

ORDERING INFORMATION

NAME	INCI	PACKAGE SIZE	ITEM NO.
Insect Repellent IR3535®	Ethyl butylacetylaminopropionate	25kg, 200kg	111887

For more information, please contact: + 49 (0) 6151 726899, IR3535@merckgroup.com

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MERCK

TOUGH ON INSECTS. GENTLE ON YOU.

IR3535® INSECT REPELLENT

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IR3535.com



IR3535® INSECT REPELLENT



TOUGH ON INSECTS. GENTLE ON YOU.

IR3535® INSECT REPELLENT

Most consumers are aware of the risks posed by mosquitoes and other insects. Therefore, they know why they need an insect repellent that is powerful enough to keep ectoparasites like mosquitoes and ticks at bay. In addition, they are becoming increasingly concerned about the impact of insecticides on nature and their own well-being. Thankfully, using IR3535® in formulations allows you to offer brands that deliver solution on both fronts.

A SOLUTION CONSUMERS CAN RELY ON

Products using IR3535® is what consumers have been looking for. It is the perfect bodyguard to help fend off nasty mosquitoes and other insects while addressing consumer concerns regarding the environment, wildlife, and personal health. IR3535® gets the job done by providing protection from vec-

tors that could transmit dangerous diseases. In addition, the ingredient is an excellent option for all ages and especially attractive for both older and younger consumers with sensitive skin.

- › Strong and reliable repellent performance
- › Long lasting performance
- › Suitable for all ages including children and pregnant or breastfeeding women
- › Maximum tolerance, even on sensitive and atopic skin
- › Fresh feeling on the skin and pleasant odor

WHAT MAKES IR3535® DIFFERENT?

In a nutshell, IR3535® offers the effectiveness modern users expect from an insect repellent without impacting wildlife, the environment, or their own skin.

- Highly effective against mosquitoes, ticks, flies, and head lice
- Equally effective as DEET
- Derivative of the naturally occurring amino acid β-alanine, offering a high degree of toxicological and ecotoxicological safety:
 - Non-toxic to aquatic organisms
 - Rapidly biodegradable in sewage treatment plants, soil and sediments
 - Safe to use for consumers of all ages including those with sensitive skin

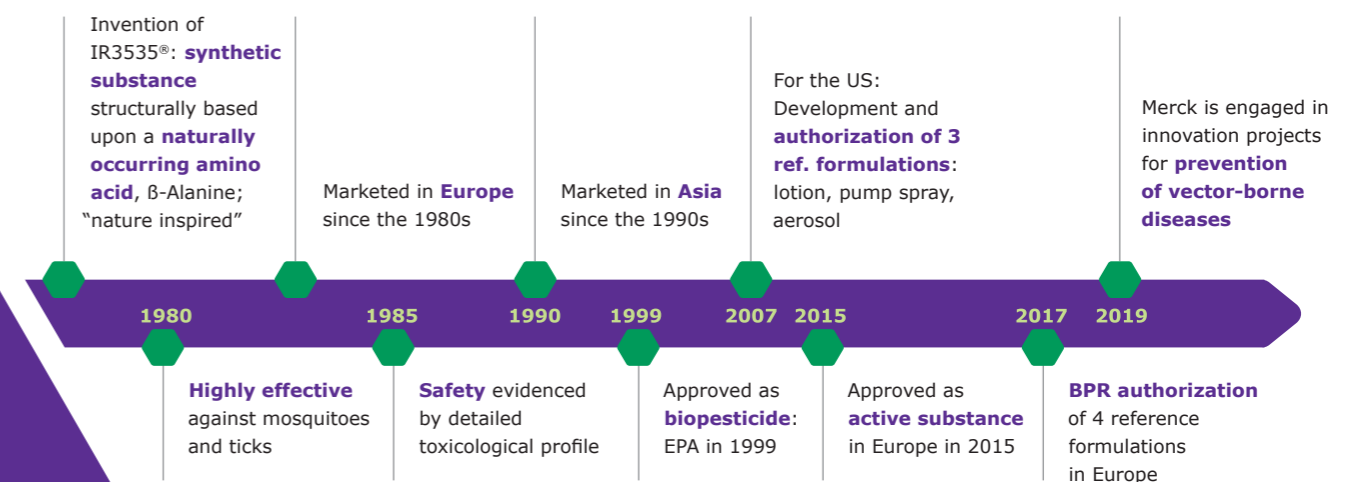


ALWAYS IN SAFE HANDS

Formulations containing IR3535® have been used safely throughout the world for over 40 years. It can be used in a wide range of products and since it is odorless there is no need for fragrances. Even

in low concentration it offers long-lasting performance in all kinds of consumer products such as lotions, sprays, and aerosols, with or without alcohol and preservatives.

Adverse side effects such as irritation or skin reactions are extremely rare. As a result, IR3535® is particularly appealing to parents, the elderly, and people with sensitive skin.



BALANCE BETWEEN SUSTAINABILITY AND EFFICACY

Like many others in our industry, we use the Sustainable Development Goals (SDGs¹) of the United Nations as a reference point. All 17 SDGs play a fundamental role in protecting health. But three goals stand out regarding IR3535®:

- › Ensure healthy lives and well-being at all ages (SDG 3)
- › Protect marine life and biodiversity (life below water; SDG 14)
- › Halt biodiversity loss (life on land; SDG 15)

Although insects have the potential to cause immeasurable harm to human beings, we do not believe we have a right to cause harm to nature in return. Offering IR3535® makes it possible to use formulations that are impacting neither humans nor nature – in the very best interests of biodiversity.



¹Source: <https://sustainabledevelopment.un.org/?menu=1300>

WORLDWIDE PROTECTION FOR EVERYONE

The World Health Organization (WHO) and many government health authorities issue regular advice for travelers and people living in regions with a high risk of insect-borne epidemics or pandemics. Their key points of advice for avoiding insect bites are:

- › Wear suitable clothing, preferably with a light color
- › Introduce physical barriers to ward off insects (such as mosquito nets)
- › Use repellents with active substances of approved effectiveness

The WHO has classified IR3535® as a Class U ingredient for use in repellents. This underscores that it is "unlikely to present acute hazard for normal use."

* Source: <https://www.who.int/csr/disease/zika/information-for-travelers/en/>

INSECTS: THE NUMBER ONE THREAT TO HUMANITY?

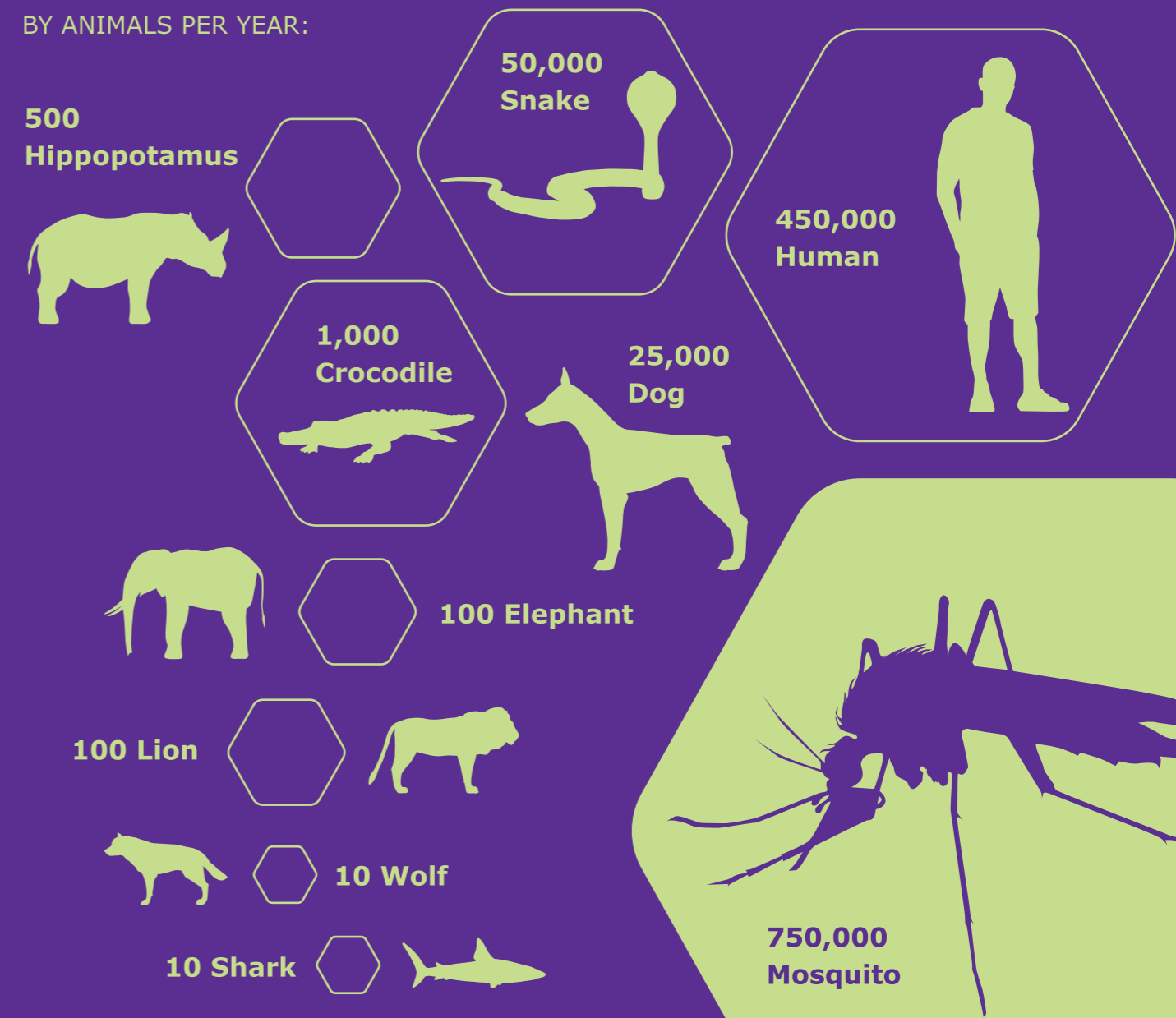


Bill Gates once highlighted in his blog that the world's deadliest animals are not crocodiles, sharks, or even snakes but mosquitoes*. In fact, arthropods in general pose a serious risk to human life everywhere, as they are carriers of e.g. viruses that cause vector-borne diseases. Their bites are not just irritating and painful but can also

cause multiple severe illnesses. Starting from serious swelling in limbs to inner organ failure, fever and ultimately, death.

The main culprits regarding vector-borne dangers to human life are mosquitoes, sandflies, ticks, blackflies, tsetse flies and lice.

NUMBER OF PEOPLE KILLED BY ANIMALS PER YEAR:



Source: Bill Gates Infographic (pictured) in: "<https://www.dailymail.co.uk/sciencetech/article-2615737/amp/Forget-sharks-mosquitoes-snails-worlds-deadliest-animals-Graphic-reveals-human-races-biggest-killers.html>". By Sarah Griffiths 2014, updated Feb 2016"

PLAY IT SAFE

IR3535® is ideal for all age groups and user categories, including infants, pregnant or breastfeeding women, and the elderly. It has an outstanding safety profile as testified by over 40 toxicological and eco-toxicological studies. It delivers particular benefits in terms of:

- › Systemic toxicity (both acute and repeated)
- › Local tolerance (skin irritation)
- › Ecotoxicity (no harm to aquatic organisms; does not accumulate in nature)

Important for uses requiring repeated application, IR3535® can be worn day and night and reapplied frequently (in accordance with label instructions).

EFFECTIVE INGREDIENT

Products with IR3535® are on the market claiming protection against specific types of insects. These include mosquitoes (e.g. *Aedes aegypti*, which transmit the Zika virus), ticks, head lice, wasps, blackflies, dust mites, and sandflies.

Some consumer benefits you may wish to highlight for your products are “long-lasting”, “non greasy”, or “odorless”. The preferred types of application for products containing IR3535® are pump sprays, aerosols, emulsions (such as creams and lotions), wipes, gels, and sticks.

We can also provide assistance with branding and both, on-pack and off-pack communication with end customers. For example, if you consider using a co-brand, we are happy to offer use of the IR3535® trademark in combination with brand registration details.

HOW IR3535® SCARES AWAY INSECTS

IR3535® is a trademark of Merck KGaA, Darmstadt, Germany, branding the active substance with the INCI Ethyl Butylacetylaminopropionate (EBAAP). The molecule is a derivative of the naturally occurring amino acid β -alanine. IR3535® has an amazing ability to make insects turn the other way! So, in scientific terms it is not an insecticide, but a repellent.

Although it is not totally understood how repellents impact olfactory receptors, publications* show that synthetic repellents likely reduce the human odorants that reach mosquitoes. Effectively, IR3535® masks odors that attract insects in the first place.

*C. J. Potter, *Curr. Biol.*, **2019**, 21, 3669; DOI:10.1016/j.cub.2019.09.007
*J. C. Dickens, *Pestic. Biochem. Physiol.*, **2013**, 106, 149; DOI: 10.1016/j.pestbp.2013.02.006

Consumers are searching for innovative repellents featuring reliable, safe ingredients and a pleasant smell. Are you looking to add repellents to your portfolio?

FORMULATING: OUR TRICKS OF THE TRADE

Because IR3535® has been used in products for over four decades, its properties in use are well known and easy to adapt to. The pure substance is a completely clear liquid and has a very slightly yellow appearance.

Please ask if you require assistance with formulations. As a rule of thumb, our advice is based on the following parameters:

- › Miscibility: water (6%), ethanol (>50%), propylene glycol (>50%), isopropyl myristate (50%), paraffin oil (3%)
- › Optimum pH: 6.5 – 8.0
- › Use level: 10 – 30%

In topical skin care products its use is for repelling mosquitoes, ticks and flies. Products are also marketed for application on hair to prevent from head-lice infestation. And its suitable to protect domestic animals from insect bites. The use for application on textile is another possibility for getting maximum protection.

GENTLE ON EVERYONE

It's comforting to know that IR3535® has an excellent safety profile and is safe to use as an insect repellent for ALL age groups. It is suitable for young children, pregnant and breastfeeding women, anyone vulnerable to infectious diseases, and even people with skin that is sensitive to chemicals.

LAUNCH YOUR BRAND QUICKLY

Authorization is already available for several formulations in the United States and Europe. To make it easier for you to introduce new products formulated with IR3535®, Merck has applied for authorization for a variety of reference formulations. This also covers different product categories and application methods.

The reference formulations can ease your market entry:

- › Formulate products faster
- › Gain further quick approvals from authorities
- › Save money
- › Save time and effort
- › Reduce time-to-market for your brand



TRIED AND TESTED

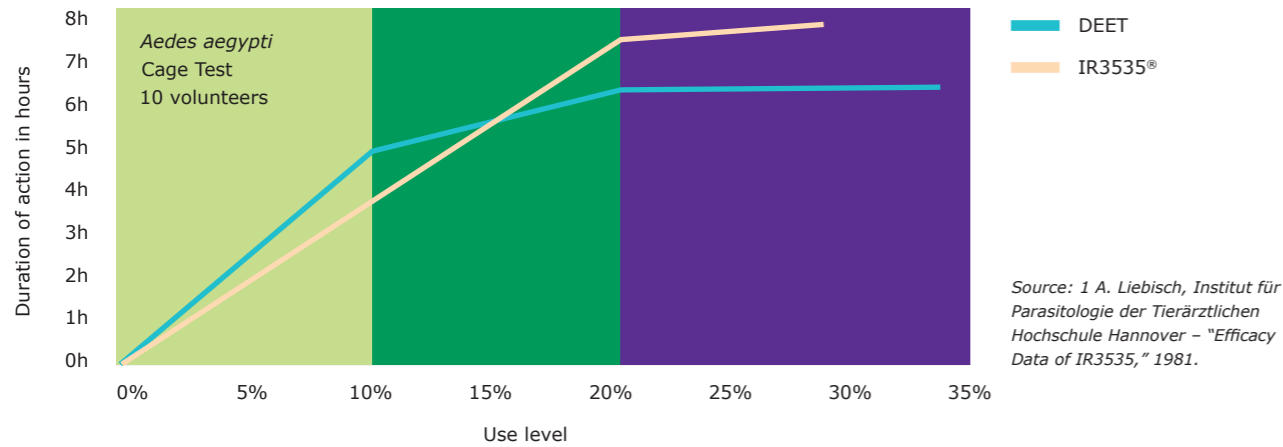
It's important to provide a reliable statement (e.g. on your packaging) of how long a repellent will remain effective. Depending on local legislation, either field tests were conducted or testing was carried out by having volunteers stick their arms into cages containing insects. Each test ended as

soon as an insect bite or sting was confirmed. The average time this took is now used to define the protection time that is mentioned on the label.

The efficacy of a repellent is dictated by the concentration of the active ingredient. Something that holds truth for all repellent substances is that exceeding concentration levels of 20 - 30% has no incremental influence on efficacy.



EFFICACY PERFORMANCE DEPENDENCY

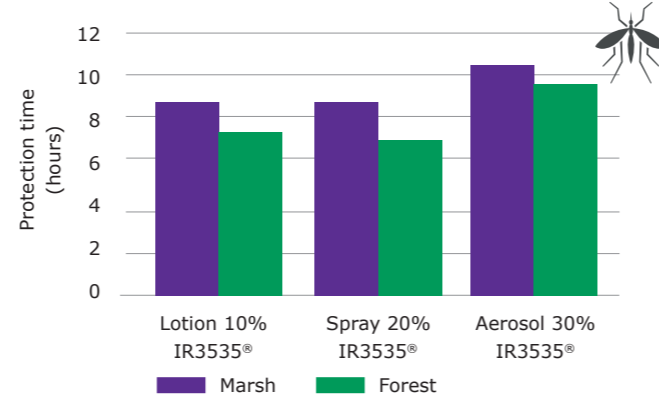


WHEN THE INSECTS GET TOUGH, IR3535® GETS GOING

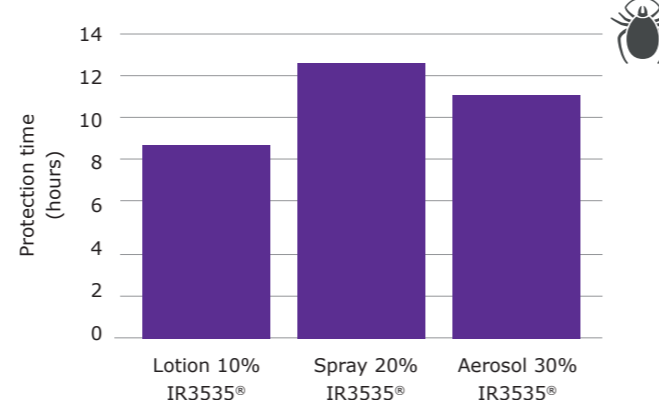
The overall duration of IR3535® protection depends on different key factors: The formulation, the type of insect, the environmental influences, the personal behavior and physical condition.

Efficacy studies show: A lotion with IR3535® may perform as well as a pump spray or an aerosol, although the use level of IR3535® is only half of the amount as e.g. in the pump spray. The impact of the kind of environment can differ between whether the mosquito detects you earlier when lingering in the woods rather than in the marsh.

ARTHROPODS: MOSQUITOES



ARTHROPODS: TICKS

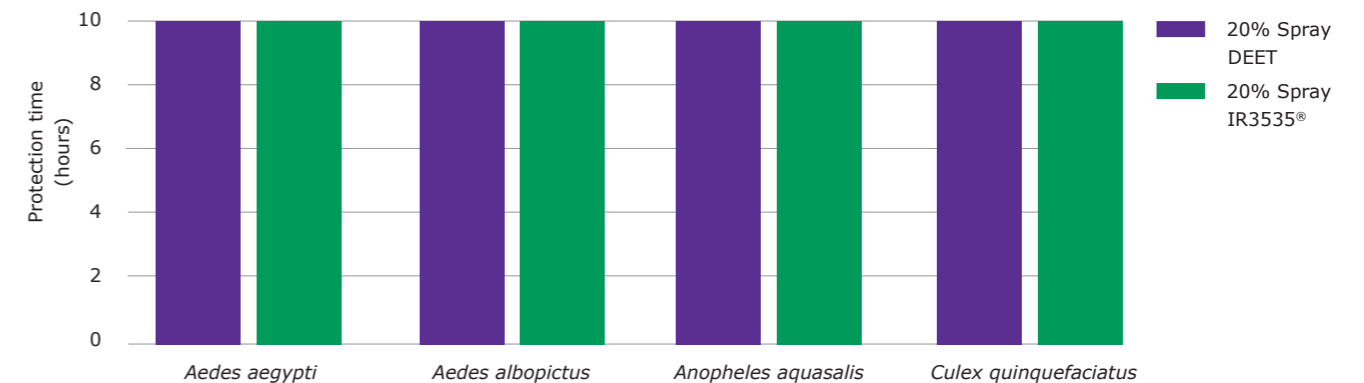


Source: Scott Carroll (2008): Prolonged efficacy of IR3535® repellents against mosquitoes and blacklegged ticks in North America

EQUALLY EFFECTIVE AGAINST ALL KINDS OF MOSQUITOES

Just because IR3535® is gentle on you and the environment doesn't mean it compromises regarding effectiveness. If substantiating your product claims is important to your brand, you can be assured that IR3535® is comparable in efficacy to DEET. This is particularly important when it comes to dangerous types of mosquitoes that transmit infectious fevers like: Chikungunya, Dengue, Zika, West Nile or Malaria.

MOSQUITO AEDES, ANOPHELES, CULEX; EXAMPLE IR3535® PUMP SPRAY

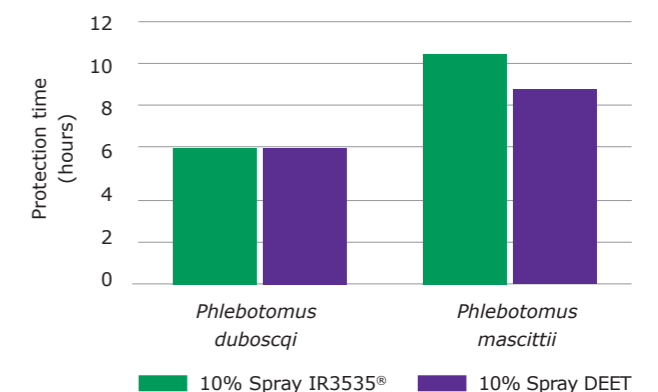


Source: Testing Institute in Brazil, 2017, Cage test according OPPTS 810.3700.

SENDS SANDFLIES AWAY

Sandflies are potential vectors of leishmaniasis, a parasitic infection transmitted through the bite of infected insects that are attracted to animals and humans. The tropical disease, leishmaniasis afflicts people and pets and can even be fatal.

SAND FLIES



Source: T. J. Naucke, S. Lorentz, H.-W. Grünwald, 2006, Institute of medical parasitology, Bonn, Germany

! Different target organisms are more or less susceptible to IR3535®

KEEPING A CLEAR HEAD

Head lice affect a surprising variety of families and age groups, but as any parent will attest, they're a curse when spreading amongst schoolchildren! Thankfully in return, IR3535® is a curse for head lice. It provides worried parents with one of the most effective ingredients for warding off infectious pests in the first place.

¹Source: F. Militão de Sousa, Veterinary Faculty State University of Ceará in Fortaleza – "Bioclinical trial to study the efficacy of a product containing IR3535," 2009

Because schoolchildren have frequent close contact with classmates, it's important to protect them from potential head lice infestations. Children dislike frequent treatment, especially on their hair, which is also why the protection provided by IR3535® means so much to parents: It lasts up to two days.

Used as a head lice repellent in a bio-clinical study, IR3535® was found to cause no irritation to sensitive scalps, no embarrassing redness, and certainly no itching.

COMPARISON WITH OTHER ACTIVE SUBSTANCES - CLASSIFICATION

	IR3535®	DEET	Icaridin	PMD
EU ECHA	Biocide	Biocide	Biocide	Biocide
US EPA	Biopesticide	Pesticide	Pesticide	Biopesticide
WHO classification	Class U* "unlikely to present acute hazard in normal use"	Class III „slightly hazardous"	Class III „slightly hazardous"	Not yet evaluated and classified by WHO
GHS classification ^{1,2}	H319 causes serious eye irritation	H302 harmful if swallowed H315 causes skin irritation H319 causes serious eye irritation	H319 causes serious eye irritation	H318 causes serious eye damage

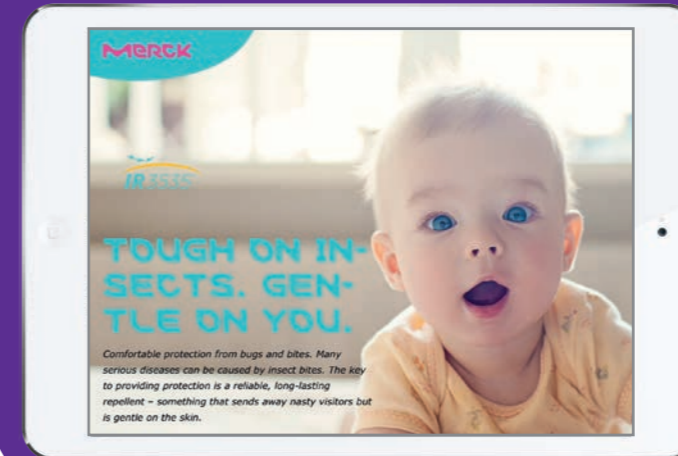
COMPARISON WITH OTHER ACTIVE SUBSTANCES - TOXICOLOGY

	IR3535®	DEET	Icaridin	PMD
Source	EU ECHA ¹	EU ECHA ¹	US EPA ²	US EPA ²
Acute oral toxicity LD ₅₀	➡ > 5.000 mg/kg bw	⬇ 1.892 mg/kg bw	⬇ 2.236 mg/kg bw	➡ > 5.000 mg/kg bw
Skin irritation	➡ No	⬇ Yes	➡ No	➡ No
Eye irritation	⬇ irritant	⬇ irritant	⬇ irritant	⬇ damaging
Neurotoxicity	➡ No	⬇ Yes	➡ No	⚠ No data

¹ EU Assessment Report; <https://echa.europa.eu/de/information-on-chemicals/biocidal-active-substances/>

² EPA Technical Document; <https://iaspub.epa.gov/apex/pesticides/?p=CHEMICALSEARCH;>
Evaluation in the EU not yet concluded and therefore not yet available

REGULARLY UPDATED INFORMATION FOR CONSUMERS



Our website provides a rich selection of important and interesting information for consumers, with many answers on the benefits, use and safety of IR3535®. find out more and go to: IR3535.com



COMPARISON WITH OTHER ACTIVE SUBSTANCES - ECO-TOXICOLOGY

	IR3535®	DEET	Icaridin	PMD
Source	EU ECHA ¹	EU ECHA ¹	US EPA ²	US EPA ²
Acute fish toxicity LC ₅₀	> 100 mg/L	97 mg/L	196 mg/L	62 mg/L
Acute daphnia immobilization EC ₅₀	> 100 mg/L	75 mg/L	>103 mg/L	68 mg/L
Algae toxicity EC ₅₀	> 100 mg/L	41 mg/L	87 mg/L	52 mg/L
Environmental fate	No accumulation	Detected in surface water*	No accumulation	No data

¹ EU Assessment Report; <https://echa.europa.eu/de/information-on-chemicals/biocidal-active-substances/>

² EPA Technical Document; <https://iaspub.epa.gov/apex/pesticides/?p=CHEMICALSEARCH;>
Evaluation in the EU not yet concluded and therefore not yet available

* S. Merel, S. A. Snyder, Environ Int., 2016, 96, 98; DOI: 10.1016/j.envint.2016.09.004

USE OF THE IR3535® LOGO

The IR3535® logo can be used in your consumer branding as an eye-catching hallmark of quality. It confirms that your product provides your end customers with safe, long-term protection. Furthermore, it signals important confirmation that they are helping conserve biodiversity and protect the environment.

