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Role of natural enemies, climatic factors and performance genotypes on regulating pests and establishment of canola in Egypt

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KEYWORDS

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Abstract Screening twenty available advance lines of canola plant based on population density of the recorded pests throughout 2011 and 2012 seasons at Ismailia Agricultural Research Station Farm, Egypt was studied. The cabbage aphids; *Brevicoryne brassicae*, thrips; *Thrips tabaci*, diamond-back moth; *Plutella xylostella,* leafminer; *Liriomyza sp*., whitefly; *Bemisia tabaci* and two-spotted spider mite; *Tetranychus urticae* were surveyed pests in canola. Six predacious species related pests; *Coccinella septempunctata, Coccinella undecimpunctata, Stethorus gilvifrons*, *Chrysoperla carnea, Syrphus corollae* and *Orius* spp. *Diaretiella rapae, Cotesia plutellae and Diadegma inslare* were the most common parasitoids emerging from the collected samples. The analysis of variance revealed significant variation among dates of observations, lines and in their interaction for all surveyed pests and their natural enemies. The percentage of explained variance of abiotic factors (minimum–maximum temperatures and relative humidity) and biotic factors (predators and parasitism percentages) altogether in the population densities of *B. brassica*, *T. tabaci*, *P. xylostella, Liriomyza sp*., *B. tabaci* and *T. urticae* in the second season were the greater percentage values as 87.0%, 94.7%, 88.9%, 70.1%, 63.2%, and 68.3%, respectively, compared to the first season (60.4%, 89.6%, 47.7%, 31.1%, 45.5% and 69.8% respectively). Mean performance of agronomic characters, phenotype's coefficient of variation (PCV), genotype's coefficient of variation (GCV), environmental coefficient of variation (ECV), heritability (Hb) and genetic advance (GS%) for yield and its attributes in canola genotypes were also studied. These results could be involved in breeding programme cultivated to improve future integrated pest management programme of canola in Egypt.

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Introduction

Shortage of oil production is considered one of the most important problems in Egypt. The wide gap between the production and consumption of edible oil reached 87%. Expanding the cultivating area by oil crops is a necessity; canola is one of these oil crops (El-Hadidi et al., 2007).

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Canola or rapeseed (*Brassica napus* L., Brassicaceae) is one of the promising oil crops all over the world (Canada, European Union and the USA). This crop is characterised by high seed oil content (40–45%), protein (23–25%), healthy oil and a highly nutritious animal feed. Canola oil has the lowest level of saturated fats of all major oil crops. It also has an excellent fatty acid profile, with high levels of Omega-3 fatty acids whose intake is associated with a lower risk of heart disease and lower blood cholesterol levels. It tested as alternative oil for petroleum products like motor fuels (called biofuels) and motor oils (Barth, 2007 and Demirel, 2009).

Canola has been recently in Egypt more as a promising new vegetable oil crop to overcome some of the local deficit of vegetable edible oil production. It could be successfully grown during the winter season. Growers prefer planting canola in a newly reclaimed land outside the old one of Nile valley to avoid the strong competition with other strategic winter season crops wheat and Egyptian clover (Ghallab and Sharaan, 2002; Megawer and Mahfouz, 2010). Growing this crop is still facing many problems; one of them heavily infested by various insect pests that attack canola causing poor growth and low yield (Lamb, 1989; Saljoqi et al., 2006; Dosdall and Mason, 2010).

Keeping the above points in view, the present study in rapeseed improvement in Egypt aimed to compare the difference of certain canola genotypes infested with the pests under field condition, and impacts on yield components and oil contents.

Materials and methods

The experimental field during two winter seasons, 2010/2011 and 2011/2012 at Ismailia Agricultural Research Station Farm, Egypt to evaluate twenty genotypes of canola was carried out. The genotypes and pedigree lines of canola were obtained from Oil Crops Research Department, Agriculture Research Center, Egypt as presented in Table 1. The experimental field design was randomised in complete blocks with three replications; plot size was 8-m^2 including five rows, 40-cm apart and 4-m long. Seeds of canola were sown. Normal cultural practices (as adding fertilizers, irrigation, weeds control, etc.) were conducted. At harvest, ten plants were taken at random from each experimental unit. The following traits were estimated: plant height (cm), number of racemes/plant, number of siliquae/plant, seed weight/plant (g) and 1000–seed weight (g). To estimate seed yield (kg/feddan (0.42 hectare)), all plants of two inner rows in each experimental plot were harvested and dried. Seeds were weighted and then it was converted. Seed oil percentage was estimated using soxhlet apparatus and petroleum either as solvent according to (AOAC 1990). Oil yield (kg/feddan) was estimated by multiplying seed yield (kg/feddan) by seed oil percentage. Erucic acid in oil (%) was determined by improving the micro kjeldhal method of (AOAC 1990).

Samplings of all the pests and natural enemies that are found on plants were collected from germination until harvest. The sampling was recorded at weekly intervals from five canola plants randomly selected from the canola field plots. The collected samples were packed immediately in paper bags and transported for examination, using a stereoscopic microscope. These specimens were examined and enclosed in glass jars of 15-cm diameter and 20-cm height covered with muslin held in position by a rubber band and checked daily. The parasitoids and hyperparasitoids were collected, sorted into species and preserved in a glass tube of 5-cm diameter containing 70% ethyl alcohol and glycerine. The tiny pests were glass slide mounted. The population densities of all the surveyed pests and their natural enemies were recorded. The rates of parasitism percentage were calculated.

Prior to statistical analysis, in order to correct for the heterogeneity of variance, all data were log-transformed log $(x + 2)$. Data were statistically analysed by using an ANOVA and Costat software, randomised as complete block design as mentioned by Gomez and Gomez (1984). The differences among treatment means were compared using least significant difference (L.S.D.) at 5% level of significance in the same software. Estimate of genetic parameters, i.e., phenotype (PCV) and genotype (GCV) coefficients of variations was done according to Johnson et al. (1955). Broad sense heritability (H) for all studied traits and genetic advance under selection were calculated according to Allard (1960).

Results and disscussion

Surveyed pests of canola and their associated natural enemies

The present study showed that the cabbage aphid; *Brevicoryne brassicae* (Aphididae: Homoptera), thrips; *Thrips tabaci* (Thripidae: Thysnaoptera), diamondback moth; *Plutella xylostella* (Noctuidae: Lepidoptera), whitefly; *Bemisia tabaci* (Aleurodidae: Homoptera), leafminer; *Liriomyza sp*. (Agromyzidae: Diptera), and two-spotted spider mite; *Tetranychus urticae*, (Teranychidae: Arachnida) were identified as major pests of canola plants at the Ismailia Governorate during 2011and 2012 seasons.

Table 1 Genotypes and pedigree of rapeseed lines.

No.	lines	Pedegree	No.	lines	Pedegree
1	Line 1	(serw 4x Serw 6)F2	11	Line 11	(N.A302 x Serw 6)F3
2	Line 2	(Serw6 x N.A302)F5	12	Line 12	(N.A355 x N.A51)F3
3	Line 3	(Serw 4x Pactol)F1	13	Line 13	(Serw 4x Pactol) F3
4	Line 4	(N.A.355 x N.A302)F2	14	Line 14	(N.A.51x Serw 6) F5
5	Line 5	(Serw 4 x Pactol)F5	15	Line 15	(N.A355 x N.A51) F4
6	Line 6	(N.A355 x N.A302)F5	16	Line 16	(Serw6 x N.A302) F4
7	Line 7	(N.A355 x N.A51)F5	17	Line 17	(Serw 4 x N.A355) F2
8	Line 8	(N.A355 x N.A302)F3	18	Line 18	(N.A.51x Serw 6) F4
9	Line 9	(N.A.51x Serw 6)F3	19	Line 19	(N.A302 xSerw 6) F2
10	Line 10	(Serw 4 x Pactol)F2	20	Line 20	(N.A355 x N.A302) F4