Comprehensive Evaluation of a Novel Early-Le-Conte Pear Clone in El-Sadat City.

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ABSTRACT

This study was conducted during the 2022 and 2023 seasons, respectively, to evaluate a novel Le-Conte pear clone *(Pyrus communis* L. × *Pyrus pyrifolia* N.) cultivated on sandy soil under drip irrigation system at El-Sadat City, Menofya Governorate, Egypt. The evaluation focused on flowering behavior, fruit physical and chemical characteristics, yield storage, molecular genetic profiling, and fire blight resistance. Flower bud break was at 16-18 March, while fruit set at 7-10 April with duration 19-24 days. Furthermore, Fruit maturity was at 20-23 June with 70-76 days with a fruit yield (23.05-23.15 Kg/tree and 4.841-4.861 ton/Fed). During fruit storage at 0±1 ºC and 90-95% humidity for one month; T.S.S significantly increased while the rest parameters decreased. Molecular analysis using six RAPD and six ISSR primers generated 13 and 23 DNA bands respectively, indicating a rich genetic profile. Notably, the examined trees showed complete resistance to fire blight (*Erwinia amylovora*), with zero infection detected across both seasons. These results highlight clone's agronomic potential and disease resistance, positioning it as a promising cultivar for commercial pear production in fire blight-prone regions. Further horticultural investigations under varying environmental conditions are recommended to confirm the stability of these traits and support the formal release of this novel clone, particularly in light of increasing climate change challenges.

Keywords: Le-Conte pear, fruit quality, yield, RAPD, ISSR, fire blight, Pyrus spp., molecular markers

Introduction

Pear (*Pyrus* spp.) is a widely cultivated deciduous fruit tree belonging to the Rosaceae family and is valued for its nutritional, economic, and medicinal importance. In Egypt, pear production has expanded in newly reclaimed lands where sandy soils and limited water resources prevail, necessitating the selection of high-performing, stress-tolerant cultivars (Abd-El-Latif et al., 2017). This phase is characterized by an endodormancy that lasts from late autumn to early spring, and it can only be broken through new growth and flowering in the following season. However, management techniques play a crucial role in reducing the chilling requirements of the buds. These techniques include proper training, fertilization, defoliation, regulating tree vigor, and delaying winter pruning (Westwood, 1978 and (Lang et al., 1987).Pear flower buds form on the ends of stems and short spurs that are two years old or older. Various factors and techniques can influence the development of these flower buds. For instance, bending the shoots may encourage flower bud formation, enhance flowering in young trees, and increase the overall yield of pear trees (Isac, 1986; Wei, 1987; Edwards and Notodimedjo, 1987). The cultivated area reached 13,870 feddans, yielding 80,993 tons (Food and Agriculture Organization of the United Nations, (FAO), 2023). Molecular markers are valuable tools for assessing genetic diversity, aiding breeders in selecting traits that enhance the productivity of economically important plants. Molecular marker data are crucial for identifying promising plant types for breeding programs. Markers such as RAPD and ISSR are widely used to evaluate genetic diversity, with studies including Awad et al. (2018) on local apricot lines, Safaa et al. (2018) on deciduous rootstocks, Abd El-Aziz et al. (2019) on apricot rootstocks, Mohamed et al. (2015) on El Amar apricot strains, Abd El-Aziz et al. (2016) on tomatoes, and Abd El-Hadi et al.

(2017) on squash. To assess the genetic diversity of pomegranate cultivars, understand their relationships, and develop genetic fingerprinting, inter-simple sequence repeats (ISSR) and other DNA markers have been used (Eldessoky et al., 2017). Plant geneticists and breeders value molecular markers for their ability to uncover new genetic information about plant genomes and assist in selecting desirable traits. Randomly Amplified Polymorphic DNA (RAPD) analysis is particularly promising for cultivar identification, as it quickly and efficiently detects a wide range of beneficial polymorphisms. RAPD analysis has been extensively used to study the genetic relationships among various fruit trees (Bartolozzi et al., 1998).The ISSR method was used to assess DNA diversity among crop genotypes (Zehdi et al., 2004). On the other hand, Kim and Ko-Kwang (2004) identified 33 Asian pear varieties using the RAPD method. Nine out of eighteen primers produced distinct and repeatable bands, allowing most of the Asian pears to be easily distinguished. A dendrogram was constructed based on Nei's genetic distance using the obtained results. Sadat pear trees are one of the genotypes selected from a private orchard in Sadat City. The genetic and phenotypic differences between plants grown from a single donor clone are known as somaclonal variation. Both genetic and epigenetic factors influence phenotypic variation in plants. Examples of somaclonal variation include cytological abnormalities, frequent qualitative and quantitative phenotypic mutations, sequence changes, and gene activation or silencing (Kaeppler et al., 2000).The aim of our study is to assess the physical and chemical parameters, as well as the fruit quality, of a new Le-Conte clone cultivated in Sadat City, and to identify its molecular genetic profile using RAPD and SCoT molecular markers. Fire blight, a destructive pear disease caused by Erwinia amylovora, leads to significant financial losses worldwide. Initially identified in North America in the 1870s, the disease has since spread to over 50 countries. China, the largest producer of apples and pears, faces a serious threat from recent reports of the disease in neighboring South Korea, Kyrgyzstan, and Kazakhstan (Yu-qiang et al., 2019).

MATERIALS AND METHODS

The experiment was conducted over two seasons (2021/2022 and 2022/2023) on early pear trees (18 years old) of the Le-Conte, grown in sandy soil with 4×5 m a part (210 trees per feddan) under a drip irrigation system at a private farm in Sadat City, Menofya Governorate, Egypt. The study included five replicates; each replicate has 5 trees in a complete randomized block design. The following parameters were measured:

A- The timing of beginning vegetative and flower bud break, full bloom, petal fall, fruit set, maturity and the duration of fruit set till maturity.

B- Number of flowers and fruitlets/shoot, number of fruits/tree, fruit set percentage per tree as well as fruit yield per tree and per feddan. Yield fitness= fruit yield per tree/planting apart m^2).

C- Physical characteristics of fruits:

1- Fruit weight: The average of 10 fruits/ tree was weighed and the average was calculated by as A.O.A.C. (2005) and Jackson (2003).

2- Fruit size: It was determined by water displacement method of 10 fruits/tree in measuring cylinder.

3- Fruit dimensions: the length (cm) and diameter (cm) of 10 fruits/tree were measured then used to determine the shape index (length/width).

4- Fruit firmness ($1/inch^2$): It was measured using a penetrometer (pressure tester) Advance Force Gauge RH 13, UK.

D- Fruit Chemical characters:

1- Total soluble solids (T.S.T. ºBrix): It was measured using A Digital refractometer (Model PR-32, Atago, Japan) by squeezing the juice of 10 fruits/tree.

2- Total acidity (%): It was assessed by titration with a standard sodium solution hydroxide solution (0.1N) using phenolphethalein as an indicator as described in (A.O.A.C., 2005). The results calculated using this equation: Total acidity (%) = NaOH X0.0075/5ml juice used. Then T.S.S./acidity ratio was calculated.

3- Vitamin C (mg/100ml of fruit juice): vitamin C was assessed in pear fruit juice as Abd El-Aziz et al. (2009).

E- At harvest time 40 pear fruits per replicate were randomly picked and stored at 0±1 ºC and 90-95% humidity from 1st July to 1st August. Every 10 days, 10 fruits samples were examined to assess: fruit weight (g), size (cm^3), length (cm), T.S.S. (%), acidity (%) and vitamin C (mg/100cm).

- Molecular Genetic Markers:

1. **DNA Isolation:** Fresh leaves were collected to extract genomic DNA using the DNeasy Plant Micro Kit (Bio Basic). The absorbance ratios A260/A280 were measured using a UV spectrophotometer. Pure DNA has an A260/A280 ratio between 1.8 and 2.0. Additionally, the quality of the DNA samples was assessed using electrophoresis on a 1% agarose gel stained with ethidium bromide.
2. **Polymerase Chain Reaction (PCR):** Six RAPD primers and six ISSR primers were used to amplify genomic DNA, creating a molecular genetic profile of the studied pear strain. The ISSR and RAPD primers were purchased from Operon Technology, Alameda, U.S.A.
3. **PCR Amplification:** For the RAPD technique, the amplification reaction was performed in a Techni TC-512 Thermal Cycler with the following conditions: one cycle at 94ºC for 4 minutes, followed by 40 cycles of 1 minute at 94ºC, 1 minute at an annealing temperature of 37ºC, 2 minutes at 72ºC, and a final extension step at 72ºC for 10 minutes. The reaction was stored at 4ºC. For the ISSR technique, the amplification reaction was carried out with the following conditions: one cycle at 94ºC for 4 minutes, followed by 40 cycles of 1 minute at 94ºC, 1 minute at an annealing temperature of 57ºC, 2 minutes at 72ºC, and a final extension at 72ºC for 10 minutes. The reaction was also stored at 4ºC.
4. **Gel Electrophoresis:** Amplified products were loaded onto a 1.5% agarose gel with ethidium bromide and a 100 bp ladder marker. The gel was run for approximately 30 minutes at 100 V in a mini submarine gel system (BioRad).
5. **Gel Reading and Analysis:** DNA banding patterns were photographed using the Bio-1D Gel Documentation system and analyzed using GelAnalyzer3 software. Clear amplicons were scored as present (1) or absent (0) for each primer and entered into a binary data matrix. DNA profiles were then generated for both RAPD Table (1) and ISSR Table (2) techniques.

Table (1): List of the used RAPD primers.

No.	Name	Sequence	No.	Name	Sequence
1	**OP-A5**	5` CCT TGA CGC A 3`	**4**	**OP-C15**	5` GAC GGA TCA G 3`
2	**OP-A9**	5` CCT TGA CGC A 3`	**5**	**OP-D1**	5` ACC GCG AAG G 3`
3	**OP-C9**	5` CTC ACC GTC C 3`	**6**	**OP-K2**	5` GTG AGG CGT C 3

Table (2): List of the used ISSR primers.

No.	Name	Sequence	No.	Name	Sequence
1	**HB-9**	5` GTG TGT GTG TGT GC 3`	**4**	**HB-12**	5` CAC CAC CAC GC 3`
2	**HB-10**	5` GAGAGAGAGAGACC 3`	**5**	**HB-13**	5` GAGGAGGAGGC 3`
3	**HB-11**	5` GTG TGT GTG TGT TGT CC 3`	**6**	**HB-15**	5` GTGTGTGTGTGTGC 3

Disease assessment:

Fire blight (Erwinia amylovora) susceptibility was evaluated by monitoring symptoms on leaves, flowers, and twigs. Observations were conducted biweekly throughout the growing season. Disease severity was recorded based on the percentage of affected tissues. According to Attia et al. (2024), disease symptoms were assessed visually in the orchard,

recording the percentage of necrotic shoots, blighted blossoms, and affected twigs. The assessment used a 0-5 scale, where 0 = no symptoms and 5 = severe infection (>75% of plant affected).

Statistical analysis: Data obtained were subjected to analysis of variance according to (Snedecor and Cochran, 1989) arranged in a complete randomized block design and M. Static program was used to compare between means of treatments according to (Waller and Duncan, 1969) at probability of 5%.

RESULTS AND DISCUSSION

1- Vegetative and flowering stage:

The phonological observations revealed that, vegetative bud occurred at 30-31 March, while flower bud break began at 16-18 march, so vegetative buds delayed about 13-14 days than flower buds (Table 3). Moreover, full bloom reached around 25-27 March after 9 days of bud break and petal fall at 30-31 March, as well as, fruit set of 90% of flowers happened at 7-10 April after 20-24 days of flower bud break. However, less flowering duration means better fruit set (Jackson, 2003). Furthermore, fruit maturity was at 20-23 June after 70-75 days of fruit set. The little duration of fruit development means very early clone. These results clearly displayed that pear flower bud form on the end of stem and short spurs that are two years old or older (Wei, 1987). The variation of fruit set and maturity duration may be attributed to differences in temperature and microclimatic conditions, aligning with reports by Prajapati et al. (2024).

Table (3): The timing of vegetative, flower and fruit development of early trees of Le-Clone.

Season	Vegetative bud break	Flower bud break	Full bloom	Petal fall	Fruit set	Maturity	Maturity duration (day)
2022	31/3	18/3	27/3	30/3	7/4	23/6	76
2023	30/3	16/3	25/3	31/3	10/4	20/6	70

2- Flowering, fruit set, fruit yield and fruit fitness:

Table (4) fixed that, number of flowers /shoot were about the same in the two studied seasons (248.5 and 245.1) while the number of fruitlets / shoot were varied (50.17-54.67) may be as set variation. However, number of fruits/tree was 553.75 and 470.33 through the 1st and 2nd seasons respectively. Fruit yield/per tree was also about (23.15 and 23.05Kg/tree), as well as, it was estimated about 4.861 and 4.841 ton/Fed. Fruit fitness expressed the relations between fruit yield and the trees occupy space. Prajapati et al. (2024) emphasized that regional temperature fluctuations significantly influence flowering, fruit set and final yield. Notably, flowering uniformity and early bloom are critical traits for synchronizing orchard management and pollination efficiency. The results suggest that the evaluated clone exhibit stable reproductive performance are consecutive seasons, indicating good and adaptability to the climatic conditions of Sadat city.

Table (4): Number of flowers and fruitlets/shoot and fruits/tree, fruit set (%) and yield (Kg/tree and ton/fed) and fruit fitness.

Season	No. of flowers/shoot	No. of fruitlet/shoot	No. of fruits/tree	Fruit set (%)	Fruit yield/tree (kg)	Fruit yield ton/Fed	Fruit fitness
2022	248.5a	50.17a	553.75a	21.97a	23.15a	4.861a	1.16a
2023	245.1a	54.67a	470.33b	22.49a	23.05a	4.841b	1.15a

3- Physical and chemical characteristics of fruits: Fruit weight (Table 5) ranging from 41.8 to 49.0g and from 39.0 to 47.6 cm^3 in size. Also, fruit length was 7.4-7.9cm as well as3.3-3.9 width results in 2.24 and 2.03 fruit shape index through the two studied seasons respectively. Fruit firmness was about 11.1-11.5 (1/inch^2) with T.S.S 10.4-010.9 % and acidity percentage

0.22-0.23 led to 47.2-47.4 T.S.S /acidity ratio. Pear fruit juice has 3.0-3.6 mg/100ml of vitamin C content. However, these results supported findings by Pillitteri et al. (2010), Mosa et al .(2021) and Awad (2023), who reported that the environment of growing area, the cultivars and the age of the trees, all of them had affected the fruit physical characteristics. Also, the length of time from the fruit set stage to maturity and harvest significantly impacts fruit weight, length, diameter and firmness.

Table (5): Physical and chemical characteristics of fruit.

Season	Fruit weight (g)	Fruit Size (cm^3)	Fruit length (cm)	Fruit width (cm)	Fruit shape	Fruit firmness ($1/inch^2$)	T.S.S. (%)	Acidity (%)	T.S.S./ acidity	Vitamin C (mg/100ml)
2022	41.8b	39.0b	7.4a	3.3a	2.24a	11.5a	10.9a	0.23a	47.4a	3.0b
2023	49.0a	47.6a	7.9a	3.9a	2.03a	11.1a	10.4a	0.22a	47.2a	3.6a

4- Physical and chemical fruit characteristics through cold storage: Table (6) announced that, fruit weight, size and length as well as acidity and vitamin C of fruit juice significantly decreased through cold storage at 0 ±1 ºC and 90-95% humidity from 1st July till 10th July till 20th July till 1st Aug. On the other hand, total soluble solids (T.S.S.) increased significantly through the same period. Moreover, agriculture practices influence the quality of the fruits, storage and market value. The percentage of juice and total sugars in fruits can vary depending on the climate and agricultural conditions which in turn affects the overall fruit quality (Shalan, 2013; Naser *et al*., 2015; abd-El-Latif *et al*., 2017). However, the results of higher T.S.S and less acidity percentages through storage showed better taste of pear fruits.

Table (6): Physical and chemical characteristics through cold storage.

Season	Fruit Weight				Fruit Size				Fruit Length			
	1/7	10/7	20/7	1/8	1/7	10/7	20/7	1/8	1/7	10/7	20/7	1/8
2022	49.8a	45.6b	44.1b	41.5c	48.4a	46.2b	43.1c	41.0d	7.8a	7.7a	7.2b	7.0b
2023	48.8a	46.2b	45.ob	40.9c	48.2a	46.3b	43.3c	40.8d	8.0a	7.9a	7.6b	7.0c
Season	**T.S.S. (%)**				**Acidity (%)**				**Vitamin C(mg/100ml)**			
	1/7	10/7	20/7	1/8	1/7	10/7	20/7	1/8	1/7	10/7	20/7	1/8
2022	10.9c	11.2b	11.9a	12.2d	0.23a	0.22a	0.22a	0.20b	3.5a	3.4a	3.3a	3.2a
2023	10.5d	11.0c	11.7b	12.0d	0.22a	0.21a	0.20a	0.19a	3.6a	3.4b	3.4b	3.2a

- **Molecular Genetic profile of new Le-Conte clone:** Data of the amplified fragments using six RAPD primers for new Le-Conte clone cultivated in Sadat city were succeeded in amplifying DNA fragments (Table, 7 and Fig. 1). Primer OP-A5 resulted in three bands with molecular sizes 440,375, 240 and 240bp and Primer OP-A9 resulted in four bands with molecular sizes1080, 265 and 240 bp. While, Primer OP-C9 indicated the amplification of one band with molecular size 375 bp and Primer OP-C15 indicated the amplification of three bands with molecular weight size 530, 240 and 200 bp. On the other hand, primer OP-D1 resulted in one DNA fragments with molecular weight 285bp.

Finally, primer OP-K2 resulted in one DNA fragment with molecular weight 285 bp. Data of the amplified fragments using those six ISSR primers for new Le-Conte clone cultivated in Sadat city were succeeded in amplifying DNA fragments (Table, 7 and Fig. 2). Primer HB-9 resulted in five bands with molecular sizes 250,270, 380, 430 and 485bp and Primer HB-10 resulted in two bands with molecular sizes 250and 380bp. While, PrimerHB-11 illustrated the amplification of three bands with molecular size 250, 270 and 380bp and also Primer HB-12 indicated the amplification of six bands with molecular weight size 250, 270, 380, 430, 485 and 570bp respectively. On the other hand, primer HB-13 resulted in four DNA fragments with molecular weight 250,430,

485 and 875bp respectively. Finally, primer HB-15 produced three amplified bands with molecular weight430, 570 and 635 bp.

First: RAPD-PCR molecular markers:

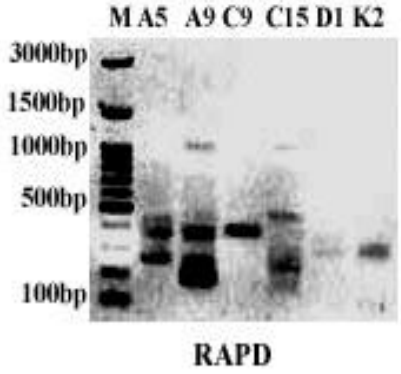

Fig. (1): DNA polymorphism using RAPD-PCR for new Le-Conte clone amplified with six RAPD primers.

Table (7): DNA polymorphism using RAPD-PCR for for new Le-Conte clone amplified with six RAPD primers.

Band No	M.W bp	OP-A5	OP-A9	OP-C9	OP_C15	OP-D1	OP_K2
1	1080	-	1	-	-	-	-
2	530	-	-	-	1	-	-
3	440	1	-	-	-	-	-
4	375	1	1	1	-	-	-
5	285	-	-	-	-	1	1
6	240	1	1	-	1	-	-
	200	-	1	-	1	-	-
Total		3	4	1	3	1	1

Second: ISSR- PCR molecular markers:

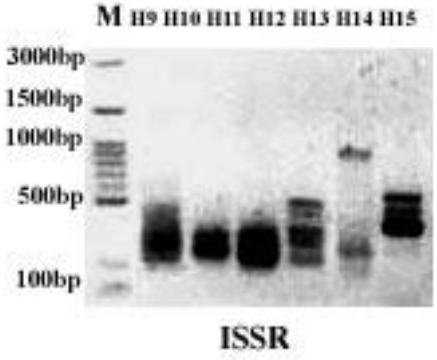

Fig. (2): DNA polymorphism using ISSR-PCR for new Le-Conte clone amplified with six ISSR primers.

Table (8): DNA polymorphism using RAPD-PCR for new Le-Conte clone amplified with six RAPD primers.

Band No	M.W bp	HB-9	HB-10	HB-11	HB-12	HB-13	HB-15
1	875	-	-	-	-	1	-
2	635	-	-	-	-	-	1
3	570	-	-	-	1	-	1
4	485	1	-	-	1	1	-
5	430	1	-	-	1	1	1
6	380	1	1	1	1	-	-
7	270	1	-	1	1	-	-
8	250	1	1	1	1	1	-
Total		5	2	3	6	4	3

- **Disease incidence and severity:** Table (9) presents data on the incidence of fire blight disease on new Le-Conte pear clone over two consecutive growing seasons (2021-2022 and 2022-2023). The evaluation was based on field observations conducted on a total of 210 trees per season to determine the presence or absence of symptoms associated with Erwinia amylovora infection. The absence of disease symptoms strongly suggests that the new Le-Conte pear clone exhibits a high level of resistance or strong tolerance to Erwinia amylovora under the environmental conditions of Sadat City, Menofya Governorate, Egypt. These findings indicate that this clone is suitable for commercial cultivation in regions where fire blight is a major concern. Fire blight, caused by Erwinia amylovora, is one of the most destructive bacterial diseases affecting pear and apple trees worldwide(Zhao et al., 2019). It spreads rapidly under favorable environmental conditions, leading to significant yield losses (Aćimović et al., 2023). The results of this study indicate that the Le-Conte pear clone exhibits strong resistance or high tolerance to fire blight, as no symptoms were observed on the examined trees during the 2021-2022 and 2022-2023 growing seasons. The complete absence of infection across two consecutive seasons suggests that Le-Conte may possess genetic resistance to Erwinia amylovora. Additionally, the environmental conditions in Sadat City, including

temperature, humidity, and orchard management practices, may have played a role in limiting disease occurrence. Previous studies have shown that certain pear cultivars exhibit varying degrees of resistance to fire blight, depending on their genetic background and the environmental conditions in which they are grown (Evrenosoğlu et al., 2019; Przybyla et al., 2012). The findings of this study align with previous research indicating that some hybrid pear cultivars (Pyrus communis L. × Pyrus pyrifolia N.) exhibit enhanced resistance to bacterial infections (Oh et al., 2021). This resistance can be attributed to natural defense mechanisms, such as the production of antimicrobial compounds, thicker cuticles, or a slower progression of bacterial colonization(Mahawer et al., 2022). However, further studies, including controlled inoculation trials, are necessary to confirm the genetic basis of resistance in this Le-Conte clone under different environmental and pathogen pressure conditions.

Table (9): Fire blight disease evaluation on new Le-Conte pear clone during the 2021-2022 and 2022-2023 Growing Seasons

Growing Season	Number of examined Trees	Number of Infected Trees	Infection rate (%)	Observations
2021-2022	**210**	**0**	**0%**	**No disease symptoms observed**
2022-2023	**210**	**0**	**0%**	**No disease symptoms observed**

- Number of Examined Trees: In each season, a total of 210 trees were assessed for signs of fire blight disease.
- Number of Infected Trees: No trees exhibited symptoms of fire blight in either season, resulting in an infection count of zero for both years.
- Infection Rate (%): The infection percentage remained at 0%, meaning no cases of fire blight were detected among the studied trees.
- Observations: Field assessments confirmed that no signs of infection-such as wilting, necrosis, or bacterial ooze-were observed on the trees in either season.

Conclusion: The present results exhibit that; vegetative bud braek began at petal fall of flower bud. The duration of flowering (bud break-fruit set) has 19-24 days while, the duration of fruit development (fruit set-maturity) has 70-76 days. Fruit set percentage has high rank (21.97-22.49%) while fruit yield was appreciative (23.05-23.15kg/tree) and (4.841-4.861 ton/Fed). Physical and chemical characteristics of fruits are agreeable with higher T.S.S. and vitamin C and low acidity percentage. Through storage of fruits at 0±1ºC under 90-95% humidity for a month fruit weight, size, length, acidity and vitamin C lessened but T.S.S. scoring higher percentage. Higher T.S.S. and lower acidity means better taste. The molecular genetic profile for new Le-Conte clone using six RAPD primers and six ISSR primers were succeeded in amplifying thirteen DNA fragments with RAPD primers with molecular weight ranging from 200-1080bp respectively and twenty three DNA fragments were resulted using ISSR primers with molecular weight range from 250-875bp. Notably, the complete absence of fire blight symptoms across two consecutive seasons suggests strong resistance to *Erwinia amylovora*, making it a promising option for cultivation in fire blight-prone regions. Further research, including genetic studies and controlled inoculation trials, is recommended to confirm the genetic basis of this resistance and its stability under different environmental conditions.

RECOMMENDATION: From the previous results, we recommended starting to propagate this new pear Le-Cone clone, and in a parallel way, do more research with Le-Conte pear cultivar, compare cultivar trials with a specific department at the Horticulture Research Institute obtain new genotypes with more resistance to fire blight.

Ethical approval

There are no experiments on people or animals in this study.

Conflict of interest

All authors proclaim that there is no conflict of interest.

Authors' contributions

Conceptualization; A.S.A, M.M.M, S.Y.M, and M.S.A.; Methodology; A.S.A, M.M.M, S.Y.M, and M.S.A.; Data Analysis; A.S.A, M.M.M, S.Y.M, and M.S.A.; Figures and tables preparation; A.S.A, M.M.M, S.Y.M, and M.S.A. ; Writing original draft preparation; A.S.A, M.M.M, S.Y.M, and M.S.A., Writing review and editing A.S.A, M.M.M, S.Y.M, and M.S.A.; Resources; A.S.A, M.M.M, S.Y.M, and M.S.A.; All authors have read and agreed to the published version of the manuscript.

Availability of data

This investigation offers all the data collected or estimated throughout this effort.

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التقييم الشامل لسلاله جديدة مبكرة من الكمثري الليكونت بمدينه السادات

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الملخـــص العربى

أجريت هذه الدراسة على أشجار سلالة مبكرة النضج من الكمثرى نامية بمزرعة خاصة بمدينة السادات بمحافظة المنوفيه – مصر، لتقييمها خلال موسمي (٢٠٢٢ و ٢٠٢٣).

هذه الأشجار مطعومة على أصل *Pyrus betulaefolia* ونامية في تربة رملية تحت نظام الري بالتنقيط لتقييم صفات سلوك التزهير؛ القياسات الطبيعيه والكيميائية للثمار؛ قياسات تخزين الثمار؛ التوصيف الوراثي الجزيئي؛ المقاومه للفحه الناريه.

أوضحت نتائج هذا التقييم أن قياسات التزهير لهذه السلالة مبكرة النضج أن كسر سكون البراعم الزهرية كان في الفترة من ١٦ مارس الي ١٨ مارس بينما كان عقد الثمار بدأ من ٧-١٠ أبريل مع استمرارية من ١٩-٢٤ يوم بالإضافه إلى ذلك كان إكتمال نمو الثمار بدأ من ٢٠-٢٣ يونيه مع استمرارية من ٧٠-٧٦ يـوم وكـان محصـول الثمـار ٢٣.٠٥ و٢٣.١٥ كجـم/شجـره و٤.٦٨١ – ٤.٨٤١ طن للفدان وخلال فتره تخزين الثمار علي درجة حرارة من صفر إلي ١ ° م ورطوبة نسبيه من ٩٠-٩٥% لمدة شهر زادت المواد الصلبه الذائبة الكلية زيادة معنوية بينما باقي القياسات انخفضت معنويا. وقد أظهرت النتائج لهذه السلاله والمقاومة للفحه الناريه بأنه صنف واعد من الكمثري للإنتاج وزراعته في مناطق انتشار اللفحه بالإضافه إلي مزيد من الدراسات البستانيه والتوصية بزارعته في بيئات متنوعة لدراسة مدي ثبات هذه الصفات لهذه السلالة الجديدة بصفه خاصة في ضوء زيادة التغيرات المناخيه.

تم استخدام تقنية التضاعف العشوائي لأجزاء من مادة DNA في جهاز سلسلة تفاعل إنزيم البلمرة عدد ستة بوادئ من تقنيه (RAPD-PCR) وستة بوادئ من تقنية البوادئ المتخصصة للقطع المتكررة على الجينوم (ISSR-PCR) لعمل التعريف الوراثي الجزيئي علي السلالة مبكرة النضج من الكمثرى محل الدراسه. وقد أظهرت النتائج التعرف على ثلاثة عشره من المواقع الجينية على جينوم الكمثرى تحت الدراسة وذلك باستخدام تقنية (RAPD-PCR)، في حين أظهرت تقنية (ISSR-PCR) التعرف على ثلاثة وعشرون من المواقع الجينية على جينوم الكمثرى تحت الدراسة. من جهة اخري أظهر الفحص الكامل للأشجار مقاومة تامة للفحه الناريه وكانت الإصابة صفر في كلا الموسمين.