eruptives than is the case for trachytic eruptives. In other words it would appear that the relative frequency of occurrence of the various rock types should be mafic > intermediate > acidic and not, as is commonly observed in the field, mafic > acidic > intermediate.

However, there is an important factor in favour of the eruption of differentiated rhyolitic eruptives. This factor is that rhyolitic melts cannot differentiate out of the rhyolite field as they are at, or close to, the ternary minimum in the $NaAlSi_3O_8$-$KAlSi_3O_8$-SiO_2 melt system. In a very crude sense it can be stated that the rhyolite field acts as an "inescapable black hole" collecting some differentiating liquids. It is suggested then that this factor may be of sufficient influence to give rise to rhyolitic eruptives being generally more voluminous than trachytic eruptives.

If the above argument is correct then the Daly Gap cannot be used readily as an argument against the use of crystal fractionation models in petrogenetic studies of volcanic rocks in basalt-rhyolite provinces in which a Daly Gap exists.

23 January 1984; Revised 28 January 1985

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INSECT-TRAPPING BEHAVIOUR AND DIEL PERIODICITY IN *SAUROMATUM GUTTATUM* SCHOTT (ARACEAE)

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THE species *Sauromatum guttatum* exhibited a syndrome of sapromyophilly and has been shown to trap in large numbers the species of flies and some beetles belonging to the groups, Muscidae, Calliphoridae, Sarcophagidae, Sepsidae, Otitidae, Bruchidae, Scarabaeidae etc[1]. The mechanism of pollination in the genus is very similar to the one described for *Arum nigrum*[2], the only difference being that window pane-phototrapping mechanism is absent in the former. The present note describes the tropical species of *Arisaema*[3].

A mixed fly and beetle pollination for this species has been described earlier [4–5]. This paper describes in detail the events of anthesis, diel periodicity and mechanism of insect trapping and release.

Figure 1 gives three diagrammatic sections of inflorescence of *S. guttatum* showing the stages of trapping (figure 1A), locking (figure 1B) and release (figure 1C) of the insects by the blossom. The individual inflorescence consists of (a) lip with scalloped margins, (b) neck enclosing a girdle of male flowers and (c) floral chamber enclosing the female as well as sterile flowers. The enclosed column within the spathe consists of a terminal appendix, a girdle of male flowers within the neck region, a bunch of sterile flowers and a girdle of female flowers within the floral chamber. The lip consists of blotches of purple and red colour and rolls over itself to one side. In the neck region the wall of spathe touches the girdle of male flowers at the two sides and leaves sufficient space laterally for the entry of insets. The main floral chamber where insects are trapped has dark ourgundy colour within. This is followed by a more or less transluscent area through which light filtered and trapped insects which dashed against it, to find an exit. Yeo[7] preferred to call such areas as 'window panes' in place of the term 'light windows' used earlier for tropical *Arisaemas*[6].

The following account describes various stages of anthokinematic changes within the blossoms.

Anthesis: It is triggered at midnight at 03.00 hr in February and March, to be followed by the release of enclosed appendix and stench production. By 05.30 the appendix is completely out, the two lateral entrances at the sides of staminate girdle are created and the production of stench started. By 07.45 hr, insects begin to alight the lip or appendix, appear agitated and walk towards the neck through which they suddenly fall inside the floral chamber from any of the two lateral entrances. The entry of insects is synchronised with the emission of stench from the appendix.

Trapping (figure 1A): The pollination syndrome appears to be on the principle of deceit, as neither nectar nor pollen is offered as food. The smell of decaying dung purhaps created the stimulus which drew fertilized females towards the floral chamber, from where

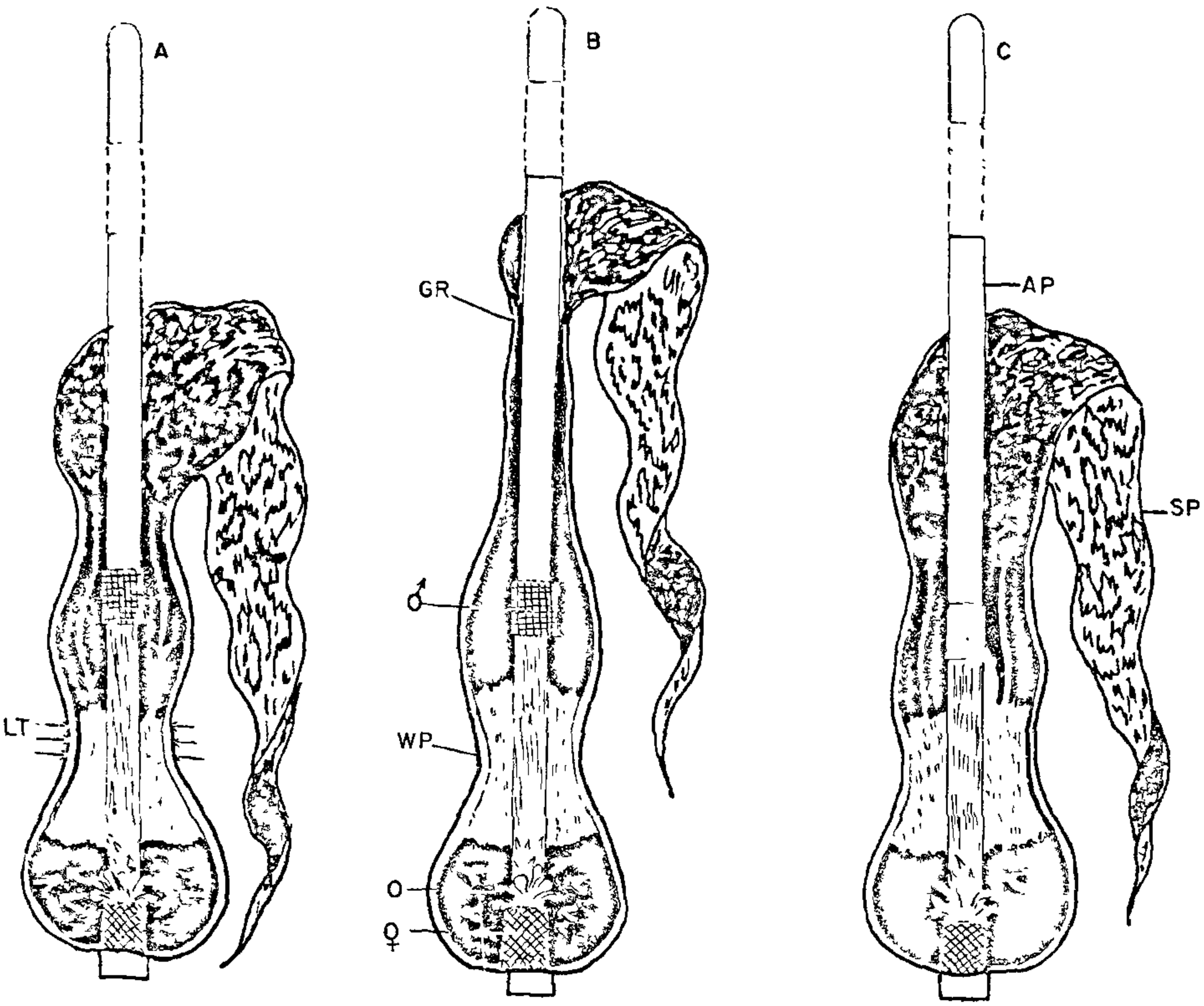

Figure 1. Three stages of flower behaviour, trapping (A), locking (B), and release (C) of the insects. AP = appendix, Gr = grip, LT = light, SP = spathe, WP = window-pane, ♂ = male flowers, ♀ = female flowers, O = neutral flowers.

their actual eggs can be collected. The insects remain trapped inside and the captive insects dash against the transluscent areas of 'window panes', in which process many of them die. Tables 1 and 2 give the data for the

Table 1 *Size-related figures of mortality of insects.*

Number of flowers	Size class	Number of dead flies	
		Minute	Large sized
8	15 to 25 cm	19 ± 2.2	5 ± 1.5
6	26 to 35 cm	33 ± 4.5	17 ± 5.3
3	36 to 45 cm	129 ± 18 3	70 ± 15.0

Table 2 Habitat-related figures of mortality of insects.

Habitats	Number of dead flies	
	Minute	Large sized
Cattle sheds	39 ± 17.1	28 ± 11.1
Hedges around bunglows	26 ± 3.3	08 ± 3.2
Natural habitats	76 ± 35.2	41 ± 18.7

dead flies collected from different size classes of flowers and from different habitats. As many as 129 small and 70 large-sized dead insects were collected from these flowers. Higher mortality figures for the

natural habitat, however, only indicated a higher catch of these flies for this habitat. The figures of death can be explained as due to the exhaution which flies have to face in the captive condition. In this state they continuously hammer their heads against the 'window panes' and the noise of their activity stops as soon as light filtration is checked and a black cloth is wrapped against the 'window panes'. If the cloth remain wrapped for a longer time the flies were seen to climb the column and attempt some successful exits from the lateral entrances. This proved that 'window pane phototrapping' phenomenon worked effectively throughout the day time.

Locking (figure 1B): Since phototrapping worked only during the day, an explanation was still needed for the inability of insects to come out from the blossom during the dark extended hours of the evening and night. This was successfully achieved by the blossom through entrance locking, effected through the inward movement of margins of lip which closely pressed against the appendix at the grip (figure 1B), thereby denying mechanical exit for the captive flies. Virtually all activity of insects within the floral chamber ceases after it, and the stasis prevails, till it is resumed on the midnight of the following day when the margins of lip resume moving away from the appendix, leaving sufficient gap for the release of the trapped insects, during the following morning hours.

Pollen rain and Release (figure 1C): During midnight at 03.00 hr on the following day, the blooming activity is again resumed and anthers matured to release the pollen which rained from the staminate girdle and dusted all the insects which were trapped inside. After the insects are thoroughly dusted with pollen, their release starts soon after, in the morning at 06.00 hr.

Diel periodicity: Table 3 gives the data of periodic events related to the phenomena of blooming. The total blooming period starting from anthesis to the exit of insects on the subsequent day consisted of 28 hr. The first insect visit started at 07.45 hr in the morning at 18°C. The exit on the following day takes place at 06.00 hr at 15°C. which continue upto 08.00 hr and 18°C. The peak periods of visits arrived at 21°C at 09.15 hr and continued upto 10.30 hr. The decline of visits was marked during the afternoon when the temperature ran higher than 28°C. The blooming events consisted of anthesis at 03.00 hr during midnight and the release of appendix and the increase in the production of stench at 05.30 hr. At this stage the flower is ready for the visits by the insects and the female flowers are mature with receptive papillae at the stigma. In this condition the flower remains open for the day. The locking of entrances and closing of flower starts during the evening at 16.30 hr and by 18.15 hr it is complete. The re-opening of the flower, on the following day starts during midnight at 03.30 hr. After pollen rain at about 03.00 hr, the flower becomes flaccid, the staminate girdle becomes loose and the grip is released, leaving ample space for the exit of insects at 06.15 hr on 16°C.

Table 3 *Diel periodicity and the events of anthokinematics.*

Time (hr)	Temp. °C	Events
03.00	14	Beginning of anthesis, gradual release of appendix, stench production.
05.30	15	Release of appendix complete, female flowers reach maturity, opening and curling of lips.
07.45	18	Setting of visits by the insects.
09.15	21	Peak period of visit by the insects.
10.30	25	–do–
11.15	28	Setting of decline of visits by the insects.
15.00	28	Decline continues.
16.30	26	Tightening of the grip against the appendix and beginning of the locking.
18.15	23	Locking complete; entry and exit of insects mechanically impossible.
18.15 to 02.45	23–14	Stasis: period of suspension of all floral activities.
3.00	14	Resumption of floral kinesis, Initiation of pollen rain from the male girdle and pollen dusting of insects.
03.00–06.15	14–16	Widening of the neck near the male girdle setting of release of insects.
08.30	19	Release of pollen dusted insects complete.

Similar to *Arisaema* the insects in S. *guttatum* are caught in a window pane photo-trapping chamber during day. These insects are locked during night, due to the closing of entrances, in the manner similar to those of tropical Colocacia[7].

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UNRECORDED PATHOGEN ON WHEAT IN INDIA

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WHEAT crop is susceptible to several diseases *viz* stem rust, leaf rust, yellow rust, leaf blight, karnal bunt, hill bunt etc. In the present study, an epidemic of leaf blotch disease on wheat observed during 1980–81 at the College of Agriculture, Dharwad is reported. The first symptom of the disease was noticed on the leaves. As the plant enters the reproductive stage, the blighting spread to top leaves. Flag leaf and glumes also were affected. The spots on leaf were brown in colour with a clear yellow halo indicating that the organism produces toxin injurious to the plant tissue (figure 1). The blotching was common on leaves and glumes. Under favourable conditions, the plant exhibited a burnt appearance. The pathogen was isolated successfully and pathogenicity was proved. Typical symptoms of the disease appeared on the leaves after ten days of inoculation.

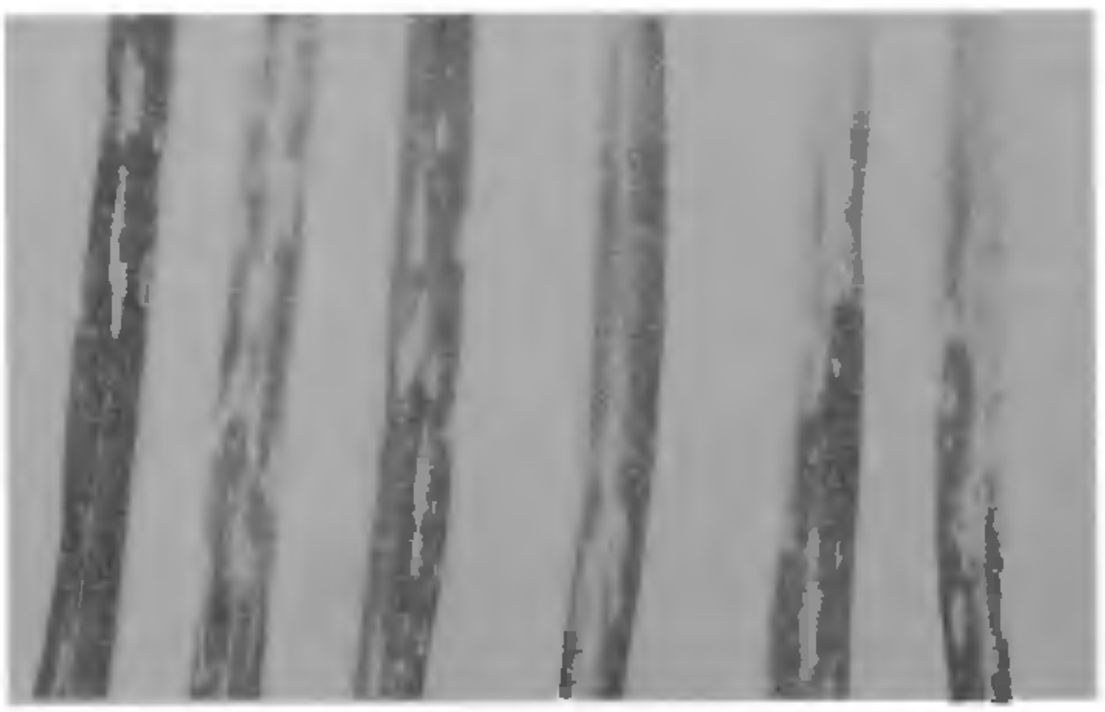

Figure 1. Symptom of *D. hawaiiensis* on wheat.

The colonies of the fungus were effuse, grey pale to dark brown in colour smooth, septate. Conidiophores solitary, geniculate, septate measuring upto 120 μ long and 2–7 μ in thickness. Conidia straight, ellipsoidal, oblong or cylindrical, rounded at the ends with 3–8 pseudo septate, measuring 13–37 μ.

This fungus was identified by Dr A. Sivanesan of the Commonwealth Mycological Institute, Kew, Surrey, London, as *Drechslera hawaiiensis* M. B. Ellis state *Cochliobolus hawaiiensis* Alcorn with Herb. IMI. number 274351.

This is a new pathogen on wheat hitherto unrecorded in India.

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KARYOLOGICAL STUDIES IN THE GENUS *CYMBOPOGON* SPRENG II. KARYOTYPE OF *CYMBOPOGON WINTERIANUS* JOWITT.

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CYMBOPOGON WINTERIANUS Jowitt (Fam. Gramineae) is an important aromatic and medicinal plant. It is also famous as Java citronella grass for its high quality aromatic oil containing a high percentage of geraniol and citronella—pharmaceutically the two very important monoterpenes[1–6]. The grass is native to Sri Lanka, where it is locally known as Mahapongiri[7] and is similar to Ceylon citronella (*C. nardus*) in many respects[8]. Although a lot of data are available on its cultivation, agronomy, commerce[7–9] and chemical analysis of its essential oil[1–6,10] its karyotype has not been reported so far except for recording its chromosome number, $2n = 20$[11].

Plants were collected from the hilly areas of Assam and raised in the experimental garden of the laboratory. Some slips were allowed to root at room temperature. Root tips were processed for the karyotypic analysis on the basis of modified techniques reported earlier[12]. For description of karyotype the method of Adhikary[13] has been adopted.