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A study on the comparative effect of smoke of Havana-pooja and diesel on *Chromolaena odorata*

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Abstract

Three healthy Chromolaena odorata plant were taken and labeled as A, B and C respectively. Two of them were given different smoke conditions for 5 days. Primarily the effect of smoke produced from havana-pooja and combustion of diesel are compared to show that both have almost similar effect on plants. Secondly the minimum conditions which are required to make Havana-pooja a treatment therapy are studied. Plant A was allowed to grow under normal condition and plant B and C were treated with the smoke of havana-pooja and diesel respectively. Similar morphological symptoms were observed in plant B and C. Our study clearly shows that if havana-Pooja is not performed with care, instead of treatment for ailments it can be as lethal as inhaling diesel smoke.

Keywords: *Chromolaena odorata*, havana-pooja, yagya, diesel, smoke.

Introduction

Chromolaena odorata (L) *or Euphatorium odoratum* L.), belongs to the family Asteraceae. Its common names include "Awolowo", "Independence weed", siam weed, riffid weed, bitter bush or jack in the bush[1].

Chromolaena odorata is an herbaceous perennial plant that forms dense tangled bushes 1.5-2.0m in height. It occasionally reaches its maximum height of 6m (as a climber on other plants). Its stems branch freely, with lateral branches developing in pairs from the axillary buds. The older stems are brown and woody near the base; tips and young shoots are green and succulent. The root system is fibrous and does not penetrate beyond 20-30cm in most soils. The flower-heads are borne in terminal corymbs of 20 to 60 heads on all stems and branches. The flowers are white or pale bluish-lilac, and form masses covering the whole surface of the bush[2]. Its leaves are opposite, flaccid-membranous, velvety-pubescent, deltoid-ovate, acute, 3-nerved, very coarsely toothed, each margin with 1-5 teeth, or entire in youngest leaves; base obtuse, but shortly decurrent; petiole slender, 1-1.5cm long; blade mostly 5-12cm long, 3-6cm wide figure-1.

C. odorata is considered invasive weed of field crops in its introduced range, and has been reported to be the most problematic invasive species within protected rainforests in Africa[3]. *C. odorata* is a highly air pollution tolerant plant. Its APTI (air pollution tolerance indices) is 39.37% which is quite high[4,5,6]. This is the primary reason behind choosing this plant. Secondly it is easily available in our surrounding.

Yagna is a spiritual experiment of sacrificing and sublimating the havana sámagri (i.e., material for oblation to fire) in the fire accompanied by the chanting of Vedic mantras figure-2. The procedure and items offered to the fire vary by what occasions the ceremony, or by the benefit expected from the ritual. Procedures invariably involve the kindling and consecration of the sacrificial fire; then invocation of one or more divinities; and, finally the making of offerings (whether real or visualized) to them with the fire as via media, amid the recitation of prescribed prayers and mantras[7].

Figure-1
Chromolaena odorata

Figure-2
Havana samagri

The interpretation of products of combustion in a Yagna in physical scientific terms is rather difficult due to the following reasons. Firstly the properties of substances which are used are vastly varying and secondly the conditions under which combustion takes place remain unspecified[8]. The factors affecting the products of combustion are the nature of substances used and their proportions; temperature attained; controlled supply of air and interaction amongst the various products formed[8].

Material and Methods

Three healthy plants were taken from same area and planted in three different pots having same type of soil. They had been labeled as plant A, B and C. Duration and amount of watering had been also kept constant for all three plants. Plant A was kept under normal condition while plant B and C were treated with smoke of havana-pooja and diesel respectively. Firstly smoke of havana-Pooja and diesel is collected in seperate glass chamber and swiftly the Plant B and C along with the pot are inserted inside their respective glass chambers for same duration. The process is repeated is repeated twice after 2 minutes to maintain the concentration of smoke inside the glass chamber figure-3.

Figure-3
Plant inside the glass chamber filled with smoke

Before the experiment the morphology and pH of leaves were studied, plant A was kept under normal environmental condition plant B was subjected to smoke treatment of havana-pooja for 5 minutes every day for 5 days plant C was subjected to smoke of diesel vehicle for 5 minutes every day for 5 days. On the 1st, 3rd and 5th day the pH of leaves were observed after the experiment by taking 0.50 g of the leaves from each plant homogenized in 5 ml distil water. This was then filtered and the pH of leaf extracted determined after calibrating pH meter with buffer solution of pH 4 and pH 9.

Results and Discussion

The pH of all three plants (A, B and C) on day 1 is found to be 5.6. While on 3rd day the pH for plant B and plant C is found to be 5.39 and 5.6 respectively. On the 5th day more decline in the pH of plant B is observed instead of plant C. Plant C was healthier in comparison to Plant B even after 5 days of diesel smoke treatment. Although some grey color spots were also observed in its leaves figure-4.

Three types of visible injuries are observed by us on plant B: (1) collapse of leaf tissue with the development of necrotic patterns, (2) yellowing or other colour changes, and (3) alterations in growth or premature loss of foliage which is similar to the effect of air pollution on plants[9] table-1.

This behaviour could be explained by two mechanisms. Firstly when conditions are conducive to stomatal opening, a proton pump drives protons (H^+) from the guard cells. As it is the case with the surrounding of Havana-pooja. This means that the cells' electrical potential becomes increasingly negative. The negative potential opens potassium voltage-gated channels and so an uptake of potassium ions (K^+) occurs. To maintain this internal negative voltage so that entry of potassium ions does not stop, negative ions balance the influx of potassium. In some cases, chloride ions enter, while in other plants the organic ion malate is produced in guard cells. This increase in solute concentration lowers the water potential inside the cell, which results in the diffusion of water into the cell through osmosis. This increases the cell's volume and turgor pressure. Then, because of rings of cellulose micro fibrils that prevent the width of the guard cells from swelling, and thus only allow the extra turgor pressure to elongate the guard cells, whose ends are held firmly in place by surrounding epidermal cells, the two guard cells lengthen by bowing apart from one another, creating an open pore through which gas can move. It allows highly energised gases of havana-pooja to enter easily and in large amount inside the leaves and because the internal energy of these gases is very high it would have definitely ill affected the coordination between two cells[10]. Secondly, the plant B showed more acidic pH as compared to plant C which may be due to the formation of H_2CO_3 which break into H^+ and HCO_3. Rise in pH should have affected the enzyme activity of the plant and due to malfunctioning of enzymes the Plant B have shown these symptoms.

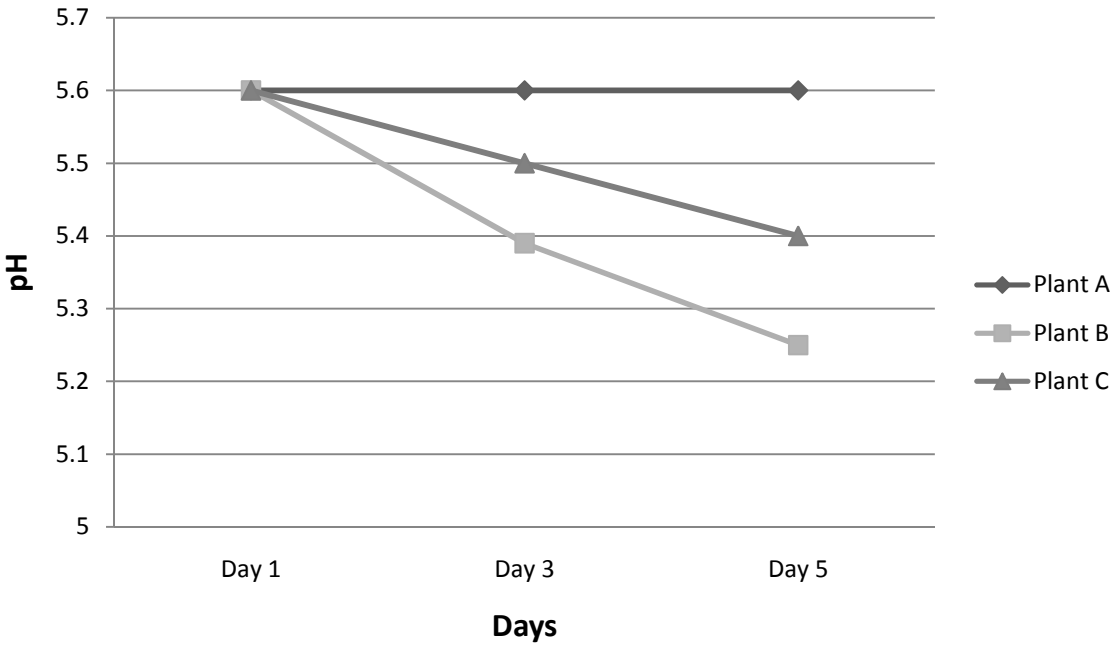

Figure-4
Variation in pH in leaves of *C. odorata* after treatment with smoke with respect to pH of normal plant

Table-1
changes in the leaves morphology as observed in the experiment

	Day1	Day 3	Day 5
Plant A			
Plant B			
Plant C			

Conclusion

Havana-pooja is an spiritual and traditional activity followed in almost all religions in the world since ages. It has been always projected as an atmosphere purifying activity. Even it has been established by many scientific researchers also. But through our study we observed that if havana-pooja is not performed with care it could be as fatal as inhaling diesel smoke. I recommend havana-pooja should be performed in open grounds or in well ventilated rooms. Havana-pooja should be performed under

bright sunlight for the photochemical process to occur. When all the volatile substances are diffused in the surrounding atmosphere, these are further subjected to photochemical reactions in the sunlight. This may be the reason why it has been recommended that Yagna should be performed in the presence of strong sunlight. These changes occur in the ultra-violet and other short wavelength regions. The products of fumigation thus go photochemical decomposition, oxidation and reduction. To some extent even CO_2 is also reduced to formaldehyde as follows:

$$CO_2 + H_2O + 112{,}000\text{cal.} = HCHO + O_2$$

From environmental purification, reduction of CO_2 produced in Yagna as above and liberation of oxygen cannot be over looked[9]. The fire should not be too high. The temperature attained in the Kunda varies between 250°C and 600°C which is very necessary of slow combustion of Havana-samgiri[9].

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