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Content

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THE IMPACT OF CARBON SINKS AND EMISSIONS FROM VARIOUS SECTORS ON CLIMATE: A REVIEW OF HIGH HUMAN DEVELOPMENT INDEX (HDI) NATIONS

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Abstract: A major worldwide problem is carbon dioxide (CO_2) emissions from fossil fuel combustion and land use changes, as well as climate change. Emphasizing the necessity of marine strata and terrestrial ecosystems in absorbing too much CO_2 and reducing the impacts of climate change, this work investigates the fundamental processes governing the worldwide carbon cycle. Although natural carbon sinks consume a sizable share of emissions, continuous fossil fuel usage and deforestation threaten to increase atmospheric CO_2 levels to never-before-seen extremes, hence with rather severe climatic consequences. Moreover, the complex interaction of policy measures, technological innovation, and economic growth is investigated by combining current research on greenhouse gas emissions across key sectors, including energy, manufacturing, transportation, and land use. Given their past emissions and present trajectories, countries with a high Human Development Index (HDI) draw special interest. Emphasizing the great need for coordinated, science-based policies, the study combines sectoral trends, emission drivers, and mitigating technologies, including carbon capture technologies and renewable energy adoption. Effective climate action, tackling both environmental and moral needs of global CO_2 reduction, is sought, hence balancing economic expansion with sustainability. Knowing the interactions of carbon between the atmosphere, terrestrial ecosystems (the living and dead organic matter on land), and the seas first helps one to understand the broader dynamics of the global carbon cycle and its effect on climate change. Particularly, their middle layers at depths of 100 to 1000 meters, the oceans act as significant reserves that soak up heat and extra atmospheric carbon dioxide (CO_2), thereby helping to somewhat stop global warming.

Keywords: Carbon dioxide, Climate, Greenhouse gas emissions

Journal of Plant Development Sciences Vol. 17(9)

AGROCHEMICAL STRESSORS ON CROP REPRODUCTIVE HEALTH: PESTICIDE AND HEAVY METAL IMPACTS AND SUSTAINABLE MANAGEMENT PATHWAYS

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Abstract: The widespread use of pesticides in agriculture has raised concerns about their unintended effects on crop reproductive success and long-term sustainability. Reproductive organs, particularly pollen grains, are highly sensitive to pesticide-induced stress, yet limited studies have examined this issue in mustard (*Brassica juncea*), a major oilseed crop in India. Excessive pesticide uses and associated heavy metal contamination act as major agrochemical stressors in crop systems. These inputs trigger primary stress pathways, including reactive oxygen species (ROS) overproduction, nutrient disruption, enzyme dysfunction, and hormonal imbalance. Such disturbances impair reproductive processes, leading to reduced pollen viability, inhibited germination, structural abnormalities in pollen, flower damage, and lower seed set. The cumulative outcomes manifest as yield reduction, decline in crop quality, accumulation of toxic residues in the food chain, and risks to biodiversity. To mitigate these impacts, a combination of Integrated Pest Management (IPM), cultural practices, physical and mechanical controls, biological agents, biopesticides, and plant growth regulators (PGRs) offers a sustainable pathway to protect crop reproduction and maintain agricultural productivity under agrochemical stress. Given the heavy reliance on pesticides in mustard cultivation, such reproductive impairments pose risks not only to crop yield and quality but also indirectly to pollinator-derived byproducts such as honey. This review, together with our preliminary experimental findings on pollen abnormalities in *B. juncea*, highlights the urgent need for further investigations into combined pesticide effects, soil parameters, and molecular responses, as well as the adoption of integrated management strategies and stress-mitigation approaches for sustainable agriculture.

Keywords: Pesticide stress, Pollen viability, Reproductive traits, Oxidative stress, Integrated pest management

Journal of Plant Development Sciences Vol. 17(9)

EXPLORING ANTIBACTERIAL POTENTIAL OF *ACORUS CALAMUS* RHIZOME AND SHOOT EXTRACT

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Abstract: The present study was carried out to evaluate the *in vitro* antibacterial potential of rhizome and shoot part of *Acorus calamus via* five different extracts namely *n*-hexane, chloroform, ethyl acetate, acetone and methanol. The agar-well diffusion method was used against two-gram positive (*Bacillus cereus* MTCC5981, *Staphylococcus aureus* MTCC96) and three-gram negative (*Escherischia coli* MTCC1697, *Klebsiella pneumoniae* MTCC109, *Pseudomonas aeruginosa* MTCC741) bacterial strains and the findings from broth dilution assay for different plant extracts demonstrated antibacterial properties on the tested strains of bacteria at various degrees, as displayed by their minimum inhibitory concentration (MIC) values. The MIC values for rhizome part of *A. calamus* were in range of 410-835 µg/ml for all the tested bacterial strains, but the significant value was displayed by methanolic extract. For *A. calamus* shoot part, MIC values against the five tested bacterial strains ranged from 415-880 µg/ml, but the acetone extract was found to be the most effective against all bacterial strains as it exhibited the lowest MIC values. The results of present study revealed that rhizome and shoot part of *Acorus calamus* possess antibacterial potential and source of new antibiotics. Therefore, medicinal plants are finding their way into pharmaceuticals, nutraceuticals and food supplements that could be useful in chemotherapy to control infectious diseases.

Keywords: *Acorus calamus*, Antibiotics, Bacterial strains, Minimum inhibitory concentration

Journal of Plant Development Sciences Vol. 17(9)

EFFECT OF MICRONUTRIENT FORMULATION ON GROWTH, YIELD AND ECONOMICS OF CAULIFLOWER (*BRASSICA OLERACEA* VAR. BOTRYTIS L.)

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Abstract: The present study was conducted to assessment of vegetable micronutrient formulation (Vegetable Special) in cauliflower. Trial was conducted during the Rabi season 2023-24 on 10 fields of nearly in the same cropping season and parity selected from village-22 NTR, Block- Nohar, District- Hanumangarh, Rajasthan. The trial performed under two groups' viz. T_1: farmers practice (No use of Vegetable Special) and T_2: 3 sprays of Vegetable Special (5 gram per liter water at 25, 50 & 75 Days After Transplanting). Data indicated that foliar application of Vegetable Special recorded significantly maximum plant height at 30 and 60 DAT (14.97 and 29.86 cm), number of leaves at 30 and 60 DAT (10.48 and 15.93), stalk length (22.63 cm), curd diameter (11.8 cm), curd weight (607.1 g) and 17.37 per cent higher yield (163.5 q/ha) over the farmers practice treatment (139.3 q/ha). Net return and B: C ratio (Rs 228800 & 3.32), respectively under T_2 treatment were also maximum followed by T_1 treatment (Rs 182900 & 2.91), respectively.

Keywords: Cauliflower, Micronutrients formulation, Foliar spray, Economics, Yield

Journal of Plant Development Sciences Vol. 17(9)

RUELLIA PSEUDOPATULA: AN ADDITION TO MADHYA PRADESH FLORA FROM KUNO NATIONAL PARK

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Abstract: In the present paper, the occurrence of *Ruellia pseudopatula* Ensermu in Madhya Pradesh, is being reported first time for the flora of Madhya Pradesh. A brief description with updated nomenclature, locality, and photographs have been provided.

Keywords: Acanthaceae**,** Addition, Flora, Kuno, Madhya Pradesh