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Occurrence of Vivipary behavior in *Tagetes erecta* L.

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Vivipary is commonly observed in many mangroves [1], wherein the seeds germinate and seedlings grow while still attached to their mother plant before dropping down to establish them or be transported elsewhere. Morphological, ecological and physiological explanations have been put forward to explain why so many mangrove species demonstrate vivipary. Vivipary is the process by which seeds germinate within the fruit, followed by subsequent embryo development before the seeds are dispersed from the parent plant. The germination of viviparous seeds usually occurs while they are still on the parent plant (precocious germination), a relatively unusual phenomenon in angiosperms. Vivipary has been reported in fewer than 100 flowering plant families, representing less than 0.1% of angiosperms [2, 3]. Here, we document the occurrence of cryptovivipary in *Tagetes erecta* L. for further research on understanding the viviparous nature in *Tagetes* and its ecological and evolutionary significance.

Asteraceae is the world diverse family, only about 12% of genera have been studied using cytoembryology to identify the reproduction system. In 3%, agamospermy was found to occur. Probably the most common reproduction system is allogamy with a sporophytic self-incompatibility; occasional selfing is also possible (stigma ageing or mentor effect). More or less obligate autogamy is relatively rare. Other uncommon reproduction systems include gynodioecy, a very rare dioecy (with heterogametic females). Asexual reproduction is a widespread phenomenon in the Asteraceae, with a wide range of mechanisms. In addition to the rare adventitious embryonic, there are common types of autonomous apomixis, agamospermy (apospory, diplospory) associated with various forms of embryogenesis (parthenogenesis, apogamety). All the types of reproduction are to be considered in the evaluation of population variation and for taxonomic conclusions because the prevailing type of reproduction substantially influences the variation limits of taxa [4]. Several members of Asteraceae family were found to have antimicrobial activity against ampicillin resistant pathogenic strains and were found to have antioxidant potential [5, 6]. Several researches have revealed the osmopriming effects on Safflower seed germination [7]. Phytochemical constituents, minerals, proteins and essential oils were investigated in different members of compositae [8, 9]. The first finding of peculiar phenomenon of vivipary was observed in the dormant twig and dried flower of *Tagetes erecta* L. in local gardens of Rajouri Dist. of J&K, India **(Figure 1 a)** during heavy monsoon, from late June through early August 2012. We observed that during continuous rainfall, the inflorescence head gets wet and the seeds begin to germinate inside the inflorescence head of almost all plants. Then the whole inflorescence head appears to hold the tuft of seedlings **(Figure 1 a)**. Further we also observed that small plantlets appeared on the old dormant twig moistened with heavy rains **(Figure 1 b)**. The previous studies reported that vivipary is dependent on excessive moisture within fruits like lemons, oranges, tomatoes, melons, etc. is often found. Paddy grains also germinate on the mother plant if

they get sufficient moisture [10]. Vivipary in Dutch white clover was noted repeatedly and was always favoured by excessive atmospheric moisture or wet condition experienced by the plant after seed-ripening [11].

Fig. 1(a) Vivipary in inflorescence of *Tagetes erecta* L.

Fig. 1(b) Vivipary in old dormant twig of *Tagetes erecta* L.

Although we do not have a conclusive explanation for this phenomenon in *Tagetes erecta L*. we presume that various intrinsic and extrinsic factors of the plant may be involved, namely physiology, soil condition, temperature and dry spell followed by high humidity induced by heavy rainfall. Vivipary, a phenomenon characterized by lack of dormancy, is important because, in addition to being a relatively unusual event in nature, it has been interpreted as a specialized trait of evolutionary and biological significance, providing new avenues for survival and as a mechanism for protecting the embryo from drought and other stress conditions [1, 12, and 13]. Since Asteraceae family is the superior family in angiosperms, having diverse species of angiosperms and vivipary is the new mode of reproduction which occurs in stress conditions, we can conclude that Asteraceae family and its members are showing an advanced feature for survival. No previous studies and reports were mentioned on vivipary in Asteraceae members as that of this report. Thus we can conclude that this study creates ample opportunities to investigate the ecophysiological and evolutionary significance of vivipary in *Tagetes* and the different members in Asteraceae family.

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