Evaluation of the Effect of Different Sowing Dates and Cultivars against Canola Root Rot Diseases

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Received: *21/4/2021*

Abstract: Damping-off, root rot and wilt diseases of canola were studied during two successive growing seasons (2013/2014.2014/2015). They were considered the most serious diseases that cause considerable losses in canola yield and quality, Serw 6 was the most resistant canola cultivar while Bactol cultivar was highly susceptible one with different sowing dates in field condition. First of October exhibited the lowest percentage in these diseases in both seasons.

Keywords: Canola, damping-off, root rot, wilt disease, sowing date, resistant, yield loss

INTRODUCTION

Canola (*Brassica napus* L.) is an important oil seed crops in most countries of the world and one of the promising oil crop in Egypt characterized with high oil content and ability to cultivate in newly reclaimed sandy land under moderate stress conditions (Haag *et al*., 1983; Silveira, 1984; Safiullina, 1984). Canola is subject to attack by several plant pathogens that cause significant losses in both quality and quantity of the yield. The most important diseases such as damping-off, white rust, downy and powdery mildews and alternaria spots (Thompson, 1982; Tewari, 1985; Hilal *et al*., 1989; Draz, 1995). Mittal (1997) found that disease incidence was less in the mixed than in the sole crop and gradually declined from the first to last sowing date. Khlifa (1997) showed that sowing date of sesame at 15th may followed by 1st may were the best dates for controlling root rot and wilt diseases under artificially infested with *M. phasealina* and *F. oxysporum*. Shalaby (1998) found that among sowing dates and sunflower cultivars (Vedoc, Vebos and Airoflower), Vedoc sown on 15 May recorded the lowest mean percentage of diseased seedlings at 15 days after sowing (10.75%), and charcoal rot (40.75%) and root rot (40.50%) incidence, and the highest seed yield (3.30 kg per plot). Choudhary *et al*. (2004) found that the efficacy of some fungicides, *i.e.* carbendazim, mancozeb, propineb and ridomil MZ (metalaxyl) against *Macrophomina phaseolina* incidence in sesame at different sowing dates. Minimum disease incidence and intensity and highest seed yield was recorded in the case of seed treatment with 2 g carbendazim/kg seed + 2 sprays of 0.05% carbendazim at 10-day intervals in all the 3 sowing dates. Chang *et al*. (2004) found that sowing date did not affect the occurrence of Rhizoctonia root rotof chickpea. Cosic *et al*. (2006) found in wheat, the highest percentage of Fusarium root rot occurred on Golubica and the least on Srpanjka with respect to their sowing density and date, there were statistically significant differences in the occurrence of Fusarium root rot at the stage of tillering between Srpanjka and other cultivars, irrelevant of sowing densities. Naseri (2013) noted that comparison of clusters recognized lower disease and greater production levels for sowing on 22 May and 5 June at 5 cm depth. Thus, shallow seeding of bean varieties in late spring should be incorporated into Fusarium root rot (FRR) and Rhizoctonia root rot (RRR) control programs. Hwang *et al*. (2014) found that the effects of sowing date, sowing depth, seed size, and seed treatment on seedling blight of canola were evaluated under greenhouse and field conditions. Early sowing resulted in higher seedling emergence in one trial year and higher seed yield in all trial years relative to a late-seeded treatment. Kesimci *et al*. (2016) found that the sowing date significantly influenced the root-rot and wilt diseases of faba bean cultivars. Hannukkala *et al*. (2016) found that late sowing date increased the risk for high incidence of stem base lesions in oil seed crops.

As for cultivar reactions to the pathogenic fungi Acharya *et al*. (1984) found that two hundred rape genotypes (both swede rape and turnip rape) were screened for resistance in infected soil under controlled conditions. None of the genotypes was immune, but five swede rape and five turnip rape genotypes displayed some resistance. Progenies of the ten genotypes were more resistant than either Regent or Candle, the two most commonly grown rape cultivars in Western Canada. Acharya *et al*. (1983) found that300 genotypes of *Brassica napus* and *B. campestris* were tested in a growth chamber programmed to simulate spring soil temps. The percentages of seedling emergence after 7 days and of survival and healthy plants after 21 days were used as criteria to rank entries. Although none of the genotypes exhibited complete resistance, 5 each of *B. campestris* and *B. napus* performed significantly better than either Regent (*B. napus*) or Candle (*B. campestris*), the 2 licensed canola cultivars most widely grown at the time of testing.

In artificially infested field plots, the progenies of these genotypes also performed better than the commonly grown cultivars. Yang and Verma (1992) found that a total of 122 genotypes from 11 species of Brassica and other closely related genera (including rape, Indian mustard, *Sinapis alba, B. nigra, B. tournefortii, cabbages,* cauliflowers, radishes and *Camelina sativa*) were evaluated in a growth chamber for resistance to pre-emergence damping-off and post-emergence seedling root rot caused by *R. solani* AG-2-

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1. Twenty-six selected genotypes were also evaluated in artificially infested field plots. None of the cultivars/lines were immune, but significant differences in the susceptibility levels were observed among and within species. Lamprecht (2011) found that all canola cultivars were highly susceptible to the multinucleate *Rhizoctonia solani* (AG-2-1), but Rocket, Spectrum and 44C11 were more resistant than the other cultivars. Spectrum and 44C73 were also more resistant to AG-4 than the other canola cultivars. Azzam *et al.* (2015) evaluated nineteen Canola (*Brassica napus* L.) mutants developed by gamma ray in previous generation and their parental varieties: Bactool, Linetto and Conny for their resistance to charcoal rot, fusarium wilt, alternaria leaf spot and powdery mildew diseases under greenhouse and field conditions during winter seasons 2012/2013 2013/2014. They showed that mutants CM1, CM2, CM8, CM12, CM14, CM17 and CM19 were the most resistant ones, while the parental varieties CM9, CM16 and CM18 were the most susceptible ones.

MATERIALS AND METHODS

Evaluation of three sowing dates and three cultivars on root rot and wilt diseases in open field:

Field experiment was carried out at the experimental in Ismailia Agricultural Research Station, in two growing seasons *i.e.* 2013/2014 and 2014/2015 winter seasons to study the effect of three sowing dates on infection with damping-off, root rot and wilt diseases as well as yield attributes and seed quality of three canola cultivars namely Serw 4, Serw 6 and Bactool were obtained Oil Crops Research, Institute Field Crops.

Three sowing dates were applied, *i.e.*, 1st October (D1), 20th October (D2) and10th November (D3). A split-split plot design with three replicates was used in this experiment. The main plots were occupied by sowing dates while, sub plots were occupied by cultivars. Each sub plot consisted of three rows, 3 m in length (area 9 m^2), each row consisted of 15 hills (20 cm distance between hills). Cultivars were sown at the rate of 15 seeds/hill. Production practices were applied as recommended for canola production in the region. The experiments were irrigated as needed, when the entries (Serw 4, Serw 6 and Bactol) cultivars were sown and left to grow. Disease assessment was as percentage of pre-emergence, post-emergence damping-off, survival plants, root rot and wilt after 15, 30 and 60 day from sowing date.

RESULTS

The field experiments were carried out at Ismailia Agric. Res. Stat. in 2013/2014 and 2014/2015 seasons to determine the effect of different agricultural treatments on controlling canola root rot and wilt diseases.

Effect of sowing dates on different cultivars of canola root rot and wilt diseases:

The effect of sowing dates on different cultivars under natural infection were studied at three sowing dates *i.e.* first of October, 20th of October and 10th of November on three different cultivars namely Serw 4, Serw 6 and Bactool, during two successive seasons 2013/2014 and 2014/2015.

Data in Tables (1 and 2) indicate that all the tested cultivars were susceptible to the aforementioned diseases with different degrees .However, there was a marked differences between the reaction of these cultivars to damping-off, root rot and wilt diseases. Cultivar reaction was shown as following:

As for season 2013/2014:

Cultivar Serw 6 recorded (25.75, 30.77 and 34.88) of pre-emergence damping off in the first of October, 20th of October and 10th of November respectively, and (21.5, 19.77 and 17.08) for post-emergence damping off and survival in the first of October, 20th of October and 10th of November respectively, root rot recorded (47.00, 51.33 and 56.33) in the first of October, 20th of October and 10th of November respectively and wilt when recorded (25.00, 30.00 and 26.67) in same respectively previous.

Bactol cultivar recorded (33.88, 37.03 and 35.21) of pre-emergence damping off in the first of October, 20th of October and 10th of November respectively, for post-emergence damping off and survival it recorded (23.82, 22.75 and 22.08) in the first of October, 20th of October and 10th of November respectively, for root rot (60.67, 61.00 and 65.00) in the first of October, 20th of October and 10th of November, respectively and for wilt (27.00, 32.33 and 27.33) in the first of October, 20th of October and 10th of November, respectively.

Serw 4 cultivar recorded (32.01, 39.83 and 35.52) of pre-emergence damping off in the first of October, 20th of October and 10th of November respectively, for post-emergence damping off and survival it recorded (18.31, 18.35 and 19.91) in the first of October, 20th of October and 10th of November respectively, for root rot (60.00, 64.67 and 60.00) in the first of October, 20th of October and 10th of November respectively and for wilt (25.67, 32.67 and 26.67) in the first of October, 20th of October and 10th of November, respectively.

As for season 2014/2015:

Cultivar Serw 6 recorded (25.03, 21.94 and 22.34) of pre-emergence damping off in the first of October, 20th of October and 10th of November respectively, and (10.75, 16.84 and 24.35) for post-emergence damping off and survival in the first of October, 20th of October and 10th of November respectively, root rot recorded (38.00, 45.00 and 43.33) in the first of October, 20th of October and 10th of November, respectively and wilt when recorded (25.00, 30.67 and 25.67) in same, respectively previous.

Bactol cultivar recorded (31.69, 27.10 and 25.58) of pre-emergence damping off in the first of October, 20th of October and 10th of November, respectively, for post-emergence damping off and survival it recorded (15.2, 26.84 and 26.51) in the first of October, 20th of October and 10th of November, respectively, for root rot (40.33, 49.67 and 53.67) in the first of

Table (1): Effect of sowing dates on percentage of pre, post-emergence damping off and survival on different cultivars of canola under natural infection during two growing seasons 2013/2014 and 2014/2015

Entries	2013/2014											
	% Pre-emergence damping off				% Post emergence damping off				% Survival			
Sowing dates	1st October	20th October	10th November	Mean	1st October	20th October	10th November	mean	1st October	20th October	10th November	Mean
Serw 6	25.75	30.77	34.88	**30.46**	21.5	19.77	17.08	**19.45**	52.75	49.46	48.04	**50.08**
Bactool	33.88	37.03	35.21	**35.37**	23.82	22.75	22.08	**22.88**	42.3	40.22	42.71	**41. 74**
Serw 4	32.01	39.83	35.52	**35.7**	18.31	18.35	19.91	**18.85**	49.68	41.82	44.57	**45.35**
Mean	**30.54**	**35.87**	**35.20**		**21.21**	**20.29**	**19.96**		**48.24**	**43.83**	**45.10**	
L.S.D at 0.05	G= 11.23 S=8.62 G×S=7.41				G= 2.19 S=4.82 G×S=2.94				G= 9.59 S=11.38 G×S=8.64			
Entries	**2014/2015**											
	% Pre-emergence damping off				% Post emergence damping off				% Survival			
Sowing dates	1st October	20th October	10th November	Mean	1st October	20th October	10th November	mean	1st October	20th October	10th November	Mean
Serw 6	25.03	21.94	22.34	**23.10**	10.75	16.84	24.35	**17.31**	64.22	61.22	53.31	**59.58**
Bactool	31.69	27.10	25.58	**28.12**	15.2	26.84	26.51	**22.85**	53.11	46.06	47.91	**49.02**
Serw 4	27.74	25.28	24.34	**25.68**	13.11	25.57	25.4	**21.36**	59.15	49.15	50.26	**52.33**
Mean	**28.15**	**24.77**	**24.08**		**13.02**	**22.58**	**25.53**		**58.82**	**52.14**	**50.49**	
L.S.D at 0.05	G= 13.10 S=10.51 G×S=6.81				G= 5.63 S=6.46 G×S= 6.30				G= 12.31 S=14.28 G×S=10.44			

*G: genotype & * S: sowing date

October, 20th of October and 10th of November, respectively and for wilt (28.00, 32.67 and 29.00) in the first of October, 20th of October and 10th of November, respectively.

Serw 4 cultivar recorded (27.74, 25.28 and 24.34) of pre-emergence damping off and survival in the first of October, 20th of October and 10th of November, respectively, for post-emergence damping off it recorded (13.11, 25.57 and 25.4) in the first of October, 20th of October and 10th of November, respectively, for root rot (43.33, 46.67 and 45.67) in the first of October, 20th of October and 10th of November, respectively and for wilt (27.67, 31.67 and 26.67) in the first of October, 20th of October and 10th of November, respectively.

Generally Serw 6 was the most resistant cultivar when exhibited the highest percentage of survival plant in both seasons, meanwhile Bactol was highly susceptible cultivar when recorded the highest percentage of pre-emergence damping off, post-emergence damping off and survival, root rot and wilt, and the lowest percentage of survival plant in both seasons, Serw 4 showed moderately susceptible reactions to damping-off, root rot and wilt diseases.

First of October exhibited the lowest percentage in root rot and wilt diseases in both seasons between sowing dates.

Table (2): Effect of sowing dates on percentage of root rot and wilt on different Cultivars of canola under natural infection after60 day after sowing during two growing seasons 2013/2014 and 2014/2015

Entries	**2013/2014**							
	% Root rot				**% Wilt**			
Sowing dates	**1st October**	**20th October**	**10th November**	**Mean**	**1st October**	**20th October**	**10th November**	**Mean**
Serw 6	47.00	51.33	56.33	**51.56**	25.00	30.00	26.67	**27.22**
Bactool	60.67	61.00	65.00	**62.22**	27.0	32.33	27.33	**29.00**
Serw 4	60.00	64.67	60.00	**61.55**	25.67	32.67	26.67	**29.00**
Mean	**55.66**	**59**	**60.44**		**25.89**	**31.66**	**26.89**	
L.S.D at 0.05	G= 3.13 S=5.10 G×S=4.74				G= 2.17 S=3.22 G×S=2.38			
Entries	**2014 /2015**							
	% Root rot				**% Wilt**			
Sowing dates	**1st October**	**20th October**	**10th November**	**Mean**	**1st October**	**20th October**	**10th November**	**Mean**
Serw 6	38.00	45.00	43.33	**42.11**	25.00	30.67	25.67	**27.11**
Bactool	40.33	49.67	53.67	**47.89**	28.00	32.67	29.00	**29. 89**
Serw 4	43.33	46.67	45.67	**45.22**	26.67	31.67	27.67	**28.67**
Mean	**40.56**	**47.11**	**47.55**		**26.55**	**31.67**	**27.44**	
L.S.D at 0.05	G= 4.81 S=3.60 G×S=3.42				G= 2.63 S=3.46 G×S= 2.60			

*G: genotype & * S: sowing date

DISCUSSION

Susceptibility of canola cultivars indicate that all the tested canola cultivars were susceptible with different degrees to infect with damping-off, root rot and wilt disease caused by the tested fungal in open field conditions. Effect of sowing dates on different cultivars on canola proved that the highest percentage of survival plants recorded with Serw 6 in both seasons (2013/2014, 2014/2015), meanwhile the lowest percentage of pre-emergence, post-emergence, root rot and wilt recorded in Bactool cultivar when recorded the highest percentage of pre-emergence damping off, post-emergence damping off, root rot and wilt, and the lowest percentage of survival plant in both seasons (2014, 2015).The first of October exhibited the lowest percentage in damping off, root rot and wilt diseases in both seasons.

Generally there is a clear difference between cultivars in its favorable sowing date to control root rot and wilt diseases. Similar results were recorded in several earlier studies on canola cultivars and sowing dates differed markedly in their reactions to pathogenic

fungi and explain important factors affect this difference between cultivars and sowing dates Hannukkala *et al*. (2016) demonstrated that late sowing date increased the risk for high incidence of stem base lesions in oil seed crops, Hwang *et al*. (2014) found that the effects of seeding date, seeding depth, seed size, and seed treatment on seedling blight of canola were evaluated under greenhouse and field conditions. Early seeding resulted in higher seedling emergence in one trial year and higher seed yield in all trial years relative to a late-seeded treatment. Lamprecht (2011) proved that all canola cultivars were highly susceptible to the multinucleate *Rhizoctonia solani* (AG-2-1), but Rocket, Spectrum and 44C11 were more resistant than the other cultivars. Spectrum and 44C73 were also more resistant to AG-4 than the other canola cultivars and Yang and Verma (1992) reported that a total of 122 genotypes from 11 species of Brassica and other closely related genera (including rape, Indian mustard, *Sinapis alba*, *B. nigra*, *B. tournefortii*, cabbages, cauliflowers, radishes and *Camelina sativa*) were evaluated in a growth chamber for resistance to pre-emergence damping-off and post-emergence seedling root rot caused by *R. solani* AG-2-1. Twenty-six selected genotypes were also evaluated in artificially infested field plots. None of the cultivars/lines were immune, but significant differences in the susceptibility levels were observed among and within species. Azzam *et al.* (2015) evaluated nineteen Canola (*Brassica napus* L.) mutants developed by gamma ray in previous generation and their parental varieties: Bactool, Linetto and Conny for their resistance to charcoal rot, fusarium wilt, alternaria leaf spot and powdery mildew diseases under greenhouse and field conditions during winter seasons 2012/2013 2013/2014. They showed that mutants CM1, CM2, CM8, CM12, CM14, CM17 and CM19 were the most resistant ones, while the parental varieties CM9, CM16 and CM18 were the most susceptible ones.

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تقييم تأثير مواعيد الزراعة والأصناف المختلفة علي مرض أعفان جذور الكانولا

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يعتبر مرض موت البادرات، عفن الجذور والذبول من أخطر الأمراض التي تسبب خسائر كبيرة في إنتاجية وجودة الكانولا. في هذه الدراسة تم عزل رايزوكتونيا سولاني وفيوزاريوم سولانى وفيوزاريوم أوكسيسبوريم من جذور نباتات الكانولا المصابة بأعفان الجذور والذبول. صنف سرو ٦ كان الأفضل من بين الأصناف المختبرة (سرو٤ ، سرو٦، باكتول) خلال موسمي ٢٠١٤ & ٢٠١٥عندما سجل أقل نسبه إصابة لأمراض موت البادرات وأعفان الجذور والذبول بينما كان الصنف باكتول هو الأعلى في نسبه الإصابة. كما أظهر الأول من أكتوبر أقل معدل للإصابة خلال الموسمين المذكورين.