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Short Communication

A study of changes in phytochemical properties of selected plants due to solid waste pollution in Agra City, India

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Abstract

Inadequate management of solid wastes is one of the main causes of environmental contamination. A preliminary phytochemical analysis of 5 selected plants in the city of Agra was carried out in a natural and polluted habitat. The plants were selected Acalypha indicates, Procera, Cannabis sativa, Croton bonplandianum and Daturastramonium. Phytochemical qualitative analysis of plants confirmed the presence of different phytochemicals such as alkaloids, flavonoids, phenols, saponins, terpenoids, natural tannins, contaminated aqueous extraction, ethanolic their habitats. In the present study, in contaminated habitats, the number of fitoconstituents decreased compared to the natural habitat for all plant species tested when using both ethanol from aqueous extracts, while Daturastramonium was not influenced in its bioactive profile.

Keywords: Phytochemical analysis, Solid Waste Pollution (SWP), Phytocostituents.

Introduction

Pollution of the environment can be caused by many human activities and also by natural forces[1]. It is thought that human exposure to pollution is more intense now than at any other time of human survival. Over the past three decades, there has been increasing concern about the public health effects attributed to environmental pollution[2]. Environmental pollution is a global problem and its potential to influence the health of human populations is important. There is no doubt that excessive levels of pollution cause harm to human and animal health, plants and trees, including tropical forests, or the environment in general[3].

The rapid development of the industrial plants in India explosion led to the passage of the villages and cities of the province generate thousands of tons of solid waste clam (MSW) per day. It is estimated that the amount of municipal solid waste will increase dramatically in the near future, as a means to achieve a homeland[4,5]. The unscientific disposal causes a harmful effect on all components of the mainstream, plant health and the vegetation model for human health[6-8]. The application of municipal solid waste plant health can be modified directly in phytochemical properties of plant growth[9]. Bioactive Phytochemicals are natural compounds in plants. These nutrients and fiberphyto compounds operate with that form an integral part of the defense system stress in a variety of diseases and conditions [10]. Phytochemicals are generally divided into two groups, the first and the second quality of their character, of course; According to the present plant metabolism. The first includes in the components of sugars, amino acids, protein and chlorophyll a general way, in the second place in the components consists of alkaloids, flavonoids, saponins, tannins, phenolic compounds, terpenoids, etc.[11,12]. This study shows that the harmful effects of the adulteration of solid waste in phytochemicals in the plant species. The new program has drawn attention to studies in phytochemicals plant scientists with sophisticated art. These techniques have been instrumental in seeking additional resources of raw materials for the pharmaceutical industry (phytochemicals)[13].

Materials and methods

Phytochemical analysis through standard methods: 250g each of fresh leaves of selected plant species, namely Acalypha indica, Calotropisprocera, Cannabis sativa, Croton bonplandianum and Daturastramonium growing under both normal and SWP conditions of selected areas (mentioned above), were collected early in the morning, they were changed into small fragments, washed with tap water rather than with distilled water.

After air drying, they were homogenized to a fine powder and stored in sealed bottles until the following analyzes were performed.

Preparation of plant extracts: 10grams of air-dried powder of individual plant species in 100ml of water and methanol (1:10) were taken in 150ml conical flasks separated from 150ml pre-sterilized to prepare plant extracts. After plugging the cotton, they were kept on a rotary shaker at 190-220rpm for 24hours.

The supernatants were collected separately in hermetically sterilized bottles and the following phytochemical color tests were carried out.

Alkaloids: 2ml of aqueous extract and methanol were taken from each plant species. The solvent extract corresponding to 2.5g of individual plant species was evaporated to dryness and the residue was heated to a boiling water bath with 5ml of 2N HCl. After cooling, the mixture was filtered and treated with a few drops of Mayer's reagent. The sample was then observed for the presence of turbidity or precipitation.

Flavonoids: 2ml of aqueous extract and solvent of different plant species were mixed with a few drops of conc. HCl. HCl and 0.5g of mg of revolutions. The presence of flavonoids was indication of a pink or magenta color developed in 3minutes.

Phenols: 2ml of aqueous extract and solvent of individual plant species were treated with a few drops of neutral ferric chloride solution. 5% of intense color developed indicates the presence of phenols.

Saponins: 2ml of each aqueous extract and solvent of individual plant species boiled with water.

After cooling the extract, it was stirred vigorously to the foam and then allowed to stand for 15-20minutes and sorted for the saponin content as follows: no foam = negative; foam less than 1cm = weakly positive; Foam 1.2cm high = positive; and foam more than 2cm high = strongly positive.

Tannins: 2ml of aqueous extract and solvent of individual plant species were taken with 10ml of distilled water. These were filtered and ferric chloride was added to the filtrate, a blue-black or blue-green precipitate was taken as an indication of the presence of tannins.

Terpenoids: in a test tube 2ml of an aqueous solvent extract species were taken and then some fragments of tin and three droplets of thionyl, violet or violet chloride were developed, which specified the existence of terpenoids.

Results and discussion

During comparative Preliminary Phytochemical screening for the presence of various phytocompounds from both aqueous as well as ethanolic extractions was tabulated in the Table-1.

Accordingly, about 06 phyto-compounds viz., Alkaloids, Flavonoids, Phenols, Saponins, Tannins and Terpenoids were identified in different selected plant species under natural as well as contaminated habitats. Among the two methods of extractions i.e. Aqueous and Ethanolic solvent extraction tested, Ethanolic solvent extraction was found to be better in yielding more constituents in all the plants considered. While major constituents presents in various plants under natural as well as contaminated habitats due to different methods of extraction is shown in Table-2.

Table-1: Preliminary phytochemical investigations of plant parts for the presence of various phytocompounds.

Name of plant species	Solvent	Akaloids		Flavonoids		Phenols		Saponins		Tannins		Terpenoids	
		C	T	C	T	C	T	C	T	C	T	C	T
Acalyphaindica	Aqueous	+	+	-	+	+	+	+	+	-	-	-	-
	Ethanol	+	+	+	-	+	+	+	-	+	+	+	+
Calotropisprocera	Aqueous	-	-	-	-	+	+	+	+	-	-	+	-
	Ethanol	+	+	-	-	+	+	+	+	-	-	+	+
Cannabis sativa	Aqueous	+	+	+	-	+	+	-	-	+	+	+	+
	Ethanol	+	-	-	+	+	-	+	-	+	+	-	-
Croton bonplandianum	Aqueous	-	+	+	-	-	+	+	-	+	+	+	-
	Ethanol	+	+	+	+	-	-	+	-	+	-	+	-
Daturastramonium	Aqueous	+	-	-	-	-	-	+	+	+	-	+	-
	Ethanol	+	-	-	-	+	+	+	+	+	-	+	+

(+) = Presence of Phytocompounds, (C) = Control (Natural Habitat), (-) = Absence of Phytocompounds, (T) = Treated (Polluted Habitat).

Table-2: Major constituents and percentage decrease in various plants due to solid waste pollution.

Name of Plant species	Aqueous			Ethanol		
	C	T	%D	C	T	%D
Acalyphaindica	3	4	-33.33	6	4	33.33
Calotropisprocera	3	2	33.33	4	4	Nil
Cannabis sativa	5	4	20	4	2	50
Croton bonplandianum	4	3	25	5	2	60
Daturastramonium	4	1	75	5	3	40

%D = Percent Decrease, (-) = Increase amount of phytoconstituents in treated plants, (+) = Decrease amount of phytoconstituents in treated plants, C = Control, T = Treated.

Maximum, 06 phyto-compounds were existing in the Ethanolic extract of *Acalypha indica* and maximum 05 phytocompounds were present in the aqueous extract of *Cannabis sativa* under control conditions, while maximum 04 Phytocompounds were present in the ethanolic as well as aqueous both extract of *Acalypha indica* under treated conditions. On the whole under treated conditions the number of phytocostituents decreased in comparison to that under control conditions in all the tested plant species when both ethanolic as well as aqueous extracts were employed. *Daturastramonium* was most affected in its bioactive profile when aqueous extract was used and *Croton bonplandianum* when its ethanolic extract was used. The rest of them showed moderate effect under treated conditions. However *Calotropisprocera* was unaffected and tolerated SWP condition.

Contaminants can enter the environment in different ways. In addition to soil, vegetation functions as a sink for air pollutants due to its ability to act as effective interceptions of material transported by air. As a result, plants are widely used as passive biomonitors in urban environments[14]. Phytochemicals act as antioxidants that stimulate the liver's protective enzymes or block damage to the genetic material. Phytochemicals inhibit the appearance of oxidative chemical species (OCS), stimulate the mechanism of antioxidant repair and the capacity for elimination of radicals in the system[15].

Phytochemical selection of selected plant species revealed the presence of 6 major constituents, namely alkaloids, flavonoids, phenols, saponins, tannins and terpenoids of therapeutic value. Alkaloids are well defined as naturally occurring organic bases of basic character containing at least one nitrogen atom in a heterocyclic ring. In general, alkaloids are very toxic, but they are used in medicine in very small quantities. They have been associated with medical applications for centuries, and one of their common biological properties is their cytotoxicity[16]. The presence of alkaloids is interesting because large amounts are used as antimalarials, analgesics, and stimulants[17,18].

Flavonoids are phenolic hydroxylated compounds known to be synthesized by plants and behave like a powerful protective agent against inflammatory disorders, thereby, reduce the formation of edema. The presence of phenols in plants makes them anti-inflammatory, anti-oxidant, antioxidant, immune system enhancers and hormonal modulators[19-21]. The presence of phenolic compounds in plants has contributed to their antioxidant properties and, therefore, to the usefulness of the plant in the herbal drug[22]. Earlier reports showed that the responses of the phenolic compounds in different ways under stress of contaminants[23]. Saponins have expectorant properties that have been used in the treatment of upper respiratory tract infections. They also have antibacterial activities and are known to possess hypocholesteric and anti-diabetic properties. Saponins are found in many plants and animals. Several workers have carried out extensive phytochemical analyzes of plants to detect the presence of saponins, although not toxic, they can generate adverse physiological reactions in the animals that consume them[24]. They show a cytotoxic effect and a growth inhibition against a variety of cells that have anti-inflammatory and anti-tumor properties[25]. Tannins bind to proteins rich in proline and interfere with protein synthesis[26]. Tannins play a significant role as a powerful antioxidant and are also responsible for hemostatic activity[27].

Plant terpenoids are generally used for their aromatic qualities. They play a role in traditional herbal remedies and are being considered for antibacterial, antineoplastic and other pharmaceutical functions. Terpenoids, which are the most abundant and structurally diverse group of secondary plant metabolites, play asignificant role in plant-insect interactions[28].

Qualitative analysis of the leaf extract of Acalyphaindica has demonstrated the occurrence of phytochemical constituents such as alkaloids, flavonoids, phenolic compounds, saponins[29] and tannins and terpenoids in the ethanolic extract[30], which conforms to current studies. Although the Calotropisprocera had been studied for carotenoids from the latex of the leaves, an active ingredient. Mudarine had been isolated from the leaves of Calotropisprocera, a resin of bitter yellow acid has also been found. Several workers reported the presence of alkaloids,

saponins, terpenoids and phenols according to current research[30,31]. Croton is rich in secondary metabolites, including alkaloids and terpenoids, including the foreign coagulant irritant coagulant[32]. Bonplandianum croton can also be explained by the presence of many types of secondary metabolites, such as saponins, tannins, flavonoids, terpenoids and alkaloids[33], which was confirmed in this study. Cannabis sativa produces a unique family of terpene-phenolic compounds called cannabods. Cannabinoids, terpenoids and other compounds are secreted by granular trichomes and are known to have a therapeutic value[34]. In the present study showed the presence of phytocompounds such as alkaloids, phenols, saponins, flavonoids and tannins. Daturastramonium was evaluated for phytochemical components such as alkaloids, saponins, tannins and terpenoids. The alkaloid content of the leaves is mainly atropine[35]. The present study showed the phyto constituents mentioned above, as well as alkaloids, phenols, saponins, tannins and terpenoids. The selected plants are known for their presence of phytochemicals with defined medicinal properties that are controlled due to Solid Waste Contamination (SWP).

Conclusion

Present studies on selected plant species, clearly showed the monitoring role of SWP on the phytochemistry, in terms of presence or absence of major phyto constituents. The eco-environment had bearing on their existence, under SWP conditions as well as their acquired tolerance. Since the tested plant species are of therapeutic significance, their responses to SWP, are of significance. Plants have been employed as indicators of a wide variety of terrestrial conditions. The potential hazards linked with solid waste have generally have been evaluated with regard to survival of plants and also due to pathogens which cause serious health problems to human beings. The city of Agra, being the international tourist centre, is known for leather based industries and the like responsible for SWP. The local Vegetation is disturbed and showed varied responses to SWP generated periodically. The native plants are especially the selected plant species also employed in various preparations of alternate medicines. If such plants are sustained to be used without any discernment for medicinal purposes, it may affect human health in future.

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