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Vivipary in *Hibiscus cannabinus* L. (Kenaf): a potential reproductive strategy in island's ecosystem

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ABSTRACT

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The occurrence of vivipary in *Hibiscus cannabinus* L. (Kenaf), from Andaman and Nicobar Islands, has been described for the first time. Vivipary in this non-mangrove plant was probably induced by ecological factors, followed by physiological factors. Vivipary in Kenaf is favoured by excessive atmospheric moisture or wet conditions and humidity. However, there is no report of vivipary in this plant growing in other regions where the moisture level is not so high.

Key-words: *Hibiscus cannabinus*, Kenaf, Malvaceae, non-mangrove, vivipary.

INTRODUCTION

Vivipary is the precocious and continuous growth of the offspring when still attached to the mother plant (Goebel 1905, Arber 1965, Font Quer 1993). It has been interpreted as a mechanism for protecting the embryo from unfavourable conditions (Rabinowitz 1978, Lee & Harmer 1980, Cota-Sánchez 2004). Various investigators have emphasized that occurrence of vivipary in flowering plants is a potential reproduction strategy (Lee & Harmer 1980, Tomlinson 1986, Farrant et al. 1993, Farnsworth 2000, Thompson 2000, Tomlinson & Cox 2000, Cota-Sánchez 2002, 2004, Tweddle et al. 2003, Ballesteros et al. 2005, Tsiantis 2006, Cota-Sánchez et al. 2007, Kuzmanovic et al. 2012, Singh 2012). The occurrence of vivipary in non-mangrove plant, *Hibiscus cannabinus* L., has been reported from Dhannikhari Experimental Garden cum Arboretum, Botanical Survey of India, Andaman and Nicobar Islands. These islands are situated close to equator and are exposed to marine impacts with warm and humid tropical climate and with temperature ranging from 18°C to 35°C. The islands receive heavy rainfall from both south-west and north-east monsoon, the former from May to September and later from October to December, with average annual rainfall ranging from 3000 to 3500 mm. Cyclonic winds, accompanied by thunder and lightning, are very frequent here. January to March have fairly dry weather with scanty rainfall. The mean relative humidity is rather high and usually remains between 66% and 85% throughout the year.

Hibiscus cannabinus L. is an important fibre and vegetable crop with medicinal properties. It is a common wild plant in most African countries and may have been domesticated as a fibre plant about 6000 years ago in Sudan and is now widespread in the tropical and sub tropical regions of the world. Kenaf is agronomically highly valuable because of

enormous production of fibre all over the world. India has long been the largest producer of Kenaf fibre estimated to be about 230,000 Ha/year (Wilson & Menzel 1964, Edmonds 1991). *Hibiscus cannabinus* L. belongs to family Malvaceae of *Hibiscus* section; *Furcaria*, a group of about 400 species which have in common a pergamentous calyx (Bailey 1949, Willis 1973, Wilson 1999). Interspecific hybridization has been attempted by various workers between *H. cannabinus* L. and other species within same section, viz. *H. subdariffa* L., *H. radiatus* Cav., *H. diversifolius* Jacq. and *H. acetosella* Welw. ex Hiern. Among them, only *H. cannabinus* L. was introduced in Dhannikhari Experimental Garden-cum-Arboretum, Nayashahar, BSI, ANRC, Port Blair. Here, vivipary in *H. cannabinus* L. is reported for the first time. However, since beginning, vivipary has been considered an important adaptive feature of mangroves, more commonly in Rhizophoraceae (Gill & Tomlinson 1969, Rabinowitz 1978, Macnae 1996, Singh 2012). In vivipary, the germination of seeds takes place within intact fruit which is still attached to the mother plant. In addition to mangroves, vivipary also occurs sporadically in some other non-mangrove plants (Mahabale 1961, Wali & Tiku 1965, Majumdar et al. 2004, 2010, Yadav et al. 2011).

MATERIAL AND METHOD

Seeds were collected locally, germinated and transplanted in the field of Dhannikhari Experimental Garden-cum-Arboretum, Botanical Survey of India, Andaman and Nicobar Regional Centre (Lat. 11°34.17'N to 11°34.42'N: Long. 92°40.20'E to 92°40.34'E, ± 100 m) as a part of conservation. Vivipary was noted repeatedly in-situ for two years 2011 and 2012.

OBSERVATIONS

In Kenaf plants, flowering and fruiting takes place from August to March. Flowers axillary, solitary and sometimes clustered near the apex, large, hermaphrodite, pedicellate, cream to light yellow or purple, the centre still dark purple, entomophilous and self-fertile (Plate 1, figure 1). Fruit ovoid, shortly beaked capsule, containing several seeds, which is usually whitish green when immature and turns light brown, dry and split open at maturity (Plate 1, figure 2). Seeds ripen in about 5-6 weeks after anthesis. Kenaf plants are generally propagated commercially from seeds. Seeds reniform to triangular with acute angles, grey to brown-black with pale yellow spots, hilum brown and viable, and remains viable for about 8 months. Seeds with 8% moisture content can retain viability for more than five to six years if stored up to 10°C temperature. Seed dormancy period is very short under ordinary storage conditions at ambient temperatures (about 35°C). Germination of untreated seeds takes about 7-8 days and soaks water for 24 hours prior to sowing, obtaining emergence in 3-4 days. Seedlings with epigeal germination. The present study includes observation of vivipary in *Hibiscus cannabinus* L. under in-situ condition. From the last week of May, Kenaf capsule begins to wither and turns brown with the advent of monsoon. In the first week of June, atmospheric moisture content increases. During incessant rainfall, the capsule gets wet and seeds begin to germinate inside the capsule which is attached to the floral axis of mother plant. The maximum ripened capsule appears to hold the tuft of seedlings and displays elongated hypocotyl with green leaves and white radicles (Plate 1, figures 3-5). The maximum number of seedlings per capsule, resulting from vivipary, is about 5-7, but very few are unviable. The capsules, bearing seedlings, finally get detached from floral axis and fall on wet soil and get established into plant (Plate 1, figure 6). This type of viviparous seedling recruitment, reported in in-situ study, is extremely uncommon and unexpected in *Hibiscus cannabinus* L., a non-mangrove plant of tropical rain forests.

DISCUSSION

Ecological criteria like temperature, humidity, light or darkness are important factors in viviparous germination. In addition, seed germination is also

Plate 1

1-6. *Hibiscus cannabinus* L. (Malvaceae). 1. Flowering twig. 2. Fruiting twig. 3-5. Various stages of vivipary on mother plant. 6. Plant grown from viviparous seedling.

affected by seed size and physiological factors such as production and function of phytohormones, osmotic gradients, etc. (Mayer & Poljakoff-Mayber 1963, Singh & Sharma 1972, Rao 1988, Carberry & Abrecht 1990, Murali 1997, Farnsworth 2000, D'Rozario et al. 2001). In the present study, vivipary is noted repeatedly in *Hibiscus cannabinus* L. (a non-mangrove plant) and is favoured by excessive atmospheric moisture or wet condition and humidity. The present in-situ study shows that the origin of vivipary depends upon the environmental conditions, specially humidity and temperatures, prevailing in island ecosystem. Soils also affect the production of level of phytohormones in non-mangrove Kenaf plant. We believe that Kenaf plant shifts towards vivipary, an efficient mechanism favouring germination and seedling establishment. It is relatively unusual natural event in mangrove plants and is interpreted as specialized trait of biological significance. It is therefore concluded that vivipary in kenaf is a potential reproduction strategy in island ecosystem.

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