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The High-quality Development Strategy of Yunnan Characteristic and Advantageous Biological Insect Industry Under The Guidance of New Quality Productivity

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Abstract

With the global economy and technological progress, new quality productivity has become a key driver for industrial upgrading and economic growth. In Yunnan Province, insects, known for their economic and ecological value, have been effectively developed into a local biologically distinctive industry. Yunnan has a long history of insect utilization, with products like lac, white wax, and Chinese gallnut contributing to local economic development. Recently, the insect industry has become a major fiscal revenue source and an important rural revitalization support in some ethnic minority areas. Yunnan has a strong foundation in insect industry research and development. By focusing on efficient utilization of insect resources and introducing new quality productivity, the province aims to drive high-quality development in this industry. This study explores how new quality productivity can lead to innovation and sustainable development in Yunnan's insect industry. It proposes strengthening scientific research investment, optimizing industrial structure, and enhancing market competitiveness to maximize social and economic benefits.

Keywords

New quality productivity; Yunnan characteristic biology; insect industry; high quality development; scientific and technological innovation.

1. Introduction

1.1. Background

In today's era, new quality productivity, as a key force to promote economic transformation and upgrading, is increasingly attracting wide attention around the world [1]. Especially in the field of biological industry, the introduction and application of new quality productivity can not only promote the transformation and upgrading of traditional industries, generate new economic growth points, but also provide new impetus for sustainable development [2]. Insects are the most diverse known biological group on Earth. About 1 to 1.6 million species of insects have been named, accounting for more than two-thirds of the known biological species. Insects are not only an important part of biological diversity, but also the largest precious biological resources on earth that have not been well exploited and utilized. In high and new technology, medicine, food and other fields closely related to national economy, insects have shown a wide range of application prospects.

1.2. Research Significance

The multi-field application of insect industry has shown its potential as an important industrial raw material and new biological material, and has been widely used in military industry, aerospace, electronics industry, information technology, medicine and other fields. For example, important insect products such as shellac, gallnut and insect ash have been widely

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used in related industries. Insects contain a variety of active substances, which have a strong bactericidal effect and a wide range of antibacterial range and have broad application prospects in the field of medicine and health. In addition, the rich nutrients in the insect body make it a high-quality animal protein resource, which can be used for human consumption or as animal feed, with important food value and economic potential. Therefore, an in-depth study of the development of the insect industry is of great practical significance for promoting the local economy and promoting sustainable development.

1.3. Research Objectives

Yunnan Province has a history of thousands of years in the utilization of insect resources. Some insect species have formed characteristic industries and become the main source of fiscal revenue and important industrial support for rural revitalization in some counties and cities, especially in ethnic minority areas. However, insect resources, as an important biological resource, have not been fully paid attention to, and the basic research and industrial development of insect resources utilization lack the macro-guidance of national policies. The purpose of this study is to explore how new quality productivity leads to the high-quality development of Yunnan's biological characteristic industries, especially the insect industry, and put forward corresponding strategies and paths. By analyzing the development status, existing problems and future trends of the insect industry in Yunnan province, this study will propose countermeasures and suggestions to strengthen scientific and technological research and development investment, optimize the industrial structure, and improve the added value of products, so as to realize the innovation-driven transformation and upgrading of the insect industry, maintain the leading position of the insect industry in Yunnan in the world, and lead the healthy development of the emerging characteristic insect industry.

2. Overview of Insect Characteristic Biological Industry in Yunnan Province

2.1. Overview of insect resources

Yunnan Province, located in the southwest border of China, is extremely rich in biological diversity. With its unique geographical environment and climatic conditions, it has nurtured rich and diverse biological resources. Among them, insects, as an important part of biodiversity, have shown their unique charm in Yunnan Province. According to statistics, Yunnan Province is home to more than 11,000 insect species, accounting for a considerable proportion of the country's insect species. These insects are not only diverse, but also widely distributed, from mountains to river valleys, from forests to grasslands, they can be found. Among them, there are some rare and unique insect species, such as the *Byasa yunnana*, *Papilio Jinshang*, which greatly enrich the biodiversity of Yunnan Province.

2.2. The current situation of insect industry in Yunnan

With the development of human society and economy, the scientific, rational and sustainable utilization of natural resources has become the basis of human existence. With the rapid increase of the world population, resource shortage and competition are inevitable. The discovery and exploitation of new natural resources is a major issue to solve the problem of human development. The shortage of resources and the competition of new resources make people turn their attention to the largest unutilized biological resource on the earth - insect resources. As a biological resource, insects have great potential for development and utilization. With the progress of science and technology and the deepening of people's understanding of biological resources, the biological industry in Yunnan Province has been developing rapidly. Among them, as an important part of the biological industry of Yunnan Province, the biological industry with insect characteristics has formed a certain scale and system. At present, the

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biological industry in Yunnan Province mainly includes biomedicine, biological agriculture, biological manufacturing and other fields. In the bio-industry with insect characteristics, Yunnan province has developed a series of products with independent intellectual property rights, such as insect protein powder, insect oil, etc. These products not only have high nutritional value but also have broad market prospects.

China has a long history in the utilization of insects, and the utilization of insect products such as the cultivation of silkworms and the production of silk, as well as the honey gathering of bees and the utilization of honey have become familiar to the public. Yunnan's lac, ash and gallnut industries have already formed distinctive insect industries, but the development of new materials and new uses has yet to be further developed. The latest research has found that insect products have a lot of room in the field of new technology and health. For example, tannic acid extracted from the gallnut produced by aphids has been found to be an important raw material for synthetic photoresist; Shellac secreted by shellac insects is used in electronic integrated circuits, medicine and other applications; And the Higher alkyl alcohol found in the wax secreted by white wax insects can alleviate Alzheimer's disease, which is in urgent need of further exploration and expansion.

Yunnan traditional medicine and ethnic medicine contain many medicinal insects with remarkable curative effect, but the basic research on screening of medicinal active substances and functional verification is weak, and the pharmacology and efficacy are not clear. The scale breeding technology has not yet broken through, resulting in a sharp reduction in the number of resources in the natural environment, seriously damaging the ecological environment, and cannot guarantee the stable supply of raw materials for pharmaceutical factories. As a treasure house of precious drug resources, insects occupy an important position in Yunnan's traditional ethnic medicine. In order to give full play to the potential of these medicinal insects, we need to conduct in-depth research on their pharmacology and pharmacodynamics system to accurately reveal their unique pharmacological mechanisms. On this basis, the development of standardized farming technologies for medicinal insects will ensure the sustainable utilization of resources and the stability of pharmacodynamics. This series of initiatives will not only greatly promote the development of China's traditional medicine but also is expected to make China an international leader in the field of research and development and utilization of insect medicine.

The Dai, Yi, Bai, Wa and other ethnic minorities in Yunnan Province have a long history of eating insects, and there are already a variety of edible insect culture. How to regulate the safety of breeding and evaluate the safety of edible and feed protein is a key issue in the development of insect protein industry in Yunnan, and it is urgent to carry out in-depth research in these aspects.

2.3. Identification of characteristic and advantageous industries

In the biological industry of Yunnan Province, insect characteristic biological industry has unique advantages and potential [3]. First, Yunnan Province is rich in insect resources, which provides a solid foundation for the development of insect characteristic biological industry. Secondly, Yunnan Province has accumulated certain technical and talent advantages in the fields of biomedicine and bio-agriculture, which can provide strong support for the development of the bio-industry with insect characteristics. Finally, with the increasing attention of people to health, environmental protection and other issues, the market demand for the insect characteristic biological industry is also expanding, which provides a broad space for the development of the insect characteristic biological industry in Yunnan province. Therefore, Yunnan Province should give full play to its advantages of insect resources and industrial base, vigorously develop the insect characteristics of biological industry, and promote it to become a new economic growth point of Yunnan Province.

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3. Integration of Development Advantages of Insect Characteristic Biological Industry and New Quality Productivity in Yunnan Province

3.1. Combination of resource advantages and new quality productivity

There are many kinds of insects in Yunnan, many of which are rare and of high economic value. These resources provide a rich raw material base for the bio-industry of insect characteristics. With the introduction of new quality productivity, these resources can be deeply developed and efficiently utilized. Through scientific and technological innovation, Yunnan's characteristic biological insect industry can realize the accurate extraction, efficient transformation and comprehensive utilization of insect resources, so as to produce more high-value-added products.

3.2. Optimization and upgrading of industrial chain and value chain

The introduction of new quality productivity not only promotes the optimization and upgrading of Yunnan insect characteristic biological industry in the industrial chain but also promotes its upgrading in the value chain. Through the introduction of advanced production technology and equipment, Yunnan’s characteristic biological industry can realize the whole industry chain coverage from raw material collection, processing, production to sales. At the same time, the application of new quality productivity also makes the quality and quality of products have been significantly improved and further enhance the market competitiveness of products [4].

3.3. Sustainable development and broad market prospects

Under the guidance of new quality productivity, Yunnan insect characteristic biological industry has shown strong development potential and broad market prospects. Through scientific and technological innovation and industrial upgrading, Yunnan's insect characteristic biological industry can not only realize its own sustainable development but also make important contributions to the prosperity of the local economy and social progress. At the same time, with the increasing attention of the world to environmental protection and sustainable development, the market demand for Yunnan's insect characteristic biological industry will also continue to grow, providing a broad space for the future development of the industry.

4. The Problems and Challenges in The Development of Yunnan's Characteristic Insect Biological Industry

4.1. Lack of technological innovation

There are obvious deficiencies in biotechnology innovation in Yunnan Province. On the one hand, insufficient investment in research and development has led to lagging development of new technologies and products, making it difficult to meet market demand. On the other hand, weak innovation ability and lack of core technologies with independent intellectual property rights have put Yunnan's biological industry at a disadvantage in international competition. Therefore, increasing research and development investment and improving innovation ability are urgent problems to be solved in Yunnan's biological industry.

4.2. Low industrial agglomeration degree

The biological industry in Yunnan Province has a low degree of industrial agglomeration, incomplete industrial chain and scattered enterprises, which makes it difficult to form scale effect and cluster effect. This not only affects the overall competitiveness of the biological industry, but also restricts the development of the biological industry to high-end and high value-added fields. Therefore, strengthening the industrial agglomeration of the biological industry, improving the industrial chain, and promoting cooperation and exchanges between enterprises are important directions for the development of the biological industry in Yunnan.

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4.3. Fierce competition in the market

With the intensification of global biotechnology competition, the competitive situation of domestic and foreign biological industry market is becoming increasingly fierce. Yunnan biological industry is facing the competitive pressure from domestic and foreign counterparts. How to stand out in the fierce market competition has become the challenge that Yunnan biological industry must face. To this end, Yunnan biological industry needs to continuously improve product quality and service level, strengthen brand building, and enhance market competitiveness.

4.4. Pressure on ecological environment

The development of the biological industry may have a negative impact on the ecological environment, such as over-exploitation of resources and environmental pollution. Yunnan is an area with a fragile ecological environment. How to protect the ecological environment and develop the biological industry at the same time is a problem that Yunnan's biological industry must face. Therefore, Yunnan's biological industry needs to actively explore the green development model and promote the harmonious coexistence of biological industry and ecological environment.

5. New Progress in The Development of The Insect Biological Industry in Yunnan

Impressive progress has been made in the application of insects in the field of new materials. The latest research has found that insect products have special value as new materials in chemical, electronics, medicine and other industries [5]. Tetrahydroxy benzophenone, an important raw material for photoresist synthesis, was found in the tannic acid series extracted from gallnut. China's photoresist mainly relies on imports, the use of gallnut products to further synthesize photoresist, can solve the important materials in the electronics industry, in the key materials are not subject to others, tetrahydroxy benzophenone products on metal ion residual content requirements are very strict, the current domestic products are not stable to reach the relevant quality standards, need to further improve product quality. On this basis, China has preliminarily developed a photoresist, with broad application prospects. It can be predicted that in the next 5 years, the demand for gallnuts may exceed 50,000 tons, while the current production of gallnut is only 10-20,000 tons, the resource gap is large, and it is necessary to further improve the efficient cultivation technology of gallnut to meet the demand. Gallnut tannic acid has been proved to have a broad-spectrum bactericidal effect, has great potential in medicine, and has a wide [6] application prospect in non-resistant feed. Shellac secreted by lac worms is widely used in electronic integrated circuits, medicine and other fields. Through the improvement of shellac properties, it can provide high quality bonding, insulation and moisture-proof new materials for integrated circuits [7]. The wax secreted by wax worms is rich in advanced alkanols (26 anols and 28 anols), and studies have found that 26 anols have acetylcholinesterase inhibitory activity, which can alleviate Alzheimer's disease [8]. It can improve the diabetes-induced protein changes of eNOS, iNOS and nNOS and inhibit glomerular sclerosis, alleviating bladder disease caused by diabetes [9]. 28 anols can induce 6-hydroxydopamine by regulating ProNGF and NGF signaling and show anti-Parkinson's effect [10]. It can lower cholesterol levels in cardiovascular patients [11]. The traditional use of ash is mainly in precision instrument casting, chemical industry, cosmetics, Chinese medicine and other industries. The discovery of new materials and new uses, especially in the field of health, will greatly promote the industrialization of ash. The separation and extraction of high-purity 26 anols and 28 anols from ash is difficult for ash processing, because the carbon of 26 anols and 28 anols is similar, difficult to separate, and it is necessary to obtain high-purity 26 anols

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and 28 anols through multiple molecular distillation. The application prospect of ash in the field of health is very attractive, but in terms of health effects and mechanisms, further experiments are needed to confirm.

More than 200 medicinal insects have been recorded in traditional Chinese herbal medicine, more than 20 of which are commonly used. Cooperation between Dali University in Yunnan Province and Tengchong Pharmaceutical and other universities and enterprises has used American cockroach to develop new drugs such as Kangfuxin liquid, Xinmailong injection and Ganlong capsule. However, insect species names in traditional Chinese medicine are confused, and the phenomenon of homoonyms and homonyms is serious. The basic research on screening and functional verification of active medicinal substances is weak, and the pharmacology is unclear. The efficient screening of effective substances by the evaluation system of pharmacological activity in vivo and vitro such as cells and animal models needs to be further in-depth. There is still many folk use of insect drugs has not been developed, such as the market demand and significant medicinal insects: Coriaria, nine incense, beak tail and other large-scale artificial breeding key technology has not made a breakthrough. It is necessary to carry out systematic and in-depth research, and the drugs with remarkable efficacy screened from a wide variety of insects in traditional medicine will be an important direction of future pharmaceutical research and development.

The development of insect protein is a hot spot in international research [11]. Insects have the advantages of high protein, short growth cycle, high edible proportion, high reproductive efficiency and low greenhouse gas emission, etc. The Food and Agriculture Organization of the United Nations actively recommends insect protein as a new source of protein. Insect protein has great prospects for development and utilization in food and animal feed additives. China has made great breakthroughs in the breeding of yellow mealworms, golden cicadas, wasps and locusts, but the food and feeding safety of insect proteins still needs to be further studied, and the safety of insect breeding technology needs to be further standardized and managed [12]. According to the characteristics of insect proteins, further research and development of processing technology is needed.

6. Countermeasures and Suggestions for The Development of Insect Characteristic Biological Industry in Yunnan

6.1. Strengthen scientific and technological innovation

Scientific and technological innovation is an important driving force to promote the development of the insect industry. First, investment in scientific research should be increased, and cooperation between universities, research institutions and enterprises should be encouraged to jointly carry out research on the development and utilization of insect resources. Secondly, we should strengthen the training of technical personnel and attract more young people to join the insect industry by setting up scholarships and providing internship opportunities. In addition, an incentive mechanism for technological innovation should be established to reward units and individuals that have made outstanding achievements in technological innovation in the insect industry to stimulate the vitality of innovation.

6.2. Cultivate industrial clusters

Industrial clusters are an important way to promote industrial development. In order to cultivate insect industrial clusters, the industrial layout should be optimized, and enterprises should be guided to gather in industrial parks to form scale effects. At the same time, cooperation and exchanges between enterprises should be strengthened to promote resource sharing and complementary advantages. In addition, policy support should be strengthened to

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provide guarantees in terms of land, funds and talent for the development of insect industry clusters.

6.3. Enhance market competitiveness

Improving market competitiveness is the key to the sustainable development of the insect industry. First of all, we should strengthen brand building, improve product quality and add value, and establish a good brand image. Secondly, we should strengthen marketing, expand sales channels and increase market share. In addition, we should pay attention to the international market dynamics, actively participate in international competition, and enhance the international influence of Yunnan insect industry.

6.4. Promote sustainable development

Developing the insect industry while protecting the ecological environment is an inevitable choice to achieve sustainable development. First of all, we should adhere to the concept of green development, adopt environmental protection technology and green production methods, and reduce the impact on the environment. Secondly, ecological protection and restoration work should be strengthened to protect insect habitats and maintain ecological balance. In addition, the publicity and education of science popularization should be strengthened to enhance the public's awareness and participation in the insect industry and ecological environmental protection.

7. Discussion

Insects are a treasure house of resources, and insect products as new materials are a brand-new field. Insects are widely distributed. In the long-term evolution process, many special insect products have evolved, such as silk, honey, lac, white wax, etc. These products are different from other biological resources and have some unique properties that other biological resources do not have. These characteristics can excavate and discover new materials with special properties and uses. Yunnan Province can vigorously promote the in-depth application of gallnut, lac, ash and insect chitin in military industry, microelectronics, chips, information technology, health and other fields to promote the development of related industries.

Yunnan has made remarkable progress in promoting the application of insects in the field of new materials. From the tannic acid series products extracted from the gallnut produced by the gallnut aphids stimulated by the plant, tetrahydroxy benzophenone has been synthesized, which is an important raw material for the synthesis of photoresist, which is a key material in the microelectronics industry, electronic liquid crystal and large integrated circuits and printed circuits. Shellac has good insulation and bonding characteristics, smeared on the integrated circuit, has the advantages of bonding, insulation, waterproof, etc., and is widely used in electronics, military industry and other industries. The special properties of these insect materials are difficult to replace by other biological materials, and they play a very important role in the development of microelectronics, military and other related industries.

Insects are also valuable pharmaceutical resources and indispensable in traditional Chinese medicine. The diversity of insects leads to the diversity of active substances in their bodies, which provides rich resources for the research of ethnic medicine and traditional Chinese medicine. Important progress has been made in the research of insect active substances and pharmacology. For example, anti-thrombotic and anti-tumor studies such as gadfly antithromboxase, bee venom hemolytic peptide, sodium cantharidate have made breakthroughs, which are expected to become important drugs for the treatment of cardiovascular diseases and anti-tumor. In addition to pharmacological and pharmacodynamic studies, good progress has been made in the large-scale culture technology of some important medicinal insects, such as cantharides, uropea and Septentharius. If a breakthrough is made in

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the pharmacology and breeding technology of insects, it will benefit human health and produce huge economic benefits. 26 anols and 28 anols, which are rich in white wax, have been proved to reduce Alzheimer's and Parkinson's syndrome, improve diabetes, and reduce cholesterol levels in cardiovascular patients, and other effects. According to the relevant procedures of national functional food, functional verification experiments will be conducted to develop new functional foods, which will have significant economic and social benefits.

Insects are a high quality protein resource with higher quality than other animal protein, and the development of insect protein is a hot field of international research. Insects have the characteristics of easy reproduction, short cycle and high input and output. Insect breeding is booming in Yunnan, and some characteristic industries have initially formed, such as yellow mealworm, which has become the main source of feed protein and related products have been exported to Europe. Crickets and wasps farming, there are hundreds of millions of yuan of income every year. The edible safety of insect protein and the safety of large-scale culture technology are issues of public concern, and also the bottleneck restricting the development of insect protein industrialization. Through systematic research, solving these problems will scientifically guide the standardized insect culture and the in-depth research and development and industrialization of insect protein, which will produce huge economic and social benefits.

8. Conclusion

Insect resources are rich in biodiversity, with the largest variety and wide distribution. Many unique insect products have evolved, and these unique products are difficult to replace by other organisms. Insects have the characteristics of large population and easy breeding, which is an important basis for industrialization. Natural resources are the basis of human survival. With the increase of population, the lack and competition of resources will profoundly affect the development of human society and economy. The discovery and exploitation of new resources is an important way to solve the contradiction of lack of resources. In order to ensure survival and development, human beings have screened the plants and microorganisms on the earth many times, but the excavation and utilization of insect resources are far from enough, and the diversity, uniqueness and availability of insect resources are insufficient. At present, many scientists in the world have realized the importance of insect resources. In recent years, the insect industry has become a research hotspot. Scientists and entrepreneurs gradually pay attention to the resources of insect materials, insect drugs and insect proteins. It can be predicted that insect resources will become a new resource competition field. China is the earliest country in the utilization of insect resources, silkworm and its product silk export has affected the economic development of the whole world, China in the insect industry research and development of the overall lead, there is a good foundation for research and development, it is recommended to attach importance to the national top-level design, into the national key research and development plan, gather the scientific and technological strength of insect resources utilization of research institutes across the country, is expected to be in the insect new materials, Insect drugs and insect proteins and other aspects of the first breakthrough, may create hundreds of billions of insect resources value.

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Ethics approval and consent to participate

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Competing interests

The authors declare that they have no competing interests

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