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POLLINATING MECHANISM AND BREEDING SYSTEM IN SOME SPECIES OF THE GENUS *CLERODENDRUM* L.[1]

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ABSTRACT

Pollinating mechanism and breeding system were studied in six species of the genus *Clerodendrum* L. belonging to the family Verbenaceae. The species can be categorised into two groups : (a) species forming normal seeds by open pollination which germinate regularly and (b) species froming normal looking seeds by natural pollination which, however, do not germinate at all. Sparse/scanty seed setting is partly, if not primarily, due to failure of pollen grains to germinate on the stigma in direct or reciprocal crosses, though pollen stainability percentages vary from 31% to 88% in *C. phlomidis* and *C. inarme* respectively. Stigmatic surface too has no adverse effect on pollen germination. Crossability barrier is strong as no hybridization experiments among the species were effective.

INTRODUCTION

The genus *Clerodendrum* L. of the family Verbenaceae is a plant of eastern hemisphere and introduced from China (Benson, 1957). They are shrubs, green house climbers and ornamental plants grown for showy flowers. Fruits are formed sparsely off and on in most of the species. Some of the species form normal seeds by open pollination which germinate regularly, while others form a very small percentage of normal looking seeds by natural pollination, which, however, do not germinate. The importance of breeding system is evident in evolutionary biology. Variability is controlled by breeding system of which pollinating mechanism forms an intergal component (Roy, 1972). In view of the poor fruit and seed setting, pollinating mechanism and breeding system were studied to get some idea regarding the hazard in fertilization and post fertilization development (Elliot, 1958).

MATERIALS AND METHODS

Altogether six species of the genus *Clerodendrum* L. were studied. They are *C. inerme* Gaertn, *C. phlomidis* L.f., *C. speciosum* D'Ombrain, *C. thomsonae* Balfcur, *C. siphonanthus* R. Br. and *C. infortunatum* Gaertn.

To study the pollinating mechanism, mature styles were fixed in acetic alcohol mixture for 24 hours, softened in lactic acid for 2 minutes, washed and then mounted under a cover glass in a drop of fresh lactic acid (Sanyal, 1959).

Direct and reciprocal cross pollinated styles were collected after 12, 24, 36 and 48 hours and stigmas were squashed in 1% aceto-carmine. Pollinations were also made on decapitated stigma in order to ascertain if the stigma has any adverse influence for pollen germination.

Estimate of pollen fertility was calculated on the basis of pollen stainability (Marks, 1952).

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Cross pollinations were made in order to study the nature of self-incompatibility/compatibility within the species and to evaluate the nature of breeding system.

Hybridizations were made between the species blooming synchronously. The techniques of hybridizations followed in the present study were same as those described by Elliot (1958). Pollen grains from dehisced anthers of the desired parent were dusted on the stigma of emasculated buds at appropriate time and interval.

OBSERVATIONS

Fruit formation and seed setting is not uniform in the species of *Clerodendrum* investigated here (Table I). Fruits were rarely seen in *C. speciosum* and *C. phlomidis*. Fruit formation is highest in *C. infortunatum*. Most of the species investigated here are ornamental and propagate vegetatively. Flowers in *Clerodendrum* are bisexual with four epipetalous stamens and the pistil has a long bifid stigma. Generally, anthers dehisce within 8-12 hours after the opening of the flowers depending on the temperature and humidity. At that stage, stigmas remain immature. After 24 hours of anthesis, stigmas mature. From the position of anthers and stigma and spirally coiled condition of filaments and styles one would expect self-pollination, but actually the flowers are mostly cross-pollinated because of protandrous condition. Besides, the time gap between maturation of pollen grains and stigmas is also a factor which determines the extent of crossing.

Mature stigma squash did not show pollen germination. No pollen grain germination was recorded on cross pollinated stigmatic surface. Also, pollination made on decapitated mature stigma did not show any germintaing pollen grains.

In aceto-carmine, 88.0%, 44.07%, 84.3%, 49.6%, 32.44% and 31.95% of pollen grains were stainable in *C. inerme*, *C. infortunatum*, *C. siphonanthus*, *C. thomsonae*, *C. speciosum* and *C. phlomidis* respectively (Table I).

TABLE I

BLOOMING PERIOD, POLLEN STAINABILITY PERCENTAGE AND SEED SET PERCENTAGE IN SIX SPECIES OF THE GENUS *CLERODENDRUM* L.

Species	Blooming period	Pollen stainability percentage	Seet set Percentage
C. phlomidis	Dec.—March	31.95%	3.6%
C. speciosum	Dec.—March	32.44%	12.3%
C. infortunatum	Feb.—June	44.07%	78.6%
C. thomsonae	June—January	49.6%	10.7%
C. siphonanthus	Oct.—February	84.3%	18.8%
C. inerme	April—Oct.	88.0%	26.5%

Hybridizations between species in all combinations resulted in shrunken and dried ovaries. No fruit formation was observed in any of the cross combinations.

DISCUSSION

In the six species of *Clerodendrum* pollinating mechanism was studied and on this basis the species can be grouped in two categories : (*a*) those that form normal seeds by open pollination which germinate regularly ; and (*b*) those that form very small percentage of normal looking seeds by natural pollination which do not germinate. In the first category are the species *C. infortunatum* and *C. inerme*, in which seed set percentage was 78.6% and 27.5% respectively (Table I). In the latter category are the species *C. thomsonae*, *C. speciosum*, *C. phlomidis* and *C. siphonanthus* and the seed formed was 10.7%, 12.3%, 3.6% and 18.8% respectively, when the flowers are left open for cross pollination.

Taking the two groups of species together, it is evident that there is either self-incompatibility or gametic degeneration operating in some species. Since the seed setting is very scanty, the normal gametic fertility was determined by pollen stainability. Pollen fertility percentage ranges from 88.0% to 31.0% in *C. inerme* and *C. phlomidis* respectively. But when these pollen grains were dusted on the receptive stigma they did not germinate at all. It is well accepted that stainability of pollen grain is a gross indicator of good pollen but not an accurate criterion of its fertility or germinability. Hence, it may be concluded that there is something intrinsic in the species which has robbed them of their fertility. Pollinations made on decapitated stigmas revealed that stigmatic surface has no adverse effect on pollen germination. It may be noted that all these species propagate vegetatively. One can, therefore, safely visualise that the failure of seed setting is partly due to, if not primarily. failure of the pollen grains to germinate on the stigma. In fact, there is no reason to believe that egg formation is completely regular. Thus due to some disturbances in the normal egg formation or pollen grains, the normal process of fertilization of seed development fails. What looks like the rudimentary seed in scanty proportion in some of the species may just be the development of integument/nucellus due to stimulus of pollination, but not necessarily the formation of embryo. Why do the gametes in these species behave this way may be partly understood or explained by their chromosomal complements, pollen germination on synthetic media, embryological investigation etc. which is in progress and will be communicated later.

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