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Short communication

Comparative efficacy of fumes of some weeds and oleo-gum resin of guggul (*Commiphora wightii*) on air microflora

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With rapid industrialization and urbanization, environmental pollution has become a serious problem. There are various types of pollution *e.g.* air, water, soil and sound. Chemical fumigation is used as an adjunct for environmental cleaning of indoors, hospital isolation rooms and other critical areas. For healthy living and to check unwanted microflora, often people use cleaning products, which have substantial risk particularly with the products containing volatile organic compounds (Nazaroff and Weschler 2004).Various chemical fumigants, *viz*. formaldehyde gas, hydrogen peroxide, chlorine dioxide *etc.* (Knapp and Battissi 2001) are used to manage air pollution. Although, chemical fumigation is effective, but possess many hazardous effects, which may be responsible for serious illness. It is evident that fumigation with formaldehyde causes sulfhydryl poisoning, protein aggregation and cancer (Rengaramanujum *et al*. 2009). The acute renal, liver, myocardial and skeletal muscle injury can also be developed in cases of severe intoxication by chemical fumigation (Arora *et al.* 1995). Moreover, these chemicals as fumigants also cause damage to the surfaces and equipments.

Plants produce many bio-chemical compounds for biological functions, including defense against insects, fungi and herbivores. The use of different plant fumes for air purification or to kill germs is well documented in our ancient literature (Saxena *et al*. 2007). Smoke produced from natural substances has been used extensively in many societies world over. Ancient ayurvedic physicians have recommended for treatment of several diseases or purification of air indoors or outdoors by use of plant products' smoke. Hence, considering the hazardous effect of chemical fumigants, plants bio-chemicals may be the lucrative alternative to use in indoors, hospitals *etc*. to combat the notorious microorganism present in the air.

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Collection of plants

Aerial parts of *Vernonia cinerea* (Compositae), *Tridax procumbanens* (Asteraceae) and *Lantana camara* (Verbenaceae) were collected from Non-wood Forest Produce Nursery of Tropical Forest Research Institute, Jabalpur and air dried. Oleo-gum resin of *Commiphora wightii* (Burseraceae) was collected from ravines area of district Morena (Madhya Pradesh).

Testing of microbial activity

An experiment was conducted in three different laboratory rooms having dimensions of 25 x 25 (625 sq ft). Bio-fumigation was carried out by burning the mixture of selected plant species dried powder with fumigation catalyst, *viz.* cow dung cake and wooden chips in ratio of 0.5:1:1 as per method described by Rengaramanujum *et al*. (2009) in an earthen pot placed in the centre of table at a height of 125 cm from the floor level. The Petri-dishes containing sterile nutrient agar medium were placed at three different distance, *viz.* 1.0, 1.5 and 2.0 m apart from the table. Petri-dishes were kept open before and after fumigation for 15 minutes. Petri-dishes were incubated at 37 ^{0}C after exposure in the air. The microbial colony count was recorded in Petri-dishes at each distance before and after fumigation after 24 and 48 hours. The experiment was carried out in three replications and the results were expressed in terms of mean cfu/15 min. These were labeled as, L1 (1.0 m), L2 (1.5 m) and L3 (2.0 m).

The effect of fumes of different weeds and guggul resin on air micro-flora of the laboratory are given in **Table 1**. There was significant (p=0.05) decrease in bacterial population after fumigation (**Figure 1**). The bacterial count was found maximum at 2.0 m distance in all the treatments after fumigation. Minimum bacterial count was observed in *C. wightii* oleo-gum resin (0.33 cfu/15 min) followed by *T. procumbanens* (0.67 cfu/15 min) at

Table 1. Mean of bacteria colonies (cfu/15 m) before and after fumigation with fumes of weeds and guggul oleo-gum resin

Species	Bacteria colony recorded before fumigation		Bacteria colony recorded after fumigation at three distance (m)							
	Mean		L1 (1.0 m)		L2 (1.5 m)		L3 (2.0 m)		Mean 24 h	Mean 48 h
	24 hrs	48 hrs	24 hrs	48 hrs	24 hrs	48 hrs	24 hrs	48 hrs		
V. cinerea	25.3 ± 4.16	30.33± 3.51	1.67±0.58	8±1.73	3.33±0.58	5.6±2.08	5±2.00	8±4.36	3.33±1.67	7.20±1.39
T. procumbens	16.7 ± 2.08	32.00±4.00	0.67±1.15	4±1.00	1.33±0.58	4±1.00	4±1.00	8.66±2.08	2.00±1.76	5.55±2.69
L. camara	18.3±8.39	26.67±8.14	2.00±1.00	4.33±1.53	4.67±3.21	7±3.46	9±3.61	14.66 ± 6.43	5.22±3.53	8.66±5.36
C. wightii	25.7±9.02	36±5.29	0.33±0.58	2.67±0.58	3.67±1.15	8±4.00	6.33±4.16	9±3.00	3.44±3.01	6.56±3.40
LSD (p=0.05)	NS	NS	NS	2.75	NS	NS	NS	NS	2.01	NS

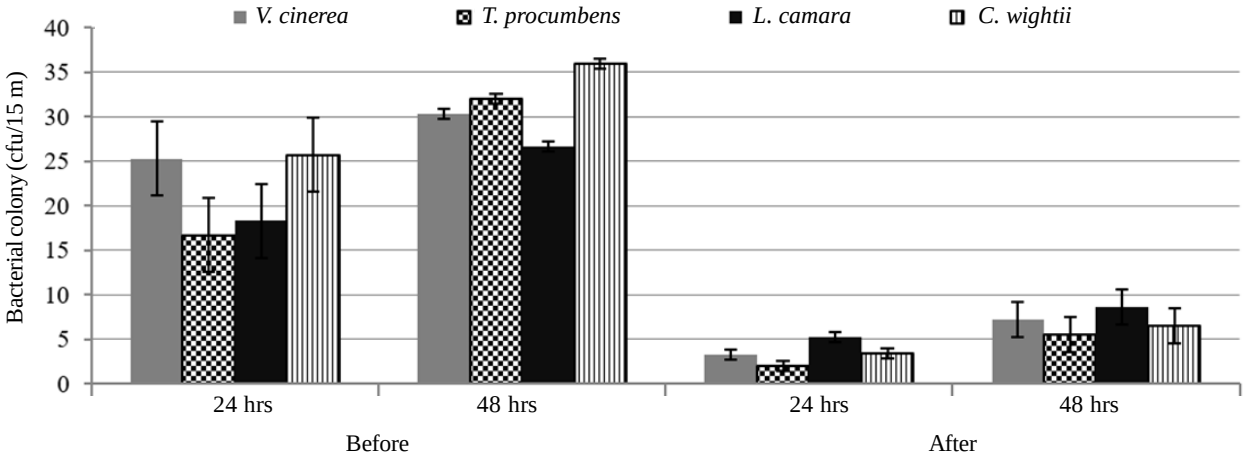

Figure 1. Air bacterial colonies before and after fumigation (microbial count expressed in cfu/15 m)

1.0 m distance. There was no significant difference in bacterial colonies count among the oleo-gum resin of guggul and weeds at both the time durations of 24 and 48 h except at distance 1.0 m (48 h). However, mean values of bacterial colonies at three distances after 24 h showed significant difference while non-significant variation in bacterial colonies were recorded in Petri-dishes exposed with the fumes of *C.wightii, V. cinerea*, and *T. procumbens*. Per cent reduction of total microbial count after fumigation was observed as 92, 96, 88 and 99% and 73, 87, 84 and 93% after 24 and 48 h by *V. cinerea, T. procumbens, L. camara* and oleo-gum resin of *C. wightii*, respectively (**Figure 2**).

Maximum reduction was observed in oleo-gum resin fumes. However, fumes of weed species were also found effective for reducing bacteria population in the laboratory rooms.

The results indicated that weeds fumes are also effective to reduce microbial population in comparison to guggul (*C. wightii*) fumes, which is an important ingredient of Havan 'samigri' (composition of various ingredients) in Yagna and are used for air purification since ancient times. The reduction in the microbial load in the air might be due to the presence of medicinal volatiles or anti-microbial chemicals in the smokes. These results also supported the findings of Nautiyal *et al.* (2007), who studied the effect of Yagna fumes and medicinal plants smoke in reduction of airborne bacteria. Pattnaik (2010) reported antibacterial activity of leaf extract and essential oils of *L. camara* against the bacteria species of *Staphylococcus aureus, Bacillus subtilis, Escherichia coli* and *Salmonella gallinarum*. The antimicrobial effects of *T. procumbens* has also been demonstrated (Sanchez *et al.* 2005). Somasundaram *et al.* (2010) has reported antibacterial activity of *V. cinerea* extracts against most prevalent microbes like *S. aureus, P. aeruginosa, B. cereus, K. pneumonia, E. coli, A. niger* and *C. albicans.* Our observations are in accordance with the findings of several workers, who suggested the advantage of smoke/fumigation by burning incense, herbs and aromatic essence.

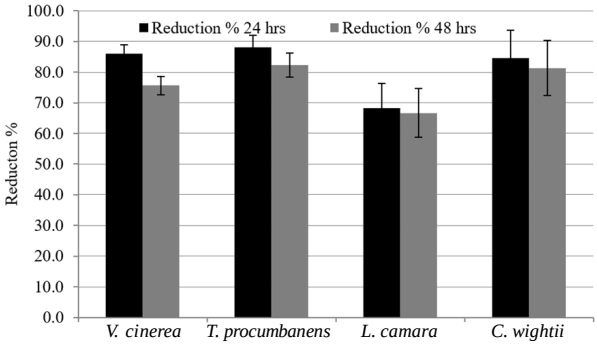

Figure 2. Percent reduction of Air-microflora after fumigation

Mohagheghzadeh *et al.* (2006) reviewed mono and multi-ingredient herbal remedies administered as smoke for the treatment of diseases, but no scientific study ever been conducted to elucidate the effect of fumes of dried power of weeds on air microflora. This study revealed that the dried powder of these weed species also have potential to reduce air microflora and can be used to prepare natural plant based fumigants.

SUMMARY

Presence of air microbes such as bacteria is reported to be associated with a number of illnesses. Chemical based cleaning products and fumigants available in the market have their limitations and sometimes pose severe ill effects on health of mankind. In order to explore the potential of weeds as bio-fumigant to reduce microflora in indoors, experiments were conducted with the fumes of three weeds namely purple fleabean *Vernonia cinerea* (Compositae), coat buttons *Tridax procumbens* (Asteraceae), *Lantana camara* (Verbenaceae) and oleo-gum resin of guggul *Commiphora wightii* (Burseraceae), an important ingredient of Yajnya 'Havan samigri' (composition of different herbal ingredients). The study revealed significant reduction in bacterial colonies (cfu/15 m) after fumigation in Petri-plates exposed to the air. Per cent reduction of bacterial count over control (before fumigation) was recorded as 79.7, 83.7, 67.3 and 82.3% and 76.7, 80.7, 61.0 and 77.3% by *V. cinerea*, *T. procumbens*, *L.camara* and *C. wightii* after 24 and 48 hours, respectively. The findings of the present study highlights that these weeds can be utilized as an ingredient in preparation of herbal fumigants for cleaning the indoors.

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