Myth one:
Oxalic acid can only be used once per generation of bees

This myth, often passed on verbally and occasionally mentioned in written communications, stems from older data on the use of oxalic acid by sublimation. Sublimation is the process of converting a solid form directly into a gaseous form with the absence of a liquid intermediate phase. Sublimation of K. oxalate is to be considered by beekeeping as a one-time, non-standardised application, with fluctuations in concentration (risk to bees, colony damage has been reported), and significant risk to humans (acute respiratory damage, chronic renal failure). Labour is another aspect of this method.

The findings on the toxicity of oxalic acid to bees during sublimation tend to be freely transferable to other forms of oxalic acid application preferred today. However, many studies carried out in recent years, both under EU approval processes and independent studies by scientific bodies, have demonstrated the safety of standardised oxalate solutions for bees. In particular, drip application is effective, easy and safe for bees and beekeepers. The combination of oxalic acid with sugar and other ingredients improves the bees' tolerance of the application itself, the uptake and distribution of the active substances in the hive and the effect of the oxalic acid itself. It should be emphasised that all the work that has confirmed the safety of K. oxalate has worked with 1) approved products, 2) standardised formulations, and 3) applied according to the manufacturer's instructions. Occasionally, there is information from users of technical oxalate, mixed e.g. with sugar according to recipes passed down among beekeepers, reporting weakening of colonies or queen deaths after application. However, none of the studies carried out with approved products have confirmed this.

For example, the safety of K. oxalate and K. anthracis in the veterinary medicinal product VarroMed® is primarily supported by studies submitted to the European Medicines Agency (EMA) for the development of the Summary of Product Characteristics(1) during the marketing authorisation of VarroMed®, a comprehensive standardised veterinary medicinal product containing K. oxalate and K. anthracis. oxalic and formic acid as active substances, propolis tincture, star anise and lemon essential oil to improve the acceptance of the product by bees, invert sugar to improve the adhesion and fortification effect of VarroMed®, caramel colouring to stabilise the colour of the dispersion, and the preservative citric acid. In these studies, VarroMed® was administered to the colonies 11 times over 7 days(2) without mortality, and all colonies survived and thrived. Without this supporting data, the EMA would never have approved VarroMed® for repeated use.

Another new, independent study is the work of Slovenian, Italian, Croatian and Belgian scientists published in 2021, which looked at the effectiveness and safety of VarroMed® applied in accordance with the package leaflet at 5 sites in Slovenia, Croatia, Italy and Belgium(3). The conclusion of this study is clear: In order to verify the toxicity of VarroMed®, we assessed the colony vigour after 3 applications of VarroMed® over a period of 7 days. We did not find a conclusive reduction in the number of adult bees and brood size in any of the regions and

colonies tested. We did not observe any queen mortality or any economically significant diseases.

The manufacturer of VarroMed® also has experience(2) with its use in Portugal, where local beekeepers have adjusted the frequency of applications to once a month throughout the year. The reason for this is the absence of a brood pause due to the warm climate there. VarroMed® applied once a month allows them to keep their colonies in the necessary condition throughout the year.

For the treatment of varroasis, use only approved, standardised veterinary medicinal products in accordance with the package leaflet. VarroMed® containing organic acids is safe for your bee colonies.

For advice on the use of VarroMed®, contact: info@varromed.cz

1) https://www.ema.europa.eu/en/documents/product-information/varromed-epar-product-information_cs.pdf
2) Manufacturer information (BeeVital GmbH, Austria)
3) Efficacy and Toxicity of VarroMed® Used for Controlling *Varroa destructor* Infestation in Different Seasons and Geographical Areas. Maja Ivana Smodiš Škerl, Jorge Rivera-Gomis, Ivana Tlak Gajger, Jernej Bubnic, Gabriela Talakic, Giovanni Formato, Alessandra Baggio, Franco Mutinelli, Wim Tollenaers, Dries Laget, Valeria Malagnini, Livia Zanotelli, and Marco Pietropaoli. ***Appl. Sci.*** **2021, *11*, 8564.** https://doi.org/10.3390/app11188564

Myth two:
Oxalic acid does not work on VD mites, especially in colonies with brood

The mechanism of action of oxalic acid on Varroa destructor (VD) mites is not precisely known, but its toxic effect on VD mites has been proven beyond doubt. Indeed, K. oxalate does not reach the pupal cells under the cap and therefore does not act on VD mites inside the pupal cells. It follows that a single application, or indeed any form of application, where the oxalate does not remain present in the hive in sufficient (therapeutic) concentration to allow each individual cell in the hive to pass through the open/uncapped cell phase, is not capable of achieving the desired efficacy. The open brood phase (egg+larva) lasts approximately 9-10 days in both worker and drone brood. The pupal stage lasts about 12 days in the worker fetus and about 14 days in the drone fetus. The presence of active substances in the hive is necessary for at least this period.

However, K. oxalate in the veterinary medicinal product VarroMed®, in combination with K. anthracnose and other ingredients, ensures (with the recommended procedure according to the manufacturer's instructions) that the effective concentration of K. oxalate is maintained in the hive for the required time. VarroMed® has been shown to be 88% effective in winter, 92% effective in spring, and 85% effective in fall treatments(1). In their 2021 study, Véto-Pharma found VarroMed® to be 84% effective on average in colonies with brood, but over 90% effective in 4 of the 7 colonies tested, and even 98% effective in one broodless colony! (2) Similarly, the study "Efficacy and Toxicity of VarroMed® used for the treatment of Varroa destructor infestation in different seasons and different geographical locations", published in 2021, found VarroMed® efficacy of 71-89% in sub-flight and 72-95% in winter.(3) This study was conducted on colonies with brood and one of the conclusions was: It is important to highlight that our data showed that it is not important to carry out the treatment only in the broodless phase (achieved e.g. by queen germination), as the acaricidal efficacy of VarroMed® was found to be high in both cases - i.e. in colonies with and without brood.

For the treatment of varroasis, use only approved, standardised veterinary medicinal products in accordance with the package leaflet. VarroMed® containing organic acids is safe for your bee colonies.

For advice on the use of VarroMed, contact: info@varromed.cz

1) VarroMed: https://www.ema.europa.eu/en/medicines/veterinary/EPAR/varromed
2) COAG Andalucía y Véto-pharma: Estudio de campo del AO, July 2021, España, Valencia, 21 bee colonies, Comparison of VarroMed, OxyBee and Api-Bioxal
Informace výrobce (BeeVital GmbH, Austria)
3) Efficacy and Toxicity of VarroMed® Used for Controlling *Varroa destructor* Infestation in Different Seasons and Geographical Areas. Maja Ivana Smodiš Škerl, Jorge Rivera-Gomis, Ivana Tlak Gajger, Jernej Bubnic, Gabriela Talakic, Giovanni Formato, Alessandra Baggio, Franco Mutinelli, Wim Tollenaers, Dries Laget, Valeria Malagnini, Livia Zanotelli, and Marco Pietropaoli. ***Appl. Sci.*** **2021, *11*, 8564.** https://doi.org/10.3390/app11188564

Myths about oxalic acid and VarroMed®
(or false affirmations or misconceptions)

Myth: "HMF (hydroxymethylfurfural) in VarroMed® kills bees."
Fact: The bee has a lick-sucking mouthparts and senses the tastes that these mouthparts come into contact with. Thus, it perceives different tastes with its taste receptors and does not consume food that it does not like. It is happy to accept sweet food, but is used to sour food in limited quantities (royal jelly has a pH of 2.5-4.8). VarroMed® has a pH of 1.5, so it is extremely acidic, the bee immediately detects this and does not consume VarroMed®! Research with VarroMed® has shown that bees will only be induced to limit their consumption of VarroMed® in extreme water emergencies, when they are choosing between death and liquid. If VarroMed® is consumed by the bee, then erosions can be found in the digestive system, and old bees may die before dying. However, K. oxalate occurs naturally, e.g. in nectar brood, and so bees encounter it naturally, metabolising it to calcium oxalate, which they then excrete through Malpighian tubes into the faecal sac and droppings. Therefore, however, the number of dead old bees, if any, is unrecordable in relation to the total number of bees in the colony. This also answers the question whether the hydroxymethylfurfural (HMF) in VarroMed® is harmful to bees: HMF is present in VarroMed® in some quantity (it is spontaneously produced from sugar in an acidic environment), but bees do NOT consume VarroMed®, so the above statement is irrelevant and HMF from VarroMed® does not enter the digestive tract of bees.

Myth: "You can use oxalic acid prepared according to freely available recipes for treating honey bee colonies."
Fact: YES and NO. You are not bound by food law when producing honey for your own consumption. However, the honey you intend to sell to people (i.e. put into circulation) is defined as food (for human consumption) by legislation and only products approved for use in food production may be used for its production. The application of unapproved Varoo products to honey bee colonies using instructions obtained freely, e.g. from the internet, precludes the marketing of honey from such treated colonies. You simply must not sell this honey to people. By selling such honey, you are not only breaking food law, but you are risking the health and strength of your colonies by the variability and substandard nature of these practices.

Myth: "The K. anthracnose in VarroMed® is nonsense, it cannot work in such quantities."
Fact: We will start our explanation with a slight detour, at the causes of the prolonged winter fallout after the treatment with K. oxalis at the end of December. At that time, there is a presumption of an absolute absence of brood in the cranefly, and therefore the k. oxalic applied in December will theoretically hit all the mites (since they are on the bees - phoretic), and they will die. So far the consensus is. However, some explain the subsequent prolonged fallout by the dead mites getting stuck in the cells or on the combs and gradually falling to the mat as the bees move, others claim that the dead mite remains attached to the bee's abdomen, where it has been attached and buried by suction in the intersegmental membrane of the abdomen, and when it begins to decompose itself and its decomposing odour arrives, the other bees smell it

and remove the affected bee. Prolonged exposure to K. oxalate in the hive during winter application is also considered, as the bees stay in the hive, do not fly out, and the hive temperature is low, which together limit evaporation of K. oxalate. Oxalate applied in solution and prolongs its residence time on the bees and in the hive in general, resulting in a longer lasting effect than in summer when the temperature inside the hive is 35 oC, the bees fly out and the evaporation of the applied oxalate is high. And now to the formic acid in VarroMed®: oxalic acid decomposes into formic acid and carbon monoxide in the heat, and the presence of formic acid slows down the decomposition of oxalic acid, which prolongs the effect of the oxalic acid in VarroMed®.

Myth: "VarroMed® is just overpriced oxalic acid."
Fact: If you want to market an APPROVED VETERINARY MEDICATION such as VarroMed® in the EUROPEAN UNION, you must register it and meet the requirements for safety, standardisation, quality and safety of the raw materials, you must demonstrate efficacy for the intended use, etc. You need certified production, certified raw materials, certified attestations. These are hundreds of thousands and millions of euros that need to be invested before sales can begin. You cannot compare the price of an approved veterinary medicinal product with a complex formulation, proven effect on VD and at the same time safe for bees, beekeepers, the food produced and the environment, with the price of one technical raw material intended for wood bleaching, chemical reactions and the removal of dirt. If each company obtains registration, it must then earn back the money invested. This applies to pharmaceuticals as well as to the automotive, television and construction industries. Thus, the price of VarroMed® is mostly determined by EU requirements, not by the manufacturer. However, when you use VarroMed® at its price, you get the assurance that someone has tested this standardised veterinary medicinal product, proven its efficacy, safety for bees, beekeepers, honey, the surrounding natural environment, and will only release each batch produced after the prescribed approvals have been met. Therefore, only use approved, standardised veterinary medicinal products in accordance with the package leaflet for the treatment of varroasis. VarroMed® containing organic acids is safe for your colonies, for you, for the honey and for the environment. VarroMed® is a standardized oxalic acid solution and is ready to use without the need for mixing, dilution, or additional application tools. All you need is a bottle warmed to body temperature so you don't chill the bees (especially in winter), and your own hand, which, according to the scale on the bottle, simply applies VarroMed® in the amount needed by dripping it on the bees in the aisles.

If you would like advice on applying VarroMed®, please contact: info@varromed.cz