

HEAT-TRANSPIRATION MAT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an improvement in a liquid absorbing (absorbent) mat for heat-transpiration used as set on a radiation plate of a heat-transpiration insecticidal apparatus.

2. Description of the Related Art

As a heat-transpiration method that transpires a chemical liquid utilizing thermal energy, a mosquito-repellent incense, an electric mosquito-repellent mat, and a liquid type electric mosquito-repellent (liquid) have been popular. Of those, the electric mosquito-repellent mat works by means of setting a rectangular absorbent mat impregnated with a chemical liquid containing an insecticidal ingredient on a radiation plate of the heat-transpiration insecticidal apparatus and heating the mat with electricity to transpire the insecticidal ingredient contained therein. Usually domestic AC power source is utilized to repel mosquitoes. However, study is being made to develop the one utilizing dry batteries, chemical reaction heat or the like for repelling insects outdoors (Hereinafter, these are generically called as "heat transpiration mat"). At any rate, when a conventional heat-transpiration mat is set on a heat-transpiration apparatus, a hand of the user must hold the transpiration surface of the mat so that inconveniently the hand contacts the insecticidal ingredient that has percolated on the transpiration surface of the mat.

To solve the problem, for example, Japan Utility Model Publication No. Sho 62-38543 discloses an insecticidal mat covered over the entire mat with a covering provided with many holes for diffusing the insecticidal ingredient. However, this is insufficient in transpiration performance and usability.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a heat-transpiration mat that can be set on a heat-transpiration insecticidal apparatus without holding the transpiration surface of the mat by hand so that there is no fear of contacting with the chemical liquid and that has no problem in transpiration performance, insecticidal potency and usability.

To attain the above object, the present inventors have conducted intensive research and as a result they have found that by provision of a holding means on a side portion of the mat the object is attained, thus completing the present invention.

That is, the present invention relates to an absorbent heat-transpiration mat that is used by impregnating the mat with a chemical liquid containing an insecticidal ingredient, and setting the mat on a radiation plate of a heat-transpiration insecticidal apparatus, wherein the mat comprises a holding means on a side portion thereof so as to be set on the radiation plate without a hand of a user contacting a transpiration surface of the mat.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a front elevation of a heat-transpiration mat according to a first embodiment of the present invention.

Fig. 1B is a side elevation of the heat-transpiration mat shown in Fig. 1A.

Fig. 1C is a cross-sectional view of the heat-transpiration mat shown in Fig. 1A along the line A-A.

Fig. 2A is a front elevation of a heat-transpiration mat according to a second embodiment of the present invention.

Fig. 2B is a side elevation of the heat-transpiration mat shown in Fig. 2A.

Fig. 2C is a cross-sectional view of the heat-transpiration mat shown in Fig. 2A along the line A-A.

Fig. 3A is a front elevation of a heat-transpiration mat according to a third embodiment of the present invention.

Fig. 3B is a side elevation of the heat-transpiration mat shown in Fig. 3A.

Fig. 3C is a cross-sectional view of the heat-transpiration mat shown in Fig. 3A along the line A-A.

Fig. 4A is a front elevation of a heat-transpiration mat according to a fourth embodiment of the present invention.

Fig. 4B is a side elevation of the heat-transpiration mat shown in Fig. 4A.

Fig. 4C is a cross-sectional view of the heat-transpiration mat shown in Fig. 4A along the line A-A.

Fig. 5A is a front elevation of a heat-transpiration mat according to a fifth embodiment of the present invention.

Fig. 5B is a side elevation of the heat-transpiration mat shown in Fig. 5A.

Fig. 5C is a cross-sectional view of the heat-transpiration mat shown in Fig. 5A along the line A-A.

Fig. 6A is a front elevation of a heat-transpiration mat according to a sixth embodiment of the present invention.

Fig. 6B is a side elevation of the heat-transpiration mat shown in Fig. 6A.

Fig. 6C is a cross-sectional view of the heat-transpiration mat shown in Fig. 6A along the line A-A.

Fig. 7A is a front elevation of a heat-transpiration mat according to a seventh embodiment of the present invention.

Fig. 7B is a side elevation of the heat-transpiration mat shown in Fig. 7A.

Fig. 7C is a cross-sectional view of the heat-transpiration mat shown in Fig. 7A along the line A-A.

Fig. 8A is a front elevation of a heat-transpiration mat according to an eighth embodiment of the present invention.

Fig. 8B is a side elevation of the heat-transpiration mat shown in Fig. 8A.

Fig. 8C is a cross-sectional view of the heat-transpiration mat shown in Fig. 8A along the line A-A.

Fig. 9A is a front elevation of a heat-transpiration mat according to a ninth embodiment of the present invention.

Fig. 9B is a side elevation of the heat-transpiration mat shown in Fig. 9A.

Fig. 9C is a cross-sectional view of the heat-transpiration mat shown in Fig. 9A along the line A-A.

Fig. 10A is a front elevation of a heat-transpiration mat according to a tenth embodiment of the present invention.

Fig. 10B is a side elevation of the heat-transpiration mat shown in Fig. 10A.

Fig. 10C is a cross-sectional view of the heat-transpiration mat shown in Fig. 10A along the line A-A.

Fig. 11A is a front elevation of a heat-transpiration mat according to an eleventh embodiment of the present invention.

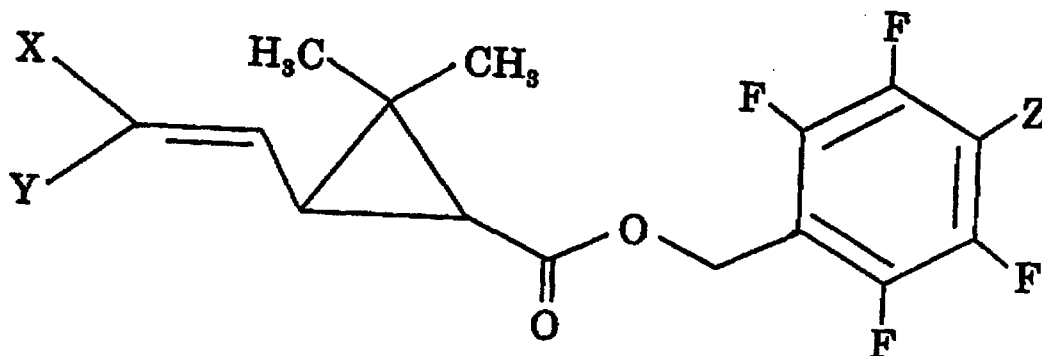
Fig. 11B is a side elevation of the heat-transpiration mat shown in Fig. 11A.

Fig. 11C is a cross-sectional view of the heat-transpiration mat shown in Fig. 11A along the line A-A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The material of the absorbent heat-transpiration mat generally includes pulp, linter or mixtures thereof, cellulose based materials such as viscose and the like. Synthetic fibers, nonwoven fabric materials, etc. may also be used as far as they are absorbent and porous. The size and shape of the mat are optional. For example, the ones having a size of about 10 to 30 mm in length, about 10 to 50 mm in width, and about 0.5 to 3.0 mm in thickness are easy to use.

The insecticidal ingredient used in the present invention is preferably a pyrethroid compound, examples of which include allethrin, furamethrin, prallethrin, terallethrin, tefuramethrin, empenethrin, or compounds represented by the following general formula (1)



wherein X and Y, which may be the same or different, independently represent a hydrogen atom, a methyl group, a halogen atom, a trifluoromethyl group or a methoxycarbonyl group, and Z represents a hydrogen atom, a fluorine atom, a methyl group, a methoxymethyl group, an ethoxymethyl group, or a propargyl group.

Specific examples of the compound of the general formula (1) include:

4-methyl-2,3,5,6-tetrafluorobenzyl 3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (hereinafter, referred to as "Compound 1"),

4-methyl-2,3,5,6-tetrafluorobenzyl 3-(2,2-difluorovinyl)-2,2-dimethylcyclopropanecarboxylate (hereinafter, referred to as "Compound 2"),

4-methyl-2,3,5,6-tetrafluorobenzyl 3-(2-chloro-2-fluorovinyl)-2,2-dimethylcyclopropanecarboxylate (hereinafter, referred to as "Compound 3"),

4-methyl-2,3,5,6-tetrafluorobenzyl chrysanthemate (hereinafter, referred to as "Compound 4"),

4-methyl-2,3,5,6-tetrafluorobenzyl 3-(1-propenyl)-2,2-dimethylcyclopropanecarboxylate (hereinafter, referred to as "Compound 5"),

4-methoxymethyl-2,3,5,6-

tetrafluorobenzyl·chrysanthemate (hereinafter, referred to as "Compound 6"),

4-methoxymethyl-2,3,5,6-tetrafluorobenzyl 3-(1-propenyl)-2,2-dimethylcyclopropanecarboxylate (hereinafter, referred to as "Compound 7"),

4-ethoxymethyl-2,3,5,6-tetrafluorobenzyl·chrysanthemate (hereinafter, referred to as "Compound 8"),

4-propargyl-2,3,5,6-tetrafluorobenzyl·3-(1-propenyl)-2,2-dimethylcyclopropanecarboxylate (hereinafter, referred to as "Compound 9"),

4-propargyl-2,3,5,6-tetrafluorobenzyl·chrysanthemate (hereinafter, referred to as "Compound 10"),

2,3,4,5,6-pentafluorobenzyl·3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (hereinafter, referred to as "Compound 11"),

2,3,5,6-tetrafluorobenzyl·3-(1-propenyl)-2,2-dimethylcyclopropanecarboxylate (hereinafter, referred to as "Compound 12"),

2,3,5,6-tetrafluorobenzyl·3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (hereinafter, referred to as "Compound 13"), and

4-methoxymethyl-2,3,5,6-tetrafluorobenzyl 3-(3-methoxy-3-oxo-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (hereinafter, referred to as "Compound 14").

It should be noted that when they have optical isomers and geometrical isomers attributed to asymmetric carbons and double bonds in the chemical structure, the isomers and optional mixtures of them

may of course be included in the scope of the insecticidal ingredient of the present invention. As the insecticidal ingredient, other insecticidal ingredients such as organophosphorus agents, carbamate agents and insect growth inhibitors may optionally be contained in addition to the pyrethroid based insecticides.

The format of the heat-transpiration mat includes the one that is effective over 1 day (12 hours), and the one formulated so as to have a sustained insecticidal effect for over 120 hours. For example, in the case of the pyrethroid-based insecticide described above, it is added in an amount of 5 mg or more for a one-day-acting mat or 50 mg or more for the latter long-acting mat. In addition to the insecticidal ingredient described above, the mat may optionally carry a stabilizer for the insecticidal ingredient, a volatilization controlling agent, a synergist, a diluent, a base, a colorant, a perfume, an antimicrobial agent, a deodorant, other active ingredient or ingredients, and the like.

The stabilizer for the insecticidal ingredient is exemplified by dibutylhydroxytoluene [BHT], dibutylhydroquinone [DBHQ], 2,2'-methylene-bis-(4-ethyl-6-t-butylphenol) [Yoshinox 425], 4,4'-butylidene-bis-(3-methyl-6-t-butylphenol), tris(2-methyl-4-hydroxy-5-t-butylphenyl)butane, stearyl- β -(3,5-di-t-butyl-4-hydroxyphenyl)propionate, 4,4'-thiobis-(3-methyl-6-t-butylphenol), 2-mercaptobenzimidazole, trinonylphenyl phosphite, etc. These may be used alone

or two or more of them may be used in combination. However, the ones that do not substantially volatilize at a heating temperature of 70 to 150°C are preferable. The volatilization controlling agent is exemplified by piperonyl butoxide, N-(2-ethylhexyl)-1-isopropyl-4-methylbicyclo[2,2,2]oct-5-ene-2,3-dicarboxyimide [Synepirine 500], N-(2-ethylhexyl)-methylbicyclo(2,2,1)hept-5-ene-2,3-dicarboximide [Synepirine 222], butyl stearate, silicone, wax and the like. However, of course it is not limited thereto.

Further, the antimicrobial agent is exemplified by hinokitiol, linalool, citral, carvone, pinene, terpene alcohol and the like.

The present invention is characterized in that on a side portion of a heat-transpiration mat a holding means is provided so that the mat can be set on a radiation plate of a heat-transpiration insecticidal apparatus without a hand of the user contacting a transpiration surface of the mat.

The holding means includes the following constructions or methods but it is not limited to this:

(1) Outside the side portion of a mat is provided a non-absorbent and heat-resistant holding piece, which is fixed through a portion of a peripheral portion of the mat.

(2) A nonabsorbent and heat-resistant sheet or coating is provided so as to cover a portion of the mat

and the covered portion serves as a holding portion.

(3) A holding frame comprising a nonabsorbent and heat-resistant plastic frame member is provided to hold the periphery of the mat.

In the present invention, the provision of the holding means on a part of the heat-transpiration mat as described above enables the mat to be set on a radiation plate of a heat-transpiration insecticidal apparatus without the hand contacting the transpiration surface of the mat. In the present invention, two types of heat-transpiration insecticidal apparatus are used depending on whether the apparatus is used for one-day or for a long period. In the case of the former one-day use type, the area of the radiation plate is substantially equivalent to that of the base area of the mat according to the conventional electric mosquito repellent. On the other hand, in the case of the latter long period use, the area of the radiation plate is suitably 0.2 to 0.6 times as large as the base area of the mat. The heating temperature of the radiation plate may be determined optionally in the range of 70 to 180°C depending on the type, physical properties and the like of insecticidal ingredient to be used. As the heat source, dry battery or a heater using a catalyst may naturally be used in addition to generally used alternating current.

Hereinafter, the present invention will be described by specific embodiments with reference to the attached drawings.

Embodiment 1

Figs. 1A, 1B and 1C show a heat-transpiration mat according to a first embodiment of the present invention. In this embodiment, a heat-transpiration mat 1 comprises a mat 2 and a holding piece 3 made of a nonabsorbent and high heat-resistant plastic resin such as polypropylene or polycarbonate attached to a side portion of the mat 2. The holding piece 3 is fixed to the side portion of the mat 2 so as to sandwich a peripheral portion of the mat 2. This construction can be formed by casting the plastic resin such that an end portion 5 of the holding piece 3 is laminated on the upper and lower surfaces of a portion of the peripheral portion of the mat 2. By holding another end portion of the holding piece 3 with fingers from the top and bottom in the direction indicated by the arrow P in Fig. 1B, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid in the mat 2.

Embodiment 2

Figs. 2A, 2B and 2C show a heat-transpiration mat according to a second embodiment of the present invention. In this embodiment, the heat-transpiration mat 1 comprises the mat 2 and a holding piece 6 made of a nonabsorbent and high heat-resistant plastic resin such as polypropylene, polycarbonate or the like attached to a side portion of the mat 2. The holding piece 6 is fixed to the side portion of the mat 2 so as to sandwich both longitudinal sides of the mat 2. This construction can be formed by casting the plastic resin

such that an end portion 5 of the holding piece 6 sandwiches both longitudinal sides of the mat 2. By holding another end portion of the holding piece 6 with fingers from the top of bottom in the direction indicated by the arrow P in Fig. 2B, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid in the mat 2.

Embodiment 3

Figs. 3A, 3B and 3C show a heat-transpiration mat according to a third embodiment of the present invention. In this embodiment, the heat-transpiration mat 1 comprises the mat 2 and a holding piece 7 made of a nonabsorbent and high heat-resistant plastic resin such as polypropylene, polycarbonate or the like attached to a side portion of the mat 2. The holding piece 7 is fixed to the side portion of the mat 2 so as to be pressed into the mat 2 from a side surface thereof. This construction can be formed by casting the plastic resin such that an end portion 5 of the holding piece 7 is pressed fitted to the inside of the mat 2 from the peripheral portion of the mat 2. By holding another end portion of the holding piece 7 with fingers from the top and bottom in the direction indicated by the arrow P in Fig. 3B, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid carried by the mat 2.

Embodiment 4

Figs. 4A, 4B and 4C show a heat-transpiration mat according to a fourth embodiment of the present invention. In this embodiment, the heat-transpiration mat 1 comprises the mat 2 and a holding piece 7a similar to that in Embodiment 3 on the side of the mat 2 except that the holding piece 7a is featured particularly in that in order to further improve ease of holding upon handling, it has a swelled portion 8 in a holding portion thereof. By holding the swelled portion 8 of the holding piece 7a with fingers from the top and bottom in the direction indicated by the arrow P in Fig. 4B, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid carried by the mat 2.

Embodiment 5

Figs. 5A, 5B and 5C show a heat-transpiration mat according to a fifth embodiment of the present invention. In this embodiment, the heat-transpiration mat 1 comprises the mat 2 and a holding piece 7b that is similar to that in Embodiment 3 except that the holding piece 7b is featured particularly in that in order to further improve ease of holding upon handling, it has a depressed portion 9 in a holding portion thereof. By holding the depressed portion 9 of the holding piece 7b with fingers from the top and bottom in the direction indicated by the arrow P in Fig. 5B, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid

carried by the mat 2.

Embodiment 6

Figs. 6A, 6B and 6C show a heat-transpiration mat according to a sixth embodiment of the present invention. In this embodiment, the heat-transpiration mat 1 comprises the mat 2 and a holding piece 7c provided on the side of the mat 2 that is similar to that in Embodiment 3 except that the holding piece 7c is featured particularly in that in order to further improve ease of holding upon handling, it is provided with a through hole 10 in a holding portion thereof. By holding the holding piece 7c where the through hole 10 is formed with fingers from the top and bottom in the direction indicated by the arrow P in Fig. 6B, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid in the mat 2.

Embodiment 7

Figs. 7A, 7B and 7C show a heat-transpiration mat according to a seventh embodiment of the present invention. In this embodiment, the heat-transpiration mat 1 comprises the mat 2 and a clip type holding piece 11 made of a nonabsorbent and high heat-resistant plastic resin such as polypropylene, polycarbonate or the like attached to a side portion of the mat 2. The holding piece 11 is fixed to the peripheral portion of the mat 2 so as to sandwich both longitudinal sides of the mat 2. Spreading the tip portions 12 of the holding piece 11 and introducing a peripheral portion

of the mat 2 therebetween can form this construction. The mat 2 is fixed by means of the spring pressure of the clip portion. By holding the holding piece 11 with fingers from the top and bottom in the direction indicated by the arrow P in Fig. 7B, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid in the mat 2.

Embodiment 8

Figs. 8A, 8B and 8C show a heat-transpiration mat according to an eighth embodiment of the present invention. In this embodiment, the heat-transpiration mat 1 comprises the mat 2 and a holding piece 11 attached to a side portion of the mat 2. The holding piece is similar to that in Embodiment 7 except that the holding piece 11 is fixed to the side portion of the mat 2 by piercing protrusion 13 provided on the opposing inner surfaces of tip portions 12, respectively, into the mat 2. By holding the holding pieces 11 with fingers from the top and bottom in the direction indicated by the arrow P in Fig. 8B, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid carried by the mat 2.

Embodiment 9

Figs. 9A, 9B and 9C show a heat-transpiration mat according to a ninth embodiment of the present invention. In this embodiment, the heat-transpiration mat 1 comprises the mat 2 and a sheeting 14 attached to

a side portion of the mat 2 so as to cover a portion of the mat 2. The material of the sheeting 14 is suitably a nonabsorbent and high heat-resistant plastic resin. The width of the sheeting 14 is preferably $1/4$ times or less of the full length of the mat 2 in the longitudinal direction. By holding the sheeting 14 with fingers from the top and bottom in the direction indicated by the arrow P in Fig. 9B, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid in the mat 2.

Embodiment 10

Figs. 10A, 10B and 10C show a heat-transpiration mat according to a tenth embodiment of the present invention. In this embodiment, the heat-transpiration mat 1 comprises the mat 2 and a coating 15 attached to a side portion of the mat 2 so as to cover a portion of the mat 2. The material of the coating 15 is suitably a metal foil such as aluminum foil or a deposited film of a metal or metal oxide. The width of the coating 15 is preferably $1/4$ times or less of the full length of the mat 2 in the longitudinal direction. By holding the coating 15 with fingers from the top and bottom in the direction indicated by the arrow P in Fig. 10B, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid in the mat 2.

Embodiment 11

Figs. 11A, 11B and 11C show a heat-transpiration mat according to an eleventh embodiment of the present invention. In this embodiment, the heat-transpiration mat 1 comprises the mat 2 and a frame member 16 made of a nonabsorbent and high heat-resistant plastic resin such as polypropylene, polycarbonate or the like attached to the mat 2 so as to surround along the periphery of the mat 2. By holding the frame member 16 with fingers from the top and bottom, the heat-transpiration mat 1 can be handled without holding a transpiration surface 4 of the mat 2, so that there is no fear of touching the chemical liquid in the mat 2.

The heat-transpiration mat of the construction as described above has excellent usability since it can be attached to or detached from a heat-transpiration insecticidal apparatus without holding the transpiration surface of the mat and also exhibits high insecticidal effect so that it is extremely useful in applications of controlling sanitary insect pests such as mosquito and fly, unpleasant insect pests such as black fly (Simuliidae), midges (Chironomidae), clothes moth (Tinea pellionella), carpet beetles (Dermestidae) and the like.

EXAMPLES

Next, the present invention will be further described with reference to the following examples and test example. However, the present invention is not limited thereto.

Example 1

A mat with a holding piece as shown in Figs. 1A, 1B and 1C was produced by insert molding polypropylene resin to a fibrous mat (50% pulp fiber and 50% cotton fiber) having a size of 22 x 35 mm, a thickness of 2.8 mm and a weight of about 840 mg. The obtained mat was impregnated with 20 mg of d-T80-furamethrin as an insecticidal ingredient, 100 mg of Synepirine 500 as a volatilization controlling agent, 15 mg of a stabilizer, 0.5 mg of a pigment, and 150 mg of IP Solvent 2028 (manufactured by Idemitsu Petrochemical Co., Ltd. main component being isoparaffin) per mat, to prepare a heat-transpiration mat for one day use according to the present invention. The obtained mat was held by the holding piece and set on a heat-transpiration insecticidal apparatus with a heat temperature of 160°C, of which the area of the radiation plate is substantially the same as the base area of the mat and then heat transpiration was continued for 12 hours in a 6-mat room (about 25 m³). As a result, this heat-transpiration mat exhibited sufficient mosquito controlling effect within the use time. Further, the heat-transpiration mat of the present invention is sufficient in view of usability since there was no fear of touching the chemical liquid since it was able to be handled without holding the transpiration surface of the mat.

Example 2

A mat with a holding piece as shown in Figs. 2A, 2B and 2C was produced by insert molding polycarbonate resin to a fibrous mat (50% pulp fiber and 50% cotton

fiber) having a size of 22 x 35 mm, a thickness of 2.8 mm and a weight of about 840 mg. The obtained mat was impregnated with 20 mg of compound 2 as an insecticidal ingredient, 60 mg of piperonyl butoxide as a volatilization controlling agent, 15 mg of a stabilizer, 0.5 mg of a pigment, and 150 mg of IP Solvent 2028 per mat, to prepare a heat-transpiration mat for one day use according to the present invention. The obtained mat was held by the holding piece and set on a heat-transpiration insecticidal apparatus with a heat temperature of 90°C, of which the area of the radiation plate is substantially the same as the base area of the mat and then heat transpiration was continued for 12 hours in a 6-mat room (about 25 m³). As a result, this heat-transpiration mat exhibited sufficient mosquito controlling effect within the use time. Further, the heat-transpiration mat of the present invention is sufficient in view of usability since there was no fear of touching the chemical liquid since it was able to be handled without holding the transpiration surface of the mat.

Example 3

A mat with a holding piece as shown in Figs. 3A, 3B and 3C was produced by insert molding polypropylene resin to a fibrous mat (50% pulp fiber and 50% cotton fiber) of 22 x 35 mm in size and 2.8 mm in thickness weighing about 840 mg. The obtained mat was impregnated with 20 mg of compound 5 as an insecticidal ingredient, 80 mg of piperonyl butoxide as a volatilization controlling agent, 15 mg of a stabilizer, 0.5 mg of a pigment, and 150 mg of IP

Solvent 2028 per mat, to prepare a heat-transpiration mat of one-day use type according to the present invention. The obtained mat was held by the holding piece and set on a heat-transpiration insecticidal apparatus with a heat temperature of 120°C, of which the area of the radiation plate is substantially the same as the base area of the mat and then heat transpiration was continued for 12 hours in a 6-mat room (about 25 m³). As a result, this heat-transpiration mat exhibited sufficient mosquito controlling effect within the use time. Further, the heat-transpiration mat of the present invention is sufficient in view of usability since there was no fear of touching the chemical liquid since it was able to be handled without holding the transpiration surface of the mat.

Example 4

A coating-processed mat as shown in Figs. 10A, 10B and 10C was produced by coating a fibrous mat (50% pulp fiber and 50% cotton fiber) having a size of 22 × 35 mm, a thickness of 2.8 mm and a weight of about 840 mg by aluminum vapor deposition. The obtained mat was impregnated with 20 mg of compound 7 as an insecticidal ingredient, 150 mg of butyl stearate as a volatilization controlling agent, 15 mg of a stabilizer, 0.5 mg of a pigment, and 130 mg of isoparaffin per mat, to prepare a heat-transpiration mat for one-day use according to the present invention. The obtained mat was held by the coating portion and set on a heat-transpiration insecticidal apparatus with a heat temperature of 90°C, of which the area of the radiation plate is substantially the same as the base

area of the mat and then heat transpiration was continued for 12 hours in a 6-mat room (about 25 m³). As a result, this heat-transpiration mat exhibited sufficient mosquito controlling effect within the use time. Further, the heat-transpiration mat of the present invention is sufficient in view of usability since there was no fear of touching the chemical liquid since it was able to be handled without holding the transpiration surface of the mat.

Example 5

A fibrous mat (50% pulp fiber and 50% cotton fiber) having a size of 22 x 35 mm, a thickness of 2.8 mm and a weight of about 840 mg was impregnated with 20 mg of compound 12 as an insecticidal ingredient, 100 mg of Synepirine 222 as a volatilization controlling agent, 15 mg of a stabilizer, 0.5 mg of a pigment, and 150 mg of IP Solvent 2028 per mat. This mat was housed in a frame member of a type of casing for paintings as shown in Figs. 11A, 11B and 11C made of a polycarbonate to clamp the four corners of the mat. Thus a heat-transpiration mat of the type for one-day use according to the present invention was prepared. The obtained mat was held by the frame member and set on a heat-transpiration insecticidal apparatus with a heat temperature of 100°C, of which the area of the radiation plate is substantially the same as the base area of the mat and then heat transpiration was continued for 12 hours in a 6-mat room (about 25 m³). As a result, this heat-transpiration mat exhibited sufficient mosquito controlling effect within the use time. Further, the heat-transpiration mat of the present invention is

sufficient in view of usability since there was no fear of touching the chemical liquid since it was able to be handled without holding the transpiration surface of the mat.

Comparative Example 1

A fibrous mat (50% pulp fiber and 50% cotton fiber) having a size of 22 x 35 mm, a thickness of 2.8 mm and a weight of about 840 mg was impregnated with 20 mg of compound 2 as an insecticidal ingredient, 60 mg of piperonyl butoxide as a volatilization controlling agent, 15 mg of a stabilizer, 0.5 mg of a pigment, and 150 mg of IP Solvent 2028 per mat, to prepare a heat-transpiration mat for one-day use according to the present invention. The obtained mat was set on a heat-transpiration insecticidal apparatus with a heat temperature of 90°C, of which the area of the radiation plate is substantially the same as the base area of the mat and then heat transpiration was continued for 12 hours in a 6-mat room (about 25 m³). As a result, this heat-transpiration mat exhibited sufficient mosquitoes controlling effect within the use time. However, upon setting the mat on the insecticidal apparatus, the mat had to be handled directly by hand so that the chemical liquid containing the insecticidal ingredient adhered to the hand.

Comparative Example 2

A fibrous mat (50% pulp fiber and 50% cotton fiber) having a size of 22 x 35 mm, a thickness of 2.8 mm and a weight of about 840 mg was coated over the entire surface thereof with aluminum foil having

provided therein 5 through holes of 5 mm in diameter. This mat was impregnated with 20 mg of compound 2 as an insecticidal ingredient, 60 mg of piperonyl butoxide as a volatilization controlling agent, 15 mg of a stabilizer, 0.5 mg of a pigment, and 130 mg of isoparaffin per mat, to prepare a heat-transpiration mat for one-day use according to the present invention. The obtained mat was held by the coating portion and set on a heat-transpiration insecticidal apparatus with a heat temperature of 90°C, of which the area of the radiation plate is substantially the same as the base area of the mat and then heat transpiration was continued for 12 hours in a 6-mat room (about 25 m³). As a result, the heat-transpiration mat of this invention was preferable in view of usability since it could be handled without holding it at the transpiration surface so that there was no fear of touching the chemical liquid containing the insecticidal ingredient. However, it failed to exhibit sufficient mosquitoes controlling effect within the use time.

Example 6

A mat (50% pulp fiber and 50% cotton fiber) was impregnated with 200 mg of compound 6 as an insecticidal ingredient, 600 mg of Synepirine 500 as a volatilization controlling agent, 15 mg of a stabilizer, 0.5 mg of a pigment, and about 50 mg of n-paraffin-based kerosene per mat. This mat was housed in a frame member of a type of casing for paintings as shown in Figs. 11A, 11B and 11C made of a polycarbonate, with the four corners of the mat being

clamped. Thus a heat-transpiration mat for long time periods according to the present invention was prepared. The obtained mat was held by the frame member and set on a heat-transpiration insecticidal apparatus having a radiation plate in the shape of a belt (area: 0.5 times the base area of the mat, heating temperature: 120°C) arranged in the middle portion of the apparatus. Then a cycle of applying an electric current for 12 hours and turning off for 12 hours was repeated for 30 days in a 6-mat room (about 25 m³). As a result, this heat-transpiration mat exhibited sufficient mosquitoes controlling effect within the use time and was convenient in that after use, it could be detached from the apparatus without holding it at the transpiration surface by hand.

Test Example 1

Various one-day use heat-transpiration mats as described in Examples 1 to 5 and Comparative Examples 1 and 2 were prepared. These mats were set on a heat-transpiration insecticidal apparatus having a radiation plate of substantially the same area as the base area of the mat (heating temperature being adjusted depending on such as the kind of the insecticidal ingredient) and used for 12 hours. After 5 hours from the initiation of use, insecticidal effect tests were performed by the following test methods. Table 1 shows the results in combination.

The insecticidal effect was given as the relative ratios based on the initial values of knock-down effect defined as 1.00 that was obtained when

allowing the mosquitoes repellent mat containing 40 mg of dl, d-cis, trans-allethrin (Pynamine forte) to transpire under the condition that the radiation plate of the heating element was kept at a temperature of 160°C.

(Open Cylinder Method)

Two plastic cylinders of 20 cm in inner diameter and 43 cm in height are layered. A cylinder of 20 cm both in inner diameter and height which is partitioned vertically with a wire net of 16 mesh (the place where the mosquitoes tested are put in) is placed thereon. A cylinder of 20 cm in inner diameter and height is further placed thereon. This set consisting of the four layer cylinders is placed on a stand, and the heat-transpiration apparatus is placed in the middle of the stand to transpire the insecticidal ingredient in the mat to be examined. Then, about 20 mosquitoes to be tested are released in the upper portion of the cylinder, and the number of mosquitoes knocked down with the time elapsed is observed. After 20 minutes of exposure, all the mosquitoes tested are removed to a sanitary polyethylene container and 3% sugar water was fed to the mosquitoes, and the insecticidal rate is determined after 24 hours keeping.

Table 1

Table 1		Heat-transpiration mat			Temperature of radiation plate of insecticidal apparatus (°C)	Relative insecticidal effect	Usability
		Fibrous mat (mg/mat) *		Holding means			
		Insecticidal ingredient	Other ingredient				
Example	1	d-T80-Furamethrin 20	Synepirine 500 100	Polypropylene holding piece (Figs. 1A-1C type)	160	1.39	o
	2	Compound 2 20	Piperonyl butoxide 60	Polycarbonate holding piece (Figs. 2A-2C type)	90	2.04	o
	3	Compound 5 20	Piperonyl butoxide 80	Polypropylene holding piece (Figs. 3A-3C type)	120	1.81	o
	4	Compound 7 20	Butyl stearate 150	Aluminum vapor deposited film (width of covered mat: 7 mm) (Figs. 10A-10C type)	90	2.17	o
	5	Compound 12 20	Synepirine 222 100	Polycarbonate frame member (Figs. 11A-11C type)	100	1.95	o
Comparative Example	1	Compound 2 20	Piperonyl butoxide 60		90	2.01	x**
	2	Compound 2 20	Piperonyl butoxide 60	Over entire mat aluminum foil (5 mm φ hole × 8)	90	0.96	o

*: Size of mat: 22 $\times$ 35 $\times$ 2.8 mm

**: When setting the mat on the insecticidal apparatus, the chemical liquid adhered to hand.

As shown in Table 1, the heat-transpiration mat of the present invention exhibited high insecticidal effect within the use time and further was excellent in view of usability in that it could be handled without touching the transpiration surface of the mat. On the contrary, the conventional product of Comparative Example 1 was disadvantageous in that the hand unavoidably touched the chemical liquid contained in the mat or the construction such that the entire surface of the mat was covered as in Comparative Example 2 was poor in transpiration performance so that there was a problem in the insecticidal effect.



WHAT IS CLAIMED IS:

1. An absorbent heat-transpiration mat that is used by impregnating the mat with a chemical liquid containing an insecticidal ingredient and setting the mat on a radiation plate of a heat-transpiration insecticidal apparatus, characterized in that the mat comprises a holding means on a side portion thereof so as to be set on the radiation plate without contact on a transpiration surface of the mat by a hand of a user.
2. A heat-transpiration mat as claimed in claim 1, wherein said holding means is a nonabsorbent and high heat-resistant holding piece attached to a side portion of the heat-transpiration mat, said holding piece being fixed to the side portion of said mat.
3. A heat-transpiration mat as claimed in claim 2, wherein said nonabsorbent and high heat-resistant holding piece is made of a plastic resin, said holding piece being detachably fixed to said mat.
4. A heat-transpiration mat as claimed in claim 2, wherein said nonabsorbent and high heat-resistant holding piece is made of a plastic resin, said holding piece being fixed integrally to said mat at the side portion thereof with a portion of said holding piece being inserted into the inside of said mat.
5. A heat-transpiration mat as claimed in any one of claims 2 to 4, wherein said nonabsorbent and high heat-resistant holding piece is further provided with a



through hole, a depressed portion or an elevated portion making it easier to hold by hand.

6. A heat-transpiration mat as claimed in claim 1, wherein said holding means is a nonabsorbent and high heat-resistant sheeting that covers a portion of said heat-transpiration mat, said sheeting being adhered on a surface of said mat.

7. A heat-transpiration mat as claimed in claim 1, wherein said holding means is a nonabsorbent and high heat-resistant coating that covers a portion of said heat-transpiration mat, said coating being coated on a surface of said mat.

8. A heat-transpiration mat as claimed in claim 1, wherein said holding means is a nonabsorbent and high heat-resistant frame member made of a plastic resin that surrounds and holds said heat-transpiration mat.