Title: A HERBAL MOSQUITO REPELLENT COMPOSITION

Abstract: The present invention relates to a formulation useful as herbal mosquito repellent, said formulation comprising an effective amount of the essential oil of Tagetes minuta, cedar, Chrysanthemum cinerariaefolium (Pyrethrum powder) and cyperus rotundus powder together with binders and fillers in the ratio of about 0.20-3.0, 0.5-15, 2.0-3.0, 2.0-3.0, 0.1-1 and 8-10 respectively.
HERBAL MOSQUITO REPELLENT COMPOSITION

FIELD

The present invention relates to a formulation useful as herbal mosquito repellent incense stick.

BACKGROUND

The formulation for the manufacturing of the herbal mosquito repellent incense stick has replaced synthetic compound (allethrin) based traditional mosquito repellents i.e. mats, coils and sprays through herbal mosquito repellent agarbatti, prepared by using natural essential oil of Tagetes minuta (Tyagi et al., 1997 International pest control 39 (6) 184-185) and powder of the pyrethrum flowers (Howard, 1911 U.S. Der. Agr. Farmers' Bull. 444 1-15, Negasawawa et al, 1951, Botyu-Kagaku 16 176-181). Natural repellent based on pyrethrum have been approved and included in WHO Data Sheet on Pesticides under No. 11, 1975 [clause 1.5] in the public health programme. Synthetic compounds though very effective in controlling the menace of mosquitoes, are highly toxic to human beings and persist in the bio-system for a long time. The use of chemical toxicants or mosquito repellents to control mosquito has proved to be one of the most controversial and emotional subjects in recent years.

The widespread use of mosquito repellents and insecticides in public health programme has caused severe environmental pollution and potential health hazards. Introduction of new more toxic and rapidly disseminating mosquito repellents/pesticides into environment has necessitated accurate identification of their potential hazards to human health. Many of them are extremely toxic to mammals/and or other non-target organisms. The extent of hazard depends on the amount of residue and its toxicity. Mosquitoes are known to transmit many diseases such as malaria, dengue, yellow fever, filariasis and Japanese encephalitis. Approximately 40 million people in India suffer from mosquito born diseases annually. There is a need to develop safe and eco-friendly mosquito repellents based on herbage.
Insect repellents play a major role in malaria eradication programmes. The mounting concern in recent years about the use of chemicals to control insect/pest have led to the restrictions and in many cases to complete or partial ban on the use of synthetic insecticides.

It has prompted researchers to develop herbal third generation eco-friendly mosquito repellents with less side effect to man and the environment. With the result, naturally known botanical substances, essential oil of Tagetes minuta, and Chrysanthemum cinerariaefolium (Pyrethrum) have been used to control mosquito as they have low mammalian toxicity and can be handled safely.

The insecticidally active constituents of pyrethrum extract, the pyrethrins, are esters, formed by a combination of two acids, chrysanthemic acid and pyrethric acid and three alcohols, pyrethrolone, cinerolone, and jasmololone. The esters of chrysanthemic acid are called pyrethrin I and pyrthrin II fraction. These compound together account for the kill and knockdown properties of insects. Chrysanthemum cinerariaefolium (Pyrethrum) provides an excellent example of natural combination of materials that is very difficult to reproduce chemically.

The insecticidal activity in fresh pyrethrum flowers is not diminished by drying at temperature upto 80°C (Godin et al. 1965 J. Sci., Food Agric. 16, 186-191).

(William, 1973 Chrysanthemum cinerariaefolium (Pyrethrum), the national insecticide Chapter 6 : 123-142) mention that pyrethrins are a safe insecticide and do not pose a hazard of acute toxicity to humans.

Alletrin has insecticidal powers and acute toxicity generally comparable to the natural pyrethrins (Negherbon, 1959, “Hand Book of Toxicology” vol. III).
A popular mosquito repellent called Tortoise brand Mosquito coil claim the use of *Chrysanthemum cinerariaefolium* (pyrethrum flower), as a insecticide.

Preliminary investigation indicated that the *Tagetes minuta* oil has synergistic activity with *Chrysanthemum cinerariaefolium* (pyrethrum), which could further enhance the important of the oil (Nais and Pant. 1966 Bull bot. Surv. India 8 : 75)


Singh and Agarwal (1988, J.chem.Eco,14(4) : 1145-51 have found that himachalol and himachalene from cedarwood oil possess very good insecticidal activity against housefly (*Musca domestica*).

Citrolo nellol and citronellal from citronella oil have been found effective oil constituents against mosquito (Travis et al 1946 J. Econ. Ent 42 686).

Saleh (1984 Phytochemistry 23(11) 2497-2498) have found that the essential oil of *Artemisia monosperma* possesses insecticidal activity against housefly.

**Prior Art**

At present a number of mosquito repellents mainly in the form of mats, coils and liquid sprays are available in the market, but all of them contain synthetic compounds eg. allethrin which causes tremendous health hazards. The market is flooded with the so called herbal mosquito repellent incense sticks but they also have several negative points; firstly they are not herbal as claimed and secondly their burning time is 1.5 to 2 hours only. The incense sticks have no aroma
because of the use of bamboo sticks, wood charcoal, sandal wood dust and Jigat- a binding agent when dipped in following solution for aroma and repellency effect.

(i) Dimethyl phthalate (DP)-55 ml
(ii) Citronella oil -30 ml
(iii) Lemongrass oil -10 ml
(iv) Allethrin/Synthetic pyrethrin -10 ml

Dimethyl phthalate causes irritation in the tender areas of the skin and eyes.

Other mosquito repellents available in the market also suffer from a number of disadvantages as shown below.

1. Mat
   (i) All the mats available in the market contain allethrin.
   (ii) Mats effective period is only 2-3 hours.
   (iii) Mats can not be used, when there is no electricity.

2. Spray
   (i) Mostly sprays contain synthetic compounds causing health hazards.
   (ii) Effective period is very less.
   (iii) All the sprays available in the market are very costly and beyond the limits of common man.
   (iv) It can not be used in open places.
3. **Coil**

(i) Harmful to health as it contains allethrin.

(ii) Some of the coils contain very high level of synthetic compound that causes irritation on skin and eyes.

(iii) The coils are available in pairs, so it is difficult to separate them from each other causing lot of breakage and spoilage.

**OBJECTS**

The main object of the present invention is to develop a formulation useful as herbal mosquito repellent, which obviates the drawbacks in the present mosquito repellents.

Another object is to provide a formulation comprising an effective amount of essential oils extracted from aromatic plants together with binding material *Litsea glutinosa* (Maida lakri), filling material *Acacia nilotica* (babul) bark powder, *Cyperus rotundus* powder and oil obtained from *cedrus deodora* used for enhancing the repellency.

Still another objective of the present invention is to provide a formulation which contains natural essential oil of *Tagetes minuta* and *Chrysanthemum cinerariaefolium* (pyrethrum powder) as insect repellents.

Yet another object is to provide a mosquito repellent formulation which is safe, biodegradable and has very low mammalian toxicity.

One more object of the invention is to provide a formulation useful as a mosquito repellent that is capable of burning for a longer period and thereby having increased efficiency in controlling mosquitoes.
Yet another object of the invention is to provide a formulation having 1 kg of maida lakri, 250 g of babul bark powder, 250 g of nagarmotha powder, 100 g of pyrethrum flower powder, 50 g of cedarwood oil and 25 g of *Tagetes minuta* oil were mixed thoroughly and incense sticks prepared manually with the help of bamboo splints.

Still another object of the invention is to provide a method of producing a formulation useful as herbal mosquito repellant, said method comprising mixing an effective amount of the essential oil of *Tagetes minuta, Chrysanthemum cinerariaefolium* (Pyrethrum powder) and *cyperus rotundus* powder together with binders and fillers.

**SUMMARY**

Accordingly, the present invention provides a herbal formulation and a method of producing the formulation which is useful as a herbal mosquito repellant, said formulation comprising an effective amount of essential oils of *cyperus rotundus* powder, *Chrysanthemum cinerariaefolium* (pyrethrum flower), cedarwood oil and *Tagetes minuta* optionally together with binders and fillers such as *Litsea glutinosa, Acacia nilotica*.

**DETAILED DESCRIPTION**

Accordingly, the invention provides a novel formulation useful as herbal mosquito repellant, said formulation comprising an effective amount of the essential oil of *Tagetes minuta, Chrysanthemum cinerariaefolium* (Pyrethrum powder) and *Cedrus deodara* (cedar) *cyperus rotundus* powder together with binders and fillers in the ratio of about 0.20-3.0, 0.5-15, 2.0-3.0, 2.0-3.0, 0.1-1 and 8-10 respectively.
In an embodiment, the invention provides a novel formulation useful as herbal mosquito repellent, said formulation comprising an effective amount of the essential oil of *Tagetes minuta*, *Cedrus deodara* (cedar), *Chrysanthemum cinerariaefolium* (pyrethrum) powder and *cyperus rotundus* powder together with binders and fillers in the preferred ratio of about 0.25:1:2.5:2.5:0.5:10.

In an embodiment, the *Chrysanthemum cinerariaefolium* (pyrethrum powder) is obtained from the flowers of the plant *Chrysanthemum cinerariaefolium* (Pyrethrum).

In another embodiment, the essential oils are obtained from natural sources such as cedar tree (*Cedrus deodara*) and the plant *Tagetes minuta*.

In another embodiment, the binders in the formulation comprise powder obtained from *Litsea glutinosa*.

In yet another embodiment, the fillers in the formulation comprises powder obtained from the bark of *Acacia nilotica*.

In still another embodiment, the powder of the bark of *Litsea glutinosa*, *Acacia nilotica*, *cyperus rotundus* powder, *Chrysanthemum cinerariaefolium* (pyrethrum flower), cedarwood (*Cedrus deodara*) oil and *Tagetes minuta* oil is in the ratio of about 10:2.5:2.5:1:0.50:0.25, respectively.

Yet another embodiment of the invention provides a method of producing a formulation useful as herbal mosquito repellent, said method comprising mixing an effective amount of the essential oil of *Tagetes minuta*, *Chrysanthemum cinerariaefolium* (Pyrethrum powder) and *cyperus rotundus* powder together with binders and fillers.
In yet another embodiment, the binder powder is obtained from the stems and stem barks of *Litsea glutinosa*

5 The incense stick manufactured out of the present composition is called “Agarbatti”.

The formulation of the present invention may be made in various physical forms such as mosquito repellent coils, sticks, solutions, emulsions etc. as are known in the art. In order to prepare such formulations in various physical forms, the essential ingredients of the formulation namely the essential oil of *Tagetes minuta*, cedar, *Chrysanthemum cinerariaefolium* (Pyrethrum powder) and powder of plant parts of *Cyperus rotundus* are mixed with binders and fillers and the like as mentioned above to increase the efficiency of the formulation. Perfumery oils may also be added to the formulation. It is also pertinent to note that the amounts of the respective ingredients of the formulation herein mentioned are only exemplary and appropriate amount of the respective ingredients will vary and may be readily determined by a person skilled in the art at the time of making the formulation in its different physical forms. The ratio of the amounts in the formulation of the present invention is not critical and vary widely. The best results would of course be obtained employing the said essential oils with the binders in the proportion aforementioned. Further, the said formulation is found to be effective against several insects specifically mosquitoes.

The invention also provides a method for the preparation of a formulation useful as an insect repellent, said method comprising the steps of mixing the essential oils obtained from *Tagetes minuta*, cedar and cyperus rotundus powder, *Chrysanthemum cinerariaefolium* (Pyrethrum powder) with conventional binders and fillers in the presence of water.
The criteria for a good repellent against mosquito depends on effective protection under all climatic conditions for a long duration and it should be free from all kinds of health hazards such as toxicity and irritation when burning inside a room. Also it should be of low cost, eco-friendly and safe with pleasant odour.

Novelty of invention lies in preparation of synergistic herbal mosquito repellent composition wherein addition of *Tagetes minuta* oil, *Cyperus rotundus* powder and *cedrus deodora* oil to the pyrethrum flower power provide the desire novel effect.

The efficacy of the presently invented formulation for mosquito repellent herbal incense stick was highly significant as shown by the examples hereinbelow and exhaustive field trials.

Different combinations have been tried which are illustrated by the following examples. However, this should not be construed to limit the scope of the present invention. Out of the five examples given below, Example 5 is found to be most suitable as it obviates the drawbacks of Examples 1-4. The Applicants have observed that when only pyrethrum powder is used in the formulation, the insect-repelling capacity of the formulation is moderate. Similarly, when pyrethrum or *tagetes minuta* oil were not used in the formulation, no repellent effects were observed. Also, when they *tagetes minuta* oil along with *Chrysanthemum cinerariaefolium* (pyrethrum) flower were used in the formulation.

In the present invention, nearly 200 combination containing different herbal mosquito repellent herbs and essential oils were tried with different ratios. It is interesting to note that only pyrethrum flower powder is not effective on mosquito when used alone without *tagetes minuta* oil and cedarwood oil. *Chrysanthemum cinerariaefolium* (Pyrethrum) flower powder also not that much effective when used with combination of the *Tagetis minuta* or cedarwood oil separately.
**Example 1**

1 kg of maida lakri powder, 1 kg of babul bark powder, 500g of nagarmotha powder, 50 g of pyrethrum flower powder, 50 g of cedarwood oil and 10 g of *Tagetes* oil were mixed homogeneously and made into a paste by adding water as per requirement. Incense Sticks were made with the help of bamboo splints manually.

Incense stick prepared by this combination showed less repellency and burning time was nearly 1.5-2 hours only.

**Example 2**

1 kg of maida lakri powder, 500 g of babul bark powder, 500 g of nagarmotha powder, 200 g pyrethrum flower powder, 50 g of cedarwood oil and 10 g of *Tagetes minuta* oil were mixed thoroughly and made into paste by adding water.

Incense stick prepared by this method showed burning period of nearly 3 hrs but gave some respiratory irritation problem due to the presence of more pyrethrum.

**Example 3**

1 kg of maida lakri, 200 g of babul bark powder, 200 g of nagarmotha powder, 50 g pyrethrum flower powder, 50 g of cedarwood oil and 10 g of *Tagetes minuta* oil were used in the preparation of paste and incense stick were made with the help of bamboo splints.

The incense stick had some burning problem due to more ratio of maida lakri in comparison to filler material.
Example 4

1 kg of maida lakri powder, 1 kg of babul bark powder, 1 kg of nagarmotha powder, 50 g of pyrethrum flower powder, 50 g of cedarwood oil and 10 g of Tagetes oil were used for making the formulation.

Incense stick prepared by this combination gave initially some manufacturing problems due to less elasticity and also they burnt less than 2 hours only.

Example 5

1 kg of maida lakri, 250 g of babul bark powder, 250 g of nagarmotha powder, 100 g of pyrethrum flower powder, 50 g of cedarwood oil and 25 g of Tagetes minuta oil were mixed thoroughly and incense sticks prepared manually with the help of bamboo splints.

Example 6

In one experiment, the following ingredients (taken in percentage by weight) were combined to derive the following formulation:

1. *Litsea glutinosa* (Maid lakri) 50-65g
2. *Acacia nilotica* (Babul bark powder) 10-20g
3. *Cyperus rotundus* (Nagarmotha powder) 10-20g
4. *Chrysanthemum cinerariaefolium* (Pyrethrum flower powder) 4-6g
5. *Cedrus deodara* (Cedar wood oil) 2-5g
6. *Tagetes minuta oil* 1-2g
It was found that this formulation was the best and most effective in repelling insects especially mosquitoes.

**Example 7**

One more experiment was conducted to derive the formulation (100g) wherein the following ingredients were taken:

1. *Litsea glutinosa* (Maida lakri) 60g
2. *Acacia nilotica* (Babul bark) 15g
3. *Cyperus rotundus* (Nagarmotha powder) 15g
4. *Chrysanthemum cinerariaefolium* (Pyrethrum flower) 6g
5. *Cydrus deodera* (Cedar wood oil) 3g
6. *Tagetes minuta oil* (Tagetes oil) 1g

The results were excellent and the formulation had excellent repelling properties.

Field trials of these herbal incense stick were conducted in 169 houses in and around Lucknow, India in different localities. Families selected for trials are represented by all sections of community. Data collected from different persons indicate that only 9% people reported some burning problem whereas 91% people were found to have no such problem; 10% people reported less repellency power, 18% mentioned medium to normal and 72% people found good repellency power. None of them reported any irritation or any other adverse effect on health. Regarding burning time and effective period of the incense stick, only 7% people reported less than 4 hours burning time, whereas 93% people mentioned 4.30 to 5 hours burning time with an after effect of 3 hours after complete burning of the incense sticks.
Some of the findings of the invention:

a) Less repellency reported when only pyrethrum flower powder used.

b) No repellency when no pyrethrum and no *tagetes minuta* oil used.

c) Less repellency when only *Tagetes minuta* oil used.

d) More effective, when *Tagetes minuta* oil and pyrethrum flower power both used with cedarwood oil.

Advantages of the invention

1. The formulation is most safe, eco-friendly, easy in use and has maximum repellency power against mosquito.

2. Field trials on human subjects reported no toxicity in one way or the other.

3. The product is cheap and no costly ingredients are required.

4. Mosquito repellent herbal incense stick can be used at any place either in villages or in open areas as it does not require any electricity.

5. This technology can generate more employment in rural areas specially for woman in cottage industry.

6. Mosquito repellent herbal incense stick can be prepared in the living houses because it does not require any heavy infrastructure and investment as compared to coils and mats.
7. Mosquito repellant incense stick prepared by this formulation burns nearly 4.5 hours to 5.0 hours with and after effect of 3 hours.
Claims:

1. A formulation useful as herbal mosquito repellent, said formulation comprising an effective amount of the essential oil of Tagetes minuta, Chrysanthemum cinerariaefolium (Pyrethrum powder) and cyperus rotundus powder together with binders and fillers.

2. A formulation as claimed in claim 1, wherein the essential oils of Tagetes minuta, Chrysanthemum cinerariaefolium (Pyrethrum powder) and cyperus rotundus powder together with binders and fillers are in the ratio of about 0.20-3.0, 0.5-15, 2.0-3.0, 2.0-3.0, 0.1-1 and 8-10 respectively.

3. A formulation as claimed in claim 1, comprising Tagetes minuta oil, Chrysanthemum cinerariaefolium (Pyrethrum flower), babul bark, cyperus rotundus powder, cedarwood (cedrus doedera) oil together with binders and fillers in the preferred ratio of 0.25:1.2.5:2.5:0.5:10.

4. A formulation as claimed in claim 1 wherein Chrysanthemum cinerariaefolium (Pyrethrum powder) is obtained from the flowers of the plant Chrysanthemum cinerariaefolium (Pyrethrum).

5. A formulation as claimed in claim 1 wherein essential oils are obtained from natural sources selected from cedar tree cyperus and the plant Tagetes minuta.

6. A formulation as claimed in claim 1 wherein the binders in the formulation comprise powder obtained from Litsea glutinosa.

7. A formulation as claimed in claim 1 wherein fillers in the formulation comprises powder obtained from the bark of Acacia nilotica.

8. A formulation as claimed in claim 1 wherein the binder powder is obtained from the stem and stem barks of Litsea glutinosa.
9. A formulation as claimed in claim 1 wherein the preferred ratio of the powder of the bark of *Litsea glutinosa*, *Acacia nilotica*, nagarmotha powder, pyrethrum flower powder, cedarwood oil and *Tagetes minuta* oil is about 10:2.5:0.25:1:0.5:0.25.

10. A formulation as claimed in claim 1 wherein 1 kg of maida lakri, 250 g of babul bark powder, 250 g of nagarmotha powder, 100 g of pyrethrum flower powder, 50 g of cedarwood oil and 25 g of *Tagetes minuta* oil were mixed thoroughly and incense sticks prepared manually with the help of bamboo splints.

11. A formulation as claimed in claim 1 wherein the following ingredients are taken in percentage by weight:

1. *Litsea glutinosa* (Maida lakri)  50-65g
2. *Acacia nilotica* (Babul bark powder)  10-20g
3. *Cyperus rotundus* (Nagarmotha powder)  10-20g
4. *Chrysanthemum cinerariaefolium* (Pyrethrum flower powder)  4-6g
5. *Cedrus deodora* (Cedar wood oil)  2-5g
6. *Tagates minuta oil*  1-2g

12. A formulation as claimed in claim 11 wherein the following ingredients are taken for 100g.

20 1. *Litsea glutinosa* (Maida lakri)  60g
   2. *Acacia nilotica* (Babul bark)  15g
   3. *Cyperus rotundus* (Nagarmotha powder)  15g
   4. *Chrysanthemum cinerariaefolium* (Pyrethrum flower)  6g
   5. *Cedrus deodora* (Cedar wood oil)  3g
   6. *Tagates minuta oil* (Tagetes oil)  1g
13. A method of producing a formulation useful as herbal mosquito repellent, said method comprising mixing an effective amount of the essential oil of *Tagetes minuta*, *Chrysanthemum cinerariaefolium* (Pyrethrum powder) and *cyperus rotundus* powder together with binders and fillers.

14. A method as claimed in claim 13, wherein the essential oils of *Tagetes minuta*, *Chrysanthemum cinerariaefolium* (Pyrethrum powder) and *cyperus rotundus* powder together with binders and fillers are in the ratio of about 0.20-3.0, 0.5-15, 2.0-3.0, 2.0-3.0, 0.1-1 and 8-10 respectively.

15. A method as claimed in claim 13, comprising *Tagetes minuta* oil, *Chrysanthemum cinerariaefolium* (Pyrethrum flower), babul bark, *cyperus rotundus* powder, cedarwood (cedrus doedera) oil together with binders and fillers in the preferred ratio of 0.25:1:2.5:2.5:0.5:10.

16. A method as claimed in claim 13 wherein *Chrysanthemum cinerariaefolium* (Pyrethrum powder) is obtained from the flowers of the plant *Chrysanthemum cinerariaefolium* (Pyrethrum).

17. A method as claimed in claim 13 wherein essential oils are obtained from natural sources selected from cedar tree *cyperus* and the plant *Tagetes minuta*.

18. A method as claimed in claim 13 wherein the binders in the formulation comprise powder obtained from *Litsea glutinosa*.

19. A method as claimed in claim 13 wherein fillers in the formulation comprises powder obtained from the bark of *Acacia nilotica*.

20. A method as claimed in claim 13 wherein the binder powder is obtained from the stem and stem barks of *Litsea glutinosa*.

21. A method as claimed in claim 13 wherein the preferred ratio of the powder of the bark of *Litsea glutinosa*, *Acacia nilotica*, nagarmotha powder, pyrethrum flower powder, cedarwood oil and *Tagetes minuta* oil is about 10:2.50:2.50:1:0.50:0.25.
22. A method as claimed in claim 13 wherein 1 kg of maida lakri, 250 g of babul bark powder, 250 g of nagarmotha powder, 100 g of pyrethrum flower powder, 50 g of cedarwood oil and 25 g of *Tagetes minuta* oil were mixed thoroughly and incense sticks prepared manually with the help of bamboo splints.

23. A method as claimed in claim 13 wherein the following ingredients are taken in percentage by weight:

1. *Litsea glutinosa* (Maida lakri) 50-65g
2. *Acacia nilotica* (Babul bark powder) 10-20g
3. *Cyperus rotundus* (Nagarmotha powder) 10-20g
4. *Chrysanthemum cinerariaefolium* (Pyrethrum flower powder) 4-6g
5. *Cedrus deodora* (Cedar wood oil) 2-5g
6. *Tagetes minuta* oil 1-2g

24. A method as claimed in claim 23 wherein the following ingredients are taken for 100g.

1. *Litsea glutinosa* (Maida lakri) 60g
2. *Acacia nilotica* (Babul bark) 15g
3. *Cyperus rotundus* (Nagarmotha powder) 15g
4. *Chrysanthemum cinerariaefolium* (Pyrethrum flower) 6g
5. *Cydrus deodera* (Cedar wood oil) 3g
6. *Tagetes minuta* oil (Tagetes oil) 1g
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 [A01N65/00] /(A01N65/00, 65:00, 53:00, 25:20)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 [A01N]

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, EPO-Internal, BIOSIS, CHEM AB Data, CAB Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Date of the actual completion of the international search: 23 November 2000

Date of mailing of the international search report: 08/12/2000
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| A        | DATABASE CAB 'Online!<br>CAB INTERNATIONAL, WALLINGFORD, OXON, GB;<br>B.K.TYAGI ET AL.: "Evaluation of<br>repellency effect of Tagetes minuta<br>(Family: Compositae) against the vector<br>mosquitoes Anopheles stephensi Liston,<br>Culex quinquefasciatus Say and Aedes<br>aegypti (L.)"
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