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Seed abortion in *Melilotus indicus* (L.) All

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ABSTRACT

The reproductive biology of *Melilotus indicus* exhibits many uncommon and interesting features during its microsporogenesis and seed development. Small ovary of this wild valuable fodder legume possesses two superimposed ovules and only one of these develops into a small hard seed while the other aborts the midway and therefore, mature pod are single seeded.

Keywords: *Melilotus indicus,* seed abortion, fodder legume

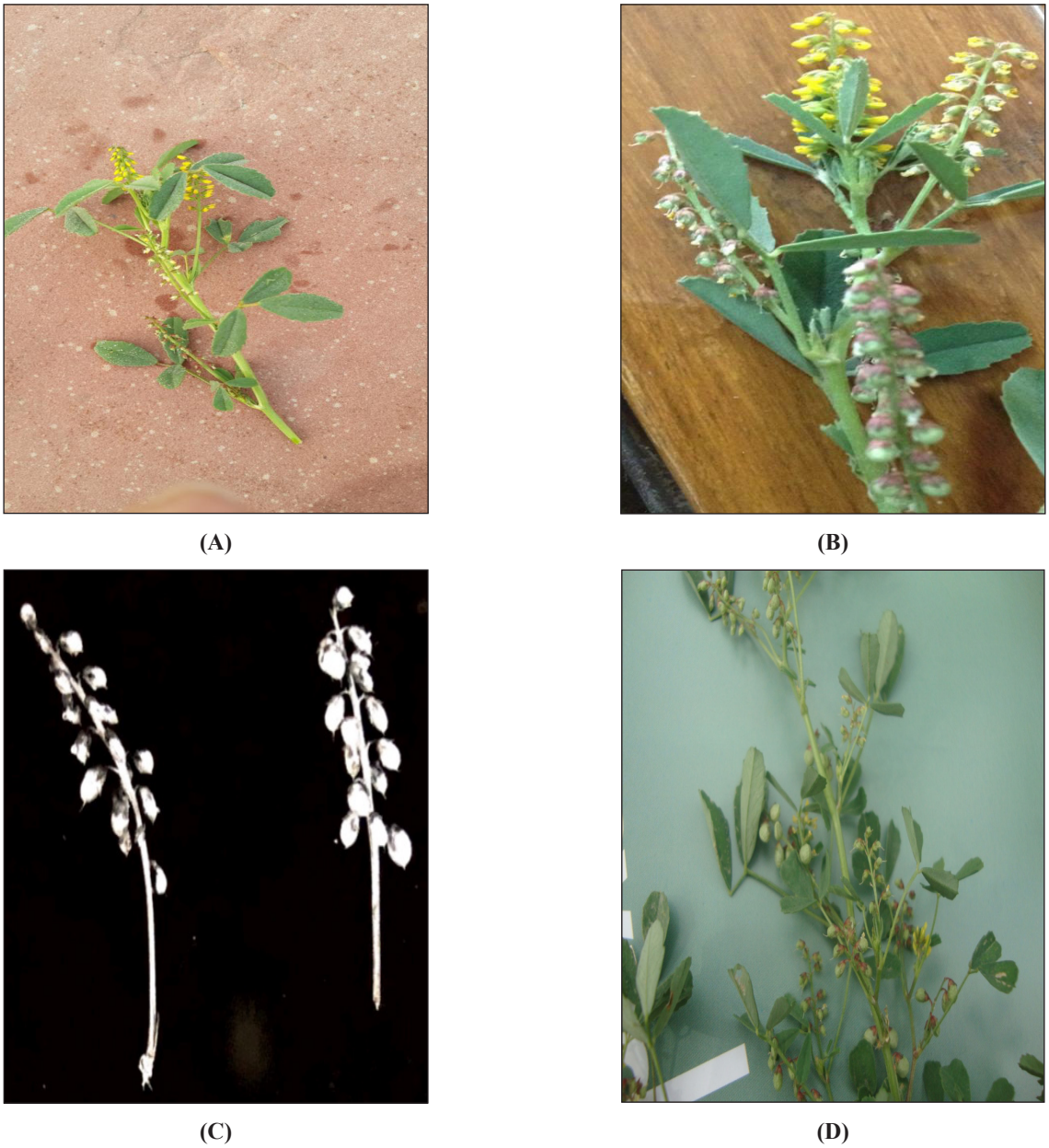
Legumes serve as the best and cheapest source of plant proteins, hence an integral part of our vegetarian diet. These plants play another significant ecological role because of their unique ability of nitrogen fixation maintaining soil fertility. Members of the family Fabaceae therefore, have been a favorite material for embryological, physiological, ecological and molecular studies. Being one of the largest groups of plants it shows a variation in its reproductive biology. *Melilotus indicus,* a wild fodder legume that produces yellow flowers in winter months, exhibits many interesting features at light and electron microscopic levels during its embryogeny (Gautam *et al.* 1991; Gautam, 2006). The small, spindle shaped ovary is covered with tiny glandular trichomes that persist well after fertilization and have a defensive function. *M. indicus* produces two superimposed campylotropous, bitegmic ovules. Interestingly, only one of these ovules matures into a hard seed while the other ovule aborts at an early stage. The hard seed coat derives from outer integument in a sequential manner and the inner integument is consumed during the ontogeny. The pod is single seeded and the seed shows insignificant enlargement. The cause and significance of seed abortion in *M. indicus* will be discussed in the present study.

MATERIALS AND METHODS

Young buds of *Melilotus indicus* (L.) All were collected from the botanical garden, University of Delhi, Delhi. The usual method of material fixation in 10% aqueous acrolein, dehydration, infiltration and embedding in glycol methacrylate was followed (Feder & O' Brien, 1968). Two-micron thick sections were cut on AO Spensor rotary Micro-tome using glass knives. Periodic acid Schiff's reagent (Jensen, 1962) and Coomassie brilliant blue (Fisher, 1968) stains were used to localize insoluble polysaccharides and total proteins respectively.

OBSERVATIONS

Flowering of *Melilotus indicus* initiates in February and continues up to March end in Delhi. Small bright yellow 20-30 papilionaceous flowers appear in axillary racemes (Fig.1 A). Almost 100% of flowers fertilize successfully (Fig.1 B, C) and produce fruits as one seeded tiny pods (Fig.1D). The spindle-shaped ovary with glandular hair on its surface encloses two superimposed ovules on marginal placenta. Ovules are bitegmic and campylotropous (Fig.2 A, B). Embryo -sac development follows the Polygonum- type (Fig.2 B, C) and the embryo development is of Solanad type. The abortion of one of the ovules was interesting to note. Both ovules enter the normal course of embryo development after fertilization but the terminal ovule degenerates soon (Fig. 2D) while the basal ovule matures into a normal hard seed that entirely occupies the pod.



(A) **(B)**

(C) **(D)**

Fig. 1. (A, B) Plant with flowers and fruits, **(C, D)** Fruiting axis with single seeded pods

RESULTS AND DISCUSSION

The abortion of seeds in legumes where ovules are arranged in rows on the marginal placenta is reported in many cases (Teixeira *et al.* 2006). The ovules located farthest from the stigma and style are fertilized at the end due to their position and are more commonly exhibit immature abortion of seeds (Hossaert & Valero, 1988; Nakamura, 1988; Bawa & Bukley, 1989). According to Kozlowski & Pallardy (1997) temperature at the time of flowering affects the fruit and seed set in many woody plants. In *Pongamia pinnata,* only one the stigmatic ovule develops into seed and the peduncular ovule aborts as a result of competition for maternal nutrients (Arathi *et al*. 1999).

Seed abortion depends on the supply of resources for seed development in *Cassia fasciculata* (Lee & Bazzaz, 1982; Lee, 1988) and in *Caesalpinia gilliesii* (Calvino, 2014). In *Bauhinia ungulata* around 70 % of the ovules within fruits fail to produce mature seeds. The ovule located at the basal end of the ovary has the lowest probability of fertilization

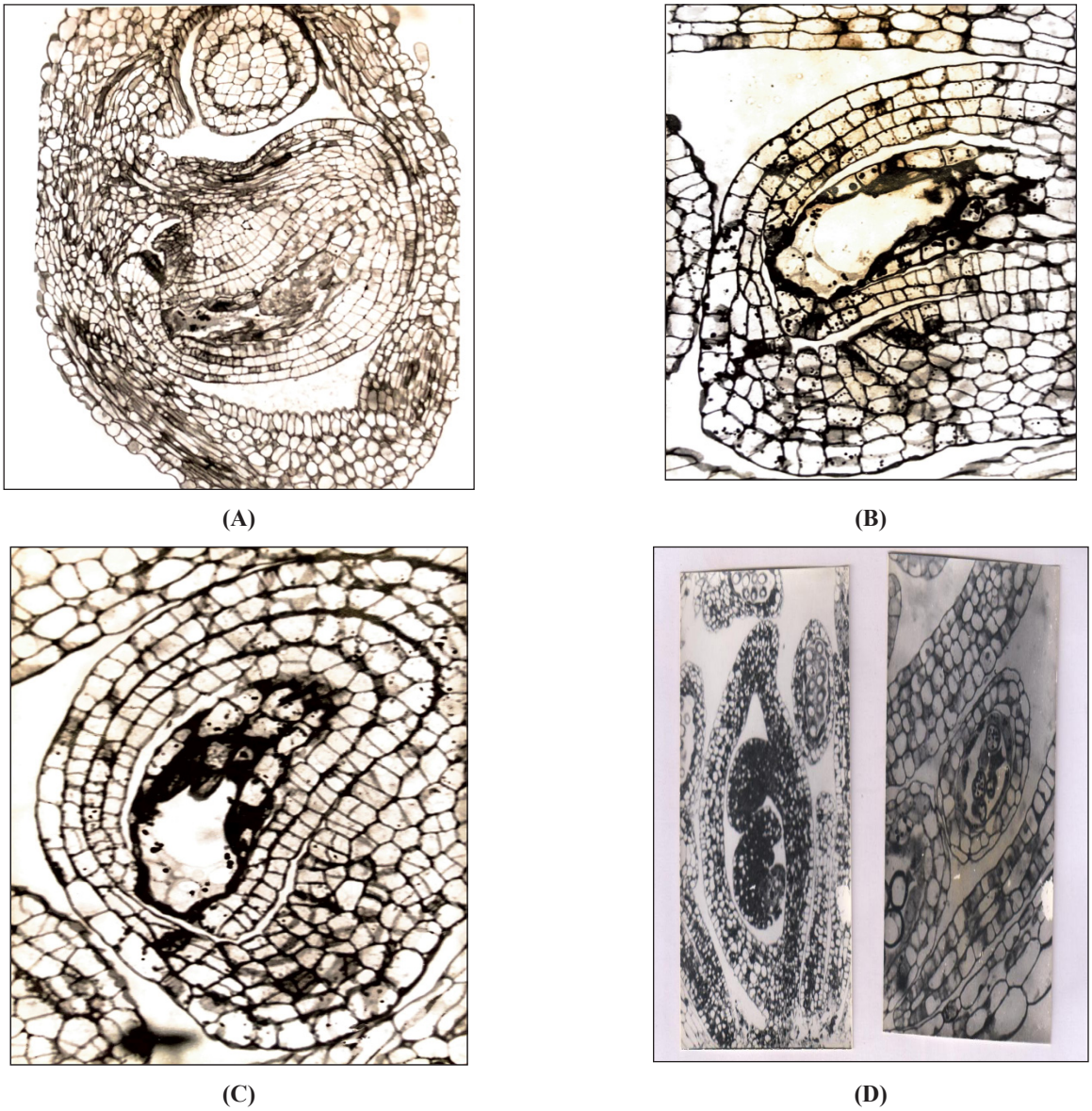


Fig. 1. (A, B) Plant with flowers and fruits, **(C, D)** Fruiting axis with single seeded pods

and therefore, the seed maturationon (Mena-Ali & Rocha, 2005). In *Melilotus indicus* the closeness of basal, peduncular seed to the maternal placenta seems to be responsible for the starvation and abortion of stigmatic seed as also reported in *Cassia* (Lee, 1988). The development of one seeded pods is a smart strategy adopted by *M. indicus* that helps in better dispersal and avoids competition between seedlings for better survival in wild.

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