

REPRODUCTIVE BIOLOGY OF *ABUTILON FRUTICOSUM* GUILL. & PERR.

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ABSTRACT

The reproductive biology of *Abutilon fruticosum* Guill. & Perr., in term of pollen ovule ratio, insect's behaviour and breeding system has been carried out. *Abutilon fruticosum* is self compatible. Breeding experiments and pollen ovule ratio indicate it is a facultative autogamous taxon. Both insect mediated and direct autogamy seems to be the rule. The flower is regularly visited by insects. Mainly bees are found to be the main pollinators whereas, butterflies are just visitors.

Key-words: *Abutilon fruticosum*, autogamy, reproductive biology,

INTRODUCTION

Knowledge of breeding system is one of the most important amongst all of the approaches available to taxonomy as it does not only affect the pattern of group variation but also evolutionary potentialities of the group concerned (Davis and Heywood, 1963). *Abutilon fruticosum* Guill. & Perr., belongs to the family Malvaceae. There are various reports available on the reproductive biology of different taxa of this family. Kadyrova *et al.* (1980) observed the growth of cotton pollen tubes on an artificial nutrient medium. Ugborogho (1982) studied the floral mechanisms as an aid to the classification of the *Sida rhombifolia* complex. Mcdad and Davidar (1984) studied the determinants of fruits and seed set in *Pavonia dasypetala*. Similarly Dawar *et al.* (1994) confirm the hybridization in *Sida ovata* complex by using the evidence from breeding system.

Apart from the above investigation there are no specific report available on reproductive biology of *A. fruticosum*. The present study is carried out to confirm the mode of pollination and fruit production of *A. fruticosum*.

MATERIALS AND METHODS

Study Sites:

All experiments and field observations were conducted in following population within Karachi University campus (a) behind the office Dean faculty of Science (b) between Botany and Chemistry departments (c) opposite to the road of Staff Club (d) For insects behaviour observations were also made from Hamdard University campus and Bund Murad near Hub Dam.

Breeding System:

Breeding experiments were performed in all populations within Karachi University campus. Following treatments were given in flowering bud stage (N=20)

- (i) Control (Open pollination): Buds were tagged and left to study the normal seed set.
- (ii) Self pollination:
 - (a) Direct autogamy: Buds were tagged and left to test for direct autogamy.
 - (b) Indirect autogamy: Pollinated by hand and bagged to test for indirect autogamy.
- (iii) Apomixis : Buds were emasculated and bagged to test for apomixis.
- (iv) Cross pollination:
 - a) Geitonogamy: Pollinated by hand with pollen from different flowers of the same plant and bagged to test the geitonogamy.
 - b) Xenogamy: Cross pollinated by hand with pollen grains of different plants to test the xenogamy.

Data Analysis:

Data for percent fruit set were analysed among different pollination treatments by one way classification . While the significant results were further analysed by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Pollen-Ovule Ratio:

The pollen ovule ratio was determined by dividing the total number of pollen grains/flower by the total number of ovules/ovary. The flower buds were collected prior to anthesis and the following counts were made (1) total no. of anthers/flower (2) Total number of pollen grains/anther (3) Number. of ovaries/ flower (4) Number of ovules/flower.

Insect's behaviour:

Flower visitors (insects) were observed and their behaviour was recorded. Insects were collected by hand net and rapidly dispatched with chloloform, transferred individually to clean vials and transported to laboratory. Pollen load was determined by removing the pollen grains from pollinators with bristled brush on glass slides. The brush was carefully cleaned between the pollen load removal to avoid contamination.

RESULTS AND DISCUSSION

The percentage of fruit set among the different pollination treatments was significantly different at $p < 0.01$. Direct autogamy resulted in higher fruit setting than the other treatments and xenogamy significantly reduced the fruit setting respectively as compared to all of the other treatments (Table 1).

Different types of insects including Lepidoptera, and Hymenoptera were observed on the flowers of *Abutilon fruticosum* certain Lepidopteras namely, *Pieris rapae* (Fig.1A), *Eurema* sp. *Coletis* sp. and *Sylepta deurogata*, regulay visits the flowers and behaved in same manner. They were merely visitors as not a single pollen grain found to be attached on their body parts. They usually alight on petals, insert proboscis in nectaries (at the base of sepals) and suck the nectar without coming into contact with sexual parts.

Some of the Hymenopteras were the main pollinators and can be devided into two groups on the basis of their foraging behavior

Group A: This group includes the *Vespa* sp. . It hovers around the flower and during hovering it collects the pollen with the forelegs and then lands on the petals and sucks the nectar by inserting proboscis in the nectaries (Fig.1B).

Group B: It includes certain Hymenopteras namely *Chrysis* sp., *Bembix* sp. and *Bombus* sp., all of these share same foraging behavior . Insects directly land on the staminal column of the flower and grasp it with the legs. From there, insert their proboscis in the nectaries. Insects usually explore all the 5 nectaries of a flower by revolving or twisting on the staminal column. During nectar sucking pollen also get deposited on the ventral side of thorax and abdomen along with the legs.

Table 1. Effect of different pollination treatment on fruit set in *Abutilon fruticosum*.

One Way ANOVA					Duncan's Multiple Range Test		
Sv	Df	SS	MS	F Value	Treatment	Rank	Mean
Treatments	4	13480	2714	22.20**	Control	1	71a
Error	19	16020	102		Direct autogamy	2	69b
Total	23	90882			Indirect autogamy	3	62c
					Geitonogamy	4	41d
					Xenogamy	5	38e

** = $P < 0.01$

Table 2. Pollen ovule Ratio of *Abutilon fruticosum*.

No. of Flowers Studied	Average No. of Anthers/Flowers	Average No. of Pollen Grains/Anther	Average No. of Pollen Grains/Flower	Average No. of Ovules/Flower	Pollen Ovule Ratio
20	74.55±13.63	181.85±19.95	13542.65±209.68	50.5±7.363	268.56±28.69

± Standard error

Breeding experiments of *Abutilon fruticosum* indicates that fruit production is significantly ($p < 0.01$) higher in selfing as compared to cross pollination. Whereas, pollen ovule ratio showed that this taxon is facultative autogamous. So there seems to be a good correlation between pollen ovule ratio and breeding system and this is also in accordance with the view of Cruden (1976) that pollen ovule ratio is general indicator of breeding system.

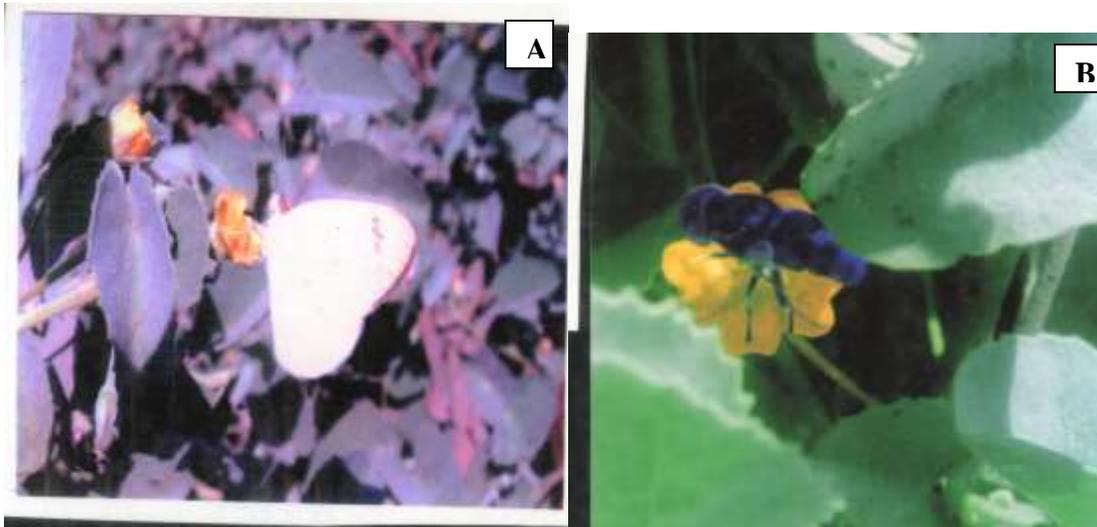


Fig.1. A: *Pieris* sp. Sucking the nectar from the flower of *Abutilon fruticosum*; B: *Vespa* sp. Sucking the nectar from the flower of *Abutilon fruticosum*

Flowers of *A. fruticosum* were regularly visited by some Hymenopteras and Lepidopteras but no pollen load was recorded from the bodies of Lepidopteras indicating that these were not pollinators. Hagerup (1951) has also pointed out that even regular insect visit to a flower do not always mean that the particular insect is the pollinator of that flower there is always a chance that some other less conspicuous insect may carry out the pollination. So Lepidopteras were the main visitors. Similar observations were also carried out by Gottsberger (1967) on some Brazilian genera of Malvaceae and Dawar *et al.* (1994) on *Sida ovata* complex. The pollen-ovule ratio was 268.56 ± 28.69 (Table 2). According to Cruden (1977), the species with this p/o value seems to be facultative autogamous. From the ongoing discussion it is concluded that *A. fruticosum* enjoys both direct and indirect autogamy.

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