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A survey of weed seed production in vegetable crops of Setifian high plateau

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ABSTRACT

Weeds are one of the most significant limiting factors in agricultural production. Weeds compete strongly with crops for light, water and nutrients. This brings about severe interference with normal crop growth, causing high crop losses and reducing the quality of produce. Most annual weeds produce a prolific number of seeds each year. Production of abundant small seeds is a common adaptation that ensures a high probability of dispersal and re-infestation. With this background, the experiment was to counting the number of seeds produced by plant weed presented in legumes and garlic crops of Setifian high plateau. Seed production of 68 weed species (56 broadleaves, 12 annual grasses and one LiIiaceae) collected from 38 vegetable crops was investigated in the north east of Algeria (the Setifian high Plateau). Weed plants were harvested in may 2014 at maturity of legumes and garlic crops, and the number of seeds per plant was determined. four weeds produced more than 1500 seeds/plant and four produced between 1000 and 1500 seeds/plant, 17 weeds had between 500 and 1000 seeds/plant, 30 weeds had between 100 and 500 seeds/plant and 13 had less than 100 seeds/plant in at least one of the two vegetable crops. The eight high seed producing weeds (more than 1000 in at least one vegetable crop) were *Sinapis arvensis, Sonchus asper, Papaver hybridum, Bromus lanceolatus, Capsella-bursa-pastoris, Glaucium corniculatum, Papaver rhoeas, Bromus madritensis.* Of the 30 species that produced between 100 and 500 seeds / plant, seven species are Asteraceae, five Fabacea, five Apiaceae and three are poaceae. Nine species have produced almost the same number of seeds in both legumes than garlic crops are: *Lathyrus ochrus, Vicia monantha,Vicia sativa, Convolvulus arvensis, Melilotus indicus, Vicia hirsuta Sonchus oleraceous, Hordeum murinum, Chrysantemum segetum*. Any longterm strategy for weed management should focus on mininizing weed seed production.

KEYWORDS: Vegetable crops, legumes, pulses, seed production, weeds, Setifian high Plateau.

INTRODUCTION

In Algeria, food legumes (pulses), are part of the agricultural landscape for millennia. These cultures are used in rotations with cereals because enrich the soil with nitrogen. Pulses are also cultivated because they are an important source of protein that can replace animal protein inaccessible to a large segment of the population [20]. In most areas, mainly for reasons of order economic and material, chemical weed control has become almost absent from the itinerary technique of the majority of farms [14]. The presence of a weed is both linked to an ecological environment (soil, climate) and agronomic practices [10], Le Bourgeois, 1993 *in*[9], and edaphic conditions (pH, texture) [11], [5] and number of seeds produced [6]. This number is highly variable between species and within a same species [11]. This production of seeds varies depending on the culture in which the weed grows [13]. Weed seeds are difficult to manage because they are (1) small, (2) abundant, and (3) produce a lot of seed [24].

Annual weeds depend on seed production as the sole means of propagation and survival. Production of abundant small seeds is a common adaptation that ensures a high probability of dispersal and re-infestation [26]. Due to high seed production potential combined with dormancy, seed longevity possesses higher advantage as

there is a chance of at least for some of them to germinate and grow into new plant. A single plant of an annual weed can produce enough seeds in one season to cover an area of one acre. One plant of *Tripleurospermum inodorum* produces over a million seeds (1,000,000) [18]. Most weed species are prolific seed producers [7], in some cases produce more than 1 million seeds/plant. Weed seeds can have numerous fates after they are dispersed into a field. While a few of these weed seeds will germinate, emerge, grow and produce more seeds [21], a large proportion of them were returned to the soil and increase in the seed bank[16], Indeed, with a seed potential of around 4,000 viable seeds per m2 and if we admit that the levees field typically represent between 5% and 10% of the number of buried seed, estimated infestations of a culture represent 200 to 400 weeds per m^2 [1]*Amaranthus powellii*, *Echinochloa crus*-galli and *Setaria faberi* produce 30,000, 100,000 and 28,700 seeds per plant respectively, while *Matricaria perforata* produces 300,000 seeds per plant[2]. In this study, we will shed light on the weed seed production, the experiment was to counting the number of seeds produced by plant weed presented in legumes and garlic crops of Setifian high plateau. Knowledge of this number is essential firstly in understanding the dynamics of weed populations and also in selecting long weed control strategies term.

MATERIALS AND METHODS

A total of 38 vegetable crops have been prospected between 10 and 30 May 2014 at the same of maturity cultures. The numbers of legumes and garlic crops were respectively of 21 and 17. Five mature plants per weed species were randomly collected in a area of about 50 x 50 m in each surveyed crops. Each plant was placed in a paper bag .In the Laboratory of Natural Resource Valorisation, Faculty of Nature Life Sciences, Ferhat Abbas University Setif-1, the plants were subsequently sanded and the mature seed are cleaned manually and counted.

RESULTS AND DISCUSSION

Weeds cause considerable losses over the world as well as in the region of study where [8] evaluated these losses by rates vary between not controlled, where as weeds impact negatively on this latter. This competition becomes more intensive during the first stages of growth, in which weeds absorb nutritive elements faster than the cultivated plant [9]. The study of weeds in every respect is very important, moreover, the study of seeds plays big role in propagating weeds because each seed gives birth to a new plant [12].The presence of weed in culture has a direct impact on operating expenses of farmers, weeding can attain 30% of this latter, but also on the quality and quantity of harvested and sorted seed lots [4]. Seed production was determined for 68 weed species: one Liliaceae (*Allium nigrum*), 12 annual Poaceae (*Aegilops geniculata* Roth., *Avena sterilis* L., *Bromus lanceolatus* Roth. *B. madretensis* L., *B. sterilis* L., *B. rigidus* Roth., *B. rubens* L., *Hordeum murinum* L., *Lolium multiflrum* Lamk., *Lolium rigidum* Gaud., *Phalaris brachystachys* Link. and *Phalaris paradoxa* L.),and 56 broadleaves. Four weeds produced more than 1500 seeds/plant and four produced between 1000 and 1500 seeds/ptant, 17 weeds had between 500 and 1000 seeds/plant, 30 weeds had between 100 and 500 seeds/plant and 13 had less than 100 seeds/plant in at least one of the two vegetable crops. The eight high seed producing weeds (more than 1000 in at least one vegetable crop) were *Sinapis arvensis*, *Sonchus asper*, *Papaver hybridum*, *Bromus lanceolatus*, *Capsella-bursa-pastoris*, *Glaucium corniculatum*, *Papaver rhoeas*, *Bromus madritensis*.

Species had less than 100 seeds / plant are considered by [27]as less prolific. Of the 30 species that produced between 100 and 500 seeds / plant, seven species are Asteraceae, five Fabacea, five Apiaceae and three are poaceae. Nine species have produced almost the same number of seeds in both legumes than garlic crops are: *Lathyrus ochrus, Vicia monantha,Vicia sativa, Convolvulus arvensis, Melilotus indicus, Vicia hirsuta Sonchus oleraceous, Hordeum murinum, Chrysantemum segetum* (table 1).

Table 1: Average number of seeds produced per plant (+SD) collected weeds in the mature legumes and garlic crops in Setifian high plateau.

	legumes crops		garlic crops	
Species	Nb. Of seeds Per plant	Nb. Of plan examined	Nb. Of seed Per plant	Nb. Of plan examined
Average <100 seeds / plant in at least one culture				
1/Carduus pycnocephalus Plymouth thistle	79±37	38	209±58	53
2/Torilis nodosa Hedge parsley	23±17	30	97±13	44
3/Eruca vesicaria Rucola	/	/	58±25	10
4/Lathyrus ochrus Cyprus Vetch	77±21	30	87±14	22
5/Vicia monantha	97±60	15	89±23	07

monantha vetch				
6/Vicia sativa The vetch	82±09	18	90±11	14
7/Plantago lagopus Round-headed plantain	/	/	78±27	18
8/Avena sterilis Sterile oat	110±11	40	68±20	38
9/Aegilops geniculata Ovate goatgrass	66±12	05	103±39	07
10/Medicago orbicularis Round-fruited medick	59±97	13	227±66	14
11/Lolium rigidum Gaud. Stiff ryegrass	/	/	100±12	31
12/Convolvulus arvensis Field bindweed	60±1	30	52±32	27
13/Centaurea diluta Ait. Algeriensis Cross. & Dur. diluted knapweed	106±28	10	100±52	07
			100 < Average < 500 seeds / plant in at least one culture	
14/Anacyclus clavatus Anacyclus clavata	335±13	09	460±49	05
15/Calendula arvensis Field marigold	223±94	07	401±43	15
16/Cichorium intybus Chicory	344±73	10	/	/
17/Picris echioides Bristly oxtongue	106±68	14	225±73	14
18/Rhagadiolus stellatus Star Hawkbit	298±35	07	127±12	10
19/Coronilla scorpioides Annual Scorpion-vetch	147±22	40	335±63	25
20/Scorzonera laciniata Cutleaf vipergrass	136±62	48	70±36	33
21/Urospermum picroides Prickly golden fleece	210±39	25	367±40	29
22/Bunium incrassatum great pignut	165±67	20	208±17	31
23/Bupleurum lancifolium Hornem Lanceleaf thorow-wax	103±17	09	63±21 ???	14
24/Borago officinalis Starflower	147±20	08	/	/
25/Scandix-pecten-veneris Shepherd's needle	148±85	41	52±11	23
26/Torilis arvensis Spreading hedge parsley	163±23	18	100±17	11
27/Turgenia latifolia Turgénie broad leaves	378±182	45	74±254	27
28/Anchusa azurea Garden anchusa	/	/	237±73	7
29/Vaccaria pyramidata Cow soapwort	198±47	12	95±12	18
30/*Scorpiurus muricatus* Prickly Caterpillar	150±45	10	/	/
31/Roemeria hybrida Hybrid Roemérie	337±140	10	/	/
32/Lolium rigidum Gaud. Stiff ryegrass	/	/	100±12	31
33/Phalaris paradoxal Hood canarygrass	156±35	14	211±72	17
34/Adonis annua Pheasant's-eye	374±211	14	215±57	14
35/Ranunculus arvensis Buttercup corn	25±38	21	105±17	09
36/Galium tricorne Rough corn bedstraw	187±22	26	85±11	30
37/Astragalus hamosus European milkvetch	430±111	06	217±35	11
38/Raphanus raphanistrum L. Wild radish	163±21	50	28±37	16
39/Melilotus indicus (L.) All. sweet clover	147±38	11	210±59	09
40/Malva parviflora L. Little mallow	277±15	17	186±4	20

41/Vicia hirsuta Hairy tare	110±37	08	160±58	11
42/Anagallis arvensis Poorman's barometer	225±18	23	110±36	17
43/Bromus rigidus Ripgut brome	127±61	47	2±18	40
500 < Average < 1000 seeds / plant in at least one culture				
44/Carduus tenuiflorus Slender-flower thistle	525±100	13	107±42	13
45/Crepis vesicaria Hawk's-beard	//		522±108	17
46/Senecio vulgaris Common groundsel	680±64	08	958±118	12
47/Sonchus oleraceous Smooth sow thistle	886±210	42	745±111	30
48/Ammi majus Bishop's flower	335±120	10	700±206	07
49/Conringia orientalis Hare's ear mustard	340±70	20	560±212	15
50/Diplotaxis erucoides White wall-rocket	562±57	10	/	/
51/Medicago polymorpha Toothed medick	543±57	17	455±78	16
52/Sinapis alba White mustard	865±178	10	677±87	18
53/Allium nigrum Black garlic	211±75	09	715±72	14
54/Medicago hispida Black medick	885±111	13	639±229	10
55/Hordeum murinum Wall barley	527±110	30	610±98	40
56/Lolium multiflorum Ryegrass	618±250	27	465±153	22
57/Phalaris brachystachys Short-spike canarygrass	237±90	09	560±173	11
58/Melilotus sulcatus Desf. Sweet-clover	503±54	19	117±38	24
59/Diplotaxis virgata Wall-rocket	610±200	13	876±158	07
60/Chrysantemum segetum L. Corn marigold	530±60	10	478±30	10
1000 < Average < 1500 seeds / plant in at least one culture				
61/Sonchus asper Spiny sow thistle	1275±347	12	987±190	10
62/Sinapis arvensis Charlock mustard	1175±340	07	737±170	09
63/Papaver hybridum The opium poppy	1130±445	16	978±128	10
64/Bromus lanceolatus *Lanceolate bromegrass*	1120±230	28	975±298	22
Average> 1500 seeds / plant in at least one culture				
65/Capsella-bursa-pastoris Shepherd's-purse	1500±200	07	/	/
66/Glaucium corniculatum *Blackspot* hornpoppy	3750±420	6	2370±350	08
67/Papaver rhoeas Corn poppy	4100±530	08	2280±450	11
68/Bromus madritensis Compact brome	2170±340	18	1040±270	30

The production of seeds varies depending on the culture in which the weed grows; 14 weeds produce more seeds in legumes than it produces in garlic crops are: *Avena sterilis* ,*Scorzonera laciniata*, *Scandix-pecten-veneris* , *Turgenia latifolia*, *Vaccaria pyramidata*, *Adonis annua* , *Galium tricorne*, *Astragalus hamosus*, *Raphanus raphanistrum* L., *Carduus tenuiflorus*, *Sonchus oleraceous*, *Sinapis alba*, *Melilotus sulcatus* Desf. , *Sinapis arvensis*, *Papaver rhoeas*, *Bromus madritensis*. 9 weeds produce more seeds in garlic than it produces in legumes crops: *Carduus pycnocephalus*, *Aegilops geniculata*, *Medicago orbicularis*, *Calendula arvensis*, *Coronilla scorpioides*, *Senecio vulgaris*, *Ammi majus*, *Conringia orientalis*, *Allium nigrum*.

Weeds are adapted to the same soil and climatic conditions similar crops. Practices that promote cultures also favor weeds [13] Independently of the prospected culture, the average annual production of seven Poaceae

seeds was according to the order of: *Aegilops geniculata* Roth., *Avena sterilis* L., *Bromus lanceolatus* Roth. *Bromus madretensis* L., *Bromus sterilis* L., *Bromus rigidus* Roth., *Bromus rubens* L., *Hordeum murinum* L., *Lolium multiflrum* Lamk., *Lolium rigidum* Gaud., *Phalaris brachystachys* Link. and *Phalaris paradoxa* L.). In the culture of légumeneuses, weeds of the family Fabaceae Produced: *Lathyrus ochrus* 77±21,*Vicia monantha* 97±60, *Vicia sativa* 82±09, *Medicago orbicularis* 59±97, *Coronilla scorpioides* 147±22, *Scorpiurus muricatus*150±45 *Astragalus hamosus* 430±111, *Melilotus indicus*147±38, *Vicia hirsuta*110±37 *Medicago polymorpha* 543±57, *Medicago hispida* 885±111 and *Melilotus sulcatus* Desf 503±54.

Seed production was absent or low in certain weeds like *Carduus pycnocephalus* (Asteraceae) , *Anacyclus clavatus* (Asteraceae) *Diplotaxis virgata* (Brassicaceae) *Anchuza azurea* (Boraginaceae). The seeds have been totally or partially destroyed by insects. These insects have not been identified, but damage has shown that insects contribute in some instances to reduce the number of seeds produced per plant. The adverse effect of insects on seed production of weeds was noted by [25, 21, 15, and 4].

Weed seeds can have numerous fates after they are dispersed into a field; a proportion of seed is shed at harvest of a crop or falls from agricultural vehicles [19]. Some of them mixed with the crop and cause a change of taste [9]. Some seeds germinate, emerge, grow, and produce more seeds; a large proportion of them will germinate and die, others decay in the soil, or fall to predation by insects, birds or mammals [22]. Weed seed production can be reduced by management factors, but according to Hartzler 1996 in[23] even a few weed escapes can produce enough seed to partly replenish weed seedbanks. A several of seeds remains in a dormant state in the soil and germinates during conditions that would otherwise be ideal for germination [7].

Conclusion:

In the present research, we performed a survey of weed seed production in vegetable crops of Setifian high plateau. Seed production was determined for 68 weed species: one Liliaceae (*Allium nigrum*), 12 annual Poaceae (*Aegilops geniculata* Roth., *Avena sterilis* L., *Bromus lanceolatus* Roth. *B. madretensis* L., *B. sterilis* L., *B. rigidus* Roth., *B. rubens* L., *Hordeum murinum* L., *Lolium multiflrum* Lamk., *Lolium rigidum* Gaud., *Phalaris brachystachys* Link. and *Phalaris paradoxa* L.),and 56 broadleaves. Among the 68 weeds: four weeds produced more than 1500 seeds/plant and four produced between 1000 and 1500 seeds/ptantare: *Capsella-bursa-pastoris* , *Glaucium corniculatum*, *Papaver rhoeas* and *Bromus madritensis* . 17 weeds had between 500 and 1000 seeds/plant, 30 weeds had between 100 and 500 seeds/plant and 13 had less than 100 seeds/plant in at least one of the two vegetable crops. The eight high seed producing weeds (more than 1000 in at least one vegetable crop) were *Sinapis arvensis*, *Sonchus asper*, *Papaver hybridum*, *Bromus lanceolatus*, *Capsella-bursa-pastoris*, *Glaucium corniculatum*, *Papaver rhoeas*, *Bromus madritensis*. Nine species have produced almost the same number of seeds in both legumes than garlic crops are: *Lathyrus ochrus*, *Vicia monantha*,*Vicia sativa*, *Convolvulus arvensis*, *Melilotus indicus*, *Vicia hirsuta Sonchus oleraceous*, *Hordeum murinum*, *Chrysantemum segetum*. The production of seeds varies depending on the culture in which the weed grows; 14 weeds produce more seeds in legumes than it produces in garlic crops and 9 weeds produce more seeds in garlic than it produces in legumes crops.

Seed production by weeds was consistent even with competition from weeds or other crops. Producing a largest amount of seeds gives a greater chance of weeds for the dispersal and re-infection. For seed companies, soiling of a lot by weed seeds results in additional sorting steps, which are responsible for additional costs and loss of good seed. In addition, the sorting of seed lots may be ineffective for certain weeds and therefore does not always get the purity levels required.

In seed production, a good weed management is needed to limit their harmfulness on several levels: competition field versus culture, decreased quality and economic value of yield, increased seed bank in the soil, sorting difficulties.... According to these results, management of weeds in crops should be firstly preventive: technical routes that would avoid the contamination of the plots should be adopted. On grassy plots already weeding strategy should give priority to the species that has a largest production capacity and focus on the technical procedures that prevent the production of new seeds.

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