The Floral Biology of Cashew (*Anacardium occidentale* L.) in relation to Pollination and Fruit set

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pollination and fruit set

Summary

This study of the floral biology of cashew (Anacardium occidentale L.), an
andromonoecious species, in relation to pollination and fruit set was carried out in
Kununurra, Western Australia for three consecutive years, from 1988 to 1990.
The reproductive phase occurred in the dry season between June and November, and
flowering started after vegetative flushing. There were more male than
hermaphrodite flowers in a panicle, and the two flower types had different opening
patterns. The hermaphrodite flowers dominated in the first two weeks but were
replaced by male flowers from week three onward. Diurnal opening patterns of
hermaphrodite and male flowers were variable but peak opening was generally in the
morning. The number of open hermaphrodite flowers was correlated with initial and
final fruit set. Premature fruit drop peaked in weeks five and six after flower
opening. Means of hermaphrodite and male flowers, initial and final fruit set and
fruit shed per panicle were 95, 578, 29, 6, and 22 respectively.

The stigma had a thick continuous cuticle with little exudate. The stigmatic
papilla cells were mainly unicellular but occasionally bicellular or tricellular, and
the stigmatic exudate contained lipid, protein and carbohydrate. The style consisted
of three layers of epidermis, parenchymatous tissue with three vascular bundles in a
triangular arrangement, and solid transmitting tissue in the centre. The cashew
pistil has a dry stigma and a solid style.

Both hermaphrodite and male flowers have large and small stamens, all of
which produce pollen grains. The four pollen types were similar in morphological
structure being tricolpate of about 44.0 x 26.3 micron dimensions. There were
similar numbers of total pollen grains produced by hermaphrodite and male flowers,
but the pollen grains differed in viability and chemical composition. The pollen grains produced by the hermaphrodite flowers had a reduced capacity for in vivo pollen germination and ovule penetration, but higher contents of both sugars and amino acids than the pollen grains from the male flowers. It is suggested that the hermaphrodite flower pollen grains are adapted to provide a food source to attract insects to visit the flowers, while the male flower pollen grains are adapted for pollination.

Nectaries were located in both hermaphrodite and male flowers, at the junctions of the panicle branches, on the leaf petiole and on the young developing fruits. Floral and panicle nectar secretion was synchronised with pollen presentation. The hermaphrodite flower secreted a higher volume of nectar than the male, but the male floral nectar had the highest concentration of sucrose and amino acids. This suggests that male flowers are adapted to encourage insects to visit large numbers of flowers to collect sufficient pollen for effective pollen transfer. It is suggested that the function of the extrafloral nectar produced from panicle branches, leaves and young fruit is to attract ants to forage and protect the cashew trees from leaf, flower and fruit eating fauna.

The cashew pistil had a relatively short period of receptivity to pollen. For optimum fertility the hermaphrodite cashew flower had to be pollinated within the first three hours of anthesis. Pollen germination and pollen tube growth was rapid in the pistil with the majority of the pollen tubes reaching the base of the style by three hours after pollination. Pollen tube growth was slower in the ovary prior to penetration of the ovule. Ovule penetration had occurred twenty four hours after pollination.

There was a reduction in yield following selfing as compared with crossing, but this was not due to pollen-pistil incompatibility. It appears that postzygotic factors were probably the cause of premature fruit drop and yield reduction.
following self-pollination. Diallel analysis showed that the arrangement of compatible genotypes in the plantation is an important yield determinant. There was significant general combining ability (GCA) in all three experiments conducted but in only one experiment was specific combining ability (SCA) significant. The characters of high GCA values as male and female parents should be selected for, along with other flowering and fruiting criteria such as synchronised flowering, the ratio of hermaphrodite to male flowers, the number of initial and final fruits set per panicle and kernel characteristics.