INTRODUCTION

Caesalpinia bonduc (L.) Roxb. [Syn. Caesalpinia bonducella (L) Fleming] is an ethnomedicinal species belonging to the family Caesalpiniaceae. The shrub is prickly and widely grows in Tripura (Deb, 1981). The seed of the plant is commonly known as natphal to the rural people of Tripura, which is extremely bitter in taste. C. bonduc is used in traditional medicine like Ayurveda, Siddha, Unani and Homoeopathy (Kirtikar and Basu, 1988; Suryawanshi and Patel, 2011). Pharmacological activities of the seeds have been reported by several workers in controlling diabetes, trichuriasis, malarial fever without any known side effect (Burkill, 1995; Quisumbing, 1978; Chakraborty et al., 2004 and Khan et al., 2012). Phytochemical analysis of the seed also revealed to contain alkaloids, flavonoids, glycosides, saponins, furano di terpenes etc. (Moon et al., 2010; Pillai and Suresh, 2011; Khan et al., 2012). The use of medicinal plant extracts for the treatment of human diseases is considered to be safe and dependable. According to WHO about 80% of people living in developing countries rely upon traditional medicine (Farnsworth et al., 1985; Mukharjee, 2002). In view of the wide pharmacological activities of seed kernel of C. bonduc, it has been necessitated to study the influence of crude water extract of C. bonduc on root meristem cells of Allium cepa L.

MATERIALS AND METHODS

The Allium test introduced by Levan (1938) was used as plant assay system in the present experiment. The bulb of Allium cepa of same size were selected for test material and allowed to grow in pots containing sand. Fresh roots measuring 2-3 cm long of 3-4 days old bulbs were taken out, washed and kept on the mouth of the experimental tubes containing different concentrations (0.05%, 0.1%, 0.25%, 0.5%, 1%) of crude extract for 4h, 6h, 8h, 12h, 24h and 48h along with control. All the concentrations of water extracts treatment significantly decreased the mitotic index compared to control in all concentrations of treatments. Cytological effects included various levels of metaphase arrest along with clumping tendency of chromosomes. Selective concentrations (0.05%, 0.1% and 1%) of treatment also produced pre-treatment effects with well spread and condensed metaphase chromosomes. Infrequent incidence of unequal separation of chromosomes at anaphase was also observed. Recovery experiment clearly suggests that the present mito-inhibition and metaphase arrest are temporary and recovered within 24h of incubation.

ABSTRACT

Cytotoxicity of seed kernel water extracts of Caesalpinia bonduc (L) Roxb. was studied in root meristem cells of Allium cepa L. The root tips of A. cepa were treated with different concentrations (0.05%, 0.1%, 0.25%, 0.5%, 1%) of crude extract for 4h, 6h, 8h, 12h, 24h and 48h along with control. All the concentrations of water extracts treatment significantly decreased the mitotic index compared to control in all concentrations of treatments. Cytological effects included various levels of metaphase arrest along with clumping tendency of chromosomes. Selective concentrations (0.05%, 0.1% and 1%) of treatment also produced pre-treatment effects with well spread and condensed metaphase chromosomes. Infrequent incidence of unequal separation of chromosomes at anaphase was also observed. Recovery experiment clearly suggests that the present mito-inhibition and metaphase arrest are temporary and recovered within 24 h of incubation.

KEYWORDS

Caesalpinia bonduc (L) Roxb
Ethnomedicine
Cytotoxicity.

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RESULTS AND DISCUSSION

Different cytological parameters were studied both in control and treated root meristem cells of *Allium cepa* L. The control mitotic index of *A. cepa* was 5.91 ± 1.77 with 37.30% of metaphase and 30.24% ana-telophase respectively. Different degrees of mitotic inhibition were recorded depending on concentration and duration of *C. bonduc* seed kernel extract treatment. However, level of mitotic inhibition was contradictory among the treatments of varying duration (Fig. 1A). The mito-inhibition is maximum and effective in 0.05% of treatment. Varying frequencies of metaphase arrest was recorded among the treatments (Fig. 1B). High level of metaphase arrest (58.33%) with very low MI 2.74 ± 1.14 was observed in 1% extract during the short duration of treatments (4 h). Among the different concentrations and duration of treatments, 1% seed extract produced maximum metaphase arrest (74.78%) during 6 hrs of treatment (Fig. 2). Infrequent mitotic polyploid cells were also observed in 1% treatment for 4 h (Fig. 8). However, metaphase arrest produced in 0.25% of 6 hrs treatment resulted in better chromosome morphology and with well spread metaphases (Fig. 3). Gradual decline in mitotic indices was associated with varying degrees of mitotic metaphase arrest during long term treatment with or without chromosomal condensation and proper separation of chromosomes (Figs. 4, 5 and 6). Majority of metaphases recorded in 8 and 12h treatments, revealed chromosomal clumping tendency. Chromosomal clumping at metaphase was also observed in control. Prolong duration of treatments for 24 and 48h resulted in complete inhibition of mitotic process leading to well stained nucleated interphase cells (Fig. 7). The present study clearly indicated the clastogenic and spindle arrest properties of the seed kernel extract, which is evident from the MI values and manifestation of spindle abnormalities. Mito-inhibition has been attributed to blocking of mitotic cycle during interphase that may result from a prolong G2 period or to the DNA synthesis (Kumar and Gupta, 2008). Mito-inhibition effect of various plant extracts or products have also been reported by several workers (Raj and Reddy, 1971; Kabarity and Malallah, 1980; Ene-Obong and Amadi, 1987; Kaushik, 1996). Analysis of different mitotic metaphase arrest produced during the present study suggests that extract of *C. bonduc* has significant effect on mitotic spindle function. This observation is in corroboration with previous plant extract studies by other workers (Ene-Obong and Amadi, 1987; Borooah, 2011; Akaneme and Amaefule, 2012). Knop’s experiment with selected concentrations clearly indicated recovery of mito-depression to normal during 24h of incubation.
Figure 2-8: Mitotic stages recorded after different concentrations and durations of *C. bonduc* water extract treatments. 2. Diplotised mitotic metaphase. 3. Condensed and well spread mitotic metaphase with 16 chromosomes. 4. Irregular condensation of mitotic chromosomes. 5 and 6. Irregular separation of mitotic chromosomes. 7. Mitotic inhibition at interphases. 8. Infrequent occurrence of mitotic polyploid cells (Fig. 1D). This indicated that different mito-inhibition produced by the seed kernel extract of *C. bonduc* is not permanent and possibly not having any adverse effect since no cytological abnormality is recorded in the present study.

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REFERENCES


