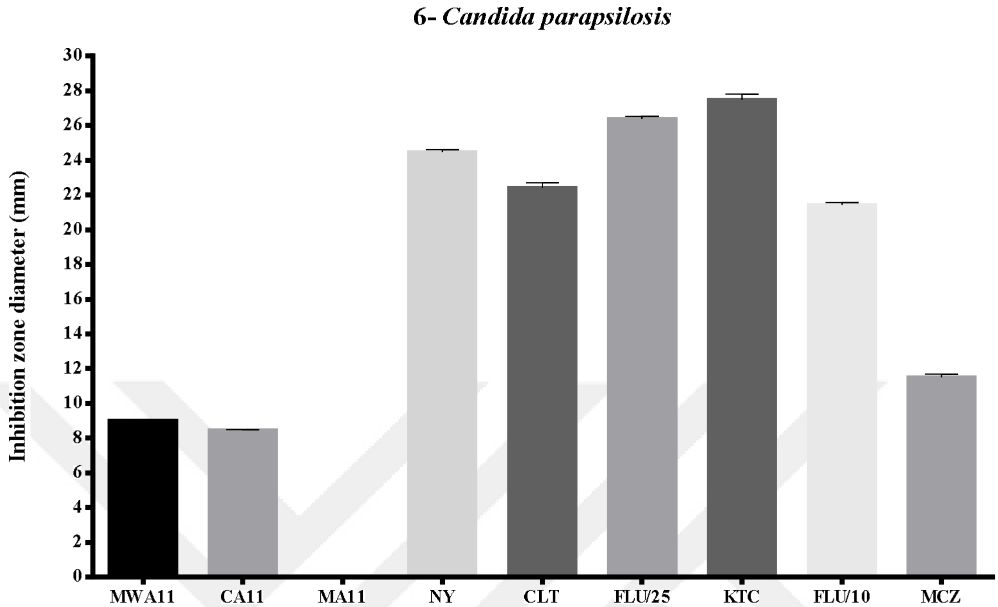
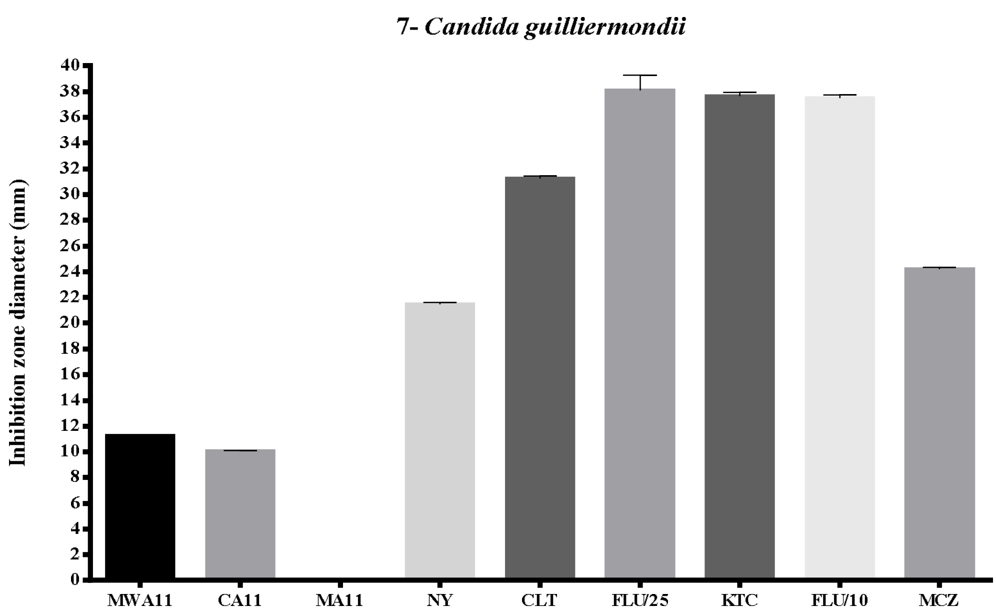


Figure A 252. Antifungal activity of *Ficus carica* L. acetonitrile extracts and antifungal discs against *C. parapsilosis*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida parapsilosis*

Figure A 253. Antifungal activity of *Ficus carica* L. acetonitrile extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Acetonitrile Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 254. Antifungal activity of *Acer monspessulanum* L. distilled water and antifungal discs against *C. albicans.*

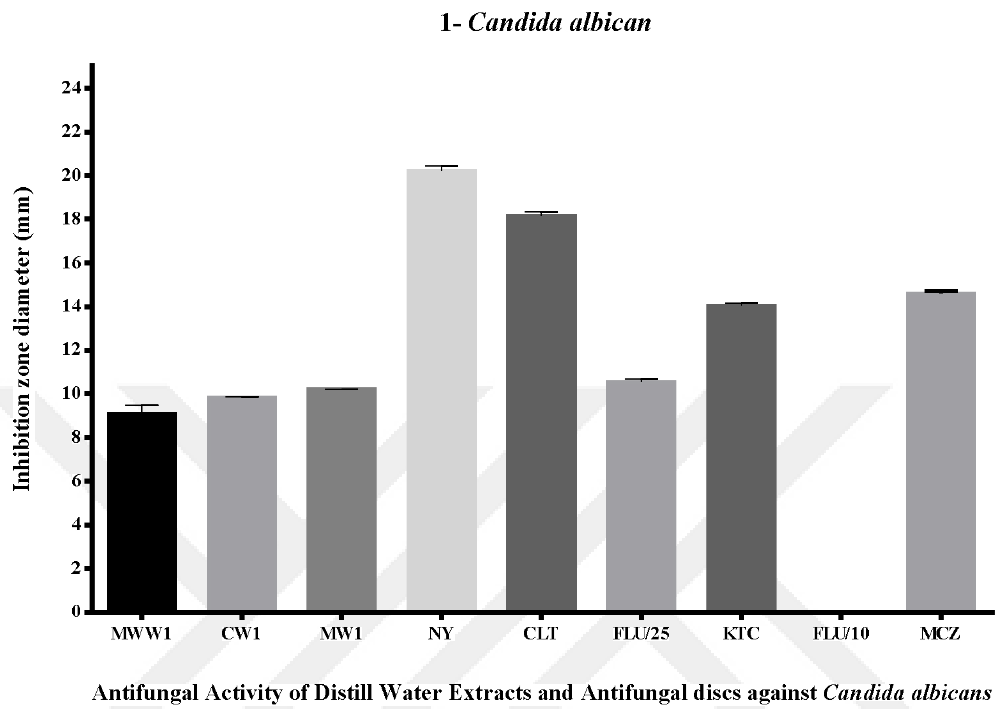


Figure A 255. Antifungal activity of *Acer monspessulanum* L. distilled water extracts and antifungal discs against *C. glabatra*

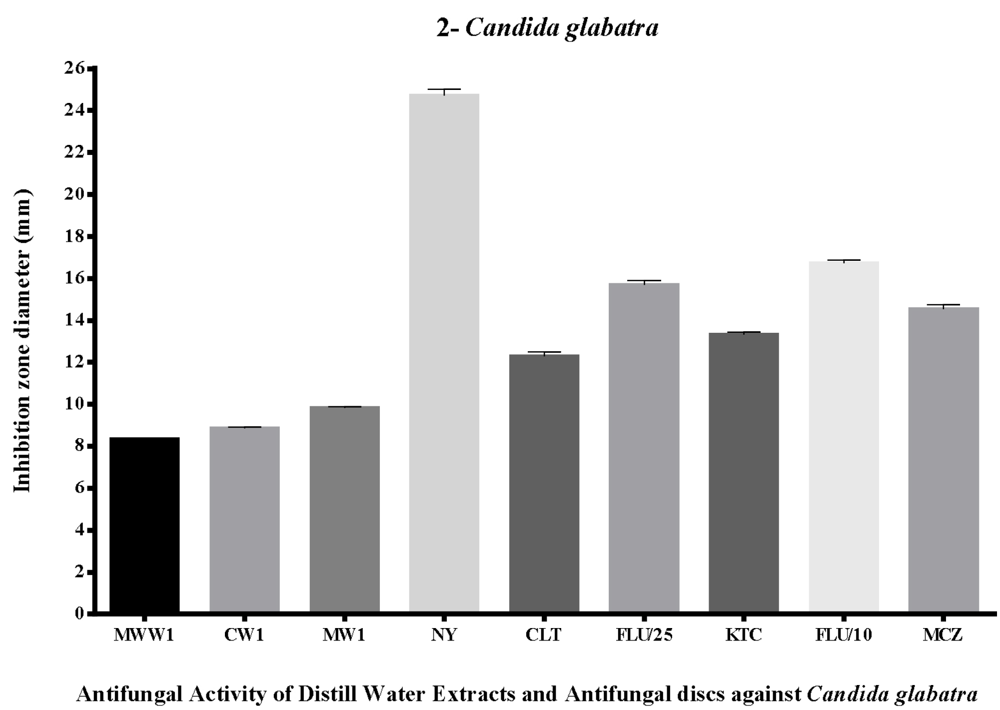
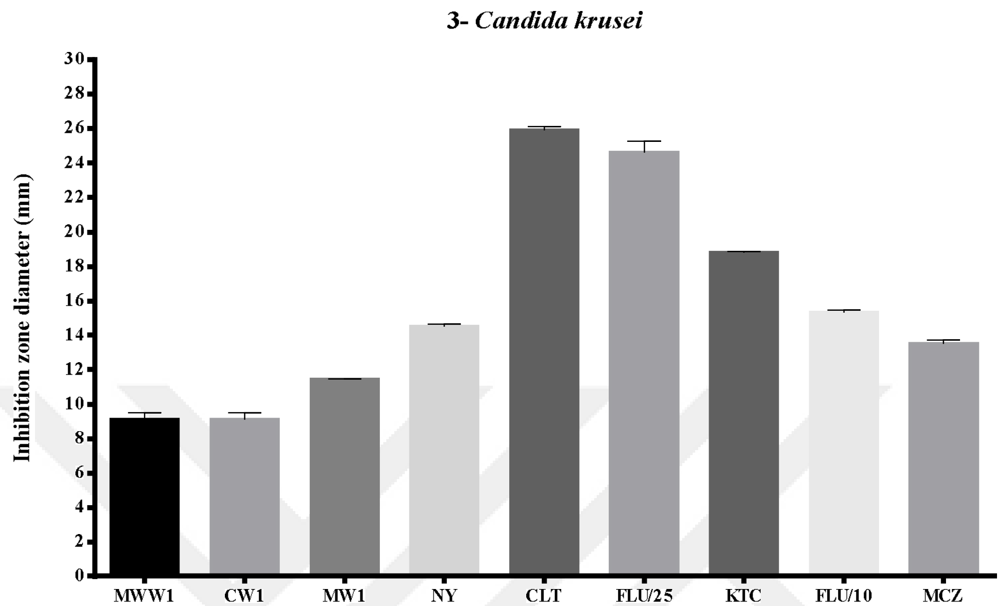
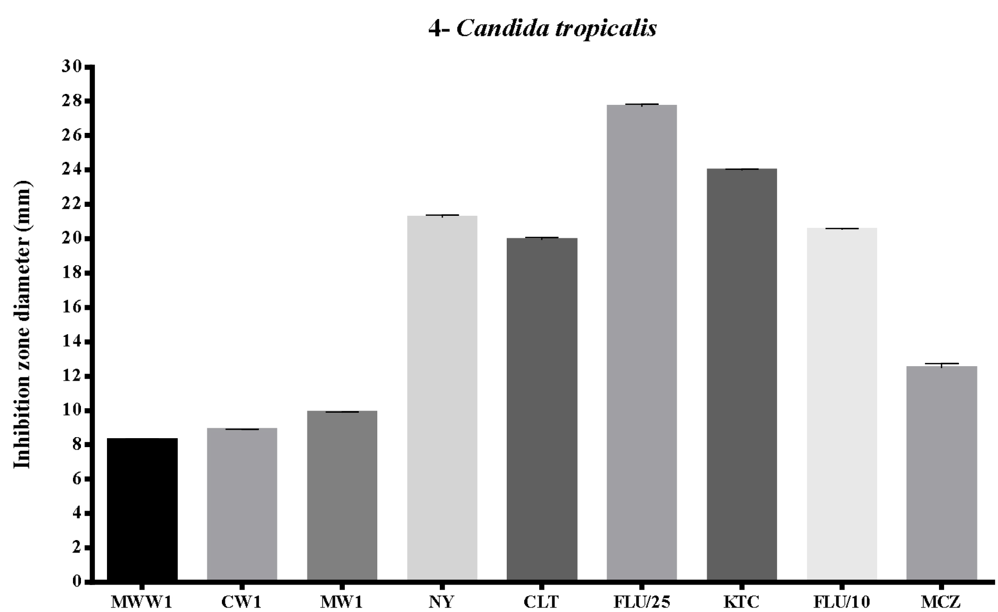


Figure A 256. Antifungal activity of *Acer monspessulanum* L. distilled water extracts and antifungal discs against *C. krusei.*



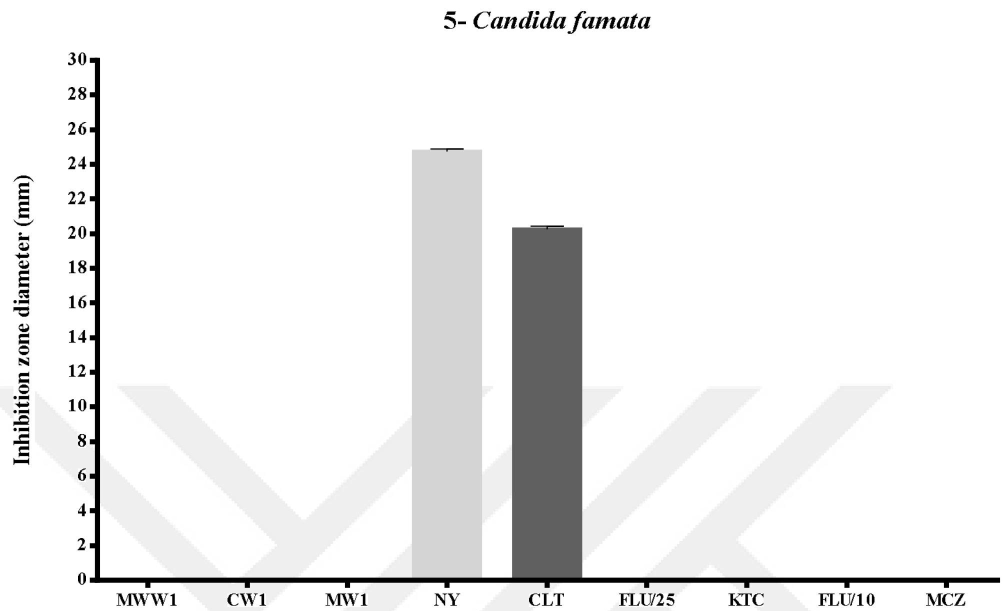
Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida krusei*

Figure A 257. Antifungal activity of distilled water extracts and antifungal discs against *C. tropicalis.*



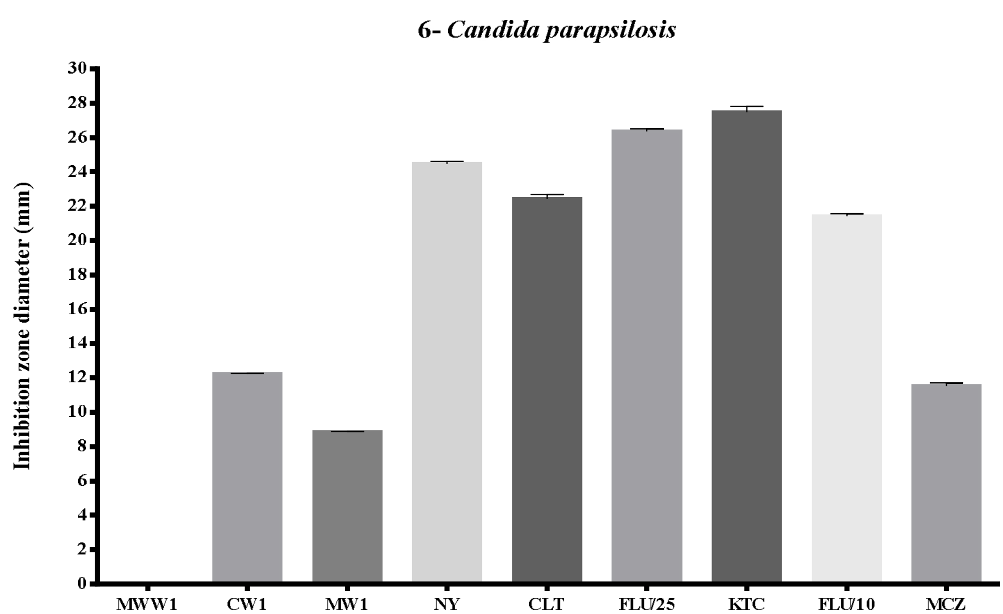
Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida tropicalis*

Figure A 258. Antifungal activity of *Acer monspessulanum* L. distilled water extracts and antifungal discs against *C. famata*



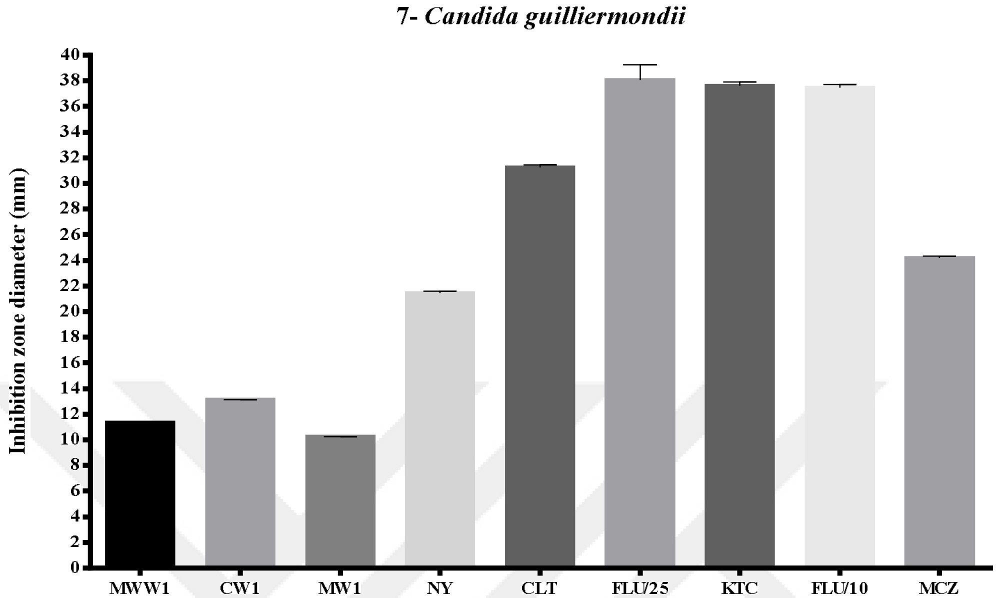
Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida famata*

Figure A 259. Antifungal activity of *Acer monspessulanum* L. distilled water extracts and antifungal discs against *C. parapsilosis.*



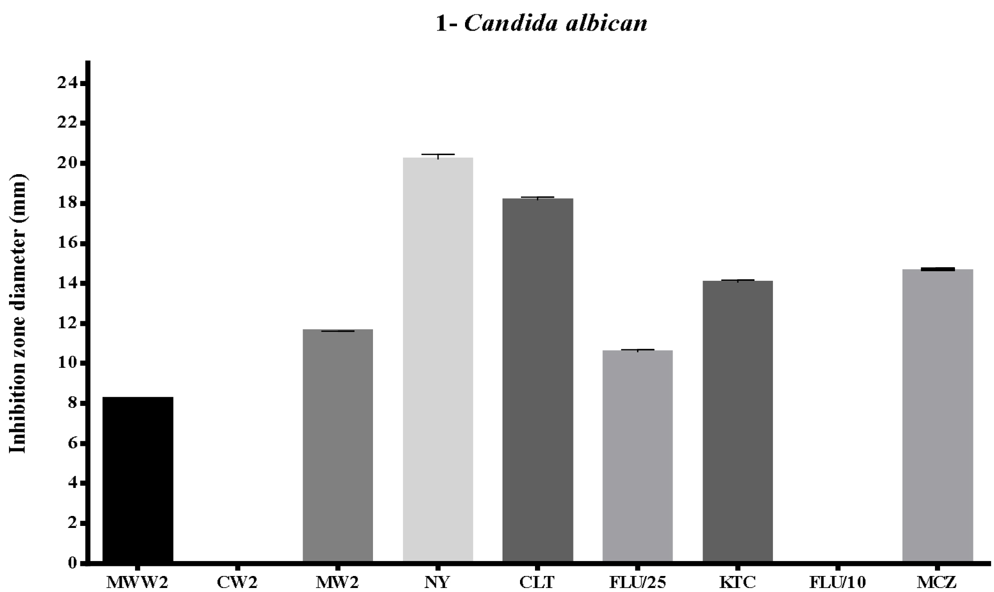
Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida parapsilosis*

Figure A 260. Antifungal activity of *Acer monspessulanum* L. distilled water extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 261. Antifungal activity of distilled water extracts and antifungal discs against *C. albicans.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida albicans*

Figure A 262. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) distilled water extracts and antifungal discs against *C. glabatra.*

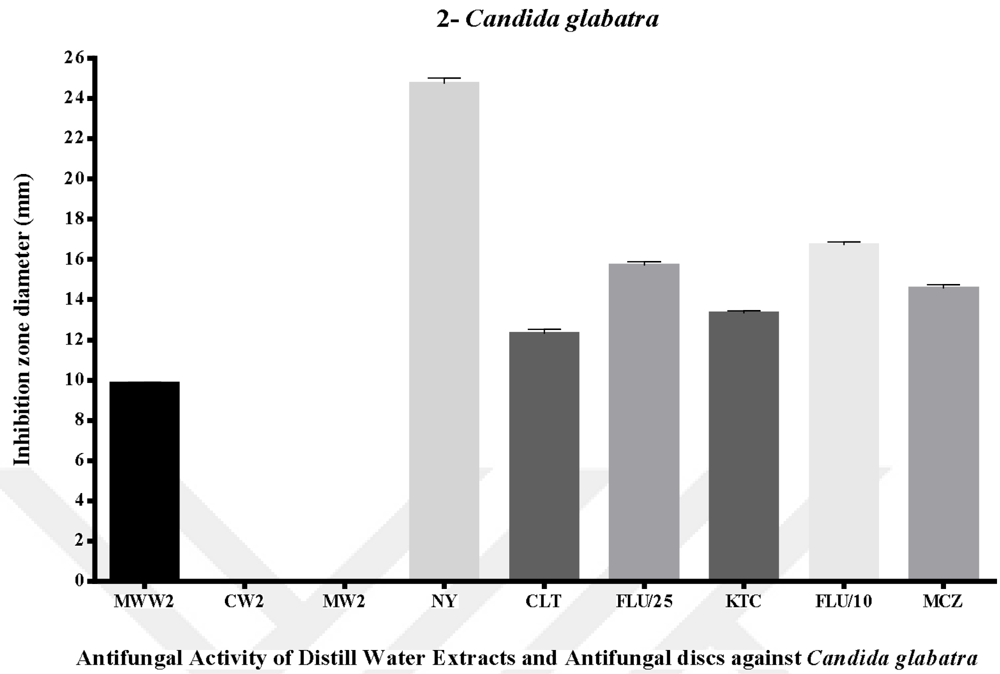


Figure A 263. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) distilled water extracts and antifungal discs against *C. krusei.*

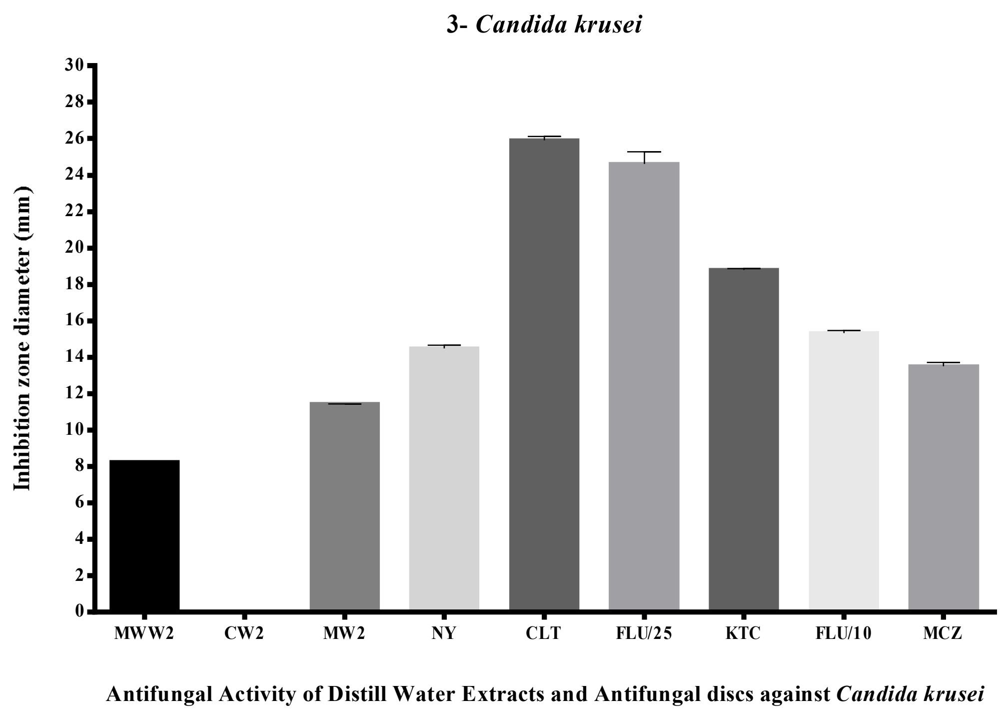
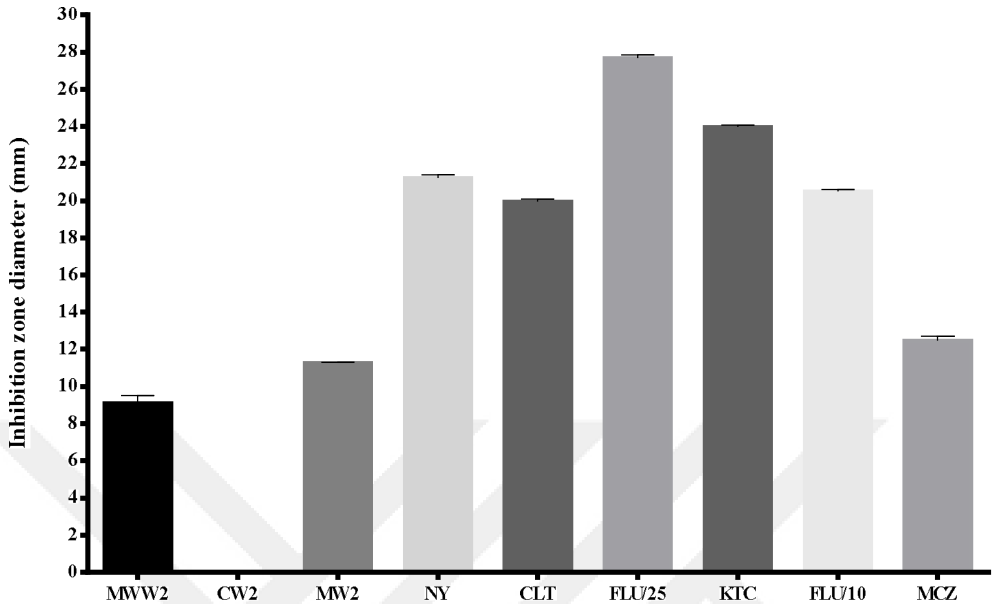


Figure A 264. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) distilled water extracts and antifungal discs against *C. tropicalis.*

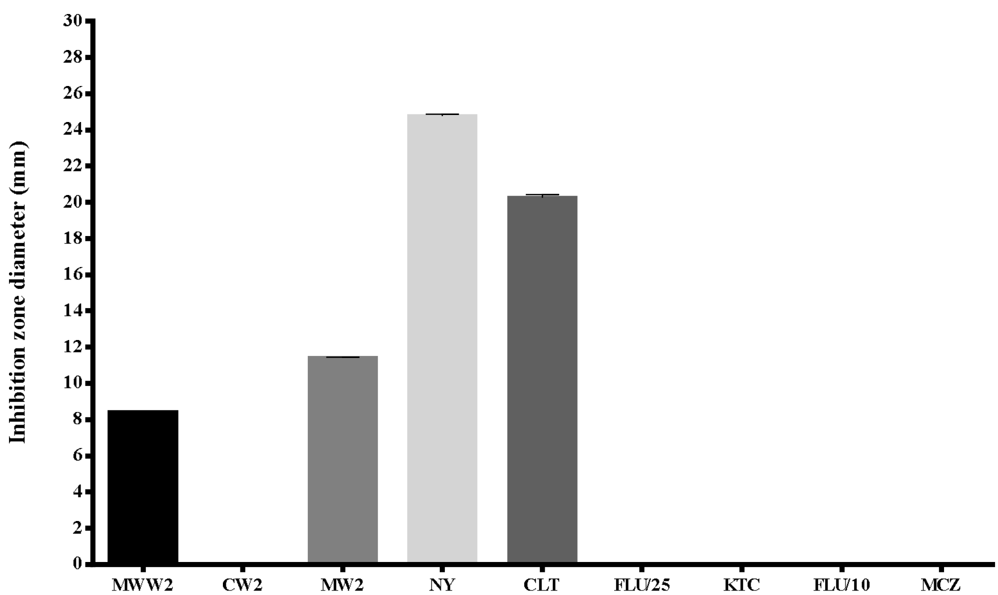
4- *Candida tropicalis*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida tropicalis*

Figure A 265. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) distilled water extracts and antifungal discs against *C. famata.*

5- *Candida famata*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida famata*

Figure A 270. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) distilled water extracts and antifungal discs against *C. parapsilosis.*

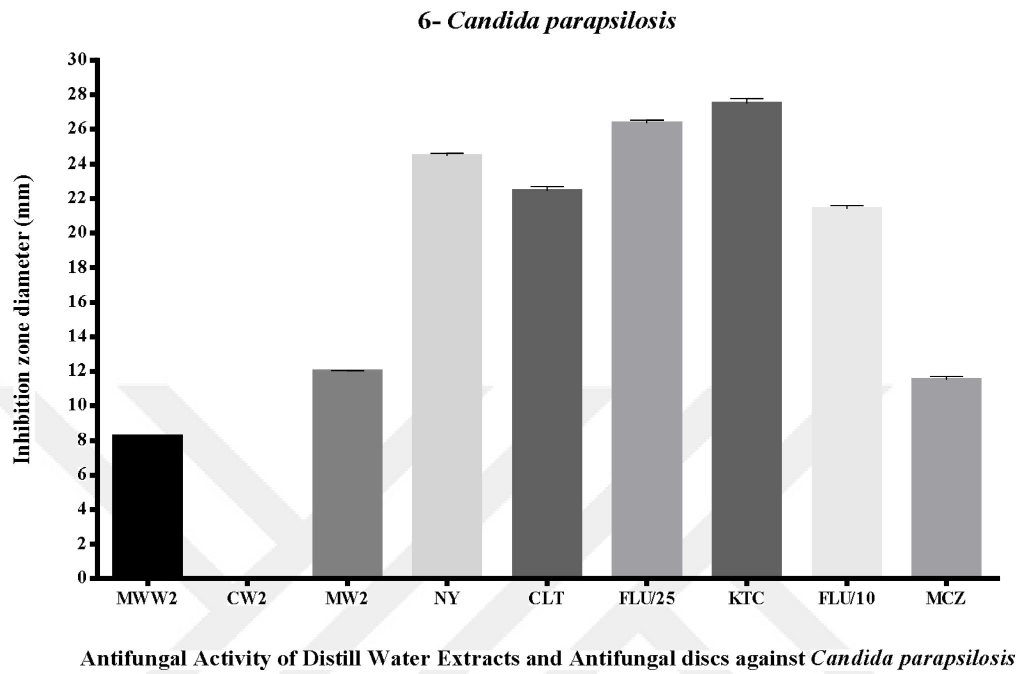


Figure A 271. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Yellow fruit) distilled water extracts and antifungal discs against *C. guilliermondii.*

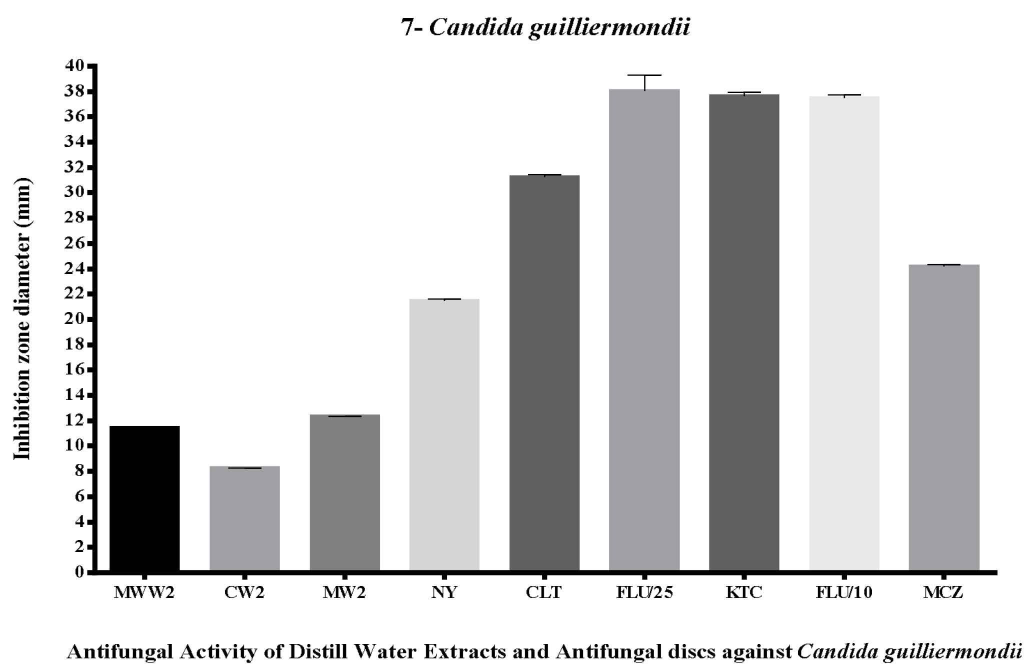


Figure A 272. Antifungal activity of *Pyrus syriaca* Boiss. distilled water extracts and antifungal discs against *C. albicans*.

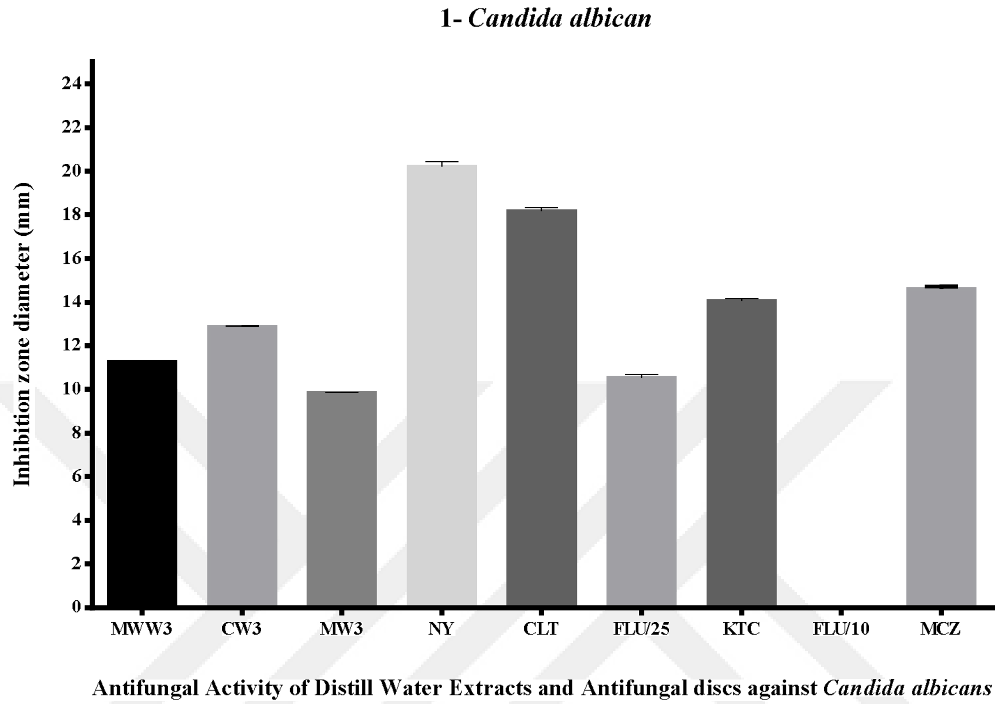


Figure A 273. Antifungal activity of *Pyrus syriaca* Boiss. distilled water extracts and antifungal discs against *C. glabatra*.

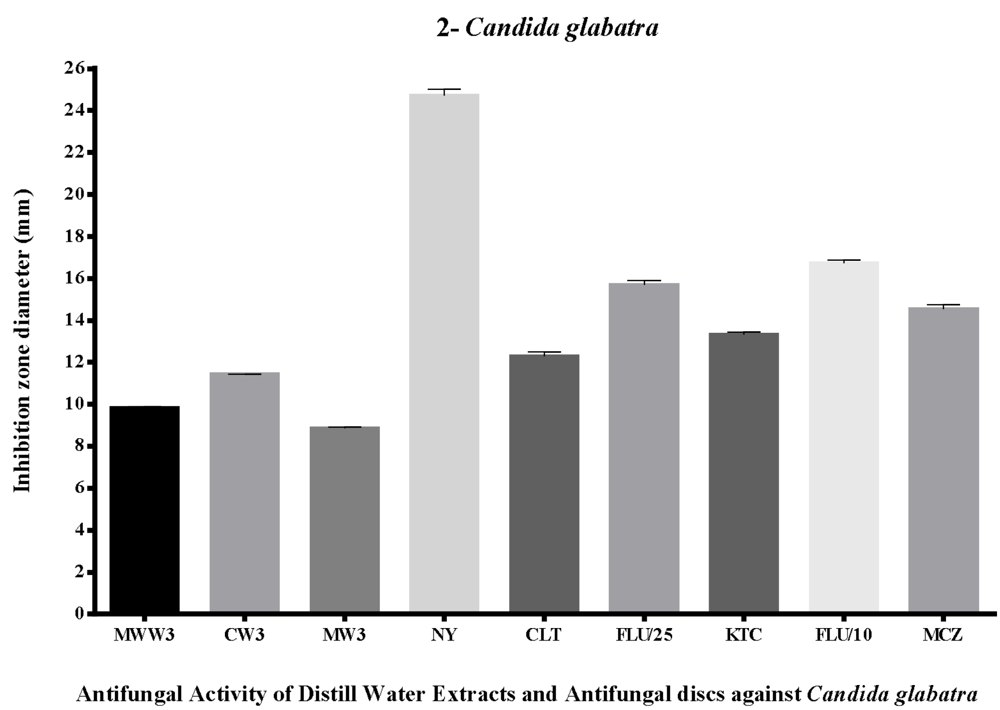


Figure A 274. Antifungal activity of *Pyrus syriaca* Boiss. distilled water extracts and antifungal discs against *C. krusei.*

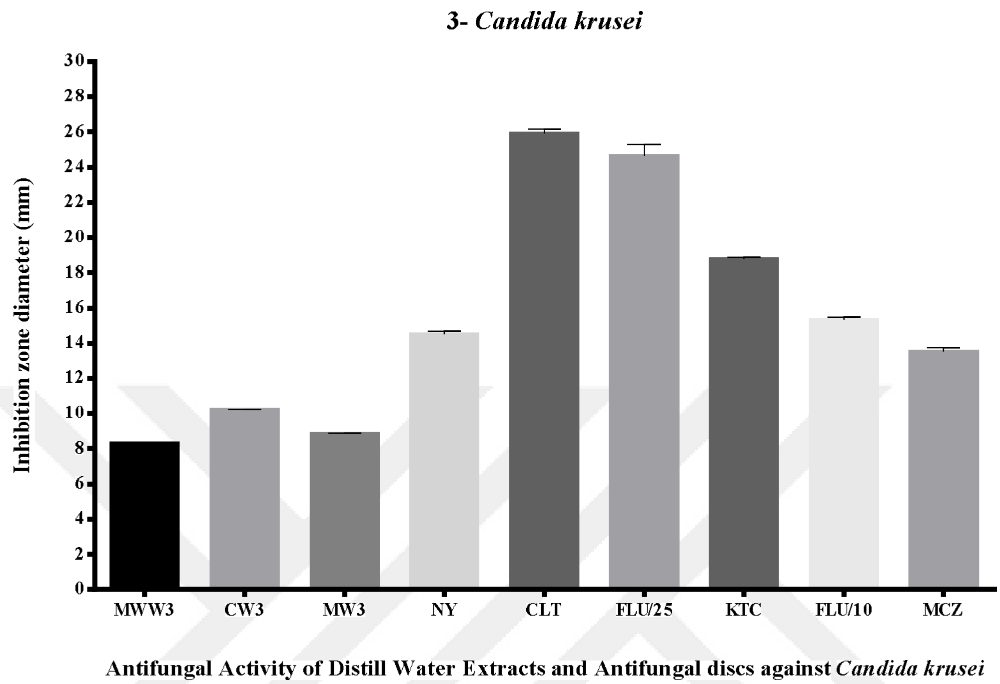


Figure A 275. Antifungal activity of *Pyrus syriaca* Boiss. distilled water extracts and antifungal discs against *C. tropicalis.*

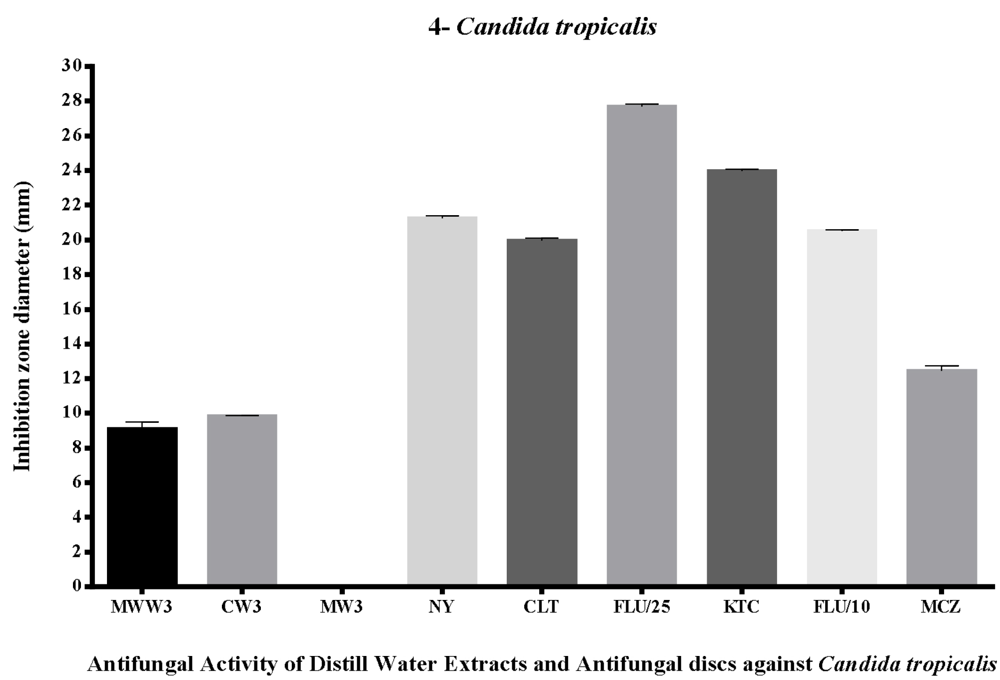


Figure A 276. Antifungal activity of *Pyrus syriaca* Boiss. distilled water extracts and antifungal discs against *C. famata.*

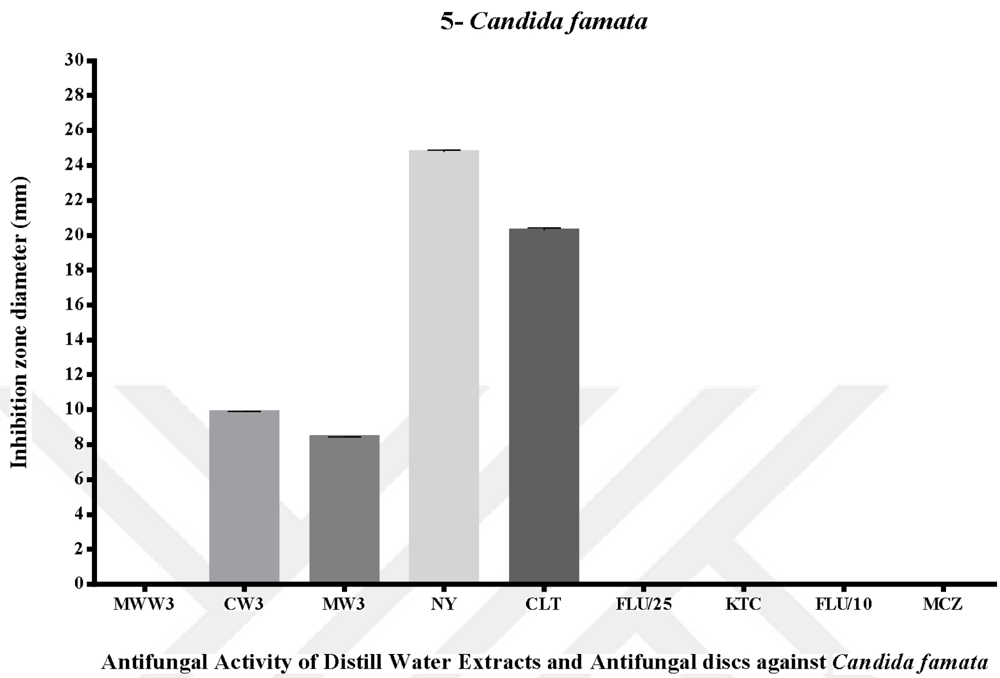


Figure A 277. Antifungal activity of *Pyrus syriaca* Boiss. distilled water extracts and antifungal discs against *C. parapsilosis.*

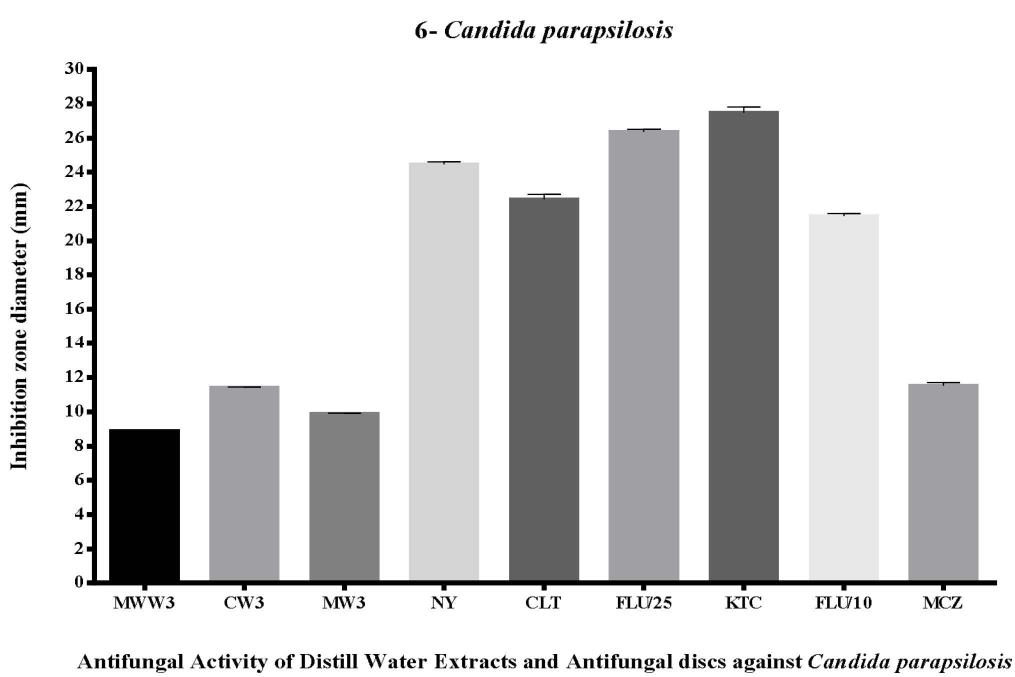
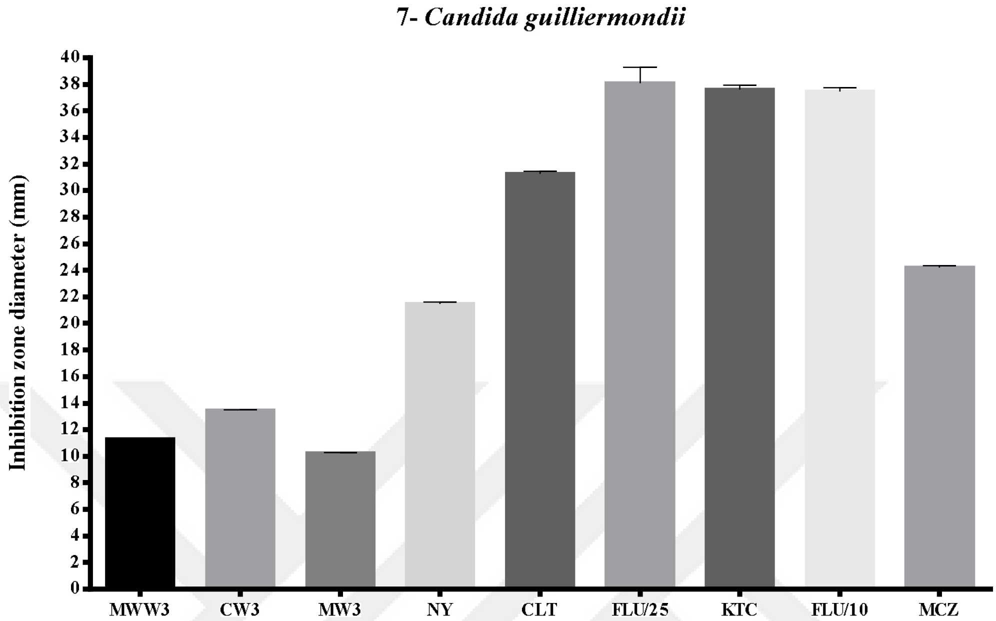
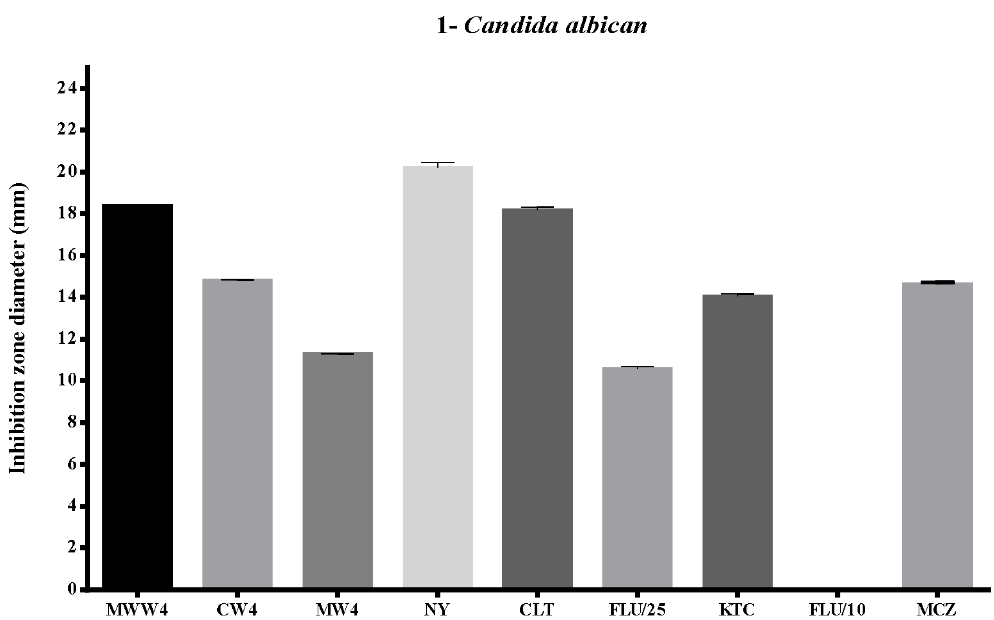


Figure A 278. Antifungal activity of *Pyrus syriaca* Boiss. distilled water extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 279. Antifungal activity of *Quercus infectoria* Oliv. distilled water extracts and antifungal discs against *C. albicans*.



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida albicans*

Figure A 280. Antifungal activity of *Quercus infectoria* Oliv. distilled water extracts and antifungal discs against *C. glabatra*.

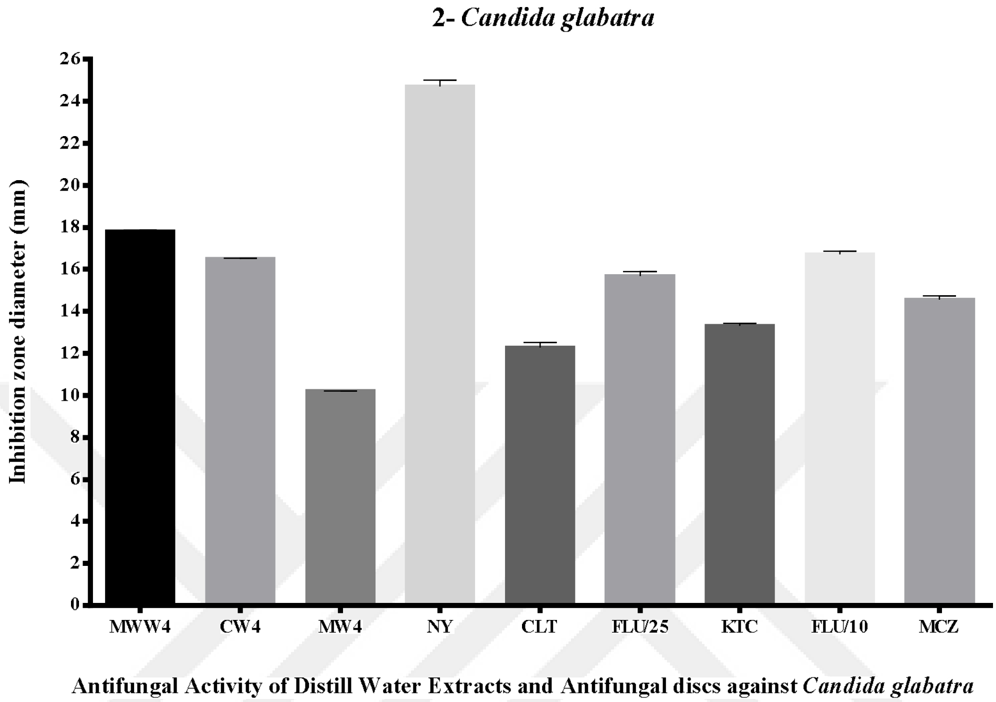


Figure A 281. Antifungal activity of *Quercus infectoria* Oliv. distilled water extracts and antifungal discs against *C. krusei.*

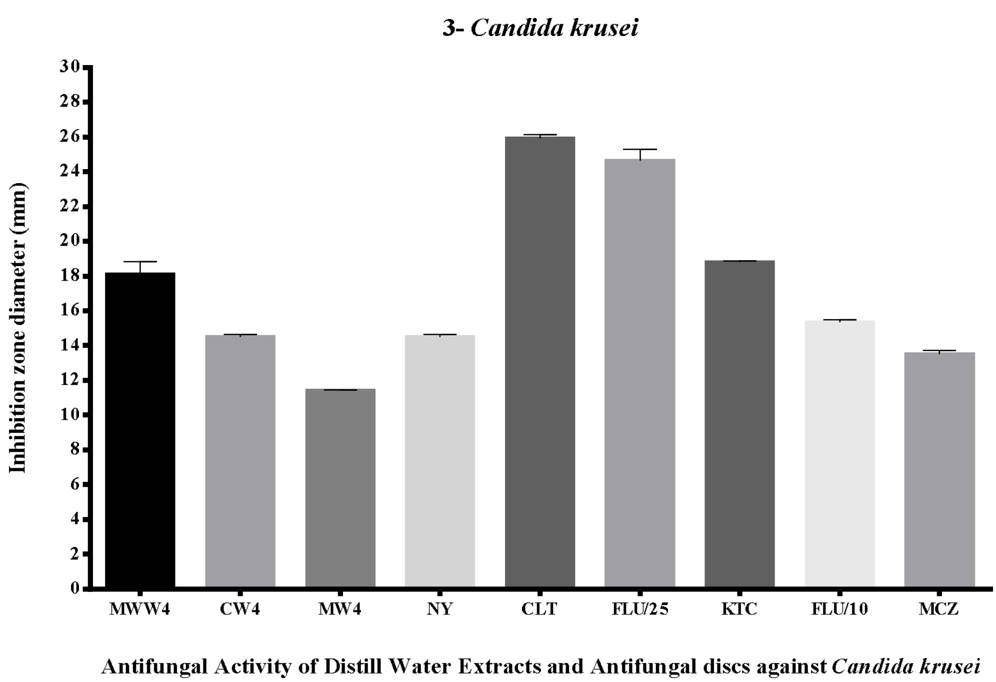


Figure A 282. Antifungal activity of *Quercus infectoria* Oliv. distilled water extracts and antifungal discs against *C. tropicalis.*

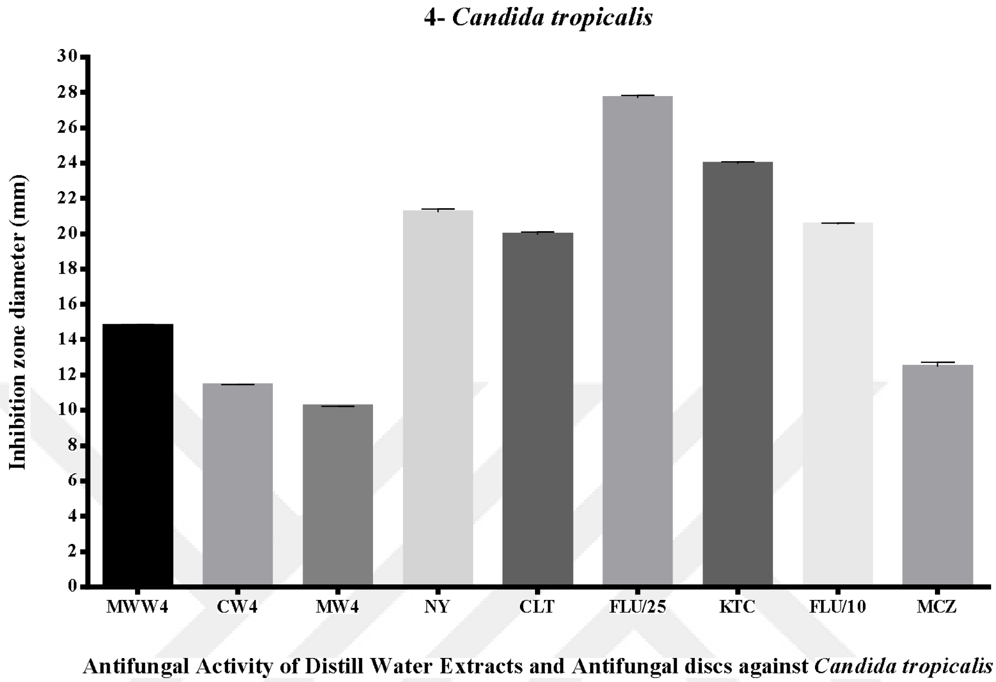


Figure A 283. Antifungal activity of *Quercus infectoria* Oliv. distilled water extracts and antifungal discs against *C. famata.*

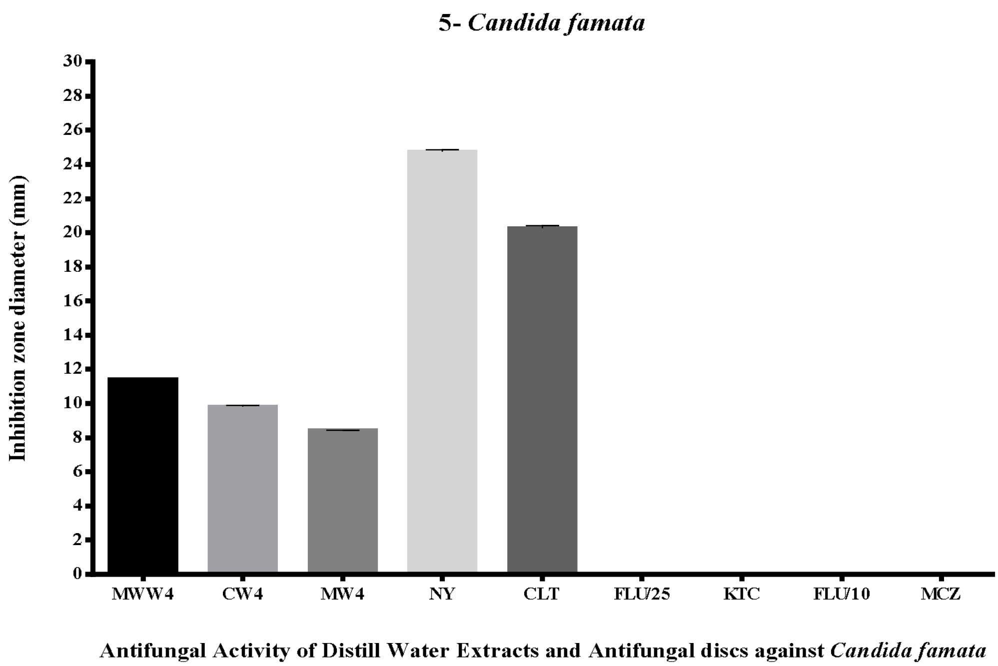
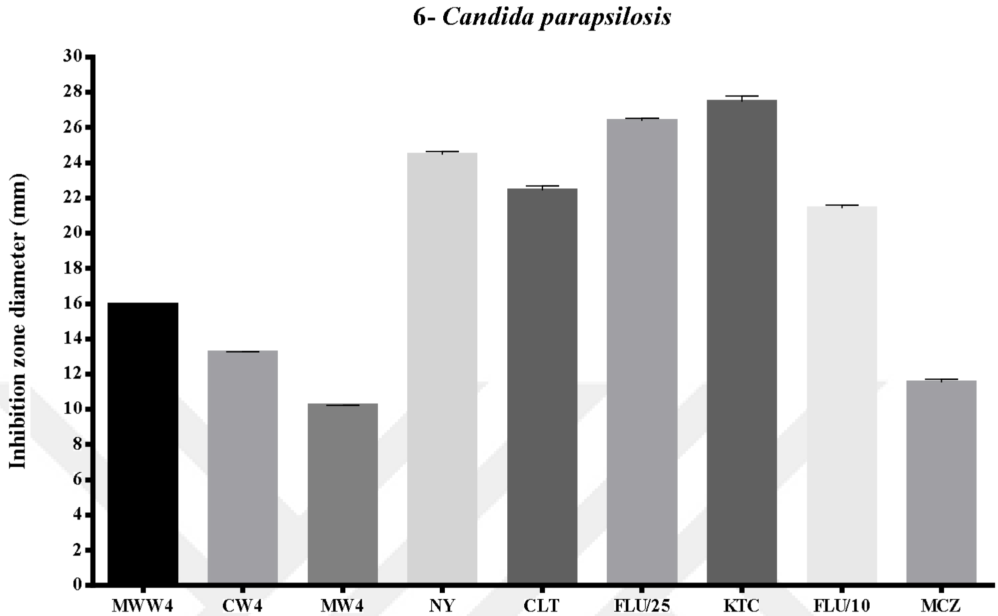
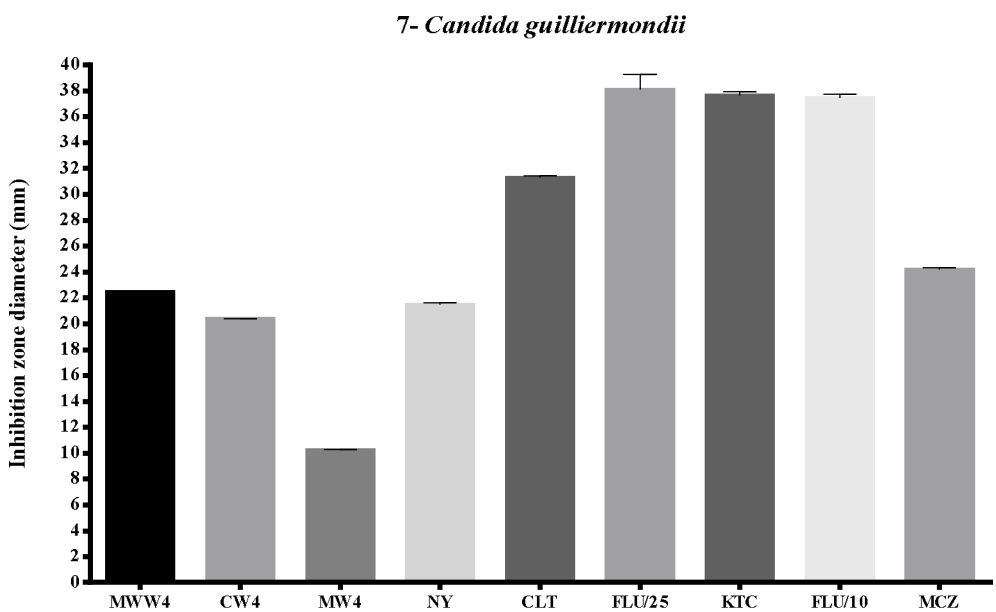


Figure A 284. Antifungal activity of *Quercus infectoria* Oliv. distilled water extracts and antifungal discs against *C. parapsilosis.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida parapsilosis*

Figure A 285. Antifungal activity of *Quercus infectoria* Oliv. distilled water extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 286. Antifungal activity of *Quercus aegilops* L. distilled water extracts and antifungal discs against *C. albicans.*

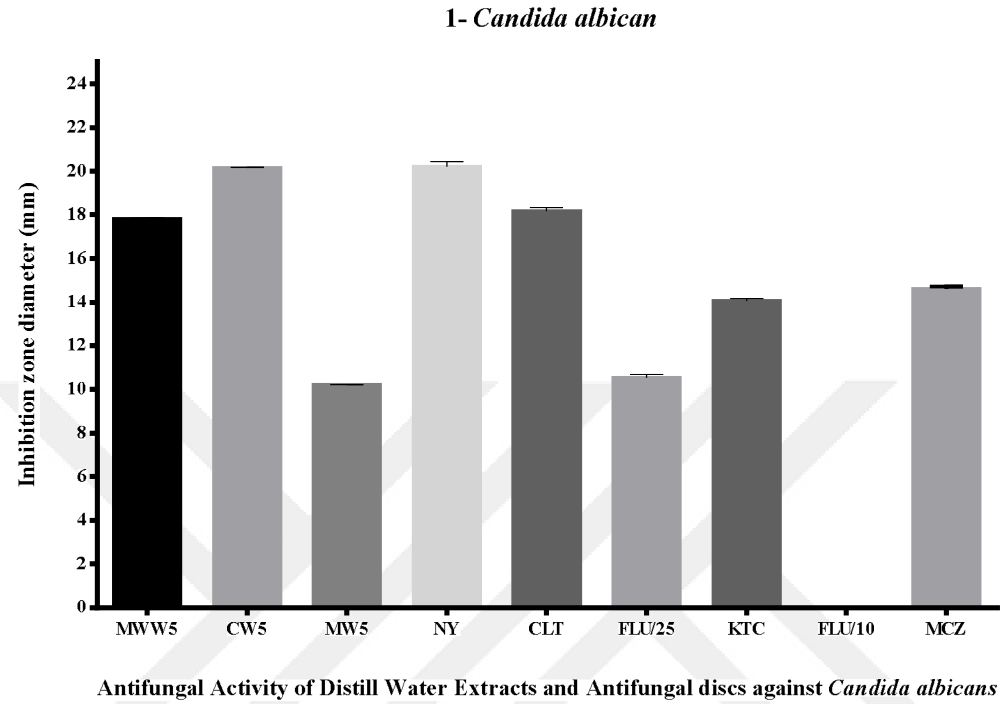


Figure A 287. Antifungal activity of *Quercus aegilops* L. distilled water extracts and antifungal discs against *C. glabatra.*

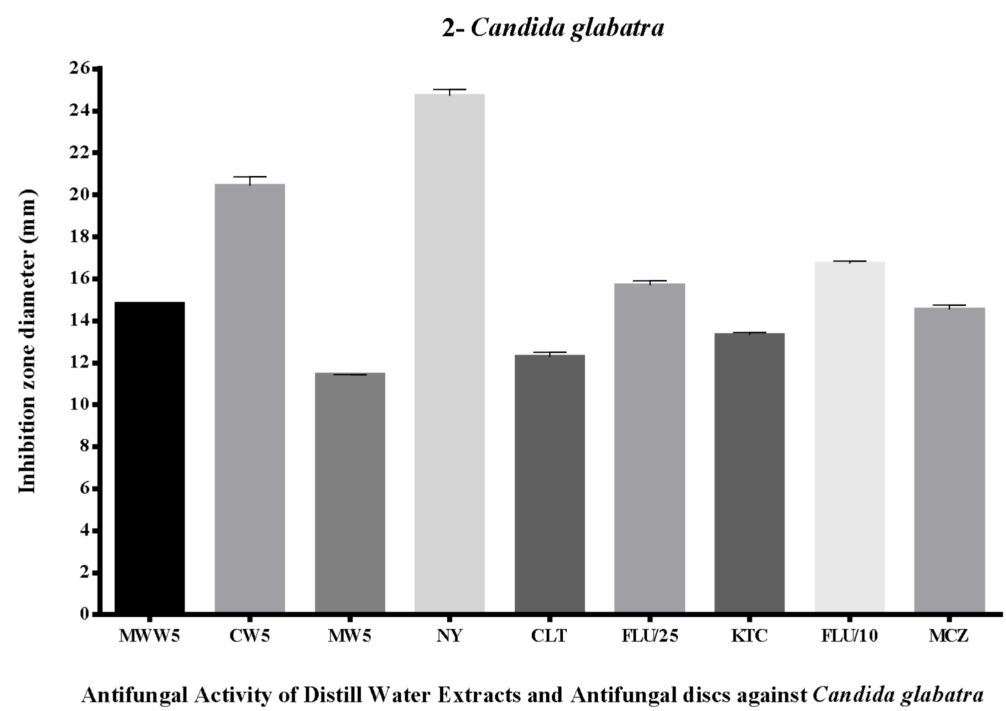
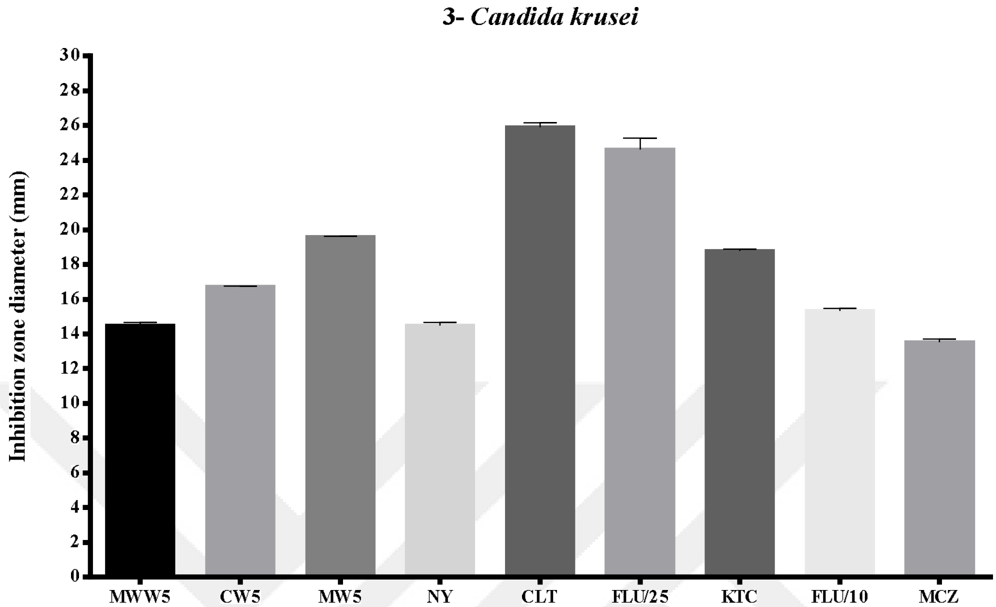
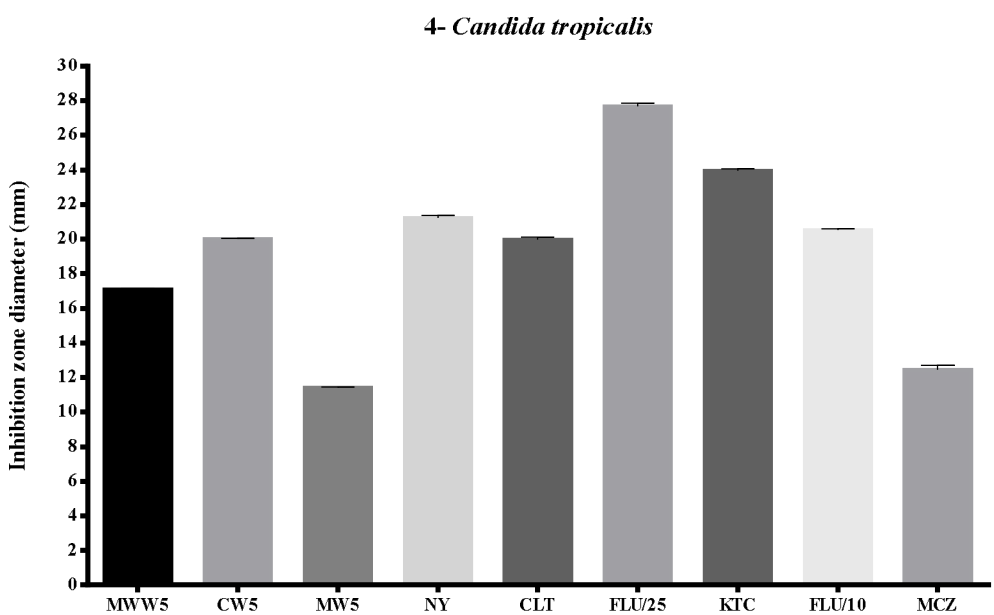


Figure A 288. Antifungal activity of *Quercus aegilops* L. distilled water extracts and antifungal discs against *C. krusei.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida krusei*

Figure A 289. Antifungal activity of *Quercus aegilops* L. distilled water extracts and antifungal discs against *C. tropicalis.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida tropicalis*

Figure A 290. Antifungal activity of *Quercus aegilops* L. distilled water extracts and antifungal discs against *C. famata.*

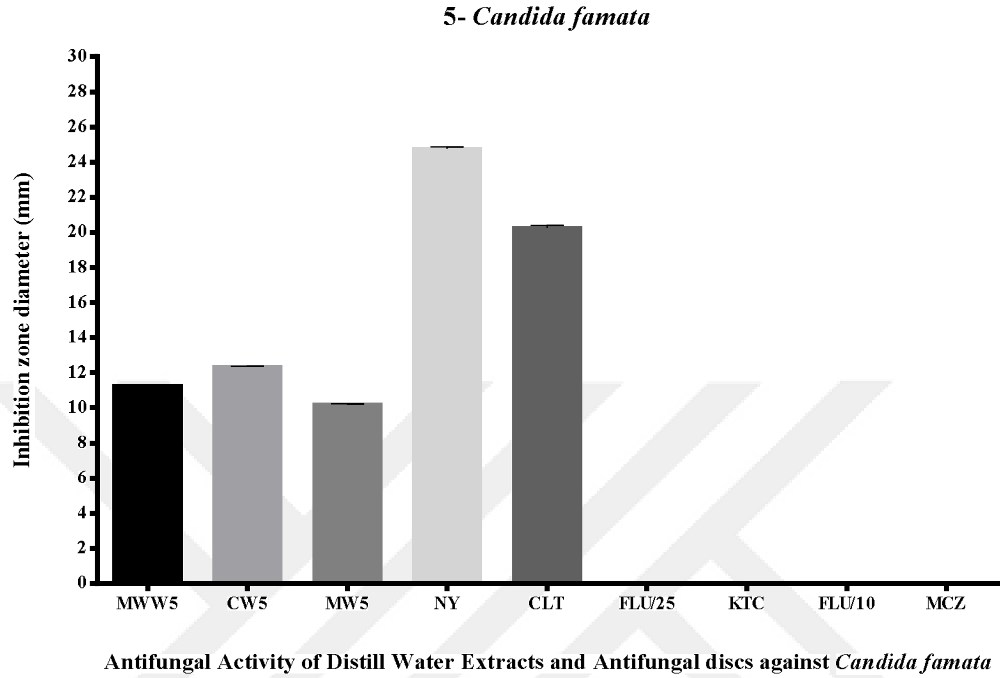


Figure A 291. Antifungal activity of *Quercus aegilops* L. distilled water extracts and antifungal discs against *C. parapsilosis.*

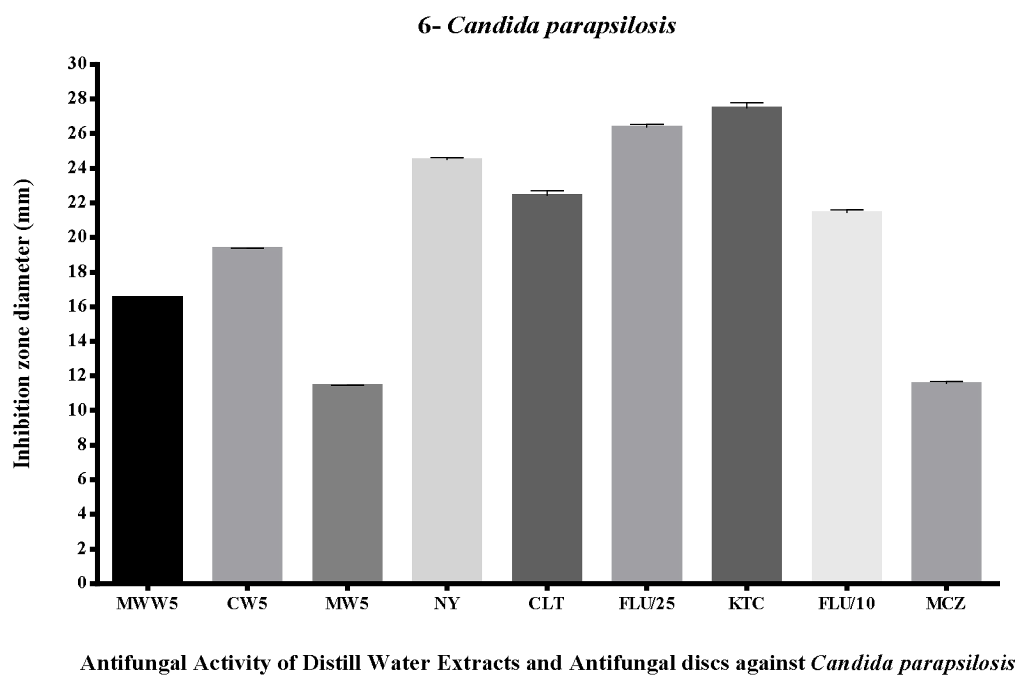


Figure A 292. Antifungal activity of *Quercus aegilops* L. distilled water extracts and antifungal discs against *C. guilliermondii.*

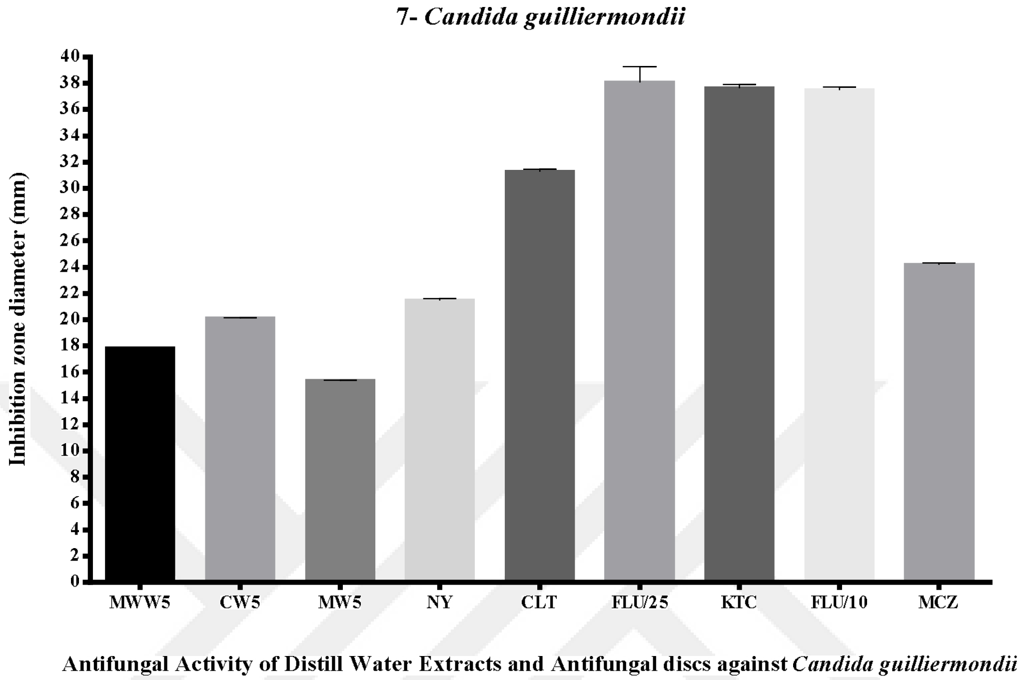


Figure A 293. Antifungal activity of *Crataegus monogyna* Jacquin distilled water extracts and antifungal discs against *C. albicans.*

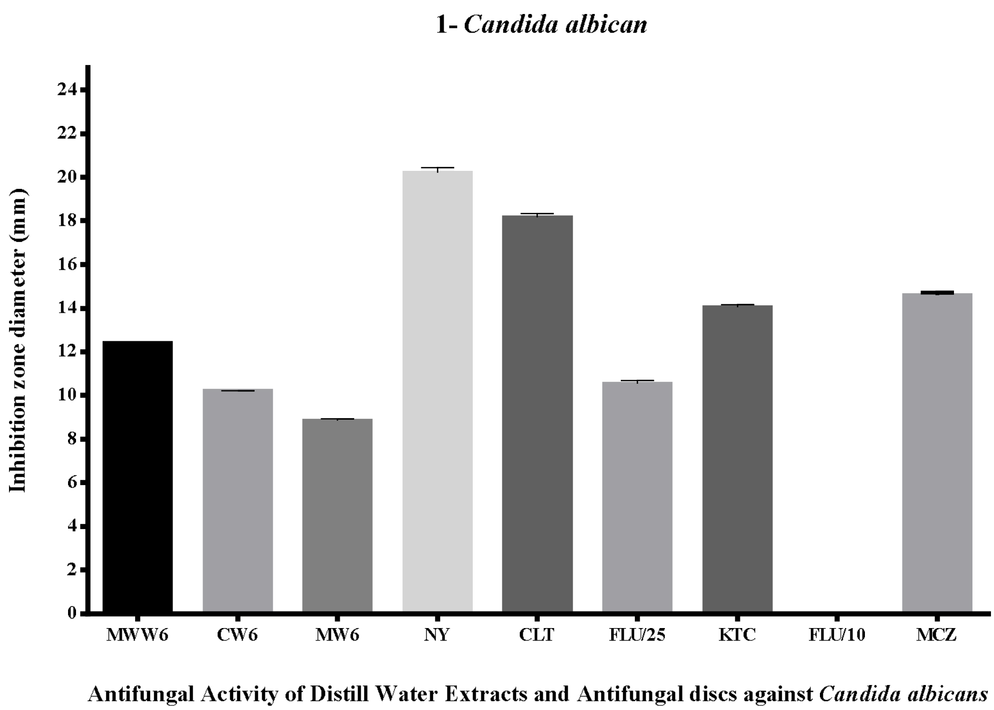


Figure A 294. Antifungal activity of *Crataegus monogyna* Jacquin distilled water extracts and antifungal discs against *C. glabatra.*

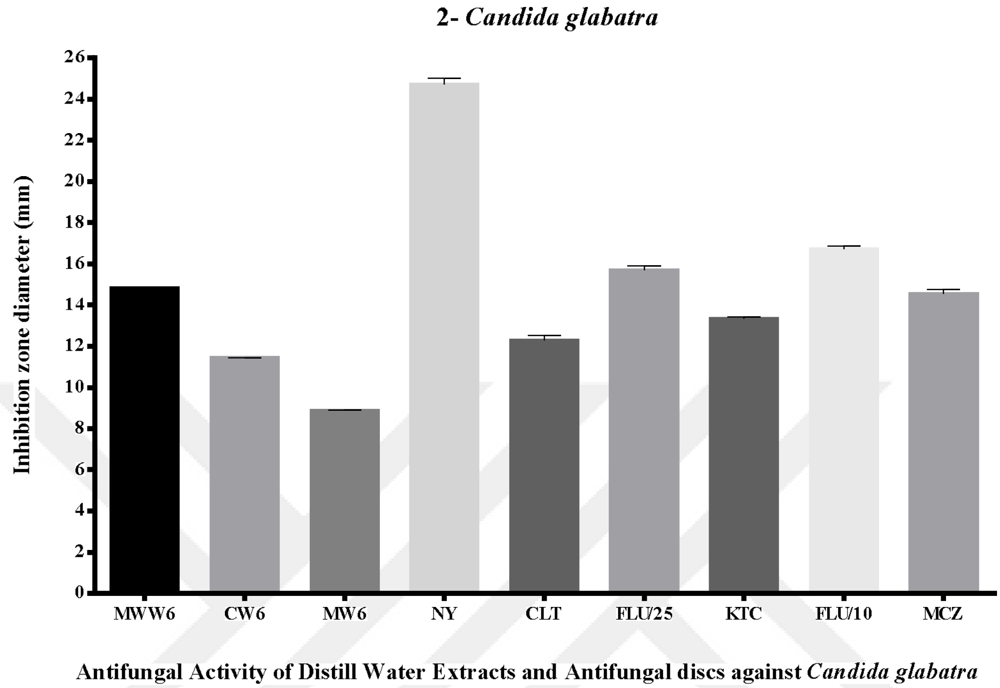


Figure A 295. Antifungal activity of *Crataegus monogyna* Jacquin distilled water extracts and antifungal discs against *C. krusei.*

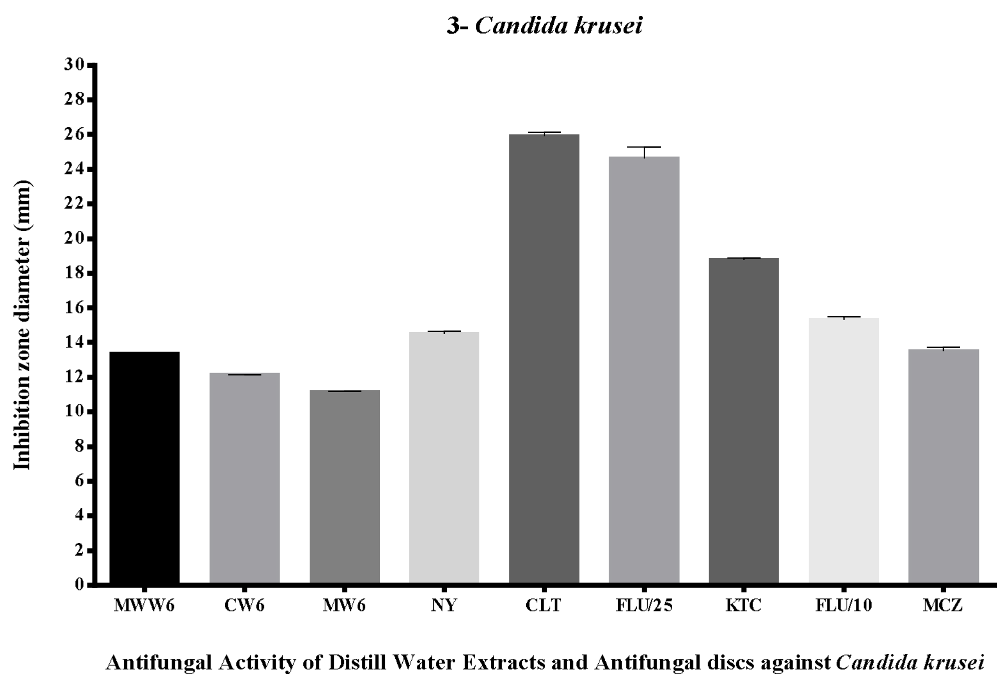


Figure A 296. Antifungal activity of *Crataegus monogyna* Jacquin distilled water extracts and antifungal discs against *C. tropicalis.*

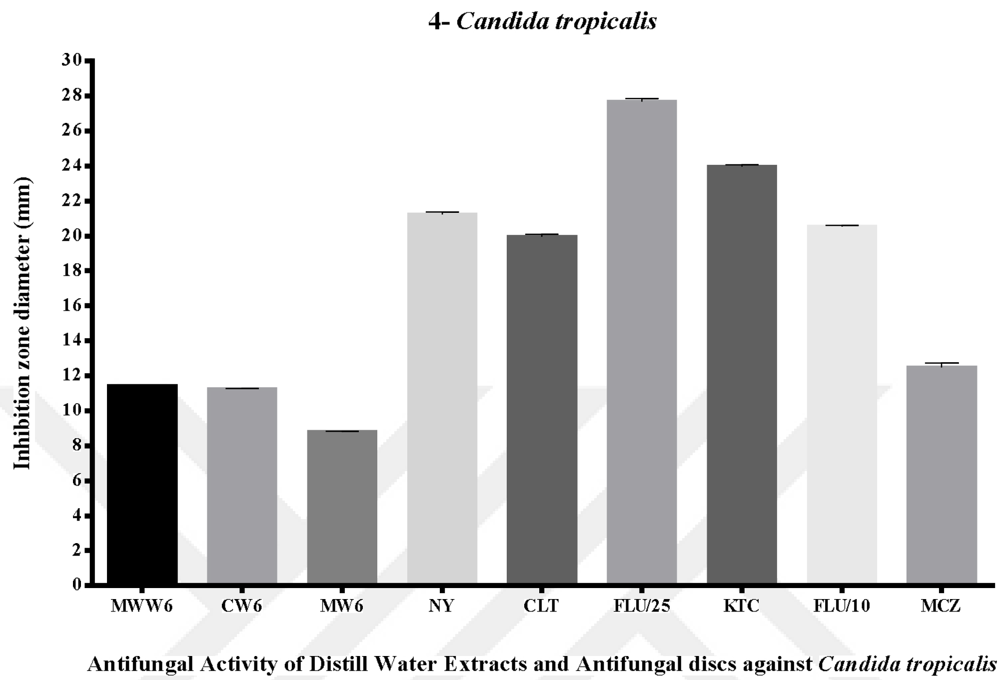


Figure A 297. Antifungal activity of *Crataegus monogyna* Jacquin distilled water extracts and antifungal discs against *C. famata.*

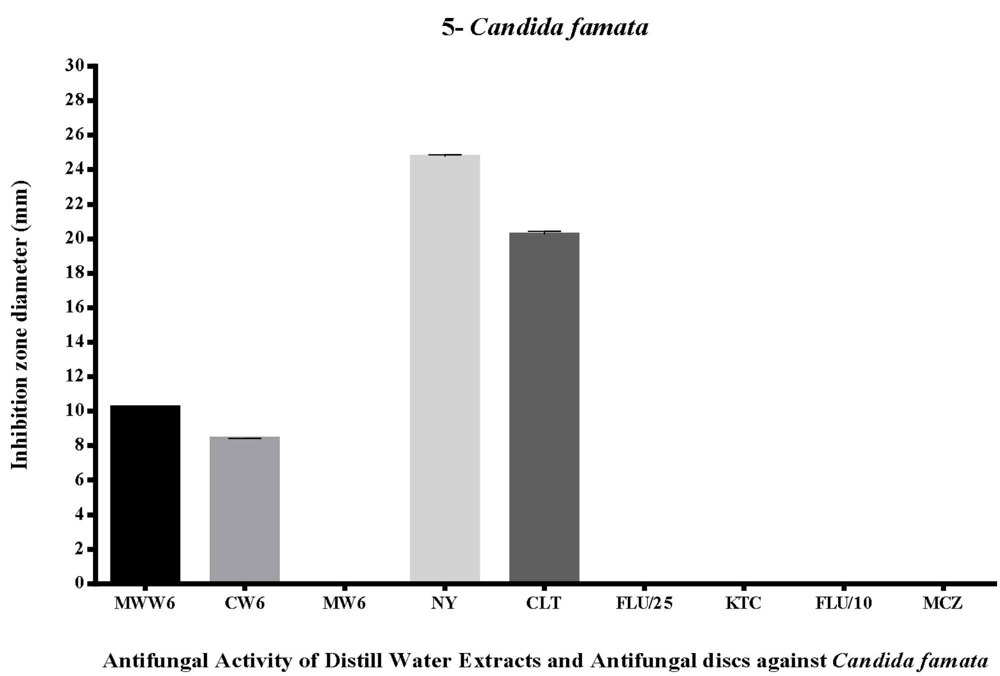
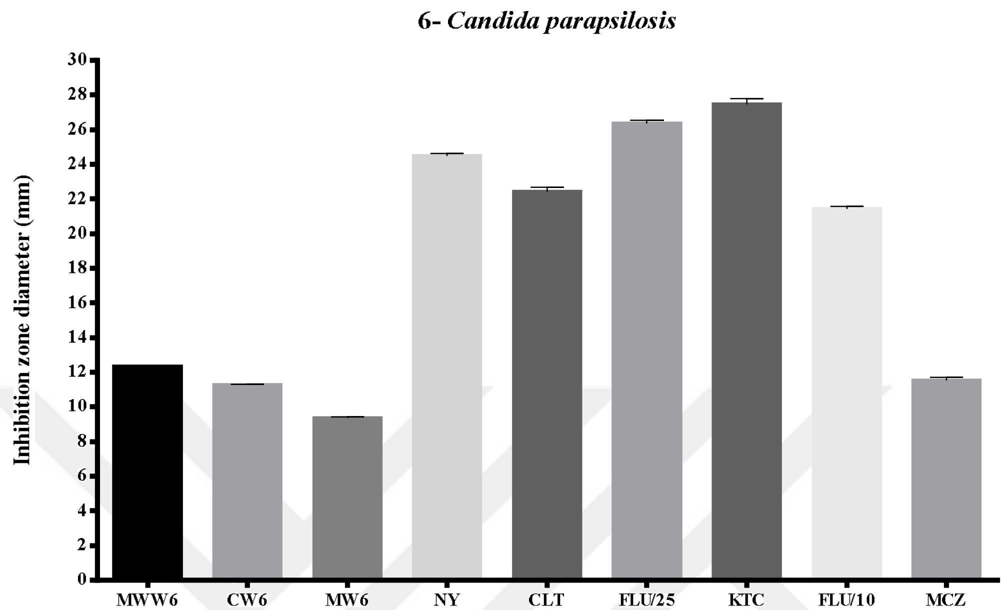
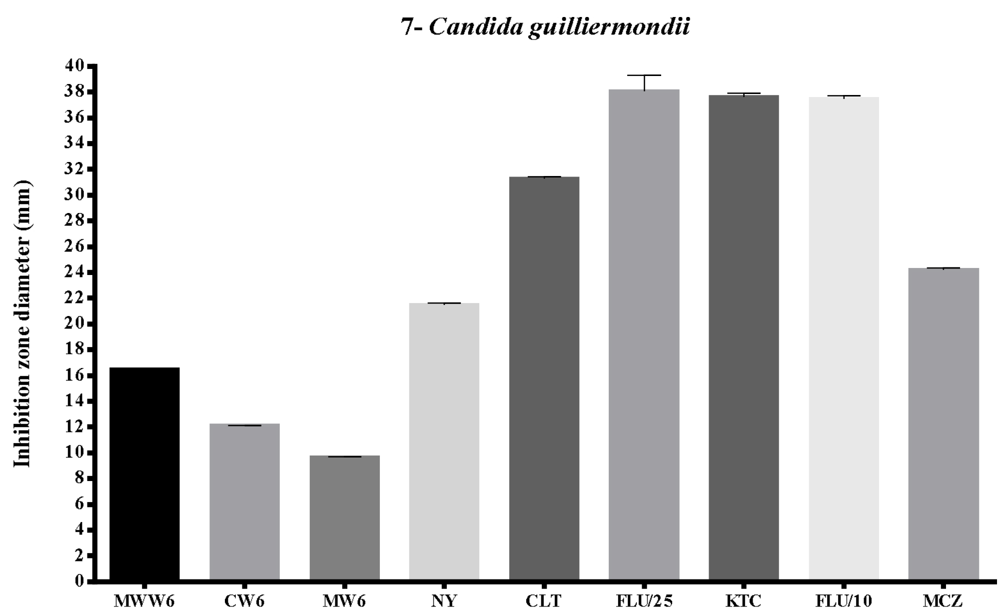


Figure A 298. Antifungal activity of *Crataegus monogyna* Jacquin distilled water extracts and antifungal discs against *C. parapsilosis.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida parapsilosis*

Figure A 299. Antifungal activity of *Crataegus monogyna* Jacquin distilled water extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 300. Antifungal activity of *Prunus argentea* (Lam.) Rehder distilled water extracts and antifungal discs against *C. albicans.*

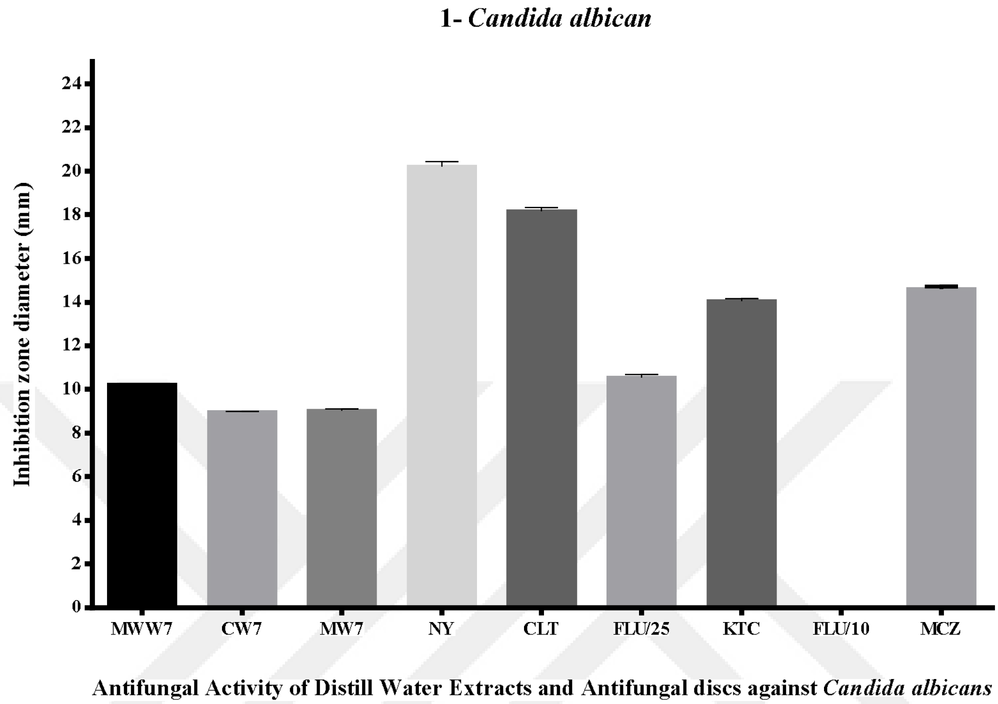


Figure A 301. Antifungal activity of *Prunus argentea* (Lam.) Rehder distilled water extracts and antifungal discs against *C. glabatra.*

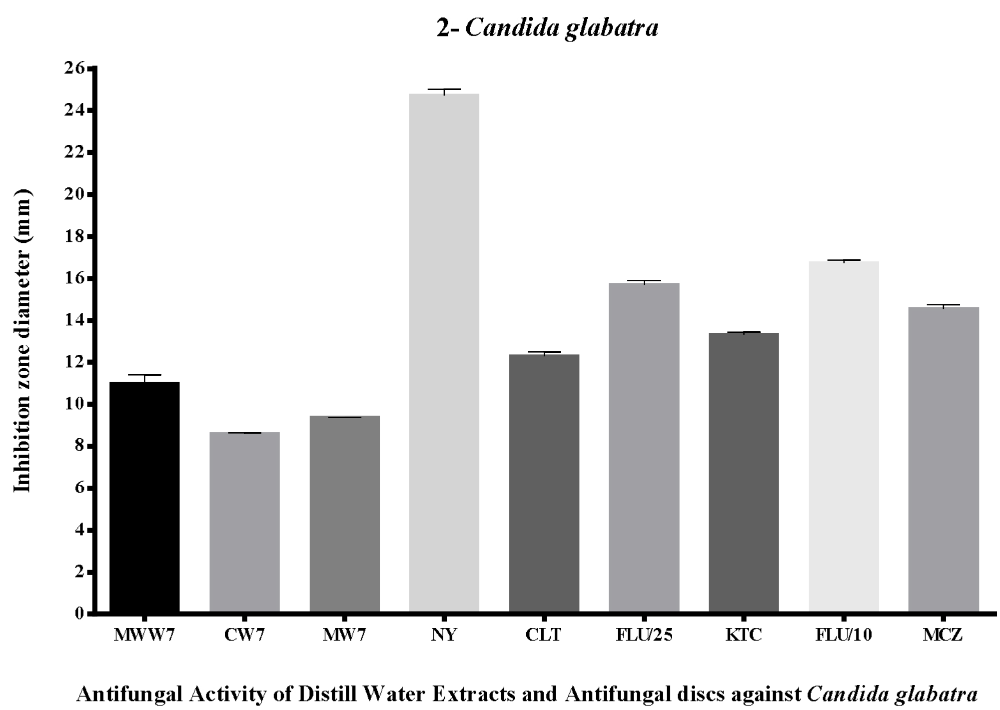


Figure A 302. Antifungal activity of *Prunus argentea* (Lam.) Rehder distilled water extracts and antifungal discs against *C. krusei.*

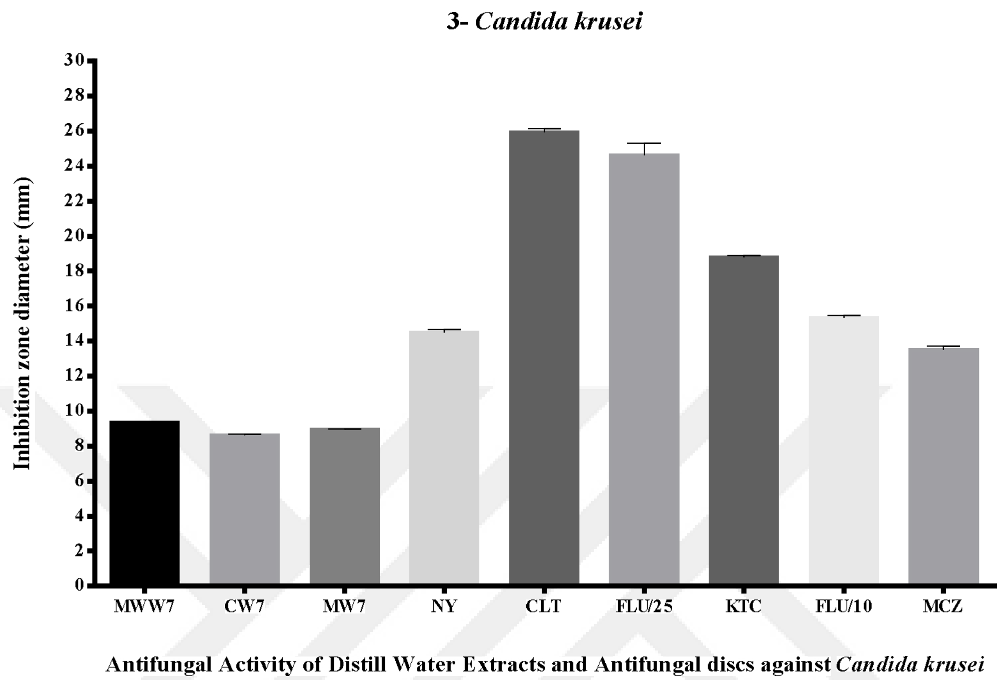


Figure A 303. Antifungal activity of *Prunus argentea* (Lam.) Rehder distilled water extracts and antifungal discs against *C. tropicalis.*

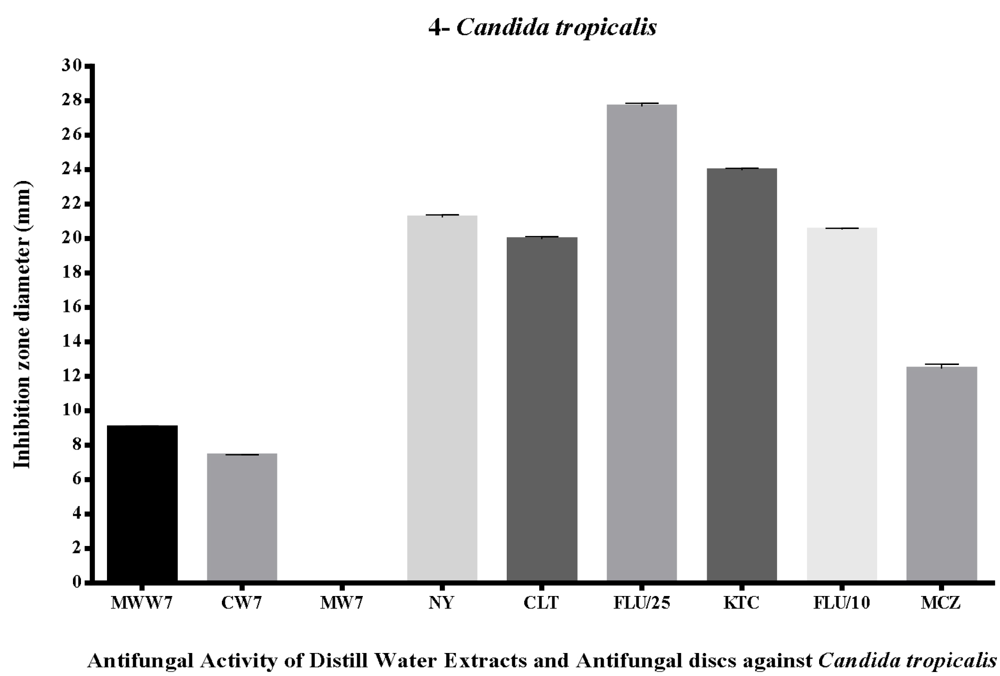


Figure A 304. Antifungal activity of *Prunus argentea* (Lam.) Rehder distilled water extracts and antifungal discs against *C. famata.*

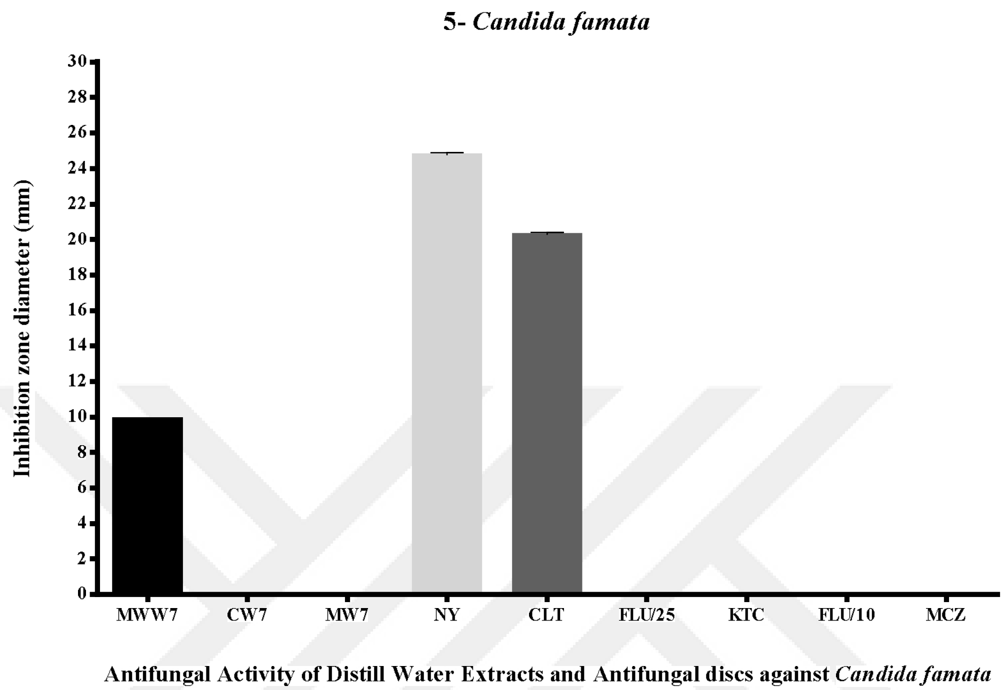


Figure A 305. Antifungal activity of *Prunus argentea* (Lam.) Rehder distilled water extracts and antifungal discs against *C. parapsilosis.*

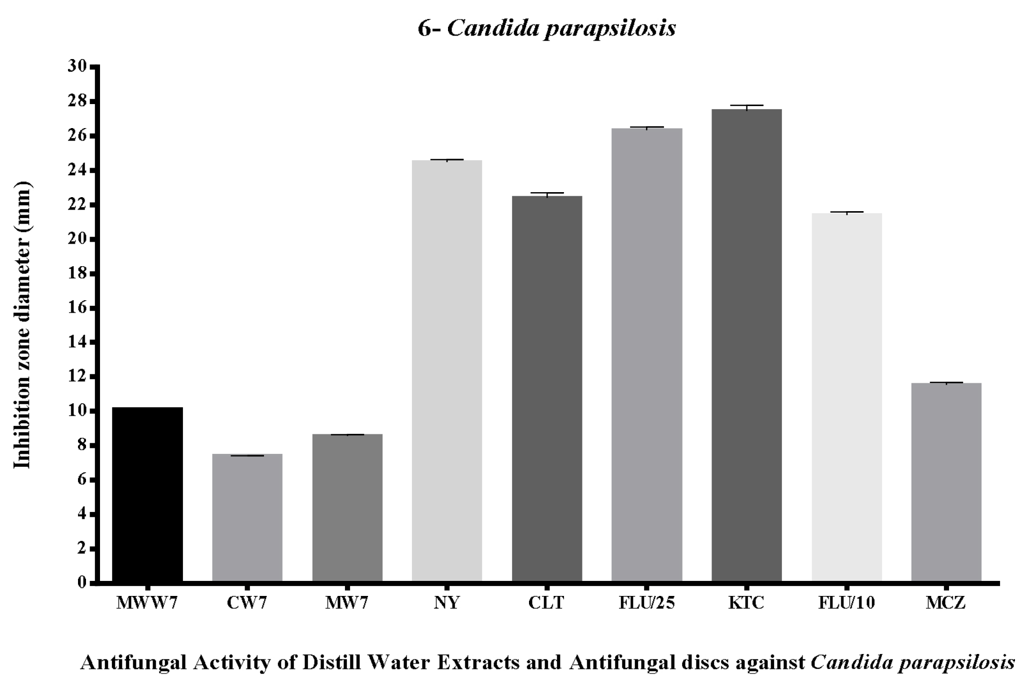
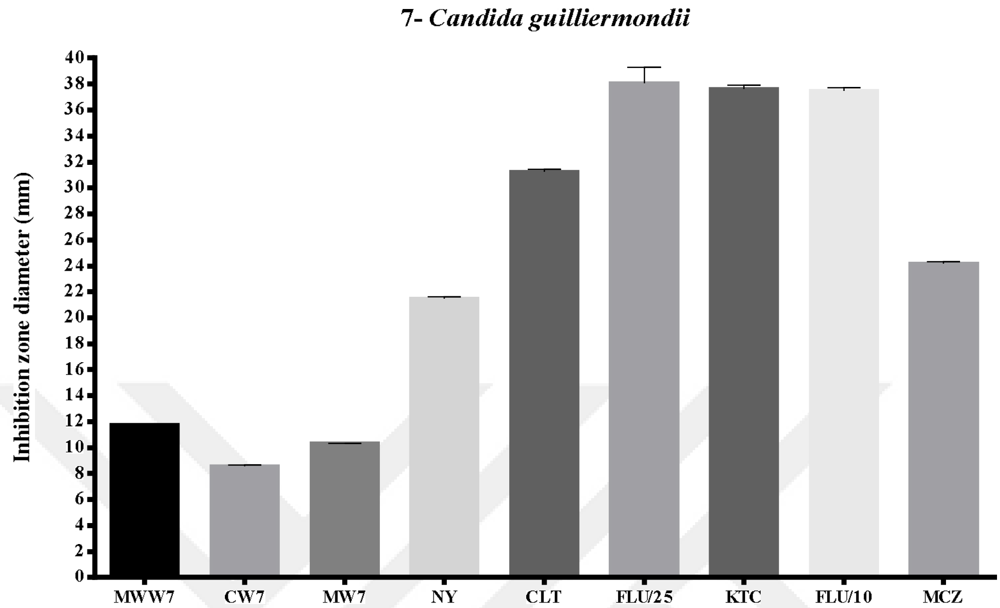
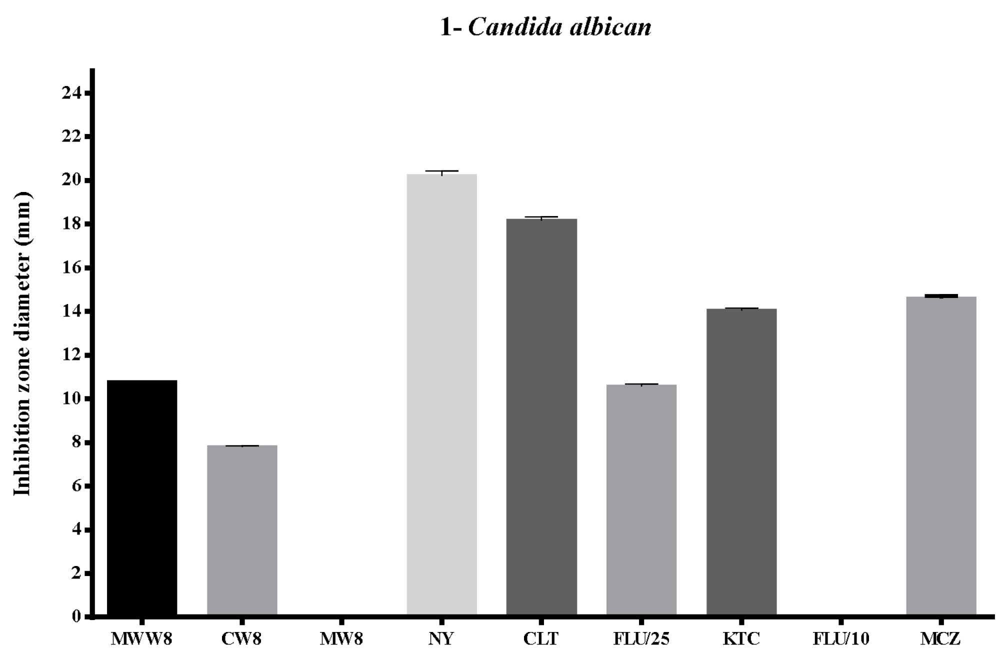


Figure A 306. Antifungal activity of *Prunus argentea* (Lam.) Rehder distilled water extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 307. Antifungal activity of *Crataegus azarolus* var. aronia L. distilled water extracts and antifungal discs against *C. albicans.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida albicans*

Figure A 308. Antifungal activity of *Crataegus azarolus* var. aronia L. distilled water extracts and antifungal discs against *C. glabatra.*

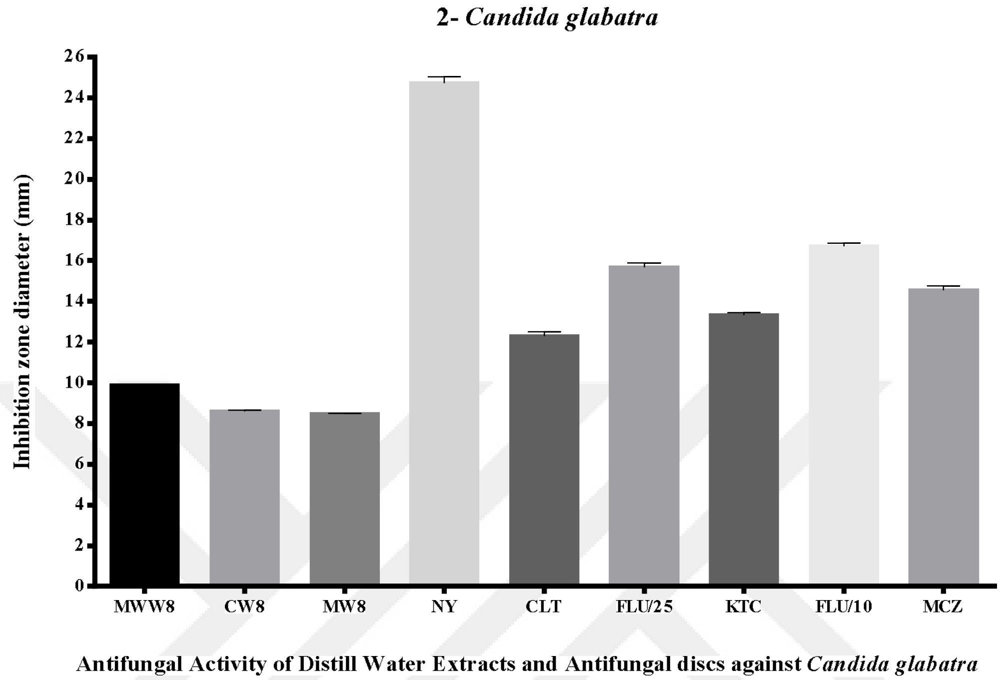


Figure A 309. Antifungal activity of *Crataegus azarolus* var. aronia L. distilled water extracts and antifungal discs against *C. krusei.*

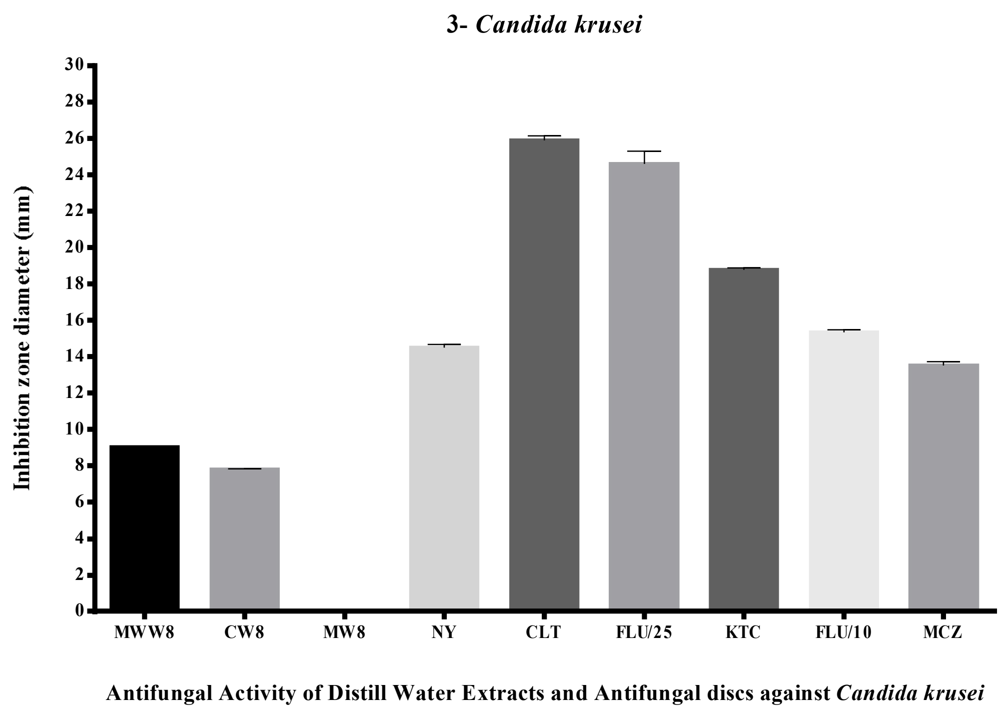


Figure A 310. Antifungal activity of *Crataegus azarolus* var. aronia L. distilled water extracts and antifungal discs against *C. tropicalis.*

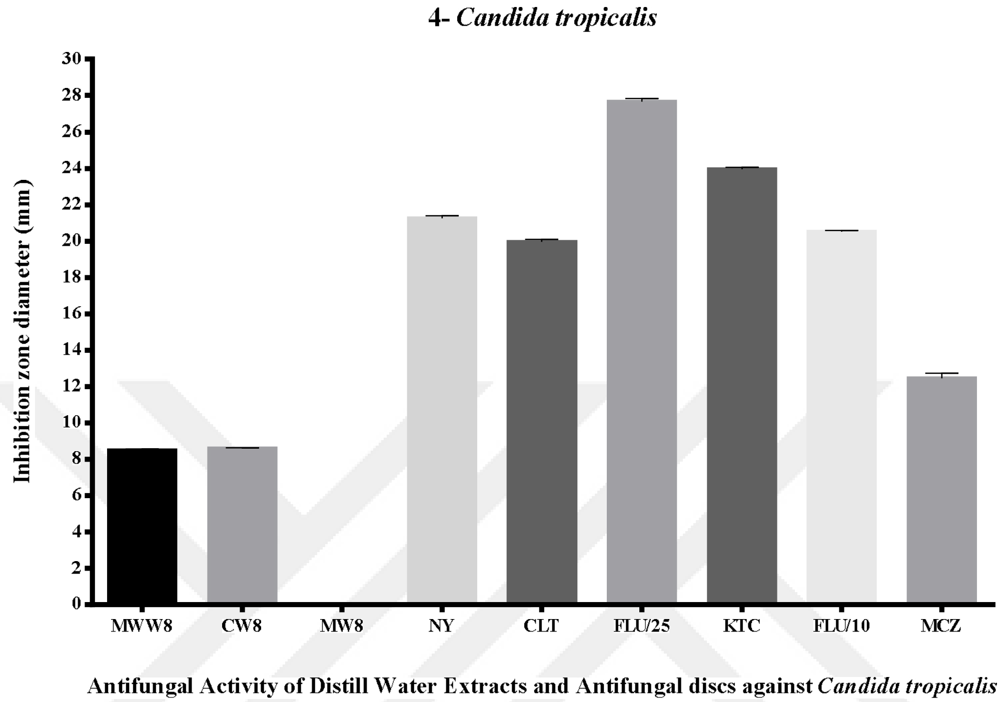


Figure A 311. Antifungal activity of *Crataegus azarolus* var. aronia L. distilled water extracts and antifungal discs against *C. famata.*

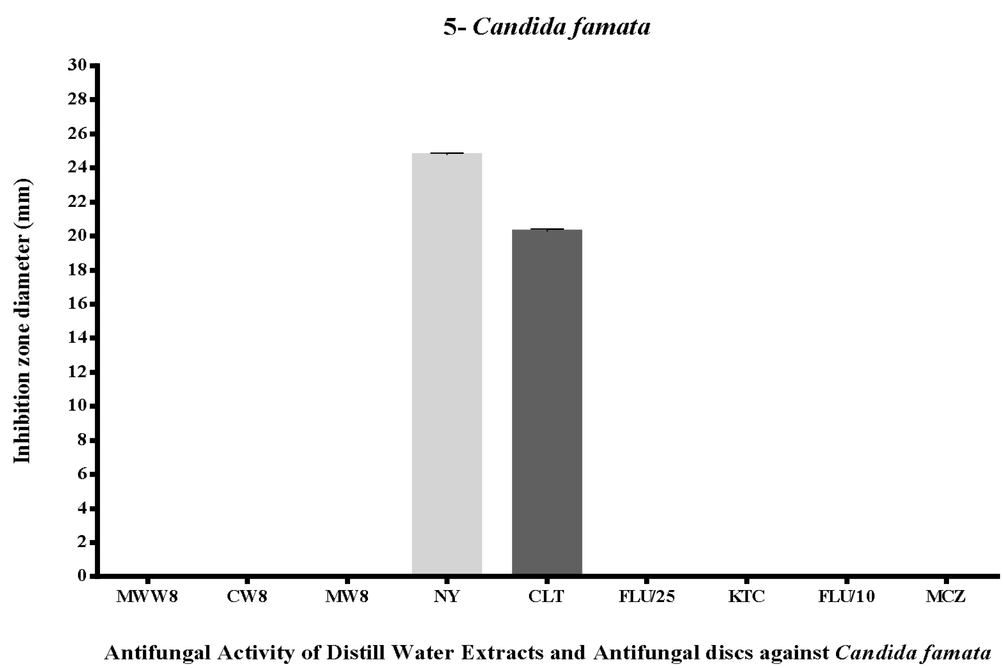
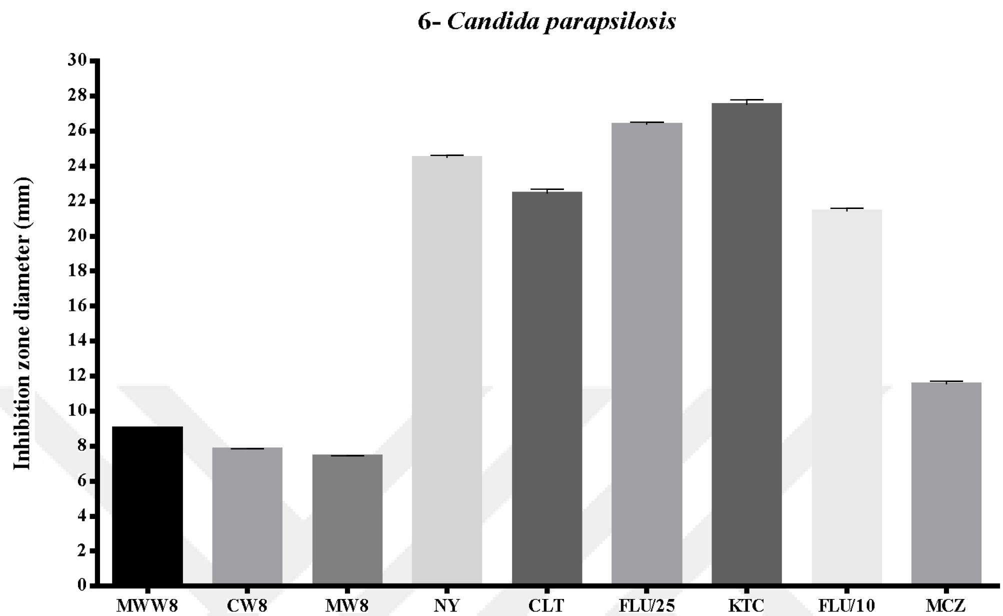
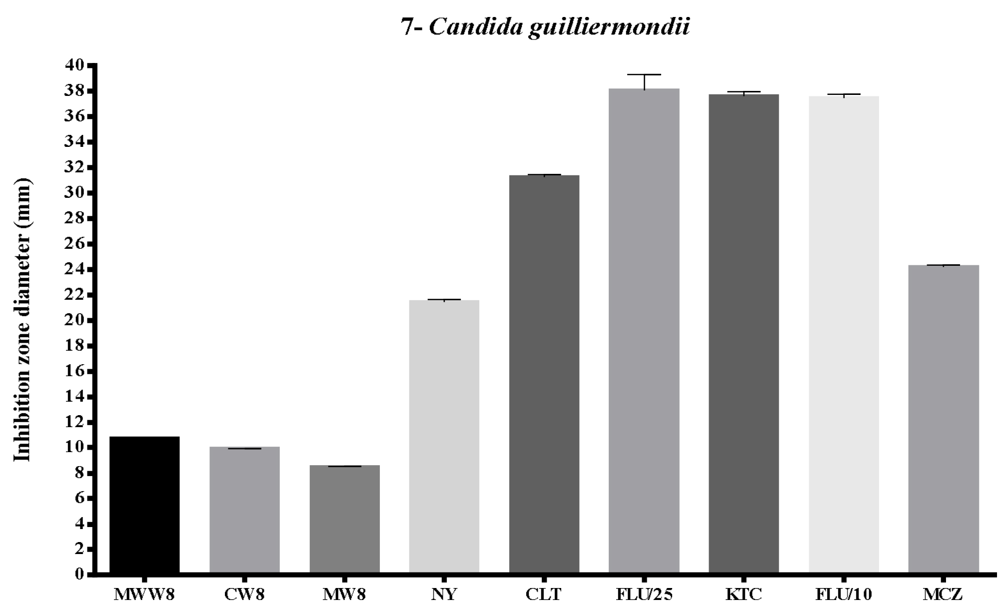


Figure A 312. Antifungal activity of *Crataegus azarolus* var. aronia L. distilled water extracts and antifungal discs against *C. parapsilosis.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida parapsilosis*

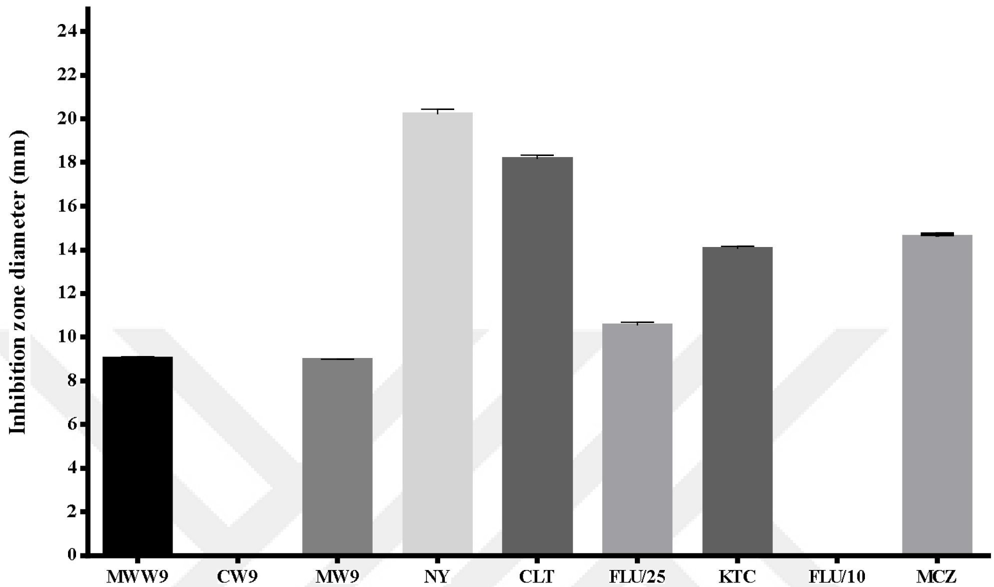
Figure A 313. Antifungal activity of *Crataegus azarolus* var. aronia L. distilled water extracts and antifungal discs against *C. guilliermondii.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 314. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) distilled water extracts and antifungal discs against *C. albicans.*

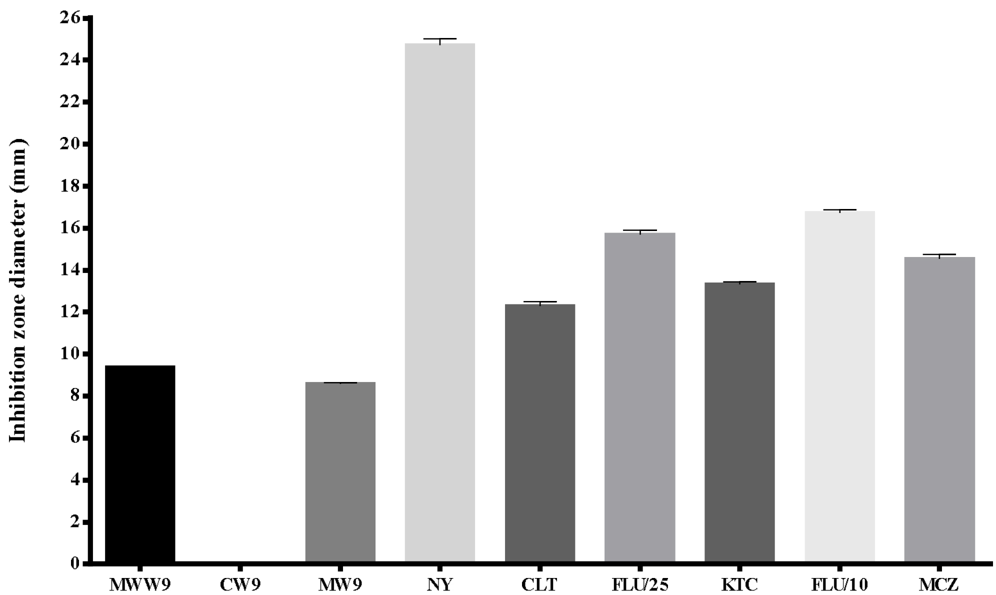
1- *Candida albican*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida albicans*

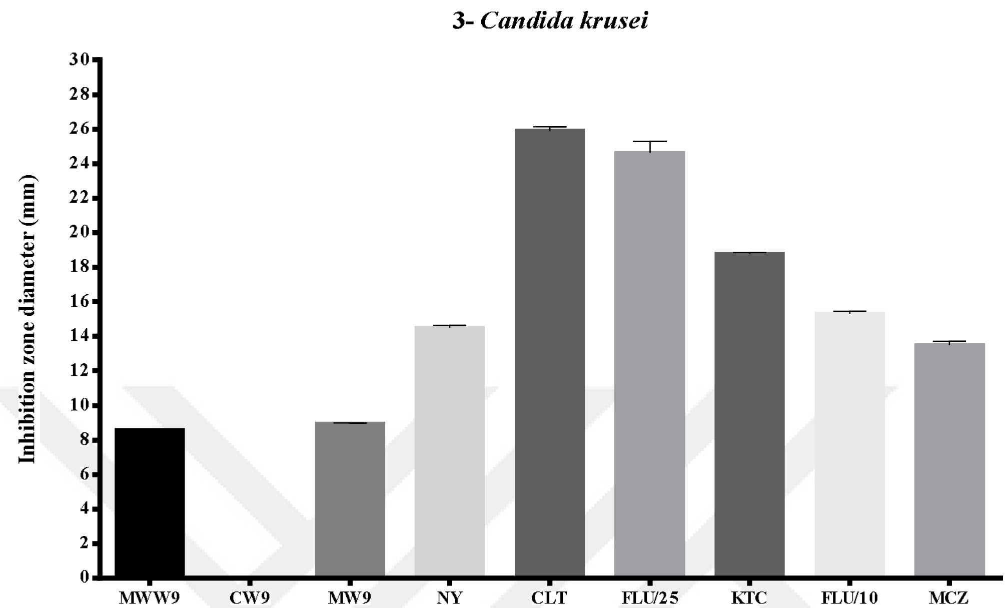
Figure A 315. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) distilled water extracts and antifungal discs against *C. glabatra.*

2- *Candida glabatra*



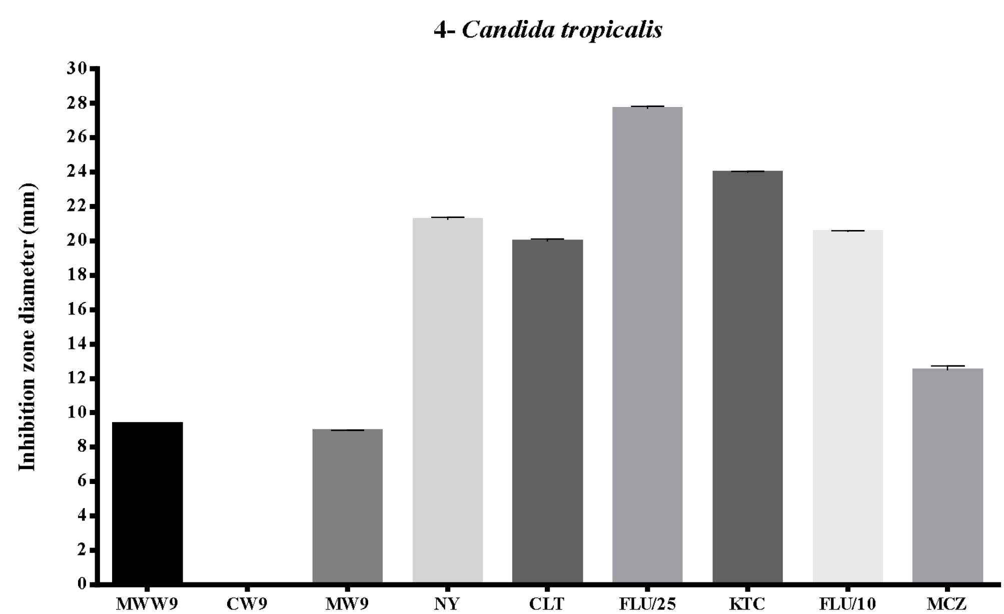
Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida glabatra*

Figure A 316. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) distilled water extracts and antifungal discs against *C. krusei.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida krusei*

Figure A 317. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) distilled water extracts and antifungal discs against *C. tropicalis.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida tropicalis*

Figure A 318. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) distilled water extracts and antifungal discs against *C. famata.*

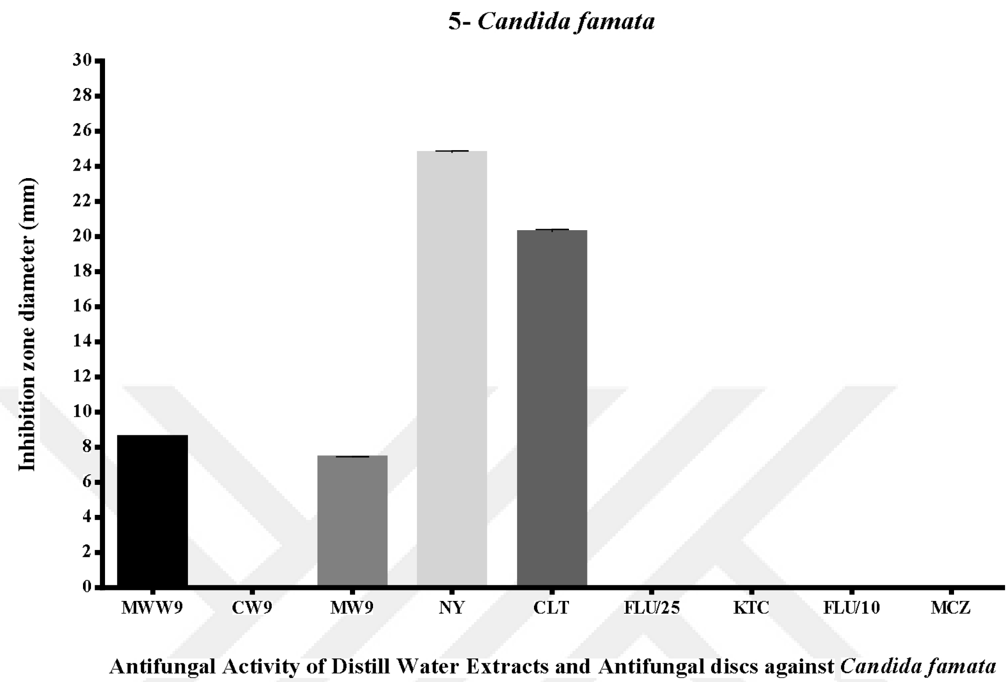


Figure A 319. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) distilled water extracts and antifungal discs against *C. parapsilosis.*

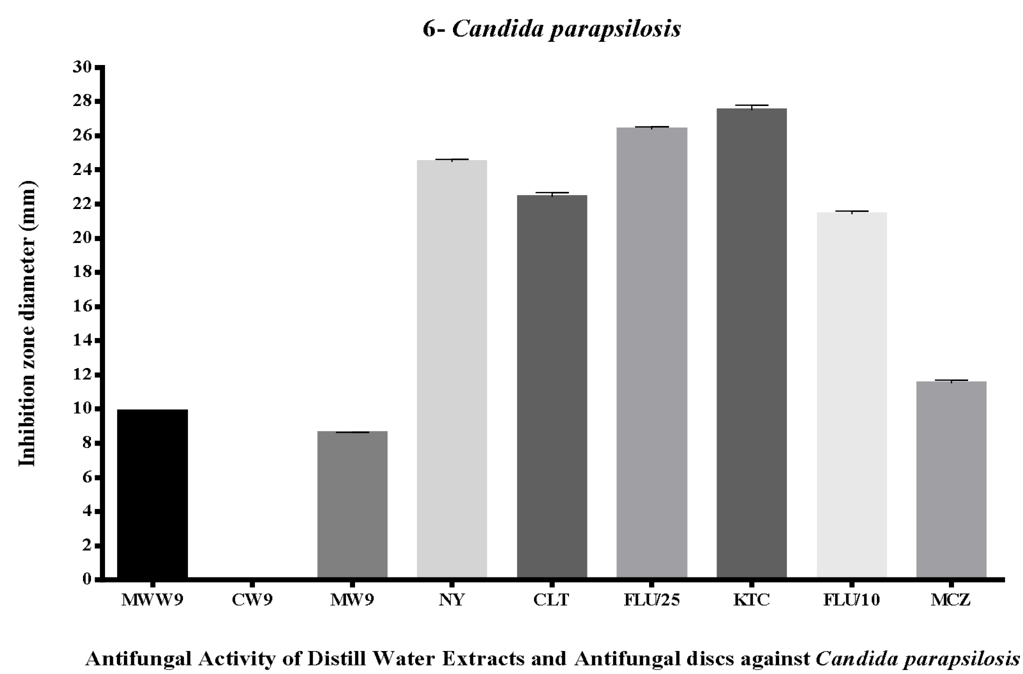


Figure A 320. Antifungal activity of *Prunus microcarpa* C.A. Mey. (Red fruit) distilled water extracts and antifungal discs against *C. guilliermondii.*

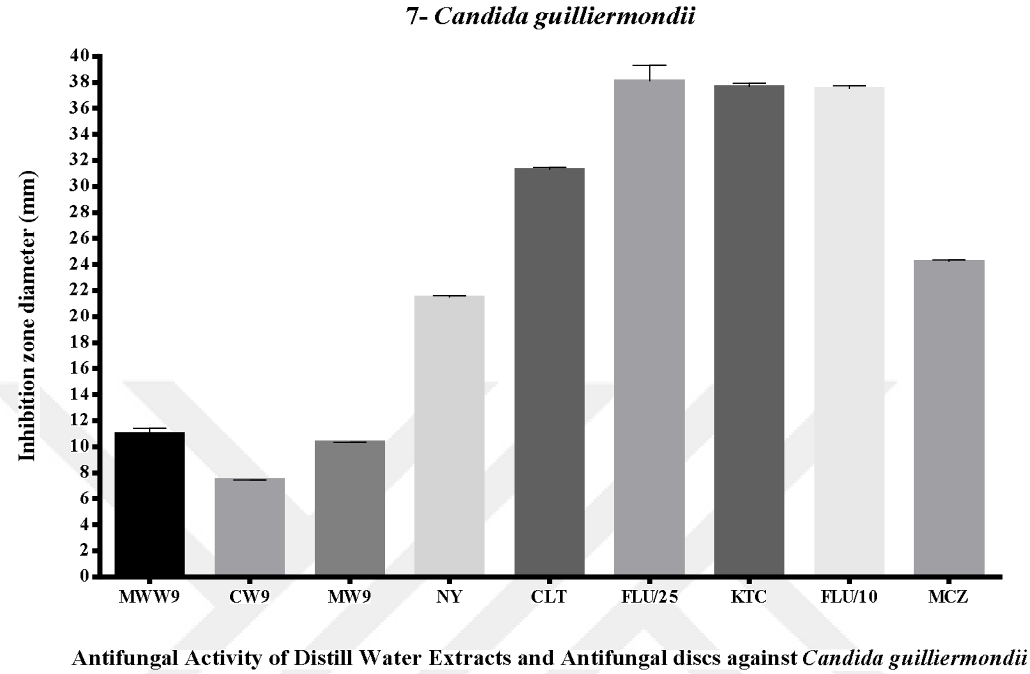


Figure A 321. Antifungal activity of *Rubus sanctus* Schreb distilled water extracts and antifungal discs against *C. albicans.*

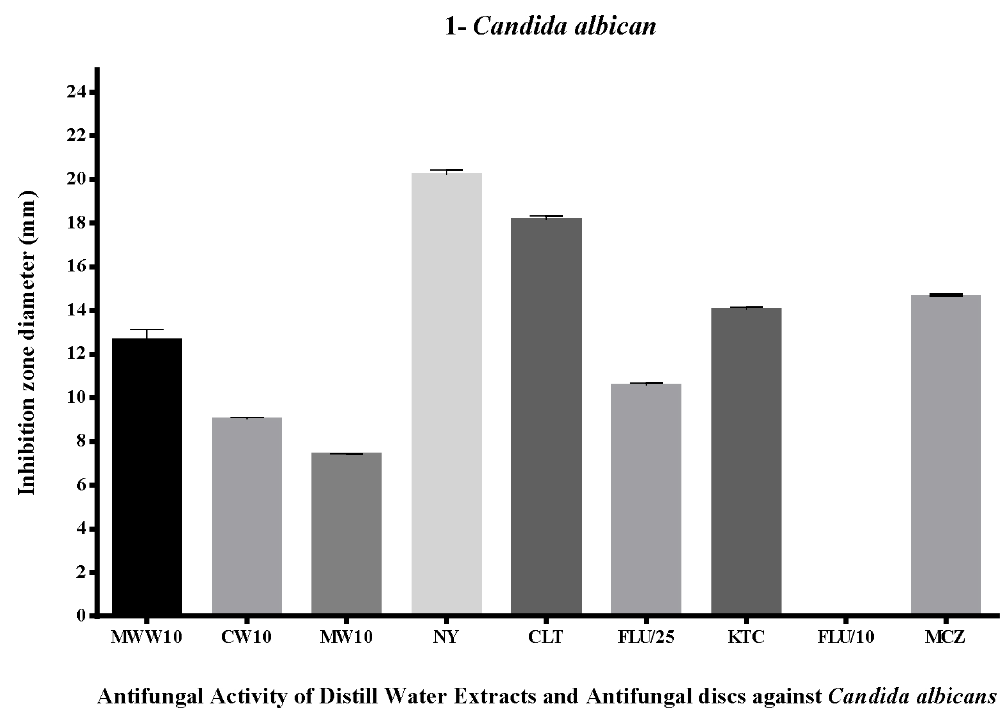
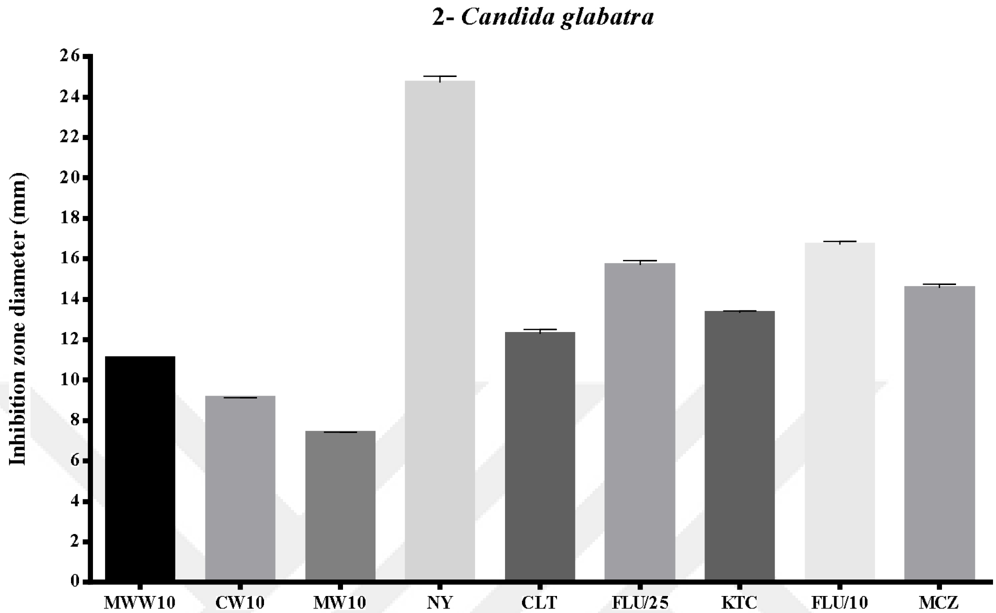
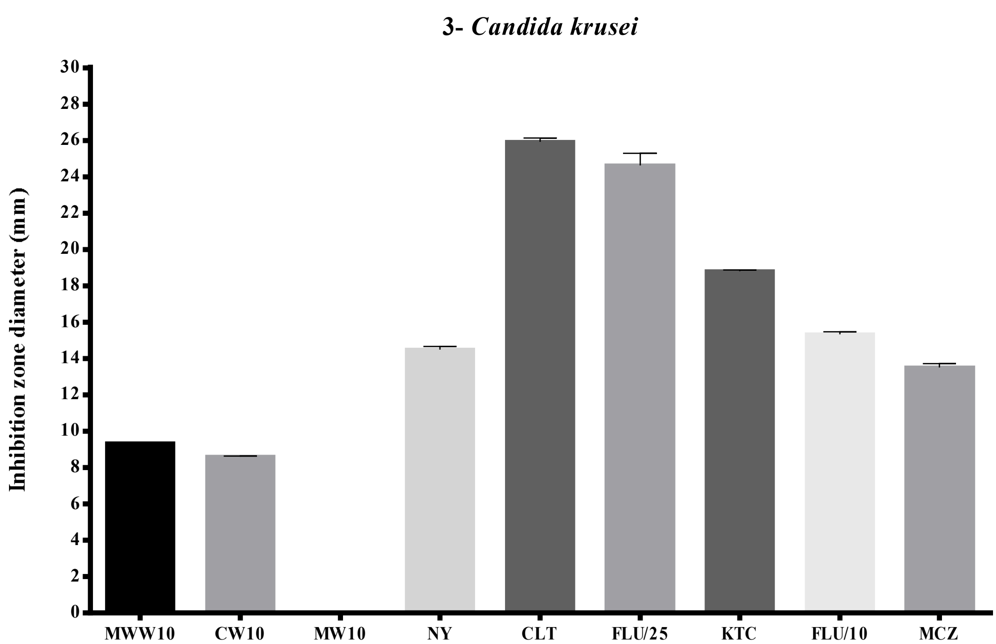


Figure A 322. Antifungal activity of *Rubus sanctus* Schreb distilled water extracts and antifungal discs against *C. glabatra*.



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida glabatra*

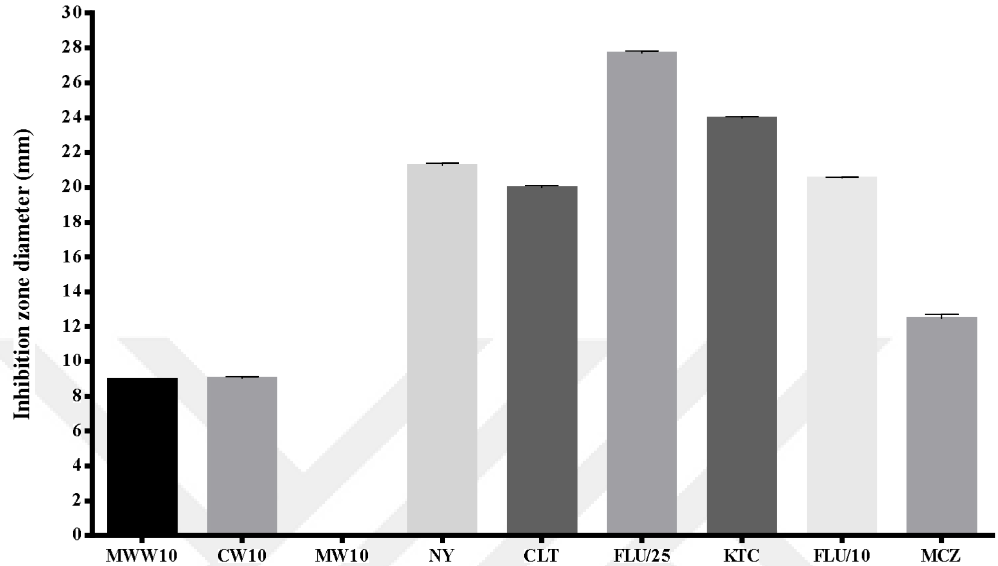
Figure A 323. Antifungal activity of *Rubus sanctus* Schreb distilled water extracts and antifungal discs against *C. krusei*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida krusei*

Figure A 324. Antifungal activity of *Rubus sanctus* Schreb distilled water extracts and antifungal discs against *C. tropicalis*

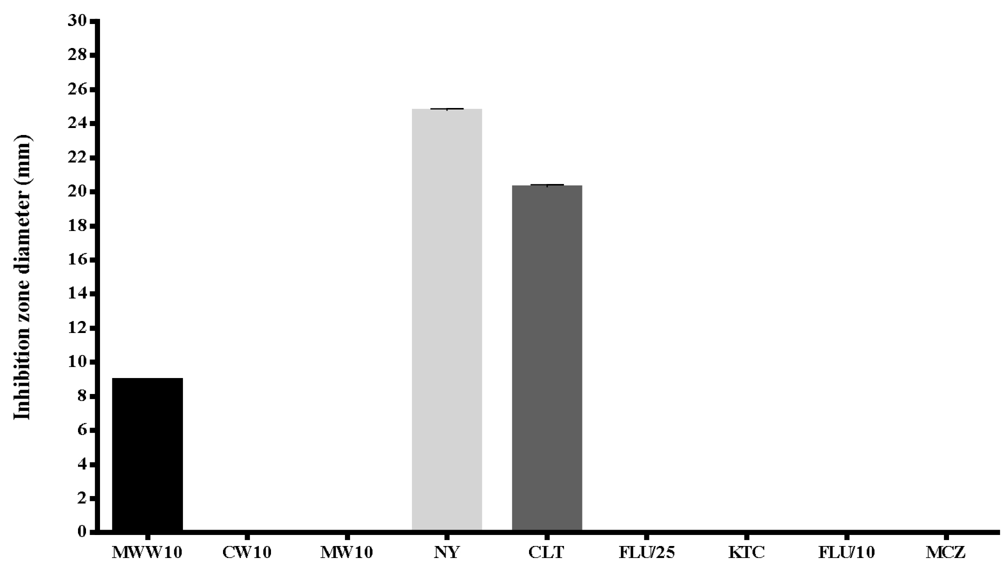
4- *Candida tropicalis*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida tropicalis*

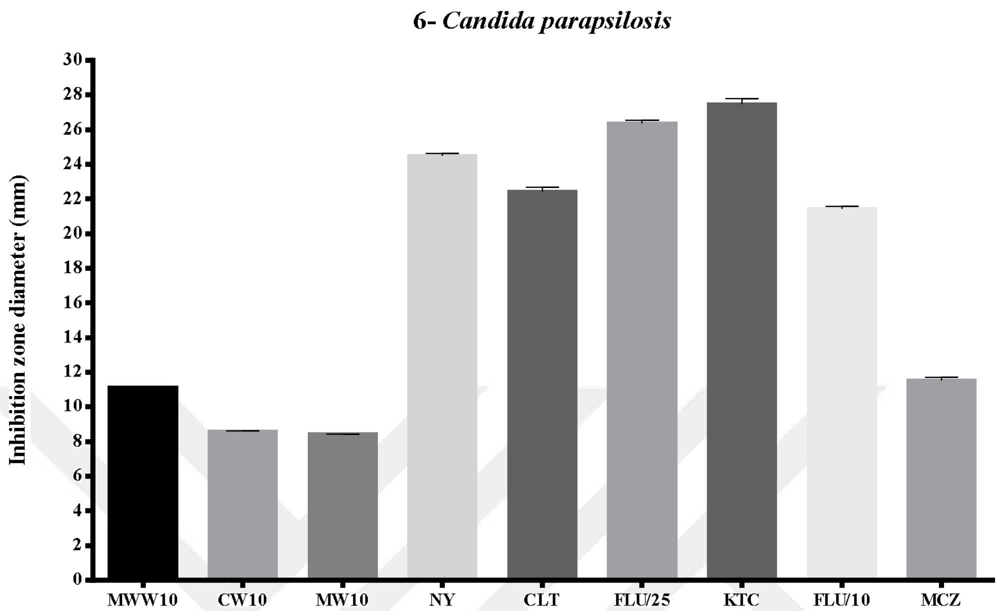
Figure A 325. Antifungal activity of *Rubus sanctus* Schreb distilled water extracts and antifungal discs against *C. famata.*

5- *Candida famata*



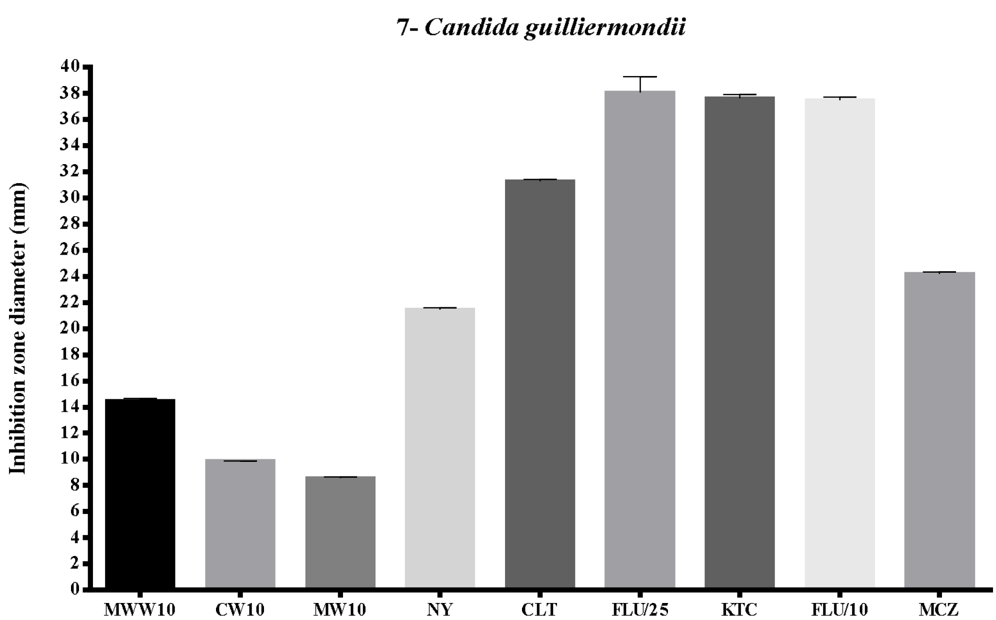
Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida famata*

Figure A 326. Antifungal activity of *Rubus sanctus* Schreb distilled water extracts and antifungal discs against *C. parapsilosis*.



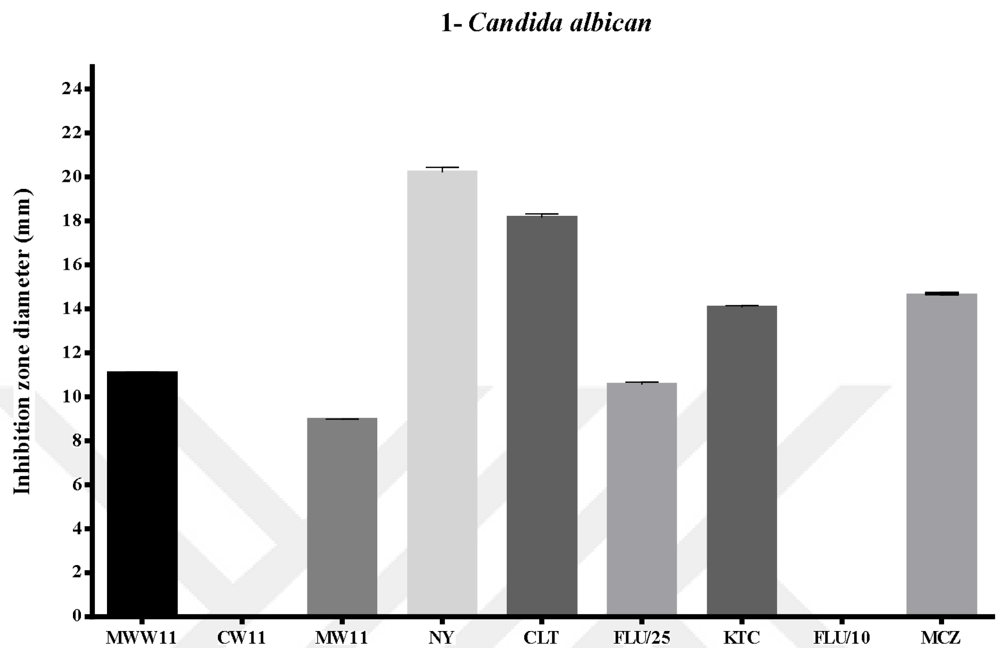
Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida parapsilosis*

Figure A 327. Antifungal activity of *Rubus sanctus* Schreb distilled water extracts and antifungal discs against *C. guilliermondii.*



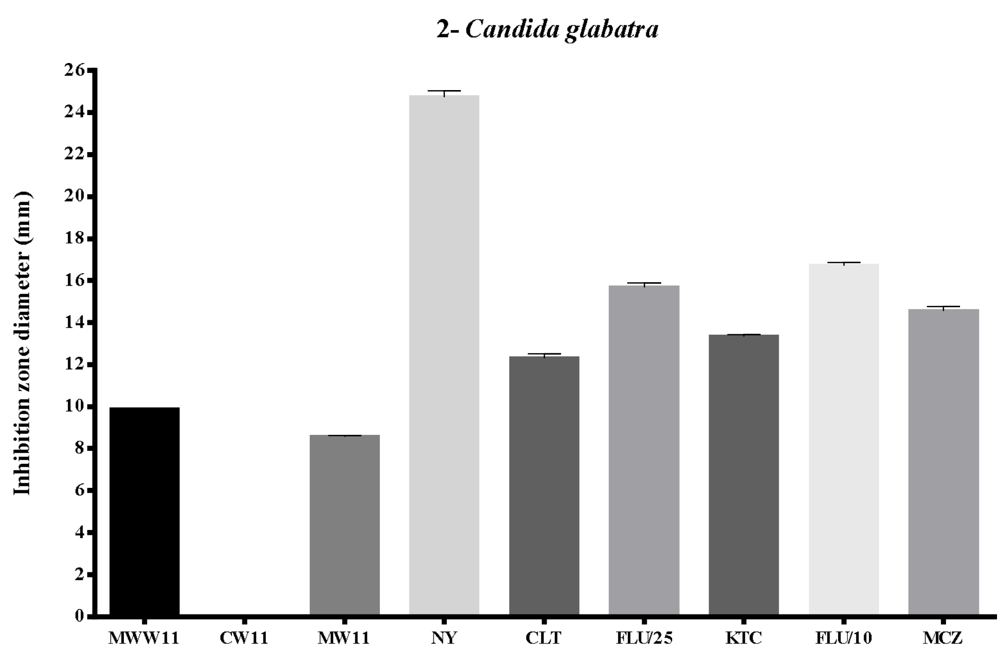
Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida guilliermondii*

Figure A 328. Antifungal activity of *Ficus carica* L. distilled water extracts and antifungal discs against *C. albicans.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida albicans*

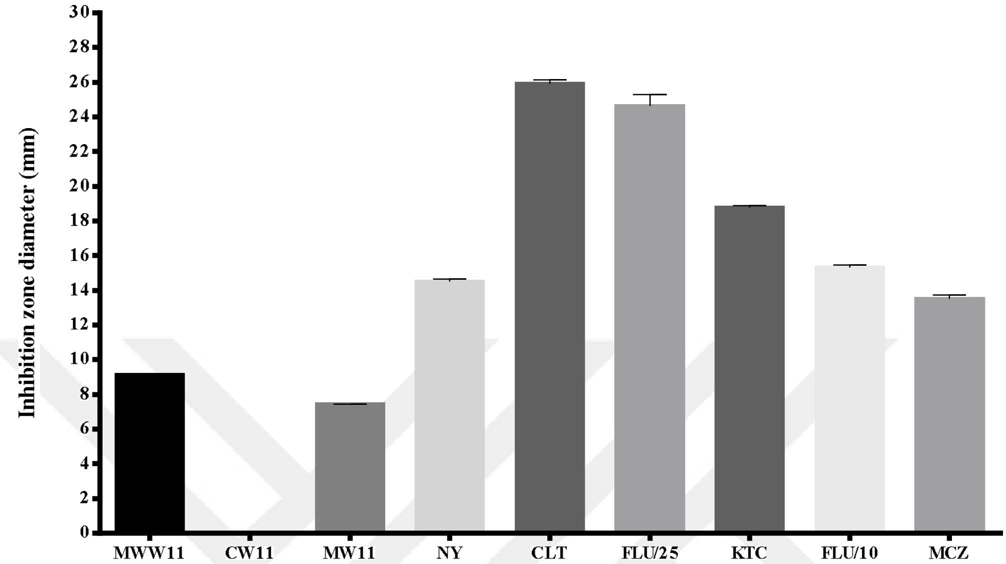
Figure A 329. Antifungal activity of *Ficus carica* L. distilled water extracts and antifungal discs against *C. glabatra.*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida glabatra*

Figure A 330. Antifungal activity of *Ficus carica* L. distilled water extracts and antifungal discs against *C. krusei.*

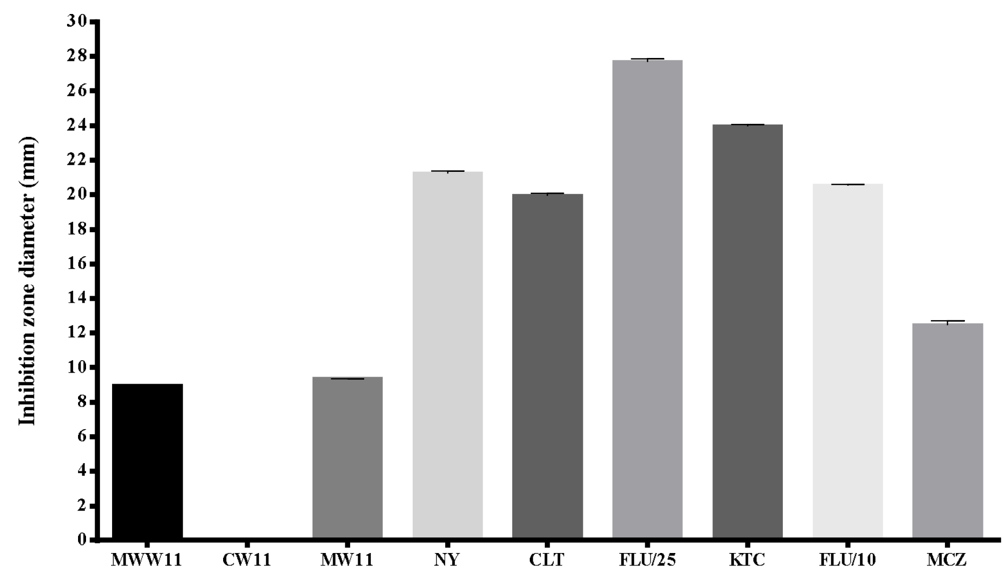
3- *Candida krusei*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida krusei*

Figure A 331. Antifungal activity of *Ficus carica* L. distilled water extracts and antifungal discs against *C. tropicalis*

4- *Candida tropicalis*



Antifungal Activity of Distill Water Extracts and Antifungal discs against *Candida tropicalis*

Figure A 332. Antifungal activity of *Ficus carica* L. distilled water extracts and antifungal discs against *C. famata.*

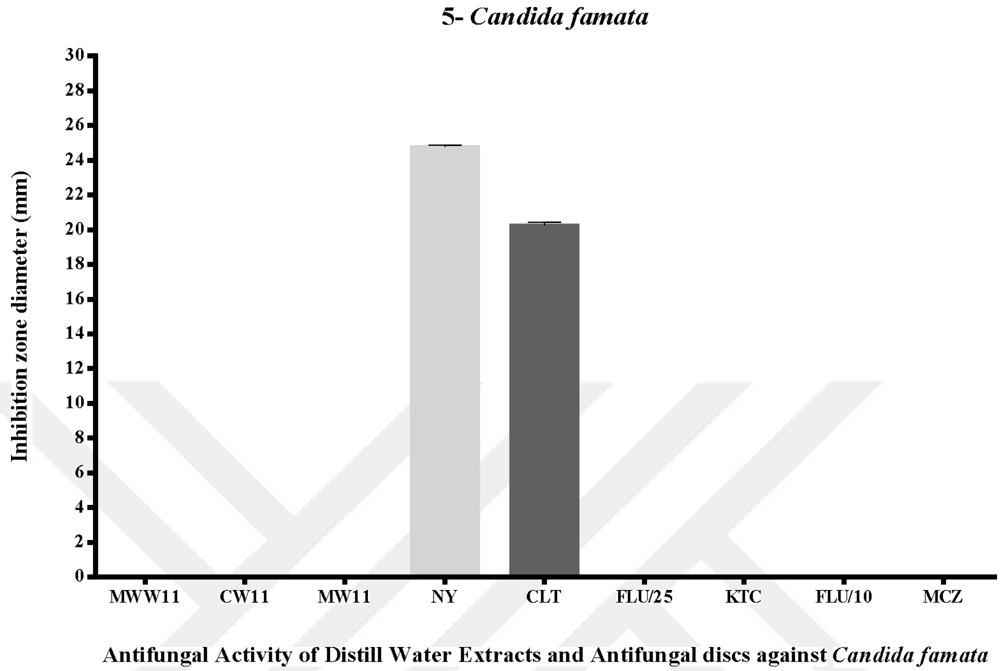


Figure A 333. Antifungal activity of *Ficus carica* L. distilled water extracts and antifungal discs against *C. parapsilosis.*

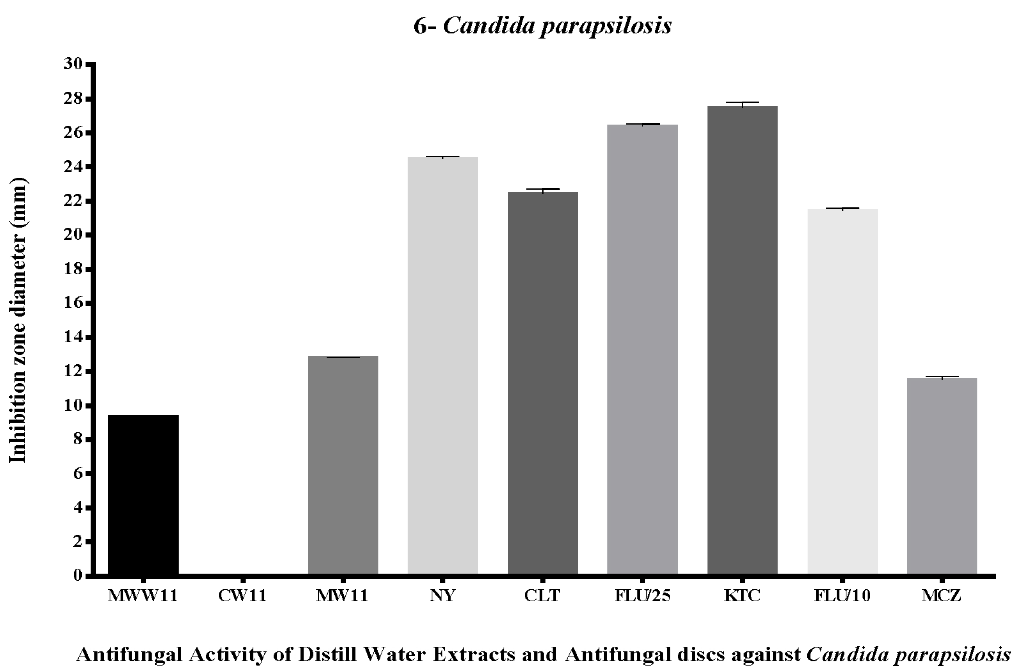


Figure A 334. Antifungal activity of *Ficus carica* L. distilled water extracts and antifungal discs against *C. guilliermondii.*

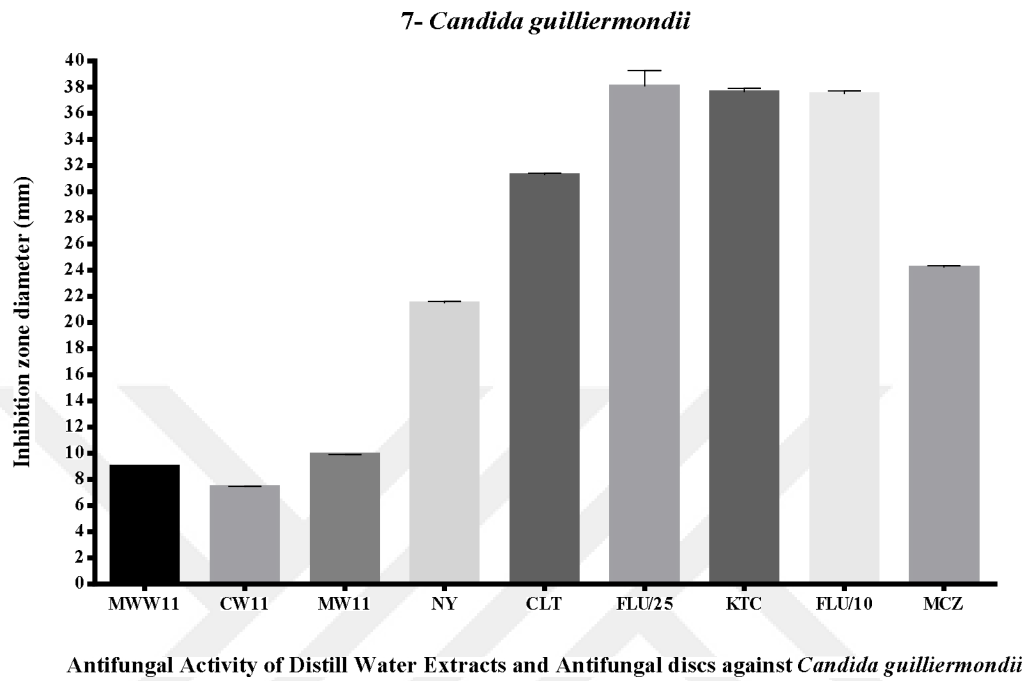


Figure A 335. The artificial antifungal disc diffusion

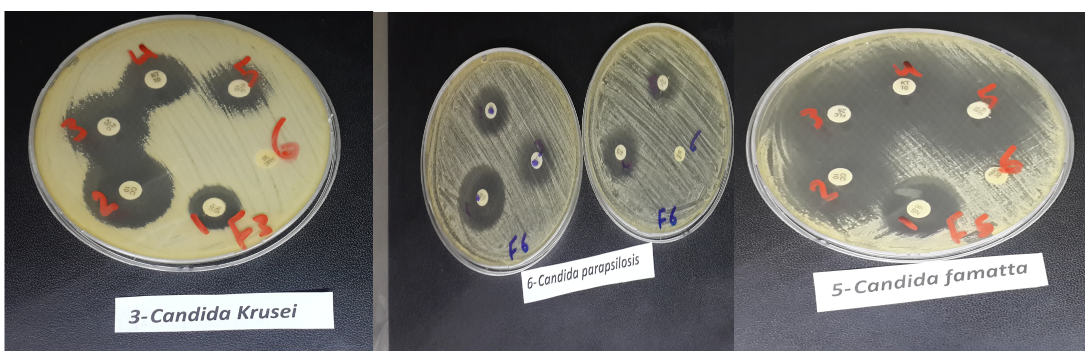


Figure A 336. The minimum inhibitory concentration

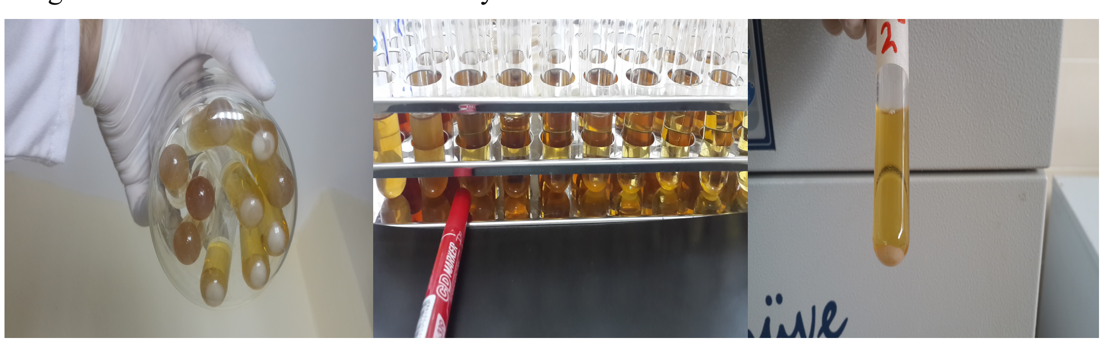


Figure A 337. Some example of a disc diffusion method to assess the effect of plant root extracts (100% v/v; application on the disc = 50µl) against *Candida* species on SDA agar plate.

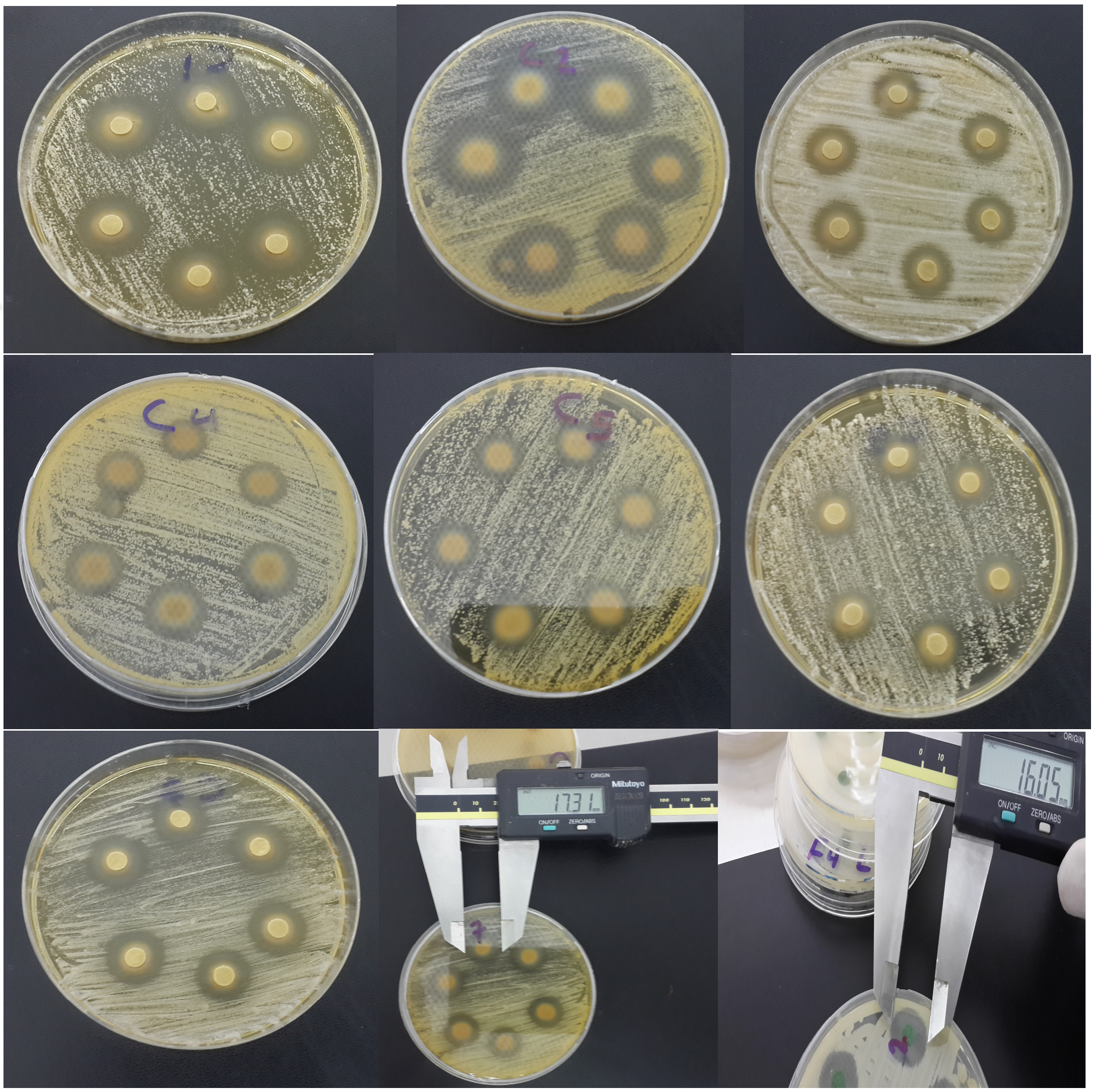


Figure A 338. Proposal of research ethical committee

حکومەتی هەرێمی کوردستان- عیراق
ئەنجومەنی وەزیران
وەزارەتی خوێندنی باڵا و توێژینەوەی زانستی
سەرۆکایەتی زانکۆی سەلاحەددین- هەولێر
کۆلێژی زانست- کاروباری زانستی و خوێندنی باڵا

حكومة أقليم كوردستان- ألعراق
مجلس ألوزراء
وزارة ألتعليم ألعالي و ألبحث ألعلمي
رئاسة جامعة صلاح ألدين- أربيل
كلية ألعلوم-ألشؤون ألعلميه و ألدراسات ألعليا

Kurdistan Regional Government-Iraq/ Council of Ministers/ Ministry of Higher Education & Scientific Research
Salahaddin University- Erbil/ College of Science

ژمارە: 45/105

ڕێکەوت: 9/5/2016 زایینی   / / 2716 کوردی

Proposal of research Ethical Committee

Dear Sir/ Maddam….

We certify that our postgraduate, Mr. Badr Qader Ismael with holding student number 14320803767, infer his research proposal from Kahramanmaras Suten ImamUniversity titled "Characterization of Various Iraqi medicinal plant root extracts and their antifungal activities on the human pathagenic fungi" is approved to conduct in Hawler Maternity Hospital in Erbil, Iraq.

Please do not hesitate to contact me If you require further information.

Asst.prof.Dr.Herish Omer Abdullah
The Dean
email: herish_omer69@yahoo.com

Deanship of College of Science
Dean Office

website: http://science.su.edu.krd

ناونیشان: هەولێر- ڕێگای کەرکوک / ژمارەی تەلەفۆن: ٢٢٦٢٧٠٢ - ٢٢٦٢١٤٠

CURRICULUM VITAE

Badr Qader ISMAEL

PROFILE:

Nationality & Citizenship: Iraqi Individual.

Date of Birth: 01 July 1973

Marital Status: Married (With three Children).

Place of Birth: Iraq-Hawler

Email address: badirbotany@gmail.com

Mob. (Turkey) 009053737911251(Iraq) 0096407504564589

Education Vitae:

1- M.Sc. in Plant Biology, University of Salahaddin, College of Sciences, 2006

2- B.Sc. in Biology, Biology, University of Salahaddin, College of Sciences, 1998

Publications researches:

1- Ali, K. Ab., M. Ib. Taha. B. Q. Ismael (2011) (Antifungal Activity of Allelopathic Plant Aqueous Extracts and *Trichoderma harzianum* on Growth of Some Wheat seed borne pathogenic Fungi) Koya University. N0. 19. P.113-128.ISSN.2073-0713.

2- Surchi, B. Q. I. (2011). Effect of Water Stress at Three Different Stage Life Cycle on Two Durum Wheat Cultivars (*Tirticum durum* L.) Koya University. N0. 21. P.197-214. ISSN.2073-0713.

3- Surchi, B. Q. I. (2012). Effect of drought stress on growth and yield of two durum wheat cultivars (*Triticum durum* l.) and two bread wheat cultivars (*Triticum aestivum* L). Zanco Journal. No. 1 V. 24. P.29-34. ISSN 2218-0230.

4- Surchi, B. Q. I. (2012). Allelopathic effects of aqueous extracts Oak plant Quercus persica L. (Fruit cap, Seeds, and Pericarp) on germination and seedlings growth of bread wheat *Triticum aestivum* L. (Cham 4 and Cham 6). Koya University. N0. 22. P.41-48. ISSN.2073-0713.

5- Surchi, B. Q. I., Y.A. R. Goran and M.H. Ibrahim. (2012). Inhibitory Effects of Aqueous Extracts of Shoot Weed Plant Lisaea heterocarpa on Seed Percent

Germination and Growth of Seedlings of Wheat, *Triticum aestivum* L. and Barley, *Hordeum vulgare*,. Koya University. N0. 25. P.21-26. ISSN.2073-0713

6- Ismael, B.Q., Rasul, S.M. Omar, S.J., Alma, M.H., (2015) Comparative studies of the antibacterial effect of some plant extracts and some antibiotics on four pathogenic bacteria. The Second Mediterranean Symposium on Medicinal and Aromatic Plants, April 22nd – 25th, 2015, Antalya.

7- Galalaey A.M.K, Fisal, D.N., Ismael, B.Q., Alma M.H., (2016). Traditional Uses of Some Medicinal Plants in Erbil (Northern Iraq). 4th Workshop and 5th Management Committee Meeting, February 17 – 19, 2016. Titanic Beach Lara Hotel, Antalya, Turkey.

8- Ismael, B. Q., Rahman L. Q., & Khudur P. K (2017). Anti-Microbial and Antioxidant Effect of Water Extract of Eucalyptus globulus And Quercus persica Plants on Gram Positive and Gram-Negative Bacteria. Diyala Journal of Medicine. DJM2017/3221602. ISSN: 97642219 Year: 2017 Volume: 12 Issue: 2 Pages: 65-73.

9- Ismael, B. Qader M. Hakkı Alma, Dr. Hero M. Ismael, Yaseen A. R. Goran1 Ali Mala Khedir Galalaey, Ali Göçeri, Shilan S. Ahmad and Halat Khalid. Phytochemical Profile and Antifungal Effect of (*Quercus infectoria Oliv.*) Plant Root Extracts on Several *Candida* spices. International Journal of Scientific & Engineering Research (IJSER). IJSER Volume 9, Issue 2, February 2018 Edition.

Language: (Writing, Reading, Speaking & Listening):

1- Kurdish: Native.

2- English: Fluent. (I have got IELTS overall 6 and Pre-Seasonal Course in the UK).

3- Arabic: Fluent.

4-Turkish Good.

Computer Proficiency:

1-MS Office 2016 (Word, Excel and PowerPoint).
2-Operating System (XP, Seven and Ten).
3-Statistical Program Social Sciences (SPSS).