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EMERGING TRENDS IN CHEMISTRY, ZOOLOGY AND PROMINENT FEATURES OF MUNG BEANS

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Abstract

One of the most significant areas is organic synthesis, which refers to the art and science of creating complex organic molecules from simpler ones. Benzodiazepines are a significant category of biologically active compounds, and the synthesis of these compounds has garnered a lot of attention in the field of medicinal and pharmaceutical chemistry. There is a limited quantity of information that is particular to species that is accessible for the bulk of the non-domesticated fish species that are presented in the majority of aquariums and zoological settings. For the vast majority of fish species that are maintained in captivity, the particular dietary needs remain unknown. Although there are commercially available formulated meals for aquaculture species like as carp, salmonids, and catfish, these feeds are often not suitable for the wide variety of fish species that are kept in public aquariums. Mung beans are among the most significant legumes that grow throughout the summer months and have a brief growth season. Mung beans have a broad range of uses all over the world, including in the fields of agriculture, health food, pharmaceuticals, and cosmetics. In addition to its anti-inflammatory and anti-microbial properties, mung beans have been demonstrated to contain antioxidant properties. In addition, mung beans have a number of beneficial benefits, including those that are anticancer, antihypertensive, antitumor, and lipid metabolism accommodation.

INTRODUCTION

An additional challenge in traditional chemistry disciplines face when considering chemistry research from the perspective of green chemistry is the requirement to draw from a variety of scientific and engineering disciplines. This is necessary not only to comprehend the chemical and physical phenomena that lie beneath the surface, but also to gain a deeper comprehension of the reasons why the approaches that are currently being utilized in chemistry need to be altered [1,2]. This is similar to the situation in non-traditional chemistry domains such as biochemistry and nanochemistry. With regard to metals such as

zinc, cadmium, cobalt, nickel, and so on, as well as the transition metals that are centred around platinum on the periodic table and are used in organometallic catalysts, the environmental and the occupational toxicologists provide assistance to chemists in gaining an understanding of the dangers and risks that are associated with human and environmental health. It is interesting to note that the greenness of the organometallic catalyst synthesis itself is rarely considered in the majority of talks on catalysis. This is because the production of large or complex ligands, which often include the use of hazardous chemicals, and the use of laborious, inefficient, multi-step syntheses is prevalent. It is also possible that the catalytic reaction necessitates the use of activating reagents such as triphenylphosphine, organoboranes, or other similar reagents that are not only inefficient in terms of mass but also dangerous. To add insult to injury, the majority of these catalysts are only effective when they are in their homogenous state; when they attach to an inert substrate, they become either less active or inactive [2,3].

The care and maintenance of fish has been the subject of a great number of that have been produced over the course of the last twenty years [4,5]. Though most of these pertain specifically to selected laboratory species such as zebrafish (*Danio rerio*), Japanese medaka (*Oryzias latipes*), fathead minnows (*Pimephales promelas*), guppies (*Poecilia reticulata*), and goldfish (*Carassius auratus*), they do provide an excellent basis for general care and maintenance of common fish species. There are also a number of excellent guides on the care and breeding of selected freshwater tropical fish species and some marine species. These guides can be helpful when setting up aquatic exhibits. Some examples of these fish species include discus, bettas, guppies, freshwater angelfish, platies and swordtails, cichlids, corydoras catfish, and clownfish. In addition, there are numerous guidelines for the general care and maintenance of common food fish species, such as common carp (*Cyprinus carpio*), striped bass (*Morone saxatilis*), and pangasius catfish (*Pangasianodon hypophthalmus*) that can be consulted. Regrettably, there is a limited quantity of information that is particular to species that is accessible for the bulk of the non-domesticated fish species that are presented in the majority of aquariums. Therefore, it is on the natural history, behavior, social connections, water quality, and nutritional needs of the fish quality [4,5].

The mung bean, also known as *Vigna radiata* L., is a significant pulse that is eaten all over the globe, particularly in Asian nations. It has a long history of use as a traditional medicine. Due to the fact that it is recognized to be a wonderful source of protein, dietary fiber, minerals, vitamins, and considerable quantities of bioactive components, such as polyphenols, polysaccharides, and peptides, it has become a popular functional food in the process of supporting proper health [6]. Not only has the mung bean been shown to alleviate hyperglycemia, hyperlipemia, and hypertension, but it has also been shown to prevent cancer and melanogenesis, in addition to possessing hepatoprotective and immunomodulatory properties. These positive effects on health are mostly attributable to the high concentration of several active chemicals that are found in mung bean, as well as their qualities. Vitexin and isovitexin have been identified as the primary polyphenols, and peptides that include hydrophobic amino acid residues and have a low molecular weight have been shown to have greater levels of bioactivity in the mung bean. It is blueprint to better employ the mung bean in food items to enhance human nutrition and further inspire development [6]. This is in light of the current spike in interest in the use of grain legumes, which has been seen in recent times.



Fig-1: Shows the potential aspects of the mung bean

Advancements in Organic Chemistry

There are a number of oxidation reagents and catalysts that are made up of nephrotoxic chemicals, such as significant metals. As a result of the fact that these compounds were often used in very large quantities, which were required to convert a great number of pounds of petrochemicals, there was a significant legacy of those metals being released into the environment, which had a significant detrimental effect on both human health and the environment. It is possible to alter it by the usage of chemicals that are not harmful [7,8].

For dry cleaning textiles, the solvent that is used the most often is percholoroethylene. It is believed that perchloroethylene is carcinogenic, and the dumping of this substance pollutes ground water at the same time. This technology allows liquid carbon dioxide to be utilized as a safer solvent in conjunction with a surfactant in order to dry clean clothing. This technique is now being used in the business sector by a few dry cleaners. In order to make use of this technology, dry cleaning machines have been modified so that the carcinogen PERC may be substituted with a green solvent [8,9]. According to conventional methods, the removal of lignin from the wood that is used for the production of high-quality white paper is accomplished by inserting tiny pieces of wood into a solution consisting of sodium hydroxide and sodium sulfide and then observing the interaction of the solution with chlorine. In addition, chlorine has a reaction with the aromatic rings of the lignin throughout the process, which results in the formation of chlorinated dioxins and chlorinated furans. As carcinogens, these chemicals are responsible for a variety of health issues. This agent incorporates the use of hydrogen peroxide (H_2O_2) as a bleaching agent in the presence of certain activators, such as TAML, which catalyze the rapid conversion of hydrogen peroxide into hydroxyl radicals, which are responsible for bleaching. It is possible to use this bleaching agent in laundry, and it results in a reduction in the amount of water that is consumed [9,10]. It breaks down lignin in a shorter amount of time and at a much lower temperature.

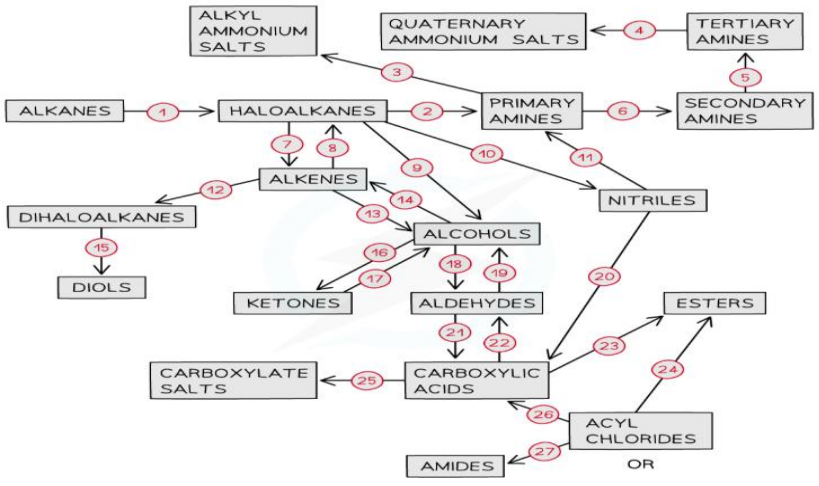

Fig-2: Shows the variety of various compounds and its related synthesis approach

One of the most significant areas of study in the discipline of organic chemistry is organic synthesis, which refers to the art and science of creating complex organic molecules from simpler ones [2,11]. This area has also had an effect on other scientific disciplines, which has led to the development of allied subjects such as medical chemistry, biology, biotechnology, materials science, and nanotechnology. These fields are dependent on developments in organic synthesis in order to get examples of molecules that are appropriate for their research. Therefore, many advancements in fields that are connected to organic synthesis would not be conceivable if innovations in organic synthesis were not made. The science community is doing research on a variety of themes, including the creation of new synthetic tools and the application of those techniques to the manufacture of different molecules. The number of synthetic tools that are available to organic chemists all over the world has increased as a result of the development of a wide range of synthetic protocols. These protocols include "classic" reactions, reactions based on organometallics, reactions based on free radicals, organocatalytic methodologies, photoredox and photocatalysis, and many others. These approaches have made it possible for labs and companies to produce a large number of compounds, including bioactive natural products, nutritious commodities, high-tech materials, electronic gadgets, polymers, and other chemicals that are present in our lives and help us live them more comfortably. The importance of organic synthesis and the advancements it has made is increased as a result of these exciting aims [11]. Organic chemistry has a number of important applications, one of the most important of which is the synthesis of bioactive molecules using concise and effective techniques. This represents a significant objective in this area [2], and a significant amount of work has been put out in order to generate multifaceted architectures and highly bioactive pharmaceuticals. They have good photophysical characteristics and uses [3], particularly in the area of photodynamic treatment, where they are used as photosensitizers. It unique method for the synthesis of numerous rosamine compounds from pyridylbenzaldehyde derivatives by using an efficient microwave-assisted technique. The photophysical characteristics of the pyridyl-rosamines that were synthesized were investigated, with the primary focus being on the use of fluorescence emission spectra and UV-Vis absorption spectra. Furthermore, in order to establish the potential of these compounds as photosensitizers, the lethal effects of these compounds on the A431 human epidermoid carcinoma cell line. It is determined that these compounds had the potential to exhibit light-induced toxicity over the submicromolar or low nanomolar range. In particular, the authors placed an emphasis on the activities of compound. Combined fluorescence diagnostics and photodynamic treatment (PDT) are two applications that might benefit from these compounds, according to these findings, which suggest that they are attractive phototheranostic candidates [11,12].

Benzodiazepines are a significant category of biologically active compounds, and the synthesis of these compounds has garnered a lot of attention in the field of medicinal and pharmaceutical chemistry. This is due to the fact that they are used as anticonvulsant, the anti-inflammatory, the analgesic, hypnotic, and sedative agents, in addition to their hypnotic activity [13,14]. In addition, the solid oxide catalyst that was used in the past has inadequate textural qualities, such as a low surface area and pore volume, which do not promote a higher performance in the synthesis of benzodiazepines. The presence of these variables encourages the search for a more effective catalyst, which ought to provide a high level of activity for the synthesis of 1,5-benzodiazepines in circumstances of moderate reaction. In recent years, mesoporous materials that have a variety of structures and pore sizes that can be adjusted have garnered a lot of interest [14,15].

Current advances in the discipline of Zoology

For the vast majority of fish species that are maintained in captivity, the particular dietary needs remain unknown. Although there are commercially available formulated meals for aquaculture species like as carp, salmonids, and catfish, these feeds are often not suitable for the wide variety of fish species that are kept in aquariums. In light of this, the general

approach is to offer a food that is both appetizing and satisfies the daily needs of the species in terms of both behavior and nutrition [16,17]. In this regard, it is necessary to conduct an investigation into the natural history of the species in order to ascertain if the fish is a carnivore, herbivore, or omnivore. This will allow the feed components to be adapted to the specific species. There are certain fish species that are not willing to simply take a pelleted, flake, or gel diet. In order to guarantee that they are consuming a suitable quantity of food before being mixed with other species, it is frequently necessary to acclimate them in isolation from population that has already been formed. There are some aquariums that feed more natural diets, such as whole dead fish or fillets (for example, mackerel, herring, capelin, and trout), shrimp, squid, molluscs, and other frozen or live organisms (for example, blood worms, krill, brine shrimp, and algae). However, it is important to ensure that these items are free of contaminants and pathogens. In the event that the fish species does not recognize or accept the diet that is being supplied, the food will typically degrade at the bottom of the tank, which will result in issues with the water quality. Alternatively, the food may be consumed by other species of fish in the tank, which may result in unwanted obesity. Both of these outcomes may lead to a negative welfare condition. Furthermore, there are kinds of fish that only consume food once a day or once a week, while there are other kinds of fish who are natural grazers and consume food wherever they go. In order to maintain a healthy habitat and fish population, it is vital to strike a balance between natural behavior, feeding, and the quality of the water [16,17].

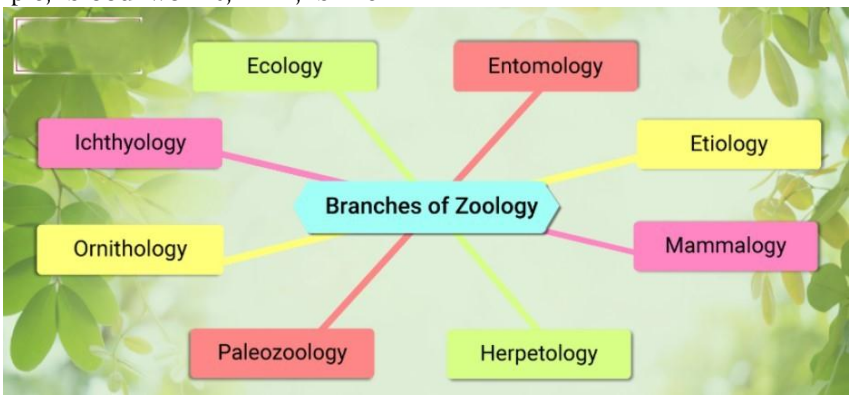

Fig-3: Shows the eminent features in the disciples of zoology and related disciplines

One of the most significant challenges to humankind's public health on a worldwide scale continues to be the prevalence of parasitic disorders brought on by helminth and protozoan infections. Despite the fact that natural immunity in humans is either uncommon or takes a long time to develop for many parasites, the immune response is able to recognize and react to infections via the use of a variety of immunological mechanisms. The few of the most important discoveries that have been made in the recent research on the immune response to helminth and protozoan diseases. Within the realm of immunoparasitology, one of the most pressing questions that has to be answered is how different immune responses might be tailored to either prevent or lessen the burden of illness [18,19]. There are a variety of protozoa (such as Plasmodium species, Toxoplasma species, Trypanosoma species, and Leishmania species) and helminth worm (such as nematodes, trematodes, and cestodes) species that are responsible for the development of parasitic disorders. The prevalence of these illnesses continues to be a significant health problem in tropical and subtropical climates all over the world. The geographic distribution of the insect vectors that transmit many of these infections, access to healthcare, and inadequate efforts and finances for eradication campaigns are all factors that contribute to this situation. There are many more variables that contribute to this as well. There are still millions of individuals who are infected, which may result in a chronic condition that is debilitating, deformity, and often death. There are medications that may be used to cure or prevent a wide variety of parasite illnesses;

however, these medications come at a high price. It will include and concentrate on a variety of topics, including the life-cycle, morphology, taxonomy, and morphology of the parasite, as well as the category of the host, and how the parasite affects and infects it, as well as the association between them. In general, parasitology is one of the branches of microbiology that investigates the specifics of a microorganism that is known as parasite. This suggests that parasites may live either on or inside of their host, from which they extract and get directly all of the things they need to continue alive, such as nutrients, which, over the course of time, inflict harm and destruction to the host [18,19].

These medications often have incapacitating adverse effects, are difficult to get or prohibitively expensive for the local population that is most likely to be affected by the disease, and the emergence of parasite resistance to effective therapies is further complicating the situation. The complexity of the parasite's lifecycle or multistage development, the multicellular composition of the parasite (for example, helminths), and the antigenic diversity of the parasite have all contributed to the lack of commercially viable vaccines for the prevention of parasitic disorders. In spite of these challenges, advancements have been achieved over the course of the last ten years in order to comprehend the one-of-a-kind and intricate interaction that exists between parasites and their hosts. The sequencing of genomes, the discovery of new therapeutic targets, and the development of vaccines against leishmaniasis and malaria have all made significant strides in recent years. Some of these advancements with a particular emphasis on Toll-like receptors (TLRs), innate lymphoid cells (ILCs), alternatively activated macrophages, chemokines, CD8+ T cells, T and B cell exhaustion, and memory T cells. These scientific achievements have furthered our knowledge of the host immune response to protozoan and helminth parasites [18,19,20].

Mung bean and its prominent features

One of the most significant edible legume crops is the mung bean, also known as *Vigna radiata* L. It is cultivated on more than 6 million hectares of land throughout the globe, which accounts for around 8.5% of the total pulse area, and it is eaten by the majority of families in Asia. It is widely cultivated in many Asian countries (concentrated primarily in China, India, Bangladesh, Pakistan, and some Southeast Asian countries) as well as in dry regions of southern Europe and warmer parts of Canada and the United States [6,7].

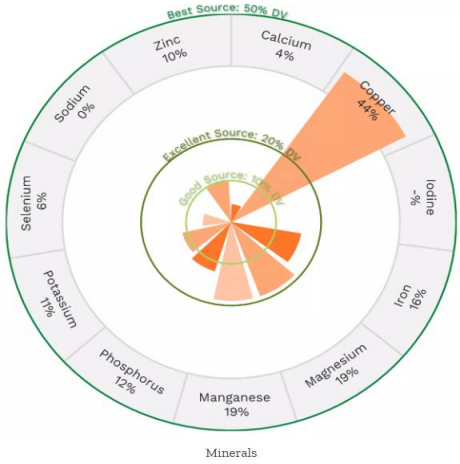

Fig-4: Shows the variety of different composition and agricultural perspectives of mung beans

This is due to the fact that the mung bean is relatively drought-tolerant, requires a low amount of inputs, and has a short growth cycle of approximately seventy days. Since the beginning of time, the mung bean has been a staple meal in the diets of China and India, which are mostly composed of cereals. A well-balanced assortment of nutrients, including as protein, dietary fiber, minerals, vitamins, and considerable quantities of bioactive substances, may be found in the mung bean [6,7]. Mung bean is a very inexpensive food that

provides an excellent supply of protein for vegetarians and those who are unable to buy animal proteins. Mung bean is also a good source of protein for people who are vegetarian. Furthermore, in comparison to the protein found in other legumes, the protein found in mung beans is very simple to digest. It has been suggested that people consume mung beans in conjunction with cereals in order to considerably improve the quality of their protein intake. This is due to the fact that cereals are abundant in amino acids that include sulfur, but they are lacking in lysine . It was indicated that mung bean protein and rice protein would be beneficial for ingestion. It would result in the highest chemical amino acid score with 72. The rice-mung bean combination diet was found to have a protein digestibility that was 84.4% of that reported for the rice-meat combination diet in newborns. This indicates that the rice-mung bean combination diet may nearly completely satisfy the requirements of the human body for protein. In addition, when compared to proteins derived from animals, proteins derived from plants have the potential to lessen the amount of land that is occupied and the emissions of greenhouse gases [21,22,23].

This presents an opportunity to strike a better balance between dietary practices and the preservation of the environment. Children are able to tolerate the mung bean well and have less flatulence as a result. Because of its high protein content and hypoallergic qualities, the mung bean has been suggested as a supplement for the preparation of weaning food for infants in a number of studies. In Pakistan, pulses are responsible for providing around 25 percent of the total iron that is taken in the diet, and the mung bean is consumed by every family. In spite of this, the presence of anti-nutritional substances in the mung bean may reduce the biological value of the nutrients that it contains. By way of illustration, phytic acid has the ability to form bonds with a number of significant divalent cations, including magnesium, calcium, zinc, and iron. Insoluble complexes that are produced as a consequence of this binding have the potential to restrict the mineral absorption and utilization that occurs in the small intestine. The anti-nutritional factor, on the other hand, may be mitigated or eradicated by the use of a variety of processing techniques, including fermentation, germination, dehulling, and cooking[22,23,24].

Properties and importance of Mung bean

Following the process of germination, the phytic acid levels in mung beans decreased by 76%, and the bioavailability values of zinc and iron improved to be 3.0 and 2.4 times greater than those of raw mung beans, respectively. It is for this reason that the antinutritional qualities of the mung bean do not prevent its use[25,26].

Flavonoids are the secondary metabolites that are found in the mung bean in the greatest abundance. Flavonoids were detected in the mung bean, and it was revealed to include five different subclasses of flavonoids: flavones, flavonols, isoflavonoids, flavanols, and anthocyanins. Under normal circumstances, they tend to accumulate in the tissues of the plant in the form of conjugates, either in the form of glycosylation or esterification; but, on occasion, they may also be found in the form of aglycones. Flavones, which include luteolin, vitexin, isovitexin, and isovitexin-6″-O-α-l-glucoside, as well as flavonols, which include quercetin, myricetin, and kaempferol, are the flavonoids that are found in the mung bean in much higher quantities. It was discovered that vitexin and isovitexin are the two most important flavonoids found in the mung bean seed. The portions of these flavonoids that were found in the seed coat provided 95.6% and 96.8% of the total amount of vitexin and isovitexin, respectively[26,27]. According to the findings of a quantitative study, the levels of vitexin and isovitexin found in the coat of the mung bean seed were as high as 37.43 mg/g and 47.18 mg/g, respectively. Furthermore, these two primary flavonoids were also extracted and identified from the broth made from mung beans, which is a traditional Chinese dish that is considered to be healthy. In addition, plasma pharmacokinetics, bioavailability, and tissue distribution of three flavones, namely Vitexin, Isovitexin, and Isovitexin-6″-O-α-l-glucoside, as well as one iso-flavonoid, dulcinoside, in rats. It was observed that vitexin (4.58 mg/kg), isovitexin (10.64 mg/kg), isovitexin-6″-O-α-l-glucoside (3.40 mg/kg), and dulcinoside (0.26 mg/kg) were able to be rapidly absorbed and distributed in the heart, spleen, liver, lung, intestine, stomach, kidney, and brain following oral administration of 2 g/kg of 95% ethanolic extract of mung bean seeds[28,29].

Furthermore, all of these substances reached their maximum concentration at approximately 1.5 hours.

Within four hours, the concentrations of the three flavones and one iso-flavonoid in each of the tissues that were examined dropped by a substantial amount, which is evidence that these compounds do not exhibit a pattern of accumulating over an extended period of time. There is a possibility that this is connected to a homeostatic link that exists between the antioxidant and oxidative state of the serum. Furthermore, significantly influenced by the analytical methodologies, and the antioxidant/oxidant balance may produce data that are more comprehensive and accurate. It is worth noting that the bio-availability of vitexin, isovitexin, isovitexin-6″-O-α-l-glucoside, and dulcinoside were found to be 5.82, 5.53, 1.37, and 17.07%, respectively. It was believed that the major differences in pharmacokinetic characteristics and bio-availabilities were attributed to the various kinds of glycosidic bonds (α or β) and glycosylation sites (C-8 or C-6) that were present in their structures. Interestingly, the four flavones were able to get through the barrier that separates the blood and the brain. One of the most significant types of flavonoid found in colored pulses is called anthocyanin. It came as a surprise to learn that this particular anthocyanin was only found in the black mung bean and not in the green mung bean[29,30].

Antioxidant activity has been shown in a variety of mung bean components, including seeds, sprouts, and even hulls. As a result of the presence of a high level of polyphenols, the methanolic extracts of mung bean demonstrate a high level of free radical scavenging and lowering power activity. In addition, acetone extracts from sprouts have more action than extracts from seeds. This is due to the fact that sprouts contain a greater quantity of total phenols and flavonoids (4.5 and 6.8 times more, respectively) than seeds do in their raw form. It was discovered that 100 grams of mung bean, 36.3 grams of dried tea, and 1462 milligrams of vitamin C all demonstrated a similar degree of free radical scavenging activity. This was determined by comparing the free radical scavenging activity of mung bean seeds soup to that of green tea and vitamin C. This high antioxidant activity is due to the presence of two major antioxidant compounds, namely vitexin and isovitexin. Additionally, vitexin was found to be effective in preventing cell death from UV-induced skin damage. Through the utilization of the DPPH (2,2-diphenyl-1-picrylhydrazyl) and FRAP (Ferric Reducing Antioxidant Power) methods, it was discovered that methanolic extracts of seed coats, which were obtained from sprouted seeds, exhibited a high antioxidant potential of 80% and 77% at a concentration of 100 µg/ml, respectively[21,24,28].

Mung beans were well-known for the detoxifying properties demonstrated. The organophosphorus insecticides, mercury, arsenic, and other heavy metals might mix with mung bean protein, tannin, and other polyphenols, which then leads to the excretion of sediments from the body. In addition to its anti-inflammatory and anti-microbial properties, mung beans have been demonstrated to contain antioxidant properties. In addition, mung beans have a number of beneficial benefits, including those that are anticancer, antihypertensive, antitumor, and lipid metabolism accommodation[26,29,30].

Conclusion

Mung beans are among the most significant legumes that grow throughout the summer months and have a brief growth season. They are also commonly cultivated in both tropical and subtropical locations. Mung beans have a broad range of uses all over the world, including in the fields of agriculture, health food, pharmaceuticals, and cosmetics, as we have mentioned in this article. Both the seeds and sprouts of the mung bean are good examples of functional foods that reduce the risk of a variety of ailments. Furthermore, in addition to the nutritional content of the seeds and sprouts, they also have benefits that are beneficial to one's health. The field of study known as organic chemistry is concerned with the structure, characteristics, and reactivity of carbon-containing molecules, which are also referred to as organic substances. Carbon has the extraordinary capacity to create stable bonds with itself as well as with a great number of other elements, which results in a wonderful diversity of molecules. This makes it a very broad area. These substances are essential to the existence of life and may be found in a wide variety of things, including biological creatures, polymers, and fuels. The field of research known as parasitology focuses on parasites, which are creatures that live on or inside a host and gain nutrition at the cost of the host. There are many different topics that are covered in review papers in the field of parasitology. These

features include the biology, life cycles, and disease-causing processes of parasites, as well as the host's reaction to parasitic diseases. Diagnostics of parasites, treatment resistance, and the creation of vaccinations are some of the issues that are often discussed in these studies.

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