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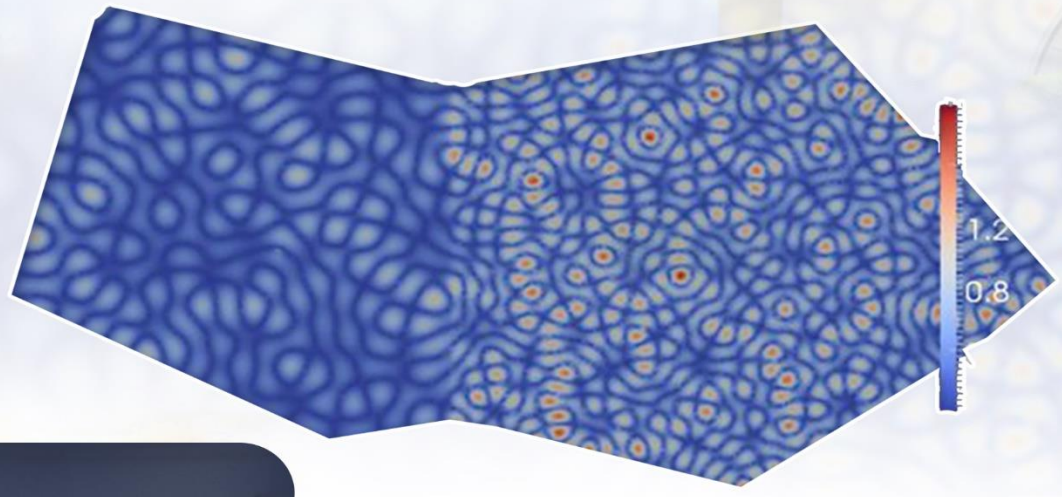

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Identification of the Most Important Weed Species in A Barley Crops in Beir Bullerjam Region – Soloq, Libya

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A B S T R A C T

A field survey was carried out to highlight the most important and problematic weeds of barley crop at District Beir Bullerjam, Soloq Region, Libya for two seasons (2020 to 2021). The current study is based on field research where recorded most weed the grown species by survey followed by using quadrats and finally calculating the weed density and their frequency. samples from the fields of the barley crop using a quadrat of size 1 m × 1 m randomly thrown at different points in the fields. The plants were identified with the help of available literature and through comparison with the already identified plant species. Data inventory has been documented in the form of family, Botanical name, vernacular name and life cycle. A total of 67 weed species belonging to 54 genera and 21 families of angiosperms. The dominant families according to the number of species were Asteraceae (14 species), Fabaceae (11 species), Poaceae (9 species), and Brassicaceae (7 species). The most dominant life cycle was annuals having 57 followed by perennials having nine species and biennials represented by only two species.The results further revealed that the highest density (43.48 m^{-2}) and (30.36 m^{-2}) were recorded for *Lolium rigidum* and *Melilotus indicus* respectively, while the highest frequency were recorded for *Melilotus indicus* and *Eruca sativa* with 84% and 80 respectively.

1 Introduction

Hordeum vulgare L. As one of the earliest domestic crops, barley has been one of the most important staple crops in the old world Neolithic agriculture upon which early agriculture was built (Harlan and Zohary, 1966). Weeds are unwanted plants that provide a hard time to any particular crop in which it occurs. Its variety and distribution differ from crop to crop and generally have no aesthetic or economic value. Such vegetation is found abundant in cultivated fields of great financial and biological significance (Jabeen and Ahmed, 2009). In no other parts of the world does uncontrolled weed growth cause as a great a reduction in crop yields as it does in dry areas where soil moisture is the limiting factor and weeds compete significantly with the crop for available moisture (Robson,1992).

Weed infestation is one of the major hindrances to crop yield including pests, diseases, and climatic influences. Weeds and crops usually have the same requirements, but weeds make their living at the expense of the crop by competition for space, nutrients, moisture, light, and carbon dioxide (Abdul Ghafoor and Shad, 1995; Klingman *et al.*, 1975; Muzik, 1970). There are around 30,000 species of weeds in the world, of which 50 to 200

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usually cause considerable damage to the major food crops (Mahmood, 1992).

Weed problems in Libya have become very important not only in the coastal belt with its higher rainfall, but also in the newly established irrigation projects in the desert where it was very difficult to find a single weed in the past (Robson, 1992). In Libya however, the recognition of weed science as a discipline with the same position as other crop protection disciplines, such as entomology and plant pathology, has been neglected (Kukula and Ghanuni, 1992). There is a good number of studies on weeds of the crops that have been reported from different parts of the country i.e., Sirte (Alaib and Ihsaeen, 2008), Melytania (Al-Zerbi, 2004), Jardina- Soloq Region (Omar *et al*. 2020), Masiklo (Abu Khsheem, 2020).

The present study aims to identify different weed species and the most dominant weed species in the barley crop by calculating the density and frequency.

2 Materials and Methods

The study area is located about 50 Km South of Benghazi city adjacent to Soloq city at approximately 32º 08′ N latitude and 20º 32′ E longitudes. The area rises about 70 m above the sea level (figure 1). The total area is approximately 600 hectares. The study lasted two years and took place throughout the spring season (2020 to 2021). Field expeditions were more frequently done from January to April when the plants were in flowering and fruiting conditions. The crop-weed association was studied by quadrate of 1 meter diameter. Twenty five quadrates were randomly placed in the fields and the number of plants of each weed species falling in the quadrate were carefully counted and listed for density and frequency.

For drying, the presser containing the specimens was placed in the drying room. After that the specimens were examined individually, rearranged, transferred to fresh sheet and again tightly bonded in the presser. The specimens were changed to dry sheet every 24 or 48 hours, until they were completely dry. The data were recorded on the following parameters:

$$\text{Density} = \frac{\text{Total number of individuals per species in all quadrats}}{\text{Total number of quadrats studied}}$$

$$\text{Frequency} = \frac{\text{Total number of quadrats with the species}}{\text{Total number of quadrats studied}} \text{ X } 100$$

The genus and species was identified by the utilization of available taxonomic literature (Erteb, 1994; Ali and Jafri, 1976-1977; El-Gadi, 1988-1989; Keith, 1965; Jafri and El-Gadi, 1977-1986 and Tackholm, 1974).

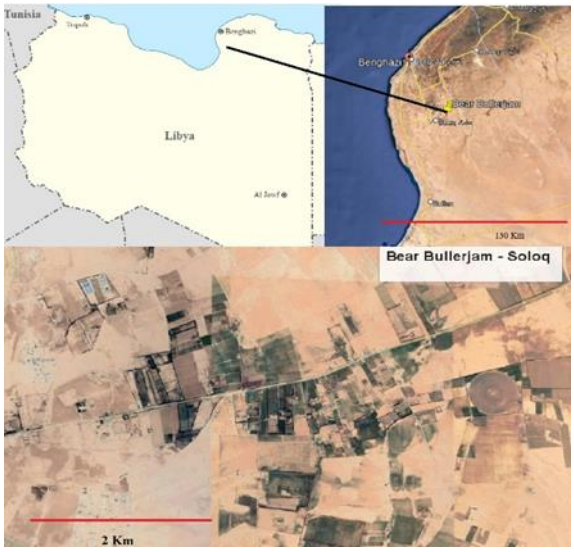

Figure (1): The study area and location (source: Bing Maps and Google Earth).

3 Results and Discussion

Weed flora of the study area is comprised of 67 species of flowering weed plants representing 54 genera and 21 families were record. A detailed list of weed species identified in barley crop in the study area along with their scientific names, families, vernacular names, and life form are shown in Table 1below.

Table (1): weed species, their vernacular names and life cycle of barley crop recorded in the study area.

Species	Vernacular name	Family	Life cycle
Allium nigrum L.	Thom Bary	Amaryllidaceae	Ann.
Allium erdelii Zucc.	Ghazool	Amaryllidaceae	Ann.
Amaranthus viridis L.	Buzinzir	Amaranthaceae	Ann.

Ammi majus L.	Sfinnari-Hameer, Khalla, Sfinnari el ma'iz	Apiaceae	Ann.
Deverra tortuosa (Desf.) DC.	Gazzah.	Apiaceae	Per.
Pseudorlaya pumila (L.) Gramde		Apiaceae	Ann.
Achillea santolina L.	Zefrah, El Batharan	Asteraceae	Ann.
Anthemis secundiramea Biv.		Asteraceae	Ann.
Calendula arvensis L.	Ain Al-Bugra	Asteraceae	Ann.
Carduus getulus Pomel		Asteraceae	Ann.
Centurea dimorpha Viv.	Bla ′ala	Asteraceae	Ann.
Chrysanthemum coronarium L.	Gahwan	Asteraceae	Ann.
Conyza bonariensis (L.) Cornq.	Ashbet Zamora	Asteraceae	Ann.
Echinops galalensis Schweinf	Shembet Elgatoos, Libid	Asteraceae	Per.
Launaea resedifolia (L.) O.Kuntze	Adeeda.	Asteraceae	Per.
Onopordum arenarium (Desf.) Pomel	Libid. Bairoff	Asteraceae	Bi.
Reichardia tingitana (L.) Roth.	Sahani.	Asteraceae	Ann.
Rhantterium suaveolens Desf.		Asteraceae	Per.
Senecio gallicus Chiax	Daraita , Mourare.	Asteraceae	Ann.
Sonchus oleraceus L.	Tefaf.	Asteraceae	Ann.
Brassica tournefortii Gouan	Al-Harra	Brassicaceae	Ann.
Capsella bursa-pastoris (L.) Medik.	Kais Al Rai	Brassicaceae	Ann.
Didesmus aegyptius (L.) Desv.	Lesless	Brassicaceae	Ann.
Diplotaxis muralis (L.) Dc.		Brassicaceae	Ann.
Enarthrocarpus clavatus Del.ex Goder.	Shultam	Brassicaceae	Ann.
Eruca sativa Mill.	Gargeer Barry	Brassicaceae	Ann.
Sinapis arvensis L.	Al-Khardal Al-Barry	Brassicaceae	Ann.
Echium angustifolium Mill.	Henna alagrab, abat elgula	Boraginaceae	Per.
Bassia muricata (L.) Asch.	Chouleta, Ghabbir	Chenopodiaceae	Ann.
Beta vulgaris L.	Selg, Selk	Chenopodiaceae	Ann.
Chenopodium murale L.	Effena	Chenopodiaceae	Ann.
Convolvulus althaeoides L.	Ullak	Convolvulaceae	Per.
Convolvulus arvensis L.	Ullak	Convolvulaceae	Per.
Astragalus asterias Stev ex Ledeb		Fabaceae	Ann.
Astragalus boeticus L.	Grambushia	Fabaceae	Ann.
Astragalus peregrinus Vahl		Fabaceae	Ann.
Hippocrepis multisiliquosa L.		Fabaceae	Ann.
Lathyrus aphaca L.		Fabaceae	Ann.
Medicago disciformis Dc.	Nafal	Fabaceae	Ann.
Medicago sativa L.	Gadb, safsafa, Berseem.	Fabaceae	Ann.
Medicago laciniata (L.) Mill.	Nafal	Fabaceae	Ann.
Melilotus indicus (L.) All	Handegog	Fabaceae	Ann.
Vicia sativa L.	Jilban.	Fabaceae	Ann.
Vicia villosa Roth	Jelbana –Hmam	Fabaceae	Ann.
Erodium cicutarium (L.) L' Herit	Dahmiyet el-ghazl.	Geraniaceae	Ann.
Erodium malacoides (L.) L' Herit		Geraniaceae	Ann.
Salvia lanigera Poir.	Sag en naga	Lamiaceae	Per.
Bellevalia mauritanica Pomel.		Liliaceae	Ann.
Malva parviflora L. var *parviflora*	Khobaiz	Malvaceae	Ann.
Malva sylvestris L.	Khobaiz, Hobbess	Malvaceae	Bi.
Orobanche schultzii Mutel.		Orobanchaceae	Ann.
Papaver hybridum L.	Bugraun, Garaun	Papaveraceae	Ann.
Papaver rhoeas L.	Bugraun	Papaveraceae	Ann.
Plantago crypsoides Boiss.	Aenm.	Plantaginaceae	Ann.
Avena fatua L.		Poaceae	Ann.
Avena sterilis L.		Poaceae	Ann.
Bromus rigidus Roth.		Poaceae	Ann.
Cutandia dichotoma (Forsk.) Trabut	Zewahn , bu ′rukba	Poaceae	Ann.
Cynodon dactylon (L.) Pers.	Najem , Najieel	Poaceae	Ann.

Hordeum murinm L.		Poaceae	Ann.
Lolium rigidum Gaud.	Bomanjor.	Poaceae	Ann.
Phalaris minor Retz.	Zewan	Poaceae	Ann.
Stipa capensis Thunb.	Behma	Poaceae	Ann.
Emex spinosus (L). Campd	Dors el-azouz & El-Enzab	Polygonaceae	Ann.
Polygonum equisetiforme Sibth. and Sm.	Gurdab	Polygonaceae	Per.
Anagallis arvensis var. *caerulea* (L.) Gouan	Ain Algatuus	Primulaceae	Ann.
Adonis dendata Delile	Zeghalil	Ranunculaceae	Ann.
Solanum nigrum L.	Anab ed. Deeb	Solanaceae	Ann.

***Abbreviations: Annual = Ann., Biennial = Bi., Perennial.**

Dicotyledons were represented by 18 families, 46 genera, 55 species whereas; Monocotyledons were represented by three families, ten genera and 12 species (Table 2). The ratio of Dicotyledons to Monocotyledons is 6: 1.

Table (2): Different taxonomic groups present in the study area.

Plant group	No. of families	No. of Genera	No. Species
Dicotyledons	18	46	55
Monocotyledons	3	10	12
Total	21	56	67

The dominant family contributing to weed flora was Asteraceae with 14 species, followed by Fabaceae with 11 species and Poaceae with 9 species. The next largest family was Brassicaceae with seven species, Apiaceae and Chenopodiaceae included three species each. The most previous studies on Libyan flora recorded that these families included the largest number of species, such as, (Ali and Jafri, 1976-1977; El-Gadi, 1988-1989; Alaib and Ihsaeen, 2008; Omar *et al*. 2020; and Ihsaeen, 2005). Five families namely, Amaryllidaceae, Convolvulaceae, Geraniaceae, Malvaceae and Polygonaceae included two species each. The remaining families were represented by one weed species each.

According to the number of species in each genus in the study area, *Astragalus* and *Medicago* were the only two genera represented by three weed species each. Seven genera, *Allium, Avena, Malva, Erodium, Convolvulus*, *Papaver* and *Vicia* were represented by two species each in the study area. The rest seventy four genera were represented by only one species each.

The study showed the majority of weed species 57 species associated with the barley crops were annuals, followed by perennials with nine species, whereas biennials represented by only two species (Figure 2).

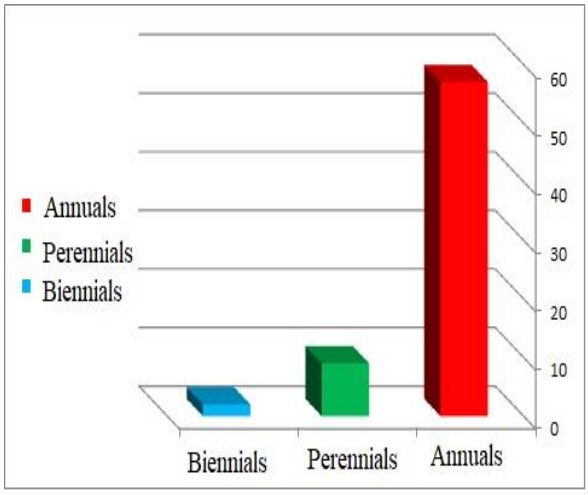

Figure (2): Life cycle of weed species in the study area**.**

The survey data showed that total 15 weed species fell into the quadrates studied. Species with a few densities were neglected (less than 0.5 plants in all quadrates). The results on weed density of a particular species are shown in Table 3. The data showed that the surveyed fields were mostly infested with *Lolium rigidum, Melilotus indicus*, *Hordeum murinm, Eruca sativa, Anthemis secundiramea*, *Vicia villosa*, *Chrysanthemum coronarium*, *Beta vulgaris, Medicago laciniata, Phalaris minor, Bromus rigidus, Malva parviflora, Avena fatua, Brassica tournefortii* and *Reichardia tingitana*. The study also showed that species of the field were a mixture of both broadleaf and grasses alike.

Table (3): Weed density (m^{-2}) and weed frequency (%) for the individual weed species of barley crop in the study area.

Species	Density (m^{-2})	Frequency (%)
Lolium rigidum	43.48	64
Melilotus indicus	30.36	84
Hordeum murinm	14.24	44
Eruca sativa	11.4	80
Anthemis secundiramea	5.12	44
Vicia villosa	3.68	52
Chrysanthemum coronarium	3.6	64
Beta vulgaris	2.36	32
Medicago laciniata	2.2	24
Phalaris minor	1.96	32
Bromus rigidus	1.92	12
Malva parviflora	1.92	44
Avena fatua	0.56	8
Brassica tournefortii	0.52	20
Reichardia tingitana	0.52	12

The weed density of dominated species (43.48 m^{-2}) was recorded for *Lolium rigidum* followed by *Melilotus indicus* with 30.36 plants m^{-2} and *Hordeum murinm* with 14.24 plants m^{-2}, whereas, the lowest weed density were calculated for *Brassica tournefortii* and *Reichardia tingitana* with 0.52 plants m^{-2} in the barley fields. In earlier study by Ihsaeen (2005) also reported that *Lolium rigidum* and *Melilotus indicus* were the highest density in barley fields in agricultural project of Sirte.

The weed frequency of weeds is the best way of indication for the prevalence of weed species in the studied area. The results of weed frequency (%) of a particular species are shown in Table 3. On the basis of the data provided the highest frequency was computed for *Melilotus indicus* with 84 % followed by *Eruca sativa* with 80 %, whereas, the lowest frequency recorded for *Avena fatua* with 8%. Most of the previous studies, such as Omar *et al.* (2020), Ihsaeen (2005) and Al-Zerbi (2004) stated that *Eruca sativa*, *Melilotus indicus*, *Lolium rigidum*, and *Bromus rigidus* have the highest frequency in different crops fields of Libya.

4 Conclusions

Among the different identified weeds *Lolium rigidum* and *Melilotus indicus* were the most problematic weed of the barley crop in Libya. This study contributed to the existing litetature by providing some knowledge about weed flora to design a solid integrated weed management plan for the different crops in the target areas.

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Supplementary material

Eruca sativa (Brassicaceae)

Calendula arvensis (Asteraceae)

Avena sterilis (Poaceae)

Melilotus indicus (Fabaceae)

Medicago disciformis (Fabaceae)

Malva parviflora (Malvaceae)

Phalaris minor (Poaceae)

Adonis dendata (Ranunculaceae)

Senecio gallicus (Asteraceae)

Achillea santolina (Asteracear)

Convolvulus althaeoides (Convolvulaceae)

Sinapis arvensis (Brassicaceae)

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