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Original Article

Weeds growth in valley of Leeyh, south of Taif area, Saudi Arabia

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Abstract

Wild plants developing in areas without the desire or wills of human and known as weeds, that could be beneficial or not. The aim of the present study was to identify and record the weed species grown in the agricultural land in the regions of Valley of Leeyh, South of Taif area, which is located on the Eastern slopes of the Al-Sarawat Mountains with an altitude of 1700 m from sea level. Different weed species has been collected, processed by cleaning and identified from the surveyed area. The study was conducted between 2016 and 2017. The results showed that Cherepodiaceae had the highest number of weeds species followed by Uriticaceae and Malvaceae. The lowest weeds species count recorded in Cappaeaceae followed by Chenopodiaceae and Aizoaceae. The highest weeds count of agricultural crops recorded in *Cucurbita pepo*, *Coriandrum sativum* and *Petroselinum annum*. The lowest weed in Taif agricultural fields recorded in the *Medicago sativa* plantations followed by *Capparis decidua* and *Zea mays*. Dominant weeds species include *Urtica dloica*, *Malva perviflore*, *Chenopodium valvaeia*, *Amaranthus vindi*, *Cynodon dactylon*, *Portulaca oleracea*. This study has the potential in developing the valley south of Taif area for agricultural purposes. The findings of this study will be beneficial in suggesting suitable weed control recommendation in agricultural crop land of Taif area.

Keywords: Agriculture, Crop, Species, Survey, Unwanted plant

Introduction

Any of those plants whose undesirable effect exceeds its beneficial effect is classified as a weed. Many agricultural crops and forest can be affected by weeds and as result, there is a decrease in their production per unit area, such weeds can be grouped into different categories and these are; annuals, biennials, and perennials. Annual weeds are amongst the majority of plant that qualifies to high reproductive potential (Bolly, 1908). The presence of weeds can be considered disadvantage because they compete with the crops for nutrients, water, and light. (Akobundu, 1987, Oudhia, 2004). Disease problems are also encouraged by weeds. These weeds have an alternative host, which are insects. The undesirable effect of weed on crops includes; comparative increase in the time of harvesting operation, high increase in the cost of production, a decrease in the quality of crop plants, and there is a high likelihood of fire incidences occurring in permanent crops, (Marwat, 1998). In semi-developed countries like Saudi Arabia, agriculture is playing a vital role in its economy. The growing population has led to a decrease in cultivated area. Thus the resources are not adequate to fulfill the necessity of this growing population. Besides, the increase of weed problem also makes situation become worse by reducing the production of agriculture crops. Hassan and Marwat, (2001) reported that soil types, soil moisture level, cultural practices, systems of

cultivation changes in season affects the distribution and abundance of weeds species in crop fields.

In the ascertain of Batianoff and Butler (2002) studying and recorded obnoxious weeds species can be an important tool for policy making and legislation of weeds and it will be useful to identify weeds of various regions and further purposes. There are many species in each weed family and the number of these species varies with every family, and as a result, the present weed survey cannot be authentic to determine the entire weed and its extension. For that, there is no trial on individual species in a family to subject to the patterns analysis of geographic distribution. However, for the purpose of universal analyses with regard to variation in weed scores and number of weeds in diverse crops, the species found signify a sufficient sample size. Most of the time, enquiring from experts is the best way for evaluating problematic species (Batianoff and Butler, 2003) and this inquiry results in a significant positive change in managing weeds. In contrast, there is a necessity of extensive field studies to assess the number of weeds and many different forms though it is expensive and time-consuming because it can't cover a large area as seen in a survey.

The list of weed species attained is rather widespread and demonstrates that weeds are still a significant problem of agricultural crops in Taif Area. The use of land and changes in the environment has caused a very swift change in groups of weeds in the last few decades as indicated by a number of authors. (Andreasen et al. 1996). In addition, the number of species has also deceased; the presence of new weeds had been noticed due to these changes. To forecast the effect of these groups of weeds and to identify new weeds in the particular region, large-scale surveys of such group of weeds are required. Even though some plant species can change due to its management and result in a reduction of weeds, it has become a very important weed. (McClosky et al. 1996). The spread of weed species that are initially present and those moves from expanding species results in new weeds. In this study, the most important weed species identified based on their distribution are very similar to that of Schroeder et al. (1993), but Abutilon the *Sorghum halepense*, *Sinapis narvensis* and some other species with a small geographic distribution are an exception. There is real difference in number of weed species for different locations, nonetheless agricultural fields in the study location consist of visible concentration of weed species.

The reduction in weeds species population in cultivation lands in the various areas hasn't yet attained to a stage of significant devastation. This was, for instance shown by *Agrostemma githago*, whom reported an extensive weed in Western Europe was a serious weed in Romania. The one who assesses the species determines if it is a weed or not. (Perrins et al. 1992), though it still depends on the geographical location in which the weed identified because different countries have different plants that classified as weed. The weed scores is slightly connected with other species, also in the sense that several meanings with different particular part or feature of the variety have conceptual connection. Varieties for dispersing capacity may relate to dispersal mechanisms, and numbers for virulent to the competitive ability of the weed to the crop. The presence of tools to control the weeds scores will ensure the effective control, so also the potentiality of the varieties to resist effective weed management. The taxonomic distribution such as (genus, family) in which different authors have connected from the state of disperse. In spite, such an approach may be difficult; the study showed that some families highly over-represented by weed species or invasive plants compared with the global family size (Maillet, 1999). Emphasis laid that a variety of the same genus or family is more likely to become a weed, Mack (1996). Weeds varieties dispersal could spread in nearer future from its current location. Similarly, there is an indication that there is an enormous weeds intensity increment challenges in Saudi Arabian arable lands. However, difference there assessors point of view could lead to bias. More studies should carry out towards forecasting the destruction of the varieties in research at several locations where they are not present. Their existence should manage and their introduction in new locations should extensively observe control.

Several studies revealed the disturbing nature of weeds on desirable crops. A research carried out in field by Roberts (1976), it revealed that *Carthamus oxyacantha, Euphorbia helioscopia* and *Fumaria indica*, when they are left to grow in wheat on rain fed management, it was recorded that higher percentage of nitrogen than crops plants. Some of the foreign invade flora varieties are not only decreased the land valued and resulting in economic losses to agriculture but also a source of hypersensitive and health hazards in Islamabad and Peshawar like *Broussonetia papyrifera*.

The *Carthamus oxyacantha* affect arable production such as chickpea and cereal production but also make it difficult for harvesting. It causes great losses of output and reduce milk value and quantity of nursing animals such as *Allium vineale* and *Asphodelus tenuifolious*. Also like *Orobanche*, *Cuscuta* and Mistletoes etc. Parasitic weeds also reduces crops and forest trees production as well. The soils of Valley of Leeyh are most suitable for crop production, but weeds are considering the biggest constraints to bring this area under cultivation. On the other hand, there is no report about weed population and management in Taif area reported yet. The aim of this survey was to obtain basic information on current weed identities in Taif area of Saudi Arabia and to evaluate species that could rise in their significance as weeds in the future. It is proposed that several weed species from the different families can possible to identify from the Valley of Leeyh, South of Taif Area, Saudi Arabia.

Material and Methods

Study area

The study area (Taif) is located on the Eastern slopes of the Sarwat Mountains with an altitude of 1700 m above sea level. It increases the rise heading towards south and west, up to 2500 m having the coordinates of the location as (N 20-22º and E 40-42º). Taif is of the most populous and potentials where estimated number of agronomic field and preserve areas in favor of about (25500) agricultural land (farm) with a total area of approximately (594 000). It has well-known place in the field of agriculture, and richest agricultural areas in the Kingdom of Saudi Arabia.

The survey was carried out between 2016 and 2017. Specimens' collection: Specimens were collected from many localities in Leeyeh south valley of Taif area. Samples were prepared as herbarium specimens for identification and recorded varieties. Majority of weed samples sampled from fields (farms). The extent of invasion of crops by weeds was based on visual or arbitrary observations. The level of intensity and invasion of crops by various weeds species was carried out with arbitrary observation or visually. The works of Mandaville (1990) and Al-Yemeny (1989) (Fig.1) were used as reference point for weed species identification. All weeds species collected from agricultural farms as shown in the experimental design below (Fig. 2).

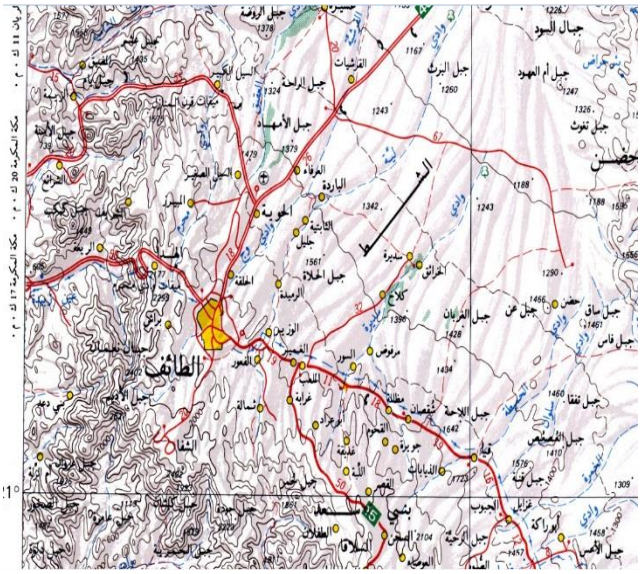

Fig.1. A map showing the area of Taif (http://www.athagafy.com/images/montada/camelmap.jpg)

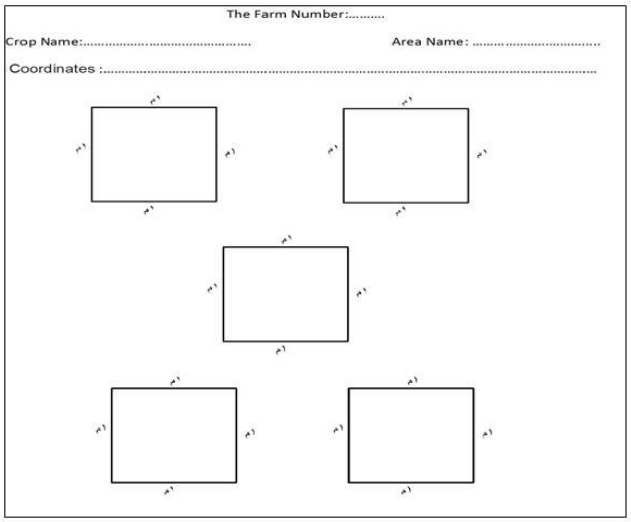

Fig. 2. Experimental design and quadrats arrangements of weeds in study area

Data analysis

Log^{+1} or log was used prior statistical analysis and then used to transform data and subject to one-way ANOVA where treatment means tested for a significant difference,using *t*-tests and least significant diference (LSD) test. A similar analysis was used previously by many researchers alike, (Zar, 2006; Juan et al., 2010; Levi et al., 2011).

Results and Discussion

Agricultural crops in the study area were determined to ascertain species of weeds found around the study area and evaluate their dominance pattern and density in the experimental areas. Pujadas (1988) stated that knowledge of weeds species in crops fields can help in successful weed management strategy in determining their densities. Table 1 shows the results and the spread of some agricultural crops developing weeds in Taif area. The weed which comes from Chenopodiaceae have the highest number followed by weed from Urticaceae family and others. The lowest number of weed comes from Cappaeaceae family. This was supported by Aldrich (1984), who reported that rarely a single predominant weed can be found in field condition, but predominant weeds mostly encompasses a few species of weeds.

Table 1. Number of weed family in agricultural crops at Valley of Leeyh South of Taif Area.

oN	Family	Weed number
1	Aizoaceae	55
2	Amaranthaceae	165
3	Brassicaceae	58
4	Cappaeaceae	3
5	Chenopodiaceae	819
6	Chenopodiaceae	51
7	Convolvulaceae	154
8	Poaceae	141
9	Asteraceae	75
10	Boraginaceae	77
11	Malvaceae	323
12	Portulacaceae	264
13	Zygophyllaceae	97
14	Urticaceae	455
15	Solanaceae	31

Results in figure 3 showed that the chenopodiaceae species has the highest density of weeds in the study location, followed by Uricaceae, Malvaceae and then the Portulacaceae. The lowest weeds density was recorded in specie of Cappaeacea, followed by Solanaceae and Brassicaceae and Aizoaceae with weeds number of less than 100. Shedayi et al. (2012) also reported that Chenopodiaceae is the most frequent families in many crop fields.

Amaranthaceae or the amaranth family and the Chenopodiaceae family has the same characteristics they are rarely trees or vines, the leaves are alternate, simple with no stipules often reddish, many salt-loving plants (halophytes).

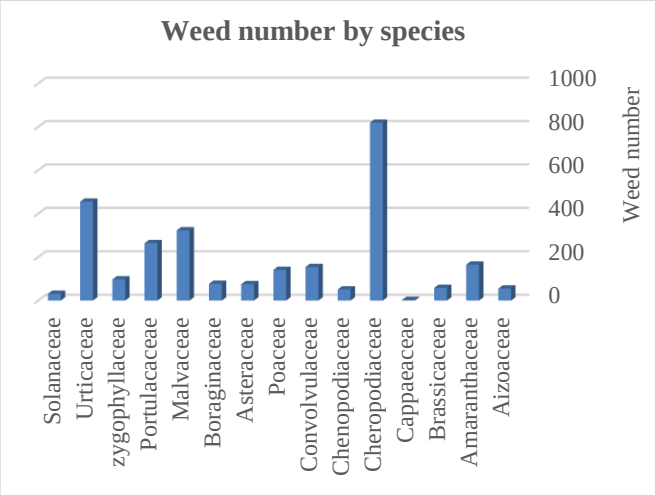

Fig. 3. Developing weeds density based on their species name in agricultural crops at Taif

Flowers of this family are actinomorphic and small; it usually has 3-5 sepals fused or free at the base whose surrounds the fruit. Petals are absent in flowers, many stamens as the sepals. Stems are often succulent, has connected and superior ovaries, fused carpels which are 1-3 with one ovule, locule and base placentation. Fruit are berries, capsulate or nutlets with characterized curved plant seeds.

Brassicaceae sometimes called the mustard family and sometimes describe together with the Cappaeaceae family because of their exact similar descriptions. These crops have mustard oils and are herbaceous. The leaves are simple, often alternate lobed, with pinnate venation. Leaf edge is often lobed or dentate. In florescence a raceme, Petals 4, not fused, forming a cross and from above, white, yellow, or pink. Stamens have six fruits per dry capsule with the inner wall (silique). Malvaceae family is trees or shrubs with peltate hairs or with stalked scales and sometimes star-shaped. It has simple leaves, which are alternate and compounded that are rarely pinnate. It stipulates falls off early. Actinomorphic flowers, with 6 merous, often with extra epicalyx external to the normal calyxes. The petals are free, mostly with 5 buds in convolute. Stamens are often 5 which are fused to a tube around the separate bundles or the stylets. It has two to many carpels and ovaries are usually superior. Fruits usually in a circle shaped schizocarp or capsule.

Poaceae, at times, regarded as the grass family are woods and mostly herbaceous. The stems are rhizomatous and regularly erectile shoots, the stem girth are cylindrical with nodes but hollowed internally. The leaves are linear, similarly in venation, forms in sheaths with ligule at the top. Flowers are spikelet with axillary terminals, which subtended by glumes. It doesn't have any sepals or petals, spikes are repeatedly formed on the bracts. Anthers and styles are dangling out from the spikes in flowering. Stamens are mostly branched and feather-like its fruits undergo caryopsis i.e. a seed in the nut. Asteraceae or aster is herbaceous typically; leaves are flexible, with pinnate venation. It has capitulum flower with bracts adjacent to it involucres. Flowers are tiny tubular and rectangular shaped, petals are fused while sepals are absent, it has 5 tiny lobes. A ring around the style fused to form the anthers, it has an inferior ovary; fruits are achene with habitual hairs around it.

Boraginaceae or the borage family regarded as herbs with rigid hairs. Leaves are different and simple. Forms of flowers that are helicoid cyme or scorpioid with 5 merous sympetalous and actinomorphic. It has pinkish corolla, which changes from purple to blue. Corolla attached to the anthers. It has superior ovary with 2 carpellate, 1 style and 4 locules which are attached to the basal of the ovary. Fruits have four nutlets, which are schizocarp.

Solanaceae is tropical herbaceous woody plants. It has leaves that lobed, mostly hairy with prickles. Sepals are stipulated and vague. It has 5 petals that are bonded which are attached to a lot. The corolla stars are funnel or tongue-shaped. It has superior ovary, with fused anthers, fruits are drupes, berry or porate and sometimes capsules. It has many seeds at the axile placenta. Results in the table below describe the spread of some developing weed species existing in Taif area.

Among these species of weeds *Urtica dloica* densities was the highest (455) followed by *Chenopodium valvaeia and Malva perviflore* with a value of 389 and 323. While the lowest weed density was recorded in case of *Capparis spinosa* and *Sonchus oleraceous* species with a value of 3. There is an important need for weed management measures in crops to get maximized yield from agricultural crops. All of the results in Table 2 are significantly different at $p < 0.05$. (LSD tests).

Table 2. Number of weed in agricultural crops

No.	Species Name	Weed number
1	*Aizoon canariense*	55
2	*Amaranthus vindi*	165
3	*Brassica tournifortii*	49
4	*Capparis spinosa*	3
5	*Chehopouiun valria*	32
6	*Chenopodium murale*	51
7	*Chenopodium valvaeia*	389
8	*Convolvulac arvensis*	73
9	*Cynodon dactylon*	132
10	*Echinops spinosissimus*	72
11	*Heliotropium currsivicium*	77
12	*Ipomoea sp.*	81
13	*Malva perviflore*	323
14	*Minuartia filifolia*	4
15	*Portnlaca oleracea*	264
16	*Sisymbrium iriol*	9
17	*Sonchus olereceus*	3
18	*Stipagrrostis bemralri*	5
19	*Tribulus terriestris*	97
20	*Urtica dloica*	455
21	*Withania sommifera*	31

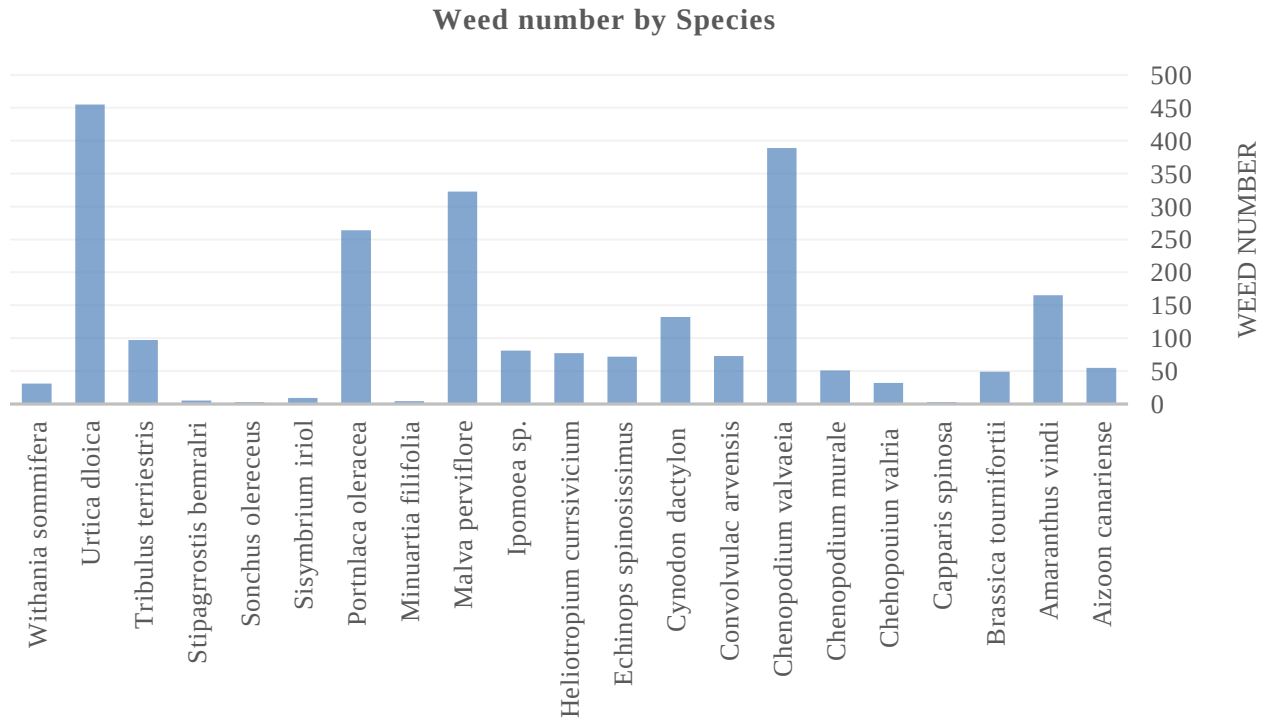

Fig. 4. Weed numbers based on their species name in an agricultural crops at Taif

The results showed significant differences about herbs densities depending on the species. Where it was most prevalent of *Urtica dloica, Chenopodium valvaeia, Malva perviflore, Portnlaca oleracea, and Amaranthus vindi*.The value of weeds 455, 389, 323, 264 and 165 respectively (Figure 4). And the less prevalent of *Capparis spinosa*, *Sonchus oleraceous*, *Minuartia filifolia*, *Stipagrrostis bemralri* and *Sisymbrium iriol*. The value weeds were 3, 3, 4, 5and 9 respectively.

The composition of weeds species in a crop is determined by the methods of cultivation, types of soil, pH of soil cultivation of seasons, conditions of the climate, cultural practices like tillage, irrigation systems, weed control measures and application of fertilizers. According to Moneruzzaman et al. (2010), growth and developments of plants differ with various operations of intercultural activities. In a recent study by Majrashi et al. (2010), they reported that plant distribution and diversity is effected by the topographical structure of the area which shows the richness of floristics in plain lands with a decrease in slope and altitude. Njoroge (1999) reported that different types of soil such as peat and paddy soil also affect the developments of weeds and densities of weed species.

Table 3. Number of weed in different types of agricultural crops

Agricultural crops	Weed number
Capparis decidua	64
Medicago sativa	27
Petroselinum crispum	399
Zea mays	64
Grape Sp.	101
Capsicum annuum	54
Coriandrum sativum	459
Cucurbita pepo	1202

Table 3 prescribed the densities of weed in different agricultural plant field. From the ascertion, it can be reported that the highest density of weeds (1202) found in *Cucurbita pepo* crops, followed by *Coriandrum sativum* crops, *Petroselinum crispum* crops, grape crops and others with a weed value 459, 399 and 101. Climatic conditions variation in genetic traits has influence in the variations of weeds intensity.

This result is in accordance with Girish et al. (2003) that reported intensities in species of weeds varies dynamically with crop species, timing and properties of the agroecology. It was also established that soil fertility and other soil properties influences weed densities. Many researchers also have shown that micro-nutrients present in the soil have a promising effect on the growth and development of the crop as well as other weed plants (Majrish et al. 2014).

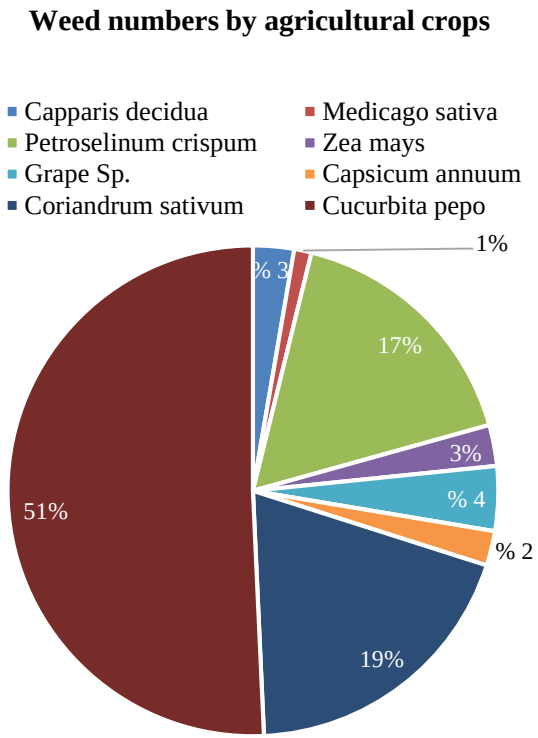

Fig. 5. Weeds density in different types of agricultural crops

Figure 5 indicates the weeds number in different types of agricultural crops. Pie chart shows that weed numbers are highest in *Cucurbita pepo* crops with 51% percentage followed by *Petroselinum crispum* with a value of 17 %. The lowest percentage of weeds density was found in *Medicago sativa* crops with only 1 %.

In Taif region, *Capparis decidua* a showed the highest frequency of weeds species. The highest density of plant populations found in the case of *Xanthium strumarium* followed by *Aristida funiculata*. Weed species recorded the highest are *Aristida funiculata*, followed by *Calotropis gigantea*. In addition, it observed in the Taif area an abundance of dominated weeds and unpalatable species i.e., *Cassia tora* and *Lantana camarain* patches indicating high grazing pressure of livestock.

Weeds associated with *Zea mays* revealed the presence of 8 species of annual and perennial plants belonging to 5 families. Of these species, 3 were dicotyledonous and 5 were monocotyledonous. The Poaceae, Fabaceae, Solanaceae and Amaranthaceae made up the total number of species. The remaining weed species belonged to the other 11 families. Its occurrence at high density and attributed to the counting method used where a stolon is considered an individual plant. *Cynodon dactylon, Cyperus rotundus, Portulaca oleracea L., Sorghum arundinaceum., Amaranthus viridis., Echinochloa colona, Gynandropsis gynandra., Amaranthus graecizans L., Euphorbia aegyptiaca Boiss., Chloris virgata., Convolvulus arvensi., Calotropis procera., Sesbania sesban., Alhagi maurorum Medik., Citrullus colocynthis., Ocimum basilicum., Solanum nigrum*. Similarly, Mehrtens et al. (2005) also reported that the poaceae family weeds are the most important weeds in maize cropping.

The major weed flora associated to *Coriandrum sativum* in the experimental site was Goose foot (*Chenopodium murale*), Corn spurry (*Spergula arvensis*), Indian sweet clover (*Melilotus indica*), Scarlet pimpernel (*Anagallis arvensis*), Common lambsquarters (*Chenopodium album* L.), Field bind wind (*Convolvulus arvensis*), Purple nutsedge (*Cyperus rotundus*) and Bermuda grass (*Cynodon dactylon*). From these weeds, Goose foot (*Chenopodium murale*) and Corn spurry (*Spergula arvensis*) among dicots and Purple nutsedge (*Cyperus rotundus*) among monocots were found most prominent weeds at all stages of crop growth. Our results are supported by the findings of Choudhary (2000), who reported that *Chenopodium murale* is the most important weed in Coriander field.

In *Medicago sativa* fields, 8 families of weeds were studied with 6 weeds species. Most weeds species are of the dicotyledonous and many species belonging to the monocotyledonous weed add up to the remaining. Poor agronomical practices will positively influence dicotyledonous over monocotyledonous (Hyvonen et al., 2003). Life cycle of weed species were biennials and perennials, and the highest number is the annuals weeds, which could attributed due to the time of sampling. The first survey has a higher infestation of perennial weeds, in these times the annual weeds produce seeds at incept of first harvest time.

Forage harvesting delayed in Taif region, which allows the rain to seed the annual weeds. However, this might explain which field has the highest infestation of weeds in the alfalfa fields of Taif region. The life cycle of annual weeds has an influence on reducing the population of alfalfa, depriving them of soil and climatic resources to their organs of reproductions and therefore allowing them in resisting to the volatile natures of agro-ecological systems (Gomaa, 2012)

Weeds surviving at Al-Taif *Grape spp*. Vineyard, 10 weed species studied in the vineyards. Blue grass, chickweed, dandelion, groundsel and *Elymus repens*. Crab grass, dandelion, pig-weed, fox-tail, fall panicum, clover, chick-weed, rag-weed, smart-weed and oxalis are the top weeds in abundance densities.

Weeds have a significant impact on *Cucurbita pepo* crop yield and quality, making crop managing challenging, significant weeds *Chenopodium album, Solanum nigrum, Tribulus terrestris*, pigwe, *Eragrostis curvula, Echinochloa spp*., and *Cyperus rotundus*. Have its place in the family, Asteraceae, Zygophyllaceae, Poaceae, Chenopodiaceae, Portulacaceae, Solanaceae, Amaranthaceae, Brassicaceae, Malvaceae, Fabaceae and Cucurbitaceae. In *Daucus carota*, about 8 weed species occurred at a density of ≥10 plants m^2 in the experimental site. Out of these species, *Oryza longistaminata* had the highest number of weeds per m^2, followed by *Ambrosia maritime, Chloris pilosa, Amaranthus viridis, Echinochloa obtuisiflora, Cyperus rotundus, Eclipta prostrata, Echinochloa crus-pavonis and Paspalum scrobiculatum.*

10 weed species were recognized from black pepper field. The most important families according to the number of represented species were Asteraceae, Amaranthaceae, Poaceae, Malvaceae and Cyperaceae. Weeds species include, but are not limited to *Commelina benghalensis, Euphorbia heterophylla, Galinsoga parviflora, Rottboellia cochinchinensis, Achyranthus aspera, Cynodon dactylon, Cyperus rotundus, Snowdenia polystachya and Oxalis corniculata.* Reinhardt and Meissner (1994) also recorded that *Chenopodium album* is one of the most important weed in many vegetable crops.

Due to flexibility in climate and environmental situations, cropping techniques, seasons of cultivation, cultural practices, composition of weed seed bank and periodicity of emergence patterns of different weed species patterns of emergence, weeds population in field crops changes which are in constant state of dynamism. Aguiar et al. (2011) stated that the knowledge of weed community distribution and composition is important for solving problems related to potential weed infestations, being directly connected to the weed control strategy. Westword et al. (2010) reported that the floristic composition of weeds intensities in a particular field changes over time, as weed populations ecological entities that are complex. Crop species, cultivation seasons, soil, climate and cultural practices have a high influence on crops yield and development (Adel et al., 2011). Pujadas and Hernandex, (1988) suggested that a diverse flora varies considerably depending on the level of different agronomical inputs employed. Micro environment changes by localized application also affect plant growth and development and their productivity. Khandaker et al. (2012) reported that plant intensity, distribution as well as morphological growth and development, also affected genetically. For example, in an irrigated field of arable crops, 79 species of weeds were recorded while in non-irrigated low input fields of crops it was recorded 334 species. An understanding of the weeds taxonomy along with intensity patterns is necessary for an effective weed control. Majrashi et al. (2015) also been reported that fertilizer application in peat and paddy soil significantly affects the root and aerial growth of some weeds in a tropical climate. Nuraini et al. (2016) also reported that organic fertilizer also affects the plant production. Species distribution and diversification also depend on monsoon season as well as the ecological site. Plant growth, development and yield also depend on fertilizer dose and type of fertilizer (Young et al. 1999). It has been reported that different agricultural techniques such as growth regulators, pruning and growth-promoting chemicals also affects the growth of the plant. Different cultural condition like soil humidity also affect the growth and development of plant (Molau, 1995).

Conclusion

This study established the complete weed profile of Leeyh valley of Southern Taif. It can be concluded that the Cherepodiaceae had the highest number of weeds species followed by Uriticaceae and Malvaceae. The lowest weeds species count recorded in Cappaeaceae followed by Chenopodiaceae and Aizoceae. The highest weed counts of agricultural crops observed in Cucurbita pepo, Coriandrum sativum and Petroselinum annum. The lowest weeds in Taif

agricultural fields are in the plantations of *Medicago sativa* followed by *Capparis decidua* and *Zea mays*. Dominant weeds species include *Urtica dloica, Malva perviflore, Chenopodium valvaeia, Amaranthus vindi, Cynodon dactylon, Portnlaca oleracea.* The findings of this research will be beneficial in suggesting suitable weed control recommendation of crop grown in Leeyh valley of Southern Taif.

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