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Cleistanthus collinus (Karada): a traditional biopesticide used by rural and tribal farmers of Odisha, India

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Abstract

*Biopesticides are types of chemicals extracted from natural materials such as plants, animals, bacteria, or certain minerals, and these chemicals can be used for controlling pests. It includes naturally occurring substances that control pests (biochemical pesticides), microorganisms that control pests (microbial pesticides), and pesticidal substances produced by plants. Biopesticides generally affect only the target pest and closely related organisms. Among the plants used as biopesticide, *Cleistanthus collinus* (Karada), a small deciduous tree, is used by the local and tribal communities of Odisha state as an effective biopesticide in their agricultural fields with little or no harmful effects. The present observation highlights the importance of local biopesticides for sustainable development and in reducing the negative impacts of chemical fertilizers.*

INTRODUCTION

From time immemorial, agriculture has been facing numerous destructive pests like fungi, weeds, and insects, leading to radical decrease in yields and in that scenario chemical

pesticides play an important role in resolving these problems in a great extent but over dependence on chemical pesticides few environmental issues have aroused the concern of the public especially in relation to the health (Sharma and Malik 2012; Bharti and Ibrahim 2020). The application of chemical pesticides on plants includes several negative effects on human health, such as acute toxicity, development of Parkinson diseases, some environmental challenges, such as decreased soil diversity and pollution, toxicity to non-target species. Most chemical pesticides are non-biodegradable and get accumulated in the environment and cause pollution to soil, water bodies, as well as depletion of the ozonosphere (Wimalawansa and Wimalawansa 2014). The undesirable effects of the misapplication of synthetic pesticides have inevitably led to alternative pest management controls. Currently, global attention gears towards the utilization of organic plant protection products or biopesticides (Essiedu et al. 2020). Biopesticides are the biological agents such as plants, animals, bacteria or certain minerals and these chemicals can be used for controlling pests used to control the population of injurious organisms to the ecosystem (Rajamani and Negi 2021). As biopesticides are eco-friendly, efficacy and sustainable, it attracts special interest and one of the promising alternatives, able to manage environmental pollution like they make their degradation fast, prevent accumulation in the environment and eliminate the formation of pollution in water and soils. The contact of biopesticides to air, moisture, high temperatures, and the sunlight adequately degrades their constituent (Mahmood et al. 2016). Some plant species used traditionally as a biopesticides are *Azadirachta indica*, *Euphorbia hirta*, *Curcuma longa*, *Cinnamomum verum*, *Jatropha curcas*, *Pongamia pinnata*, *Vitex negundo*, *Melia azedarach*, *Zingiber officinale*, *Cleistanthus collinus* etc. (Bhat et al. 2021). Among them, *Cleistanthus collinus* (Plate 1) is commonly used as a biopesticide by different rural and tribal communities in Odisha state. It is locally known as Karada and used in agricultural fields to protect the crop from various infectious pests. *Cleistanthus collinus* is a small deciduous tree belonging to the family Euphorbiaceae. is a small tree with elliptical leaves and silky villous inflorescence. It is commonly found in deciduous dry hilly forests. It is known by various names in different languages in India like Garari (Hindi), Karada (Odia), Vadisaaku (Telugu), Oduvanthalai (Tamil), and Odaku (Malayalam). Many parts of the plant are reported as toxic and the aqueous extract of crushed leaves is used as cattle and fish poisons, abortifacient, suicidal and homicidal agents (Chichaghare et al. 2019). The alcoholic extract of the leaves, roots, and fruits of *C. collinus* are used to treat gastrointestinal disorders and it possesses anticancer activity (Chichaghare et al. 2019). The active principles of the plant *C. collinus* were isolated and reported by various groups worldwide. The major phytochemicals

responsible for poisoning belong to the category of glycosides, tannins, saponins, lignans and lactones of which the prominent active constituents are cleistanthins, oduvin and diphyllin. In severe cases of poisoning in humans, the toxicity causes hypokalemia, hypotension, cardiac arrhythmias, mixed metabolic and respiratory acidosis, and renal failure (Kazi and Gude 2022). Keeping the negative impacts of chemical pesticide, authors highlighted the use of biopesticide in agricultural works.



Plate 1: Vegetative parts of *Cleistanthus collinus*

METHODOLOGY

A random survey was carried out in August 2023 in Mayurbhanj and Sundargarh districts of Odisha state, India. The authors visited different villages to document the diverse traditional biopesticides used by the local and tribal farmers in their agricultural fields. The authors have discussed with many tribes like Bathudi, Bhuiyan, Santhal, etc. and visited agricultural fields to observe crop health (Kumar et al. 2021).



Plate 2: *Cleistanthes collinus* in agricultural fields of study areas

OBSERVATIONS

During the survey for the present study and other biodiversity-related works in the study areas, the authors found some plants used as biopesticides. In many tribal villages in Mayurbhanj and Sundargarh, the stem of *Cleistanthus collinus* is used as a biopesticide in paddy cultivation. They also used other plants in their vegetable gardens and agricultural fields, like *Pongamia pinnata*, *Azadirachta indica*, *Vitex negundo*, etc. The farmers of the study areas used to place a twig of *Cleistanthus collinus*, *Azadirachta indica*, or *Pongamia pinnata* in their agricultural fields. According to them, these plants work as a biopesticide to control pests, resulting in a good crop yield. The concept behind this is that the bitterness of these plants' dissolves in the water and soil of the agriculture field, which helps in controlling unwanted pests. *Cleistanthus collinus* has a lower toxicity than chemical pesticides but is also effective against many pests, thus promoting organic farming (Plate 2). *Cleistanthus collinus* might have diverse bioactive compounds that are responsible for its toxicity. Further research is needed to add value for sustainable development.

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