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RESEARCH ARTICLE

POLLEN STORAGE CONDITIONS AND POLLINATION WITH STORED POLLENS ON FRUIT SET, SEED YIELD AND QUALITY IN OKRA HYBRID (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH.)

Rekha H. Hallur, Shantappa T, Archana A. M and Jagadeesha R. C

Kittur Rani Channamma College of Horticulture, Arabhavi -591 218, University of Horticultural Sciences, Bagalkot-587102, Karnataka, India.

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Corresponding Author

Rekha H. Hallur.
Shantappa T, Archana A. M and Jagadeesha R. C

Abstract

The present study entitled "pollen storage conditions and pollination with stored on fruit set, seed yield and quality in okra hybrid" was under taken in the Kittur rani Channamma College of Horticulture, Crop Improvement and Biotechnology department field. In present study selected the Arka Anamika and IC-550848 of okra as female and male parents, respectively. Two pollen storage conditions like refrigerated (C_1) and ambient (C_2). Pollination with fresh pollens (P_0) and stored pollens of one, two, three and four days (P_1, P_2, P_3 and P_4, respectively). The interaction study also carried in this experiment. Among the storage conditions, refrigerated condition and among the pollination with stored pollens, one day stored pollens has recorded higher fruit set, seed yield and quality. In the interaction study, storage of pollens under refrigerated condition and pollination with fresh pollens (C_1P_0) even the interaction of C_2P_0 i.e., storage of pollens under ambient condition and pollination with fresh pollens has presented higher results of fruit set, seed yield and quality in okra hybrid.

Introduction:-

The practice of storing pollen goes back to the early years of human civilization. A systematic study on the storage of pollens was initiated towards the end of 19th century, when the longevity of pollen of more than 80 spp stored under air dry conditions were investigated. In okra also storage of viable pollens for longer period is essential for pollination, as it eliminates the laborious problems encountered when parent flowers at different times, pollens can be collected and stored successfully for pollination during hybrid seed production. The storage of pollens under controlled temperature and humidity condition is being practiced. However, refrigerator, earthen pot with water at bottom is being used to store the pollen grains. To know the fruit set, seed yield and quality in okra by pollen storage conditions and pollination with stored pollens, this study was under taken.

Material and methods:-

We have selected Arka Anamika as female parent and IC-550848 as male parent. Here under study, two aspects are considered like pollen storage conditions and pollination with stored pollens. Pollen storage conditions like refrigerated (C_1) and ambient (C_2) conditions. Under pollination with stored pollens, the fresh pollens (P_0), one (P_1), two (P_2), three (P_3) and four (P_4) days stored pollens were used for pollination and the interaction study was also carried out. Pollination was carried out every day morning from 6.00 AM to 8.00 AM till the completion of flowering period of female parent Arka Anamika by collecting the pollens from male parent IC-550848. The observations are recorded on fruit set percentage, number of crossed fruits retained, germination percentage, seedling shoot length, seedling root length, seedling dry weight and seedling vigor index.

Results and Discussion:-

Initially scientists have studied on Effect of pollen storage conditions and pollination with stored pollens on number of flowers pollinated, fruit set percentage and crossed fruits retained (%) in okra hybrid. For each treatment 100 flowers were crossed. In this study refrigerated stored pollens and pollination with fresh pollens were shown significantly higher results of fruit set percentage (74.40 and 72.73) and crossed fruits retained percentage (83.83 and 82.50), respectively compared to storage of pollens under ambient condition and duration of pollen storage. In the interaction study the treatment combination of C_1 P_0 and C_2 P_0 has recorded significantly higher results of fruit set percentage (84.33) and crossed fruits retained percentage (83.33) compared to other treatment combinations (Table 1). These results may be attributed to sufficient loss of pollen viability due to diurnal fluctuations in ambient temperature and relative humidity, which might have affected fertilization of ovules and resulted poor fruit set and seed yield components. These results are also confirmed by Petrova *et al.* (1981) and Islam and Khan (1998) in brinjal; Yogeesha *et al*. (1999) and Jolli (2004) in tomato.

Table 1:- Effect of pollen storage conditions and pollination with stored pollens on number of flowers pollinated, fruit set percentage and crossed fruits retained (%) in Okra hybrid.

Pollen storage conditions (C)	No. of flowers pollinated	Fruit set percentage	Crossed fruits retained (%)
C_1- Storage of pollens under refrigerated condition	100	74.40	72.73
C_2 - Storage of pollens under ambient condition	100	64.13	62.07
S. Em±	-	**0.64**	**0.56**
C.D. @ 1%	-	**2.59**	**2.29**
C.D. @ 5%	-	**1.89**	**1.67**
Pollination with stored pollens (P)			
P_0- Pollination with fresh pollens	100	83.83	82.50
P_1- Pollination with one day stored pollens	100	73.17	71.67
P_2 - Pollination with two days stored pollens	100	70.33	68.33
P_3- Pollination with three days stored pollens	100	63.83	61.50
P_4- Pollination with four days stored pollens	100	55.17	53.00
S. Em±	-	**1.01**	**0.89**
C.D. @ 1%	-	**4.10**	**3.61**
C.D. @ 5%	-	**2.99**	**2.64**
Interaction (C x P)			
C_1 P_0	100	84.33	83.33
C_1 P_1	100	79.00	77.67
C_1 P_2	100	74.00	72.33
C_1 P_3	100	69.33	67.00
C_1 P_4	100	65.33	63.33
C_2 P_0	100	84.33	83.33
C_2 P_1	100	67.33	65.67
C_2 P_2	100	66.67	64.33
C_2 P_3	100	58.33	56.00
C_2 P_4	100	45.00	42.67
S. Em±	-	**1.42**	**1.26**
C.D. @ 1 %	-	**5.79**	**5.11**
C.D. @ 5%	-	**4.23**	**3.73**

Here in this experiment scientists have studies the pollen storage conditions and pollination with stored pollens on number of seeds per fruit, 100 seed weight and total seed weight of crossed fruit per plant in okra hybrid (Table 2). Among the pollen storage conditions and pollination with stored pollens, the refrigerated stored pollens and pollination with fresh pollens has recorded significantly higher values of number of seeds per fruit (52.00 and 58.00), 100 seed weight (6.32 and 6.88) and total seed weight of crossed fruit per plant (81.66 and 109.37). Even in the interaction study the treatment combination C_1P_0 and C_1P_0 had recorded the maximum and significant results of for the observations number of seeds per fruit (58.33), 100 seed weight (6.93) and total seed weight of crossed fruit per plant (113.74). Kivadasannavar *et al*. (2008) reported that the use of fresh pollen recorded significantly higher seed germination and seedling vigor index followed by pollen stored in refrigerator for one day.

Table2:- Effect of pollen storage conditions and pollination with stored pollens on number of seeds per fruit, 100 seed weight and total seed weight of crossed fruit per plant of okra hybrid.

Pollen Storage conditions (C)	**No. of seeds per fruit**	**100 seed weight (g)**	**Total seed weight of crossed fruit per plant (g)**
C_1- Storage of pollens under refrigerated condition	52.00	6.32	81.66
C_2 - Storage of pollens under ambient condition	43.33	5.59	48.22
S. Em±	**0.63**	**0.03**	**2.38**
C.D. @ 1%	**2.58**	**0.14**	**9.67**
C.D. @ 5%	**1.88**	**0.10**	**7.06**
Pollination with stored pollens (P)			
P_0- Pollination with fresh pollens	58.00	6.88	109.37
P_1- Pollination with one day stored pollens	48.33	6.05	68.38
P_2 - Pollination with two days stored pollens	47.00	5.75	55.57
P_3- Pollination with three days stored pollens	43.33	5.65	45.24
P_4- Pollination with four days stored pollens	41.67	5.43	46.15
S. Em±	**1.00**	**0.05**	**3.76**
C.D. @ 1%	**4.08**	**0.22**	**15.30**
C.D. @ 5%	**2.98**	**0.16**	**11.16**
Interaction (C x P)			
C_1 **P_0**	58.33	6.93	113.74
C_1 **P_1**	56.00	6.33	95.75
C_1 **P_2**	53.33	6.27	75.84
C_1 **P_3**	47.33	6.10	58.26
C_1 **P_4**	45.00	5.97	64.71
C_2 **P_0**	58.33	6.93	113.74
C_2 **P_1**	40.67	5.77	41.00
C_2 **P_2**	40.67	5.23	35.30
C_2 **P_3**	39.33	5.20	32.22
C_2 **P_4**	38.33	4.90	27.58
S. Em±	**1.42**	**0.07**	**5.31**
C.D. @ 1%	**5.77**	**0.30**	**21.63**
C.D. @ 5 %	**4.21**	**0.22**	**15.79**

Among the pollen storage conditions the pollens stored under refrigerated stored pollens has recorded significantly higher results of germination % (85.07), seedling shoot length (17.86) and seedling root length (17.86) compared to ambient stored pollens. In pollination with stored pollens, fresh pollens used for pollination are observed higher results of germination % (94.17), seedling shoot length (20.43), seedling root length (16.22) but other treatments of pollen storage duration were shown lower results. In the interaction study the treatment combination C_1P_0 and C_2P_0 has recorded maximum and significantly higher results of germination %, seedling shoot length and root length (94.33, 20.40 and 16.33, respectively) compared to all other treatment combinations (Table 3). The increase in seedling vigor can also be attributed to higher per cent of germination, root length and shoot length. Such results were reported earlier by Chen (2003) in brinjal, Singh (2009) in okra and Yogeesha *et al.* (1999) and Jolli (2008) in tomato. On the other hand seed quality traits were lower in the treatment of pollination with four day stored pollens which can be attributed to immature and thinner seeds obtained from fruits of delayed pollination.

Table 3:- Effect of pollen storage conditions and pollination with stored pollens on germination %, shoot length (cm) and root length (cm) in okra hybrid.

Pollen Storage conditions (C)	**Germination %**	**Seedling shoot length (cm)**	**Seedling root length (cm)**
C_1- Storage of pollens under refrigerated condition	85.07	17.86	15.11
C_2 - Storage of pollens under ambient condition	81.33	16.21	13.35
S. Em±	**0.34**	**0.11**	**0.09**
C.D. @ 1%	**1.40**	**0.45**	**0.36**
C.D. @ 5%	**1.02**	**0.33**	**0.27**
Pollination with stored pollens (P)			
P_0- Pollination with fresh pollens	94.17	20.43	16.22
P_1- Pollination with one day stored pollens	88.33	17.42	14.35
P_2 - Pollination with two days stored pollens	83.00	16.93	14.00
P_3- Pollination with three days stored pollens	78.00	15.85	13.73
P_4- Pollination with four days stored pollens	72.50	14.55	12.87
S. Em±	**0.55**	**0.18**	**0.14**
C.D. @ 1 %	**2.22**	**0.72**	**0.58**
C.D. @ 5 %	**1.62**	**0.52**	**0.42**
Interaction (C x P)			
C_1 P_0	94.33	20.40	16.33
C_1 P_1	91.67	18.77	15.33
C_1 P_2	85.67	17.97	14.97
C_1 P_3	80.33	16.70	15.07
C_1 P_4	73.33	15.47	13.87
C_2 P_0	94. 33	20.40	16.33
C_2 P_1	85.00	16.07	13.37
C_2 P_2	80.33	15.90	13.03
C_2 P_3	75.67	15.00	12.40
C_2 P_4	71.67	13.63	11.87
S. Em±	**0.77**	**0.25**	**0.20**
C.D. @ 1%	**3.14**	**1.02**	**0.82**
C.D. @ 5 %	**2.29**	**0.74**	**0.60**

Here in this experiment scientists have studies the pollen storage conditions and pollination with stored pollens on seedling dry weight (g) and seedling vigor index in okra hybrid (Table 4). Among the pollen storage conditions and pollination with stored pollens, the refrigerated stored pollens and pollination with fresh pollens has recorded significantly higher values of seedling dry weight (0.31 and 1532) and seedling vigor index (0.37 and 1924). Even in the interaction study the treatment combination C_1P_0 and C_1P_0 had recorded the maximum and significant results of for the observations seedling dry weight (0.37) and seedling vigor index (1924). Patil (2005) reported that use of stored pollen in refrigerated condition recorded significantly higher fruit set (%), seed yield, seed germination, seedling dry weight and vigor index compared to farmer's method of pollen storage. Whereas, fresh pollens recorded significantly higher results for these traits as compared to two day and three day old pollens in brinjal.

Table 4:- Effect of pollen storage conditions and pollination with stored pollens on seedling dry weight (g) and seedling vigor index in okra hybrid

Pollen storage conditions (C)	**Seedling dry weight (g)**	**Seedling vigor index**
C_1- Storage of pollens under refrigerated condition	0.31	1532
C_2 - Storage of pollens under ambient condition	0.26	1336
S. Em±	**0.00**	**9.49**
C.D. @ 1%	**0.01**	**38.65**
C.D. @ 5%	**0.01**	**28.21**
Pollination with stored pollens (P)		
P_0- Pollination with fresh pollens	0.37	1924
P_1- Pollination with one day stored pollens	0.29	1543
P_2 - Pollination with two days stored pollens	0.28	1408
P_3- Pollination with three days stored pollens	0.26	1238
P_4- Pollination with four days stored pollens	0.24	1056
S. Em±	**0.005**	**15.01**
C.D. @ 1 %	**0.02**	**61.11**
C.D. @ 5 %	**0.01**	**44.60**
Interaction (C x P)		
C_1 P_0	0.37	1924
C_1 P_1	0.32	1720
C_1 P_2	0.31	1540
C_1 P_3	0.29	1341
C_1 P_4	0.28	1134
C_2 P_0	0.37	1924
C_2 P_1	0.26	1366
C_2 P_2	0.25	1277
C_2 P_3	0.22	1136
C_2 P_4	0.20	977
S. Em±	**0.01**	**21.23**
C.D. @ 1%	**0.03**	**86.42**
C.D. @ 5 %	**0.02**	**63.07**

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