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Vivipary in Cucurbita pepo L. (Pumpkin): An unusual case of Seed Germination within the Fruit

Sk Md Ismail Al Amin[1], Achintya Kumar Samanta[2] and [*]Susanta Kumar Maity[3]

[1&3]Department of Botany, Govt. General Degree College, Keshiary (under Vidyasagar University), Keshiary, Paschim Medinipur - 721105 (India)
[2]Department of Botany, Ramnagar College (Under Vidyasagar University), Depal, Purba Medinipur - 721 453 (India)
[*]Correspondence Id: smaity.bot@gmail.com

Abstract

Viviparous germination, the precocious sprouting of seeds while still attached to the parent plant, is an uncommon phenomenon in *Cucurbita pepo* (commonly known as pumpkin). Observations indicate that vivipary is more likely to occur under conditions of high humidity, extended fruit retention on the vine and hormonal imbalances particularly reduced levels of abscisic acid (ABA), a hormone that normally inhibits germination during seed maturation. Seeds exhibiting viviparous germination often show reduced viability and morphological abnormalities, which negatively affect seed quality and overall yield. During the investigation, ripe fruits were cut into two halves, revealing that some seeds had begun germinating within the fruit while still on the mother plant. Understanding the physiological and hormonal mechanisms underlying vivipary in *C. pepo* is crucial for improving post harvest management and seed production strategies. The main aim of this study is to document and present the abnormal behavior of seed germination in *C. pepo*, specifically the occurrence of vivipary.

Key words : Viviparous germination, *Cucurbita pepo,* High humidity, Seed viability, Seed abnormalities.

Viviparous germination, defined as the premature germination of seeds while still attached to the mother plant or enclosed within the fruit, is an atypical and generally undesirable phenomenon in many crop species, including *Cucurbita pepo*. Under normal developmental conditions, seeds enter a period of dormancy following fruit maturation, thereby preventing germination until favourable environmental conditions are encountered. In vivipary, however, this dormancy is bypassed, resulting in precocious germination within the fruit. Such abnormal development can reduce seed viability, compromise fruit quality and cause substantial

economic losses in both seed production and fresh market pumpkin cultivation.

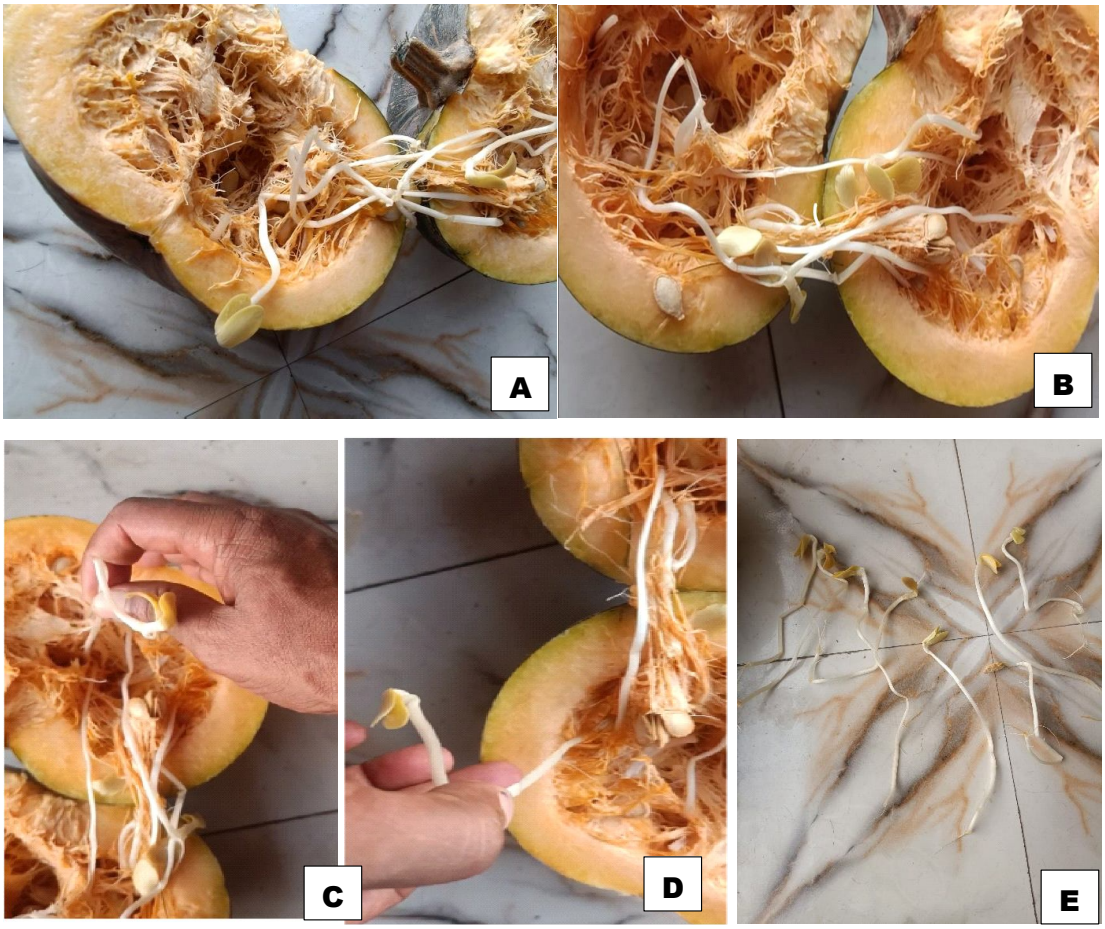
Although vivipary is relatively rare under standard field conditions, it can be induced in *C. pepo* by specific environmental and physiological factors, including high humidity, prolonged fruit retention on the vine and hormonal imbalances particularly reduced levels or sensitivity to abscisic acid (ABA), a key regulator of seed dormancy. Vivipary has been documented across diverse plant species, such as maize, bell pepper and rice[6,8,9]. In several species, including *Arabidopsis thaliana*, maize and rice, vivipary has been linked to decreased ABA accumulation or impaired embryonic responsiveness to ABA[7,9,11,14].

From both physiological and agronomic perspectives, understanding the factors underlying vivipary in *C. pepo* is critical. This study investigates the environmental and hormonal determinants of viviparous germination in *C. pepo*, with the aim of informing management practices and breeding strategies to mitigate its impact under commercial production systems.

The present study was conducted on *Cucurbita pepo* L., a widely cultivated vegetable crop used as a food source. Fully ripened fruits showing no visible signs of external damage or disease were randomly selected from agricultural fields during the normal harvesting season. The collected fruits were transported to the storeroom and stored at room temperature for further use. One ripened fruit collected directly from the field was cut longitudinally into two halves using a clean, sharp knife and its internal structure was carefully examined. On the inner side of the fruit, approximately half of the seeds exhibited visible signs of germination, such as radicle protrusion and plumule emergence and were recorded as viviparous. The number of viviparously germinated seeds and normal seeds per fruit was recorded and all seeds were manually removed.

At the same time four other fruits from the same collection were examined. These fruits contained only normal seeds and showed no evidence of viviparous germination. The morphological features of the germinating seeds, including radicle length, plumule development and seedling vigour were examined visually. Normal and viviparous seeds were separated and observed individually. Additionally any internal damage to fruit tissues caused by developing seedlings was documented. The study was observational in nature and data were recorded descriptively to confirm the occurrence of vivipary in *Cucurbita pepo* fruits under natural conditions.

During the course of the present study, viviparous germination was observed in fruits of *Cucurbita pepo*. A total of 56 seeds were observed, of which 25 seeds showed signs of germination while still enclosed within the fruit (Fig. A-D) and 31 seeds appeared normal. Seeds exhibiting visible signs of germination, such as radicle protrusion and plumule emergence, were recorded as viviparous. These seeds showed premature radicle protrusion and, in several cases, elongation of the plumule, indicating a breakdown of normal seed dormancy. The resulting seedlings were weak and abnormally developed (Fig. E) and the seedlings continued to grow within the fruit cavity, causing internal tissue damage and a



Figures: A-D Viviparously germinated seeds within the fruit. E- Viviparously germinated seedlings were carefully separated from the fruit.

noticeable reduction in market quality. The simultaneous emergence of both radicle and plumule prior to seed dispersal clearly confirms the occurrence of vivipary.

Vivipary is most commonly associated with halophytic species adapted to saline or swampy environments, where continuous moisture favours immediate germination. In contrast, it is considered a rare phenomenon in non-halophytic angiosperms such as *C. pepo*. Nevertheless, sporadic cases of viviparous germination have been reported in several crop and wild species, including *Carica papaya*[1], *Hedychium elatum*[3], *Ophiorrhiza succirubra*[4], *Ophiorrhiza mungos*[5], *Capsicum annuum*[10], *Memecylon umbellatum*[12], *Vigna radiata* and *Zea mays*[13].

The occurrence of vivipary in *C. pepo* during this study is likely attributable to the

accumulation of excess moisture within the fruit, particularly under conditions of high ambient humidity and prolonged fruit retention after maturity. Such conditions create a favourable microenvironment for germination and may disrupt hormonal regulation, especially the maintenance of abscisic acid mediated dormancy. Similar moisture induced vivipary has been reported in *Carica papaya*[1] and *Jatropha curcas*[2].

The present findings demonstrate that although vivipary is rare in *C. pepo*, it can occur under specific post maturity and environmental conditions. The production of weak, non viable seedlings from viviparous seeds further emphasizes its negative impact on seed quality and crop productivity. These results underscore the importance of timely harvesting, proper post harvest handling and adequate storage conditions to minimize the risk of viviparous germination, particularly in regions prone to high humidity.

Viviparous germination in *Cucurbita pepo* is strongly influenced by environmental factors, particularly high humidity and delayed harvesting during seed development. This study underscores the importance of timely fruit harvesting and proper post harvest handling to minimize the risk of vivipary and its associated economic impacts. Additionally, breeding programs focused on enhancing seed dormancy stability may provide long term solutions for preventing vivipary in commercial pumpkin production.

References :

1. Ahirwar J.R. and S. S. Ahirwar (2023). *Research Journal of Agriculture and Forestry Sciences. 11*(1): 40–41.
2. Ajay D.C. and J.T. Sudhakar (2008). *Current Science. 95*(3): 321–322.
3. Bhadra S., M. Ghosh, A. Mukherjee and M. Bandopadhyay (2013). *Phytotaxa. 130*(1): 55–59.
4. Bora A. and D. Bhattacharyya (2018). *The Indian Forester. 144:* 1230–1231.
5. Dintul K.P., C.V. Sibi, P. Ravichandran and K. Satheeshkumar (2015). *Plant Biology. 17*(1): 294–295.
6. Eyster W.H. (1931). *Genetics. 16:* 574–590.
7. Karssen C.M., D.L.C. Brinkhorst-van der Swan, A.E. Breekland and M. Koornneef (1983). *Planta. 157:* 158–165.
8. Marrush M., M. Yamaguchi and M.E. Saltveit (1998). *Journal of the American Society for Horticultural Science. 123:* 925–930.
9. Miyoshi K., E. Nakata and Y. Nagato (2000). *Breeding Science. 50:* 207–213.
10. Patade V.Y., M. Kumari and A. Zakwan (2011). *Current Science. 100*(8): 1122.
11. Robichaud C.S., J. Wong and I.M. Sussex (1980). *Developmental Genetics. 1:* 325–330.
12. Thite S.V., P.R. Hande and B.A. Kore (2016). *National Academy Science Letters. 39*(1): 47–49.
13. Thakur V, C.K. Mahadev and C.M. Nawalagatt (2021). *Indian Journal of Agricultural Sciences. 91* (12): 1818–20.
14. Wang Xu, Lili Zhang, Xiaochun Xu, Wei Qu, Jingfu Li, Xiangyang Xu, Aoxue Wang (2016). *Breed Sci. 17;* 66(3): 372–380.