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Carvacrol: An Excellent Natural Pest Control Agent

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Abstract

Carvacrol is found especially in many angiospermic plants, also conjointly produced naturally by from *Origanum vulgare*, thyme, oil obtained from pepperwort, wild bergamot and essential oils isolated from some plants. It is having scientific value in the ayurveda, chinese medicine, western herbalism and modern sciences due to its biological and pharmacological activities. Besides, it plays a vital role in pest control. Present report emphasizes on carvacrol to exploit its pest management efficacy and potency.

Keywords: Essential oil; Phenolic monoterpenes; Larvicidal; Ovicidal

Introduction

Environmental issues are circumscribing the employment of traditional pesticides. Growing resistance of pests to present pesticides has given urgency to the look for better, safer compounds and safer delivery systems. the necessity to treat a lot of exactly has conjointly provided additional opportunities for the utilization of natural products [1]. Being tropical country India has a wealth of plants, that continues to be underutilized, apart from neem which is getting used from ancient time for inset management [2]. The rapid growth of information of natural products, with biological activities towards pests currently provides a choice for treatment and a basis for biorational approaches to the planning of pest management agents [3]. Significantly over the past twenty-five years, there has been abundant activity directed to chemical work on isolation and identification of a large array of biologically active natural products that in same means affects the behavior, development and replica of pests and the growth of weeds [4,5]. Natural pheromones, antifeedants, insects and plant growth regulators have found commercial application, equally artificial analogs supported the natural products and have caught wider market [6].

Carvacrol is a chemical compound found in numerous angiospermic plants and herbs [7]. Carvacrol is a natural phenol, containing ten carbon unit having IUPAC name 5-isopropyl-2-methylphenol and molecular formula $C_{10}H_{14}O$ [8]. This molecule isomeric with thymol, is produced by *Thymus, Thymbra, Coridothymus, Satureja, oreganum* and *Lippia pepperwort, Origanum vulgare* and Wild bergamot [9]. Carvacrol is what provides oregano a slightly spicy flavor, is colorless, and includes a distinct heat odor. Carvacrol exhibits wonderful anti-microbial properties and makes it helpful within the production of cosmetics, food preservatives and for treating diseases [10]. The focus of this case report is to highlight the extensive effects of carvacrol on the various agricultural pest.

The effective functional group in carvacrol

The biological activities of carvacrol are believed to be related to the functional group. It is suggested that the activities of carvacrol dependent upon the position of the hydroxy functional group and molecular configuration instead of volatility and molecular size [11,12]. The most promising potential for exploitation of this molecule as pest management chemical lies in the synthesis of derivatives and analogs through simple synthetic procedures and through the establishment of structure-activity relationships. Throughout preliminary studies it had been discovered that with the knowledge of the essential functional group, a molecule with high activity and specificity can be designed [13,14]. Thus, systematic derivatization of carvacrol could prove it as both source and a model for new commercial pest management agents having a natural base in forthcoming time.

Mode of action of carvacrol in pest

Mode of action of carvacrol for various effects have not been determined but reports provide some clues for its possible specific mechanisms [15]. Carvacrol exhibits several types of biological activities in pests [16]. Carvacrol induce an immediate neurotoxicity and it is reported that hydrophobicity of compounds influences the penetration through the cuticle and piperonyl butoxide synergized the toxic effects [17]. Carvacrol also inhibits acetylcholinesterase. The acetylcholinesterase inhibitory effect of carvacrol was found to be ten time stronger than that exerted by its structural isomer thymol [18]. They act at the picrotoxinin site of the GABA (γ-aminobutyric acid) receptor-ionophore complex and as an antagonist of GABA, thus, inhibiting the chloride uptake into the neuron through the chloride channel. Substituted carvacrol have been seen to elicit lindane like GABA antagonistic effects. Carvacrol affects the sensory receptor of the insect in repellent activity [19].

No any harmful effect

There are no any known noxious effects of carvacrol, and it's been consumed by humans for many years suggesting that there's no toxic result [20]. Studies have conjointly shown that carvacrol is metabolized

and excreted within twenty-four hours of consumption, which shows that there is little risk of its increase within the body to any potential harmful level [21].

Carvacrol in pest management

Natural phenols are having pest management strength against many agricultural as well as public health pests [22]. Carvacrol as insect-control agents is reported by Tsao et al. where carvacrol and their analogs have shown comparatively wide-ranging bioactivity against agricultural and public health insect pests [23]. Carvacrol has been reported to have expressively enhanced larvicidal [24], ovicidal [25], acute and fumigant [26] activities against insects [27]. Carvacrol ethers showed better insecticidal action. Some of them displayed insect growth and development activity against mosquito larvae [28]. Carvacryl ethers and esters have been synthesized and evaluated as antibacterial agents [29]. Our research group is working on simple modification of carvacrol towards bioactive derivatives from 15 years [30,31]. A part of research work on carvacrol is on ether and ester derivatives and comprises of evaluation of antifungal, antibacterial activities on plant pathogenic microorganisms as well as insecticidal activities against stored grain pests [32]. Carvacryl esters were found to be most active against plant pathogenic bacteria. Carvacryl acetate and carvacryl allyl ether exhibited similar antibacterial activity in comparison with standard streptomycin against *A. radiobacter* and *P. solanacearum* [27].

Future prospects

Integrated Pest Management (IPM) is changing the scenario of today's pest management. Plant products are rising as a viable part of IPM. The growing awareness of pesticide safety and government regulative policies are increasing the opportunities for nontoxic or moderately virulent, safer, effective and environmentally friendly pest management agents. The future pest management programme for sustainable agriculture and public health emphasizes on botanicals, isolated potent plant products and their derivatives in addition to safer chemicals and biopesticides. Therefore, now a day's natural products are rapidly gaining importance. Expansive analysis activities are occurring for derivatization of natural products isolated from essential oils of higher plants and one amongst them is carvacrol having promising pest management effectuality. Carvacrol may be structurally modified to convert it into the potent and eco-friendly pesticides for future pest management. Thus, derivatization of carvacrol, rendering them comparatively stable and more target specific molecules, may be a viable strategy towards a more biorational approach to pest management.

Conclusion

Carvacrol is a simple phytochemical component, showing potent biological activities. The potent pesticidal activities of carvacrol and its derivatives have, attracted a lot of attention recently. Studies have shown the efficacy of carvacrol against a number of different pests of different origin. These findings indicated a possible use of carvacrol as effective tool against a wide variety of agricultural pests. The promising numbers of the satisfying potential of carvacrol is encouraging and further investigations are needed to fully realize the potential of these derivatives in agricultural research.

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