Society for Growing Australian Plants (Queensland Region) Inc.

Cairns Branch
PO Box 199
Earlville Qld 4870

Newsletter No. 107
Feb 2011

Society Office Bearers

Chairperson	Tony Roberts	40 551 292
Vice Chairperson	Mary Gandini	40 542 190
Secretary	David Warmington	40 443 398
Treasurer	Robert Jago	40 552 266

Membership Subscriptions- Qld Region- (Please Note: New fee structure) Renewal $35.00, New Members $40, each additional member of household $2.00 **Student** - Renewal $23 New Members $28.00, **Cairns Branch Fees** -$10.00 Full Year

To access our Library for the loan of publications, please contact David Warmington
Newsletter Editor: Tony Roberts travelling_botanist@yahoo.com.au

Dates to remember

Cairns Branch Meetings and Excursions – third Saturday of each month.

NEXT MEETING AND EXCURSION

19 Feb 2011 Ivan Evans Walk (see below for directions).

Tablelands Branch Excursion– Sunday following the meeting on the fourth Wednesday of the month. Any queries please contact Chris Jaminon 4095 2882 or hjaminon@bigpond.com

Townsville Branch
General Meeting Please contact John Elliot: jw-elliott@aapt.net.au for more information

Crystal Ball

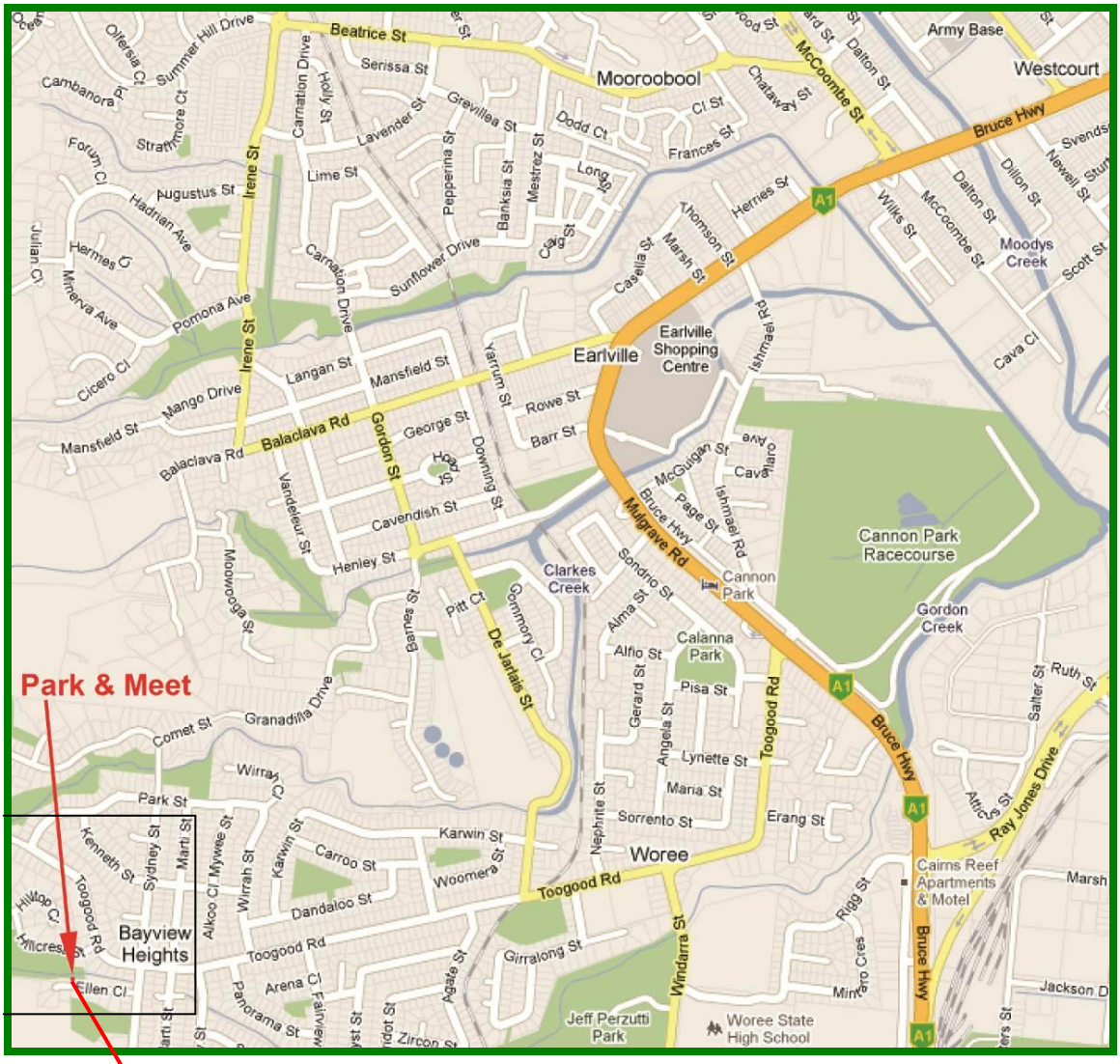
March 19th - AGM and ordinary meeting

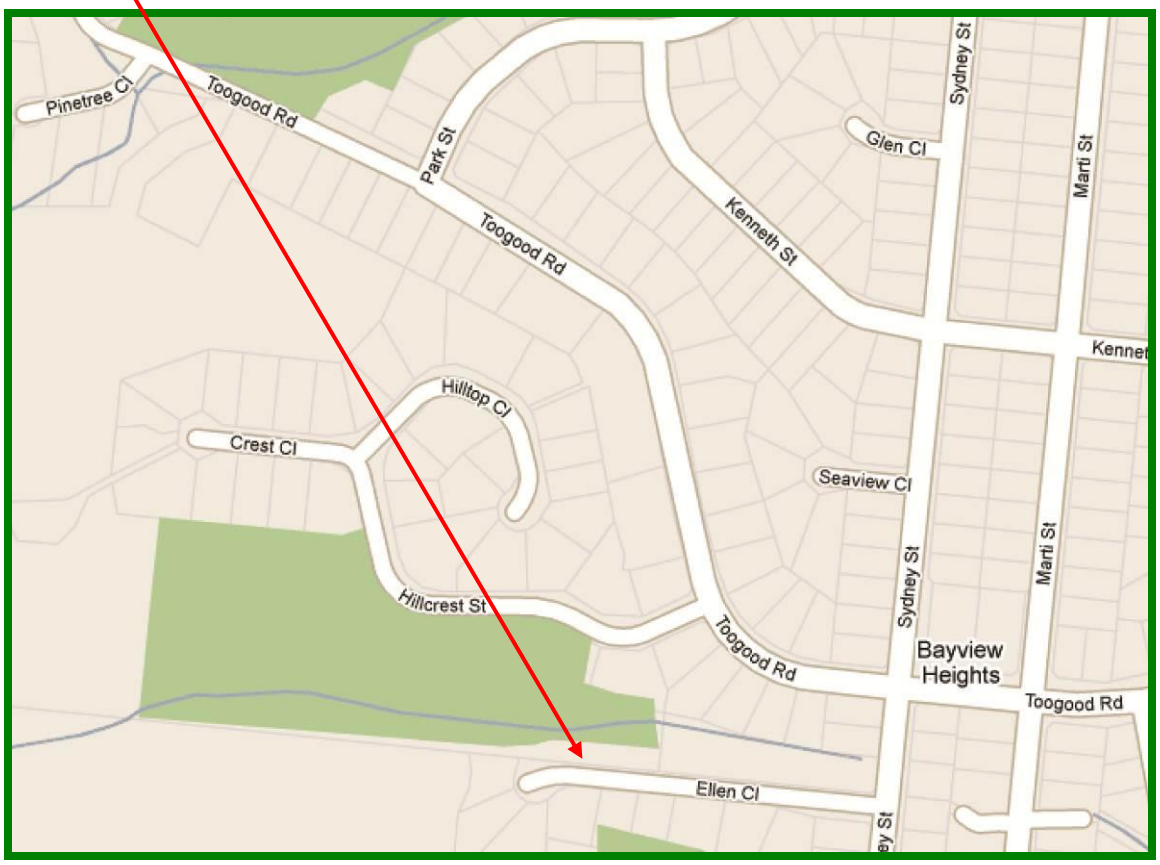
February

We will meet at 12:00 at the entrance to the Ivan Evans Walk on Ellen Close, Bayview Heights (See map next page). The vegetated trail wanders up to a scenic lookout, offering views over Cairns and Trinity Bay, then heads back downhill to Toogood Rd.

YASI

Hope everyone survived Yasi with a minimum of damage. It could be interesting to compare what species we see that have succumbed to the storm. If you get a chance, note the damaged trees in your area and when we get together we can compare notes. We may be able to make some general recommendations with regard to species selection in cyclone prone areas.


Park & Meet
Beatrice St
Mooroobool
Westcourt
Army Base
Bruce Hwy
Irene St
Earlville
Earlville Shopping Centre
Balaclava Rd
Gordon St
Mulgrave Rd
Cannon Park Racecourse
Cannon Park
Clarkes Creek
Gordon Creek
Calanna Park
De Jarlais St
Toogood Rd
Woree
Bayview Heights
Cairns Reef Apartments & Motel
Ray Jones Drive
Windarra St
Jeff Perzutti Park
Woree State High School
Moodys Creek
Marsh


Pinetree Cl
Toogood Rd
Park St
Toogood Rd
Kenneth St
Sydney St
Glen Cl
Marti St
Hilltop Cl
Crest Cl
Seaview Cl
Hillcrest St
Toogood Rd
Sydney St
Marti St
Bayview Heights
Toogood Rd
Ellen Cl

Botany Online

Recently, several important products have been made freely available on the WWW. The three I feature in this issue should be useful to us all, to some degree.

Australian Tropical Rainforest Plants Edition 6 (RFK6)

This is the latest iteration of the RFK. It has been updated to include herbs, palms, mistletoes and pandans, with most flowering plant species present in rainforest of northern Australia. It includes 2553 species in 175 families, of trees, shrubs, vines, forbs, grasses and sedges, epiphytes, palms and pandans.

Probably the most significant update though, is its conversion to the Lucid platform. Operation is a little different to the old system but easily grasped within a couple of minutes of use if you're familiar with the old system.

The key is available at:
http://www.cpbr.gov.au/cpbr/cd-keys/rfk/index.html

Australian Tropical Rainforest Orchids.

This product is a Lucid based, identification key to the 224 orchid species currently recognised in northern Australia's rainforests. It is described as the orchid module of the *Australian Tropical Rainforest Key* (RFK) The key is available at:

http://www.cpbr.gov.au/cpbr/cd-keys/orfk/index.html

Census of the Queensland Flora 2010

This publication provides an authoritative published list of all the known native and naturalised species of plants, algae and lichens in Queensland, updated from the previous listing (Bostock & Holland 2007). It is presented in PDF format which when opened in most of the available PDF readers, facilitates easy searching via the program's search button.

This publication is available at:

http://www.derm.qld.gov.au/wildlife-ecosystems/plants/pdf/qld-flora-census.pdf

Meet the Locals

A rather interesting plant occurs in abundance on Mt Whitfield but usually goes unnoticed due to its distribution, flowering time and the fact that it 'dies back' during the dry season.

Tacca leontopetaloides (the native bat plant or Polynesian arrowroot) occurs in the family Taccaceae within the order Dioscoreales.

Taccaceae, is a small, widespread, tropical family (2 genera & 30sp) of herbaceous plants. They have perennial, tuberous rhizomes, large petiolate leaves that are often divided to several orders. The flowers are produced in umbels atop an elongated peduncle and are surrounded by large bracts.

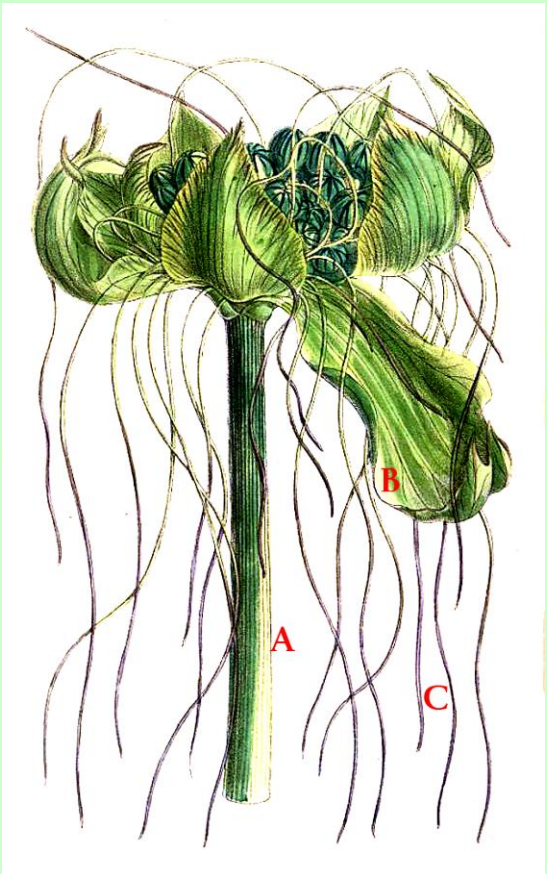
The Taccaceae of Mt Whitfield One species of Taccaceae occurs on Mt. Whitfield; in the genus *Tacca*.

Tacca leontopetaloides, Tacca, Arrowroot, Native Bat Plant, occurs in the tropics, eastward from Africa through Asia to the Pacific Islands. It is found in Australia from the Kimberly area of Western Australia across the Northern Territory to North Queensland, thriving particularly well in sandy soils.

It is an herbaceous plant consisting of one to three, thrice divided lamina on petioles to 1.5m tall and one or two inflorescences on scapes (A) to 1.7m tall.

The inflorescence is surrounded by up to 12 involucral bracts (B) and is arranged in a cymose umbel of usually 20 to 40 bisexual flowers. Filiform bracts (C) are present between flowers. The flowers are pedicellate with 3 sepals and 3 petals onto which the 6 stamens are inserted.

The fruit is a green, ribbed berry to 30 x 21mm containing numerous seeds.



The plant is deciduous, dying back to a subterranean tuber after fruiting.

The tuber of the Tacca is quite starchy, and is an important food source on some Pacific Islands, particularly those with only sandy soils (atolls and low islands). The plant was originally introduced to the Pacific Islands by the early Polynesian settlers, probably from South East Asia.

The tuber is grated or pounded into a container of water where the starch settles to the bottom. The starch is then rinsed over several days to rid it of its bitterness.

Medicinally in the past, the starch was used to cure diarrhoea and other digestive tract problems

Upcoming public seminars at ATFI (from Stuart Worboys)

Some members may be interested in upcoming public seminars to be held at the Australian Tropical Forests Institute, James Cook University Cairns Campus. Seminars take place at 3:30pm in E2.113 on the fourth Wednesday of each month, followed by drinks and nibbles in the ATFI Common Room

Feb 24 Gary Wilson, PhD candidate, Australian Tropical Herbarium and School of Marine & Tropical Biology, JCU Cairns. Carnivorous plants and crocodiles: chasing Nepenthes on Cape York

Mar 23 Bradley Smith, Research Strategy and Special Projects Manager, Division of Research and Innovation, JCU Cairns. Bangs for bucks – Structural change in science and research funding and policy in Australia.

April 27 Mike Heywood, Regional Program Manager, Tree Kangaroo Conservation Program, based at JCU Cairns. Huon Peninsula Conservation Initiative

May 25 Dr Mark Harrington, Postdoctoral Fellow, Australian Tropical Herbarium, JCU Cairns. Evolution of the Australian flora - insights from molecular data

June 22 Prof. David Rentz, School of Marine & Tropical Biology, JCU Cairns; Research Fellow ANIC, Canberra, and Research Fellow California Academy of Sciences. Some results from a recent Rapid Assessment Project in the Muller Range in Papua New Guinea

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A Student Paper from the Past

Pollination Techniques of *Tacca leontopetaloides* in North Queensland

Introduction

Tacca leontopetaloides occurs in the tropics, eastward from Africa through Asia to the Pacific Islands. It is found in Australia from the Kimberly area of Western Australia across the Northern Territory to North Queensland (Hewson, 1986).

Drenth (1972) claims that in the genus, flowers exhibit the syndrome of sapromyophily, and are consequentially pollinated by flies. He surmises the involucral and filiform bracts could act as additional attractants for these insects. Hewson (1986) however believes further studies of pollination mechanisms are needed.

The aim of this study was to describe the pollination techniques of *Tacca leontopetaloides* at two study sites in North Queensland.

Methods and Materials

Study Sites

The study was conducted at two sites in Far North Queensland, Australia (Figure 1):

Site 1, studied from 8th - 11th December 1998, was situated at ≈19º 01'S 146º 16'E, ten kilometres east of Paluma township along Mount Spec Road. The elevation was 300m ±50m and had an easterly aspect with a gradient from 1:3 to 1:1, and an average annual rainfall of approximately 2500mm. The site was open forest dominated by Eucalyptus, *Alstonia*, *Casuarina* and *Tristaniopsis* species. Site 1 contained about 1500 *Tacca leontopetaloides* plants. During this study period, steady light rain fell most of the time and the sun was continually obscured by cloud.

Site 2, studied from 13th January - 22nd February 1999, was situated at ≈16º 53'S 145º 44'E, one kilometre west of Cairns Airport on Mount Whitfield. The elevation was 200m ±100m and had an easterly to south-easterly aspect with a gradient from 1:5 to 1:1, and an average annual rainfall of approximately 2000mm. The site was open forest dominated by *Eucalyptus*, *Xanthorrhoea* and *Casuarina* species. Site 2 contained about 500 *Tacca leontopetaloides* plants. During this 41-day study period, precipitation was recorded on 28 days.

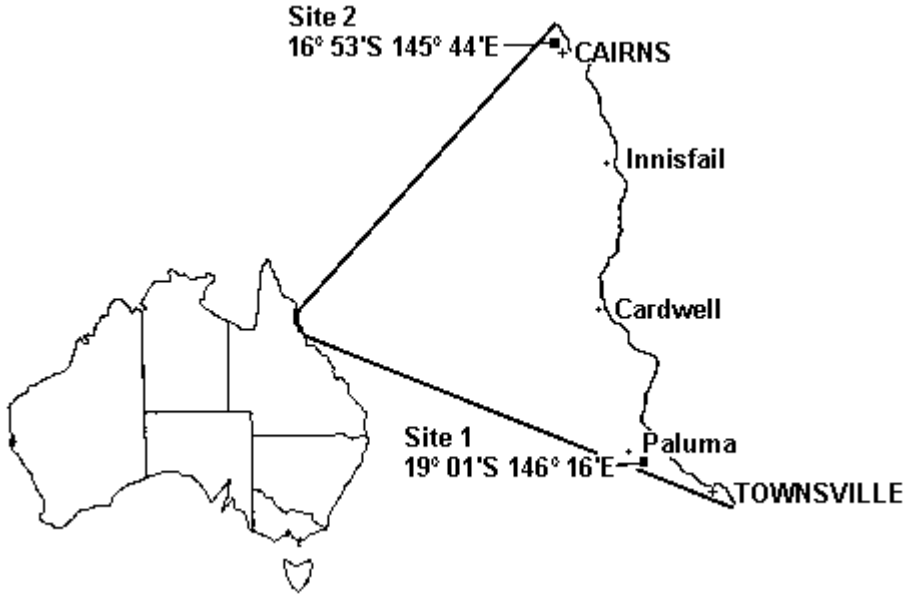

Figure 1. Location of the Study Sites

The Subject species

Tacca leontopetaloides is a herbaceous plant in the family Taccaceae. Plants usually bear one to three leaves on petioles to 1.5m tall and one or two inflorescences on scapes to 1.7m tall. The inflorescence is surrounded by up to 12 involucral bracts and is arranged in a cymose umbel of usually 20 to 40 bisexual flowers. Filiform bracts are present between flowers. The flowers are pedicellate with 3 sepals and 3 petals onto which the 6 stamens are inserted (Figure 2).

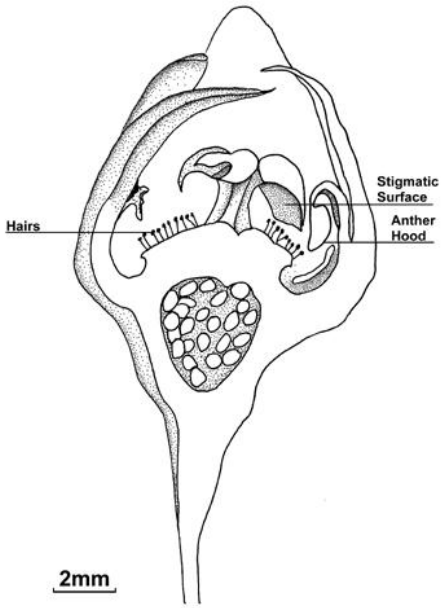

Figure 2. Flower of *Tacca leontopetaloides* (longitudinal section)

The plant is deciduous, dying back to a subterranean tuber after fruiting. About 50% of the plants at Study Site 1 were flowering during the study period. Plants at Study Site 2 started appearing in early January 1999 with the number in flower peaking in early February 1999.

Pollen reference

Pollen from a mature flower of *Tacca leontopetaloides* was mounted on a microscope slide and studied under a microscope. A pollen grain was drawn as a reference to assist in identifying pollen found on floral visitors.

Flower opening and floral visitors

At Study Site 1, 18 plants with inflorescences were tagged. The flowers of these tagged plants were observed for 15 minutes at hourly intervals over a period of two days, to; record opening times, note flowering process and trap floral visitors.

The flowers at Study Site 2 were observed intermittently over the 41-day study period to record the flowering process and to trap floral visitors. To increase the chance of trapping pollinating insects, flypaper was suspended between two inflorescences for seven days and the insects trapped were identified to class and inspected for pollen.

Experiments

Stigma Receptivity

Stigma receptivity was tested using a solution of 3% hydrogen peroxide placed on the stigmatic surface. Bubbling of the hydrogen peroxide solution indicates the presence of esterase which is present when the stigmatic surface is receptive (Anon, 1998). The stigmas were tested *in situ* due to the short style and false readings caused by cut tissue reacting with the solution.

Nectar Content of Flowers

Mature flowers were tested for nectar using calibrated microcapillary tubes

Anther Dehiscence

Immature flowers and those 1, 2, 3 and 4 days after initial opening were collected and dissected to determine the timing of anther dehiscence.

Estimation of Breeding System

The breeding system of a plant can be estimated by determining the mean pollen / ovule ratio (Anon, 1998). Table 1 below details the relationship between pollen / ovule ratio and breeding system. The mean Pollen / ovule ratio of two *Tacca leontopetaloides* flowers was calculated and compared to Table 1.

Breeding System	**Pollen to Ovule Ratio**
Cleistogamy	2.7 – 5.4
Obligate Autogamy	18.1 – 39.0
Facultative Autogamy	31.9 – 396.0
Facultative Xenogamy	244.7 – 2558.0
Obligate Xenogamy	2108.0 – 195525.0

Table 1. Estimation of Breeding System (from Anon, 1998, after Cruden)

Autogamy and Selfing Trial

To test the ability of the flowers to self-pollinate (autogamy) and their self-compatibility (selfing), ten inflorescences, containing only immature flowers, were bagged at Site 2 to eliminate possible pollinators. They were monitored and de-bagged once fertilisation was evident (swelling of the ovary). Bags and inflorescences were inspected for possible pollinators.

Results

The tagged inflorescences at Site 1 were found to consist of 17 to 55 flowers with a mean of 30. Mature flowers were open from ≈ 2359 – 1200. At Site 2, tagged inflorescences contained between 1 and 106 flowers with a mean of 22. Mature flowers at Site 2 opened from ≈ 1800 – 0600.

The flowers at both sites were green/brown in colour, flecked with purple, the involucral bracts, green edged with purple and the filiform bracts green / purple.

The flowers opened earlier and closed later on dull days. They responded to heavy rain by closing.

During the study periods, 3 floral visitors were observed: 2 *Diptera* and 1 *Coleoptera*. The flypaper trapped possible floral visitors from *Diptera*, *Hymenoptera*, *Coleoptera* and *Araneae* classes. No actual or possible (from the flypaper) floral visitors were found to be carrying any pollen matching that of the pollen reference. At Study Site 1, 13 of the 18 tagged inflorescences housed spiders. None of the resident spiders carried any pollen.

As flowers matured their pedicel elongated raising them above the immature flowers. Flowers opened daily for about 4 days. Once the ovary of fertilised flowers began to swell and the pedicel continued to extend the flower and developing fruit fell out of the way of newly mature flowers. Not all flowers of an inflorescence opened at once. 1 – 5 flowers were open per inflorescence at a time.

The stigmas of newly opened flowers were found to be receptive on the under-surface, the top surface being glossy. The anthers of newly opened flowers were found to have dehisced, with some pollen deposited on the stigmatic surfaces.

The mean pollen / ovule ratio was calculated as 112:1. Using Table 1 (from Anon, 1998), this equates to Facultative Autogamy. Of the ten inflorescences bagged in the Autogamy and Selfing trial one inflorescence was completely eaten by a caterpillar, eight contained flowers with developing fruit and one small inflorescence containing two flowers failed to develop fruit. Of the 154 flowers in the bagged inflorescences 43% developed into fruit.

Discussion

The different floral opening times at the two sites may be explained by the weather conditions in view of the flower's response to light and rain. The flowers at Site 1 were monitored over a 48-hour period irrespective of the weather, as access was gained along a sealed road, but Site 2 was only monitored when the earth access track was passable (ie during the drier days).

Although no pollinators were found, the colour of the flowers and bracts, the lack of nectar and the trap like structure of the flowers sexual parts, found in the plants at the two study sites, concurs with the Fly Pollination Syndrome Traits described by Rost *et al* (1998). Faegri and van der Pijl (1966) and Drenth (1976) agree, observing that the flowers of the family Taccaceae are pollinated by a group of *Diptera* attracted by the "impression of decaying substance". They report that the flower's colouration and odour attract the flies to the inflorescence. Once the flies crawl inside a flower they find nothing to offer and attempt to leave. This manoeuvre is however difficult, as the sexual parts of the flower are built as traps (Figure 2), and the insects effect pollination while executing their escape.

The "Autogamy and Selfing Trial" and the "Estimation of Breeding System Experiment" indicated the flowers of *Tacca leontopetaloides* are capable of autogamy. The autogamy in the flowers could be attributed to several techniques adopted by other insect pollinated plants. Preanthesis self-pollination is commonly found in entomophilous type flowers. Some species executing complete fertilisation by this means and others partial fertilisation, allowing some cross-pollination by the insect vector. This strategy enables successful colonization by plants in the absence of a pollen vector hence most successful colonizing plants are predominantly self-pollinated (Faegri and van der Pijl, 1966). Alternately The weather may have been the stimulus for the cleistogamous behaviour of the flowers. As mentioned previously, the flowers responded to rain by closing. Frankel and Galun (1977) report a phenomenon labelled "Ecological Cleistogamy" (flowers closing during adverse weather). They allege that flowers employ Ecological Cleistogamy to ensure pollination during times of unfavourable environmental conditions. It is possible that the rain during the study period induced Ecological Cleistogamy in the subject flowers. It would be premature to attribute the apparent autogamy of the subject plants found in this study to either of these techniques without further studies. Additionally the unexpected short flowering period and site inaccessibility due to heavy rain and track damage from cyclone Rona prevented the execution of "Apomixis Trials" consequentially the production of fruit in the absence of pollen cannot be discounted.

Acknowledgments

Mary Gandini is thanked for her assistance in data collection and her comments on the draft report.

References

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