Weeds Identification in West of Mazandaran Province *Citrus* Orchards (Iran)

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Abstract

Mazandaran province is leading in citrus growing in Iran with nearly 84000 hectares area of *Citrus* orchards. One of the problems of citrus growers and nurseries is the bothering of weeds. Weeds are caused limitation in nutrients resources, water, light and space for *Citrus* trees and seedlings which result in growth, yield and fruit quality reduction. Establishing an integrated grove floor management program involves a consideration of plant species growing as weeds and competing in the rooting zone of trees.

Inputs into management decisions include: 1) the identification of native and introduced species; 2) knowledge of their relative level of competitiveness/interference with treesand other cultural practices; 3) an understanding of their impact on pest and disease management strategies; and 4) an informed selection of efficacious, cost-effective, and environmentally compatible management options (1). The first step to control and management of weeds is accurate identification and acquaintance with biology of them. In order to identify and study the weeds, an experiment was carried out in west of Mazandaran province during 2010-2011. The weeds were photographed in natural habitat and collected during survey of *Citrus* orchards from Ramsar to Chalus cities (west of Mazandaran province) and identified on the basis of reliable flora of Iran and finally dried for preparing a collection. Meanwhile some of the ecological and morphological characters were also recorded. Results showed that the

weeds consist of 130 species and belong to 42 families. The most weeds were related to *Poaceae* family with 27 species.

Key Words: Weeds; Citrus; Morphological characters; Mazandaran Province.

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Introduction

Citrus is the collective name for many related species of fruit trees. They are all evergreen shrubs or small trees growing 5-15 m tall, often with thorny branches. *Citrus* is one of the most important fruit crops in the world. Oranges are the most widely grown type of citrus fruit, by far. They account for around 55% of the citrus area and over 60% of production. Taken together, tangerines, madarin oranges and clementines are next most widely grown, followed by lemons and limes, with a smaller area of grapefruit (2). *Citrus* fruits are produced in more than 70 countries with tropical and subtropical climates, although the top 10 countries produce over 70% of the world output (3, Figure1). Temperatures more than a few degrees below freezing will destroy most *Citrus* species.

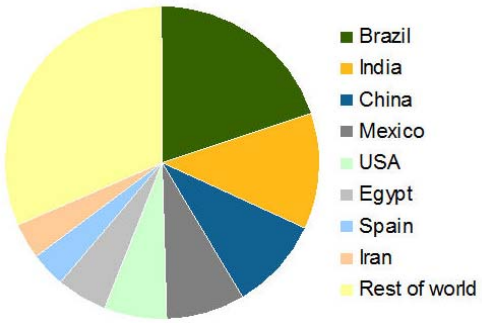

Figure 1. Areas of oranges harvested in leading countries (FAO, 2008).

Since 1980, the world area of oranges has increased from about 2.3 to nearly 4.2 million hectares. Brazil has maintained its lead position in area grown and production, but cropping in China and India has increased substantially. In terms of production, Brazil grows twice as many oranges (18.5 million tonnes in 2008) as its nearest rival, the US(3, Table1).

Table 1. Citrus production details for leading countries (FAO, 2008)

	Area Harvested (thousand ha)	Average Yield (tonnes/ha)	Production (million tonnes)
Brazil	836, 602	22.1	18.5
India	502,800	9.4	4.4
Portugal	389.578	11.8	3.7
Spain	331,297	13.0	4.3
USA	268,350	34.1	9.1

Iran is the eighth largest *Citrus*-producing country in the world. *Citrus* in Iran is grown in nine Provinces, 91.44% is presented in Mazandaran, Fars, Kerman, Hormozgan and Khuzestan. Mazandaran alone produces 38.83% of the Iran total, with Fars, Kerman, Hormozgan and Khozestan accounting for 28.91%, 11.24%, 11.18% and 1.28% respectively (4). Variety of agro-climate conditions prevailing in Iran not only provide ample opportunities for *Citrus* cultivation in north and south of country but also present an abundance of a wide range of weed species. Optimum productivity of *Citrus* can be obtained only when all the aspects of production technology including weed management are given due consideration. Weeds are one of the major problems in *Citrus* cultivation. Direct reduction in citrus tree growth and yield can occur when weeds compete with trees for light, water, nutrients, and space. However, not all weeds compete with citrus trees in the same way or with the same level of competition.Water requirements for vegetation regrowth after mowing can impact

water availability within the grove. During this regrowth period, grasses use more water from the soil compared to broadleaf plants (5). Vines can be more competitive for sunlight than other plants. Weeds can also compete with *Citrus* trees in many ways but with varying intensities. The ability of plants to intercept varying levels of water, light, and nutrients makes some weeds more competitive with *Citrus* than other species. Therefore, highly competitive weeds should be of great importance to the production manager. Successful weed control is extremely important in groves that contain weeds that are highly competitive. In an IPM program, the most competitive weeds are identified and removed before they produce seeds. With time, seeds in the soil can be reduced with suppression, cultural, and sanitation methods (6). On the other hand, most of the weeds are the primary or secondary hosts of pests and pathogenetic factors (7,8,9). Association of weeds on the land under cultivation and especially a round rosella of *Citrus* trees can spread rottenness and increase the risk of association of pathogenetic factors. Considering favorable conditions of humidity and temperature that is suitable for the growth of species of weeds, in *Citrus* orchards in north of Iran, gardeners pay much labour expenses to eliminate these weeds. These expenses can play an important role in the economy of the gardeners (10). Some of these weeds have poisonous effects on human or animal and may cause some diseases (11,12).

Weeds in *Citrus* fruit gardens can be managed in three ways: prevention, control and uprooting. The necessity of the accomplishment of this process is to be well informed of the botanical classification and biology and structural characteristics of the weeds. In other words, a thorough knowledge of the life cycle, growing season and ways of plant reproduction will play an important role in choosing the way of weed control or uprooting (13). On the basis of physical characteristics, these weeds can be classified into types of standing, recumbent, anadromous, repent, stolonate. In another aspect, the weeds can be classified into types of long-day, short-day, day-neutral or grass weed and broadleaf (14). The present work studied

botany of weeds and registration of biological and morphological characteristics of them. Also in this study families and species relative abundance were distinguished on the basis of the position of the garden which is classified into coastal, plain and mountainside regions. Thus, we can prevail over difficulties in *Citrus* fruit gardens in north of Iran by received information and proper management.

Materials and Methods

The study was conducted during 2010-2011 in citrus fruit gardens of coastal, plain and mountainside regions in west of Mazandaran province including Ramsar, Tonekabon, Chalous cities and their suburbs. The perfect samples of garden weeds in different times from the beginning to the end of weeds growth which is classified into three period; winter, spring and summer were randomly collected. The samples were completely healthy and diseases free. Each weed sample was put in a nylon bag for more survey and then sent them to the plant biology laboratory of Iran Citrus Research Institute (ICRI). Samples were dried by standard press board in herbarium at the dimension of 29×42cm and then labeled for the following steps. After complete drying, each sample was fixed on a herbarium particular cartoon and botanical information such as vegetative form, life cycle, vegetative and reproductive features like stem and leaf shape, phyllotaxy, anthotaxy, type of inflorescence, type of fruit, method of reproduction, time of anthesis and habitat recorded on it. In this research, position of weeds dispersion in the described regions was surveyed as well.

Results and Discussion

The results of this study showed that there were 130 weed species belonging to 42 families. Most of these weeds pertained to *Poaceae* family and were perennial. Relative abundance of perennial and biennial weeds are much more than the annual ones (Figure 3).

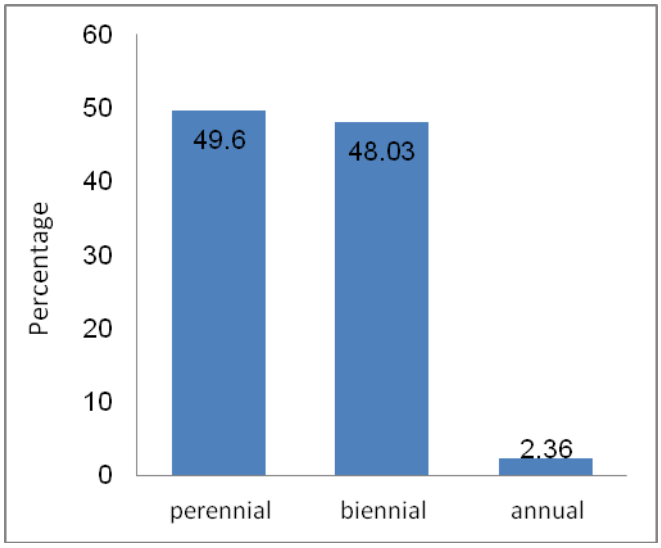

Figure 3.Relative abundance of species on the basis of life cycle.

The luxuriant growth of a large variety of perennial species makes the consequences at poor weed control most damaging to citrus production. Weeds compete, especially with young trees, for limited resources, such as nutrients, water, light, and space in *Citrus* orchards, and harbor insects and rodents that attack *Citrus* trees. The competition often results in reductions of tree growth, leaf nitrogen level, water potential, fruit yield and fruit quality. Weeds also reduce soil and air temperature, thus increasing the chance of frost damage to *Citrus* during cold seasons.

Citrus trees are injured when exposed to -2.2˚C for 4 h. Any increase above this critical temperature has practical significance during cold nights. Weeds also affect harvesting operations, water distribution patterns from irrigation systems emitters, disease control, and environmental conditions within the grove. It was found that the most relative abundance of the weed species in these gardens are *Cynodon dactylon, Digitaria sanguinalis, Setaria*

glauca, *Dactylis glomerata* and *Acalypha australis* and relative abundance of broadleaf weeds are much more than the grass ones (Figure 2).

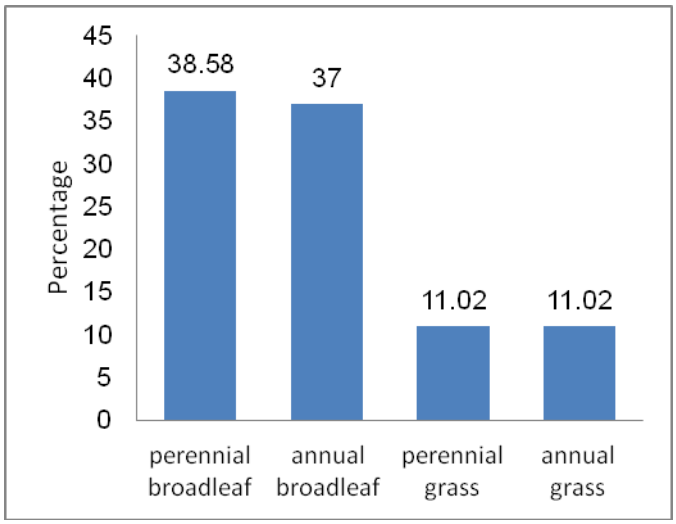

Figure 2. Relative abundance of weed species.

Among these plants *Poaceae*, *Asteraceae* and *Brassicaceae* families were more than the other ones and the relative abundance of the mentioned families are taken into high consideration. Although on the basis of ecological-agricultural conditions the related flora may be changed, but the dominant weeds are resistant samples that it is very difficult to control them (Table 2).

Table 2. Weeds in citrus orchard

Scientific name	Family	Common name	Life cycle	Reproduction method
Amaranthus retroflexus	Amaranthaceae	Redroot pigweed	Annual	Seed
Asplenium trichomanes	Aspleniaceae	Maidenhairspleenwort	Perennial	Spore- Rhizome
Artemisia annua	Asteraceae	Sweet wormwood	Annual	Seed
Cichorium intybus	Asteraceae	Common chicory	Perennial	Seed -Rhizome
Conyza Canadensis	Asteraceae	Butter weed	Annual	Seed

Lapsana communis	Asteraceae	Common nipplewort	Perennial	Seed
Urospermum picroides	Asteraceae	Sheep´s beard	Annual	Seed
Xanthium strumarium	Asteraceae	Lesser burdock	Annual	Seed
Alliaria petiolata	Brassicaceae	Garlic mustard	Annual	Seed
Capsella bursa-pastori	Brassicaceae	Sheph erd´-purse	Annual	Seed
Campanula odontosepala	Campanulaceae	Shade like bell flower	Perennial	Seed
Chenopodium album	Chenopodiaceae	Lamb´ s squarters	Annual	Seed
Calystegia silvatica	Convolvulaceae	Field bearbind	Perennial	Stolon
Carex divulsa	Cyperaceae	Mat grass	Perennial	Rhizome
Carex nigra	Cyperaceae	Osier sedge	Perennial	Rhizome
Cyperus rotundus	Cyperaceae	Purple nutsedge	Perennial	Rhizome
Equisetum arvense	Equisetaceae	Field horse tail	Perennial	Spore-Rhizome
Acalypha australis	Euphorbiaceae	Australis copper-leaf	Annual	Seed
Geranium dissectum	Geraniaceae	Cut-leaved geranium	Annual	Seed
Lamium album	Lamiaceae	White dead nettle	Perennial	Rhizome
Oxalis corniculata	Oxalidaceae	Creeping oxalis	Perennial	Seed -Stolon
Lathyrus annus	Papilionaceae	Annual pea vine	Annual	Seed
Trifolium repens	Papilionaceae	White clover	Perennial	Seed -Stolon
Visia sativa	Papilionaceae	Common vetch	Annual	Seed
Aegilops crassa	Poaceae	Thick goat grass	Annual	Seed
Alopecurus myosuroide	Poaceae	Mouse foxtail	Annual	Seed
Cynodon dactylon	Poaceae	Bermuda grass	Perennial	Rhizome
Echinochloa crus-galli	Poaceae	Barnyard grass	Annual	Seed
Lolium temulentum	Poaceae	Darnel rye grass	Annual	Seed
Paspalum distichium	Poaceae	Sea-side millet	Perennial	Rhizome
Poa annua	Poaceae	Annual bluegrass	Annual	Seed
Setaria glauca	Poaceae	Yellow foxtail	Annual	Seed

Polygonum persicaria	Polygonaceae	Heart-spot knotweed	Annual	Seed
Portulaca oleracea	Portulacaceae	Common pursuance	Annual	Seed
Pteris cretica	Pteridaceae	Cretan brake	Perennial	Rhizome
Potentilla reptans	Rosaceae	Creeping cinquefoil	Perennial	Stolon
Rubus caesius	Rosaceae	European dewberry	Perennial	Stolon
Rhynchocorys elephas	Scrophulariaceae	Mild chancre grass	Perennial	Seed
Veronica persica	Scrophulariaceae	Tournefort speedwell	Annual	Seed
Urtica dioica	Urticaceae	Big-sting nettle	Perennial	Seed -Rhizome

The position of different weed families dispersion in coastal, plain and mountainside *Citrus* gardens has been presented as a table (Table 3). It could be seemed from Table 3 that the relative abundance of different families varies. These results suggest that on the basis of the existing different climate and soil characteristics in mentioned regions, the weeds could be diverse even in family level.

Table 3. The position of different weed families' dispersion in coastal, plain and mountainside citrus gardens

Family names	The number of families	Distribution regions
Brassicaceae- Caryophyllaceae- Hypericaceae-Malvaceae-Primulaceae-Verbenaceae-Zygophyllaceae- Boraginaceae-Equisetaceae	9	Coastal
Phytolaccaceae-Scrophulariaceae- Solanaceae-Asparaginaceae- Caprifoliaceae	5	Plain
Convolvulaceae- Crassulaceae- Discoreaceae-Geraniaceae-Juncaceae-Lythraceae -Onagraceae-Amaranthaceae- Apiaceae	9	Mountain side
Chenopodiaceae-Cyperaceae- Euphorbiaceae- Hypericaceae Plantaginaceae-Ranunculaceae- Rosaceae-	7	Coastal and plain

Campanulaceae- Geraniaceae- Lamiaceae-Papaveraceae-Poaceae- Utricaceae	6	Plain and mountain side
Asteraceae- Papilionaceae – Polygonaceae	3	Coastal, plain, mountainside

There is not family that belongs to both coastal and mountainside regions

All weed species are not equally competitive with *Citrus* trees. Grasses, especially sod-forming species are more aggressive competitors than most broadleaf species. These results are consistent with results reported by Murphy (7). Vines can germinate in shaded areas and grow into the tree canopy, creating a host of problems for the tree and fruit harvesting operations. Mowed grass can be very competitive due to the moisture demands of vigorous regrowth. Relatively sparse weed growth on poor sandy soils may be more harmful than that on heavier soils with greater moisture and nutrient reserve to be shared between trees and weeds. Large numbers of seeds representing numerous vegetation species reside in the surface soil layers in which tree roots are established this result is in agreement with Futch and Singh (6,16). From a practical and economical standpoint the total elimination of weed seed and plant parts is neither economically practical nor desirable. *Citrus* is cultivated in a variety of agro-climatic conditions. Due to this varied agro-climate, the ecosystem harbours of wide range of weed species. Losses from water and fertilizer used by weeds are undoubtedly substantial. This fact confirmed the results by Mirshekari (15). Therefore for a successful management program, species in groves must be identified and their abundance, location and change occurring in populations over time must be determined. If weeds are properly identified while in the seedling or vegetative stage, then proper control can be achieved through: 1) increased flexibility in timing control options; 2) possible reduced herbicide application rate; and 3) reduced impact from control measures. Our findings are in good agreement with those of others (6).

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