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Stimulation of Growth and Development of *Celosia argentea* L. by Crude Extracts of *Senna alata* (L.) Roxb

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ABSTRACT: The effects of different concentrations of *Senna alata* crude water extracts on the germination, growth and flowering of *Celosia argentea* were studied. All concentrations of this extract induced a consistent decrease in absolute percentage and rate of germination, and inhibited radical elongation in *Celosia argentea*. Earliness in flowering and overall increase in height was obtained from seedlings sprayed with 75 % C and 100 % C crude water extracts. @JASEM

Celosia argentea L is an annual herbaceous vegetable of the family Amaranthaceae. Six species of the genus *Celosia* in Nigeria had earlier been describe by Hutchinson and Dalziel (1954). Other useful descriptions, economic importance and mineral composition of *Celosia argentea* have been recorded (Omueti, 1980; 11TA 1972; Grubben, 1976). *Senna alata* L is a leguminous plant of the family Caesalpiniaceae. The medicinal potentialities of this plant have been documented (Ayensu, 1978; Nwalozie, 1984). The effects of several medicinal plant extracts on other plants have been investigated at different times mainly at the cytological level (Palmer *et al.*, 1960; Hussein and Hakeem 1961; Cardinali, 1961; Tarkowska, 1971; Cornors, 1971; Shehab 1979, 1980; Nwalozie, 1984; Okoli and Russom 1986). For instance, increased depressive effect on the mitotic index, loss of tugor after six hours, and stimulation of an increase in the percentage of cells at prophase with corresponding decrease of cells in other phases were all cytological effects of high concentrations and long duration of treatment of *Allium cepa* roots with crude extracts of *Pulicaria crispa* (Shehab, 1979). It is noteworthy that the cytological effects of these extracts will always manifest in different physiological results. Thus, Onofeghara (1981) using water extracts of *Senna alata* was able to achieve earliness in the flowering of *Arachis hypogea* and *Vigna unguiculata* reducing their flowering periods from 42 to 105 days and 64 to 150 days respectively. This particular study looks at the physiological effects of *Senna alata* water extracts on the germination, growth and flowering of *Celosia argentea.*

MATERIALS AND METHODS

Preparation Of Extract: Seeds of *Celosia argentea* and leaves of *Senna alata* were used for this study. 300g of the fresh leaves of *S. alata* were weighed out on a top loading meters balance (model PB163) and blended with a homogenizer in 1 Litre of distilled water. The green paste so obtained was filtered under suction (850 air compressor, 54750FBF). The wine coloured filtrate was stored in the refrigerator at 4°C until required. This was regarded as 100% crude water extract (C). From this stock concentration lower concentrations of 75% C, 50% C, 40% C, 30%C, 25% C, 12% C, 10% C, and 5% C were prepared.

Germination Studies: Petri-dishes lined with 9cm Whatman filter paper moistened with distilled water, were used as germinators. 3 replicates each containing 50 seeds was used for each concentration. A control experiment was also set up for each treatment. To each petri dish, 10ml of the particular concentration (i.e. 5%C , 10% C, 12.5% C, 25% C, 30% C, 40% C, 50% C, 75%C and 100% C) was added and left at room temperature. Measurements were taken at intervals of 24hours and the emergence of radicle (Agboola, 1998) was taken as indicative of germination.

Growth Studies: Four plastic buckets were filled with top soil from the garden and seeds of *Celosia argentea* were sown in them. Nine other sets each having four buckets were treated similarly. Twenty-one days after sowing (i.e. at 4 –5 leaf stage) the various concentrations of crude water extract were sprayed on the stems and on the surfaces of the foliage using a spraying pump. One set of four buckets, which was sprayed with distilled water served as the control. The height and leaf area of the plants were measured at weekly interval, so also were the dry weight, relative growth rate (RGR), and net assimilation rate (NAR). The time of flowering was noted. The seedlings were watered twice daily (morning and evening) except the evening the plants were treated.

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Results were tested statistically using t-test method for the comparison of means as modified by Ukwuije (1994).

RESULTS

Crude water extract of *S. alata* induced a considerable decrease in the absolute percentage and rate of germination of *C. argentea* seeds over a period of 48hours. Germination occurred earlier in the lower concentration against the higher concentrations of 75%C and 100%C. At lower concentrations of 5%C, 12.5%C., 25%C, 30% and 40%C, there was a general decrease in percentage germination compared with the control. The germination rate and the percentage also fell significantly with increase in concentrations although the pattern lacked a definite trend as shown in Figure 1. An inhibitory effect to radicle elongation was noticed from all concentrations of *S. alata* water extract used in this study as shown in Figure 2. The lower concentrations of *S. alata* crude water extract spray were inhibitory to growth in height (Figure 3), leaflet enlargement (Figure 4), and total dry weight (Figure 5) of *C. argentea* seedlings when compared with the control after 6 weeks. Within this same period, seedlings sprayed with the higher concentrations of the crude extract (75%C and 100%C) showed significantly promotory effects in height and leaflet enlargement. Although the dry weight of 75%C was lower than that of the control, this particular concentration with 100%C recorded high dry weights at the end of the period when compared with other concentrations. For the height (Figure 3), there was no consistency in the pattern of increase with increasing concentrations for the first 3 weeks, but the mean height for the last 3 weeks had a consistent increase.

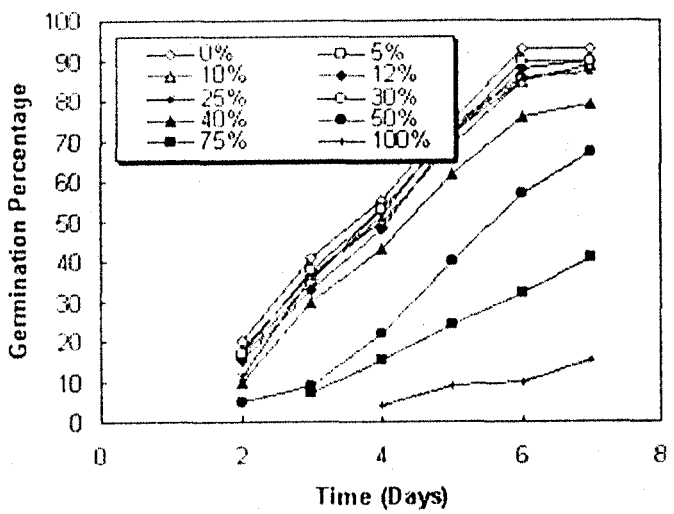

Fig. 1: Effects of Senna alata crude water extract on germination of Celosia argentea

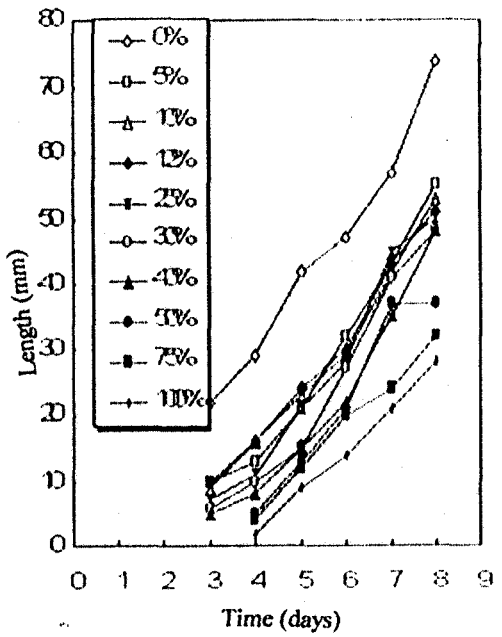

Fig. 2: Effects of Senna alata crude water extract on radicle length of Celosia argentea

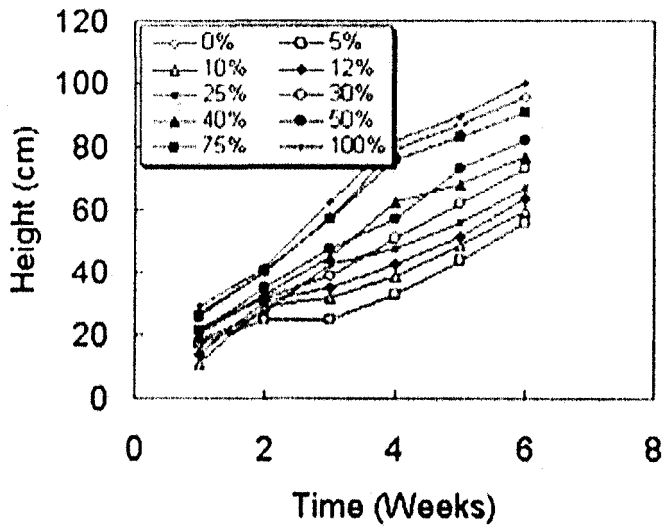

Fig. 3: Effects of Senna alata crude water extract on height of Celosia argentea

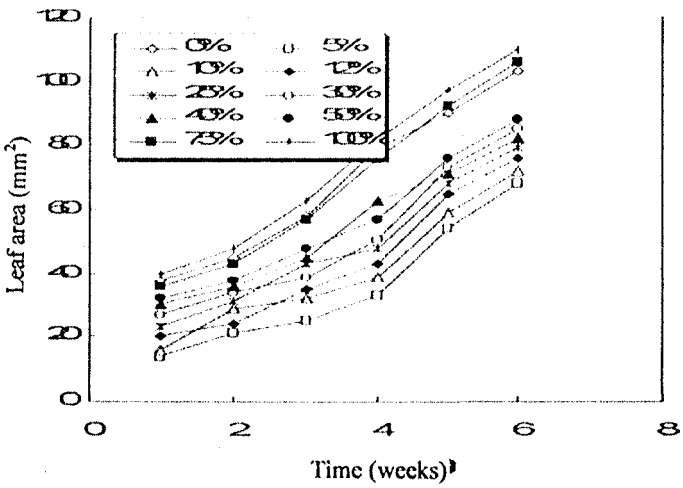

Fig. 4: Effects of Senna alata crude water extract on leaf area of Celosia argentea

The RGR of the seedlings treated with the lower concentrations and 75%C were all fairly constant throughout the 6 weeks. While the RGR of the control was higher than those of the above concentration throughout the six weeks, 100%C recorded the highest RGR for all the weeks (Figure 6). There was a fairly constant decrease in NAR by seedlings treated with 5%C, 10%C and 12.5%C. The other concentrations used including the control did not have any particular pattern of increase or decrease. 100%C recorded the highest NAR (Figure 7). High concentrations of the *S. alata* crude water extract caused earliness in flowering. Seedlings of *C argentea* sprayed with 75%C and 100%C flowered 40days after sowing, that is, approximately 6 weeks after sowing (seedlings were sprayed 3 weeks after sowing). Control and 25%C flowered 8 weeks after sowing.

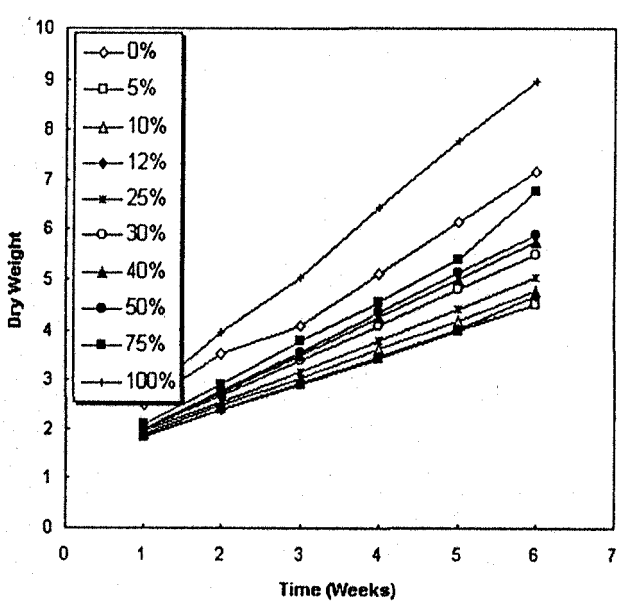

Fig. 5: Effects of Senna alata crude water extract on dry weight of Celosia argentea

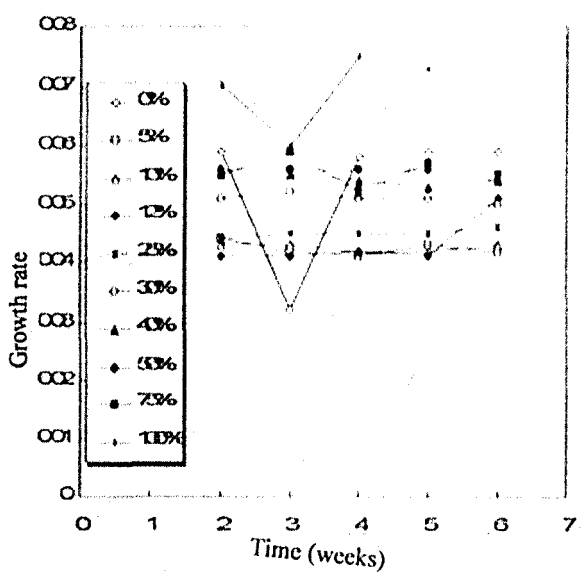

Fig. 6: Effects of Senna alata crude water extract on relative growth rate of Celosia argentea

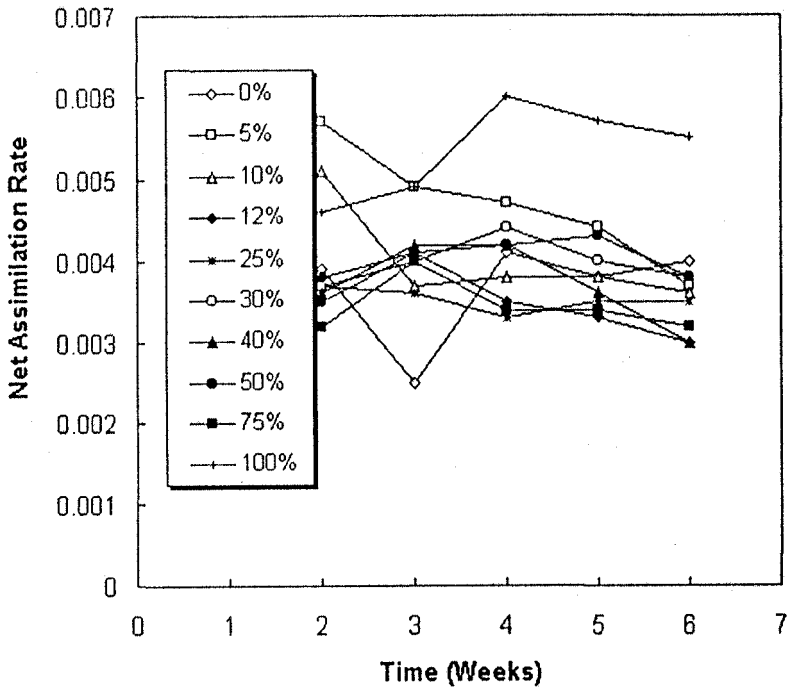

Fig. 7: Effects of Senna alata crude water extract on net assimilation rate of Celosia argentea

DISCUSSION

The slower rates of germination together with lower absolute percentage of *C. argentea* seeds treated with crude water extracts of *S. alata* is as a result of inhibition of cell division in the embryonic meristems of the seeds. Cytomitotic studies on onion root cells have revealed that *Senna alata* leaf water extract causes a reduction in the mitotic index (Okoli and Russom, 1986), and this might account for the slower rate of germination of the *C. argentea* seeds. Cytological studies using other medicinal plants have also revealed similar effects (Amer and Ali, 1969; Shehab, 1979, 1980; Kabarity and Malallah; 1980; Okoli and Russom, 1986).

The same effects on growth were observed by Nwalozie (1984) using *S. alata* leaf water extract. Some of these earlier workers were of the view that inhibition of cell division and some other accompanying abnormalities might be as a result of DNA polymerization, partial dissolution of nucleoproteins, breakage and exchanges of certain fibre units of chromatids, reduced synthesis of DNA, protein and such cellular components necessary for the growth of the embryonic axis. These in turn delay or suppress radicle and or plumule emergence. It is noteworthy that inspite of the low rate of germination and decrease in absolute percentage germination, the extract appears to have been metabolised constantly by the germinating seeds and moreso as substantial percentage germination was observed to have occurred even in the higher concentration of the extract. It is possible that the seeds have some innate ability to withstand stress.

Crude extracts such as those used in this study usually contain a variety of substances including such growth promotory substances, as gibberellins, auxins and cytokinins (Nwalozie, 1984), which are active at very low concentrations. High concentrations of this extract also contain alkaloids and protein inhibitors (Joubert, 1982), which play overriding role in inhibiting germination. It is thus seemingly possible that the concentrations of the extract used in this study were very high, hence, the inhibitory effect on germination.

All other concentration of *S. alata* crude water extract except 75%C and 100%C used in spraying seedling of *C. argentea* 3 weeks after sowing were inhibitory. It therefore appears that the optimal promotory concentration lies between 100% ± 25. The general increase in height and most of the other growth parameters of seedlings treated with *C. alata* extracts over the untreated is a fact traceable to the increased rate of cell division, enlargement and protein synthesis which are promotory effects usually associated with plants treated with gibberellins and cytokinins.

The ability of *S. alata* to promote early flowering of *C. argentea* is a significant observation. The extract reduced the flowering time by about 16 - 18 days. Thus the extract helped the seedlings to accomplish the vegetative growth earlier and proceeded to their flowering. This is similar to the effects of gibberellin in flowering (Krishnamoorthy, 1975) and in germination (Weyers *et al.*, 1987; Agboola and Adedire, 1987). It is important to note that promotion of earliness reduces the reproductive cycle of that plant thus making it economically and commercially available within a limited time.

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