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# Bio-efficacy of Herbal Extracts in Controlling House Dust Mites

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**ABSTRACT** House dust mites are the most important source of allergens in domestic environment. The present investigation was undertaken with objective to test the bio-efficacy of different herbal seed extracts in controlling house dust mites among rural household of Udaipur district. Most of the rural households in the study were scheduled tribe and illiterate. Labour work was their main occupation. The findings of the study concluded that respondents were facing varied allergic diseases due to house dust mites. Some of these problems were asthma, coughing, watery eyes, sneezing, eczema, skin rashes etc. Ironically, it was quite depressing to note that rural people were totally unaware about the cause of these problems. Illiteracy, unawareness and lack of exposure were the factors responsible for this. Herbal seed extracts can be used to control house dust mites like *neem, karanja* and castor. These seed extracts are locally available, eco-friendly and cost effective too.

## INTRODUCTION

The UNDP's Human Development Report (2005) pinpointed safe water and adequate sanitation as the two most important indicators of human progress. Despite the fact that there exists close connection between poor sanitary conditions and severe health hazards, sanitation continues to be an unmet, challenge especially in the developing countries of the third world (Madhuri and Sikligar 2005).

National Common Minimum Programme adopted by the government of India, has also given highest priority to provide water and sanitation to all, especially in rural areas. But the challenge in sanitation is indeed enormous.

An overwhelming population of our country lives in rural areas. More than half the people in these villages live in *kaccha* houses, made of mud, thatch and other poor quality material. Floor of these houses are made up of mud and cow dung plaster. The roads of the villages are *kaccha*. The houses in the villages are situated in clusters on the roadsides. By walking on the road or by foot traffic the process of dust accumulation also increases in the houses.

Dust accumulation is a natural process. It includes assemblage, for example, variety of products like fiber, insect segments as well as assemblage of various animal and plant origin products. There are number of household activities performed within the house which also leads to accumulate dust in the house. Along with improper ventilation, unhygienic and insanitary conditions, this dust accumulation results in the occurrence of microorganism called house dust mites. House dust mites primarily live on dead skin cells which are commonly called dander, which shed regularly from humans and their animal pets (Barbogg 2003).

House dust mites are higher in number in areas where there is high humidity and lower light intensity. The preferable environment for the growth of house dust mites is 70-80 percent and in 20-30°C temperature. House dust mites due to very small size (250 to 300 microns in length) and translucent bodies are not visible to unaided eyes (Hart et al. 1998).

House dust mites have been widely viewed as the most important source of indoor allergens in house dust (Institute of Medise, Washington 2000). Throughout the year house dust mites are the major cause of various health problems like stuffy nose, sneezing and watery eyes what some people describe as a 'permanent cold'. However there are reports of red rashes around the neck. Other allergic reactions may include headache, fatigue and depression (Hart 1998; Singh and Rao 2001).

Various measures can be available to control house dust mites such as physical, chemical, environmental and herbal. Physical and chemical control measures are not suitable for rural masses because of their lifestyles, financial constraints and backwardness that restricts them to adopt new technologies. Rural people have a

close association with local herbs and their products which are locally available in rural areas. These are *karanja,* castor, *neem, tulsi* and custard apple. These herbs especially seed kernel contains an acaricidal effect that have a property of killing all types of pests and mites. Therefore these herbs can be used as seeds extracts in controlling house dust mites which are locally available, cost effective and eco-friendly also. Hence, the present paper was undertaken with the following objectives-

1.To find out the health problems faced by the respondents in association with house dust mites.

2.To test the bio-efficacy of herbal seed extracts in controlling house dust mites.

## METHODOLOGY

For the study purpose two blocks of Udaipur were selected, namely Badgaon and Girva. From these two blocks two villages were selected randomly. The study was conducted into two phases. During the first phase, a household survey of 60 homemakers was conducted who had mud flooring houses. An interview cum observation schedule was developed to collect the information regarding respondents' family background, health problem faced by the respondents, disinfectant used etc. The unit of enquiry was rural households and homemakers were key informants.

After referring suitable households for the study, in the second phase laboratory experiments were conducted to test to bio-efficacy of different types of seeds extracts (of various concentration levels 3,5,7,9 ). These were namely *karanja, neem, tulsi*, custard apple and castor. After testing the bio-efficacy of seed extracts three most effective seed extracts *karanja,* castor and *neem* were further applied among 45 respondents' houses (15 for each seeds extract) having mud flooring. Rest of the 15 respondents' houses seemed as control group. The dust samples (2 gms) of the respondents' houses were collected on 1st, 15th and 28th days of herbal seeds extracts treatment to test their efficacy on house dust mites mortality rate.

## RESULTS AND DISCUSSION

### Respondents Family Background Information

***Caste:*** Majority of the respondents belonged to scheduled tribe (87 percent). Tribals are known as indigenous people. They are known for their backwardness, they live in isolated areas therefore they are unaware about sanitation and modern hygenic practices. The type of family affects cleaning practices (Table 1).

**Table 1: Family background information of the respondents' household (N=60)**

| *S. No.* | *Particulars* | *F* | *%* |
|---|---|---|---|
| *1* | *Caste* | | |
| | a. General | 3 | 5 |
| | b. Scheduled caste | 3 | 5 |
| | c. Scheduled tribe | 52 | 87 |
| | d. Other backward caste | 2 | 3 |
| *2* | *Type of Family* | | |
| | a. Joint | 13 | 22 |
| | b. Nuclear | 47 | 78 |
| *3* | *Literacy Level* | | |
| | a. Illiterate | 58 | 96 |
| | b. Literate | 2 | 4 |
| *4* | *Age Group (in years)* | | |
| | a. Lower age group | 22 | 37 |
| | b. Higher age group | 38 | 63 |
| | Mean | 42 | |
| | SD | 13.99 | |
| *5* | *Household Annual Income (in Rupees)* | | |
| | a. Lower income level (up to 45100 rupees) | 34 | 57 |
| | b. Higher income level (above 45101 rupees) | 26 | 43 |
| | Mean | 45100 | |
| | SD | 11752 | |

***Type of Family:*** Data revealed that one-fourth of the respondents were from joint families and about three- fourth of the respondents belonged to nuclear families. Predominance of nuclear families revealed that it is customary among tribals that soon after marriage, the son separates from the family and establishes his own house (Vyas 1978; Lodha 2001).

***Literacy Level:*** Majority of the respondents (96 percent) were illiterate. Only a meager number of the respondents (4 percent) were literate up to primary level. Higher level of illiteracy shows unawareness regarding sanitary and hygienic practices especially about micro-organisms which are invisible through naked eyes.

***Age Group:*** Most of the respondents were in expanding stage of family life cycle. The average age of the respondents was 42 years (Sd = 13.99). Near about two-thirds of the respondents were in higher age group and rest of them (37 percent) were in lower age group.

***Household Income:*** Data of household income shows the socio-economic status of the

family. The economic status of the families has an important impact on the growth, multiplication of assets and finally accumulation of house dust mites in their surroundings (www.ingentaconnect.com 2002). Data shows that average annual income of the respondents' household was Rs. 45,000 (Sd = 11752). More than half of the respondents' household annual income was below average whereas 43 percent were having above average annual income. Higher income levels of the households encourage respondents to use the technology, more exposure to mass media and greater awareness about hygienic practices.

## HEALTH PROBLEMS FACED BY THE RESPONDENTS

The house dust mite is the commonest allergen encountered in most of the developing countries but most of the villagers are ignorant about the harmful effects of house dust mites due to its microscopic size. House dust mites are the major cause of all year round complaints of stuffy nose, sneezing and watery eyes what some people describe as a "permanent cold". In addition to these allergies dust mite can trigger asthma and eczema (Discover Magazine 1998).

***Awareness of Problems:*** The data in Table 2 clearly shows that majority of the respondents were unknown of the health problems they face. The common problems found among respondents were respiratory diseases like asthma (68 percent), sneezing (13 percent), wheezing (10 percent) and coughing (8 percent). Bronswik (1981) also supports these findings that mite allergens are mainly present in feces of house dust mites and may become airborne and inhaled by patients, giving rise to asthma, rhinitis or atopic dermatitis.

Apart from respiratory, skin related diseases were also caused by house dust mites. Discover Magazine (1998) also reported that the house dust mite is an important cause of eczema and skin related diseases among human beings. Beck et al. (1989) found that the severity of eczema seems to depend on the concentration of house dust mite allergen in the dust and skin related diseases. Though respondents faced skin problems like red rashes (35 percent) and eczema (12 percent) but they did not know about the causative factor. Due to unhygienic practices of rural households, certain parts of the body where moisture content is high becomes good place for assemblage of house dust mites and these are behind the pinnae of ears (Stella 1974).

Other common problems associated with the house dust mites which were faced by rural households were mainly headaches (63 percent) and fatigue (37 percent). The respondents were unknowledgeable about health problems caused by the house dust mites. However, only a meager number of the respondents were aware about problems faced like headaches (3 percent) and fatigue (7 percent) but unaware about causative factor.

***Period of Problem:*** Period of problem depends upon the severity and suitable growth conditions of house dust mites. House dust mites were found in abundance during high humidity and low temperature atmospheric conditions. The population density of house dust mites is influenced greatly by various parameters of which changing weather conditions exert a vital role. This would result in the occurrence of seasonal rises in their population density, often reaching peak development during rainy season, approaching the minimum level during summer and becoming moderate during winter season (Tilak and Jogdand 1989).

Most of the respiratory problems were faced by the respondents throughout the year like sneezing (18 percent), asthma (22 percent), wheezing (17 percent), coughing (20 percent). Some of the respondents face problem of sneezing (12 percent), asthma (7 percent) and coughing (8 percent) after rainfall. Coughing (7 percent) and wheezing (8 percent) was also found to be related to seasonality in little number of the cases.

Dirty skin also becomes a perfect breeding place for skin diseases like eczema, itching and rashes. Moist body parts with perspiration give a preferable environment for the growth of tropical fungus and house dust mites (Stella 1974). Skin related problems like red rashes on skin were faced throughout the year by 17 percent of the respondents. However, others face it after rainfall (8 percent) or seasonally (8 percent). Other skin diseases like eczema were also faced seasonally (5 percent) and during low humidity time (3 percent). Other diseases like headache (23 percent) and fatigue (18 percent) were faced by the respondents throughout the year. At the same time fatigue was also faced during the time of low humidity (25 percent) and seasonal variation (20 percent).

**Table 2: Respondents' health problems associated with the house dust mites (N = 60)**

| S.No. Particulars | Health Problems* | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Respiratory | | | | | | | | Skin related | | | | Others | | | |
| | Sneezing | | Asthma | | Wheezing | | Coughing | | Red rashes | | Eczema | | Headache | | Fatigue | |
| | F | % | F | % | F | % | F | % | F | % | F | % | F | % | F | % |
| *1. Awareness of Problems* | | | | | | | | | | | | | | | | |
| (a) Aware | 8 | 13 | 41 | 68 | 6 | 10 | 5 | 8 | - | - | - | - | 2 | 3 | 4 | 7 |
| (ii) Not aware | - | - | 2 | 3 | 2 | 3 | - | - | 29 | 48 | 13 | 22 | 20 | 33 | - | - |
| (iii) Unknown | 17 | 28 | 17 | 28 | 22 | 37 | 4 | 7 | 21 | 35 | 7 | 12 | 38 | 63 | 22 | 37 |
| *2. Problem Faced* | | | | | | | | | | | | | | | | |
| (i) Throughout the year | 11 | 18 | 13 | 22 | 10 | 17 | 12 | 20 | 10 | 17 | - | - | 14 | 23 | 11 | 10 |
| (ii) After rainfall | 7 | 12 | 4 | 7 | 2 | 3 | 5 | 8 | 5 | 8 | 1 | 2 | - | - | 2 | 3 |
| (iii) Low humidity | - | - | - | - | - | - | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 3 | 15 | 25 |
| (iv) Seasonally | 1 | 2 | - | - | 5 | 8 | 4 | 7 | 5 | 8 | 3 | 5 | 4 | 7 | 12 | 20 |
| (v) Never | - | - | - | - | - | - | - | - | 4 | 7 | - | - | - | - | - | - |
| (vi) Sometimes | 2 | 3 | - | - | - | - | 2 | 3 | - | - | - | - | - | - | - | - |
| *3. Affected Age* | | | | | | | | | | | | | | | | |
| (i) Children | 9 | 15 | 9 | 15 | 11 | 18 | 9 | 15 | 8 | 13 | 4 | 7 | 4 | 7 | 4 | 7 |
| (ii) Adult | 1 | 2 | 1 | 2 | 6 | 10 | 2 | 3 | 2 | 3 | 1 | 2 | 2 | 5 | 3 | 5 |
| (iii) Middle age | 4 | 7 | 7 | 12 | 10 | 17 | 8 | 13 | 3 | 5 | 3 | 5 | 34 | 57 | 25 | 42 |
| (iv) Aged | 12 | 20 | 15 | 25 | 12 | 20 | 5 | 8 | 15 | 25 | 3 | 5 | 32 | 53 | 20 | 33 |
| *4. Occurrence Time (Daily)* | | | | | | | | | | | | | | | | |
| (i) Morning | 11 | 18 | 10 | 17 | 12 | 20 | 14 | 23 | 6 | 10 | 4 | 7 | 19 | 32 | 7 | 12 |
| (ii) Mid day | 1 | 2 | 3 | 5 | 3 | 5 | 2 | 3 | 4 | 7 | 3 | 5 | 4 | 7 | 10 | 17 |
| (iii) Evening | 4 | 7 | 6 | 10 | 12 | 20 | 11 | 18 | 5 | 8 | 1 | 2 | 17 | 26 | 16 | 27 |
| (iv) Night | 6 | 10 | 1 | 2 | 2 | 3 | 8 | 13 | 8 | 13 | 3 | 5 | 14 | 23 | 3 | 5 |
| *5. Problem Solved/Remedial Measures* | | | | | | | | | | | | | | | | |
| (i) Use of *neem* solution | - | - | - | - | - | - | - | - | 4 | 7 | 2 | 3 | 2 | 3 | - | - |
| (ii) Medicine | - | - | 5 | 8 | 3 | 5 | - | - | - | - | - | - | 8 | 13 | 12 | 20 |
| (iii) By sleeping | - | - | - | - | - | - | - | - | 9 | 10 | 12 | 8 | - | - | - | - |
| (iv) By bathing | 20 | 34 | 3 | 5 | 5 | 8 | - | - | - | - | - | - | 8 | 13 | 8 | 13 |

***Affected Age:*** Lewis et al. (1994) stated that children especially below the age of 5 years are more susceptible group that gets affected by the house dust mites. This is because children have a direct exposure to dust and they frequently put their hands, toys and other objects into their mouth. Second major group susceptible to mite allergens is old age, which was due to weaker sensory channel. They cannot keep proper hygiene and sanitation, which may cause allergic diseases.

Children due to less resistance power were found to be more prone to respiratory diseases like wheezing (18 percent), sneezing (15 percent), asthma (15 percent) and coughing (15 percent) whereas middle age persons were more susceptible to wheezing (17 percent). Older people were also more allergic to respiratory diseases such as sneezing (20 percent), asthma (25 percent) and wheezing (20 percent). Skin related problems were more among children (13 percent) and aged persons (25 percent). Middle age persons face the problem of he-adache (57 percent) and fatigue (42 percent). Headache (53 percent) and fatigue (33 percent) was common among aged people also.

***Occurrence Time:*** House dust mites' allergens are generally found at their peak rates in morning and evening time or when relative humidity of ambient indoor air would be highest. Similar findings of house dust mites' occurrence allergens time was found by Bahir et al. (1997).

Generally all the respiratory diseases among respondents occur during morning hours of a day like sneezing (18 percent), asthma (17 percent) and coughing (20 percent). Some of these diseases occur during evening hours also such as asthma (10 percent) and coughing (20 percent). Skin diseases were more common among respondents during morning hours like red rashes (10 percent), eczema (7 percent). Red rashes (13 percent) were found to occur during

night time also. Headache was found to be common in respondents during morning (32 percent), evening (28 percent) and night (23 percent). Fatigue was common during mid day (17 percent) and evening (27 percent) among the respondents.

***Problem Solved:*** For eradication of house dust mite problems many types of chemical, physical, herbal and environmental treatments are available to control the problem of house dust mites. Some of these types are – regular cleaning of draperies, furniture, textiles that will keep dust mite populations low. Special dust clothes or other cleaning implements that are treated chemically to hold rather than scatter dust may be helpful. Avoid wet mopping because it increases moisture in the air (Barbogg 2003).

Respiratory diseases of respondents like asthma (8 percent) and wheezing (5 percent) were solved through medicines. No any treatment was taken by the respondents for sneezing (34 percent). The respondents used *neem* bathing as remedial measures for skin diseases. Headache (13 percent) and fatigue (20 percent) problem were solved by consuming medicine.

**Reasons for Non-utilizing Disinfectant**

The respondents reported varied reasons for non-utilization of disinfectant. Majority of the respondents (82 percent) were facing the non-availability of resources as a major reason for non utilization the disinfectants (Table 3).

**Table 3: Reasons for non-utilization of disinfectant for household cleaning by the respondents (N=60)**

| *S. No.* | *Reasons** | *F* | *%* |
|---|---|---|---|
| 1. | Non availability of resources | 49 | 82 |
| 2. | Financial constraints | 46 | 77 |
| 3. | Lack of education | 29 | 48 |
| 4. | Technological complications | 34 | 57 |
| 5. | No need/ no interest | 29 | 48 |
| 6. | Lack of time | 2 | 3 |
| 7. | Unawareness | 2 | 3 |

* Multiple responses.

Other responses were, lack of money (77 percent), lack of education (48 percent), technology complication (57 percent), no interest and need (48 percent) lack of time (3 percent) and unawareness (3 percent).

**Table 4: Bio-efficacy of herbal seed extracts against house dust mites in laboratory**

| *S. No.* | *Treatments of seed extracts* | *Concentration or dose (%)* | *Total number of mites released* | *Live mites after 24 hours* | *Percentage mortality* | *Corrected percentage mortality* |
|---|---|---|---|---|---|---|
| 1 | T1 *Karanja* seed | 3 | 20 | 16 | 20 | 15.78 |
| | extract T2 *Karanja* | 5 | 20 | 8 | 60 | 57.89 |
| | seed extract T3 | 7 | 20 | 7 | 65 | 63.15 |
| | *Karanja* seed extract | | | | | |
| | T4 *Karanja* seed | 9 | 20 | 7 | 65 | 63.15 |
| | extract | | | | | |
| 2 | T5 Castor seed extract | 3 | 20 | 17 | 15 | 10.52 |
| | T6 Castor seed extract | 5 | 20 | 9 | 55 | 52.63 |
| | T7 Castor seed extract | 7 | 20 | 9 | 55 | 52.63 |
| | T8 Castor seed extract | 9 | 20 | 9 | 55 | 52.63 |
| 3 | T9 *Neem* seed extract | 3 | 20 | 17 | 15 | 10.52 |
| | T10 *Neem* seed extract | 5 | 20 | 10 | 50 | 47.36 |
| | T11 *Neem* seed extract | 7 | 20 | 10 | 50 | 47.36 |
| | T12 *Neem* seed extract | 9 | 20 | 10 | 50 | 47.36 |
| 4 | T13 Custard apple seed | 3 | 20 | 17 | 15 | 10.52 |
| | extract | | | | | |
| | T14 Custard apple seed | 5 | 20 | 15 | 15 | 10.52 |
| | extract | | | | | |
| | T15 Custard apple seed | 7 | 20 | 15 | 15 | 10.52 |
| | extract | | | | | |
| | T16 Custard apple seed | 9 | 20 | 15 | 15 | 0.52 |
| | extract | | | | | |
| 5 | T17 *Tulsi* seed extract | 3 | 20 | 18 | 10 | 5.26 |
| | T18 *Tulsi* seed extract | 5 | 20 | 17 | 15 | 10.52 |
| | T19 *Tulsi* seed extract | 7 | 20 | 17 | 15 | 10.52 |
| | T20 *Tulsi* seed extract | 9 | 20 | 16 | 20 | 15.78 |
| 6 | T21 Control | - | - | 19 | 5 | - |

**Effect of Herbal Extracts on House Dust Mites**

To test the effect of herbal seed extracts on HDMs mortality rate lab experiments were conducted on different concentrations (3,5,7,9) of seed extracts. In lab experiments, highest mortality rate of house dust mites was observed in 7 and 9 percent concentration of *karanja* seed extract (63.15 percent) that was somewhat near to the 5 percent of the same extract. In case of castor seed extracts, 5, 7 and 9 percent concentrations were found to be equally effective against the house dust mites. The similar results were also observed in case of *neem* seed extracts (Table 4).

**House Dust Mites Mortality Rate**

Through laboratory experiments the three most effective herbal seed extracts namely *karanja*, *neem* and castor (at 5% mortality rate) were further applied to respondents' houses mud flooring to test its bio-efficacy (Table 4).

**1st Day After Treatment**

Figure 1 depicts that all the treatments were found to be significantly superior over control. First day after application of *karanja* seed extract (5 percent) was found to be most effective treatment in reducing the house dust mites' population (86.72 percent), followed by castor seed extract at 76.27 percent. The *karanja* seed extract (5 percent) was found statistically superior over other treatments. Whereas the *neem* seed kernel extract (5 percent) was found to be as a least effective treatment against the house dust mites.

**15th Days After Treatment**

Fifteen days after application of seed extracts treatment *karanja* seed extract, treatment was proved to be most effective against the percentage reduction in the population of house dust mites (68.69 percent) followed by castor seed extract (at 5 percent, 56.47 percent reduction). In the *neem* seed extract, treatment (5 percent) was found least effective against the house dust mites. The *karanja* seed extract (5 percent) was found to be statistically superior over all other treatment of 15 days.

**28 Days After Application**

The results of twenty- eight days after application of herbal treatments revealed similar results as similar days where *karanja* seed extract (5 percent) was proved as the most significantly superior in terms of house dust mites mortality rate (65.53 percent reduction) followed by castor seed and *neem* seed extracts. Both the treatments were at par with each other statistically (Table 5).

**Temperature and Humidity**

House dust mite population in many climatic regions can be controlled by modifying tempe-

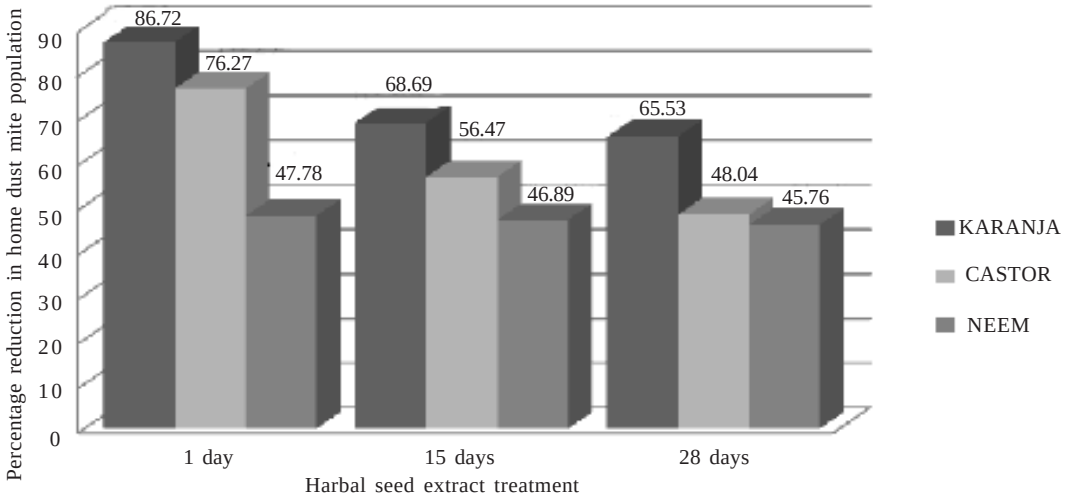


**Fig. 1. Bioefficacy of harbal seed extracts on house dust mite**

**Table 5: Analysis of variance showing field effectiveness of herbal seed extract against house dust mites**

| *Source of variance* | *d.f.* | *S.S.* | *M.S.S.* | *'F' value* |
|---|---|---|---|---|
| *One Day After Application* | | | | |
| Replication | 14 | 344.21 | 24.58 | 0.99 |
| Treatment | 2 | 4870.12 | 2435.06 | 98.58* |
| Error | 28 | 691.62 | 24.70 | |
| *Fifteen Days After Application* | | | | |
| Replication | 14 | 477.93 | 34.13 | 0.93 |
| Treatment | 2 | 1229.14 | 614.57 | 16.76* |
| Error | 28 | 1026.42 | 36.65 | |
| *Twenty- Eight Days After Application* | | | | |
| Replication | 14 | 932.35 | 66.59 | 2.62 |
| Treatment | 2 | 1185.39 | 592.69 | 23.29* |
| Error | 28 | 712.32 | 25.44 | |
| *Mean* | | | | |
| Replication | 14 | 191.95 | 13.71 | 1.76 |
| Treatment | 2 | 2013.55 | 1006.77 | 129.74* |
| Error | 28 | 217.36 | 7.76 | |

* Significant at 0.05 level of probability

rature and humidity within dwelling (Bonswijk et al. 1991; Fletcher et al. 1996; Boer et al. 1998; Korsgard, 1999). In all the three treatments, most limiting factors which effect the growth of house dust mites population are indoor humidity and temperature. The average indoor temperature was 29.38 (SD=2.18) and humidity was 67.83 (SD=5.30) of respondents houses which are ideal conditions for the growth of HDMs (Table 6).

**Table 6: Temperature and humidity of the respondents' houses**

| *S.No.* | *Particulars* | *Mean* | *SD.* |
|---|---|---|---|
| 1 | Temperature | 29.38 | 2.18 |
| 2 | Humidity | 67.83 | 5.30 |

The average humidity found in rural houses was 67.83 percent (Sd = 5.30) and favourable temperature was found 29.380C with Sd = 2.18.

On the basis of pooled mean, all the treatments were observed to be significantly superior over control in percent reduction in the house dust mite population. *Karanja* seed extract (5 percent) was proved to be most effective (74.31 percent reduction) followed by castor seed extract (60.65 percent) in reduction of the house mites rate. On the other hand, *neem* seed extract was found to be least effective treatment because it led to only 46.80 percent reduction of mite population.

Thus, the overall order of effectiveness of the treatments was: *karanja*, castor and *neem* seed extract at 5 percent concentration. Hence, *karanja* seed extract (5 percent) was recommended for the control of the house dust mite population in houses. Statistically, the difference between the mortality rate of mites was highly significant with respect to seeds extracts and days of application and also interaction effect.

*Karanja* seed extract was found most effective in controlling house dust mites as compared to other seeds extracts. *Karanja* seed may contain more poisonous chemicals as compared to other seeds. *Karanja* seeds were found to contain 27-36.4 percent of bitter fatty oil which has insecticidal properties (Chopra 1949). The seeds of castor also contain ethanol and methanol and the seeds of *neem* contain anamorphous bitter properties and also a crystalline substance, margospoerine. These chemicals must be having acaricidal properties for mortality of house dust mites. These observations are in agreement with Rai et al. (2001) and Singh and Rao (2001).

## CONCLUSION

Thus, it can be summarized that rural households were unaware about the house dust mite problems that they were facing due to illiteracy, ignorance, lack of exposure to mass media and unawareness. The main problems they were faced were respiratory and skin problems like asthma, wheezing, coughing, itching and red rashes. Locally available seeds of *karanja*, castor and *neem* were utilized as extracts in controlling these harmful mites due to their acaricidal properties. *Karanja* seeds were found as most effective in controlling house dust mites.

## RECOMMENDATIONS

From ancient times herbs had been used in order to lead a healthy, peaceful and disease free

life. Benefit should be taken from local plants that are very useful in treatments of house dust mite diseases. The herbal seed extracts from these plants are locally available, cost effective and eco-friendly which should be popularized among people.

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