Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231-6345 (Online)
An Online International Journal Available at http://www.cibtech.org/jls.htm
2012 Vol. 2 (1) January-March, pp. 27-29/Bhattacharya and Sinha
Research Article

FLOWER – INSECT INTERACTION IN *JATROPHA GOSSYPIFOLIA* LINN.

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ABSTRACT
The present observation highlights on floral biology, flower visitors, pollination and fruit set of *Jatropha gossypifolia* L. of the family Euphorbiaceae. Forenoon pattern of flower anthesis was noticed. Pollen anthesis took place after flower anthesis. Each male flower produced 2341±189 pollen grains. Nectar secretion coincided with pollen presentation time. The flowers attracted the insect visitors of Hymenoptera (*Apis dorsata, A. florea, A. mellifera, Eumenes conica, and Vespa* sp) and Coleoptera (Beetles). Among the different insect flower visitors, *Apis* spp were frequent to pollinate the flowers.

Key Words: *Flower, Insects, Pollination, Jatropha Gossypifolia*

INTRODUCTION
Floral visitors are dependent upon nectar and pollen for their nutrition. Among different groups of flower visitors' insects are predominant. They visit to million of flowers and have been considered as potential pollinators following the rules governing co-evolution and pollination systems between conspecific plants and their pollinators. Lack of adequate floral resources may lead to weak interaction between plants and their appropriate pollinators, which in turn causes lower limits of flower visits and pollination success. Faegri and van der Pijl (1979) provided a number of examples on floral visitors, floral resources and its dependence upon pollination and fruit set. There might have a correlation between nectar secretion and entomophilous nature of diocious plants. Role of foraging dynamics and floral sex allocation on fruit set of certain plants were documented by Willis and Kevan (1995) and Brunet and Charlesworth (1995) respectively. Dafni and Giurta (1999) reported about functional significance of plant-pollinator interactions in relation to floral symmetry and nectar guides. Lughadha and Proenca (1996) showed increased pollinators population in presence of nectar and pollen abundance. Strauss (1997) showed the relation between floral characters, pollinators and plant fitness; while Dafni and Giurta (1999) enriched the literature by focusing the functional ecology of floral guides in relation to insect behaviour and vision. The present observation has been done in order to know the floral biology, flower visitors, pollination and fruit set of *Jatropha gossypifolia* L. (Euphorbiaceae), a medicinally important plant and also to determine the relationship between floral features and flower visitors for preliminary documentation to pursue further research on reproductive biology of this selected taxon.

MATERIALS AND METHODS
The flower visitors observed to visit the flowers of *J. gossypifolia* were caught and identified on self-expertise basis consulting with reference materials. Flower anthesis was noticed by tagging ten flowering shoots from ten different plants, which were observed at 1 h intervals for 24 hrs. To study the pollen anthesis almost mature anthers were sectioned and immediately covered with cover glass before observation. Pollen production, floral resource measurements and other floral characters were determined following Dafni (1992) and Kearns and Inouye (1993). The fruit-set was estimated as per the process of Kearns and Inouye (1993). A total of 160 censuses (2 minutes each at intervals of 15 minutes) were made to record the mean durations of visits and mean abundance (%) of different flower visitors. Foraging behaviours of flower visitors were observed visually.

RESULTS AND DISCUSSION

Jatropha gossypifolia L. (Euphorbiaceae), a medicinal plant grows abundantly in West Bengal. It flowers throughout the year with a peak season in July-September. The unisexual, epigynous, regular, nectariferous, greenish white flowers (20-107 male and 2-19 female per inflorescence) show forenoon (800-1200 hrs) pattern of anthesis with subsequent pollen release. Each flower produced 2341±189 pollen grains. Floral rewards presentation starts after flower opening (Table – 1). At this time insects of Hymenoptera and Coleoptera pay visits with different modes of behaviour and vision to flowers (Table-2). With regard to floral structure and floral visitors' adaptive features, it is stated that honeybees (*Apis dorsata*, *A. florea*, *A. mellifera*) are effective pollinators. *Eumenes*, *Vespa* and beetles are not considered as effective pollinators as the pollination syndromes of these visitors do not match with *Jatropha gossypifolia* flower. Both male and female flowers showed forenoon pattern of anthesis and attracted different insect visitors. Among these *Apis dorsata, A. florea* and *A. mellifera* were most common and effective pollinators with regard to the floral structure and pollination syndrome. The present study showed variation among honeybees in the duration of flower visits and their abundance (Table – 2). Anthesis pattern, visitors' attraction, and pollinators' discrimination are related to floral features and availability of maternal resources (Faegri and van der Pijl, 1979; Wolfe and Barrett, 1987; Endress, 1994; Strauss, 1997). Male-female flower ratio was approximately 4:1. A total of 2341±189 pollen grains are produced per flower. The ratio of male and female flowers per inflorescence, even per tree of any dioecious or monoecious plant may not be considered as conservative indices, because the floral bud initiation, flower maturation and production, although genetically regulated; and should have constancy, yet it may have dependence upon nutrient contents, various physical and physiological factors, and possibly by other adaptive features of a plant acclimatized in a specific micro-environment. According to Niesenbaum (1992) and Brunet and Charlesworth (1995) the sex ratio and floral sex allocation are not conservative, rather sequentially variable.

Table 1: Floral characters of *Jatropha gossipifolia* Linn. Floral characters Observations

Flowering period	**July-September**
Flower type	Unisexual, regular, epigynous and nectariferous
Flower colour	Greenish white
Mean No. of male flowers per inflorescence	49±1.3, range 20-107
Mean No. of female flowers per inflorescence	12.2±0.75, range 2-19
Mean No. of inflorescence/branch	c. 4.62, range 3-8
Flower odour	Present
Flower anthesis time (hrs.)	800-1200
Pollen anthesis time (hrs.)	830-1230
Mean No. of anthers/male flower	c.12
Mean No. of pollens/anther	c.195, range 90-250
Mean no. of pollens/flower	2341±189
Mean fruit-set/inflorescence	c.6.5±0.95

A male-female competition may generate to attract flower visitors and finally it may affect the adaptive radiation of pollinating system and success in this plant. If the primary floral reward competition continues in a plant during whole reproductive season, then flower visitors may get preferences of choosing the flowers, extend their visit durations, increase foraging efficiency, extract more rewards, gain

additional energy, increase pollen transfer ability and deposit greater amount of pollen leading to increased pollination success. Forage behaviour of honeybees is in accordance with Dafni and Giurta (1999).

Table 2: Flower visitors of *Jatropha gossypifolia* Linn.

Floral visitor	Visit duration (Seconds)	Mean abundance (%)	Forage type
Apis dorsata	7-15 (c.10.2)	29	Pollen, Nectar
A.florea	11-30 (c.16.7)	24	Pollen, Nectar
A.mellifera	15-35 (c.21)	9	Pollen, Nectar
Eumenes conica	4-7 (c.4.2)	20	Nectar
Vespa sp	3-6 (c.2.3)	6	Nectar
Beetle	40-60(c.45)	12	Pollen, Nectar

Even, the functional ecology of male-female competition with regard to floral rewards offering to visitors and adaptability to pollination and plant fitness may attain a pre-requisite role in flower evolution and plant-insect interaction in this plant.

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