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DRAFT EAST AFRICAN STANDARD

**Spatial application mosquito repellent — Specification — Part 6:
Vaporizing mat**

EAST AFRICAN COMMUNITY

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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards..

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 078, *Healthcare and medical devices*.

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

DEAS 1252 consists of the following parts, under the general title *Spatial application mosquito repellent — Specification*:

- *Part 1: Coils*
- *Part 2: Spray*
- *Part 3: Candles*
- *Part 4: Papers*
- *Part 5: Liquid vaporizers*
- *Part 6: Vaporizing mats*
- *Part 7: Tablets*
- *Part 8: Liquid detergents*

Introduction

Mosquito is one of the most harmful insects for mankind. To control them, many products are available on the market in various recipes such as spray, soap, oil, powder and repellent. Out of these, mosquito repellent is the most popular as it has germicidal and disinfectant properties and is able to repel mosquitoes and is convenient to use.

Mosquito repellents are used for warding off mosquitoes, which is the most harmful insect. Nowadays, mosquito repellents are used for controlling mosquitoes and are complimenting other mosquito destroyers gradually. With the rise in the standard of living, increasing urbanization and population, the demand of mosquito repellents in form of paper is constantly increasing particularly in tropical places. It is a convenient method for protection against mosquitoes, so it has a tremendous market potential. Thus there is a very good scope for development of such units in the country.

Spatial repellents are chemical products designed to be 'active' (requiring heat or electricity) or 'passive' (requiring no heat or electricity) and release volatile chemicals into the air within the treated space. Product examples that are currently available include mosquito coils, spray, candles, papers, liquid vaporizers, vaporizing mats, tablets and liquid detergents among others. However, many more types of spatial repellent products are waiting to be developed.

Spatial repellents elicit a range of behaviours in mosquitoes, including movement away from a chemical stimulus, interference with host detection (attraction-inhibition), and interference with feeding response (feeding-inhibition), ultimately reducing human-mosquito contact.

Standardization of vaporizing mat mosquito repellents involves setting consistent criteria to ensure product safety, efficacy, and quality across different manufacturers. This standard helps to assess aspects such as the active ingredient concentration, release rate, duration of effectiveness and toxicological safety.

Spatial application mosquito repellents — Specification — Part 6: Vaporizing mats

1 Scope

This Draft East African Standard specifies requirements, sampling and test methods for spatial application mosquito repellents formulated and prepared as mosquito vaporizing mats.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

DEAS 1120-2, Mosquito repellents — Performance test guidelines — Part 2: Spatial repellents

ISO 24153, *Random sampling and randomization procedures*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <http://www.iso.org/obp>

— IEC Electropedia: available at <http://www.electropedia.org/>

3.1

mosquito

blood-sucking dipterous insect of the family *Culicidae*. *Aedes*, *Anopheles*, *Culex*, *Mansonia*, and *Stegomyia* are genera containing most species involved in the transmission of protozoan and other disease-causing parasites.

3.2

mosquito repellent

substance applied to deter mosquito from approaching or settling on surfaces

3.3

natural repellent

repellent that contains, plant-based compounds

3.4

synthetic repellent

conventional repellent containing chemical compounds manufactured to imitate the natural compounds

3.5

competent authority

government agency or body in charge of regulations for a specific product

3.6

vaporizing mat

mat/fibreboard impregnated with active ingredients with the aim to repel mosquitoes by heating

4 Active ingredients

4.1 Natural repellents

4.1.1 Active ingredients used in natural repellents shall be natural plant based compounds such as essential oils or any other plant extract registered by the competent authority as mosquito repellents.

4.1.2 The manufacturer shall provide adequate data on the repellence and safety of such ingredients.

4.1.3 The manufacturer shall have adequate data justifying the proportion of ingredient(s) for which claims are made, used in the product.

4.1.4 The essential oils used in natural repellents shall be safe for users and provide the required efficacy. Annex A gives some ingredients (essential oils) and safe concentration commonly used in natural repellents.

4.1.5 The concentration of plant-based active ingredient and recommended application shall be safe to the user and provide the required efficacy. Annex B provides the efficacy of some plant-based mosquito repellents.

4.2 Synthetic repellents

4.2.1 Synthetic repellents shall contain synthetic chemical compound (s) or their mixture with natural plant based compounds, which are able to deter mosquitoes from approaching and settling on surfaces.

4.2.2 The concentration of the active ingredients and the recommended application/use shall ensure the declared efficacy and shall be safe and proved by scientific evidence.

4.2.3 Synthetic repellents and their active ingredients shall be approved and registered by competent authority before being released to the market. Annex C gives the list of some of active ingredients used in synthetic repellents.

5 Requirements

5.1 General requirements

5.1.1 The size of the mat shall be compatible with the associated heater.

5.1.2 After heating the mat on the appropriate heating unit for 4 h, a minimum of 20% of the active ingredient content shall remain.

5.2 Biological efficacy

When tested in accordance with DEAS 1120-2, the product shall repel at least 85% of the mosquitoes available in space, after protection time indicated by the manufacturer.

6 Packaging

Mosquito repellent in form of vaporizing mats shall be packaged in suitable containers that shall protect the contents and shall not react with the product or cause any contamination during storage, handling, transportation or use.

7 Labelling

The package shall be legibly and indelibly labelled in English and/or any other official language (such as French and Kiswahili) used in the importing East African Partner State, with the following information:

- a) name of the product as “Mosquito repellent”
- b) form of the product as “vapouring mat”
- c) name and physical address of manufacturer;
- d) batch number;
- e) date of manufacture;
- f) date of expiry;
- g) total number of mats in the box;
- h) active ingredient content;
- i) protection time;
- j) directions for use;
- k) special population whose exposure is prohibited (children and pregnant women); and
- l) disposal instructions

8 Sampling

Sampling shall be done in accordance with ISO 24153.

Annex A (normative)

Some common essential oils in natural repellents that may be hazardous

Table A.1 — Some common ingredients (essential oils) in natural repellents that may be hazardous

Common name	Scientific name	Safe concentration %	Hazard
Anise	<i>Pimpinella anisum</i>	3.6	Based on 0.11 % methyl eugenol; carcinogen
Basil	<i>Ocimum sp.</i>	0.07	Based on 6 % methyl eugenol; carcinogen.
Bergamot	<i>Citrus</i>	0.1	Sensitizing and phototoxic; skin irritant.
Cajeput	<i>Bergamia</i>	0.004	Based on 97 % methyl eugenol; carcinogen.
Cedar	<i>Melaleuca alternifolia</i>	1	Likely allergenic contaminants if nootkatone not 98 % pure.
Cinnamonium	<i>Cinnamomum cassia</i>	9	Sensitising skin irritant
	<i>Cinnamomum verum</i>	0.05	Based on 75.5 % of cinnamaldehyde, sensitising skin irritant.
Citronella	<i>Cymbopogon nardus</i>	2	Safety is controversial; based on 0.2 % methyl eugenol or 1.3 % citral; sensitising skin irritant.
		18.2	Based on 29.1 % geraniol, sensitising skin irritant
Citronella (java)	<i>Cymbopogon winterianus</i>	2	Based on 2 % methyl eugenol; carcinogen
Citrus oils	<i>Citrus sp.</i>	16 – 25	Based on 0.005 % - 0.0 025 % bergapten; phototoxic skin irritant
Clove	<i>Syzyguim aromaticum</i>	0.5	Based on 92 % eugenol; sensitising skin irritant
Eucalyptus	<i>Eucalyptus globulus</i> <i>E. globulusmaidenii</i> <i>E. radiata</i> <i>E. smithii</i> <i>E. camaldulensis</i>	20	High in 1,8-Cineole can cause Central Nervous System (CNS) and breathing problems in young children.
Fever tea, lemon bush	<i>Lippie javanica</i>	2	Based on 5 % citral in related species; sensitizing skin irritant.
Geranium	<i>Pelargonium graveolens</i>	6	Based on 1.5 % citral; sensitising skin irritant

Common name	Scientific name	Safe concentration %	Hazard
	<i>Pelargonium x asperum</i>	17.5	Based on 30.3 % geraniol; sensitising skin irritant
Ginger	<i>Zingber sp.</i>	12	Based on 0.8 citral; sensitising skin irritant
Huon oil, Macquarie pine	<i>Langarostrobos franklini</i>	0.004	Based on methyl euginol
Huon oil, Macquarie pine	<i>Langarostrobos franklini</i>	0.004	Based on methyl euginol; carcinogen
Lemongrass	<i>Cymbopogon citrates</i>	0.1	Based on 90 % citral; sensitising skin irritant
Lime	<i>Citrus aurantifolia</i>	0.7	Phototoxic skin irritant
Litsea	<i>Litsea cubeba</i>	0.1	Based on 78 % cotral; sensitising skin irritant
Marigold	<i>Tagates minuta</i>	0.01	Phototoxic skin irritant
Mint	<i>Menthe piperata and spicata</i>	2	Based on 0.1 % trans-2-hexenal; sensitising skin irritant
Nutmeg	<i>Myristica fragrans</i>	0.4	Based on 1 % methyl eugenol; carcinogen
Palmarosa	<i>Cymbopogon martini</i>	16	Based on 1.2 % farnesol; sensitizing skin irritant
Pine	<i>Pinus sylvestris</i>	Prepare with antioxidants	Oxidation creates phototoxic skin irritants
Pyrethrum	<i>Chrysanthemum cinerariifolium</i>	0.5	Based on TWA (Time-Weighted Average): 5 mg/m ³ (8-hour exposure) Higher concentrations in air (e.g., from foggers in enclosed rooms) may exceed this and become hazardous.
Rosemary	<i>Rosemarinus officinalis</i>	36	Based on 0.011 % methyl eugenol; carcinogen
		16.5	High in Camphor CT (Chemotype)
		22	High in α-Pinene CT
		6.5	High in Verbenone CT
Rue	<i>Rota chalepensis</i>	0.15	Based on presence of psoralenes; phototoxic skin irritant
Tea tree	<i>Leptospermum petersonii (lemon scented)</i>	0.6	Based on 76.7 % Citral (Geranial + Neral), sensitising skin irritant
Thyme	<i>Thymus vulgaris</i>	2	Based on 0.1 % trans-2-hexenal; sensitising skin irritant
Violet	<i>Viola odorata</i>	2	Based on 0.1 % trans-2-hexenal; sensitizing skin irritant

Common name	Scientific name	Safe concentration %	Hazard
Ylang-ylang	<i>Canarium odoratum</i>	2	Based on 4 % farnesol; sensitizing skin irritant

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Annex B (informative)

Plant-based insect repellents: a review of their efficacy, development and testing

Table B.1 — An overview of repellent plant efficacy from literature review

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
<i>Myrtaceae</i>					
<i>Corymbia citriodora</i>	Australia Brazil Bolivia China India Ethiopia Tanzania Kenya	Lemon eucalyptus Lemon Scented Gum Quwenling	Citronellal PMD (by product of hydrodistillation) (p-methane-3,8-diol) Citronellol Limonene Geraniol Isopulegol δ -pinene	30 % PMD applied topically	96.88 % protection from mosquitoes for 4 h
				PMD towelette (0.57 g) applied topically	90 % protection from <i>An. Arabiensis</i> for 6 h
				50 % PMD applied topically	100 % protection from <i>An. Gambiae</i> and <i>An. Funestus</i> for 6 – 7 h
				20 % PMD (1.7 mg/cm ²) applied topically.	100 % protection for 11 h – 12 h against <i>A. stephensi</i> .
				20 % PMD applied topically	100 % protection against <i>Ae. Aegypti</i> for 120 minutes.
				Thermal expulsion (leaves)	78.7 % protection from <i>An. Arabiensis</i> .
				Direct burning (leaves)	70.1 % protection from <i>An. arabiensis</i>
				Periodic thermal expulsion (leaves)	74.5 % protection from <i>An. Gambiae</i> s.s.
				Periodic direct burning (leaves)	51.3 % protection from <i>An. Gambiae</i> s.s.
				Thermal expulsion (leaves)	48.71 % protection from <i>An. Gambiae</i> s.l.

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
<i>Eucalyptus spp.</i>	Guinea-Bissau Ethiopia Tanzania Portugal	Eucalyptus	1,8-cineole citronellal Z- and α - citral α - pinene	Thermal expulsion (leaves)	72.2 % protection from mosquitoes for 2 h
<i>E.camaldulensis</i>	Ethiopia			Thermal expulsion (leaves)	72.2 % protection from <i>An.Pharaohensis</i>
					71.9 % protection from <i>An. Arabiensis</i>
				Direct burning (leaves)	66.6 % protection from <i>An.Pharaohensis</i>
					65.3 % protection from <i>An. Arabiensis</i>
<i>Eugenia caryophyllus</i> or <i>Syzygium aromaticum</i> or <i>Eugenia aromatic</i>	India	Clove lavang cravinho-da india	Euginol Carvacrol Thymol Cinnamaldehyde	100 % essential oil applied topically	100 % protection against <i>Ae.</i> <i>aegypti</i> for 225 min
					100 % protection against <i>An.</i> <i>Albimanus</i> for 213 min
				100 % essential oil applied topically	100 % protection against <i>Ae.</i> <i>aegypti</i> for 120 min
					100 % protection against <i>C.</i> <i>quinquefasciatu</i> <i>s</i> for 240 min
					100 % protection against <i>An.</i> <i>Dirus</i> for 210 min
Verbenaceae					
<i>lippia spp.</i>	Kenya Tanzania Ghana Zimbabwe	Lemon bush	Myrcene Linalool α - pinene eucalyptol		
<i>L. javanica</i>			Alloparinol Camphor Limonene α - terppeneol	5 mg/cm ² plant extract applied topically	100 % protection against <i>Ae.</i> <i>aegypti</i> for 8 h

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
			verbenone	Alcohol plant extract applied topically	76.7 % protection against <i>An. Arabiensis</i> for 4 h
<i>L. uckambensis</i>		Fever tea		Potted plant	33.3 % protection against <i>An. Gambiae</i> s.s
				Periodic thermal expulsion (leaves)	45.9 % protection against <i>An. Gambiae</i> s.s
				Periodic direct burning (leaves)	45.9 % protection against <i>An. Gambiae</i> s.s
				Potted plant	25.01 % protection against <i>An. Gambiae</i> s.s
<i>L. cheraliera</i>			Eucalyptol Caryophyllene lpsdienone p-cymene		
<i>Lantana camara</i>	Kenya Tanzania	Lantana Spanish flag West Indian Lantana Wild sage	Caryophyllene	Potted plant	32.4 % protection against <i>An. Gambiae</i> s.s
				Potted plant	27.22 % protection against <i>An. Gambiae</i> s.l
				Flower extract in coconut oil	94.5 % protection against aegypti and ae. <i>albopictus</i> for one hour
				Periodic thermal expulsion (leaves)	42.4 % protection against <i>An. Gambiae</i> s.s
<i>Lamiaceae</i>					
<i>Ocimum</i> spp. <i>O. americanum</i>	Kenya Tanzania Zimbabwe Nigeria Ghana Cameroon Eritrea	Tree basil Nchu avum Lime basil Kivumbasi Myeni Madongo African blue Basil Hairy basil	p-cymene estragosl linalool linoleic acid eucalyptol eugenol camphor citral thujone limonene ocimene and others	Potted plant	39.70 % protection against <i>An. Gambiae</i> s.s
				Potted plant	37.91 % protection against <i>An. Gambiae</i> s.l
				Fresh plants combined with O.	50 % protection against <i>An.</i>

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
	Ethiopia			suave bruised and applied topically	<i>Gambiae s.l</i>
				Periodic thermal expulsion (leaves and seeds)	43.1 % protection against <i>An. Gambiae s.s</i>
				Periodic direct burning (leaves and seeds)	20.9 % protection against <i>An. Gambiae s.s</i>
				100 % essential oil combined with vanillin 5 % applied topically	100 % protection against <i>Ae. aegypti</i> for 6.5 h
					100 % protection against <i>C. quinquefasciatus</i> for 8 h
					100 % protection against <i>An. Dirus</i> for 8 h
<i>O. suave</i>				Thermal expulsion (leaves)	73.6 % protection from <i>An. Arbiensis</i>
					75.1 % protection against <i>An. pharaoensis</i>
				Direct burning (leaves)	71.5 % protection from <i>An. arbiensis</i>
					79.7 % protection against <i>An. pharaoensis</i>
				Periodic thermal expulsion (leaves and seeds)	53.1 % protection from <i>An. gambiae s.s.</i>
				Periodic direct burning (leaves and seeds)	28.0 % protection from <i>An. gambiae s.s.</i>
<i>O. basilicum</i>				Thermal expulsion (leaves)	78.7 % protection from <i>An. arabiensis</i>
					79.2 % protection from <i>An. pharaoensis</i>
				Direct burning	73.1 % protection from

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
				(leaves)	<i>An. arabiensis</i>
					70.0 % protection from <i>An. pharaoensis</i>
				100 % essential oil applied topically	100 % protection for 70 min
<i>O. kilimandscharikum</i>				Thermal expulsion (leaves and seeds)	44.54 % protection against <i>An. gambiae s.l.</i>
				Thermal expulsion (leaves and seeds)	37.63 % protection against <i>An. funestus</i> .
				Periodic thermal expulsion (leaves and seeds)	52.0 % protection against <i>An. gambiae s.s.</i>
				Periodic direct burning (leaves and seeds)	26.4 % protection against <i>An. gambiae s.s.</i>
<i>O. forskolei</i>				Fresh plants hung indoors	53 % protection against mosquitoes entering human dwelling
<i>Hyptis spp. Hyptis suaveolens</i>	Kenya Tanzania Ghana Gambiae	Bushmint Wild hops Wild Spikenard Hangzimu Hortela-do	Myrcene	Smouldering on charcoal	85.4 % repellency against mosquitoes for 2 h
				Fresh leaves	73.2 % repellency against mosquitoes for 2 h
				Periodic direct burning (leaves and flowers)	20.8 % repellency against <i>An. gambiae s.s.</i>
<i>Menthe spp. M. piperata</i>	Brazil Bolivia	Hortela-do-campo Peppermint		100 % essential oil applied topically	100 % protection against <i>Ae. aegypti</i> for 45 min
<i>M. arvensis</i>		Menta Japanese mint		100 % essential oil volatilized in a kerosene lamp	41 % protection against indoors against <i>Mansonia spp.</i>
<i>Thymus spp. Th. vulgaris</i>	China Former Soviet Union Korea Middle-	Thyme	α - terpinene carvacrol thymol p-cymene linalool	α - terpinene topically	97.3 % protection against <i>Culex</i>

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
	East Mediterranean		geraniol		<i>piemens sallens</i> for 82 min
				Carvacrol topically	94.7 % protection against <i>C. pipiens sallens</i> for 80 min
				Thymol topically	91.8 % protection against <i>C. pipiens sallens</i> for 70 min
				Linalool topically	91.7 % protection against <i>C. pipiens sallens</i> for 65 min
				p-cymene	89.0 % protection against <i>C. pipiens sallens</i> for 45.2 min
				100 % essential oil applied topically	100 % protection against <i>An. Arbimanus</i> for 105 min and <i>Ae. aegypti</i> for 135 min
				Direct burning (leaves)	85 % - 90 % protection for 60 min - 90 min
<i>Pogostemon spp.</i>	China	Patchouli		100 % essential oil applied topically	100 % protection against <i>Ae. aegypti</i> for 120 min
<i>Pogostemon cablin</i>	India Malaysia Thailand	Oriza		100 % essential oil applied topically	100 % protection against <i>C. quinquefasciatus</i> for 150 min
					100 % protection against <i>An. Dirus</i> for 710 min
<i>Poaceae</i>					
<i>Cymbopogon</i>	China India Indonesia				

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
<i>C. nardus</i>	Brazil Burundi South Sudan DRC Kenya Rwanda Uganda Botswana		citronellal	40 % essential oil applied topically	100 % protection for 7 h - 8 h against <i>An. Stephensi</i>
				100 % essential oil applied topically	100 % protection against <i>Ae. Aegypti</i> for 120 min
					100 % protection against <i>C. quinquefasciatus</i> for 100 min
					100 % protection against <i>An. dirus</i> for 70 min.
				10 % essential oil applied topically	100 % protection against <i>Ae. Aegypti</i> for 20 min
<i>C. martini</i>	Tanzania Kenya	palmarosa	geraniol	100 % essential oil applied topically	100 % protection against <i>An. culicifacies</i> for 12 h
					96.3 % protection against <i>C. quinquefasciatus</i> for 12 h
				Topically (100 % essential oil)	98.8 % protection against <i>C. quinquefasciatus</i> for 10 h
<i>C. citratus</i>	USA South Africa Bolivia	Lemongrass oil	Citral α - pinene	Topically (100 % essential oil)	74 % protection against <i>An. Darlingi</i> for 2.5 h
					95 % protection against <i>Mansonia spp.</i> for 2.5 h
				Methanol leaf extract applied	78.8 % protection

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
				topically (2.5 mg/m ²)	against <i>An. Arabiensis</i> for 12 h
				100 % essential oil applied topically	100 % protection for 30 min
<i>C. winterianius</i>	Burundi South Sudan DRC Kenya Rwanda Uganda Botswana			100 % essential oil combined with vanillin 5 % applied topically	100 % protection against <i>Ae. Aegypti</i> for 6.5 h
					100 % protection against <i>C. quinquefasciatus</i> for 8 h
					100 % protection against <i>An. Dirus</i> for 8 h
<i>C. excavatus</i>				Extract applied topically	66.7 % protection against <i>An. Arabiensis</i> for 3 h
<i>Pelargonium Reniforme</i>		Rose Geranium		Alcohol plant extract applied topically	63.3 % protection against <i>An. Arabiensis</i> for 3 h
Meliaceae					
<i>Azadirachta indica</i>	India Sri Lanka China Brazil Bolivia Pakistan Ethiopia Guinea Bissau Kenya Tanzania	Neem	Azadirachtin saponins	Direct burning (leaves)	76.0 % protection from mosquitoes for 2 h
				Periodic thermal expulsion (leaves)	24.5 % protection from <i>An. Gambiae</i> s.s.
				1 % neem oil volatilized in a kerosene lamp	94.2 % protection from <i>Anopheles spp.</i>
					80 % protection from <i>Culex spp.</i>
2 % neem oil applied topically	56.7 % protection from mosquitoes for 4 h				
Asteraceae					
<i>Chrysanthemum cinerariifolium</i>	Kenya	Pyrethrum	a) Pyrethrins • Pyrethrin I • Pyrethrin II b) Cinerins • Cinerin I	In aerosol mosquito repellent products, pyrethrins are	0.1% formulations are effective for quick acute repellency but

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
			<ul style="list-style-type: none"> • Cinerin II c) Jasmolins • Jasmolin I • Jasmolin II 	<p>typically present at concentrations ranging from 0.1% to 0.5% by weight. This concentration is effective for rapid insect acute repellency while maintaining safety for humans and pets when used as directed.</p> <p>To enhance the efficacy of pyrethrins, they are often combined with synergists such as piperonyl butoxide (PBO). PBO inhibits the insect's ability to detoxify the pyrethrins, thereby increasing the repellency effect. The ratio of PBO to pyrethrins in formulations can range from 3:1 to 20:1, depending on the specific product and target mosquito.</p>	<p>may not offer prolonged protection.</p> <p>0.5% formulations, especially with synergists, offer chronic repellency of exposed insects (~95–98%) but still short residual effect.</p>
<i>Tagetes minuta</i>	Uganda Zimbabwe India Burundi	Khaki weed		Topically	86.4 % protection against <i>An. Stephensi</i> for 6 h
				Topically	84.2 % protection against <i>C. quinquefasciatus</i> for 6 h
				Topically	75 % protection against <i>Ae. Aegypti</i> for 6 h
				Fresh leaves (4 kg)	Reduced human landings indoors
<i>Artemisia ssp.</i>					
<i>A. vulgaris</i>	India Egypt Italy	Mugwort wormwood St. Johns plant Old uncle henry	Camphor Linalool Terpenen-4-ol α - and β - thujone β - pinene		

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
	Canada USA	Sailors Tobacco			
<i>A. monosperma</i>	Siberia Brazil	Felon herb Naughty man	Myrcene Limonene Cineol	5 % leave extract applied topically	100 % protection for 4 h
Caesalpiniaceae					
<i>Daniellia oliveri</i>	Guinea-Bissau The Gambiae	Churai Santao Santang Santango		Direct burning (bark)	77.9 % protection against mosquitoes for 2 h
				Direct burning (bark)	77 % protection against mosquitoes
Fabaceae					
Glycine max	Worldwide	Soya		2 % soya bean oil	100 % protection against <i>Ae.</i> <i>Aegypti</i> for 95 min
Rutaceae					
<i>anthoxylum limonella</i>	Thailand	makaen		100 % essential oil applied topically	100 % protection against <i>Ae.</i> <i>Aegypti</i> for 120 min
					100 % protection against <i>C.</i> <i>quinquefasciatu</i> <i>s</i> for 170 min
				10 % essential oil combined with vanillin 5 % applied topically	100 % protection against <i>An.</i> <i>dirus</i> for 95 min
<i>Citrus hystrix</i>	Indonesia Malaysia Thailand Laos	Kaffir lime Limau Purut		100% essential oil combined with vanillin 5% applied topicall	100 % protection against <i>An.</i> <i>Stephensi</i> for 8 h
					100 % protection against <i>Ae.</i> <i>Aegypti</i> for 3 h
					100 % protection against <i>C.</i> <i>quinquefasciatu</i> <i>s</i> for 1.5 h
					100 % protection against <i>An.</i>

Plant	Location	Other names	Repellent compound (s)	Tested mode of use	Repellency % protection
					<i>dirus</i>
Zingiberaceae					
<i>Curcuma longa</i>		Turmeric Curcuma Indian saffron		100 % essential oil combined with vanillin 5 % applied topically	100 % protection against <i>Ae. Aegypti</i> for 4.5 h
					100 % protection against <i>C. quinquefasciatus</i> for 8 h
					100 % protection against <i>An. dirus</i> for 8 h

Annex C (informative)

Active ingredients for synthetic repellents

Table C1 — List of some active ingredients for synthetic repellents

Active ingredient	Assessing risks to Health and Environment
<p>Transfluthrin</p> <p>2,3,5,6-tetrafluorobenzyl (1R,3S)-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate</p>	<p>Transfluthrin, if used contrary to product instructions, may cause symptoms of poisoning including nervousness, anxiety, tremor, convulsions, skin allergies, sneezing, running nose and irritation. No specific antidotes are known, but symptomatic treatment with antihistamines may help to control any allergies.</p>
<p>Etoc/ prallethrin</p> <p>(S)-2-methyl-4-oxo-3-prop-2-ynylcyclopent-2-enyl(1R)-cis,trans-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylat</p>	<p>Prallethrin is a synthetic pyrethroid with fast knock-down activity against household insect pests.</p> <p>Prallethrin is of low mammalian toxicity, with no evidence of carcinogenicity" and "is very toxic to bees and fish but of low toxicity to birds.</p>
<p>Metofluthrin (S1264)</p> <p>E-isomer (8.4%): 2,3,5,6-tetrafluoro-4 (methoxymethyl) benzyl (E)-(1R,3R)-2,2-dimethyl-3-(prop-1-enyl)cyclopropanecarboxylate</p> <p>Z-isomer (91.6%): 2,3,5,6-tetrafluoro-4 (methoxymethyl) benzyl (Z)-(1R,3R)-w,w-dimethyl-3-(prop-1-enyl)cyclopropanecarboxylate</p>	<p>The vapors of metofluthrin are highly effective and capable of repelling up to 97% of mosquitoes in field tests. Metofluthrin is used in a variety of consumer products, called emanators, for indoor and outdoor use. These products produce a vapor that protects an individual or area. Effectiveness is reduced by air movement. Metofluthrin is neurotoxic, and is not meant to be applied directly to human skin.</p> <p>Although metofluthrin has insectidal properties against other insects, it may not be an effective repellent for insects other than mosquitoes.</p>
<p>d-Alethrin (Pynamin Forte)</p> <p>(RS)-3-allyl-2-methyl-4-oxocyclopent-2-enyl (1R)-cis, transchrysanthemate</p>	<p>The compounds have low toxicity for humans and birds. It is highly toxic to fish and aquatic invertebrates. At normal application rates, allethrin is slightly toxic to bees. Insects subject to exposure become paralyzed (nervous system effect) before dying. Allethrins are toxic to cats because they either do not produce, or produce less of certain isoforms of glucuronosyltransferase, which serve in hepatic detoxifying metabolism pathways.</p>
<p>Meperfluthrin</p> <p>[2,3,5,6-tetrafluoro-4-(methoxymethyl)phenyl]methyl (1R,3S)-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropane-1-carboxylate</p>	<p>Meperfluthrin is described as pesticide formulated for household and public hygiene situations to control mosquitoes and other insects. Example pests controlled are mosquitoes; cockroaches; bedbugs; and fleas. Mode of action is broad spectrum insecticide with contact and inhalation activity, effects insects presynaptic voltage gate sodium channels in nerve membranes rapid causing knockdown.</p>

Bibliography

- [1] RS 337-2: 2017, Mosquito repellents —Specification — Part 2: Coils containing allethrin
- [2] RS 393-6: 2018, *Spatial application mosquito repellents — Specification — Part 6: Vaporizing mats*

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