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Viability and germinability tests and establishment of *Aegilops cylindrica* and *Ambrosia trifida* seeds in imported wheat and soybean under Egypt condition

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ABSTRACT

Experiments were conducted at the Giza farm station in wire house and laboratory of Weed Research Central Laboratory, Agricultural Research Center, during 2019/2020 to 2021/2022 seasons. To study the viability of exotic alien weed seeds, which are contaminated with wheat grains and soybean seeds, in randomized complete design with four replicates. The sources of the shipments were Russia, Ukraine and American United States. These results pointed that a lot of wheat grains and soybean seeds were mixed with weed seed species, which growing during winter, spring and summer seasons. The two species under study don't distribute in Egyptian sowing soil up till now. The highest percentage of seeds viability of *A. trifide* was 75 and 75% Stand (class$_1$), 25 and 10% dead (class$_0$) and 0 and 15% class$_{0.5}$ (intermediate) in 2021 season and 2022 in the first generation seeds under Egyptian condition, respectively. The germinability and establishment of *A. cylandrica* and *A. trifide* have the highest germination percentage and complete the life cycle and produced viable seeds under Egypt conditions. The highest germination percentage of *A. cylandrica* was resulted from sowing date 15th September, 15th October. Breaking dormancy by storage seeds in cool conditions and soaking seeds in water for 72 hours and sowing date in early spring season was need to improve germination percentage of *A. trifide* seeds. The mean number of seed bank and germinability seed bank in the second season was 21 seed/kg soil and 5 seedling/pot of *A. trifide* and 70 seedling/m^2 of *A. cylandrica.*

Keywords: *Aegilops cylandrica*, *Ambrosia trifida*, exotic weeds, viability, germination percentage, grain wheat and soybean shipments.

1. Introduction

Seed viability and vigor test of weed seeds are commonly tested by the standard germination test under optimum moisture and temperature conditions and the various environmental factors in the sowing field conditions and genetic factors adversely influence on germination and emergence, (Copeland and Donalds, 1999). Jointed goatgrass (*Aegilops cylindrica*), family poacea, seed caryopses a winter annual grass weed is a growing concern to winter wheat (*Triticum aestivum* L), *A. cylindrica* species is spread only by seeds, seed germinated at temperatures between 10 and 35 ºC with optimum temperatures from 18 to 23 ºC, (Fandrich and Smith, 2006; CABI, 2019 and Wang *et al*., 2020). Inter specific hybridization between *Aegilops cylindrica* and *T. aestivum* can occur, naturally when the two species come in contact (Belae, 1968), the mean hybridization under field conditions was 3%, (Guadagnuolo *et al*., 2001).

At maturity of *A. cylindrica*, the spikes disarticulate at the base and fall to the ground as the dispersal unite, (Spetsov *et al*., 2006). *A. Cylendrica* is a hard to control by the selectivity herbicide because of its close genetic association and hybridization with wheat (Davy *et al*., 2008). Individual plants of *A. Cylendrica* can produce over 30 tillers/plant and 3000 - 4000 seeds under good nutritional and water management conditions, (Duan *et al.,* 2005).

Giant ragweed (*Ambrosia trifida*) germinates in the spring (April) and growth rapidly, the growth rate and final height of the plant in the range of 30 cm to 2 m. and the flowering in induced by a dark

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period of 8 hour, usually flower in the period July to October and seeds are produced from mid-August, (Bohren, 2006 and wittenberg, 2005) *Ambrosia* has broad amplitude in regard to germination and temperature , between 7°c to 28°c with an optimum at about 15°c , change in temperature has prolonged the growing season in e.g. Germany, with 8-10 days after sowing, (Fumanal *et al*., 2007). The various sources the germination varied between 48 to 80 % (Karrer *et al*., 2011), the conditions for germination of different species may differ in terms of the substantial, temperature and time, the substrate for germination may be sand, an organic medium, on top of paper or between papers. The high yield losses due to *Ambrosia* competition was at sowing spring and summer crops than winter crops (Clewis *et al*. ,2001) and the herbicide treatments less or not effective on *Ambrosia* (Harison *et al.,* 2001; Louis *et al.,* 2005 and Hartmann *et al.,* 2005).

Weeds control is the main elements for agriculture production. Weed problems start with weed seeds contaminants in crop production and re-infestation the new areas (Duary, 2014 and Aygun *et al.,* 2017). Internationally traded grain commodities as a pathway for the transportation of invasive alien species of weed seeds into new areas among contaminants, regions and nations had a significant impact on the recipient ecosystems and caused major economic losses in agriculture production and other industries (Pimantel *et al.,* 2000; Pallewatta *et al.,* 2003; Shimono *et al.,* 2015 and Wilson *et al.,* 2016).

The aim of this study was a) increased productivity of agricultural production by produced more information about the viability, germination and establishment of Invasive Alien Species (IAS) weed seed consignment with imported grain wheat and soybean under Egypt condition to plan strategically weed control of its weed species, b) reduced the cost of weed control by prevent the entry alien weed species which invade agriculture in the territory of Egypt. c) Providing the decision-makers by more information about the effect of its weed species on agricultural productivity.

2. Material and Methods

2.1. Source of materials:

This study was carried out at Giza in wire house and laboratory of Weed Research Central Laboratory, Agricultural Research Center, to study the germination and viability of exotic alien weed species, about 109 samples of wheat and 43 samples of soybean seeds, were taken by quarantine officers during the period from 15Th September 2019 to 15Th September 2020 and inspected by the Weed Research Central Laboratory staff to detect the degree of contamination by weed seed consignment with these shipments. The sources of these shipments were Russia, Ukraine, USA and some other countries.

Laboratory and wire house experiments were conducted to viability test, germinability and establishment of exotic alien weed species. The two weed species studied were *Aegilops cylindrica* (goatgrass, jointed) as grassy weed and *Ambrosia trifida* (Giant ragweed) as broad leaved weed.
The experiment was designed as a completely randomized design of two populations of *Aegilops cylindrica*: five sowing times was studied. Each treatment was replicated four times and germination tests were performed from 15th December 2020 to July 2022.

2.2. Method of detection:

Weed seeds detection was carried out by seed cleaning includes the use of aspirators, screens and other separators to remove debris and weed seeds from the crop based on size, shape or weight.
Video microscope and magnified lens and the count were carried out as no. of weed seeds / kg of grains. The detection of weed seed consignment in imported grain shipments identification and storage under suitable condition for each species until used to estimate the germination %.

Weed species obtained from Ukraine, USA and Russia were used as plant material in this study. Scientific name, family name, seed and seedling photo of seed samples of these weed species which presented in Fig.1 and 2.

2.3. Seed storage:

Aegilops cylindrica was storage under laboratory condition, but *Ambrosia trifida* was storage in refrigerator the period between one to three months for stratification of seeds dormancy. Seeds of common ragweed were collected immediately after collection, seeds were dried at room temperature air purified and placed at 4°C ± 2°C in a dark refrigeration chamber until the beginning of the experiment (Hall *et al*., 2021).

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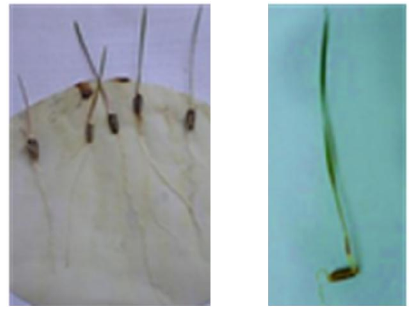
Botanical name
***Aegilops cylindrical* L**

Family name
Poaceae

Seeds photo



Seedling photo

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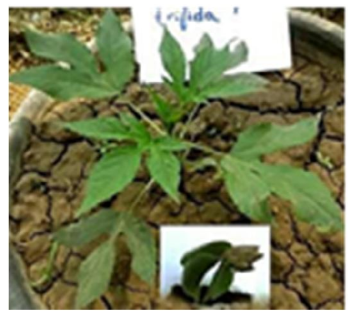
Botanical name
***Ambrosia trifida* L**

Family name
Asteraceae

Seeds photo



Seedling photo

Table 1: Mean of air temperature and relative humidity in 2020, 2021 winter, spring, summer and autumn seasons, Central Laboratory for Agricultural Climate.

Months	Air temperature (°C)	Relative humidity (%)	Air temperature (°C)	Relative humidity (%)	Air temperature (°C)	Relative humidity (%)
	Year 2020		Year 2021		Year 2022	
January	11.39	69.17	14.05	59.05	10.65	62.68
February	13.08	66.28	14.18	61.52	12.86	61.08
March	15.99	60.95	15.51	62.38	14.03	53.85
April	19.05	56.50	19.84	50.20	22.73	38.93
May	23.58	51.15	26.99	36.64	25.23	39.18
June	27.55	41.67	28.17	41.25	29.16	42.18
July	29.92	42.84	30.65	41.52	29.82	42.24
August	30.22	45.25	30.95	43.13		
September	29.47	50.37	27.88	51.61		
October	25.63	56.98	23.90	56.52		
November	18.93	63.75	20.66	61.56		
December	15.65	60.37	13.67	65.54		

2.4. Indirect tests of viability of Ambrosia trifida:

To determine quickly the viability of weed species seeds which normally germinate slowly or show dormancy under the normal germination methods as well as exposure of weed seeds to unsuitable conditions interim, caused weed seeds inter the secondary dormancy, can be using tri-phenyl tetrazolium chloride (TTC) methods.

2.5. Tri-phenyl Tetrazolium Chloride (TTC):

Its solution in water is colorless, but in living tissues the (TTC) is red. The test is commonly used for testing seed quality with various instructions produced by, the International Seed Testing Association. Certain adaptations for specific seeds are commonly made. In case of weed species were hypothesized that the variance between seed populations collected from the period 2019 to 2020 seasons, two populations of weed species seeds were tested.

Under a dissecting microscope, seeds were counted in 3 classes, stained (class1 =alive), not stained no fully developed embryo present (class0 =dead), intermediate (class0.5) in cases that are only lightly or partly stained (Starfingeret *et al*., 2012).

Class$_1$	**Class $_{0.5}$**	**Class $_0$**

Fig. 1: Standard of classification stained embryos of common ragweed after TTC treatment (HALT-Ambrosia team, 2013).

2.6. Germinablity and establishment test:

Seed samples were collected from imported grain wheat and soybean seeds, which imported from different countries during 2019 to 2020 seasons. Seeds were tested for the viability degree of the seeds.

Ten seeds/row of trays were filled by pasteurize soil, which pasteurize by microwave heating for the period 2 hours, were placed one seeds/hill at 2 cm deep in a seedling tray, after the trays were irrigated as necessary. The presence seedlings on the surface soil was counted every day after planting and transplanting to pot 50 cm diameters for complete the life cycles in wire house under Egypt conditions. The germination percentage was determined for each species as follow:

$$\% \text{ of emergence} = \text{number of seedling/number total sowing seeds} * 100$$

Treatments:

The treatments were arranged in complete randomized design with four replicates (r).

1- Stratification of seeds dormancy treatments of Ambrosia trifida:

1. Control without any treatments for breaking the dormancy.
2. Storage at cooled (0-5 °C).
3. Storage under laboratory condition.
4. Soaked in fresh tap water for 72 hours.

2- Sowing dates:

Six sowing dates beginning in the winter season as 15Th September, 1St and 15Th October, 1St and 15Th November and 1St December for *Aegilops cylindrica*. After 20 days from sowing the emergence percentage was recorded, then transplanted into the pots (diameter 25 cm and depth 75 cm and were filled with soil) to study the ability of seedling continue to maturity stage.

Ambrosia spp. seeds were sowed directly in the soil, ten sowing date 1St and 15Th February, 1St and 15Th March, 1St and 15Th April, 1St and 15Th May and 1St and 15Th June of giant ragweed. Fourth achenes of Ambrosia spp. collected from imported soybean seeds during the period from October to December 2020, then stored in the darkness at 0 – 5 °C in refrigerator for three months for stratification of seeds dormancy, then soaked in fresh tap water for 72 hours, after that, the seeds were sowed in trays filled by soil which was pasteurized by microwave heating for 3 hours long. After 45 days from sowing the emergence percentage was recorded, then transplanted into the pots (diameter 25 cm and depth 75 cm and were filled with soil) to study the ability of seedling continue to maturity stage.

In 2021/22 second season:

1. Sowing the seeds of weed species which produced from the first season (first generation) under Egypt conditions by the same systems, which description above in the first season.

2. Follow up the re-infestation by its weed species in wire house soil as well as in the pots, which sowed by its weed (germinability of soil seed bank).

The Data were recorded as follow:

1. Description of spikelet and seeds, seedling vegetative growth and flowering of weed species.
2. Anatomy (a longitudinal and cross section) identification of weed species.
3. Classification of vitality seeds (TTC-test) of weed species.
4. Germination percentage.
5. Shoot and radical length (cm).
6. Soil seed bank and germinability of weed species under study in the second season.

Statistical Analysis

The experimental design was randomized complete design. For each of the studied species, the germination percentage analyzed by one way ANOVA, all data were statistically analyzed according to technique of analysis of variance for randomized complete design as mentioned by Gomez and Gomez, (1984) by means of "Genstat 18th edition" computer software package.

Least significant difference (LSD) at 5% level of probability was used for mean comparisons was tested using univariate procedure with procedure option set for all plots in Genstat 18th Edition.

3. Results

Part A: Weed species contaminated with imported grain wheat.

Must imported grains wheat was contaminated with the weed seeds, which associated with wheat in growing fields at harvested, and can be difficult cleaning because the semi-shape, size and density of grain wheat also the mature times of these weed species was the same time of the maturity date of wheat crops, more over the contaminate stores shop department store by weed seeds. Its weeds more frequency presented in grains wheat introducing invaded to new areas through the grains intended for processing or consumption, but these weeds were less risk on the agricultural production than the wheat grains, which imported for sowing (seeds for sowing), but this risk should be not ignored because during the pathway from imported station to the end uses site for processing can be fall some weed species seeds in growing soil and re-infestation in the next years.

The complex weed species were mentioned in imported grains wheat. The numbers of weed seeds/kg grains wheat sample and the frequency represented in grain wheat shipments as *Aegilops cylindrica* was more frequency mentioned in samples of wheat grains about 54% from the total inspection shipments were contaminated by *A. celindrica*. The numbers of *A. cylindrica*, was more than 4 – 83 spikelet/ kg sampled followed by *Avena* spp., *Lolium* spp., *Bromus* spp., as grassy weeds then *Fallopia convolvulus, Galium aparine, Papaver* spp, *Thlaspi arvense, Aconitum* spp., *Consolida ajacis, Convolvulus arvensis* was less frequency and numbers. *Ambrosia trifida*, and *Ipomoea* spp. was rare found in grain wheat due to their weeds presented and growing in the spring or early summer season or the perennial weeds.

Table (2) reported that the number of weed seeds/kg in imported grain wheat sample before and after processed cleaning of grains wheat, which applied at the end use. Wheat samples were contamination by many weed species different from in the size and shape, some weed species didn't screening from grain wheat when cleaning by sieves such as *Avena* spp., *Aegilops cylindrica* with screening by sieving clean.

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Table 2: Weed species and number of seeds contaminated incoming wheat seeds-lots received to the Weed Research Central Laboratory before screenings (B.S) and after screenings (A.S.) during 2019-2020 period.

Scientific name	Seed number /1 kg sampleegrain wheat									
	Sample 1		Sample 2		Sample 3		Sample 4		Mean	
	B. S.	A. S.	B. S.	A. S.	B. S.	A. S.	B. S.	A. S.	B. S.	A. S.
***Avena* spp.**	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Aconitum napellus* and *Consolida ajacis	32.0	0.0	40.0	0.0	8.0	0.0	20.0	0.0	25.0	0.0
Aegilops cylindric	8.0	8.0	20.0	20.0	0.0	0.0	8.0	8.0	9.0	9.0
***Brassica* spp.**	84.0	0.0	12.0	0.0	0.0	0.0	12.0	0.0	27.0	0.0
Bromus secalinus	0.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0	3.0	0.0
***Chenopodium* spp.**	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
Convolvulus arvensis	4.0	2.0	4.0	2.0	20.0	6.0	8.0	6.0	9.0	4.0
Galium aparine	12.0	8.0	4.0	0.0	8.0	8.0	0.0	0.0	6.0	4.0
Lolium temulentum	0.0	0.0	4.0	0.0	0.0	0.0	4.0	0.0	2.0	0.0
Papaver somniferum	0.0	0.0	96.0	0.0	0.0	0.0	4.0	0.0	25.0	0.0
Thlaspi arvense	0.0	0.0	16.0	0.0	0.0	0.0	12.0	0.0	7.0	0.0

***Aegilops cylindrica* (goatgrass, jointed)**
Germenability and establishment test:

Spikelet identification: Fertile lemma oblong, 9 - 11 mm long, shorter and more cylindrica shape, the same internodes of wheat plant, 5- veined, lemma, apex truncate, awned only on distal spikelet, 1-awned grain oblong, brown color. Principal lemma awn 30-80 mm. long overall, palea 1.1 length of lemma, its species didn't present in Egypt up till now. The automatic classification of seeds should be based on knowledge of seed size, shape, color and texture, size and shape characteristics have larger discriminating power than color and textural ones (Granitto *et al*., 2002; Scott, 2013). Goatgrass, jointed spikelet includes two or more seeds and more germinability under Egypt conditions (Fig. 2).

Fig. 2. Life cycle of goatgras under Egypt condition

Fig (2) pointed that the life cycle of jointed plant from seeds to the end cycle under Egypt condition and produced the viability seeds include seedling, growth characters of its species, tiller stage, flowering and produced spikes which re-infestation in the next years and colonizer able to invade rapidly the sowing soil in Egypt. Jointed winter grassy weeds have more tiller, the leaves are alternates hairy, 3-15 cm long and 0.2-0.5 cm wide. Inflorescence, indicated in narrow cylindrica spike. The plant height about 36 to 54 cm, root length 12 to 29 cm with root size about 2 to 9 cm^3, number of branches/plant about 20 to 79, plant weight 25 to 89 g/plant and the number of spikelet/plant between 329 to 540 spike produced from jointed transplanting in pots under wire house at Giza Research Station.

Anatomy identification of jointed:

Grass nods played the imported role, as the interfaces between leaf and stem, (Fig. 3) reported that the transverse section of the third internode, intermediate pattern of bundles in jointed, bundle rings green in two separate bundles in the center of nodes regions and leaf sheath around about the node region. Longitudinal section in the right figure presented hallow in jointed plant is narrow compared to other grassy weed species under this study, as well as the central cavity in upper the node is narrow than the lower the node. The stem of jointed plant thin than other grassy weed specie, both leaf trace and axial or cauline bundles are stained. The leaf sheath base, in the lower end area of the internode, diameter of the internode below is usually smaller this zone than above internode.

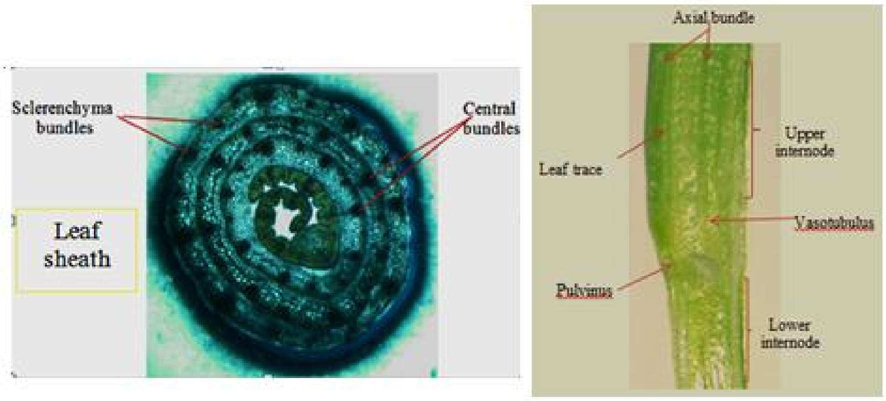

Fig. 3: Longitudinal and cross section in the third internode of jointed weed.

*Aegilops cylindrica*is a fast growing winter annual grass that tillers profusely and produces considerable quantities of seeds that shatter easily. Its close gen and hard to control selectively because of its close genetic association and hybridization with wheat, Davy *et al*. (2008), many of *Aegilops* species, especially hybridize with *Triticum aestivum*, in the genus *Triticum*; consequently, *A. cylindrica* has also been called *Triticum cylindricum*, the leaves have a membranous, short ligule and hairy auricles. The inflorescence instruction of narrow cylindrical spike, slightly tapering towards the apex usual length 5–8 cm, but can be up to 12 cm long including the awned and around 0.3 cm wide, with 4–12 (normally 6–8) fertile spikelet arranged compactly and alternatively along the main axis of the spike, *Aegilops cylindrica* distribution in Europe is difficult to classify(CFIA, 2008; CABI, 2019).

Tri-phenyl Tetrazolium Chloride (TTC)

The germination of goatgrass was rapidly and the highest germination percentage can be presented the viability of goatgrass seeds, in cases cane be depend on germination percentage and didn't need application TTc for presented the viability of seeds under this study.

Effect of sowing date on germination %of jointed weed

Table (3) from the results reported that the sowing dates were significantly effect on the germination percentage of jointed in the two populations in 2019/20 and 2020/21 seasons as well as on the first generation in 2020/21 season. The highest germination percentage was resulted from sowing date 15 September and 15 October in the two populations Russia and Ukraine. These results due to the jointed weed seeds can be germinated the range of temperature between 5 -35^{o}C and the optimum degree between 15-20^{o}C as well as the ecological sequences of weed management practices in the previous years. The leatest emergence percent was obtained from the sowing date 15th November in Russia population and 1St December in Ukraine population due to the edaphic characteristics of the site and regional climate.

Germinability soil seed bank of goatgrass in the second season

Table (3) and Fig (4) mentioned that the re-infestation of jointed in soil seed bank in field experimentsafter the first season and the beginning the second season in August 2020/21.The highest number of germinability seed bank was obtained from sowing dates 15Th December followed by 1St October and 15Th September 2019, but the less number was resulted from the late sowing date due to the shortest period plant growing till the flowering and end life cycle of jointed as well as the harvested was before shattering and fall spikelet in soil.

Table 3: Effect of sowing date on germination % in 2019/20 and 2020/21 winter season on germination % in the first generation under Egypt condition and germiniability seed bank in 2021 season in the two populations of jointed.

Sowing date	Russia Population				Ukraine Population			
	Germination %			Germinability seed bank	Germination %			Germinability seed bank
	2020	2021	2021 F.G.	2021 Seedling/m^2	2020	2021	2021 F.G.	2021 Seedling/ m^2
15Th September	100	60.0	95.0	66	90	90.0	75.0	66
1St October	80	80.0	90.0	67	90	80.0	65.0	67
15Th October	100	85.0	90.0	70	100	65.0	70.0	70
1St November	80	80.0	70.0	28	75	45.0	70.0	28
15Th November	65	80.0	70.0	-	85	80.0	70.0	-
1St December	85	70.0	35.0	-	60	80.0	80.0	-
L.S.D	21.7	30.1	21.6	N.S.	19.8	32.6	22.0	N.S.
CV%	8.3	13.6	8.5	-	15.5	11.1	4.7	-
S.E.	10.7	14.1	10.1	-	9.3	15.3	10.3	-

Fig. 4: Re-infestation of jointed seed bank in field experiment in the second season 2020/21 winter season.

Effect of sowing date on Shoot and radical length (cm) of jointed weed

Table (4) showed that the radical and shoot length (cm) were affected significantly by sowing date. The shortest radical and shoot was resulted from sowing time at 1ST December in the first season, but in the second season was the highest value in shoot length was obtained from the late sowing date due to change in environmental and the degree of temperature in the second season.

Breaking of seed dormancy

From the results in the germination test mentioned that the highest germination of jointed weed without application the break dormancy.

Part B: Weed species was contaminated with imported soybean

Imported soybean was mixed with numerous of foreign weed seeds, which grow in winter, early spring and summer season and perennial weed infestation of soybean fields due to the sowing date of soybean beginning in early spring and summer season. The majority of weed seed contamination with samples of imported soybean inspection on this study was *Ambrosia trifide*, L (giant ragweed) followed by *Convolvulus arvensis* and *Ipomoea lonchophylla* were less frequency and the numbers of seeds/ one kg soybean seeds and did not enough sufficient to complete this study. The frequency mentioned of *Ambrosia trifide* seeds about 100%, 75% and 60% from the total soybean seeds imported from Argentina, Ukraine and USA, respectively, by the number of seeds between 4-20 seeds/one kg soybean seeds.

Table 4: The effect of sowing date of jointed weed populations on seedling growth characters after 20 days from sowing of in 2019/20 and 2020/21 winter seasons and first generation under Egypt condition.

Sowing date	Russia population				Ukraine population				First generation	
	Shoot length (cm)		Radical length (cm)		Shoot length (cm)		Radical length (cm)		Shoot length (cm)	Radical length (cm)
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
15Th September	-	11.3	-	6.4	-	14.8	-	5.1	15.2	3.4
1St October	-	8.8	-	9.3	-	13.7	-	10.9	9.6	9.9
15Th October	10.6	15.1	15.5	4.4	11.1	13.9	14.1	12.7	13.5	3.0
1St November	10.8	14.1	7.3	8.9	8.3	14.4	6.6	12.0	18.4	3.4
15Th November	7.0	13.4	3.8	8.1	5.3	13.1	7.0	4.1	16.2	2.7
1St December	5.2	11.8	4.2	10.3	4.7	15.6	2.9	3.6	10.3	5.7
L.S.D	4.2	4.2	2.1	2.0	3.7	2.1	3.3	2.1	4.4	2.3
CV%	14.7	4.3	17.3	5.3	31.3	4.5	19.0	7.3	4.1	12.9
S.E.	1.8	1.9	0.9	0.9	1.6	0.9	1.5	0.9	2.0	1.1

Germenability and establishment test

Fig (5) pointed that giant ragweed didn't present or distribution in growing soil in Egypt up till now. Giant ragweed produced more seeds about 200-500 seeds/plant and its seeds have more viability, germinability and establishment of giant ragweed until complete life cycle and produced the viability seeds under Egypt condition and invade the field sowing and have risk in field crops productivity. The plant height about 85 to 175 cm, number of branches/plant about 20 to 30 and number of seeds/plant about 240 to 350 seeds/plant produced from giant ragweed transplanting in pots under wire house at Giza Research Station.

Ambrosia trifida **(Giant ragweed)**

Fig. 5: Life cycle of giant ragweed under Egypt condition

Seed bank and germinability soil seed bank of giant ragweed in the second season

Table (5) recorded that the sowing date of giant ragweed germination percent was highly significant effect in both experiments in the first and second seasons. The highest germination percentage was resulted from sowing date on 15th February in both large and small size of seeds, but in the large size of seeds gives the greatest germination in 1St and 15Th February than the small size of seeds may be due to the small size seeds did not complete maturity due to these seeds resulted from the top flowers spike.

There were no viable seeds produced by post ripening when cutting the branches, which did not complete ripening young seeds at the terminal spick of their seeds less ability to germinate, different germination rates depending on the time available to finalize ripening. The few ripened seeds developed from branches germinated by 60 %, but this partition cannot be seriously interpreted because of the small sample size, which germinated by 27 %; stage (HALT Ambrosia, 2013)

Table 5: Effect of sowing date on germination % of giant ragweed large and small seed size in 2021 and 2022 seasons.

Sowing date	2021	2022	
		Second experiment	First generation
1St February with large size seeds	50.0	55.0	50.0
15Th February with large size seeds	60.0	60.0	70.0
1St March with large size seeds	25.0	65.0	10.0
15Th March with large size seeds	20.0	40.0	35.0
1St April with large size seeds	20.0	65.0	0.0
15Th April with large size seeds	0.0	10.0	5.0
1StMsy with large size seeds	0.0	45.0	5.0
15Th May with large size seeds	0.0	40.0	25.0
1St June with large size seeds	0.0	20.0	0.0
15Th June with large size seeds	0.0	15.0	0.0
1St February with small size seeds	15.0	75.0	45.0
15Th February with small size seeds	50.0	25.0	50.0
1St March with small size seeds	15.0	35.0	45.0
15Th March with small size seeds	5.0	40.0	25.0
1St April with small size seeds	20.0	5.0	0.0
15Th April with small size seeds	0.0	5.0	0.0
1StMsy with small size seeds	0.0	45.0	10.0
15Th May with small size seeds	0.0	75.0	20.0
1St June with small size seeds	0.0	20.0	0.0
15Th June with small size seeds	0.0	10.0	0.0
L.S.D	17.9	20.7	20.5
CV%	53.5	5.6	27.8
S.E	8.8	10.3	10.2

In 2022 season reported that continue the germination of *A. trifide* until 15Th June with increased the germination % than 2021 season due to increase the air temperatures and humidity during April and May 2021 the temperature was more than 35 °C, which caused inter seed in secondary dormancy. Its seeds show innate dormancy after seed set in autumn and need stratification of about 4 weeks of temperatures around 0°C (Baskin & Baskin, 1998). If the conditions after stratification are not nice for germination (darkness, drought, temperature regime at low positive values, low O2 or high CO2 concentration in the soil) enforced (secondary) dormancy can be initiated (Baskin & Baskin, 1980).The emergence of ragweed on arable fields around Kaposvar (Hungary) and found that 98 % of the seeds germinated between April 1st and May 1st at densities of 190 seedlings per m^2. The last germination occurred at the end of July. Emergence time obviously had some influence on final shoot dry weight, measured at the end of the vegetation period (Kazinczi, 2008; HALT Ambrosia, 2013).

Effect of sowing date on shoot and radical length (cm) of giant ragweed

Table (6) pointed that the effect of sowing date on shoot and radical length in large and small seed size was significantly. The greatest value of shoot and radical length was resulted at sowing date on 1 March as well as the large seeds give the greatest shoot and radical length than the small seed size in both seasons.

Table 6: The effect of sowing date on shoot and radical length (cm) of *Ambrosia trifida* population in 2021 and 2022 seasons.

Sowing date Size of seeds	2021		2022		2022 F.G.	
	Shoot length (cm)	Radical length (cm)	Shoot length (cm)	Radical length (cm)	Shoot length (cm)	Radical length (cm)
1St March with large size of seeds	7.4	5.1	7.4	4.1	5.9	3.2
15Th March with large size of seeds	5.3	6.7	5.2	3.1	4.9	4.0
1St March with small size of seeds	6.4	5.4	6.8	3.3	2.6	1.5
15Th March with small size of seeds	4.6	3.9	4.9	3.1	2.2	1.5
L.S.D	1.8	3.8	3.0	1.9	2.6	2.1
CV%	19.5	44.9	2.6	8.2	27	30.4
S.E	0.8	1.7	1.5	0.9	1.3	1.1

Fig (6) and Tables (7) mentioned that TTC treatment were classified viability of giant ragweed to “stained” (=class 1), “unstained” = dead (class 0), and “intermediate” (class 0.5; only parts of the embryo stained). The viability of giant ragweed was 75% stained, 0.0 and 5% intermediate and 25 and 10% un-stained in 2021 and first generation in 2022 season, respectively.

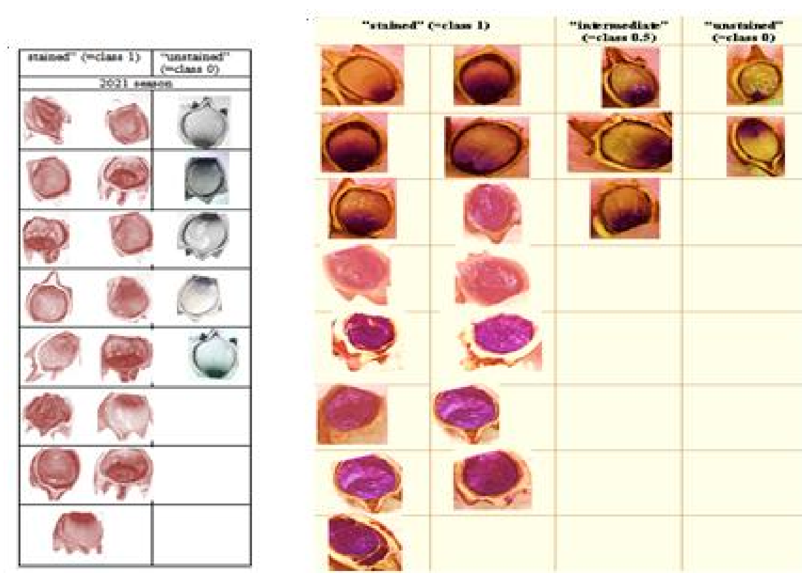

Fig. 6: Viability seeds classification of giant ragweed in 2021 and 2022 seasons**.**

Table 7: Viability classification of giant ragweed seeds in 2021 season and first generationin the second season 2022 season.

Seeds class	No. of seeds	% from tested seeds	No. of seeds	% from tested seeds
	2021 season		2022 season	
Stained (=class 1)	15	75	15	75
Intermediate (=class 0.5)	0	0	3	15
Unstained (=class 0)	5	25	2	10

Discussion

Part A:Weed species contaminated with imported grain wheat:

Must imported grains wheat was contaminated with the weed seeds, which associated with wheat in growing fields at harvested. The numbers of weed seeds/kg grains wheat sample and the frequency represented in grain wheat shipments as *Aegilops cylindrica* was more frequency mentioned in samples of wheat grains about 54% from the total inspection shipments were contaminated by *A. celindrica*. The increase of trade, travel, and transport of goods, across facilitated the spread of invasive alien species (IAS) with increasing negative impacts. IAS is moved across borders become invasive and had extensive economic impacts in the United States and India approximately US$130 billion per year. Invasive alien species are now recognized as one of the greatest biological threats to our planet's environmental and economic well be being, a non-seed-shattering habit is likely to be related to contamination, such as, oilseed rape goat grass and barley, were serious contaminants corresponds with the harvest time of spring wheat and the several factors might affected the contamination, such as field abundance of weeds at harvest, life cycle of weeds (annual or perennial), plant height of weeds , weed seed size and presence or absence of a pappus and status as weed or crop (Kurokawa, 1999; McNeely *et al*., 2001; Konishi *et al*., 2006; Asai *et al*., 2007; and Shimono and Konuma, 2008). *Aegilops cylindrica* is a fast growing winter annual grass and the seed dispersal is mainly by humans and by agriculture tool, the main dispersal was as a contaminant of grain wheat. A remarkable case was the introduction of *Aegilops cylindrica* in Washington State as a contaminant in wheat seed for breeding, (Davy et al., 2008; USDA-ARS, 2010).

Wheat samples were contamination by many weed species different from in the size and shape, some weed species didn't screening from grain wheat when cleaning by sieves such as *Avena* spp., *Aegilops cylindrical* with screening by sieving clean. The port elevators are used to receive, clean, dry, store and shipment of wheat grains before export, Canadian Food Inspection Agency, (CFIA, 2006).The grain is cleaned to remove the dockage to meet the export standards as established by the Canadian Grain Commission (CGC), any material left in grain after the cleaning is called foreign material, the foreign material usually includes weed seeds. The harvesting and cleaning of grain wheat was a significant effected on level of weed seed contamination, sieves may be used to separate trash, soil, small species of seed and other small particles; blowers remove light material such as chaff and empty florets from grass seed samples. The higher degree of contamination number of weed seeds that exceeded the permissible level (26-996 seeds/ kg), cleaned by sieves tile to had permissible level (CGC, 2006b; Shimono and Konuma, 2008; ISTA, 2009 b; Mekky *et al*., 2010 b; FAO, 2018; and CABI, 2019).

***Aegilops cylindrical* (goatgrass, jointed):**

Jointed weeds can be emergence and complete life cycle under Egypt condition and produced the viability seeds and colonizer able to invade rapidly the sowing soil in Egypt. The highest germination percentage was resulted from sowing date 15 September and 15 October in the two populations Russia and Ukraine. These results due to the jointed weed seeds can be germinated the range of temperature between5 – 35°C and the optimum degree between 15 – 20°C as well as the ecological sequences of weed management practices in the previous years. The leatest emergence percent was obtained from the sowing date 15th November in Russia population and 1StDecember in Ukraine population due to the edaphic characteristics of the site and regional climate. Goatgrass, jointed can be emergence during August until December and the second flush in March and April, (Fandrich and Smith, 2006).The highest value in shoot length was obtained from the late sowing date due to change in environmental and the degree of temperature in the second season. These results due to late emergence and slow of growth characters due to reduced the temperature degree in this period. These results were agreement with, (Mooney and Hobbs, 2000; Puth and Post, 2005; Fandrich and Smith, 2006b and FAO, 2018).

Part B: Weed species was contaminated with imported soybean:

The majority of weed seed contamination with samples of imported soybean inspection on this study was *Ambrosia trifide*, L (giant ragweed) followed by *Convolvulus arvensis* and *Ipomoea lonchophylla*were less frequency and the numbers of seeds/ one kg soybean seeds and did not enough sufficient to complete this study. *Ambrosia trifide* is native in North America and are considered invasive to other parts of the world (European food Safety Authority, 2007).

***Ambrosia trifide* (Giant ragweed)**

The highest germination percentage was resulted from sowing date on 15th February in both large and small size of seeds, but in the large size of seeds gives the greatest germination in 1St and 15Th February than the small size of seeds may be due to the small size seeds did not complete maturity due to these seeds resulted from the top flowers spike. Giant ragweed (*Ambrosia trifida*) and perennial ragweed (*Ambrosia psilostachya*) were frequently detected in imported wheat, maize, soybean and sorghum seeds and seen to possess the highest potential phytosanitary risk for Egypt. Its weed species was not found in Egypt and achenes of these weeds were detected, they had the ability to germinate and to produce viable seeds under Egypt conditions, (Mekky *et al*., 2010 b). These results the shatter breaks of giant ragweed spike before harvested and the next summer season re-infestation the field's crop. A non-seed-shattering habit is likely to be related to contamination, such as, oilseed rape and barley, where serious contaminants correspond with the harvest time of spring wheat (Konishi *et al*., 2006). The viability of giant ragweed was 75% stained, 0.0 and 5% intermediate and 25 and 10% un-stained in 2021 and first generation in 2022 season, respectively. Ragweed seeds from various sources were tested for germinability (germination test and vitality (TTC-test with different concentrations of TTC-solutions, the overall germination rates varied between 48 and 80 %, Its solution in water is colorless, but in living tissues the (TTC) is red. The test is commonly used for testing seed quality with various instructions produced by, the International Seed Testing Association. Certain adaptations for specific seeds are commonly made. In case of weed species were hypothesized that the variance between seed populations collected from the period 2019 to 2020 seasons, two populations of weed species seeds were tested, seeds were counted in 3 classes, stained ($class_1$ =alive), not stained no fully developed embryo present ($class_0$ =dead), intermediate ($class_{0.5}$) in cases that are only lightly or partly stained, (Karrer *et al*.,2001; Starfinger *et al.,2012*)

Conclusion

Giant ragweed and jointed weeds didn't distribution in sowing soil of Egypt country, but more contaminated with imported grain wheat and soybean seeds. Giant ragweed and jointed weeds have a highly viability and emergence with the suitable wither in Egypt condition for the complete life cycle as well as produced the viability seeds under Egypt condition and invade the field sowing and have risk in field crops productivity.

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