

The role of the interstice staminodes of *Bucephalandra* Schott (Araceae: Schismatoglottideae)

by Wong Sin Yeng
 Department of Plant Science & Environmental Ecology
 Faculty of Resource Science & Technology
 Universiti Malaysia Sarawak
 94300 Kota Samarahan, Sarawak
 Malaysia
 sywong@frst.unimas.my

Peter C. Boyce
 phymatarum@gmail.com



Figure 1. *Bucephalandra akantha* sp. nov. ined. (P.C. Boyce & S.Y. Wong AR-3889, BO, SAR) a. Plants in habitat with inflorescences at various stages of anthesis. b. Inflorescence at onset of pistillate anthesis. Note the inflated spathe with a slit extending from the tip to c. 1/3 the length of the limb. c. Spadix at onset of pistillate anthesis, spathe artificially removed. Note the erect interstice staminodes and thecae, and the papillate stigmas. d. Inflorescence at staminate anthesis. The spathe limb has been naturally shed. Note the staminodes sealing the entrance to the lower spathe, and that the thecae have reflexed and produced a pollen droplet from the tip of the horn. e. Spadix at staminate anthesis, spathe artificially removed. Note the reflexed interstice staminodes and thecae, the pollen droplet secreted from the tip of the thecae horns. f. Inflorescence c. one day after anthesis. The spathe limb is completely shed, as too are the spent parts of the spadix. Note the umbonate scar in the middle of the still white interstice staminodes. g. Inflorescence c. four weeks after anthesis.

ABSTRACT

Fieldwork in various parts of Borneo has now conclusively shown that the motile staminodes of the *Bucephalandra* Schott are not part of the pollination mechanics but, rather, are implicated in post-anthesis and pre-dispersal protection of the developing fruits.

Keywords

Araceae, *Bucephalandra*, Schismatoglottideae, motile staminodes, splash-cup, Borneo.

Introduction

Bucephalandra Schott is a small genus of obligate rheophytes endemic on Borneo. There are currently five described species, a further three awaiting transfer from congeneric *Microcasia* Becc., and about 19 taxonomic novelties awaiting formal description. *Bucephalandra* species are unique among Araceae by the presence of motile scale- or shield-shaped staminodes situated at the interstice of the pistillate and staminate flower zones. It has been speculated that these staminodes play a role in manipulating pollinators during anthesis by controlling access to the pistillate flower zone (Bogner, 1980; Bogner and Hay, 2000), but conclusive observations have been wanting.

Field observations of seven different *Bucephalandra* species (of which one is figured here for illustrative purposes) has established that pistillate anthesis begins 2-3 hours after dawn, with the spathe inflating to create a slit in the upper part of the spathe limb (Fig. 1b), the papillate stigmatic surface becoming sticky, and production of a weak to rather powerful esteric or fruity odour attracting almost exclusively *Colocasiomyia* (Diptera: Drosophilidae), although recently a species has been observed to be pollinated by a single species of Chrysomelidae (Coleoptera). Pistil receptivity is c. 6 hours, and during this time the interstice staminodes and thecae are erect (Fig. 1c). The spathe limb remains in this 'gaping' phase for about 24 hours, but the interstice staminodes begin to lower by the evening of the same day (Fig. 1d, e). By midnight of the same day the tips of the interstice staminodes are pressed on the inner wall of the lower spathe, effectively sealing the lower spathe chamber (Fig. 1d, e). By this time the stigmas are dry and no longer receptive and the inflorescence is in the transition phase from pistillate to staminate anthesis. At no time do the interstice staminodes retain insects in the lower (pistillate) part of the spathe, and by the time they are sealing the lower spathe no insects are present in or on the inflorescence.

Staminate anthesis begins 2-3 hours after dawn on the second day. The staminate flower thecae reflex (Fig. 1e), and a second floral odour emission attracts a new wave of *Colocasiomyia* flies. Soon after this the spathe limb gape increases, and then very rapidly (under five minutes) the limb abscises at its junction with the lower spathe (Fig. 1a), with the limb variously splitting and coiling outwards from the margin. These rapid spathe limb movements coincide with pollen droplet extrusion from the tips of the thecae horns (Fig. 1b). Staminate anthesis lasts about an hour, at the end of which period all pollen droplets have been taken by the flies, and the spathe limb has fallen to leave the funnelliform lower spathe. Dependent on the species, between a few hours and four days after staminate anthesis the spent parts of the spadix above the interstice staminodes are shed to leave a faintly umbonate scar in the middle of a disk of white staminodes (Fig. 1f).

Within a few days of staminate anthesis, and providing fertilization has been successful, the staminodes sealing the persistent lower spathe change from white to green (apparently become photosynthetic), thicken, and harden (Fig. 1g). Most species also have tannin cells visible on the upper surface of the staminode. The staminodes remain in this condition until the fruits are fully developed, by which time the enlarged berries push the staminodes upwards (Fig. 1h). Shortly after this, the staminodes become much paler and are then shed. This coincides with the now exposed fruits changing from green to yellowish green or yellowish white and rapidly decomposing to a mucilaginous pulp in which are embedded the green seeds (Fig. 1i).

Note that the staminodes are now green and thickened. Note, too, the lower spathe is also thickened and green. Tannin cells are just visible on the staminodes. h. infructescence c. seven weeks after anthesis. The developing fruits are beginning to push the staminodes upwards. i. infructescence c. eight weeks after anthesis. The staminodes have been shed and the fruits have decomposed to a mucilaginous pulp containing the seeds. Photographs: P.C.Boyce.

Dispersal is via a splash-cup mechanism, with water drops striking the inside of the erect persistent funnellform lower spathe and ejecting the seeds. The seeds, with the aid of the micropylar appendage anchor on the mosses or tiny fissures on the surrounding rock.

In summary, by the time that the interstice staminodes begin to lower the pistillate flowers are already pollinated and/or the stigmas no-longer receptive. In all observations interstice staminodes have no function in retaining pollinators inside the spathe during the anthesis transition period, as occurring in numerous unisexual flowered aroid genera. Rather pollinating insects are attracted in two waves by separate floral odour emissions coinciding with the onset of pistillate and staminate anthesis. The appearance and texture of the post-anthesis staminodes, and their persistence until the mature fruit force their loss, is strongly indicative of a role in protecting the developing fruits. In many respects the staminodes of *Bucephalandra* homeotically fill the role of the sloughing styler plates of the monsteroideae of many Monsteroideae (e.g., *Epipremnum* Schott, *Scindapsus* Schott, etc.).

The observations offered here are a part of a wider and on-going study of the biology of *Bucephalandra*; the results from that work are in progress. This paper is intended as a preliminary marker to dispel the long-held but erroneous belief that the staminodes of *Bucephalandra* are involved with pollinator management.

References

- Bogner, J. 1980. The genus *Bucephalandra* Schott. *Aroideana* 3(4): 134-143.
 Bogner, J. & Hay, A. 2000. Schismatoglottideae in Malesia II - *Aridarum*, *Bucephalandra*, *Phymatarum* and *Piptospatha*. *Telopea* 9(1): 183-194.

The IAS Newsletter is published by:

The International Aroid Society Inc.
 PO BOX 43-1853
 South Miami, FL 33143
 USA

This edition of the IAS Newsletter is Copyright © 2013 by the International Aroid Society, Inc.