

AN OVERVIEW OF APPLICATIONS OF HETEROCYCLIC COMPOUNDS IN AGRICULTURAL FIELD

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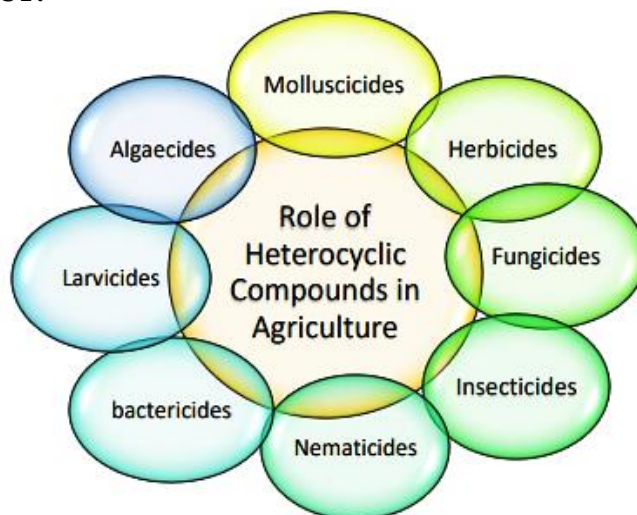
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ABSTRACT:

Heterocyclic compounds display distinct applications in the agricultural field due to their diverse chemical properties. Heterocyclic compounds are popular in agricultural chemistry and play a key role in the agrochemical industry. This article will focus solely on the application of synthetic compounds in an agricultural field. A variety of pesticides have been developed as insecticides, fungicides, plant growth regulators, nematocides, rodenticides, Larvicides, bactericides and herbicides. The article's main goal is to provide information about heterocyclic compounds, which make up the largest class of agrochemical compounds. These are essential, having a broad range of industrial, agricultural, and synthetic uses.

KEYWORDS: Agricultural field, heterocyclic compounds, pesticides, insecticides, herbicides

GRAPHICAL ABSTRACT:



INTRODUCTION:

Cyclic rings of atoms bearing at least one heteroatom have been identified as heterocyclic compounds. The most often seen heteroatoms are sulfur, nitrogen, and oxygen; however, heterocyclic rings containing other heteroatoms, such as iron, magnesium, selenium, phosphorus, and so on, are also frequently found [1-3]. Heterocyclic compounds are inextricably linked to all kinds of life and vast synthetic investigation and functional value of heterocyclic compounds have led to a significant increase in research interest in these molecules. They bridge the gap between biology and chemistry, the fields that yield so much scientific discovery and application. Due to their many important biological and medicinal applications, heterocyclic compounds have attracted a lot of research as well as mostly used in veterinary products, agrochemicals, and pharmaceuticals. In the agricultural field, heterocyclic compounds play an important role as agrochemicals. The agrochemical and chemical industries are frequently linked together due to heterocyclic compounds having enormous latent. In the past two decades, around 70% of all agrochemicals that are brought to the market have more than one heterocyclic loop [4-6]. The primary interest of agrochemical companies in heterocycles is typically related to their regular measures. Excellent biological activity is exhibited by many unsubstituted or infrequently substituted heterocycles; consequently, the substance that acts as a pharmacophore needs to incorporate its heterocyclic core [7-10]. In this review focus on the use of heterocyclic compounds in agricultural field and many researcher have been developed pesticides which act as insecticides, herbicides fungicides, rodenticides, plant growth regulators (PGRs), larvicides, molluscides and algaecides.

2. Applications of Heterocyclic Compounds in Agricultural Field:

Most of Heterocyclic compounds in agricultural field work as agrochemical and few of these are listed as follow

2.1. Insecticides:

Insecticides attack the nervous system of insects to restrict their inhibition or breeding. Organophosphate, Carbamates, Nicotinoids, Fumigants, and Biorational are a few insecticides. Abdel-Raheem, Shaban AA, et al reported that four pyridine-containing distyryl neonicotinoid analogs were promising insecticides against cowpea aphid, *Aphis craccivora* koch [11]. Ramadan, Sayed K., et al. reported that a new series of N-heterocycles including pyridazinone, oxadiazole, triazolopyridazinone, and triazole derivatives were synthesized from the acid hydrazide has potency against lab and field strains of *C. pipiens* larvae [12]. El-Ossaily, Y. A., et al. testified insecticidal activity of some heterocyclic compounds containing styrylpyridine moiety [13]. In 2024 Gad, Mohamed A., et al. investigated as the trifluoromethylpyridine Scaffold as insecticides toward *Aphis gossypii* Insects [14]. El-Gaby, M. S. A., et al. examined insecticidal activity of some new heterocyclic compounds containing pyrazole moiety against *Spodoptera frugiperda* [15]. Ismail, Mahmoud F., et al. tested insecticidal activity against cotton leaf worm of new heterocyclics which scaffold on hydrazide-hydrazone derivative [17]. El-Saghier, Ahmed M., et al. synthesized 1, 3, 4-(thiadiazine/thiadiazole)-benzenesulfonamide derivatives as IGR analogues against *Spodoptera littoralis* [18].

2.2. Herbicides:

Herbicides prevent the growth of weeds that can leach the nutrients required by the crops for growing. Furthermore, 2,4-D, Clethodim, Glyphosate, Bentazon, and Clethodim herbicides. Recently Huang, Yuqian, et al. reported that 2-(2-Oxo-3-pyridyl-benzothiazol-6-yloxy) hexanoic acids exhibiting remarkably potent herbicidal activity [18]. Liu, Na, et al. designed N-(5-(3, 5-methoxyphenyl)-(thiazole-2-yl)) phenoxyacetamide Derivatives [19]. Zhang, Meng, et al. synthesized pyrrolidinone-Containing 2-phenylpyridine derivatives as novel protoporphyrinogen oxidase inhibitors [20]. Liu, Qing, et al. assessed Novel herbicidal as 6-Indazolyl-2-picolinic Acids [21]. Na, L. I. U., et al. tested activity of novel N-(5-(3, 5-dinitrophenyl) thiazol-2-yl)-2-phenoxyacetamide compounds [22].

2.3. Fungicides:

Fungicides help prevent and remove fungi's growth. Also, they can easily decay in the soil in the presence of air. Maneb, nabam, and cycloheximide are fungicides. Saeedian Moghadam, Ebrahim, et al. studied Diazole and Diazine Based Fungicides [23]. Mukhriddin, Khudoynazarov, et al. reported indole acetic acid derivatives with fungicide-based heterocyclic compounds [24]. Wang, Sheng, et al. reviewed research progress of oxazole derivatives as fungicides in agriculture [25]. Liu, Xing, et al. outlook research and application of benzopyran derivatives in the discovery of agricultural chemicals [26]. Wei, Junjie, et al. reported arylfluorosulfates as Novel Fungicidal Agents against Plant Pathogens [27]. Jiang, Yu, et al. investigated novel quinoxalinone-1, 2, 3-triazole derivatives as potential antifungal agents for plant anthrax disease [28].

2.4. Larvicides:

Larvicides are pesticides that control or restrict larvae or mosquito growth or restart their breeding to prevent vector-borne diseases like malaria. Ismail, Mahmoud F., et al. reported larvicidal efficacy against *C. pipiens* of some new heterocyclic compounds emanated from 2-cyano-N'-(2-(2, 4-dichlorophenoxy) acetyl) acetohydrazide [29]. El-Sayed, Mahmoud KF, et al. reported larvicidal efficacy of annulated Benzo [h] chromenes against *Culex pipiens* L. Larvae [30]. El-Helw, Eman AE, et al. investigated larvicidal activity benzo [h] quinoline derivatives against *Culex pipiens* L. Larvae [31]. Alkherb, Wafa AH, et al. revealed larvicidal efficacy of pyrazolopyrimidine derivatives conjugated with selenium nanoparticles against *Culex pipiens* L. and *Musca domestica* L. larvae [32].

2.5. Bactericides:

Pesticides kill or restrict the spreading of harmful bacteria throughout crops and livestock. An, Lian, et al. reported antimicrobial evaluation of new quinazoline derivatives containing both a piperazine linker and the N-acetyl moiety [33]. Teng, Kunpeng, et al. investigated chiral pyranone fused indole derivatives with antibacterial activities against *Xanthomonas oryzae* pv *oryzae* for protection of rice [34]. Dai, Peng, et al. informed Novel 5-Sulfonyl-1, 3, 4-thiadiazole-Substituted Flavonoids as Potential Bactericides and Fungicides [35]. Guan, Mingming, et al. synthesized and investigate aryl amide derivatives containing thiazole as type iii secretion system inhibitors against *Pseudomonas aeruginosa* [36]. Zhang, Awei, et al. reported 5-

(Thioether)-N-phenyl/benzyl-1, 3, 4-oxadiazole-2-carboxamide/amine Derivatives as an antibacterial agent [37].

CONCLUSION:

The purpose of this review was to gather the research work reported by researcher on heterocyclic compounds for their various agrochemical activities. In the search for agrochemicals with their high efficiency and lower toxic effect on human being and exhibited considerable biological activity and could be the trend in future agrochemical research and development. This research concludes that the several heterocyclic analogue is an active versatile moiety that has been explored in recent years and will continue to be developed and synthesized in the future.

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DECLARATION:

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