The Annual Report of International Seabuckthorn Development for the Year of 2022
国际沙棘发展报告（2022 年度）

International Seabuckthorn Association (ISA)
Management Center for Seabuckthorn Development
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Notes to the publication The Annual Report of International Seabuckthorn Development (the 2023 Edition)

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Preface

Seabuckthorn is a multi-purposes plant known as *Hippophae* in Latin name, Seabuckthorn in English, Shaji in Chinese, Облепиха in Russian, Sanddorn in German, Argousier in French, Espina de Mar in Spanish, Tyrni in Finnish, Havtorn in Swedish and Tsestallu/Charma/ Bardiphal in India respectively.

International Seabuckthorn Association (ISA) with the Headquarter in Beijing, China, is an academic and industry-based international non-governmental and non-profit organization that is voluntarily formed by enterprises, institutions, individuals and other organizations which are active in the research and development of seabuckthorn around the world. The purpose of the ISA is to give full play to the role of seabuckthorn in facilitating environmental protection, economic development and human health, promote exchanges and global cooperation in seabuckthorn cultivation, scientific research, production, economy and trade, personnel, information, etc., and provide international communication service of seabuckthorn toISA members and all sectors of the society.

ISA has the following scope of activities:

1. Give play to the self-discipline role of the seabuckthorn industry, formulate industry regulations, standardize industry behaviors, and promote the development of the industry;
2. Investigate and research the developmental dynamics and trends of seabuckthorn at home and abroad, and provide consulting services for the construction and development of seabuckthorn;
3. Undertake international exchange and cooperation projects entrusted or funded by government agencies and other organizations;
4. Build international seabuckthorn information network and database, and promote international exchanges and cooperation of seabuckthorn;
5. In accordance with relevant provisions, edit and publish professional publications, and expand the popularity and publicity of seabuckthorn knowledge;
6. Organize and host exchange activities such as seabuckthorn

academic seminars at home and abroad;
7. Carry out personnel training and exchange visits in the field of seabuckthorn.

For the purpose of information exchange, data sharing among member countries and to improve attraction globally, it is the responsibility and work plan of ISA Secretariat to publish *The Annual Report of International Seabuckthorn Development*. We fully understand that Country Report of Seabuckthorn Development in the Year of 2022 is the important basic materials. The members of Board/Scientific Committee of ISA are requested to provide with the following national-wide statistical information in 7 aspects listed in Appendix as in detail as possible. And then kindly submit the document in English and/or in Chinese to Mr. Zhang Bin, Deputy Secretary General of ISA, by email of *isazhangbin@qq.com* and to Dr. TIAN Xiangrong,Deputy Secretary General of ISA, by email of *7605202@qq.com.*

By the October of 2023, we have received the Country Report of China, Democratic People's Republic of Korea, Finland, Germany, Greece, India and Latvia, respectively. All these reports have been translated into Chinese or English for further bilingual printing with assistance from the Board and Scientific Committee of ISA.

According to the uncompleted statistics, by the end of 2022, seabuckthorn was found in 52 countries. The global seabuckthorn resource was around 2,520,000 ha (with yearly increase of 117,000 ha), including 2,205,000 ha in China.

This Report was financially supported by Ministry of Water Resources, the People's Republic of China with joint technical supports from Gansu Agricultural University, Dalian Minzu University, Desert Forestry Experimental Center of Chinese Academy of Forestry and Shanxi Academy of Forestry and Grassland Sciences .

We are looking forward to the better ISA operation and global seabuckthorn development.

The Editing Committee

序 言

沙棘是一种广泛分布在欧亚大陆温带地区的多功能植物资源，在中国西北、华北地区又名：醋柳、酸刺、黑刺、酸溜溜、圪针。其拉丁文：*Hippophae*，英语：Seabuckthorn，俄语：Облепиха，德语：Sanddorn，法语 :Argousier，西班牙语 : Espina de Mar，芬兰语 :Tyrni，瑞典语：Havtorn。在印度不同地区分别称为 : Tsestallu, Chharma, Bardiphal。

国际沙棘协会于 1999 年由中国水利部沙棘开发管理中心联合世界各国沙棘专家共同发起，在 2001 年印度会议上同意成立。2011 年 9 月，经国务院批准、民政部注册登记，成为第 27 家总部设在中国的国际组织，其业务主管单位为中华人民共和国水利部。协会由会员代表大会、理事会、专业委员会、秘书处四级组织管理机构组成，秘书处挂靠在沙棘中心。协会理事会成员由全球主要沙棘国家的代表组成，技术委员会成员由世界各国的知名沙棘专家组成。

协会的目标和宗旨是全面发挥沙棘在促进环境保护、经济发展及人类健康等方面的作用，推进中国与世界各国在沙棘种植、科研、生产、经贸以及人员和信息等方面的交流与合作，为会员和社会各界提供沙棘领域的国际交流服务。

协会主要任务是：

一、发挥沙棘行业自律作用，制定行业规章，规范行业行为，推动行业发展；

二、调查研究国内外沙棘发展动态和趋势，提供沙棘建设与开发咨询服务，组织举办全国性、国际性学术会议；

三、承办政府机构等组织委托或资助的国际交流与合作项目，组织举办沙棘专业技术培训和专题考察；

四、建设国际沙棘信息网络和资料库，促进国际沙棘交流与合作；

五、编辑出版专业刊物，加大沙棘知识的普及和宣传力度。

六、组织主持国内外沙棘学术研讨会等交流活动。

七、开展沙棘领域人员培训和互访。

为加强国际沙棘协会各成员之间的信息交流，分享世界各国沙棘发展成功经验，国际沙棘协会秘书处成立了《国际沙棘发展报告》专门工作组，组织邀请了国际知名沙棘专家撰写其所在国家的2022年度沙棘发展报告。截止2023年10月，我们收到来自中国、朝鲜、芬兰、德国、希腊、印度和拉脱维亚等国家的报告并组织翻译成中文（或英文）。现将上述7个国家的报告汇编成《国际沙棘发展报告》，用中英文双语出版。

据不完全统计，截止 2022 年底，沙棘植物分布在全球 52 个国家，总面积约 2,520,000 公顷（约合 3780 万亩），比上一年增加约 117,000 公顷（约合 175 万亩）。其中，中国约 2,205,000 公顷（约合 3308 万亩），其他国家约 313,000 公顷（约合 472 万亩）。

本报告得到水利部有关司局的大力支持，得到甘肃农业大学、大连民族大学、中国林业科学院沙漠林业研究中心、山西省林业和草原科学研究院等单位的技术帮助。

祝愿国际沙棘协会及全球沙棘事业更好更快发展！

《国际沙棘发展报告》编委会

2023 年 12 月

Appendix:

The Recommended Format/Framework for ISA Member Country Report of Seabuckthorn Development in the Year of 2022

1. The national-wide seabuckthorn resources of plantations and berry yield.

1.1. The total area of seabuckthorn resources up to the year of 2022 including the natural stands and the artificial plantations, and the increased areas in the year of 2022.

1.2. The harvested and the estimated amounts of total production of seabuckthorn berries in your country in the year of 2022.

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2. 全国沙棘加工企业总数、总产量、总产值。主要生产企业及产品简要介绍。

3. 全国沙棘科学研究情况（研究人员、研究领域、主要成果），重点研究单位（大学、研究所、企业）简要介绍。

4. 全国沙棘从业人员情况，协会会员总数（集体会员、个人会员）。先进人物简要介绍。

5. 当年全国有关沙棘的重要活动、事项简要介绍。

6. 当年本国有关沙棘的主要政策文件、发表的研究论文等。

1. Country report of China

中国沙棘发展报告

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Seabuckthorn Development of China in 2022

2022 年中国沙棘发展报告

Management Center for Seabuckthorn Development, Ministry of Water Resource
Secretariat of International Seabuckthorn Association (ISA)
水利部沙棘开发管理中心
国际沙棘协会秘书处

1. The national-wide seabuckthorn resources of plantations and the increased areas (including the natural stands and the artificial plantations), estimated yield and harvested qualities of total seabuckthorn berries in the year of 2022

一、中国沙棘资源总面积及当年新增面积（含天然林和人工生态林、经济林）、当年（估算）鲜果总产量及采收量。

China has the richest and largest area of seabuckthorn natural stands and artificial plantation. By the end of 2022, there were nationally in total 2,205,000 ha(33,080,000 mu)of seabutkthorn resources, accounting for 88% of the global resources of 2,520,000 ha(37,800,000 mu). The increased artificial seabuckthorn plantation is about 64,000 ha(96,0000 mu), including 39,000 ha(59,0000 mu) for ecological purposes and 25,000 ha(370,000 mu) for economic purposes.

中国是天然沙棘林和人工种植沙棘林面积最大的国家。截止 2022 年 12 月，全国沙棘资源总面积约 3308 万亩，占世界沙棘资源总面积 3780 万亩的 88%，比上一年增加 96 万亩。

In China, seabutkthorn is distributed naturally and artificially planted in 16 provinces (or autonomous regions, or municipality) e.g. Beijing, Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Henan, Sichuan, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang. At present, seabuckthorn resources are mainly distributed in the "Three Northern Regions". Among them, Inner Mongolia has the largest area both in existing and newly increased seabuckthorn resources in 2022, from Hulunbeir in the north to Ejina County in the west, and the newly added planting area of seabuckthorn has reached

目前全国 16 个省、自治区、直辖市（北京、河北、山西、内蒙古、辽宁、吉林、黑龙江、河南、四川、云南、西藏、陕西、甘肃、青海、宁夏、新疆）有沙棘天然分布和人工种植沙棘。目前沙棘资源主要分布在“三北地区”，其中内蒙古的现存和 2022 年新增沙棘资源面积最多，从北端的呼伦贝尔一直到最西端的额济纳旗都有分布，仅在鄂尔多斯 2022 年就新增沙棘生态林 30

more than 20,000 ha (300,000 mu) alone in Ordos in 2022. The area of seabuckthorn resources in Xinjiang is not the largest in China, but the newly increased area of economic seabuckthorn plantation come out on top in the national scale. And because of the better sunshine, the seabuckthorn berries, especially in northern of Xinjiang, is with very high quality both for fresh eating and industry processing.

多万亩。新疆的沙棘资源面积虽然不是全国最多的，但是新疆每年新增的经济林都名列前茅，受光照影响，新疆尤其是北疆地区沙棘品质非常出众。

In 2022, the yields of wild seabuckthorn in China decreased more than those in 2021. Affected by destructive harvesting in recent years, a large amount of wild seabuckthorn fruit production in Shanxi, Hebei, Gansu etc. had serious reduced, especially in Shanxi province. The wild fruit production in 2022 is about 12,000 tons less than in 2021. Taking Beijing Powdery Health Industrial Co. Ltd., for example, in 2022, the pure fruit of wild seabuckthorn was purchased by 2000 tons, which was about 20% lower than the previous year, while the cost increased by about 25%.

2022 年全国野生沙棘结果情况比 2021 年下降较多，受最近几年破坏性采收的影响，山西、河北、甘肃等地大量野生沙棘减产严重，尤其是山西减产尤为严重。2022 年野生果实产量较 2021 年减少约 1.2 万吨。以北京宝得瑞健康产业有限公司为例，2022 年收购野生沙棘净果 2000 吨，较前年下降 20% 左右，但是采收成本增加了 25% 左右。

On the point of the artificial seabuckthorn fruit production in national scale, the fruit yield of the artificial plantation increased by about 30% compared with in 2021, due to the increase of artificial planting area and the highly fruiting year of seabuckthorn plant, as well as the advantages of manual management and protection playing. Large part of them are of Russian varieties with big berry of seabuckthorn, and only a small part are of Chinese seabuckthorn (*Hippophae rhamnoides*) selection. For an example, the fruit production of seabuckthorn of Heilongjiang Bamiantong Forestry Bureau was up to 2000 tons in 2022, but only about 800 tons in 2021, and the overall increased by more than 200%.

2022 年全国人工沙棘林结果情况看，受种植面积和达盛果期面积增加，以及人工管护的优势发挥，人工林产果量较 2021 年增加 30% 左右。其中以大果沙棘为主，仅有少量的小果人工沙棘林。以黑龙江八面通林业局为例，2022 年大果沙棘产量为 2000 吨，2021 年仅为 800 吨左右，整体产量多增加了 200% 多。

In estimation for the year of 2022, there were around 600,000 to 700,000 tonnes of seabuckthorn berries yield, about 250,000 to 350,000 tonnes of harvesting available, and about 80,000 to 150,000 tons be actually used for processing.

据估算 2022 年，全国沙棘果实产量在 60 万 −70 万吨之间，可采收约 25 万 −35 万吨，实际采收加工利用约 8 万 −15 万吨，其中野生沙棘果实产量在 20 万 −35 万吨，实际采收在 2 万 −6 万吨，较 2021 年略有下降，减量主要原因是我国沙棘多分布在大山沟深地区，并且

The fruit production of wild seabuckthorn (*Hippophae rhamnoides*) forest is about 200,000-350,000 tons, but the actual available harvest is only 20,000-60,000 tons, a little bit lower than that in 2021, which is mainly due to the fact that Chinese natural seabuckthorn is mostly distributed in the remote mountains and valleys areas , and it is inconvenient to harvest, resulting in waste of seabuckthorn resources. And the other reason is due to the destructive harvesting recent years, the seabuckthorn berries of wild seabuckthorn is decreasing year by year.

沙棘有刺，不便采收，造成沙棘资源浪费，随着破坏性采收的加深，野生沙棘产量逐年递减。

In China, about more than 85% of econonic-purpose industrial seabuckthorn plantation are Russian varieties with large fruit, and the fruit yield of individual plant can reach to 20-35 kg. The total national fruit output of inductrial plantation is about 200,000 tons, and the actual harvested is between 150,000 and 180,000 tons. In 2022, about 66,000 ha (1,000,000 mu) of indutrial seabuckthorn plantation gradually entered the highly fruit-bearing period in Xinjiang, Heilongjiang, Jilin and northern Inner Mongolia. In the next three years, the annual amount of seabuckthorn large fruit will be increased by 50,000-80,000 tons, and the production of berries will grow at an annual rate of 10-15%.

沙棘工业种植园 85% 以上为大果沙棘，果子直径较大，单株结果可达到 20−35 公斤。沙棘种植园果实产量大约在 20 万吨左右，实际采收量达到 15 万 −18 万吨之间。2022 年，位于新疆、黑龙江、吉林、以及内蒙古北部人工种植园约 100 万亩大果沙棘原料林逐渐进入结果期，在接下来的 3 年间，每年大果沙棘果实可采收量将新增 5 万 −8 万吨，并且其产量将以每年 10−15% 速度增长。

The current seabuckthorn resources in China is shown in Table 1.

其现有沙棘资源状况见表 1.

Table 1. Total area up to 2022 and the newly increased area of seabuckthorn in 2022 in China (unit: 10,000 mu, 1 ha equal to 15 mu)

表 1. 2022 年中国主要省现有及新增沙棘资源面积 (单位：万亩，1 公顷 =15 亩)

产区 Province	截至 2022 年底 Up to end of 2022	2022 年新增沙棘生态林 New SBT for ecological purpose	2022 年新增沙棘经济林 New SBT for economic purpose
河北 Hebe	131	1	5
山西 Shanxi	594	2	1
内蒙古 Inner Mongolia	645	35	5
辽宁 Liaoning	98	1	1
吉林 Jilin	27	1	4
黑龙江 Heilongjiang	63	1	5
四川 Sichuan	65	1	0
云南 Yunnan	10	0	0
西藏 Tibet	142	2	2
陕西 Shaanxi	376	4	1
甘肃 Gansu	494	3	1
青海 Qinghai	464	3	1
宁夏 Ningxia	95	1	1
新疆 Xinjiang	97	3	10
其他地区 (北京、河南) Other provinces	7	1	0
合计 in total	3308	59	37

2. Germplasm resources of seabuckthorn, natural distribution of Hippophae (species, subspecies), newly bred varieties

Seabuckthorn is found in 52 countries in the world. China has the most abundant natural seabuckthorn germplasm resources in the world. According to the classification by Professor LIAN Yongshan, Chinese taxonomic scientist, there are globally 6 species

二、沙棘种质资源情况，天然分布的种类 (种、亚种) 及新品种培育

全球约有 52 个国家有沙棘分布。中国是世界上天然沙棘种质资源最丰富的国家。按照我国

and 12 subspecies of seabuckthorn. Among them, there are 6 species and 8 sub-species distributed in China, e.g.
Hippophae rhamnoides
Hippophae rhamnoides ssp. sinensis
Hippophae rhamnoides ssp. yunnanensis
Hippophae rhamnoides ssp. turkestanica
Hippophae rhamnoides ssp. mongonica
Hippophae salicifolia
Hippophae tibetana
Hippophae gyantsensis
Hippophae neurocarpa
Hippophae neurocarpa ssp. stellatopilosa
Hippophae neurocarpa ssp. neurocarpa
Hippophae goniocarpa
Hippophae goniocarpa ssp. litangensis
Hippophae goniocarpa ssp.goniocarpa

沙棘植物学家廉永善的分类方法，沙棘属植物分为 6 个种 12 个亚种，其中在中国分布有 6 个种 8 个亚种，分别是鼠李沙棘（种），柳叶沙棘（种），西藏沙棘（种），江孜沙棘（种），肋果沙棘（种），棱果沙棘（种），中国沙棘（亚种），云南沙棘（亚种），蒙古沙棘（亚种），中亚沙棘（亚种），肋果沙棘（亚种），理塘沙棘（亚种），棱果沙棘（亚种）。

Better seabuckthorn varieties have been introduced from Russia, Mongolia, Germany, Finland, which are with better economic properties of large berry, reliable yield, high content of seed oil, less thorn or thornless, convenience for harvesting and processing. The national seabuckthorn breeding network led by Management Center for Seabuckthorn Development, Ministry of Water Resource is set up in order to do seabuckthorn breeding programme by selection, introduction and crossing, and is expected to achieve the new seabuckthorn varieties with comprehensive advantages such as large fruit, high yield, no thorns or less thorns, strong resistance, rich nutrition, and adaptable for widespread application in the "Three North Regions" areas in recent years.

目前，我国先后从蒙古、俄罗斯、德国、芬兰等国引进了优良沙棘品种，其特点是果实大，种子含油量高、枝条无刺或者少刺，方便采摘和加工。水利部沙棘开发管理中心牵头组织的全国沙棘育种网，正在采用“选、引、育”相结合的科学方法，有望在近几年培育出具有果实大、产量高、无刺或少刺、抗性强、营养成分丰富、适宜在“三北”地区广泛推广应用等综合优势的沙棘新品种。

3. The national seabuckthorn industry development, total number of enterprises, total output, total output value and market demand analysis

三、目前中国沙棘产业发展、企业总数、总产量、总产值及市场需求分析

Chinese seabuckthorn industry started in 1980’s and in rapid development in early 21st

中国的沙棘产业起步于 20 世纪 80 年代中后期，在 21 世纪初开始快速发展。近年来沙棘高科

century. In recent years, seabuckthorn high-tech products continue to appear, which covered more than 200 kinds of seabuckthorn products in 8 categories such as food, medicine, health care products and cosmetics. After nearly 40 years of development, there are more than 5,000 various types of seabuckthorn processing enterprises in China, with an annual output value of about 26-30 billion yuan. Many enterprise have achieved good economic and social benefits, like Conseco Seabuckthorn Co., Ltd, Beijing Powdery Health Industrial Co. Ltd, Hebei Shenxing Seabuckthorn Academy, Lvliang Yeshanpo Food Co.Ltd, Shanxi Wutaishan Seabuckthorn Co. Ltd, Shaanxi Haitian Pharmaceutical Co.Ltd, Shaanxi Huanglong Guoshoutang Bioengineering Co. Ltd, Inner Mongolia Yuhangren High-tech Industry Co. Ltd, Inner Mongolia Shamozhihua Bio-industry Tech Co. Ltd, Inner Mongolia Chundian Industry Co. Ltd, and Gansu Aikang Seabuck thron Co. Ltd, Qinghai CommScope Biotechnology Co., Ltd., Xinjiang Kangyuan Bio-tech Co. Ltd, Heilongjiang Shengbaotai Agriculture Co. Ltd, etc.

技产品不断出现。其产品涵盖了食品、药品、保健品、化妆品等 8 大类 200 多个品种。经过近四十年的发展，全国现有各类沙棘加工企业 5000 余家，年产值达 270-300 亿元左右。其中北京的高原圣果、宝得瑞，河北的神兴集团，山西的吕梁野山坡、五台山，陕西的海天药业、陕西黄龙国寿堂，内蒙古的宇航人、沙漠之花、淳点实业，以及甘肃艾康、青海康普、新疆康元、黑龙江圣宝泰等都是其中的佼佼者，取得了较好的经济效益和社会效益。

In 2021, there were 3,225 seabuckthorn related enterprises in China, and in 2022, this number increased to 5,695, and the number of registered enterprises increased by nearly 2 times. That is mainly because a lot of seabuckthorn promotion job has done in recent years, and more and more people have realized the healthcare effects of seabuckthorn, the market become more big and popular, and then the consumption increased year by year, leading to more and more enterprises enter to seabuckthorn related field.

2021 年我国于沙棘相关企业 3225 家，2022 年中国与沙棘相关企业增加到了 5695 家，企业注册数量增加了近 2 倍。其主要原因是沙棘目前推广增加，普通人越来越多得认识到沙棘的健康作用，进而使得消耗量大增，进入的企业也越来越多。

In terms of food processing, seabuckthorn can be used as raw materials to make a variety of beverage and wine, such as fruit juice drinks, fruit wine, jam, cakes and dairy products, etc. In the field of medicine and health care, there are preparations for treating cardiovascular and cerebrovascular diseases, expelling phlegm, benefiting lung,

在食品加工方面，以沙棘为原料可制成多种饮料食品和酒类，如：果汁饮品、果酒、果酱、各种糕点及奶制品等；在医药保健方面，有用于治疗心脑血管系统病症、祛痰、利肺、养胃、健脾、活血化瘀、烧烫伤、刀伤及冻伤等方面的制剂；在轻工及其它方面，沙棘也显示了其独特的价值；开发了滋养皮肤、促进细胞代谢、促进上皮组织再生、具有抗过敏、抑菌、强渗透力和保护皮肤自然色泽的护肤用品及洗化用

nourishing the stomach, strengthening the spleen, promoting blood circulation and removing blood stasis, burning and scalding, knife injury and frostbite, etc. Seabuckthorn also shows its unique value in light industry and other aspects. Skin care products and toiletries have been developed for nourishing the skin, promoting cell metabolism and epithelial tissue regeneration, and also with the functions of anti-allergy, antibacterial, strong permeability and protecting the skin. Seabuckthorn stems have hard wood and can be used to make plywood and other building materials.

In recent years, seabuckthorn seed oil, fruit oil, juice powder, procyanidin, flavone, dietary fiber and so on are the main extracts of seabuckthorn in the domestic and foreign markets. Seabuckthorn seed oil and fruit oil, as intermediates and raw materials of drugs, cosmetics and functional foods, have a widely application fields and huge market potential. The demand for various natural seabuckthorn extracts and fruit juices, such as seabuckthorn concentrate juice, fruit juice powder, oil, flavonoids, etc., has doubly increased. Some globally well-known enterprises, such as Nestle, P&Gs, etc., have launched or developed a number of seabuckthorn related products. According to statistics, there are more than 200 kinds of seabuckthorn related products such as functional food, beverage, medicine, beauty and skin care products, washing articles, feed, bait and so on.(As shown in Table 2)

品；沙棘的枝干木质坚硬，可用于制作胶合板等建筑材料的原料。

近年来，国内外市场上的沙棘提取物主要为沙棘籽油、沙棘果油、沙棘果粉、原花青素、沙棘黄酮、沙棘膳食纤维等。沙棘籽油和果油作为药品、化妆品、功能食品的中间体和原辅料，应用领域广阔、市场潜力巨大。对各种天然沙棘提取物和果汁，如沙棘汁浓缩汁、沙棘果粉、沙棘油、沙棘黄酮等的需求成倍增长，一些国内外知名企业如雀巢公司、保洁公司等都已推出或开发了多个沙棘相关产品。据统计，目前市场上已形成销售的沙棘类相关产品有功能食品、饮料、药品、美容护肤产品、洗涤用品、饲料、饵料等八大类约 200 多种产品。（见附表 2）

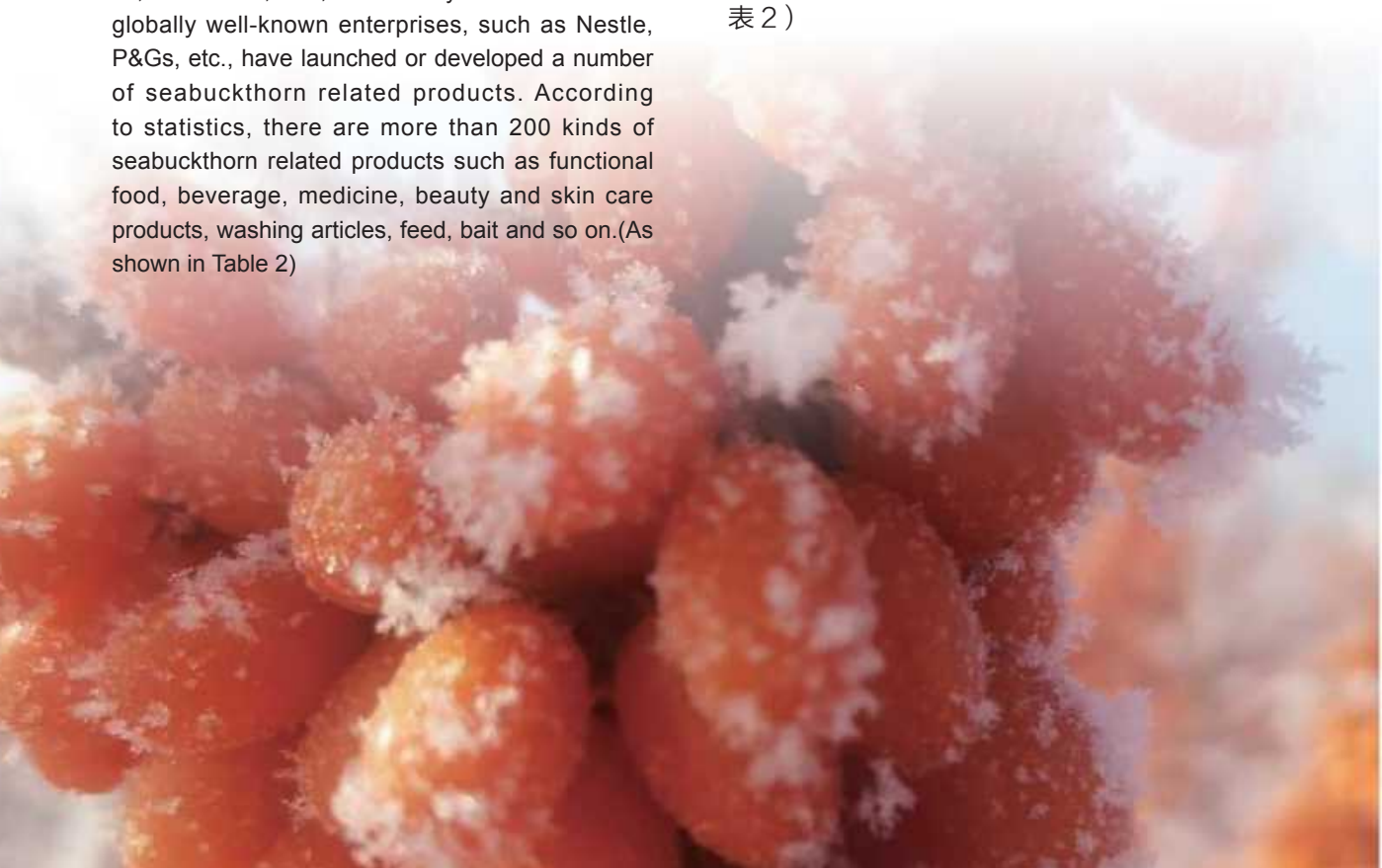

Table 2. The utilization of seabuckthorn in China
表 2. 沙棘应用情况

应用领域 Application sections	应用范围 Application scope	相关产品 Products
食品加工 Food production	饮料、果酒、果醋、果酱、果粉、糕点、奶制品，drink,wine, vinegar, jam, pastry, dairy products, etc.	沙棘醋、沙棘酒、沙棘茶、冻干粉等食品。seabuckthorn vinegar, wine, tea，freeze-dried powder， etc.
医药保健 Medicine & healthcare product	心脑血管、祛斑、润肺、健脾养胃、宫颈糜烂、外伤 treatment for cardiovascular, gastric ulcer, lung improvement,cervical erosion, scald, burn,etc.	五味沙棘散、参芪沙棘合剂、心达康片、沙棘干乳剂，沙棘籽油栓剂等 Wuwei seabuckthorn power, seabuckthorn compounds with ginseng and jaundicen，XinDaKang tablets，etc.
轻工业及其他方面 Daily stuffs processing	化妆品、洗涤用品 cosmetic, detergent etc,	沙棘护肤、洗漱用品 seabuckthorn products for skin care

According to incomplete statistics, from 2016 to 2022, the sales revenue of seabuckthorn extract products alone is 560 million yuan, 940 million yuan, 1.56 billion yuan, 2.1 billion yuan, 2.5 billion yuan, 3.1 billion yuan and 4.9 billion yuan, respectively. The data show that the seabuckthorn industry has a significant growth every year, and it is expected that the sales revenue will reach about 5.5 billion yuan by 2023.

据不完全统计，2016 年至 2022 年，仅沙棘提取物产品的销售收入分别为 5.6 亿元、9.4 亿元、15.6 亿元、21 亿元、25 亿元，31 亿，49 亿，数据显示，沙棘产业每年都有明显的增长，预计到 2023 年销售收入达到 55 亿元左右。

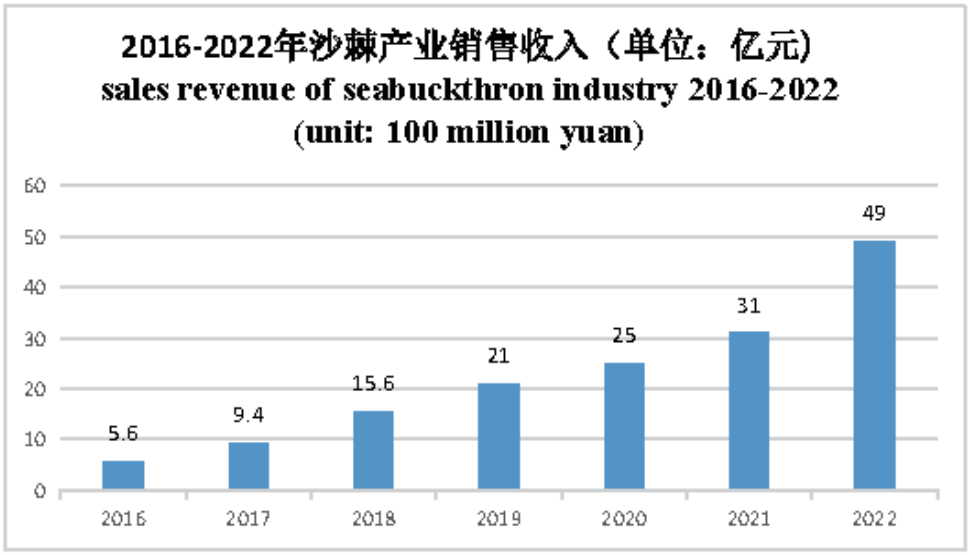

Figure 1. Sales revenue of Seabuckthorn extract products
图 1. 沙棘提取物产品销售收入

It is estimated that the output value of seabuckthorn extracted products corresponding to pharmaceuticals, cosmetics, health care products and other downstream industries is about 1:22.

据测算：沙棘植物提取物产品对应的药品、化妆品、保健品等下游产业的产值为 1：22 左右。

The application proportion of seabuckthorn extracted products in major related industries in 2022 is shown in Figure 2:

2022 年沙棘提取物产品在主要相关行业的应用占比情况如图 2：

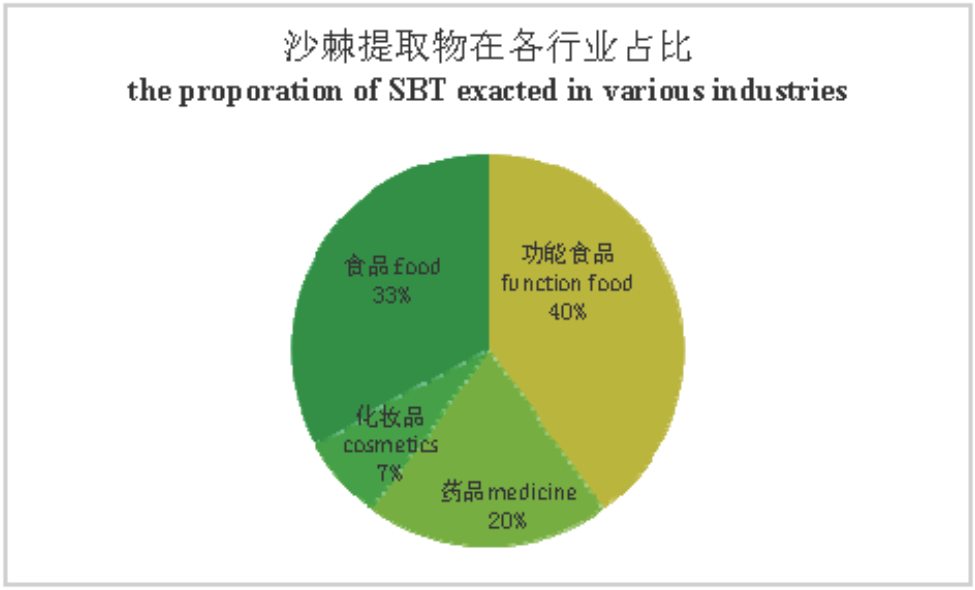

Figure 2. Application of Seabuckthorn extracted products in major related industries in 2022
图 2. 2022 年沙棘提取物产品在主要相关行业的应用情况

In 2022, the price of seabuckthorn seeds has been maintained at about 40 yuan /kg,the dried fruits is 80 yuan /kg, the total flavonoids extracted with 10-30% of purity content is 1100-2500 yuan /kg, seabuckthorn seed oil is 1200 yuan /kg. If the seed oil capsulated, the price of per kilogram is about 2000 yuan.

2022 年，沙棘种子的价格一直保持在 40 元 / kg 左右。沙棘药材干果的价格：80 元 /kg；沙棘总黄酮提取物的价格：10–30% 含量的 1100–2500 元 /kg；沙棘籽油：1200 元 / kg，制成沙棘油软胶囊后每公斤沙棘油的价格为 2000 元左右。

On the base of market analysis and experts predict, the production of seabuckthorn products in China only accounts for 1/5 of the international and domestic market demand, which showed that the market supply and demand of seabuckthorn has a

据国内市场分析和专家预测，我国生产沙棘产品仅占国际、国内市场需求量的 1/5，这说明

great potential, its demand is still increasing year by year, because of the improvement of people's living conditions. The application of seabuckthorn extractive compounds has also been expanding, and its function has been recognized by the more and more consumers, the demands are growing fast in the fields of food, functional food, cosmetics and other industries. The proportion for drugs requirement decreased due to the continuous expansion of marketing technology of seabuckthorn extract and the long time need for application.

沙棘市场供求潜力很大，随着人民生活水平的提高，其需求量还在逐年增加。沙棘提取物应用领域也不断扩大，并被广大消费者所认同，以食品、功能食品、化妆品和其他行业增长最快；而药品因沙棘提取物销售技术的不断扩大以及药品申报时间漫长而占比下降。

Among the seabuckthorn extracted products, seabuckthorn seed oil is the most demanding one in the market at present, and the market is in short supply. Seabuckthorn fruit powder, as an additive or auxiliary material for emerging functional products, is currently being recognized and accepted by relevant industries and markets,

沙棘提取物产品中，沙棘籽油是目前市场需求最旺盛的产品，市场处于供不应求状态；沙棘果粉作为新兴功能产品添加剂或辅料，目前正在被相关行业和市场认知和接受，下图为 2019–2022 年国内相关行业的主要知名企业对沙棘提取物主要产品的市场需求情况。

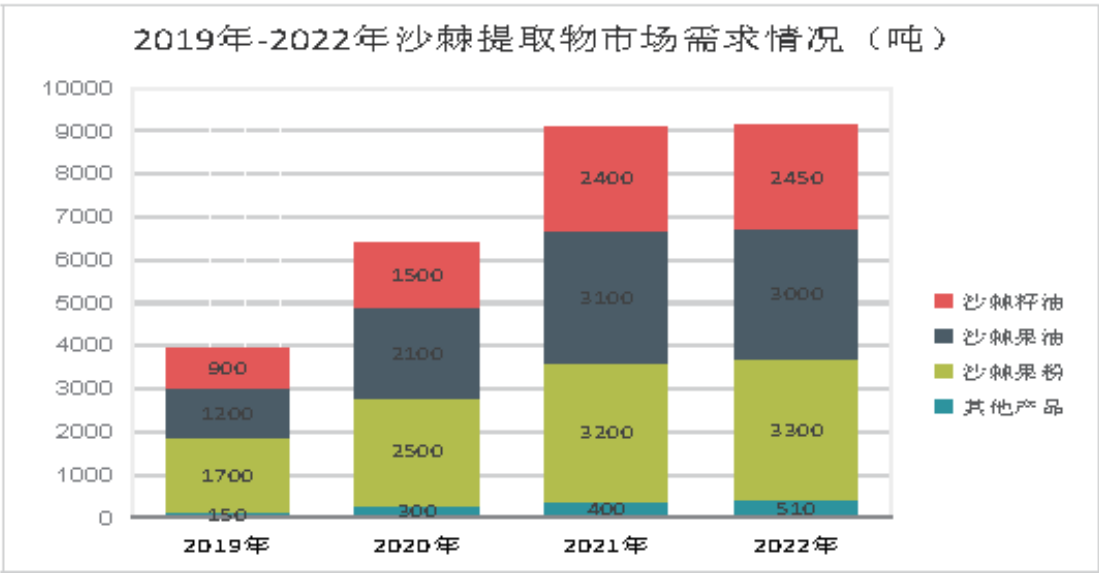

Figure 3. Market demand for seabuckthorn extract from 2019–2022
图 3. 2019–2022 年沙棘提取物市场需求情况

4. Brief introduction of the scientific research situation of seabuckthorn in China (including universities, research institutes, enterprises), key research units (researchers, research fields, main achievements)

四、中国沙棘科学研究情况（大学、研究所、企业），重点研究单位（研究人员、研究领域、主要成果）简要介绍

1.Management Center for Seabuckthorn Development, Ministry of Water Resource

1. 水利部沙棘开发管理中心

Management Center for Seabuckthorn Development, Ministry of Water Resource (hereinafter referred to as the Seabuckthorn Center), the predecessor was the Seabuckthorn Coordination Office of the National Leading Group for Water Resources and Soil & Water Conservation, established in 1985 (referred to as the National Seabuckthorn Office), and was renamed as Management Center for Seabuckthorn Development, Ministry of Water Resources in 1997. It undertakes the coordination and management of the national seabuckthorn on the resources construction, development and utilization. Seabuckthorn Center has a processing enterprise, which has three bases on seabuckthorn breeding or nursery in Dongsheng, Junger and Dalat counties, Inner Mongolia Autonomous Region. At present, the Seabuckthorn Center has 9 full-time staffs specializing in seabuckthorn research and management, including 6 senior and 3 deputy senior.

水利部沙棘开发管理中心（以下简称沙棘中心）前身是成立于 1985 年的全国水资源与水土保持工作领导小组沙棘协调办公室（简称全国沙棘办），1997 年更名为水利部沙棘开发管理中心，承担着全国沙棘资源建设、开发利用等方面的协调管理工作。沙棘中心下辖一沙棘加工企业，并在内蒙古自治区鄂尔多斯市东胜区、准格尔旗、达拉特旗曾建有 3 处沙棘育种或苗木繁育基地。目前，沙棘中心有专门从事沙棘研究和管理的专职人员 9 人，其中正高级 6 人，副高级 3 人。

Since 1985, the Seabuckthorn Center has been responsible for compilation of 13 standards related to seabuckthorn, including 8 industry standards of the Ministry of Water Resources and 5 group standards of the International Seabuckthorn Association. And eight of national patents, nine of all kinds of science and technology progress award have been achieved, including 4 items of provincial and ministerial level , 5 with others level. 8 monographs and 4 anthologies as well as 150 scientific and technological papers about

1985 年以来，沙棘中心负责编制有关沙棘方面的标准 13 个，其中水利部行业标准 8 个，国际沙棘协会团体标准 5 个。获得国家专利 8 项，获得各类科技进步奖 9 项，其中省部级 4 项，其他 5 项。主编出版专著 8 部、文集 4 部；发表科技论文约 150 篇。现有各类沙棘良种

have been edited and published. There are 28 seabuckthorn varieties, including 6 hybrid varieties, 10 introduced varieties, and 12 selected varieties, bred by Seabuckthorn Center.

28 个，其中杂交沙棘品种 6 个，引进沙棘良种 10 个，选育沙棘品种 12 个。

2.Rural Revitalization Science and Technology Institute, Heilongjiang Academy for Agricultural Science

2. 黑龙江省农业科学院乡村振兴科技研究所

Rural Revitalization Institute of Heilongjiang Academy of Agricultural Sciences was founded in 1948, formerly known as Berry Research Institute, located in Suilang County, Heilongjiang Province, engaged in berry resource collection, breeding and related cultivation technology research in the northeast black soil region. From 2019, the name changed to Rural Revitalization Institute and moved to Harbin, the capital city of Heilongjiang Province. The Institute has several research teams including for berry, drupe, caryopsis and seabuckthorn etc. The Seabuckthorn research laboratory has more than 6.7 ha (100 mu) of dedicated scientific research base, 1 greenhouse for seabuckthorn cutting seedlings, 1 piece of box of plant tissue culture, artificial climate box, 752N spectrophotometer, photoelectric leaf surface meter, soil nutrient analyzer, soil moisture meter, conductivity meter, PCR meter, electron microscope and other test facilities and instruments.

黑龙江省农业科学院乡村振兴所成立于 1948 年，原名为浆果研究所，位于黑龙江省绥棱县，面向东北黑土区从事浆果资源搜集、育种及相关栽培技术研究。从 2019 年起更名为现名，并搬迁至黑龙江省哈尔滨市。乡村振兴所下设浆果、核果、颖果、沙棘及乡村振兴等多个研究室，其中沙棘研究室现有专用科研用地 100 余亩，沙棘育苗大棚 1 栋，植物组培实验室 1 个，光照培养箱、人工气候箱、752N 分光光度计、光电叶面仪、土壤养分测定仪、土壤水分测定仪、 电导率仪、PCR 仪、电子显微镜等多种试验设施和仪器。

Since 1988, the Institute has carried out research on the collection and evaluation of seabuckthorn germplasm resources from both home and abroad, the breeding of new varieties, experimental demonstration and popularization. Up to the end of 2022, the institute has won 15 science and technology awards related to seabuckthorn, including 7 awards with provincial and ministerial level and 8 with other level. The seabuckthorn research team wrote or participated in the compilation and publication of 7 monographs, published more than 40 scientific and technological

1988 年起，乡村振兴所开展了国内外沙棘种质资源的搜集整理评价、新品种选育、试验示范及推广等研究工作。截止目前，乡村振兴所已获有关沙棘方面的各类科技奖 15 项， 其中省部级 7 项， 其他 8 项。编写或参编出版专著

papers, formulated 2 provincial standards, obtained 1 patent for invention and 1 patent for utility model. Six improved varieties and more than 100 strains of seabuckthorn were selected and bred. After moving from Suileng to Harbin, the Institute built about 70 mu of seabuckthorn test fields and 10 mu of seabuckthron nursery, with an annual output of 200,000 seabuckthorn seedlings. At present, there are 4 full time staffs involved in seabuckthorn related works, including one senior, one intermediate, two others.

3.Liaoning Provincial Institute for Dryland Agro-forestry Research

Liaoning Provincial Institute for Dryland Agro-forestry Research (hereinafter referred to as Dryland Institute) is located in Chaoyang City, Liaoning Province, under the Liaoning Academy of Agricultural Sciences, and was integrated by the former Liaoning Institute of Soil and Water Conservation and the Liaoning Institute of Afforestation in Arid Areas in November 2018. The main responsibilities are to carry out soil and water conservation, forest cultivation, and restoration technology for degraded ecosystems, and research on the breeding, cultivation and processing technology of new varieties of grains, fruits and vegetables, and etc. The institute has Key Laboratory of Soil Erosion & Soil and Water Conservation with Liaoning provincial level, which has scientific research equipment such as soil mass analyzer, plant runoff meter, photosynthesizer, etc. It can meet the needs of plant physiology, soil erosion and other research work. The institute has four scientific research and production bases, including seabuckthorn germplasm resource nursery, production demonstration garden, cutting orchard and breeding nursery in Chaoyang and Jianping County, with a total area of nearly 60 mu.

7 部； 发表科技论文 40 余篇； 制定省级标准 2 项。获得发明、实用新型专利各 1 项。 选育沙棘良种 6 个，品系 100 余个。在从绥棱搬迁至哈尔滨后，乡村振兴所新建沙棘各类试验场圃 70 亩、苗圃地 10 亩，年产沙棘苗木 20 万株。目前，有 4 人参与沙棘相关的各项工作，其中：正高级 1 人，中级 1 人，其他 2 人。

3. 辽宁省旱地农林研究所

辽宁省旱地农林研究所（以下简称旱地所）坐落于辽宁省朝阳市，隶属于辽宁省农业科学院，由原辽宁省水土保持研究所和原辽宁省干旱地区造林研究所于 2018 年 11 月优化整合而成。主要工作职责是开展水土保持、 森林培育、退化生态系统恢复技术，及杂粮、果蔬、林木新品种选育、栽培和加工技术研究等，设有辽宁省土壤侵蚀与水土保持重点实验室，拥有土壤团粒分析仪、植物径流仪、光合仪等科研仪器设备，能满足植物生理、土壤侵蚀等研究工作需要。全所建有 4 处科研生产基地，其中在朝阳县柳城、建平县富山两处科研 基地建有沙棘种质资源圃、生产示范园、采穗圃及育苗圃，总面积近 60 亩。

Since 1959, the Dryland Institute has started the introduction and cultivation experiment of seabuckthorn, and up to now, it has won 10 awards of various kinds, including 7 at the provincial and ministerial level, and 3 at the municipal level. , participated in the compilation of 2 monographs and published more than 60 scientific and technical papers, obtained 2 utility model patents; Formulate 2 local standards in Liaoning Province. At present, 3 improved varieties and more than 40 strains of seabuckthorn have been selected. Two multi-functional seabuckthorn breeding nurseries were established. There are 5 mu of seabuckthorn nursery garden, and providing 100,000 high-quality seabuckthorn seedlings every year, such as the varieties with big fruit introduced from abroad and hybrid-selected from F1 population between Russian-Chinese. At present, there are 8 researchers involved in seabuckthorn related works, including two senior, two deputy senior and three intermediate and one others.

从 1959 年开始，旱地所即开始沙棘引种栽培试验，截止目前，已获有关沙棘方面的各类成果奖 10 项，其中：省部级 7 项，市厅级 3 项。参编专著 2 部， 发表科技论文 60 余篇。获得实用新型专利 2 项；制定辽宁省地方标准 2 项。现 拥有沙棘良种 3 个、品系 40 多个。建立有多功能沙棘育种圃 2 处。有沙棘苗圃地 5 亩，每年可提供引进大果、蒙中杂交等优质沙棘苗木 10 万株。目前，有 8 人参与沙棘工作，其中: 正高级 2 人，副高级 2 人，中级 3 人，其他 1 人。

4.Xifeng soil and water conservation scientific experimental station, Yellow River Water Conservancy Commission

Xifeng Soil and Water Conservation Scientific Experimental Station of Yellow River Conservancy Commission (hereinafter referred to as Xifeng Water Conservation Station) is located in Qingyang City, Gansu Province. Founded in 1951, Xifeng Water Conservation Station is one of the "Three Stations" early established in the water conservation system of the Ministry of Water Resources. It is engaged in experimental research, comprehensive control and demonstration and promotion on the soil and water conservation for the Loess Plateau and gully region. Since 1957, the experimental research on seabuckthorn has covered many aspects such as raising seedlings, breeding and planting demonstration. Up to now, Xifeng Water Conservation Station has won 8 scientific and technological progress awards related

4. 黄河水利委员会西峰水土保持科学试验站

黄河水利委员会西峰水土保持科学试验站（以下简称西峰水保站）坐落在甘肃省庆阳市，成立于 1951 年，为水利部系统建站悠久的水保“三站”之一， 面向黄土高塬沟壑区从事水土保持试验研究、综合治理和示范推广等业务。从 1957 年开始，有关沙棘的试验研究涵盖了育苗、育种、种植示范等多方面工作。截止目前，已获有关沙棘方面的各类科技进步奖 8 项，其中，国家级 1 项，省部级 3 项，其他 4 项。编写或参编出版专著 4 部； 发表科技论文 50 余篇。建立多功能沙棘育种圃 2 处 49 亩，苗圃 5 亩，年产苗木 10 万株。 目前，全站有 8 人

to seabuckthorn, including 1 at the national level, 3 at the provincial and ministerial level, and 4 others, written or participated in the compilation and publication of 4 monographs, published more than 50 scientific and technological papers. Two multi-functional breeding nurseries were established, about respectively 49 mu and 5 mu, producing 100,000 seedlings annually. At present, the station has 8 full time staffs involved in seabuckthorn related work, including: one senior, two deputy senior, three intermediate and two others.

参与沙棘有关各项工作，其中， 正高级 1 人，副高级 2 人，中级 3 人，其他 2 人。

5.Tianshui soil and water conservation scientific experimental station, Yellow River Water Conservancy Commission

Tianshui Soil and Water Conservation Scientific Experimental Station of Yellow River Conservancy Commission (hereinafter referred to as Tianshui Water Conservation Station) is located in Tianshui City, Gansu Province. Founded in 1942, one of the "Three Stations" early established in the water conservation system of the Ministry of Water Resources. It is engaged in experimental research, comprehensive control and demonstration and promotion on the soil and water conservation for the beam hilly and gully region in Loess Plateau. Up to now, Tianshui Water Conservation Station has won 6 scientific and technological progress awards related to seabuckthorn, including 1 at the national level, 2 at the provincial and ministerial level, and 3 others, published more than 20 scientific and technological papers. There is about 5 mu for seabuckthorn breeding nurseries, producing 100,000 seedlings annually. At present, the station has 12 full time staffs involved in seabuckthorn related work, including: one senior, one deputy senior, two intermediate and eight others.

5. 黄河水利委员会天水水土保持科学试验站

黄河水利委员会天水水土保持科学试验站（以下简称天水水保站）坐落在甘 肃省天水市，成立于 1942 年，为水利部系统建站最为悠久的水保站，面向黄土梁状丘陵沟壑区从事水土保持试验研究、综合治理、示范推广等工作。建站后不久即开始了沙棘有关试验研究。截止目前，已获有关沙棘方面的各类科技进步奖 6 项，其中：国家级 1 项，省部级 2 项，其他 3 项。发表科技论文 20 余篇。有沙棘专用苗圃地 5 亩，年产苗木 10 万株。 目前，全站有 12 人参与沙棘有关的各项 工作，其中：正高级 1 人，副高级 1 人，中级 2 人，其他 8 人。

6. Research Institute of Qinghai-Tibetan Plateau Wild Plant Resources, Qinghai Academy of Agriculture and Forestry Sciences

6. 青海省农林科学院青藏高原野生植物资源研究所

Research Institute of Qinghai-Tibetan Plateau Wild Plant Resources is one of the 8 specialized research institutes of Qinghai Academy of Agriculture and Forestry Sciences, which was founded in 1951, located in Xining City, Qinghai Province. The Institute is one of the earliest research organization in China to carry out seabuckthorn research. Before 1982, the research of seabuckthorn in the institute had been in the forefront of relevant research in the country. At that stage, there were 3 translations of foreign information and more than 10 research reports published. The institute has a comprehensive analysis laboratory and biotechnology laboratory. Since the 1950s, the institute began to work on information, resource population, seedling, planting and ecology of seabuckthorn. Up to now, the Institute has won 4 provincial and ministerial science and technology progress awards related to seabuckthorn□participated in the compilation and publication of 3 monographs, published more than 60 scientific and technological papers, formulate 9 local standards of Qinghai province, and obtained one patent, one provincial improved variety. There are 5 mu of nursery base for seabuckthorn, producing about 100,000 high-quality seabuckthorn seedlings annually. At present, there are 7 full time staffs working on seabuckthorn research, including 2 senior, 2 deputy senior and 3 intermediate.

青海省农林科学院坐落在青海省西宁市，成立于 1951 年，下设 8 个专业研究所，野生植物研究所于 2001 年从林研所中分出。林研所是我国进行沙棘研究较早的一个研究机构，1982 年之前全所的沙棘研究已经走在了全国相关研究的前列，这一阶段发表的国外情报类译文就有 3 篇，研究报告有 10 余篇。全院设有综合分析实验室和生物技术实验室， 综合分析室有青海省技术质量监督局颁发的计量认证合格证书。从上世纪 50 年代 开始，即开始沙棘情报、群落、育苗、种植及生态等多方面工作。截止目前，野生植物所已获有关沙棘方面的省部级科技进步奖 4 项。参编出版专著 3 部； 发表科技论文 60 余篇。制定青海省地方标准 9 项。获得专利 1 项、省级良种 1 个。有沙棘专用育苗地 5 亩，年可产优质沙棘苗木 10 万株。 目前从事沙棘研究的人员有 7 人，其中正高级 2 人、副高级 2 人、中级 3 人。

7.Desert Forestry Experimental Center，Chinese Academy of Forestry

The Desert Forestry Experimental Center of Chinese Academy of Forestry (hereinafter referred to as the Center), located in Dengkou County, Inner Mongolia Autonomous Region, was established in 1979, which is mainly engaged in the fields of collecting tree species resources, the improving afforestation technology, constructing artificial oasis protection forest and studying on ecological and economic benefits in the Yellow River area. Since 1986, the Center began to study on

7. 中国林业科学研究院沙漠林业实验中心

中国林业科学研究院沙漠林业实验中心（以下简称沙林中心） 坐落在内蒙古自治区磴口县，成立于 1979 年，面向黄河河套区主要从事树种资源收集与改良造林技术、人工绿洲防护林营造技术及生态经济效益试验研究，从 1986 年开始沙棘良种选育试验研究。沙林中心有实

seabuckthorn. The Center has 2 laboratories, which can be used for routine plant physiology experiment analysis and soil physicochemical experiment analysis; In the first experimental field, there is a plant tissue culture building with an area of 427 m^2 and a modern greenhouse with an area of 1200 m^2. There is a seabuckthorn nursery house with an area of 480 m^2. In 2022, the Center mainly focused on seabuckthorn election and breeding , the production of clonal seedlings and hybrid breeding trials. In 2021, the Center cooperated with the Forestry Research Institute of Chinese Academy of Forestry and three improved varieties passed the national approval, including Hongji No. 1 (S-SV-HR-020-2021), Zhongji No. 3 (S-SV-HR-21-2021) and Zhongji No. 4 (S-SV-HR-022-2021). Relying on the project titled "Construction of National Germplasm Bank of Seabuckthorn", the seabuckthorn germplasm bank and fine varieties preservation base was carried out on the basis of existing resources, so as to realize scientific conservation and standardized management for seabuckthorn germplasm resources, and 140 mu of seabuckthorn germplasm conservation forest was planted up to now.

验室 2 个，可用于常规植物生理学实验分析和土壤理化实验分析；在第一实验场建有植物组培楼 1 座，面积 427 m^2 ，现代化温室 1 座，面积 1200 m^2；建有沙棘育苗棚 1 座，面积 480 m^2。2022 年，中国林业科学研究院沙漠林业实验中心主要围绕沙棘良种选育、沙棘无性系苗木生产和杂交选育试验等方面开展工作。2021 年，与中国林业科学研究院林业研究所合作，通过审核国家级良种 3 个，包括“红棘 1 号”（国 S-SV-HR-020 -2021）、“中棘 3 号”（国 S-SV-HR-21 -2021）和“中棘 4 号”（国 S-SV-HR-022 -2021）。依托《沙棘国家种质资源库建设》项目，以现有资源为基础，进行沙棘资源库优良品种保存区建设，实现沙棘种质资源的科学保存与资源库规范化管理；完成沙棘种质资源保存林栽植 140 亩。

8.Shanxi Academy of Forestry and Grassland Sciences(Seabuckthorn Engineering Technology Research Center, National Forestry and Grassland Administration)

Shanxi Academy of Forestry and Grassland Sciences (hereinafter referred to as Shanxi Academy of Forestry) is located in Taiyuan City, Shanxi Province, and the base for seabuckthorn breeding experiment is located in Shouyang County, Shanxi province. Shanxi Academy of Forestry was founded in 1959, mainly engaged in economic forest, forest tree breeding and cultivation, forestry ecology and landscape engineering, forest management and service functions, resource protection and utilization, etc. Since 1986, the research on seabuckthorn has

8. 山西省林业和草原科学研究院（国家林业草原局沙棘工程技术研究中心）

山西省林业和草原科学研究院（以下简称山西省林科院） 位于山西省太原市，沙棘育种试验主要基地位于山西省寿阳县。山西省林科院成立于 1959 年，面向山西省主要从事经济林、林木良种培育、林业生态与景观工程、森林经营与服务功能、资源保护及利用等方面试验研究。从 1986 年开始，有关沙棘的试验研究涵

covered all aspects as in provenance testing, improved varieties selection and breeding, clonal propagation, high-yield cultivation, extraction of flavonoids and proanthocyanidins, supercritical CO2 extraction of oil, drying of seabuckthorn fruit residue and product development etc. Up to now, it has won 2 provincial and ministerial science and technology progress awards on seabuckthorn, published more than 60 scientific and technological papers, obtained 4 patents, and formulated 2 local standards in Shanxi province. The seabuckthorn germplasm resource nursery of 4 sites with area of 106 mu was established. There are 5 mu of special seabuckthorn nursery, producing more than 100,000 high-quality seabuckthorn seedlings annually. At present, 16 full time staffs involved in sea-buckthorn related work, including 7 senior , 5 deputy senior, 4 intermediate.

盖了种源试验、良种选育、无性繁殖、丰产栽培以及黄酮和原花青素提取、油脂超临界 CO2 萃取、沙棘果渣干燥及产品研发等多方面工作。截止目前，已获有关沙棘方面的省部级科技进步奖 2 项，发表科技论文 60 余篇，获得专利 4 项，制定山西省地方标准 2 项。建立沙棘种质资源圃 4 处、106 亩；有专用沙棘苗圃 5 亩，年可产优质沙棘苗木 10 万余株。目前，山西省林科院有16人参与沙棘有关各项工作，其中: 正高级 7 人，副高级 5 人，中级 4 人 。

In 2022, the Seabuckthorn Engineering Center undertook 6 national and provincial scientific research projects, and finished the seabuckthorn scientific research, technical services, academic exchanges and achievement transformation and promotion around the subject research tasks.

2022 年，沙棘工程中心共承担国家和省级科研项目 6 项，围绕课题研究任务，开展了沙棘科学研究、技术服务、学术交流和成果转化推广等方面的工作。

In the field of seabuckthorn scientific research, carried out the seabuckthron breeding and selection, high-yield cultivation and processing technology of seabuckthorn fruit. In terms of breeding and cultivation, 43 seabuckthorn clones and 9 hybrid families were introduced from Heilongjiang, Gansu, Qinghai and Xinjiang. A regional trial in 4 different climatic zones was conducted on 120 excellent family seedlings selected from Chinese seabuckthorn (*Hippophae rhamnoides ssp. sinensis*) in central and northern Shanxi province, and 56 mu of experimental forest was established. Fifty excellent germplasm resources of seabuckthorn were collected from the middle and upper reaches of the Yellow River, and their germplasm resources fingerprints were constructed. The cultivation and management

在沙棘科学研究方面，分别开展了良种选育、丰产栽培技术及沙棘果品加工工艺等研究。在良种选育及丰产栽培研究方面，从黑龙江、甘肃、青海、新疆引进 43 个沙棘无性系、9 个杂交家系；在山西中北部 4 个不同气候区对 120 份中国沙棘优良家系苗木进行区域试验，建立试验林 56 亩；收集黄河中上游中国沙棘优良种质资源 50 份，并构建 50 份优良种质资源指纹图谱；对 180 亩人工沙棘栽培示范园进行了施

techniques such as fertilization, shaping and pruning, disease and pest control were studied in 180 mu of artificial seabuckthorn cultivation demonstration plantation.

肥、整形修剪、病虫害防治等栽培管理技术研究。

In the seabuckthorn fruit processing, the fermentation technology of seabuckthorn fruit juice was optimized, and the suitable strains and formula for fermentation were determined. The contents of main nutrients in seabuckthorn fruit residue were analyzed, and the fermentation method of biological transformation and suitable microbial fermentation parameters were established, which making the extraction of total flavonoids from seabuckthorn fruit residue was increased by more than 10%.

在沙棘果品加工工艺研究方面，优化了沙棘果汁发酵工艺，确定了沙棘果汁发酵适宜菌种及配方；分析了沙棘果渣中主要营养成分含量，建立了沙棘果渣总黄酮含量提高的生物转化发酵方式及适宜的微生物发酵工艺参数，使沙棘果渣中总黄酮含量提高了 10% 以上。

In innovation aspect, 2 local improved varieties, namely "Jinji No. 3" (Jin S-SC-HR-023-2022) and "Yanji No. 3" (Jin S-SC-HR-024-2022) were approved by related organization, the center published 5 papers, and developed 2 utility model patents as well as.

在创新成果方面，审定地方良种 2 项，分别为“晋棘 3 号”（晋 S-SC-HR-023-2022）和“雁棘 3 号”（晋 S-SC-HR-024-2022），发表论文 5 篇，研制实用新型专利 2 项。

In the transformation of research results, relying on the national standard "Afforestation Technical Regulations" and the local standard "Seabuckthorn cutting-seedling Technical Regulations", the Seabuckthorn Engineering Center undertook the central governent financially supported project of 2022 for forestry science and technology promotion demonstration titled "Seabuckthorn selected varieties propagation and afforestation technology demonstration", which produced about 70,000 seedlings of seabuckthorn fine varieties, and cultivated 450 mu of seabuckthorn demonstration afforestation, more than 300 people received technical training. It has greatly promoted the cultivation of improved varieties and the standardization of seabuckthorn orchard establishment, the project achieved a significant ecological and economic as well as social benefits.

在成果转化方面，沙棘工程中心依托国标《造林技术规程》和地方标准《沙棘扦插育苗技术规程》，承担了 2022 年中央财政林业科技推广示范项目“沙棘良种苗木繁育及造林技术示范”，培育沙棘良种苗木 7 万株，完成沙棘示范造林 450 亩，开展技术培训 300 余人次，大大促进了栽培良种化、建园标准化，取得显著的生态、经济、社会效益。

9.Gansu Agricultural University

In 2022, relying on projects titled "China-Russia Seabuckthorn Processing Technology Gansu International Science and Technology Cooperation Base" and "China-Russia Seabuckthorn Joint Scientific Research Center", Gansu Agricultural University got the international cooperation project from the Ministry of Science and Technology, "Research on Key Technologies of Seabuckthorn Berry Harvesting Equipment and Non-thermal Processing" (2014DFR31230) and the National Natural Science Foundation project "Study on Mechanism of Quick-frozen seabuckthorn Fruit Removal and Technology of Low-damage Removal in China" (52065006), the following results were obtained.

In scientific research aspect, (1) Comparison of nutritional components, functional components and antioxidant activities in different seabuckthorn fruits and leaves, including Chinese seabuckthorn (*Hippophae rhamnoides ssp. sinensis*), Hippophae tibetana and good variety Shenqiuhong. The results showed that the contents of total sugar, fructose, total acid, quinic acid and malic acid, and the contents of total phenol, total flavone, VC and VE in Chinese seabuckthorn (*Hippophae rhamnoides ssp. sinensis*) fruits were significantly higher than those of other seabuckthorn fruits, the contents of soluble sugar, titrable acid, protein and amino acid of "Shenqiuhong" fruit were significantly higher than those of other seabuckthorn. The contents of total phenol, total flavone, VC, VE (γ-VE, α-VE), total carotenoid and β-carotene in Chinese seabuckthorn leaves were the highest. The contents of total sugar, glucose, fructose, total acid, quinic acid and citric acid in the leaves of "Shenqiuhong" were the highest. The soluble sugar in the leaves of the three kinds of seabuckthorn was mainly glucose, and the organic acid was mainly quinic acid. The contents of VE, carotenoids, polyphenols and flavonoids in leaves were significantly higher than those in

9. 甘肃农业大学

2022 年度，甘肃农业大学以“中－俄沙棘加工技术甘肃省国际科技合作基地”，“中国－俄罗斯沙棘联合科研中心”为依托，在科技部国际合作项目“沙棘浆果采收设备与非热加工关键技术研究”（2014DFR31230）、国家自然科学基金项目“中国沙棘速冻脱果机理及低损伤脱果技术研究”（52065006）的支持下取得了如下研究成果。

科学研究方面：（1）不同沙棘果实和叶片的营养成份、功能成份和抗氧化活性的比较。比较了中国沙棘、西藏沙棘和“深秋红”沙棘果实和叶片的营养成份、功能成份和抗氧化活性。结果表明，中国沙棘果实的总糖、果糖、总酸、奎宁酸和苹果酸含量，及其总酚、总黄酮、VC、VE 含量显著高于其它沙棘。“深秋红”果实的可溶性糖、可滴定酸、蛋白质和氨基酸含量显著高于其它沙棘。中国沙棘叶片的总酚、总黄酮、VC、VE（γ－VE、α－VE）、总类胡萝卜素和 β－胡萝卜素含量最高。“深秋红”叶片的总糖、葡萄糖、果糖以及总酸、奎宁酸和柠檬酸含量最高。三种沙棘叶片的可溶性糖以葡萄糖为主，有机酸以奎宁酸为主。叶片的 VE、类胡萝卜素、多酚和黄酮类物质含量显著高于果实。三种沙棘叶片和果实均呈现良好的

fruits; Both leaves and fruits of the three kinds of seabuckthorn all showed better effect of antioxidant activity in vitro and cellular, and the leaves shew stronger. The antioxidant effect of Chinese seabuckthorn was the best among the three kinds of seabuckthorn.

体外和细胞抗氧化活性，叶片的抗氧化活性更强。中国沙棘的抗氧化效果在三种沙棘中表现最优。

(2)Changes and relationship of quality and dielectric properties of seabuckthorn fruits during freezing period. The effects of different freezing conditions on quality indexes and dielectric parameters of seabuckthorn fruit were evaluated by measuring the changes of quality indexes and electrical parameters of seabuckthorn fruit at different freezing temperatures and freezing times. The results showed that the lower the freezing temperature and the shorter the freezing time, the better the preservation of fruit quality. The dielectric parameter increased with the decrease of freezing temperature and the extension of freezing time. The measurement of dielectric properties is simple and without damaging the fruit, therefore, the quality of seabuckthorn fruit can be predicted by measuring the change of dielectric properties of seabuckthorn fruit during freezing.

（2）冷冻期间沙棘果实品质和介电特性的变化及其关系。通过测定沙棘果实在不同冷冻温度和不同冷冻时间条件下的品质指标和电参数变化，评估了不同冷冻条件对果实品质指标和介电参数的影响。结果表明，冷冻温度越低、冷冻时间越短、越有利于果实品质的保存，介电参数值随着冷冻温度降低而增加，也随着冷冻时间延长而增加。由于介电特性的测定较为简便，且不会破坏果实。因此，通过测定冷冻期间沙棘果实介电特性的变化可对果实的品质变化进行预测。

(3) The potential suitable distribution area of Chinese seabuckthorn was analyzed based on MaxEnt model, which was used to analyze the dominant climate factors in the potential distribution area of Chinese seabuckthorn, and to predict its potential distribution area. The results showed that annual rainfall, hydrothermal conditions in the growing season, rainfall in the driest season and the lowest temperature in the coldest month were the main climatic factors, and among which annual rainfall was the most important dominant climatic factor for limiting the distribution of Chinese seabuckthorn. The total suitable area of potential geographical distribution of Chinese seabuckthorn is 1.651 million km^2, where it is mainly distributed in western and northern of Hebei, the whole area of Shanxi, northern of Shaanxi and Qinling Mountains,

（3）基于 MaxEnt 模型分析中国沙棘的潜在适宜分布区。利用最大熵（MaxEnt）模型对中国沙棘的潜在分布区的主导气候因子进行分析，并预测中国沙棘的潜在分布范围。结果表明，年降雨情况、生长季的水热状况、最干季降雨和最冷月最低温等是限制中国沙棘分布的主要气候因素，其中年降雨是限制中国沙棘分布的主导气候因子。通过模拟得到中国沙棘潜在地理分布的总适生区面积为 165.1 万 km^2。主要集中分布于河北西部、北部，山西全境，陕西北部及秦岭山区，宁夏南部，甘肃东部、南部

southern of Ningxia, eastern and southern of Gansu and Qilian Mountains, eastern of Qinghai, western of Sichuan and eastern and central of Tibet.

及祁连山区，青海东部，四川西部和西藏东部及中部地区。

In product development aspect, (1) Device design and pilot plant test for seabuckthorn leaf scales removal and fruit threshing and cleaning. In order to reduce the diffusion of tea particle dust, improve the working environment and enhance the sensory quality of seabuckthorn leaf tea, a device for removing the leaf scales was designed, which showed that this device has remarkable effect on controlling the seabuckthorn leaf milli dust diffusion. In view of the problems such as low stripping rate, high impurity and damage rate as well as the complicated process, a fruit threshing and cleaning machine integrating crushing, fruit-removing and impurity removal was developed and designed, which showed a significant effect on fruit threshing and cleaning.

在产品开发方面：（1）沙棘叶除毫装置和沙棘脱果清选机的设计及中试。为了减少沙棘叶茶加工生产线茶毫粉尘扩散，改善生产人员作业环境及提高沙棘叶茶感官品质，设计了一种除毫装置。中试结果表明，该除毫装置除毫效果显著，可有效控制茶毫粉尘扩散。针对中国沙棘冷冻果枝脱果期间枝果脱净率低，果实含杂率和破损率高，工序复杂等问题。开发设计了一种集破碎、脱果、除杂一体的脱果清选机。中试结果表明，沙棘脱果清选机具有良好的脱果清选效果。

(2) Series beverage development, because of the high content of malic acid in Chinese seabuckthorn fruit, which lead to the taste of its products too sour. The content of total acid and malic acid can be effectively reduced, but much more release of aroma substances in seabuckthorn pulp by adding Schizomyces miliaria in seabuckthorn pulp. The seabuckthorn beverage produced by this method has a moderate sugar-acid ratio and a stronger aroma. The mixed juice was developed by combining Huangguan pear juice or celery juice with seabuckthorn raw pulp, that the flavor, color and aroma of the mixed juice were significantly better than those of pasteurized products, and the active components of seabuckthorn were well preserved. The aging treatment to seabuckthorn honey fermented wine was carried out by means of ultra-high pressure, microwave and ultrasonic wave, the test showed that all treatments could improve the physicochemical properties and aroma quality of the samples, and ultra-high pressure aging is the best for maintaining the aroma, taste

（2）系列饮料开发，中国沙棘果实较高含量的苹果酸会导致其产品口味过酸。通过在沙棘原浆中添加粟酒裂殖酵母，可有效降低沙棘原浆的总酸和苹果酸含量，原浆中更多香气物质的释放。采用该法生产的沙棘饮料糖酸比适中，香气更浓。采用黄冠梨汁或芹菜汁与沙棘原浆复配研发混合果汁，通过超高压对混合果汁进行杀菌处理，制得的复合沙棘果汁饮料风味、颜色和香气显著优于巴氏灭菌产品，且良好保存了沙棘的活性成分。采用超高压、微波、超声波等方法对沙棘蜂蜜发酵酒进行催陈处理。结果显示，处理均可改善样品的理化性质和香气质量，其中超高压催陈样品的香气、口感、酒体和颜色的评价最高，其总酚和类黄酮成分

and color of the samples, and also preserved the antioxidant capacity stronger.

保存更好，抗氧化能力更强。

One Belgian international invention patent was granted with title of "seabuckthorn tea rich in proanthocyanidins for the prevention of alcohol-induced intestinal damage (BE202/5714)" .

论文、专利成果，发表相关论文一篇；授权一项比利时国际发明专利“富含沙棘籽原花青素的能够预防酒精性肠道损伤的沙棘茶”（BE2021/5714）。

10.Dalian Minzu University

10. 大连民族大学

Dalian Minzu University is affiliated to the State Ethnic Affairs Commission, the only one university for ethnic minorities located in the open areas of Northeast China and coastal areas on the construction purpose of high-level modern comprehensive university. The university has 2 first-level master's programs in biological engineering and Ethnology, and 6 professional master's degree programs in forestry and etc. It has 12 provincial and ministerial key disciplines, 10 provincial and ministerial key laboratories for biotechnology and resource utilization, and 6 provincial and ministerial engineering (technology) research centers. 2 virtual teaching and research construction pilots approved in the second batch of he Ministry of Education, 14 provincial and ministerial-level practical education bases, 9 of undergraduate experimental teaching demonstration centers and 3 virtual simulation experimental teaching center with provincial and ministerial level. The National Innovation Alliance of Shiny Leaf Yellowhorn (*Xanthoceras sorbifolium Bunge*) Industry was approved to establish, and won two second prizes of the National Science and Technology Progress Award and two second prizes of the National Teaching Achievement Award. The university has 1305 staff members, of which 70% have a doctor's degree and nearly 95% have a master's degree or above.

Dalian Minzu University has long been engaged in the research of "innovation and utilization of woody oil germplasm resources, including the yield, quality, resistance formation and regulation

大连民族大学隶属于国家民族事务委员会，是全国 110 多所中央部属高校之一，是国家唯一设在东北和沿海开放地区、以工科为主多学科协调发展的民族高等学校，学校以铸牢中华民族共同体意识为主线，建设目标为高水平现代化综合大学。学校拥有生物工程、民族学 2 个一级学科硕士点，拥有林业等 6 个硕士专业学位授权点。拥有省部级重点学科 12 个，生物技术与资源利用教育部重点实验室等省部级重点实验室 10 个，省部级工程（技术）研究中心等 6 个。拥有教育部第二批虚拟教研室建设试点 2 个，省部级实践教育基地 14 个，省部级本科实验教学示范中心 9 个，省部级虚拟仿真实验教学中心 3 个。获批组建文冠果产业国家创新联盟，获国家科技进步二等奖 2 项，国家级教学成果二等奖 2 项。学校现有教职工 1305 人，专任教师中有博士学位的占近 70%，有硕士以上学位的教师近 95%。

mechanism analysis, breeding, cultivation and utilization of seabuckthorn and other woody oil plants. It has undertaken 1 European Union Marie Curie IIF project, 12 National Natural Science Foundation projects, 1 National 863 Program, 2 sub-projects supported program of national science and technology and 6 provincial and ministerial key projects. 8 new plant varieties and 4 improved varieties have been cultivated by hybridization and marker-assisted selection breeding methods. The university has a large number of better natural resources like seabuckthorn, shiny leaf yellowhorn and tea-oil tree, especially the seabuckthorn resources with excellent properties. In recent years, the yield, quality, resistance formation and regulation mechanism of woody oil plants have been studied, a series of genes, transcription factors and non-coding RNA associated with important traits were identified, their functions are analyzed, the regulatory network between them is constructed. The University has obtained 15 authorized invention patents, published 72 SCI indexed papers, formulated 5 local standards and 2 group standards, and won 7 provincial and ministerial scientific research awards. The promotion of varieties and technology has reached 18,240 ha (273,600 mu) and the projects have achieved significant economic, ecological and social benefits.

大连民族大学长期从事“木本油料种质资源创新与利用”，包括沙棘等木本油料产量、品质和抗性形成与调控机制解析、育种、栽培和利用等方面的研究工作，先后承担的欧盟玛丽居里 IIF 项目 1 项、国家自然科学基金 12 项、国家 863 计划 1 项、国家科技支撑计划子课题 2 项及省部级重点项目 6 项。采用杂交和分子标记辅助选择育种方法培育出林木新品种 8 个、良种 4 个；持有大量的沙棘、文冠果和油茶资源，特别是具有优良性状的沙棘资源。近年来致力于木本油料产量、品质和抗性形成与调控机制的研究，鉴定了一系列重要性状相关的基因、转录因子和非编码 RNA 等；分析了它们的功能；构建了它们之间的调控网络；获授权发明专利 15 项，发表 SCI 收录论文 72 篇，制定地方标准 5 项、团标 2 项，获省部级科研奖励 7 项。品种和技术已推广 27.36 万亩，带动 10.76 万人长效致富，取得了显著的经济、生态和社会效益。

5. The situation of seabuckthorn practitioners in China, the main member units of the International Seabuckthorn Association (China) Enterprise Committee

五、中国沙棘从业人员情况，国际沙棘协会（中国）企业委员会主要会员单位介绍

For more than thirty years, China has established a powerful seabuckthorn expert team, with around 15,000 professionals, covering forestry, agriculture, water and soil conservation, gardening, medicine, health and other more than 10 sectors and fields, etc., who are highly qualified and come from major universities and professional research institutes all over the country with a strong advantages over

三十多年来，中国拥有强大的沙棘专家团队，涉及的技术专业领域广泛。沙棘从业人员约 15000 多人，包括林业、农业、水土保持、园艺、卫生等十多个行业和领域，专家资历深厚，来自全国各大高等院校及专业科研院所，专家

other countries. The international cooperation project on seabuckthorn has achieved good results by joint cooperation of experts.

力量较其他国家具有很强的优势，通过专家联合，共同开展沙棘国际合作项目，取得了很好的成效。

The Enterprise Committee (China) as a sub-organization of International Seabuckthorn Association, was established in May 2017, with 103 group members by the end of 2022. (shown in Table 3)

国际沙棘协会（中国）企业委员会成立于 2017 年 5 月，是国际沙棘协会的二级机构，截止 2022 年底有团体会员 103 个。（详见表 3）

Table 3. Name list of Enterprise Committee (China) of ISA
表 3. 国际沙棘协会（中国）企业委员会团体会员名单

序号 No	名称 Name of member	备注 Title in Committee	联系人 Contact person	职务 Title
1	高原圣果沙棘制品有限公司 CONSECO Seabuckthorn Co. Ltd	会长单位 Chairman	殷丽强 YIN Liqiang	总经理 General Manager
2	北京宝得瑞健康产业有限公司 Beijing Powdery Health Industrial Co. Ltd	副会长单位 Vice Chairman	王辉斌 WANG Huibin	总经理 General Manager
3	北京汇源食品饮料有限公司 Beijing Huiyuan Food & Beverage Co., Ltd	副会长单位 Vice Chairman	李生延 LI Shengyan	副总裁 Vice President
4	河北神兴沙棘研究院 Hebei Shenxing Seabuckthorn Academy	副会长单位 Vice Chairman	张泽凯 ZHANG Zekai	营销总监 Marketing Manager
5	吕梁野山坡食品有限责任公司 Lvliang Yeshanpo Food Co.Ltd	副会长单位 Vice Chairman	牛茂林 NIU Maolin	董事长 Chairman
6	吉林吉隆东北沙棘产业有限责任公司 Inner Mongolia Jilong Eco-tech Co. Ltd	副会长单位 Vice Chairman	刘三利 LIU Sanli	董事长 Chairman
7	上海容邦企业集团有限公司 Shanghai Rongbang Enterprise Group Co., Ltd.	副会长单位 Vice Chairman	李相军 LI Xiangjun	董事长 Chairman
8	陕西海天制药有限公司 Shaanxi Haitian Pharmaceutical Co.Ltd	副会长单位 Vice Chairman	宋凯乐 SONG Kaile	董事长助理 Assistant Chairman
9	青海康普生物科技股份有限公司 Qinghai Kangpu Biotechnology Co., Ltd.	副会长单位 Vice Chairman	孙允武 SUN Yunwu	总经理 General Manager
10	新疆康元生物技术集团股份有限公司 Xinjiang Kangyuan Bio-tech Co. Ltd	副会长单位 Vice Chairman	刘宗浩 LIU Zonghao	董事长 Chairman

11	新疆达尔生物科技有限公司 Xinjiang Dar Biotechnology Co., Ltd	副会长单位 Vice Chairman	张杰 ZHANG Jie	总经理 General Manager
12	山西五台山沙棘制品有限公司 Shanxi Wutaishan Seabuckthorn Co. Ltd	理事单位 Board member	赵志侃 ZHAO Zhikan	董事长 Chairman
13	承德宇航人高山植物应用技术有限责任公司 Chengde Yuhangren Alpine Plant Application Technology Co., Ltd.	理事单位 Board Member	刘春海 LIU Chunhai	董事长 Chairman
14	山西省林业和草原科学研究院 Shanxi Academy of Forestry and Grassland Sciences	理事单位 Board Member	贺义才 HE Yicai	所长 Director
15	鸿泰农林科技开发有限公司 Hongtai Agri-Forestry Technical Development Co. Ltd	理事单位 Board member	张艳锋 ZHANG Yanfeng	董事长 Chairman
16	山西科林生物技术开发有限公司企业 Shanxi Kelin Bio-tech Development Co. Ltd	理事单位 Board member	宁聚保 NING Jubao	总经理 General Manager
17	山西助农药茶资源开发有限公司 Shanxi Zhunong Herbal Tea Resources Development Co. Ltd	理事单位 Board member	宫铁军 GONG Tiejun	董事长 Chairman
18	内蒙古淳点实业有限公司 Inner Mongolia Chundian Industry Co. Ltd	理事单位 Board member	毕书杰 BI Shujie	董事长 Chairman
19	内蒙古森工集团有限公司 Inner Mongolia Wood Industry Co. Ltd	理事单位 Board member	许玉成 XU Yucheng	处长 Division Chief
20	内蒙古大兴安岭重点国有林管理局 Inner Mongolia Daxinganling State-owned Forestry Bureau	理事单位 Board member	周艳昌 ZHOU Yanchang	总会计师 Chief Accountant
21	内蒙古沙漠之花生态产业科技有限公司 Inner Mongolia Shamozhihua Bio-industry Tech Co. Ltd	理事单位 Board member	胥申 XU Shen	董事长 Chairman
22	内蒙古宇航人高技术产业有限责任公司 Inner Mongolia Yuhangren High-tech Industry Co. Ltd	理事单位 Board member	姚玉军 YAO Yujun	业务经理 Manager
23	内蒙古鄂尔多斯乌兰集团公司 Inner Mongolia Erdos Wulan Group Co.	理事单位 Board member	康占义 KANG Zhanyi	副总经理 Deputy General Manager
24	大连民族大学植物研究所 Botanical Institute of Dalian Minzu University	理事单位 Board member	阮成江 RUAN Chengjiang	所长 Director
25	辽宁省旱地农林研究所 Liaoning Provincial Institute for Dryland Agro-forestry Research	理事单位 Board member	张东为 ZHANG Dongwei	副所长 Deputy Director
26	因科瑞斯药业（营口）有限公司 Increase Pharmaceuticals (Yingkou) Co., Ltd.	理事单位 Board member	胡小虎 HU Xiaohu	部门经理 Department Manager

27	黑龙江圣宝泰农业有限公司 Heilongjiang Shengbaotai Agriculture Co. Ltd	理事单位 Board member	赵胜臣 ZHAO Shengchen	董事长 Chairman
28	黑龙江省八面通林业局 Bamiantong Forestry Bureau of Heilongjiang Province	理事单位 Board member	段国庆 DUAN Guoqing	副局长 Deputy Head
29	黑龙江延寿县鼎鑫生物工程有限公司 Heilongjiang Yanshou County Dingxin Bioengineering Co.Ltd	理事单位 Board member	张建东 ZHANG Jiandong	总经理 General Manager
30	黑龙江众源冬果沙棘开发有限责任公司 Heilongjiang Zhongyuan Dongguo Seabuckthorn Development Co.Ltd	理事单位 Board member	杜中元 DU Zhongyuan	董事长 Chairman
31	黑龙江省农业科学院乡村振兴研究所 Heilongjiang Academy for Agricultural Science	理事单位 Board member	单金友 SHAN Jinyou	研究员 Chief Researcher
32	林下产业黑龙江有限公司 Forest Industry Heilongjiang Co., Ltd.	理事单位 Board member	丛志甲 CONG Zhijia	总经理 General Manager
33	上海沃迪智能装备股份有限公司 Shanghai Wodi Smart Equipment Corporation	理事单位 Board member	王冲 WANG Chong	业务经理 Manager
34	江苏嘉奥网络科技有限公司 Jiangsu Jiaao Network Technology Co., Ltd	理事单位 Boder Member	陈芳 CHEN Fang	经理 Manager
35	四川星瑞健康产业集团有限公司 Sichuan Xingrui Health Industry Group Co., Ltd.	理事单位 Board Member	莫勇 MO Yong	总经理 General Manager
36	陕西黄龙国寿堂生物工程有限公司 Shaanxi Huanglong Guoshoutang Bioengineering Co. Ltd	理事单位 Board member	陈家顺 CHEN Jiashun	董事长 Chairman
37	清华德人西安幸福制药有限公司 Qinghua Deren Xi’an Happiness Pharmaceutical Co. Ltd	理事单位 Board member	刘红娜 Liu Hongna	研究员 Researcher
38	兰州大学药学院 College of Pharmacy, Lanzhou University	理事单位 Board member	杨志刚 YANG Zhigang	副院长 Vice Dean
39	青海倍力甘草科技发展有限责任公司 Qinghai Beili Licorice Science and Technology Development Co., Ltd	理事单位 Board Member	骆俊才 LUO Juncai	董事长 Chairman
40	新疆景华天宝科技发展有限公司 Xinjiang Jinghua Tianbao Tech-development Co. Ltd	理事单位 Board member	刘佳羽 LIU Jiayu	总经理 General Manager
41	新疆疆果四季科技有限公司 Xinjiang Jiangguo Siji Technology Co., Ltd	理事单位 Board member	步艳东 BU Yandong	总经理 General Manager
42	新疆慧华沙棘生物科技有限公司 Xinjiang Huihua Seabuckthorn Bio-tech Co. Ltd	理事单位 Board member	蔡永国 CAI Yongguo	经理 Manager

43	新疆中科沙棘科技有限公司 Xinjiang Zhongke Seabuckthorn Tech Co. Ltd	理事单位 Board Member	徐均 XU Jun	总经理 General Manager
44	新疆喀纳斯亿嘉康生物科技有限公司 Xinjiang Kanas Yijiakang Biotechnology Co., Ltd.	理事单位 Board Member	彭正荣 PENG Zhengrong	总经理 General Manager
45	新疆昆仑天和国际贸易有限公司 Xinjiang Kunlun Tianhe International Trade Co., Ltd.	理事单位 Board Member	蒋剑飞 JIANG Jianfei	总经理 General Manager
46	中国农业科学院农业资源与农业区划研究所 Institute of Agricultural Resources and Zoning, CAAS	会员单位 Member	尤飞 YOU Fei	研究员 Chief Researcher
47	山西山阳生物药业有限公司 Shanxi Shanyang Bio-Medicine Co. Ltd	会员单位 Member	姜瑞林 JIANG Ruilin	总经理 General Manager
48	山西维仕杰食品饮料有限责任公司 Shanxi Weishijie Food & Drink Co. Ltd	会员单位 Member	赵永卫 ZHAO Yongwei	董事长 Chairman
49	山西金科海生物科技有限公司 Shanxi Jinkehai Bio- tech Co. Ltd	会员单位 Member	郭海利 GUO Haili	董事长 Chairman
50	山西献果园生物科技有限公司 Shanxi Xianguoyuan Bio-tech Co. Ltd	会员单位 Member	曹满 CAO Man	董事长 Chairman
51	山西葆源生物科技有限公司 Shanxi Baoyuan Bio-tech Co. Ltd	会员单位 Member	郭林宝 GUO Linbao	总经理 General Manager
52	山西恒义生物科技有限公司 Shanxi Hengyi Bio-tech Co. Ltd	会员单位 Member	许张兵 XU Zhangbing	总经理 General Manager
53	山西高原圣果沙棘生物有限公司 Shanxi Gaoyuanshengguo Seabuckthorn Biological Co. Ltd	会员单位 Member	武国昌 WU Guochang	总经理 General Manager
54	山西待见生物科技有限公司 Shanxi Daijiane Biotechnology Co., Ltd	会员单位 Member	陈志辉 CHEN Zhihui	总经理 General Manager
55	大山小果生物科技（山西省）有限公司 Dashan Xiaoguo Biotechnology (Shanxi Province) Co., Ltd	会员单位 Member	邢如乐 XING Rule	总经理 General Manager
56	内蒙古万柳生态农业有限责任公司 Inner Mongolia Wangliu Eco-agriculture Co. Ltd	会员单位 Member	郭秋实 GUO Qiushi	董事长 Chairman
57	内蒙古大唐药业股份有限公司 Inner Mongolia Datang Pharmaceutical Co. Ltd	会员单位 Member	梁国栋 LIANG Guodong	总经理 General Manager
58	内蒙古吉文林业局 Inner Mongolia Jiwen Forestry Bureau	会员单位 Member	杨英新 YANG Yingxin	总经理 General Manager

59	内蒙古毕拉河林业局 Inner Mongolia Bilahe Forestry Bureau	会员单位 Member	杨静磊 YANG Jinglei	主任 Director
60	内蒙古库都尔林业局 Inner Mongolia Kuduer Forestry Bureau	会员单位 Member	王获玺 WANG Huoxi	主任 Director
61	内蒙古大杨树林业局 Inner Mongolia Dayangshu Forestry Bureau	会员单位 Member	王元成 WANG Yuancheng	主任 Director
62	内蒙古蒙鑫农林产业科技有限公司 Inner Mongolia Mengxin Agri-forestry Industrial Technology Co. Ltd	会员单位 Member	高玉琼 GAO yuqiong	总经理 General Manager
63	内蒙古大沙棘实业（集团）有限公司 Inner Mongolia Dashaji Industrial Co. Ltd	会员单位 Member	陈羿达 CHEN Yida	总经理 General Manager
64	内蒙古鄂尔多斯市天骄资源发展有限责任公司 Inner Mongolia Erdos Tianjiao Resource Development Co. Ltd	会员单位 Member	李云飞 LI Yunfei	董事长 Chairman
65	内蒙古森工集团阿尔山森林工业有限公司 Inner Mongolia Forest Industry Group Alshan Forest Industry Co. LTD	会员单位 Member	徐成才 XU Chengcai	总经理 General Manager
66	吉林修养堂药业保健品有限公司 Jilin Xiuyangtang Pharmaceutical & Healthcare Product Co. Ltd	会员单位 Member	李晓光 LI Xiaoguang	董事长 Chairman
67	吉林省富智达生态科技发展有限公司 Jinlin Fuzhida Eco-tech Development Co. Ltd	会员单位 Member	刘杰 LIU Jie	经理 Manager
68	黑龙江省长乐山大果沙棘开发有限公司 Heilongjiang Changleshan Seabuckthorn Development Co. Ltd	会员单位 Member	王忠校 WANG Zhongxiao	董事长 Chairman
69	黑龙江延寿县御禄园茶业有限公司 Heilongjiang Yanshou County Yuluyuan Tea Industry Co. Ltd	会员单位 Member	李承捷 LI Chengjie	董事长 Chairman
70	黑龙江盛农食品有限公司 Heilongjiang Shengnong Food Co. Ltd	会员单位 Member	姚忠华 YAO Zhonghua	董事长 Chairman
71	黑龙江牡丹江东安区康利果蔬农民专业合作社 Mudanjiang Donganqu Kangli Fruit & Vegetable Farmer Cooperative	会员单位 Member	邵珠宽 SHAO Zhukuan	经理 Manager
72	黑龙江金科沙棘有限公司 Heilongjiang Jinke Seabuckthorn Co. LTD	会员单位 Member	王忠国 WANG Zhongguo	董事长 Chairman
73	牡丹江市大棘生物科技有限公司 Mudanjiang Daji Biotechnology Co., Ltd.	会员单位 Member	刘宇航 LIU Yuhang	总经理 General Manager
74	江苏常州燕和堂商贸有限公司 Changzhou Yanhetang Trade Co. Ltd	会员单位 Member	陈从梅 CHEN Congmei	董事长 Chairman

75	江苏扬州福尔喜果蔬汁机械有限公司 Yangzhou Fuerxi Fruit & Vegetable Juice Machinery Co.Ltd	会员单位 Member	许荣华 XU Ronghua	董事长 Chairman
76	浙江杭州沙美生物科技有限公司 Hangzhou Shamei Bio-tech Co. Ltd	会员单位 Member	李云天 LI Yuntian	经理 Manager
77	宁波元硕生物科技开发有限公司 Ningbo Yuanshuo Bio-tech Co. Ltd	会员单位 Member	赵晓峰 ZHAO Xiaofeng	总经理 General Manager
78	山东清香茗泽农业科技有限公司 Shandong Qingxiang Mingze Agri-tech Co. Ltd	会员单位 Member	于海洋 YU Haiyang	总经理 General Manager
79	山东菏泽中禾健元生物科技有限公司 Shandong Heze Zhonghe Jianyuan Bio-Tech Co. Ltd	会员单位 Member	储文宾 CHU Wenbin	总经理 General Manager
80	滨州一诺惠泽生物科技有限公司 Binzhou Yinuo Huize Biotechnology Co., Ltd	会员单位 Member	杜高翔 DU Gaoxiang	董事长 Chairman
81	河南胜景堂生物科技有限公司 Henan Shengjingtang Bio-tech Co. Ltd	会员单位 Member	韩宜冬 HAN Yidong	董事长 Chairman
82	纯真时代生物科技（广州）有限公司 Chunzhen Times Biotechnology (Guangzhou) Co., Ltd	会员单位 Member	关伟 GUAN Wei	董事长 Chairman
83	四川成都川大华西保健品有限公司 Sichuan Chengdu Chuanda Huaxi Healthcare Product Co. Ltd	会员单位 Member	黄祥芳 HUANG Xiangfang	经理 Manager
84	成都骏亿丰商贸有限公司 Chengdu Junyifeng Trading Co., Ltd	会员单位 Member	赵大勇 ZHAO Dayong	总经理 General Manager
85	陕西尔林兔药业有限公司 Shanxi Erlintu Pharmaceutical Co. Ltd	会员单位 Member	李勇建 LI Yongjian	总经理 General Manager
86	延安圆方（集团）公司 Yan’an Yuanfang (Group) Company	会员单位 Member	赵志强 ZHAO Zhiqiang	总经理 General Manager
87	甘肃甘农生物科技有限公司 Gansu Gannong Bio-tech Co. Ltd	会员单位 Member	傅雨萌 FU Yumeng	总经理 General Manager
88	甘肃艾康沙棘制品有限公司 Gansu Aikang Seabuckthron Co. Ltd	会员单位 Member	马静 MA Jing	总经理 General Manager
89	青海久实虫草生物科技有限公司 Qinghai Jiushi Chongcao Bio-tech Co. Ltd	会员单位 Member	曾静 ZENG Jing	经理 Manager
90	青海安旭生物科技集团有限公司 Qinghai Anxu Bio-tech Co. Ltd	会员单位 Member	马安成 MA Ancheng	经理 Manager

91	青海伊纳维康生物科技有限公司 Qinghai Tangut Bio-tech Co. Ltd	会员单位 Member	董树林 DONG Shulin	副总经理 Vice General Manager
92	宁夏隆薯闽宁助残商贸中心 Ningxia Longsu Minning Zhucan Trade Center	会员单位 Member	辛同宝 XIN Tongbao	总经理 General Manager
93	新疆西域珍品生物科技有限公司 Xinjiang Xiyuzhenpin Bio-tech Co. Ltd	会员单位 Member	李婧 LI Jing	总经理 General Manager
94	新疆乌苏市佳禾畜牧科技有限公司 Xinjiang Wusu Jiahe Livestock-tech Co. Ltd	会员单位 Member	宋悦恒 SONG Yueheng	经理 Manager
95	新疆吉萃元农业科技有限公司 Xinjiang Jicuiyuan Agricultural Science and Technology Co., Ltd	会员单位 Member	陶桐生 TAO Tongsheng	总经理 General Manager
96	新疆金圣果农业专业合作社 Xinjiang Jinshengguo Agricultural Professional Cooperative	会员单位 Member	赵军丰 ZHAO Junfeng	总经理 General Manager
97	新疆青河县隆濠生物科技发展有限公司 Xinjiang Qinghe County Longhao Bio-tech Co. Ltd	会员单位 Member	孙文胜 SUN Wensheng	总经理 General Manager
98	新疆一七零团丝路沙棘生物科技有限公司 Xinjiang 170 Tuan Silk Road Seabuckthorn Bio-technology Co., Ltd.	会员单位 Member	王军扬 WANG Junyang	总经理 General Manager
99	阿勒泰太阳石健康产业发展有限公司 Altay Sunstone Health Industry Development Co., LTD	会员单位 Member	邓惠中 DENG Huizhong	总经理 General Manager
100	新疆布尔津县松源林果生物科技有限公司 Xinjiang Burjin County Songyuan Linguo Bio-technology Co., Ltd	会员单位 Member	靳慧林 JIN Huilin	董事长 Chairman
101	新疆戈壁记忆品牌管理有限公司 Xinjiang Gobi Memory Brand Management Co., Ltd.	会员单位 Member	张文莉 ZHANG Wenli	董事长 Chairman
102	新疆汇邦生物科技有限公司 Xinjiang Huibang Biotechnology Co., Ltd	会员单位 Member	李波 LI Bo	总经理 General Manager
103	新疆吉克普林沙棘生物科技有限公司 Xinjiang Jike Pulin Seabuckthorn Biotechnology Co., Ltd	会员单位 Member	赵丹 ZHAO Dan	总经理 General Manager

6. Introduction of important activities, major events in 2022

(1) About the International Cooperation

At present, China has initially established cooperative association with Russia, Germany, France, Greece, Latvia, Romania, Finland, Sweden, Mongolia, Japan, Korea, India, Nepal, Pakistan, Kyrgyzstan, Iran, Canada, the United States, Chile, Peru, Bolivia, and other countries. And once got the technical and financial supports for technology and economic cooperation from the World Bank, the United Nations Development Programme, the European Union, Perot Fund of the Group 77, and International Centre for Integrated Mountain Development , the cooperation on seabuckthorn with other countries have been carried out each year.

Chinese government attaches great importance to ecological progress and has put forward the "Belt and Road Initiatives". Seabuckthorn is a kind of efficient soil and water conservation plant, which can improve ecological environment and promote economic development, with its great ecological value and economic value. It is the good opportunity for seabuckthorn development in conjunction with the "Belt and Road Initiatives", to promote bilateral and multilateral seabuckthorn exchanges and cooperation. Along the Belt and Road there are related to 65 countries and regions globally, more than a dozen countries, including Russia, Mongolia, Kazakhstan, Tajikistan, Uzbekistan, Iran, India, Nepal, Pakistan, Germany, Finland, Latvia, etc. who have already carried out seabuckthorn cultivation and industrial development, and have a solid base for cooperation.

International Seabuckthorn Association as an international non-governmental, non-profit

六、2022 年中国有关沙棘的重要活动、重大事项介绍

1. 国际合作开展情况

目前，中国已初步建立了与俄罗斯、德国、英国、法国、希腊、拉脱维亚、罗马尼亚、芬兰、瑞典、蒙古、日本、朝鲜、印度、尼泊尔、巴基斯坦、吉尔吉斯斯坦、伊朗、加拿大、美国、智利、秘鲁、玻利维亚等国家的合作联系，并曾经获得了世界银行、联合国开发署、欧盟、77 国集团佩罗基金、国际山地综合开发中心等国际组织的技术和资金支持，每年与各国开展沙棘科技交流或经济合作。

中国政府高度重视生态文明建设，提出“一带一路”倡议。沙棘是一种高效的水土保持植物，可以改善生态环境，促进经济发展。沙棘具有巨大的生态价值和经济价值。我们必须抓住政策上的重大机遇，特别是与“一带一路”倡议相结合，推动双边和多边沙棘国际交流与合作。在“一带一路”相关的 65 个国家和地区中，有十多个国家（包括俄罗斯、蒙古、哈萨克斯坦、塔吉克斯坦、乌兹别克斯坦、伊朗、印度、尼泊尔、巴基斯坦、德国、芬兰、拉脱维亚等）已经开展沙棘种植和产业发展，具备一定的基础条件。

国际沙棘协会是由中国、德国、俄罗斯、芬兰等国专家于 2001 年发起成立，由全球积极开

organization, and with members from seabuckthorn enterprises, research institutes and individuals was launched in 2001 by international seabuckthorn experts from China, Germany, Russia, Finland. And in 2011, ISA was approved by the Chinese Ministry of Foreign Affairs and Ministry of Water Resources and then officially certificated by Ministry of Civil Affairs, which is the 27th international organization headquartered in China.

展沙棘研究与开发的企事业单位、个人和其他组织自愿组成的学术性、行业性国际非政府、非营利组织，是经中国外交部同意、水利部批准，于 2011 年在中国民政部正式注册、第 27 个总部设在中国的国际性社团机构。

On October 15, 2019, at the General Assembly of International Seabuckthorn Association held in Berlin, Germany, 14 members from 7 countries, including China, Germany, Russia, Finland, Latvia, India and Canada, were elected as the second Board of Directors. Mr. ZHAO Dongxiao, former Director General of Management Center for Seabuckthorn Development, Ministry of Water Resources, and Prof. LU Shunguang, Deputy Director General were elected as Chairman and Secretary General of International Seabuckthorn Association respectively. Mr. Veli-markku Korteniemi from Finland, Dr. Jorg-Thomas Morsel from Germany and Dr. Yury A. Zubarev from Russia were elected as Vice Chairmen respectively. Professor Baoru YANG from Turku University, Finland was elected as the new Chairperson of Scientific Committee of International Seabuckthorn Association. (As shown in Table 4)

2019 年 10 月 15 日，在德国柏林召开的国际沙棘协会会员代表大会上，选举产生了由来自中国、德国、俄罗斯、芬兰、拉脱维亚、印度、加拿大等 7 个国家的 14 名成员组成的第二届理事会。在随后召开的国际沙棘协会第二届理事会第一次会议上，水利部沙棘开发管理中心主任赵东晓、副主任卢顺光分别当选为国际沙棘协会理事会主席、秘书长。来自芬兰的 Veli-Markku Korteniemi、德国的 Jörg-Thomas Mörsel、俄罗斯的 Yury A. Zubarev 分别当选为副主席。芬兰图尔库大学杨宝茹教授当选为新一届国际沙棘协会科技委员会主席。（详见附表 4）

Table.4 Name-list for Board Members of International Seabuckthorn Association
表 4. 国际沙棘协会理事会成员名单

序号	姓名 name	性别 Sex	国家 Country	工作单位 Employed Institution	职 务 Title	在协会的任职 Title in ISA
1	赵东晓 ZHAO Dongxiao	男 M	中 国 China	水利部沙棘开发管理中心 Management Center for Seabuckthorn Development, Ministry of Water Resource	原主任 Director General	主席、理事 Chairman
2	维里·马尔库·科特涅米 Veli-Markku Korteniemi	男 M	芬 兰 Finland	Aromtech 有限公司 Aromtech Ltd	总经理 General Manager	副主席、理事 Vice Chairman
3	约尔·托马斯·莫塞尔 Jörg-Thomas Mörsel	男 M	德 国 Germany	UBF 有限公司 UBF Ltd	首席执行官 CEO	副主席、理事 Vice Chairman
4	尤里·祖巴列夫 Yury A. Zubarev	男 M	俄罗斯 Russia	西伯利亚利萨文科园艺研究所 Lisavenko Research Institute of Horticulture for Siberia	高级研究员 Senior Researcher	副主席、理事 Vice Chairman
5	吕荣森 LU Rongsen	男 M	中 国 China	中国科学院成都生物研究所 Biology Institute,Chinese Academy of Science	教授 Professor	理 事 Board member
6	维伦德拉·辛格 Virendra Singh	男 M	印 度 India	喜马偕尔邦农业大学 CSK Himachal Pradesh Agricultural University	教授，印度沙棘协会秘书长 Professor	理 事 Board member
7	莫沫 MO Mo	男 M	中 国 China	水利部水土保持司 Dep.of Soil and Water Conservation	副司长 Deputy Director General	理 事 Board member
8	杨宝茹 YANG Baoru	女 F	芬 兰 Finland	图尔库大学 University of Turku	教授，食品科学系主任 Professor, Head of Dept. of Food Science	理 事 Board member
9	达里加 瑟格丽娜 Dalija Seglina	女 F	拉脱维亚 Latvia	拉脱维亚园艺研究所 Institute of Horticulture, Latvia	加工生化部主任 Head of Unit of Processing and Biochemistry	理 事 Board member
10	纳塔莉亚·杰米多娃 Natalia Demidova	女 F	俄罗斯 Russia	俄罗斯北方林业研究所 Northern Research Institute of Forestry	科学部副主任 Deputy Director on Sciences	理 事 Board member
11	安德烈·布鲁威利斯 Andrejs Bruvelis	男 M	拉脱维亚 Latvia	拉脱维亚沙棘协会 Seabuckthorn Association of Latvia	主 席 Head	理 事 Board member
12	阿尔芬斯·乌提欧 Alphonsus Utioh	男 M	加拿大 Canada	食品研发中心 Center for Food Research and Development	博 士 Senior Researcher	理 事 Board member
13	卢顺光 LU Shunguang	男 M	中 国 China	水利部沙棘开发管理中心 Management Center for Seabuckthorn Development, Ministry of Water Resource	副主任 Deputy Director General	秘书长、理事 Secretary General
14	夏静芳 XIA Jingfang	女 F	中 国 China	水利部沙棘开发管理中心 Management Center for Seabuckthorn Development, Ministry of Water Resource	处 长 Division Chief	副秘书长、理事 Deputy Secretary General

Since the establishment of ISA, 8 times of International Seabuckthorn Conferences have been successfully held in India, Germany, Canada, Russia and China normally every two years. In August 2018, ISA Board meeting decided to hold the 9th International Seabuckthorn conference in Thessaloniki, Greece, in May 2023, with the theme of Seabuckthorn in a changing climate: New challenges, new technologies and new Perspectives.

国际沙棘协会自成立以来，已先后在印度、德国、加拿大、俄罗斯和中国成功举办了 8 届两年一次的国际学术大会。2018 年 8 月理事会决定，主题为“不断变化气候条件下的沙棘：新挑战、新技术和新前景”的第九届国际沙棘协会大会将于 2023 年 5 月在希腊塞萨洛尼基市举办。

On November 1, 2022, H.E. ZHU Chengqing, Vice Minister of Water Resources of China, pointed out when investigating the International Seabuckthorn Association that internationa lseabuckthorn cooperation is very important. As one of the four international organizations managed by the Ministry of Water Resources, the ISA has carried out a series of international cooperation and exchange services, and played a great role as an international platform by sharing seabuckthorn story of China. Entering a new stage, we must strengthen our confidence, and firmly believe that seabuckthorn, initiated by H.E. Madam QIAN Zhengying, former Vice Chairman of CPPCC, must have a glory future. In order to strengthen international cooperation on seabuckthorn, we should be focus on enhancing mutual lexpert exchange and learning from other countries.

2022 年 11 月 1 日，水利部副部长朱程清调研国际沙棘协会时指出：沙棘国际合作很重要，国际沙棘协会作为水利部管理的四个国际组织之一，开展一系列国际沙棘合作交流业务，用沙棘讲好“中国故事”水利篇章，很好发挥了国际平台作用。进入新阶段，一定要坚定信心，钱正英副主席开创的沙棘事业大有可为！要进一步加强国际间沙棘合作，在与其他国家相互交流借鉴的基础上，着力增强中国的影响力、话语权，主动服务中国大国外交战略，服务“一带一路”建设。

(2) Major seabuckthorn events in China

2.2022 年中国重大沙棘事件

① In November 2022, Zhu Chengqing, Vice Minister of Water Resources, paid a visit to Seabuckthorn Center and International Seabuckthorn Association.

(1) 2022 年 11 月，水利部副部长朱程清一行调研水利部沙棘开发管理中心和国际沙棘协会工作。

② In December 2022, 2022 Annual Meeting of the International Seabuckthorn Association (China) Enterprise Committee and the National Seabuckthorn Academic Exchange Conference was successfully held by video.

(2) 2022 年 12 月，国际沙棘协会（中国）企业委员会 2022 年年会暨全国沙棘学术交流会以视频方式顺利召开。

③ In 2022, International Seabuckthorn Association issued and implemented three new group standards, namely Seabuckthorn Fruit Powder, Seabuckthorn Leaf Tea and Code for Evaluation of High-yield Seabuckthorn Variety.

(3) 2022 年，国际沙棘协会新颁布实施《沙棘果粉》《沙棘叶茶》《果实丰产型沙棘品种评价规范》3 项团体标准。

④ ISA releases International Seabuckthorn Development Report 2021 (Chinese and English version).

(4) 国际沙棘协会发布《2021 年度国际沙棘发展报告》（中英文）。

⑤ The "Internet + Obligation Planting" project declared by ISA was approved by the China Green Foundation, and which will carry out in Shanxi province.

(5) 中国绿化基金会办公室批准由国际沙棘协会申报设立“互联网 + 全民义务植树”项目。

⑥ The project titled in "Transcriptional regulation mechanism of tissue-specific Expression of Key genes of seabuckthorns oil", led by the Dalian Minzu University, jointly applied for with the Russian Sciences Academy and the Russian Academy of Agricultural Sciences was approved by the National Natural Science Foundation of China.

(6) 由国际沙棘协会理事单位、大连民族大学牵头，联合俄罗斯科学院、俄罗斯农业科学院申报的“沙棘油脂关键基因组织特异性表达的转录调控机制”项目获得国家自然科学基金项目批准。

⑦ In November 2022, experimental materials of 2,000 Chinese seabuckthorn (*Hippophae rhamnoides ssp. sinensis*) seeds, provided by Inner Mongolia Yuhangren High-tech Industry Co. Ltd, ISA (China) Enterprise Committee member, were launched into space by Shenzhou-14 spacecraft at Jiuquan Satellite Launch Center.

(7) 2022 年 11 月，由国际沙棘协会（中国）企业委员会理事单位 – 内蒙古宇航人公司精选提供的 2000 粒中国沙棘种子实验材料搭载神舟十四号载人飞船在酒泉卫星发射中心发射升空。

⑧ The project with title of "Breeding technology for new hybrid varieties of seabuckthorn with high quality and high yield" applied by Seabuckthorn Center of the Ministry of Water Resources was selected into the key promotion and guidance catalogue of Advanced Practical Technology of Water Conservancy in 2022.

(8) 由水利部沙棘开发管理中心申报的“广适优质高产沙棘杂交新品种选育技术”入选 2022 年度水利先进实用技术重点推广指导目录。

⑨ In September 2022, Seabuckthorn Development

in China (1985-2020), an English publication jointly written by Prof. HU Jianzhong and Prof. LU Shunguang was published by China Forestry Publishing House.

(9) 2022 年 9 月，胡建忠、卢顺光主编的沙棘英文专著 Seabuckthorn Development in China (1985–2020) 由中国林业出版社出版发行。

⑩ In December 2022, Department of Finance with Forestry and Dept. Of Grassland Bureau of Ningxia Hui Autonomous Region co-issued the Financial Support Policy and Implementation Measures for Accelerating the Reform of Forest Rights and Promoting High-quality Development of Under-forest Economy, encouraging to scientifically collect the seabuckthorn and other forest products, supporting enterprises in deep processing to enhance the added value of forest products.

(10) 2022 年 12 月，宁夏回族自治区财政厅、林业和草原局联合印发《加快推进山林权改革，促进林下经济高质量发展的财政扶持政策暨实施办法》，鼓励科学采集沙棘等林产品，支持企业深加工，提升林产品附加值。

7. Promulgated major technical standards and published papers on seabuckthorn in 2022

七、2022 年中国颁布沙棘主要技术标准及发表论文

In 2022, 216 papers related to seabuckthorn were published as in Appendix (data source: https://www.cnki.net/), covering several topics of seabuckthorn resources and utilization.

2022 年共发表了与沙棘相关的论文 216 篇见附件（数据来源：知网 https://www.cnki.net/），研究领域涵盖人工造林、沙棘产业、大果沙棘、沙棘果、沙棘叶、沙棘汁、沙棘黄酮、沙棘多糖等多个方面。在学科方面包含林业、农业基础科学、农艺学、植物保护、农业经济、生物学、轻工业、中医学、中药学、畜牧与动物医学等方面（详见附件）。

Appendix : Scientific articles/papers/thesis on seabuchthorn published 2022 in China

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2. Country Report of DPR Korea

朝鲜沙棘发展报告

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Sea Buckthorn Research in Democratic People's Republic of Korea–2022

2022 年朝鲜民主人民共和国的沙棘研究

Institute of Economically Valued Forest under the State Academy of Forestry has been a leading institute in the research of sea buckthorn in DPR of Korea. The research on sea buckthorn has been active and one peer-reviewed paper was published in domestic scientific journal in 2022 based on long-term continuous sea buckthorn research.

朝鲜国家林业科学院下属的经济林研究所是该国从事沙棘研究的领先机构。2022 年，积极开展了基于长期持续的沙棘研究，在国内科技期刊发表了一篇经专家评议的科技论文。

一 Title of Research Project 正在执行的研究课题

"Sea buckthorn variety plantation establishment technology in Northern part of the country"

在朝鲜北部地区建立沙棘优良品种种植园技术研究

二 Research institute and number of researcher 研究机构介绍

- Medical Plant Department of Institute of Economic Valued Forest, the State Academy of Forestry
- 6 researchers

朝鲜国家林业科学院下属的经济林研究所药用植物研究室，有 6 名研究人员

三 Research results in 2022 2022 年的主要研究成果

- Research on the influence of slacked lime (calcium hydroxide) to the main soil types of Northern part of the country – pumice soil and loam as planting medium of SBT seedling, had been conducted successfully. Soil type of Samjiyon City of Ryanggang Province is pumice soil and loam. Certain amount of slaked lime had been applied in every planting hole of two kinds of soil types of experimental site in Samjiyon City and the survival rate and growth status of planted SBT seedlings in slacked lime added plot is much higher and better than comparing one.

- In several counties and cities of Northern part of the country, the survival rate and growth property of planted seedlings of 7 SBT varieties including Unhung No 1 ~ No 7 had been identified.

- Morphological and ripening characteristics and berry quality of 4 good varieties of SBT had been verified in Unhung Experimental stand.

成功开展了熟石灰（碳酸钙）对北方地区沙棘种植地主要土壤类型（岩质土、壤土）的影响。Ryanggang 省 Samjiyon 市的土壤类型为岩质土和壤土，在 Samjiyon 市的两类土质试验区，每个种植坑施用一定量的熟石灰。结果显示，施用熟石灰的沙棘苗木保存率及生长状况均好于对比。

在朝鲜北部地区的几个县市开展 7 个沙棘品种（Unhung No 1 ~ No 7）种植试验，得到了苗木的保存率和生长状况结果。

获得了 4 个 Unhung 沙棘品种试验林的形态特征、果实品质及成熟特性。

四 Introduction of Research Results 研究成果介绍

- Locations where research results had been introduced were 8 cities and counties of Ryanggang Province and Huiryong City of North Hamgyong Province in Northern part of the country.
- The total ha of technical introduction in 2022 was 100 ha
- Introduced varieties were Unhung No 1 ~ No 7.
- The introduced technology was cutting propagation and pruning technology.

试验地处朝鲜北部地区的 Ryanggang 省的 8 个县、市和 Hamgyong 省北部的 Huiryong 市。总共引种了 7 个品种：Unhung 1 号 ~ 7 号，2022 年种植总面积 100 公顷，期间开展了扦插繁殖和修剪技术研究。

五 The present and future research plan 今后研究计划

- New SBT variety - Unhung No 8 which had been developed in Huiryong City will be registered as National Forest Plant Variety within this year.

- Future research will be focused on development of new SBT variety with berry size - 1g.

年内， 将对在 Huiryong 市新培育的沙棘新品种 Unhung 8 号在国家林木品种管理局进行登记注册。将来的研究重点是培育单果重量达到 1 克的沙棘新品种。

3. Country Report of Finland

芬兰沙棘发展报告

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Sea Buckthorn Research and Development in Finland in 2022
Country Report to International Sea Buckthorn Association
芬兰 2022 年度沙棘研究开发国家报告

In Finland, there were active developments in research, cultivation, industrial processing and utilization of sea buckthorn. In addition, pilot effort initiated by the University of Turku has been on-going to use sea buckthorn in protection of the Baltic sea ecosystem. TYRNIRAKI project continued in 2021 and continued in 2022. A plantation was established in Utsjoki in 2021. New development has happened in commercial plantation and processing of sea buckthorn in Finland.

芬兰积极开展沙棘种植和工业加工利用。由芬兰图尔库大学发起的利用沙棘保护波罗的海生态系统示范项目 TYRNIRAKI 在 2021 年、2022 年继续开展。2021 年，芬兰在 Utsjok 建立了一处沙棘种植园，芬兰在沙棘商业化种植和加工方面取得了新进展。

一 RESEARCH 研究方面

University of Turku (UTU) has been a leading institute in the research on sea buckthorn in Finland. The research on sea buckthorn has been active as part of the long-term continuous sea buckthorn research.

图尔库大学一直以来是芬兰沙棘研究的领先机构，积极开展基于长期、持续的沙棘研究。

1.1 Research Completed in 2022

A clinical intervention study was performed as a joint project between University of Turku (Finland) and Peking University (China) to study the impact of three-month dietary supplementation with sea buckthorn puree on human subjects with hypercholesterolemia. State-of-art metabolomics

1.1 2022 年完成的研究

作为芬兰图尔库大学与中国北京大学合作项目，开展为期三个月的膳食补充临床干预研究，观察沙棘果肉对人体高胆固醇血脂症的影响。采用最先进的代谢组学和宏基因组学方法，研究了肠道微生物群的代谢谱和组成。结果表明，

and metagenomics methods were applied to study the metabolic profile and the composition of gut microbiota. The results revealed beneficial impacts of seabuckthorn puree on metabolism and gut microbiota of subjects with hypercholesterolemia. The results were published as a peer-reviewed scientific paper.

Chen K, Zhou F, Zhang Z, Li P, Zhang Y, Yang B (2022) Dietary supplementation with seabuckthorn berry puree alters plasma metabolomic profile and gut microbiota composition in hypercholesterolemia population. Foods 11, 2481. https:// doi.org/10.3390/foods11162481

沙棘果肉对高胆固醇血症患者的代谢和肠道微生物群产生有益的影响。研究结果以如下的同行评议科学论文的形式发表。

Chen K, Zhou F, Zhang Z, Li P, Zhang Y, Yang B (2022)，膳食中添加沙棘浆果泥可以改变高胆固醇血症人群的血浆代谢组学特征和肠道微生物群组成， Foods 11, 2481. https:// doi.org/10.3390/foods11162481

二 On–going Research Projects 有关项目进展

2.1 Impact of growth latitude on seabuckthorn composition and quality

Berries and leaves are collected annually from Finnish sea buckthorn varieties “Tytti” and “Terhi” cultivated southern (Turku) and northern Finland (Kittilä and Karigasniemi). Analysis work is on-going to study the composition of berries and leaves in order to investigate latitude and weather conditions at different growth locations on biosynthesis and accumulation of secondary metabolites in seabuckthorn.

2.1 生长纬度对沙棘组分和质量的影响研究

每年从栽种在芬兰南部（Turku）和芬兰北部（Kittilä and Karigasniem）采集芬兰沙棘品种“Tytti”和“Terhi”的果实和叶子。目前正在研究沙棘和叶片的组成，以研究不同生长地点的纬度和天气条件对沙棘次生代谢产物的生物合成和积累的影响。

2.2 Seabuckthorn berry press residues as natural food preservatives

In Europe, sea buckthorn berries are commonly used to produce juice by pressing, resulting in press cakes as residues/by-products. The aim of the research is to study the efficacy of adding seabuckthorn berry

2.2 沙棘压榨果渣作为天然食品防腐剂研究

在欧洲，沙棘浆果通常被用来生产压榨果汁，导致压榨后渣饼作为残留物或副产品。本研究旨在研究添加沙棘果渣饼在冷冻和冷藏期间延

press cakes in retarding the lipid oxidation in Baltic herring fish mass during frozen and cold storage. Dried seabuckthorn press cakes and supercritical CO2-extracted press cake s (oil and lipids removed) were added to Baltic herring fish mince at dosage of 1-4 weight% based on fresh weight of fish mass before storage. The lipid oxidation status were studied by measuring peroxide value and by analysis of volatile compounds produced as secondary oxidation products before and after storage. The sensory properties and consumer acceptance was also evaluated. The results showed that seabuckthorn press cakes effectively delayed the lipid oxidation in fish mince during cold and frozen storage. At dosage 3-4%, addition of press cake negatively influenced consumer acceptance of the products produced from minced fish after frozen storage. Lowering the dosage of press cake addition to level of 1.5% was sufficient to maintain the antioxidative efficacy without compromising the sensory quality and consumer acceptance of fish mince products.

缓波罗的海的鱼类体中脂质氧化的效果。将干沙棘压榨果渣饼和超临界 CO2 提取的压榨果渣饼(除去油和脂)根据贮藏前的鲜重,以1–4%重量比的剂量加入波罗的海的鱼肉酱中。通过测定过氧化物值和分析二次氧化产物的挥发性化合物，研究了脂质氧化状态。对感官特性和消费者的接受度也进行了评估。结果表明，沙棘果渣能有效延缓冷冻冷藏鱼肉的脂质氧化。在剂量为 3–4% 时，过量添加沙棘果渣对冷冻鱼肉产品的消费者接受度产生负面影响。将果渣添加量降低到 1.5%，足以维持抗氧化效果，而不影响感官质量和消费者对鱼肉产品的接受度。

2.3 TYRNIRAKI Project

TYRNIRAKI project received funding
The Turku University Foundation granted funding to the TYRNIRAKI. A short-term researcher has been employed for the project in 2021. The soil samples were analysed in terms of physical properties and microbial composition. A manuscript is being prepared based on the results.

2.3 TYRNIRAKI 项目

TYRNIRAKI 获得经费资助。图尔库大学基金会资助了 TYRNIRAKI 项目。2021 年，该项目聘请了一名短期研究员。通过对土壤样品的物理性质和微生物组成进行了分析。目前正在根据这些结果准备一篇论文初稿。

2.4 Sea buckthorn plantation in Utsjoki

A plantation was established by University of Turku in Utsjoki, Finland in 2021. The plantation has now about 300 seabuckthorn bushes, which is the most northern seabuckthorn plantation in the world. The plantation will be used for studying the impact of subartic latitude on the composition and

2.4 关于在 Utsjoki 的沙棘种植园

2021 年，图尔库大学在芬兰的乌茨约基（Utsjoki）建立了一个种植园。该种植园目前约有 300 株沙棘灌木，是世界上最北端的沙棘种植园。该种植园将用于研究亚北极纬度对沙

physiology of seabuckthorn. The establishment of the plantation is supported by the Turku University Foundation and the University of Turku.

棘组份和生理的影响。该种植园的建立是由图尔库大学基金会和图尔库大学支持的。

After two years of struggling to survive in the harsh conditions of the far north, there are clearly visible difference between the two varieties “Tytti” and “Terhi” in terms of the conditions of the bushes. “Tytti” suffered from the dry summer without special irrigation showing dried undeveloped leaves and berries, whereas “Terhi” managed quite well bearing more healthy and developed berries. The plantation needs more intensive care e.g. regular watering in order to flourish. Samples of berries, leaves and soil have been taken every year for further analysis.

在遥远的北方的恶劣条件下顽强生存了两年之后，“Tytti”和“Terhi”这两个沙棘品种在灌木丛状态下有明显的区别。“Tytti”品种遭受了干燥的夏天，没有特殊的灌溉，表现出干燥的未发育的叶子和果实，而“Terhi”品种则适应得很好，形成了更健康和更成熟的浆果。种植园需要更多的特别管护，例如定期浇水才能茂盛生长。每年我们都会采集沙棘浆果、叶片和土壤的样本进行进一步分析。

Variety ”Terhi” in the plantation of Karigasniemi, Utsjoki, Finland, photo taken by Baoru Yang on September 3, 2023
Utsjoki Karigasniemi 种植园中的沙棘品种 Terhi（Baoru Yang 拍摄于 2023 年 9 月 3 日）

Variety “Tytti” with berries dried young from drought in the summer.
Photo taken by Baoru Yang on September 3, 2023
沙棘品种 Tytti 因夏季干旱未成熟果实干瘪（Baoru Yang 拍摄于 2023 年 9 月 3 日）

三 Seabuckthorn plantations to reduce phosphorus leakage into the Finnish Archipelago Sea via the outlet–rivers (TYRNIRAKI project)

“种植沙棘减少磷通过河口排泄到芬兰群岛海”项目 (TYRNIRAKI)

A ten-year sea buckthorn project, “TYRNIRAKI”, organized by the University of Turku has started in South-West Finland to reduce leakage of phosphorus, nitrogen and other nutrients from the farmed fields into the local rivers. The Archipelago Sea suffers from severe eutrophication, and annual “cyanobacterial blooming” is not anymore only a visual problem. The increased rainfalls and shorter snow-covered winters, evidently due to the climate change, worsens the situation. The TYRNIRAKI project lead by the Food Chemistry and Food Development unit of the University of Turku aims to utilize seabuckthorn stands in nutrient sequestration in the Finnish Archipelago Sea drainage basins. The effects of the seabuckthorn stands to the nutrient cycles are monitored by studying the composition and the quality of the soil and the biomass produced, as well as the soil microbiome. In 2020, over 3,000 seabuckthorn saplings were planted in five different river bank areas in the southwestern Finland.

由图尔库大学组织的一个为期十年的沙棘项目“TYRNIRAKI”已经在芬兰西南部启动，以便减少磷、氮和其他营养物质从农田流入当地河流。芬兰群岛海遭受着严重的富营养化，每年“蓝藻繁盛”不仅仅是一个视觉问题。明显由气候变化引起的降雨增加和冬季降雪缩短使这一情况更加恶化。由图尔库大学食品化学与食品开发中心主持的 TYRNIRAKI 项目，其目的是利用沙棘林隔离芬兰群岛海流域的有机营养。通过对沙棘林分组成、质量、生物量和微生物群的研究，监测沙棘林分对土壤养分循环的影响。2020 年，在芬兰西南部的 5 个不同河岸地区种植了 3000 多棵沙棘树苗。

3.1 The Finnish Archipelago Sea

The Finnish Archipelago Sea is one of the most valuable natural resources in the Nordic countries. The sea with its 40 000 islands and islets started to be formed only 10 000 years ago after the local icecap melted towards the end of the ice age. This inland sea is shallow, the salt content is low and the connection to the Atlantic Ocean is very narrow. This is why the nutrient leakages cause an immediate problem and we have to reduce the local runoffs from our farmed fields in the rivers and further into the sea. The whole ecosystem suffers

3.1 芬兰群岛海域的问题

芬兰群岛海是北欧国家最宝贵的自然资源之一。海洋和它的 40000 个岛屿和小岛开始形成于 10000 年前，当地冰冠在冰河时代末期融化了。这片内海较浅，含盐量较低，与大西洋的连接非常狭窄。这就是养分排泄造成迫在眉睫的问题，我们必须减少当地从农田流入河流的径流进而排入大海。整个生态系统受损，导致生活环境变差。我们需要几个选项来解决这个问题，“TYRNIRAKI”项目就是其

and our living conditions are getting worse. We need several options to resolve the problem and the "TYRNIRAKI" project is one of them. (TYRNIRAKI; tyrniä ravinteiden kierrätykseen, seabuckthorn to harvest nutrients)

3.2 The action plan

The first seabuckthorn (SB) seedlings were planted in May 2020 in five riverbed and seashore fields in SW-Finland. The four SB varieties were all of Finnish origin. Ten-year agreements with the farmers guarantee the proper management of the bushes that are at disposal of the University of Turku for research and follow-up. The sea buckthorn fields bind nutrients and carbon, and the soil quality is improved and the biodiversity increases. Neither fertilizers nor herbisides/ pesticides are used on the test fields. The leakages in the local rivers and into the sea decrease, and P and N are removed by harvesting and by the field treatments.

This brings along additional business opportunities for the farmers and the goal is to multiply the SB plantations according to the upcoming results.

3.3 A plan for the entire country

The aim is to multiply the concept but it requires changes in the domestic farming regulations, especially related to the shelter zones. Further, significant financial and political support from the government is necessary. It is a long-term project and results faster than in 10 years should not be expected. The farmers have taken a positive attitude. Multidisciplinary co-operation in natural sciences, technology, nutrition, agricultural sciences, also with entrepreneurs and industry is a must. Removal of phosphorus from the fields is more effective than from the sea.

中 之 一。(TYRNIRAKI;Tyrniä ravinteiden kierrätykseen, sea buckthorn to harvest nutrients 沙棘收获养分)

3.2 具体行动计划

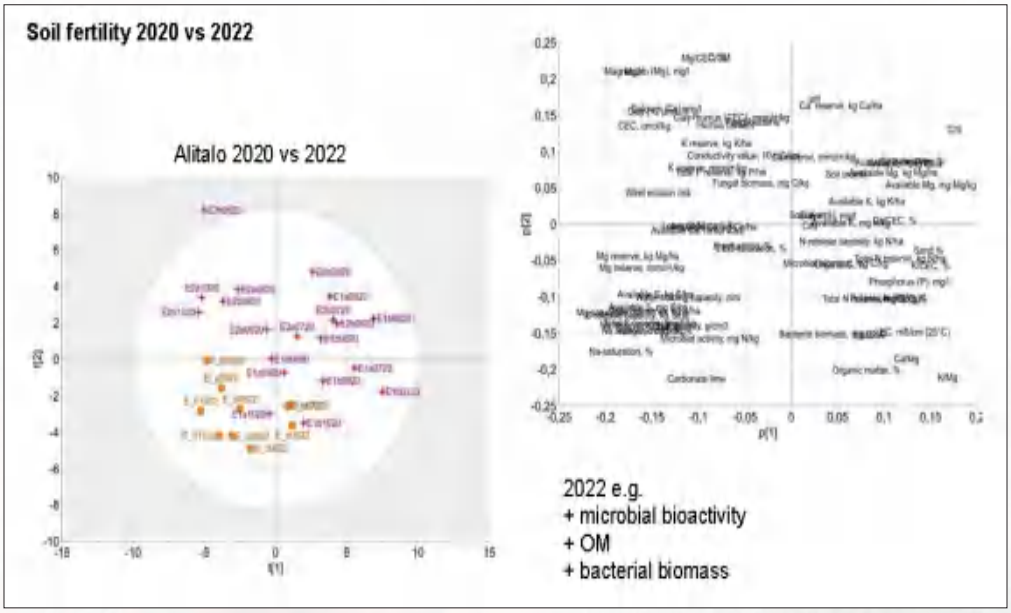
第一批沙棘幼苗于 2020 年 5 月在芬兰西南部的 5 个河床和海滨地区种植。4 个沙棘品种都来自芬兰。与农民签订的 10 年协议保证对图尔库大学用于研究和后续工作的沙棘林进行适当管理。沙棘林地固定了养分和碳，改善了土壤质量，增加了生物多样性。试验林地既不使用化肥，也不使用除草剂 / 杀虫剂。当地河流和海洋的排污量减少，磷和氮通过收集和田间处理被清除。(见图 1)。

这为农民带来了额外的商业机会，目标是根据即将得到的研究结果扩大沙棘种植园。

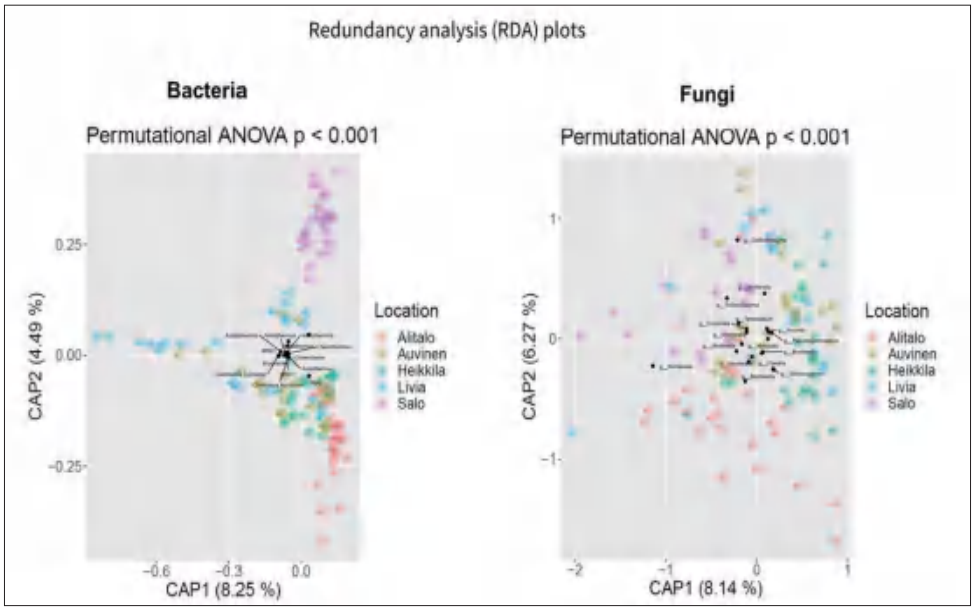
3.3 整个芬兰的国家计划

实施该项目目的是扩大推广这一理念，但它需要改变国内的农业法规，特别是与保护区有关的法规。此外，来自政府的重大财政和政治支持是必要的。这是一个长期项目，不应指望 10 年内就能取得成果。农民们采取了积极的态度。在自然科学、技术、营养、农业科学以及企业家和工业领域的多学科合作是必须的。从林地里去除磷比从海里除磷更有效。

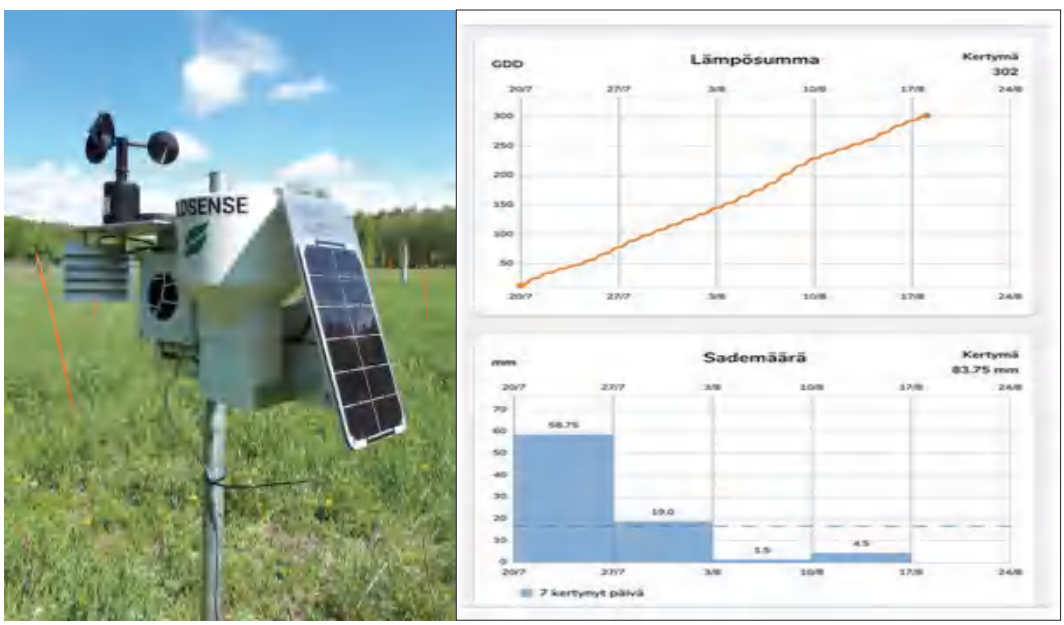
Some preliminary research findings
图 1：项目思路 一些初步研究发现



Seabuckthorn plantation changes the soil fertility of plantation field during 2020 and 2022.
图 2 2020–2022 年，沙棘林改善了林地土壤肥力



Some preliminary findings on the soil microbiome of different plantation field of seabuckthorn in southern Finland.
图 3 芬兰南部不同沙棘种植地土壤微生物群的初步研究成果



FieldSense weather stations. Weather conditions affect e.g. N mineralization, Preactions, microbes, plant metabolism, risk of pests
图 4 野外遥感气象站。天气条件影响氮矿化、磷反应、微生物、植物代谢、害虫风险

四 Cultivation and crop in Finland 芬兰的沙棘种植和采收

In 2022 in Finland there were 160 growers and they had total area 70 ha in such stage that it was possible to get crop. The total crop was 50 tons. In addition to growers there are many small home growers with some bushes and these are not included in statistics. In the coastal area of Finland there are wild sea buckthorn bushes and people have right to pick berries. This wild crop is not included in statistics. In Finland the biggest volumes in sea buckthorn products are juices and beverages. Because cultivation is so small, berries and juice are mainly imported. About 500 tons of frozen berries were imported. Also in Finland there is special production of products based on sea buckthorn. These are sea buckthorn oils produced by supercritical fluid extraction process by Aromtech Ltd. Use of sea buckthorn material is thousands of tons calculated as weight of fresh berries. Products are food supplements and products for different symptoms.

Aromtech Ltd has continued co-operation with vocational college on Lapland to boost sea buckthorn cultivation in Northern part of Finland. The way is to combine education and pilot cultivation. Aromtech has invested on sea buckthorn bushes. Students of the college can get experience of cultivation, crops, handle and sales of crops before starting their own cultivation on their home fields. This experimental phase is reported here.

2022 年，芬兰有 160 个沙棘种植者，目前可采收沙棘总面积为 70 公顷，总产量为 50 吨。除了这些种植者之外，还有许多小型的家庭种植者种植少量沙棘，不包括在统计数据中。在芬兰的沿海地区，分布有野生的沙棘灌丛，人们有权采摘野生沙棘浆果。这种野生沙棘也不包括在统计数据中。在芬兰，沙棘产品数量最多的是果汁和饮料。由于当地种植规模太小，沙棘浆果和果汁主要依靠进口，每年进口大约 500 吨冷冻沙棘浆果。在芬兰生产有以沙棘为主的特色产品。Aromtech 公司通过超临界流体萃取工艺生产沙棘油，加工数千吨的沙棘鲜果。加工产品是作为食品补充剂和针对治疗不同症状的产品。

Aromtech 公司继续与位于拉普兰（Lapland）的职业学院合作，促进芬兰北部沙棘的种植。途径是教育与试点种植栽培相结合，由 Aromtech 投资沙棘种植，该学院的学生在自己开始果园种植之前，可以先学到沙棘种植、采收、处理和销售果实的经验。以下是实验阶段的一些结果。

4.1 Commercial cultivation project in Lapland

Aromtech established own seabuckthorn plantation in 2019. The purpose of the plantation is to show to local farmers that seabuckthorn is a suitable crop for northern conditions as well. The two-hectare farm is located in Tervola, north of the 66th latitude, in connection with the agricultural vocational school.

Finnish varieties were planted on a flat organic field of two hectares. Used varieties are: 1600 pcs. Tytti, 1600 pcs. Terhi and 20 pcs. Tarmo. The plant rows are 250 meters long, the row spacing 4.5 meters, the spacing between the seedlings 1.2 m for females and 2 m for males. The boys were planted in their own rows on the east and west sides of the plantation and girls in the middle. Later, the boys were also placed at the ends of the girls' rows, so now the boys are surrounding the girls.
The ground surface in the plant rows is covered with woven polypropylene fabric, drip irrigation pipes are installed underneath. The entire area is fenced to keep out moose, roe deer and reindeer, as well as over-eager pickers. During the planting phase, the PH of the soil was adjusted to the right level by liming and fully matured compost was given as fertilizer.

The first berry crop was harvested in September 2022. At that time, the average height of shrubs was about 170 cm. The harvesting method is to cut 60-70% of the plant, saving 40-30%, so that the green leaf surface remains to gather strength for regrowth. The purpose is to cut 1/3 of the plants every year. The bushes are allowed to rest for two intervening years.
In harvesting, branches full of berries are cut into pieces about 25-30 cm long, and at the same time most of the leaves are removed. The cut branches are collected in plastic baskets, about 6-7 kg each. The baskets are transported to a freezer container and frozen at -28°c. Later, the storage temperature is -20-22°c.

4.1 在拉普兰的沙棘商业栽培项目

Aromtech 公司于 2019 年建立了自己的沙棘种植园。这个种植园的目的是向当地农民展示沙棘也是一种适合北方条件的作物。这个占地两公顷的农场位于北纬 66 度的 Tervola，与农业职业学校相连。

种植园建在一块占地两公顷平坦的有机土地上，种植的芬兰沙棘品种为： Tytti 品种 1600 株、Terhi 品种 1600 株和 Tarmo 品种 20 株。每行沙棘林长 250 米，行间距 4.5 米，株距：雌株为 1.2 米、雄株为 2 米。雄株独自种植在种植园的东西两侧，雌株种植在中间。然后，在雌株行的两端再种植雄株，这样雄株就包围着雌株。行间地面覆盖聚丙烯织物，滴灌管安装在下面。整个种植园都被围起来，以防止麋鹿、狍和驯鹿以及过早的沙棘采摘者进入。在种植阶段，通过施用石灰调整土壤的 PH 值到适当的水平，并施用完全成熟的堆肥。

2022 年 9 月第一次采收沙棘浆果。当时，沙棘林平均高度约为 170 厘米。收获方法是砍去树体的 60–70%，留下 40–30%，使绿叶保持收集能量和再生。其目的是每年砍伐三分之一的沙棘，然后轮休两年。 在采收过程中，结满果实的树枝切成大约 25–30 厘米长的短枝，同时去除大部分的叶子。将沙棘短果枝收集在塑料筐里，约 6–7 公斤一筐，运送到冷冻库在 –28° c 冷冻。随后在 –20–22° c 下储存。

Total crop was 2,5 tons of pure berries were obtained by mechanical separation. Therefore, the calculated first yield per hectare is over 4,2 tons. Only the Terhi variety was harvested, because it seems to mature younger than Tytti.

通过机械分离，总共收获了 2.5 吨沙棘纯鲜果。通过推算，第一年沙棘产量超过 4.2 吨 / 公顷。只采收了 Terhi 沙棘品种，因为它似乎比 Tytti 品种结果早。

View of plantation in 2021
种植园景观

Cutted branches with berries will be freezed
即将冷冻的沙棘短枝果

First commercial harvest in 2022
第一年商业采收

4. Country Report of German

德国沙棘发展报告

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President des Sanddorn e. V.

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德国沙棘协会主席

Annula Report of German Seabuckthorn Development in 2022

General situation when growing Seabuckthorn

2022 年德国沙棘发展年度报告

In 2022, the acreage in Germany was stable compared to the years before. At the same time, we had to contend with significant influences from climatic changes in the conditions in the plantations. Form the 2018 and 2019, we had to live with a significant lower amounts of precipitation on the one hand and up to 15% more hours of sunshine on the other. Resulting from this environmental situation the plant systems of SBT were subject to considerable stress. As a result we have considerable lost of plant exceeding the usual amount of less the 5% in plantations what is under normal conditions the average. The effect is subject of scientific joint projects that are still going on. It is observed in different areas in Germany but mostly in the northern part near the coastline of Baltic coast. Consultation with colleagues from our neighbor Poland (Prof. Stanislaw Pluta) shows that it seems to be a local problem and not belonging to other areas along Baltic sea. This dying of SBT plants cannot be explained by conditions of the location or the varieties. It seems to be a combination of different reasons. The Hergo variety is particularly affected, whereas the Leikora variety is less affected. This is the same as we already reported years ago. In the discussion about reasons we see different possible reasons:

- genetical age of plants
- diseases (viral as well as bacterial)
- dry climate (water stress)
- warm winter – sometimes no frost during wintertime
- missing dormancy resulting from missing frost
- non optimal management of plantation in compared to time before

However, there are also inland plantations, i.e. not near the Baltic Sea, where such observations can be made. Detailed observation showed that plantations were partly

2022 年，德国的种植面积与前几年相比保持稳定。与此同时，我们不得不应对种植园区气候变化的重大影响。在 2018 年和 2019 年，我们不得不面对降水量显著减少、日照时间增加 15%。由于这种环境条件，沙棘植物系统受到了相当大的胁迫。因此，我们有相当多的植株损失，明显超过正常情况下种植园平均 5% 的损失。这种影响是目前正在进行中的科学联合研究的主题。这一现象发生在德国的不同地区，但主要在靠近波罗的海沿岸的北部。经过咨询我们邻国波兰的沙棘同行 Stanislaw Pluta 教授，这似乎是一个局部问题，不涉及波罗的海沿岸的其他地区。这一沙棘植物死亡现象不能用种植区地区环境条件或品种差异来解释，这似乎是不同因素的组合。Hergo 沙棘品种受影响尤其严重，而 Leikora 品种受影响较小。这和我们几年前报道的一样。关于原因讨论，我们分析有以下可能的原因：

- 沙棘植株的遗传年龄
- 病害（病毒性和细菌性）
- 干旱气候（水胁迫）
- 暖冬，有时冬天无霜
- 由于冬季无霜导致的休眠缺失
- 与以往相比，缺乏优化的种植园管理

然而，也有内陆种植园，即不靠近波罗的海地区也发生这一现象。详细观察表明，种植园部

irrigated, but partly operated without and there was no direct correlation. So a direct correlation to the water supply cannot be determined directly. As a consequence we lost one complete plantation of about 50ha with more than 80% died plants.

分灌溉与部分不灌溉，没有直接相关性。因此，不能明确与供水的直接关系。为此，我们完全损失一个约 50 公顷的沙棘种植园，超过 80% 的植株死亡。

The mentioned observation on faded berries we observed also in 2022. The fact that the berries on the sunny side show clear traces of fading of color is in our explanation also a result of higher light radiation. In winter 2021/2022 as well as to 2022, we now had periods of frost. We observe actually in 2023 a reduced mortality of plants. From the entirety of the observation, one must conclude that the causes are probably of a complex nature and cannot be tied to a single parameter. A joined project of several institutes focus on several strategies to locate the reason. Microbiological, genetical, technological are included. We are waiting for results in end of 2023.

2022 年，我们开展沙棘浆果褪色观察。向阳面的浆果有明显的褪色痕迹，这一结果也是因为更强光辐射的结果。在 2021/2022 年冬季和 2022 年，我们有了霜冻期。我们观察到 2023 年植物的死亡率有所下降。从整个观察结果中，我们可以得出这样的结论：沙棘植株死亡原因可能是自然复合因素，而不是单个参数影响。为集中应对上述战略问题，几个机构联合开展了一个研究项目，涉及微生物学、遗传学和技术学。我们正在等待 2023 年底的研究成果。

一 Research work 研究工作

The main research focus was on horticulture. As described above, an attempt was made to determine the causes of the death of Seabuckthorn plants. Beside this the question of plant diseases took an essential role. In two projects, the infestation with bacteria and possibly viruses was taken into account. Final results are still not available. There is also no correlation to the known problems (*Verticillium*). Actually, it seems only to indicate that the plants with diseases had some special, but not newly found bacteria from ground.

主要的研究重点是沙棘园艺栽培。如上所述，我们希望确定沙棘植物死亡的原因。除此之外，植株病害问题也至关重要。在两个项目中，都考虑到了细菌和可能的病毒感染，目前还没有最终的结果。这与已知的问题（黄萎病 *Verticillium*）也没有关联。实际上，这似乎只是表明，染病沙棘植株有一些特殊的，但不是新发现的地上细菌。

In processing technology, research work focuses on the use of waste and by-products in the production of Seabuckthorn juice. One actual question is the use of leaves for tea production. It is not finally decided weather

在加工技术方面，研究工作集中在沙棘汁加工中产生的废物和副产品的利用。一个实际的问

this is to be registered as a novel food or not. Data situation is difficult.

题是利用沙棘叶生产加工沙棘茶叶。目前的基础数据还很缺乏，我们还没有最终决定是否要注册为一种新食品。

The use of pomace for extraction of valuable substances is still of interest. There are different directions of research. For example, the development of tea or the utilization of extracts from leaves should be a possible option. The novel food legislation in EC in this case seems to be one main hindering circumstance as a possibly resulting approval procedure is time and money consuming. Such procedures are usually not affordable for small businesses. That is a certain barrier. In the case of tea, the problem is simple, as it is now recognized that Seabuckthorn already has been used in the past to make tea. There are also enough sources showing use in human nutrition in other non-EC countries. Extracts from leaves, expeller of seed processing of seabuckthorn are, however, a little more difficult to classify. Medical studies on the effects of Seabuckthorn products, extracts and other products that can be produced on the basis of Seabuckthorn have only been carried out to a limited extent.

使用沙棘果渣来提取有价值的物质仍然是一个有趣的问题，这里有不同的研究方向。例如，直接开发茶叶，或从沙棘叶提取有效成分，应该是一种可能的选择。在这种情况下，欧盟的新食品立法似乎是一个主要的障碍，因为其批准程序很消耗时间和金钱，对小企业来说通常负担不起的，这是个具体的障碍。就茶而言，问题要简单，因为现在人们认识到，历史上沙棘在已经被用来制茶了。在其他非欧共体国家，也有足够的资料来源表明沙棘在人类营养应用。然而，沙棘种子加工和沙棘叶提取物的分类却比较困难。目前，以沙棘医学疗效研究为基础生产沙棘产品、提取物和其他等产品所开展的工作还十分有限。

二 Situation in cultivation 栽培现状

The harvested Seabuckthorn has to be divided into wild stocks and plantations. The wild stocks are mainly found on the coasts of the North Sea and the Baltic Sea (on the coast line and on the islands). They cover around 100-200 ha. Of course, large amounts of only thinly planted areas must be taken into account. Since these stocks are used, among other things, to stabilize the dunes on the coast, they are subject to special protection. Not all of these areas can be harvested. Thus the use of cutting technology is only possible to a very limited extent. Plantation facilities are currently around 800 ha in Germany. The areas are slowly but steadily increasing. Due to the problems with the death

德国可采收的沙棘分为野生种群和人工沙棘林。野生种群主要分布在北海和波罗的海海岸（在海岸线上和在岛屿上），总面积约为 100–200 公顷。当然，一大部分属于是稀疏分布的林地。由于这些种群除了其他用途外，主要用于稳定海岸沙丘，它们受到特殊的保护，并不是所有的野生沙棘林都可以采收。因此，沙棘剪枝采收只能限定在非常有限的范围内。目前，德国的沙棘种植园面积约为 800 公顷，目前在缓慢

of Seabuckthorn plants in last year, the number of newly planted fields has been somewhat reduced. Farmers are insure weather to plant or not. The annual increase should be in the order of 50-80 ha in 2023. It should be noted that in principle there is no statistical recording of the plantations planted with Seabuckthorn. Such areas are only recorded when farmers access public subsidies. As a result, it is not possible to make a final statement about how much area is actually built on with Seabuckthorn.

而稳步地增长。由于去年沙棘植株死亡影响，新种植的面积有所减少，农民对发展沙棘种植园犹豫不决。到 2023 年，年增幅应为 50–80 公顷。需要注意的是，原则上我们还没有沙棘种植园的统计记录，只有那些获得公共补贴的沙棘种植户才会有记录。因此，我们还无法明确实际的最终沙棘种植面积。

三 Use of Seabuckthorn 沙棘加工利用

The processing capacities have grown further and doubled compared to 2018. Actually there is an imbalance between selling juice and selling oil when there is an excess of oil. Such fluctuations are not new to us and usually changes shortly. About 40% of the processed quantities of Seabuckthorn come from Germany, the rest of the amount is purchased internationally. The main supplier countries are Romania, Hungary, the Czech Republic and the Baltic states. In addition, purchases are made from Asian countries, for example Mongolia. There is actually no import of berries or juice directly from Russia. But nevertheless we observed imports over third countries.

There is practically no processing that uses only one component. As a rule, both the juice and the oil are primarily obtained. The remaining pomace is processed to a large extent and the seeds obtained are used for oil production. There are applications for the recycling of the shells or the press residues from the extraction of seed oil. However, these are only estimated for around a third of the biomass. The remaining residues are usually used to generate energy, i.e. sold to appropriate companies for the production of bio-gas.

与 2018 年相比，加工能力进一步增长，增长了一倍。实际上，当沙棘油过剩时，沙棘果汁和沙棘油销售之间存在着不平衡。这种波动对我们来说并不新鲜，通常很快就会改变。沙棘加工的原料40% 来自德国，其余来自国际购买，主要的供应国是罗马尼亚、匈牙利、捷克共和国和波罗的海国家。此外，也从亚洲国家采购，例如蒙古。实际上，德国虽然没有直接从俄罗斯进口沙棘果或果汁，但我们还是观察到了通过第三国的进口。我们实际生产加工中，并不是只利用单一沙棘组份的。通常，沙棘果汁和油是主要的产品，剩余的果渣经过进一步加工，种子用于沙棘油提取，种子油提取压榨后的种皮或残渣还可循环利用。然而，这些利用估计只占约三分之一的生物量，剩余的残留物通常用于生产能源，即出售给某些公司用于生产沼气。

四 Activity of the German Seabuckthorn Association 德国沙棘协会的活动

Our organization held various events in 2022. This also included very interesting lecture conferences dealing with Seabuckthorn as well as other wild plants. In addition, excursions were carried out. Some of our members have organized events themselves, including celebrations with high publicity and the like.

德国沙棘协会于 2022 年举办了一系列活动，包括关于沙棘和其他野生植物的非常有趣的学术会议、讲座，并组织了野外考察。协会的一些成员自己也组织了活动，包括深度宣传的庆祝活动等。

五 Summary 总结

Overall, the development in the area of Seabuckthorn is steady and points in one direction of an increase in production and consumption. In our estimation, the development speed is in a normal range. There is no excessive growth associated with the risk of loss. The aim is to develop the product Seabuckthorn and all of its derivatives in a stable manner. Compared to other fruits, Seabuckthorn will remain a niche product here in the future. Even if it might be interesting at first glance to develop it into a mass-produced item, from the producers' point of view it is much more interesting, because it is more profitable, to produce niche products. Such products are rewarded with high prices in the market and are therefore economically interesting for both growers and processors. Seabuckthorn also plays an important role in Germany for agricultural businesses in what is known as the “sideline”. So these are crops that are not grown as the main task of agriculture. Some of these plantations are also operated by people who have completely different commissions in their main occupation. Nevertheless, the quantities produced on these areas are considerable.

总体而言，德国的沙棘开发稳步发展，沙棘产品生产和消费持续增长。据我们估计，沙棘开发速度是在一个正常的范围内，没有与损失风险相关的过度增长。我们的目标是以一种稳定的方式开发沙棘产品及其所有衍生物。与其他水果相比，沙棘在欧洲仍将是的一个小众产品。即使乍一看，把沙棘开发成一种规模化生产的产品可能会很有趣，但从生产商的角度来看，对沙棘会更有兴趣，因为生产小众而有特色的产品更有利可图。这类产品在市场上获得了高价格的回报，因此对种植者和加工者来说都是经济上有积极性的。沙棘尽管不是德国农业生产的主要栽培作物，但它作在德国的农业产业中也扮演着重要的角色，被称为“辅助产业”。其中一些沙棘种植园由那些其主要职业有完全不同的人所经营。然而，其沙棘果实产量却相当可观。

Euro–Work Conference
欧洲沙棘学术交流会

Participants to Euro–Works
欧洲沙棘学术交流会议代表

5. Country Report of Greece

希腊沙棘发展报告

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The General Information of Seabuckthorn Development in Greece
希腊的沙棘开发基本情况

***Hippophae* in Ancient History**

Although in modern Greece the sea buckthorn used in recent years, in antiquity its use was widespread. Relevant references are texts by Theophrastus, a student of Aristotle, but mainly Dioskourides, the father of Pharmacology.

The name derives from the troops of Alexander the Great, who noticed that the sick and injured horses that ate leaves and fruit of the plant were recovering faster, acquire more power, while the hair grew stronger and became more radiant. The Latin name of the genus Hippophae comes from the words horse <Hipp (a) - (horse) + -faes. the -fais <faos (light, shine), so it means bright, shiny horse+.

古代历史中的沙棘

尽管在现代希腊，沙棘的利用只是近些年的事。但是在古代，沙棘被广泛应用，相关文献可以查询亚里士多得的学生、西奥弗拉斯塔斯 Theophrastus（译者注：希腊哲学家）的著作，但主要来自现代药物学之父狄奥斯可里德斯 Dioskourides。

沙棘的名称起源于亚历山大大帝的军队，其征战中受伤的战马在吃了沙棘树上果实、叶片之后，迅速恢复、强健体壮、毛色发亮。沙棘属植物拉丁名 Hippophae 就是由 Hipp (a)（马）和 faes. the −fais <faos（发亮、发光）组成，意为“闪闪发光的马”。

一 Structure (Group of Companies) 希腊沙棘相关机构介绍

1.1 Structure (Group of Companies)

- AGRICULTURAL CENTER
- New Agro Solutions
- Agricultural supplies
- Consultant agency
- Official representative M.A. Lisavenko Institute of Siberia
- Scientific and technical support to “Hippophae Hellas“
- Research
- Cultivation methods

1.1 NAGRO.S（“农业新途径”公司），其职能包括

农业中心；
农业发展新途径；
农业供货商；
咨询机构；
俄罗斯西伯利亚里莎文科园艺研究所在希腊的官方代表；
Hippophae Hellas 公司的科技支撑；
科学研究；
栽培种植。

1.2 G.P. Hippophae Hellas S.A.

- Farming Company
- Producers Group
- Cultivation – agricultural production, providing crop support services, commodities
- Trading.
- 98 Producers -160 hectares
- 5 YEARS OBJECTIVE = 600 HECTARES
- GRASP-GLOBAL G.A.P.& Organic certification of the producer berries
- Research
- In the management processing of the fruit

1.2 G.P. Hippophae Hellas S.A（赫拉斯沙棘公司），其特点是

种植型企业；

加工集团；

农业生产栽培、提供作物支持服务、商品贸易；

吸收 98 个种植户、160 公顷种植园；

5 年规划种植 600 公顷；

全球浆果生产者 G.A.P. 和有机认证（GRASP）；

科学研究；

食品加工管理。

1.3 GOLDEN FOOD

- sales / marketing
- Agricultural products services company
- Research
- and development of innovative products from seabuckthorn fruit

1.3（金色食品公司），其特点是

销售与市场营销；

农产品服务；

科研；

沙棘创新性产品开发。

二 HIPPOPHAE HELLAS , Group of Companies （赫拉斯沙棘公司）介绍

2.1 Advantages of the company

- Exclusive producer of M.A. LISAVENKO varieties in Greece
- Production management and sales agreements.
- Necessary certifications.
- Commercialize several seabuckthorn products.
- Reduce facilities cost.
- Reducing production costs.
- Research and technological applications.
- Create processing factory.

2.1 公司的优势

俄罗斯里沙文科园艺研究所培育沙棘品种在希腊的唯一繁育商；

生产管理与销售协议；

必要的认证；

若干个沙棘产品商业化；

降低设备成本；

降低生产成本；

技术研究与应用；

建立加工企业。

2.2 Technical Support

- Supply of certified and commercial varieties worldwide at M.A. LISAVENKO Institute.
- Design of the orchard (planting distances, pollinator arrangement, irrigation system, fertilization, plant protection, soil preparation).
- Installation of the orchard under the supervision of specialized agronomists.
- In the field of care (plant protection, fertilization, weed control, irrigation, pruning).
- In the harvest of the fruit.
- Support is provided by the specialized scientists of the agronomic department of Hippophae Hellas with visits and step by step advice on cultivation in collaboration with the School of Agricultural Sciences of the University of Thessaly and M.A. LISAVENKO Institute, by providing a detailed cultivation manual to the farmers.

2.2 技术支撑优势

俄罗斯里沙文科园艺研究所提供经认定的全球商业化沙棘系列品种；

果园设计：种植株行距、授粉树布设、灌溉系统、施肥、植株保护、土壤整理等；

在专业化农艺师指导下，果园建设布局；

大田管理：树体保护、修剪、施肥、除草、灌溉；

果实采收；

Hippophae Hellas 公司的专业农艺师以及合作方特雷萨利 Thessaly 大学农学院的栽培技术指导，俄罗斯利沙文科园艺研究所向种植户提供详细的栽培手册。

2.3 The Group has the following Collaborations

- M.A. LISAVENKO institute of Siberia

- Agriculture University of Thessaly
- Moscow Central Botanical Garden
- International Seabukcthorn Association (ISA)

2.3 合作团队

俄罗斯西伯利亚里沙文科园艺研究所；

俄罗斯莫斯科中央植物园；

希腊特雷萨利 Thessaly 农业大学；

国际沙棘协会。

三 HIPPOPHAE HELLAS Berries 沙棘果实情况

3.1 HIPPOPHAE HELLAS

3.1 公司生产的沙棘果实主要指标（见下表）

Quality, Characteristics 质量特征	
Variety 品种名称	Chuiskaya（丘依斯克）, Klavdia, Essel, Altaiskaya（阿尔泰）, Chechek, Athena（雅典娜）, Augoustina（奥古斯缇娜）
Size average 平均果实大小	1,5 cm – 1g 果径 1.5cm, 单果重 1g
Brix average 糖度（可溶性固形物）	14
Acidity average 酸度	1,3
Oil % average 含油率	5
Flesh – Kernel % 果肉 – 种子比例	96 – 4
Certification 产品认证	GRASP–GLOBAL G.A.P. Organic 全球浆果生产者 G.A.P. 和有机认证
Active Ingredient 活性成分	Flavonoids, Omega (3–6–7–9), Vitamin E,C,D,E,K,B(1,2,6,9,12), Trace elements K,P, Ca, Mg, Fe, Se, Various amino acids, Carotenoids and other. 黄酮类、欧米伽 3–6–7–9、维生素 ,C,D,K,B、多种微量元素、多种氨基酸、类胡萝卜素等
Productivity 产量	15 tones per Hectare 15 吨 / 公顷
Cost of production 生产成本	0,80 Euro per kilo 0.8 欧元 / 公斤

3.2 Differentiation

- Production cost
  harvesting capability, productivity (over 100 kilos per person per 8 hours, 15 tones per hectare every year)
- Quality characteristics of the berries
  Size, taste, components
- Early period of harvesting
  Middle June

3.2 沙棘果实特点

生产成本优势：采收能力（每人 8 小时采收 100 公斤以上）、产量（15 吨 / 公顷 / 年）；

质量优势：果实大小、风味、营养成分；

成熟采收期早：6 月中旬。

3.3 PRODUCTION AND SALES PROCESSING

- June 2022, Harvest of 50.000 kilo Hippophae berries.
- IQF or/and other products created outsourcing.
- High level of interest from European and American companies for absorption of the berries and the products in food market.
- Prepared unique products for the global market

3.3 产品加工与销售

2022 年 6 月收获 50 吨沙棘鲜果；

IQF 或 / 及其他深加工产品；

来自欧洲和美洲公司食品市场对沙棘鲜果及其制品的高度兴趣；

面向全球市场的独特产品。

HIPPOPHAE HELLAS Products
公司的产品介绍（见下表）

Type 产品种类	Concentrated aseptic 40 Brix sea buckthorn juice with the oil 沙棘浓缩汁（无菌，含油，糖度 40）
Variety 沙棘品种	Chuiskaya（丘依斯克）, Klavdia, Essel, Altaiskaya（阿尔泰）, Chechek
Certification of fruits 果实认证	Global G.A.P. 全球浆果生产者 G.A.P. 和有机认证
Product Type 产品种类	Juice with oil 含油果汁
Place of Origin 产地	Greece 希腊
Processing Type 加工方式	Direct press, pasteurization 直接压榨，灭菌
Purity (%) 纯度	100%
Appearance 外观	Orange color juice, with a characteristic smell and taste 橙色，带有独特香气和口味
Brix 糖度	40
Acidity 酸度	4.12
Ph 值	3.58
Active Ingredient 活性成分	Flavonoids, Omega (3-6-7-9) , Vitamin E,C,D,E,K,B(1,2,6,9,12), Trace elements K,P, Ca, Mg, Fe, Se, Various amino acids, Carotenoids and other. 黄酮类、欧米伽 3-6-7-9、维生素 ,C,D,K,B、多种微量元素、多种氨基酸、类胡萝卜素等
Application 应用领域	Use in the food industry Medicinal use and manufacture of cosmetics 可用于食品、药品、化妆品工业

Type 产品种类	Concentrated aseptic 40 Brix sea buckthorn juice with the oil 沙棘浓缩汁（无菌，含油，糖度 40）
Pesticides 农药残留	ND 不检出
GMO 转基因	Free 非转基因
Preservative 防腐剂	No 无
Shelf Life 保质期	1 year (for unopened packaging and in temperature from 0 to + 20 ° C) 1 年（密封包装，温度 0–20° C）
Packaging 包装	Barrel 桶
Weight (kg) 重量（公斤）	220

Hippophae Hellas S.A.is the exclusive supplier of the first Greek energy drink «Black Broth»

Hippophae Hellas S.A 公司是希腊第一款功能饮料“黑色肉汤”Black Broth 的唯一供货商。

四 Research 研发、推广与销售

4.1 Research

In collaboration with the Agricultural University of Thessaly, M.A. LISAVENKO of Russia and other collaborating institutions have been carried out, are in progress and are planned research projects concerning the following fields:

- Increase – development and physiology of our cultivated varieties in Greek soil and climate conditions.
- Techniques– cultivation methods pollution, irrigation, fertilization, plant protection, weedicide, enemy control using the intelligent agriculture from planting to collection
- Processing- development of innovative techniques and products of high added value. The aim of acquiring productivity know-how, improving the quality of quality, reducing production costs in combination with friendliness to environment.

4.1 科学研究

启动与 Thessaly 农业大学、俄罗斯利沙文科园艺研究所等单位的合作，以下领域的研究项目以及规划并取得进展：

提高产量：在希腊当地土壤、气候条件下，沙棘栽培品种的生长、生理特性；

种植技术：沙棘栽培方法、施肥、树体保护、除草剂、应用智慧农业种植和采收技术病虫害防治；

产品加工：创新技术及高附加值产品开发，目的是提高生产效率、产品质量，降低成本，符合环保。

4.2 Marketing - Advertising

- Reference to the ERT1 state TV news for the Hippophae event organized in Athens with Lisavenko Institute participation. (The meeting was covered by many internet and press media in Greece.)
- Tribute to AGROWEEK show in ERT3 state TV.
- Presentation in ert3.gr TV show.
- Interviews in Athens – Macedonian news agency.
- Several publications in press and electronic media with excellent reviews.

4.2 市场营销、宣传

ERT1 国家电视台新闻报道了在雅典举办、俄罗斯利沙文科园艺研究所参加的沙棘活动（该会议被希腊多家新闻媒体和网络报道）：

在 ERT3 国家电视台 AGROWEEK 栏目展播；

在 ert3.gr TV 节目播放；

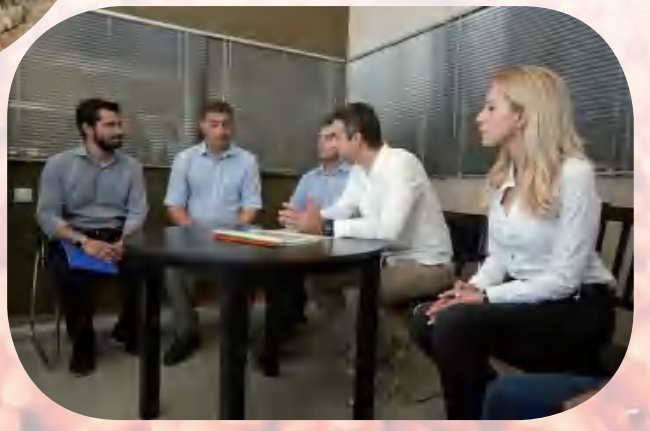
在雅典马其顿新闻机构专访；

多个新闻和电子媒体出版物中出色采访。

4.3 CONFERENCE IN ATHENS FOR SEABUCKTHORN 4.3 举办专题会议

CONFERENCE IN ATHENS FOR SEABUCKTHORN, participating in the dedication year, Greece – Russia 2016

2016 年在雅典举办了希腊 – 俄罗斯国际沙棘会议，当地政要出席了会议。



6. Country Report of India

印度沙棘发展报告

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Research & Development on Seabuckthorn in India

2022 年印度沙棘发展报告

CSK Himachal Pradesh Agricultural University, Palampur has done pioneering work on seabuckthorn since 1993. University has been provided grants of about Rs, 700 lakhs by various funding agencies like ICAR, MEF and DBT, MIDH et., More than 10 adhoc research projects have been completed successfully by the university during last two decades and two projects are in progress. More than 10 students have worked on the various aspect of seabuckthon during their Ph.D., MSc. &M.Vsc. degree programes. At present more than 25 Scientists are working on seabuckthorn in the university. Systematic studies have been done in various areas of seabuckthorn like surveys and selection of resources, evaluation of high yielding local land races and exotic form, agroforestry and silvipastural system, propagation, cultivation, fruit harvesting , value added health products, animal feed and use of seabuckthorn extract for the treatment of various ailments in animals.

自 1993 年以来，位于帕拉姆普尔的喜马偕尔邦农业大学在沙棘方面开展了一些开创性的工作。ICAR、MEF 和 DBT、MIDH 等多个机构向该校提供了约 70 亿卢比的资助。在过去 20 年中，该校成功完成了 10 多个特设研究项目，其中两个项目正在进行中。十余名学生在攻读博士和硕士期间从事了有关沙棘的各方面研究。超过 25 名科学家正在该校开展沙棘研究，主要涉及沙棘资源开发利用各领域，如沙棘调查和优株选择、高产本地品种和外来品种的评估、农林业和造林系统、繁殖、栽培、果实采收、增值保健产品和动物饲料，以及利用沙棘提取物治疗动物疾病等。

Fig. 1. Visit of Hon’ble Vice Chancellor CSKHPKV Prof. Dr H K Chaudhry to seabuckthorn stands in Spiti valley, H.P.

图 1. 喜马偕尔邦农业大学副校长 H K Chaudhry 教授参观位于 H.P.Spiti 山谷的沙棘林

The Hon'ble Vice Chancellor CSK HP Agricultural University, Palampur, Prof. H K Chaudhry during his visit to Spiti valley, during November 2021 visited the natural seabuckthorn habitat at Ragrik village along with Director of Research, Director Extension Education and team of scientists (Fig. 1). During his visit a meeting with the District Administration (ADC Kazza) along with whole team of scientist was organized to discuss the potential of sea buckthorn in the valley and ensured to extend all technical support to harness its potential. Presently two research projects worth 97.25 lakhs are in operation at HARC Kukumseri in Lahaul, i.e Mass propagation and cultivation of high yielding sea buckthorn cultivars for livelihood improvement in tribal areas of Himachal Pradesh funded by DST and Establishment of Seabuckthorn Research & Training Centre funded by Department of Horticulture, Government of Himachal Pradesh under MIDH scheme.

喜马偕尔邦农业大学副校长 H K Chaudhry 教授于 2021 年 11 月访问了斯皮蒂山谷，与研究主任、推广教育主任和科学家团队一起参观了 Ragrik 村的天然沙棘林（图 1）。访问期间，他还组织了一次与地区管理局（ADC Kazza）以及整个科学家团队的会议，讨论了沙棘的潜在价值，并确保提供所有技术支持以开发利用其潜在价值。目前，总预算 9725 万卢比的两个研究项目正在 Kukumseri 的高地农业研究与推广中心（HARC）实施，即由 DST 资助的用于改善生计的喜马偕尔邦部落地区大规模繁殖和种植高产沙棘品种项目，以及由喜马偕尔邦政府园艺部根据 MIDH 计划资助的沙棘研究与培训中心建设项目。

一 Research Achievements 研究成果

1.1 Improvement of seabuckthorn germplasm bank and mother orchards

The potential local selection and exotic form of seabuckthorn are being maintained in the mother orchards at High Land Agriculture Research and Extension Centre (HAREC) at Kukumseri, in Lahaul (Table 1). These genotypes belongs to *Hippophae rhamnoides* and *H. salicifolia*. These plants are being used formass multiplication.The work on improvement of the Mother orchard of existing seabuckthorn at HAREC Kukumserihas been

1.1 改进种质库和母本园

在位于 Kukumseri 的高地农业研究和推广中心（HAREC）的母本园中，沙棘本地品种和外来品种得到了保护（表 1）。这些沙棘属于鼠李沙棘和柳叶沙棘（*Hippophae rhamnoides* 和 *H. salicifolia*）。高地农业研究和推广中心（HAREC）现有的沙棘母本果园的工作已经启动，为了满足未来对改良品种以及沙棘选种种植材料的需求，在 2022 年 3 月和 2023 年 3 月栽种了俄罗斯高产品

initiated and new mother orchards of the high yielding Russian varieties have been planted in March 2022 and March 2023 to meet the demand of planting materials of improved varieties/selection of seabuckthorn in future. Germplasm bank was strengthened by introducing seeds of ten varieties of seabuckthorn from Russia, Latvia and Belarus during 2013-14 through NBPGR. These varieties are under testing at HAREC Kukumseri (Fig. 2).

种的新母本园。2013–2014 年间，通过国家生物和植物保护研究中心（NBPGR）从俄罗斯、拉脱维亚和白俄罗斯引进了 10 个沙棘品种的种子。这些品种正在高地农业研究和推广中心（HAREC）进行种植观察（图 2）。

Fig. 2. Newly established Sea buckthorn mother orchard of Exotic varieties
图 2. 新建成的外来品种沙棘母本果园

表 1. CSKHPKV Palampur 引进的外来品种清单

Sr. No.	编号	来源国	来源机构
	NX-1	俄罗斯	西伯利亚细胞遗传学研究所细胞学与遗传学
	NX-4	俄罗斯	同上
	NX-5	俄罗斯	同上
	NX-2	俄罗斯	同上
	NX-3	俄罗斯	同上
	NX-10	俄罗斯	北方林业研究所
	NX-11	俄罗斯	同上
	NX-6	拉脱维亚	同上
	NX-7	拉脱维亚	拉脱维亚国家果树种植研究所
	NX-8	白俄罗斯	白俄罗科学院中央植物园

注：拉脱维亚的沙棘品种原产于俄罗斯。

1.2 Production of planting materials

Local seabuckthorn selection “Drilbu” (H. salicifolia), a unique seabuckthorn genotype in Himalaya, selected from Tinu village, Lahaul, and two exotic form of seabuckthorn i.e. HI-2 from Russia, (H. rhamnoides spp. mongolica) and NX-12 an exotic form from Ukrain origin imported from Russia have been selected for mass multiplication (Fig. 3). During last two years 20,000 plants of high yielding seabuckthorn plants were produced and supplied to the farmers and department of forest.

1.2 品种繁育

采自 Lahaul 的 Tinu 村的当地品种“Drilbu”（*H. salicifolia* 柳叶沙棘）是喜马拉雅地区独一无二的品种，另有 2 种外来来自俄罗斯的 HI-2（*H. rhamnoides spp. Mongolica* 蒙古沙棘）和从俄罗斯进口的来自乌克兰的外来品种 NX-12 已被用于大规模繁殖（图 3）。过去两年间共生产 20,000 株高产沙棘苗供应当地农民和林业部门。

Fig. 3. Multiplication of planting materials
图 3. 种植材料的繁育

1.3 Demonstration on cultivation of seabuckthorn

Four thousand rooted plants of three seabuckthorn cultivars, *H. salicifolia* (Drilbu) the local selection, HI-2 from Russia, (*H. rhamnoides spp*. *mongolica*) and NX-12 an exotic form from Ukraine have been provided to farmers for demonstration on cultivation of seabuckthorn in collaboration with forest department in Lahaul (Fig. 4). The demonstration on seabuckthorn alley cropping with apple and rajmash has also been initiated at HAREC, Kukumseri (Fig. 5).

1.3 栽培示范

与 Lahaul 的森林部门合作，向当地农民提供了 4 千株 3 种沙棘栽培苗，包括当地选育的 Drilbu（*H. salicifolia* 柳叶沙棘）、来自俄罗斯的 HI-2（*H. rhamnoides spp. Mongolica* 蒙古沙棘）和来自乌克兰的 NX-12（图 4）。此外，还在 Kukumseri 的高地农业研究与推广中心（HAREC）开展了沙棘与苹果和菜豆的间作种植示范（图 5）。

Plantation of High yielding Seabuckthorn varieties in community and forest land by SHG and Mahila Mandals

Fig. 4. Saplings of high yielding selection given to farmers at Seabuckthorn Farm, Kukumseri, Lahaul.
图 4. Kukumseri 沙棘农场的农民选择的高产苗

Fig. 5. Development of Alley cropping with Apple at HAREC Kukumseri
图 5. 高地农业研究与推广中心（HAREC）沙棘与苹果间作情况

1.4 Nutrient dynamics in relation to maturation of Berries　1.4 沙棘浆果成熟期间的营养变化

To study the nutrient dynamics in relation to maturation of fruits, the berries were collected three times during its maturation to access the best time for harvesting of different varieties / selection of seabuckthorn. Sample collection of berries was done between 20th September to 10th October. First collection was done 20th September (I), second on 29th September (II) and third on 10th October (III).

为了研究果实成熟期间的营养变化，在果实成熟期间采集浆果 3 次，以获得不同品种沙棘以及选择沙棘的最佳采集时间。浆果样品采集于 9 月 20 日至 10 月 10 日期间进行。第 1 次采集是在 9 月 20 日（I），第 2 次采集是 9 月 29 日（II），第 3 次采集是 10 月 10 日（III）。

a.Oil content in Berries: It was observed that the oil contents in fresh fruits of different seabuckthorn cultivars varied significantly with the time of harvesting and the cultivar. Two years data revealed that the maximum oil content (3.03%) was found in local selection Darcha, followed by 2.29% in NX-12 during the second harvesting and the least during 3rd harvesting in all selection. However the maximumoilcontentwas observed in NX-12 and Dirlbu cultivars during second harvesting. Overall, exotics HI-2 and NX-12 have lesser contents of oil than the local cultivar “Darcha”.

a. 浆果的含油量：不同沙棘品种新鲜果实的含油量随采收时间和品种的不同存在显著差异。两年的数据显示，所有品种中，当地的 Darcha 的含油量最高（3.03%），其次是第 2 次收获时的 NX−12（2.29%），第 3 次收获时沙棘的含油量最低。然而，在第 2 次收获过程中，NX−12 和 Dirlbu 品种的含油量最高。总体而言，外来品种 HI−2 和 NX−12 的油脂含量低于本地品种。

b.Vitamin E & Vitamin C:-Vitamin E contents in fresh fruits of different seabuckthorn cultivars varied from a minimum of 0.2 mg/100g to 4.0 mg/100g during the different harvesting dates the maximum Vitamin E content was observed in local selection i.e. Darcha during all the harvesting dates followed by NX-12 during 2nd harvesting. However, the vitamin C content was found maximum in Drilbu cultivar during all the harvesting dates.

b. 维生素 E 和维生素 C: 在不同采收期，不同沙棘品种鲜果中的维生素 E 含量从最低 0.2mg/100g 到 4.0 mg/100g 不等，在所有采收期，当地选育的 Darcha 品种维生素 E 含量最高，其次是第 2 次采收的 NX−12。然而，在所有采收期中，Drilbu 栽培品种的维生素 C 含量最高。

It has been observed that the maximum content of oil, Vitamin E and Vitamin C was during 1st

harvesting in cultivar HI-2 and Darcha which were reduced as the harvesting was delayed. So these cultivars have to be harvested by 20th September. However, NX-2 and Drilbu cultivars showed maximum nutrient dynamics during 2nd harvesting date which means the harvesting can be done in the last week of September to 1st week of October.

HI-2 和 Darcha 栽培品种在第 1 次收获时油脂、维生素 E 和维生素 C 的含量最高，但随着收获时间的推迟，含量有所下降。因此，这些品种必须在 9 月 20 日之前收获。然而，NX-2 和 Drilbu 栽培品种在第 2 个采收期表现出最大的营养变化，表明可在 9 月最后一周至 10 月第一周采收。

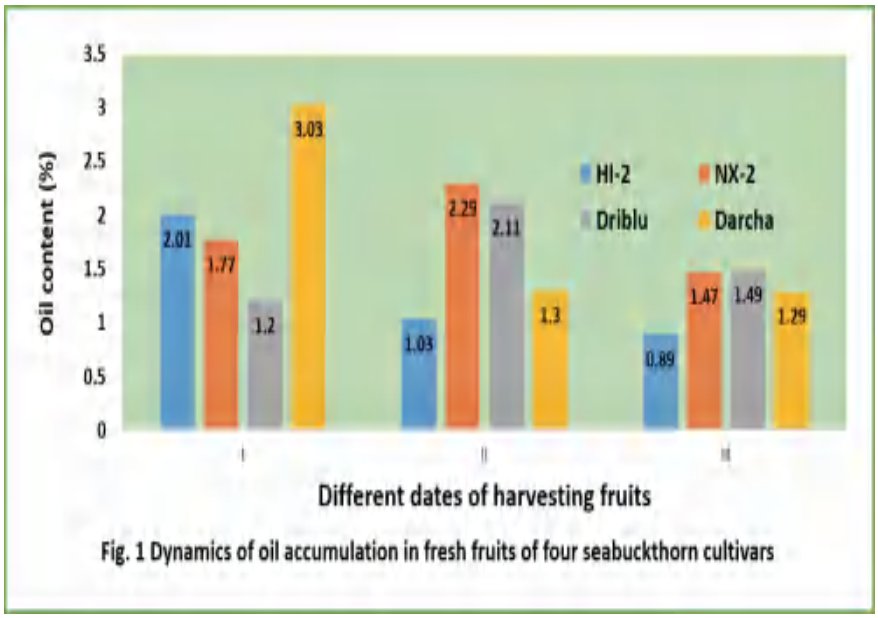
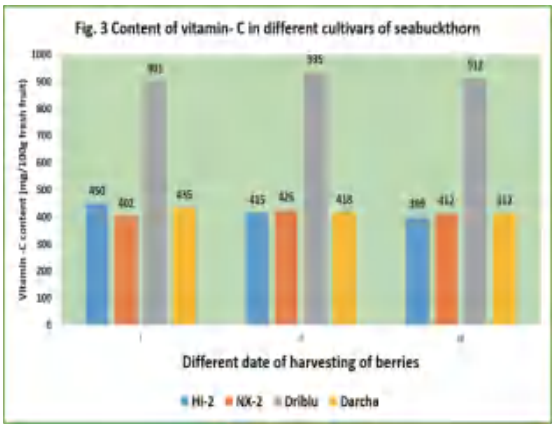


Fig. 1 Dynamics of oil accumulation in fresh fruits of four seabuckthorn cultivars



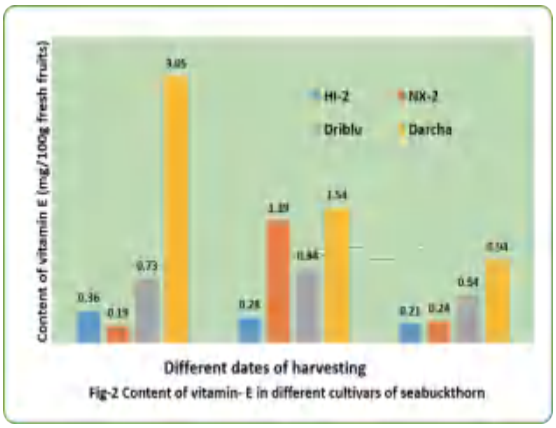


Fig 6. Nutrient dynamics in seabuckthorn cultivars
图 6: 沙棘品种营养成分变化动态

1.5 Development of Entrepreneurship among women farmers　1.5 支持妇女创业

A women Self Help Group Khandorma is being strengthened by providing planting materials of improved selections of seabeackthorn varieties and technical support in collaboration with the Department of Forest Lahaul under the project SECURE Himalaya (GOI-UNDP-GEF) project in Lahaul Pangi. CSKHPKV Palampuris providing technical support under MIDH Project on seabuckthorn“ Establishment of Research and training Centre” to the Women Self Help Group Khandorma of Tingrit Panchayat. SHG has established small processing unit at Tingrit with the financial support from Department of Forest Lahaul. They are producing various products (Fig. 7).

在 Lahaul Pangi 实施的“喜马拉雅安全”（GOI-UNDP-GEF）项目下，与 Lahaul 林业局合作，通过提供改良沙棘品种的种植材料和技术支持，加强了妇女自助团体 Khandorma 的实力。CSKHPKV 帕兰普里斯根据 MIDH 项目“建立研究和培训中心”，为 Tingrit 村委会的妇女自助组 Khandorma 提供沙棘方面的技术支持。在 Lahaul 林业局的资助下，自助小组在 Tingrit 建立了小型加工厂。她们正在生产各种产品（图 7）。

Fig 7. Women Self Help Group “Khandorma” of Tingrit Panchayat, Lahaul, HP.
图 7. Tingrit 村委会的妇女自助小组“Khandorma”

二 University of Delhi, Delhi 德里大学的沙棘研究

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Recent global climate change has prompted researchers worldwide to extensively examine the stress hardy crops. Seabuckthorn (*Hippophae*), a high-altitude Himalayan bioresource has been extensively explored for its huge pharmaceutical and nutraceutical potential. However,this stress tolerant plant growing in extremeclimatic conditions could be a storehouse of multiple stress tolerant genes/proteins. Despite the fact, seabuckthorn genome is not yet sequenced thus its molecular, genomic and proteomic aspects are least explored. Being an inherently cold tolerant shrub growing in the Himalayan cold deserts, it can be an excellent system to explore its cold/freezing stress tolerance mechanism. Over the last few years, our laboratory is trying to analyse the stress modulatory pathways in seabuckthorn using proteomics as a tool. For preliminary studies, procedures were established to grow seedlings under laboratory conditions.Cold/freeze modulated proteome in seabuckthorn seedlings had been deciphered using Gel and LCMS/MS based proteome analysis and the proteo-map (2-D gels)of H. rhamnoides seedlings secretomeis available on world 2D-PAGE repository (ExPASy Bioinformatics Resource Portal).Nevertheless, till date proteomic analysis to understand stress tolerance is restricted to laboratory grown H. rhamnoides

近年的全球气候变化促使世界各地的研究人员广泛关注抗逆作物。喜马拉雅山高海拔地区的生物资源沙棘因其巨大的制药和营养保健潜力被广泛开发。这种生长在极端气候条件下的抗逆植物可能是多种抗逆基因 / 蛋白质的宝库。尽管沙棘基因组尚未测序，对其分子、基因组和蛋白质组方面的研究较少。作为一种生长在喜马拉雅寒冷沙漠地带的固有耐寒灌木，沙棘可以作为揭示其耐寒 / 耐冷机制的绝佳植物。在过去的几年里，我们的团队试图利用蛋白质组学这一工具来分析沙棘的胁迫调节途径。为了进行初步研究，我们制定了在实验室条件下培育幼苗的程序，利用基于凝胶电泳和 LCMS/MS 的蛋白质组分析，破译了沙棘幼苗中耐受低温 / 冰冻影响的蛋白质组，并在世界 2D-PAGE 资源库（ExPASy 生物信息学资源门户网站）上提供了沙棘幼苗分泌组的蛋白质（2-D 凝胶电泳图）。但迄今为止，了解抗逆性的蛋白质组分析仅限于实验室培育的沙棘幼苗，因此我们小组最近正试图了解自然生长

seedlings. Therefore, recently our group is trying to understand the stress tolerance traits in naturally growing seabuckthorn. Interestingly, a custom-built Proteome database has been developed using label free (nanoLC MS/MS) proteomics approach to allow better annotation of proteins. Comparative gel-based and gel-free shotgun proteomics approach was used to dissect stress acclimation strategies in high-altitude Trans-Himalayan (*H. rhamnoides, H. tibetana*) and lower altitude adapted Sikkim (*H.salicifolia*) germplasm.NanoLCMS/MS analysis allowed identification of 4870 proteins clustered into 1035 protein groups indicating differential abundance of metabolic, regulatory and stress responsive proteins in Trans-Himalayan and Sikkim germplasm.Gene ontology and KEGG analysis showed differential regulation of proteins associated with metabolic processes, stress signalling,defense responses, redox regulation, protein remodelling, and secondary metabolite or fatty acid biosynthesis. Validation of downstream metabolic signatures also supported the proteomic plasticity suggesting their probable involvement in differential stress acclimation strategies.To sum up, these interesting findings showed a clear trade-off between growth and stress tolerance phenomenon in diverse seabuckthorn populations. High-altitude adapted Trans-Himalayan populations repress their growth and divert energy resources in the direction of better stress responses to survive extreme climatic conditions. In contrast, Sikkim populations at lower elevations invest in resource allocation or growth-promoting pathways in response to milder stress conditions. To the best of our knowledge, this is the first comprehensive proteome analysis to examine the altitudinal gradient associated stress acclimation strategies in different naturally growing Indian seabuckthorn populations. The dataset generated through these findings is submitted in PRIDE 'PRoteomicsIDEntifications database' with accession number "PXD023184". To our surprise, it represents the first seabuckthorn proteome data repository of all the three different Indian seabuckthorn species (*H.rhamnoides, H.tibetana, H.salicifolia*) growing naturally in Himalayas.

的沙棘的抗逆性，有趣的是，我们利用免标记（纳米液相色谱 MS/MS）蛋白质组学方法开发了一个蛋白质组数据库，以便更好地对蛋白质进行注释。采用基于凝胶电泳和无凝胶电泳的鸟枪蛋白质组学方法，比较了高海拔的喜马拉雅山西藏沙棘 (*H. rhamnoides, H. tibetana*) 和低海拔的柳叶沙棘 (H. salicifolia) 对胁迫环境的适应策略。从高海拔和低海拔沙棘中鉴定的 4870 个蛋白分布于 1035 个蛋白质组，这些差异蛋白涉及代谢、调控和逆境胁迫响应。GO 和 KEGG 分析结果表明，与代谢过程、应激信号、防御反应、氧化还原调节、蛋白质重塑以及次生代谢物或脂肪酸生物合成有关的蛋白质的调控存在差异。下游代谢特征的验证也支持蛋白质组的可塑性，表明它们可能参与了差异应激适应策略。这些有趣的发现表明，在不同的沙棘种群中，生长和耐应激之间存在着明显的稳态现象。适应高海拔的喜马拉雅种群抑制生长，并将能量资源转向更好的应激反应，以利于在极端气候条件下生存。相反，低海拔的 Sikkim 种群可将能量资源分配或转移给促进生长的途径，以应对较温和的胁迫条件。据悉，这是首次对不同自然生长的印度沙棘种群中与胁迫适应策略相关的海拔梯度进行全面的蛋白质组分析。这些发现产生的数据已提交给 PRIDE "PRoteomicsIDEntifications 数据库 "，登录号为 "PXD023184"。可喜的是，它代表了印度喜马拉雅山地区自然生长的所有 3 种不同的沙棘（鼠李沙棘 *H.rhamnoides*、西藏沙棘 *H.tibetana* 和柳叶沙棘 *H.salicifolia*）的首个沙棘蛋白质组数据库。

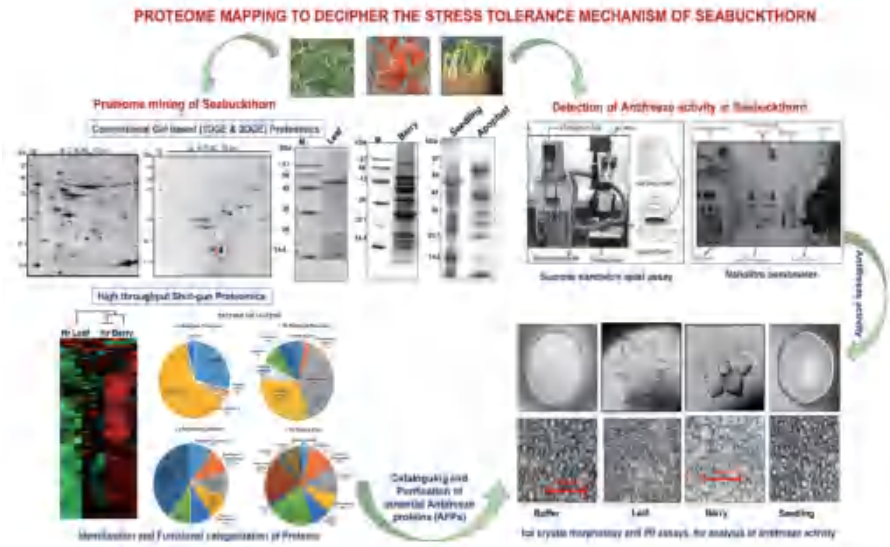

Fig 1. Proteomic mapping of different seabuckthorn tissues (seedling, leaf and berry) to understand their stress tolerance mechanism.
图 1 不同沙棘组织（幼苗、叶片和浆果）的蛋白质组图谱，以解析其抗逆机制

Interestingly, proteome analysis also showed the presence of various antifreeze proteins (AFPs), homologous to PR proteinsin both seabuckthorn seedlings and their naturally growing counterparts. AFPsareicebindingproteinswhichprevent addition of water molecules to growing ice crystal planes by adsorbing in a non-colligative manner. Ithelpstheoverwinteringplantsto survivewithfreeze stress and tolerate temperature as low as - 40 °C. Our group is also focusing on purifying the potential AFP candidates from laboratory grown and naturally growing H.rhamnoidesprocured from Lahaul and Spiti valley of Himachal Pradesh. In our laboratory, we have devised a specialized technique to purify the AFPs using Ice affinity Chromatography. A method was also optimized to detect the antifreeze activity in seabuckthornusing Phase contrast microscopy coupled with Nanoliter osmometer. Interestingly, dual functioning chitinase-AFPs have been purified from H.rhamnoidesseedlings (31 & 34 kDa), leaf (34 & 39 kDa) and berry (30 kDa). Further, ice-affinity chromatography have

蛋白质组分析还显示，在沙棘幼苗及其自然生长的同类植物中存在与病程相关蛋白（PR）同源的各种抗冻蛋白（AFPs）。AFP 是一种冰结合蛋白，以非共轭方式吸附，防止水分子加入生长中的冰晶平面。它有助于越冬植物在冰冻胁迫下生存，并能耐受 −40℃的低温。我们的研究小组还专注于从喜马偕尔邦 Lahaul 和 Spiti 山谷采集的实验室生长和自然生长的沙棘中提纯潜在的 AFP 候选物质。在实验室里，我们设计了一种使用冰亲和色谱法纯化 AFP 的专门技术，还优化了用相差显微镜结合纳升渗透压计检测沙棘中防冻活性的方法。有趣的是，从沙棘幼苗（31 和 34kDa）、叶片（34 和 39kDa）和浆果（30kDa）中纯化出了具有双重功能的几丁质酶 −AFPs。此外，冰亲和色谱法还被用于从幼苗（聚半乳糖醛酸酶抑

been used for purification of ice binding proteins/ AFPs from seedling (Polygalacturonase inhibitor protein, 41 kDa), leaf (low temperature induced protein, 41 kDa& transmembrane protein, 39 kDa) and berry (disease resistance protein, 41 kDa). These purified AFPs were also explored for their biotechnological potential.It is noteworthy, that seabuckthorn AFPs allowed enhanced survival of red blood cells (RBCs) by providing protection againsthemolysis of cryopreserved rat RBCs. However, efforts are still underway for large scale purification of these AFPs and their utilization in biomedical research for cryopreservationofRBCs. In addition to exploring theseabuckthornproteome and its biotechnological applications, recently nanotechnology an emerging area of research, with promising applications in the field of electronics, food industry, fabrics and biomedicine has gained our attention. Therefore,we wanted to explore the nanobiotechnological potential of this valuable bioresource for green synthesis of *H.rhamnoides* leaf and berrygold nanoparticles (AuNPs). UV-Visible spectroscopic studies and transmission electron microscopy analysis confirmed rapid synthesis of monoisotropic spherical Leaf (2 mins, 27+3.2 nm) and anisotropic Berry (15 mins, 55+4.5 nm) AuNPs.These AuNPsexhibited shape dependent anticancer, antioxidant and antibacterial activity suggesting their promising application as nano-drug formulationsfor biomedical applications. Further, owing to their higher nano-catalytic activity, these AuNPshave been utilized for efficient remediation of dye contaminated waste water into reusable non-toxic by-products with industrial applications. In future, a kit would be developed for degradation of dye-contaminated wastewater.

制蛋白，41kDa）、叶片（低温诱导蛋白，41kDa 和跨膜蛋白，39kDa）和浆果（抗病蛋白，41kDa）中纯化冰结合蛋白 /AFPs。此外，还对这些纯化的 AFP 进行了生物技术潜力方面的探索。值得注意的是，沙棘 AFPs 通过对冷冻保存的大鼠红细胞溶血的保护，提高了红细胞（RBCs）的存活率。然而，这些 AFP 的大规模纯化及其在 RBCs 冷冻保存的生物医学应用的研究仍在进行中。除了探索沙棘蛋白质组及其生物技术应用之外，最近纳米技术这一新兴研究领域也引起了我们的关注，其在电子、食品工业、织物和生物医学领域的应用前景广阔。因此，我们希望探索这种有价值的生物源在绿色合成沙棘叶片和浆果金纳米颗粒（AuNPs）方面的纳米生物技术潜力。紫外 – 可见光谱研究和透射电子显微镜分析证实了单向球形的叶片金纳米粒子（2 分钟，27+3.2 nm)和各向异性的浆果金纳米粒子(15 分钟，55+4.5 nm ）的快速合成。这些 AuNP 抑制了形状依赖性的抗癌、抗氧化和抗菌活性，这表明它们作为生物医学应用的纳米药物配方具有很好的应用前景。此外，由于其较高的纳米催化活性，这些 AuNP 已被用于将受染料污染的废水有效修复为可重复使用的无毒副产品，并用于工业用途。未来，将开发一种用于降解染料污染废水的试剂盒。

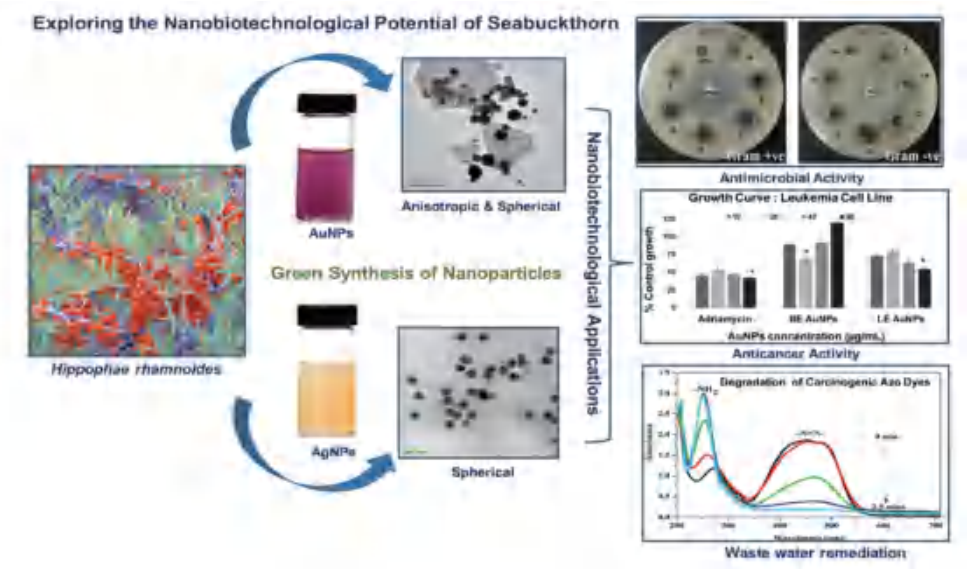

Figure 2 :Seabuckthorn mediated green synthesis of gold (AuNPs) and silver (AgNPs) nanoparticles and exploring their nanobiotechnological potential in biomedicine and allied industries
图 2 沙棘介导的金（AuNPs）和银（AgNPs）纳米粒子的绿色合成及其在生物医学和相关产业中的纳米生物技术潜力探索 .

2.1 Major Highlights of the Research work

- 2021, Worldwide first seabuckthorn proteome data repository of all the three different Indian seabuckthorn species(*H. rhamnoides, H.tibetanaand H.salicifolia*) growing in Himalayas. Dataset is available in PRIDE 'PRoteomicsIDEntifications database'with accession number "PXD023184".
- 2020, Research article highlighted in Vol 68(1), 58-76Cover Page of "Physiologia Plantarum" (Impact Factor : 5.081).
- 2019,Best posterawardin 3rd National Conference of Seabuckthorn Association of India on "Seabuckthorn: Translating

2.1 研究的主要亮点

- 2021 年，建立世界上第一个印度喜马拉雅山 3 种不同沙棘（*H. rhamnoides*、*H. tibetana* 和 *H. salicifolia*）的沙棘蛋白质组数据库。数据集可在 PRIDE "PRoteomicsIDEntifications 数据库"中查阅，登录号为 "PXD023184"。
- 2020 年，在《Physiologia Plantarum》发表封面文章，第 68(1)卷，58-76 页(影响因子：5.081）。
- 2019 年，在德里大学植物学系举行的印度沙棘协会第三届全国会议 "沙棘：将

Research into Sustainable Utilization & Conservation" held at Department of Botany, University of Delhi. (Cash prize of Rs. 5000/-).

研究转化为可持续利用和保护”上获得最佳海报奖（奖金 5000 卢比）。

- 2017,Best posteraward atNational Conference on Seabuckthorn on "Improving Health & Sustainable Development of Himalayan Region", organised by Seabuckthorn Association of India,Defence Institute of High Altitude Research (DIHAR) & Ladakh Autonomous Hill Development Council held at DIHAR, Leh-Ladakh, India. (Cash prize of Rs. 5000/-).

- 2017 年，由印度沙棘协会、国防高海拔研究所（DIHAR）和拉达克自治山区发展委员会在印度 Leh-Ladakh 国防高海拔研究所举办的“改善喜马拉雅地区的健康和可持续发展”上获全国沙棘会议最佳海报奖（奖金为 5000 卢比）。

- 2016, Research article highlighted on Vol 7(2), Cover page of "Journal of Proteins & Proteomics".

- 2016 年，在《蛋白质与蛋白质组学杂志》（Journal of Proteins & Proteomics）发表封面论文，第 7（2）卷。

- 2012-15,Submission of 2-DE gels of H. rhamnoides seedlings secretome. World-2DPAGE Repository (ExPASy Bioinformatics Resource Portal), Database no. 53.

- 2012–15，提交沙棘幼苗分泌组的 2-DE 凝胶，World-2DPAGE 知识库（ExPASy 生物信息学资源门户），数据库编号 53。

- 2012, Procedures have been established to grow seedlings under laboratory conditions. A method has been optimized to detect antifreeze activity using Phase contrast microscopy coupled with Nanoliter osmometer.

- 2012 年，制定了在实验室条件下培育幼苗的程序，优化了一种使用相差显微镜和纳升渗透计检测防冻活性的方法。

- 2012, Additionally, a specialized technique has been developed for purification

- 2012 年，开发了一种利用冰亲和色谱法纯化抗冻蛋白（AFPs）的专门技术。此

ofantifreeze proteins (AFPs) using Ice affinity chromatography. Moreover, a method is devised to test the efficacy of these purified AFPs for cryopreservation of red blood cells (RBCs) from rat.

外，还设计了一种方法用于测试这些纯化的 AFPs 在冷冻保存大鼠红细胞（RBC）方面的功效。

2.2 Projects Completed

Project 1:"A genomics and proteomic approach to identify, characterize, clone and over-express Hippophaerhamnoides antifreeze proteins (AFP) for crop improvement and food industry"
Sanction No:BT/PR10799/NDB/51/171/2008 dated 01/01/2009
Duration :4+1 years

Project 2:"Characterizing un-explored Seabuckthorn germplasm in Sikkim for antifreeze proteins, secondary metabolites, its comparison with germplasm of Lahaul and Spiti valley, Himachal Pradesh and also utilizing the bioresources for uplifting the livelihood of local people".
Sanction No: IBSD/A1/P(PH-2)/4 dated 29th March, 2017
Duration:2.5 years (29th March, 2017 – Sep, 2019)

2.2 已完成项目

项 目1：采用基因组学和蛋白质组学方法，鉴定、描述、克隆和过度表达用于作物改良和食品工业的沙棘抗冻蛋白（AFP）。
编 号：BT/PR10799/NDB/51/171/2008 dated 01/01/2009
时 间：4+1 年

项 目2："对锡金未开发的沙棘种质进行抗冻蛋白和次生代谢物的鉴定，将其与喜马偕尔邦 Lahaul 和 Spiti 山谷的种质进行比较，并利用生物资源改善当地人民的生活"。
编 号：IBSD/A1/P(PH-2)/4 dated 29th March, 2017
时 间：2.5 年 (29th March, 2017 – Sep, 2019)

2.3 Publications

1.Bhavana Sharma andRenu Deswal(2021). Comparative proteome profiling of seabuckthorn leaves from low altitude 'Sikkim' & high altitude 'Himachal Pradesh' Himalayan regions hints towards differential stress adaptive responses. Journal of Proteins & Proteomics, ISSN No : 2524-4663. (Impact factor – 1.0**).

2.Bhavana Sharma andRenu Deswal(2020). Ecophysiolomic analysis of stress tolerant Himalayan shrub H. rhamnoides shows multifactorial acclimation strategies induced by diverse environmental conditions. Physiologia Plantarum,68, 58-76. ISSN No: 1399-3054. (Impact factor –5.081). #Research work highlighted on the cover page of Physiologia Plantarum.

3.Bhavana Sharma, Shaweta Arora, Dinabandhu Sahoo andRenu Deswal(2019). Comparative fatty acid profilling of Indian seabuckthorn showed altitudinal gradient species-specific variations. Physiology & Molecular Biology of Plants, 26, 1-9. ISSN No : 0974-0430 (Impact factor – 3.023).

4.Bhavana Sharma, Ravi Gupta, Dinabandhu Sahoo andRenu Deswal(2019). Purification of dual-functioning chitinases with hydrolytic & antifreeze activities from H.

2.3 近期发表论文

1.Bhavana Sharma and Renu Deswal (2021)， 喜马拉雅山脉低海拔地区锡金和高海拔 地区喜马偕尔邦沙棘叶片的蛋白质组比较分析表明了不同的应激适应性反应，蛋白质与蛋白质组学杂志， ISSN No: 2524-4663 (影响因子 – 1.0**)

2.Bhavana Sharma and Renu Deswal (2020)， 喜马拉雅灌木沙棘的生态生理学分析表明了不同环境条件下的多因素适应策略，植物生理学杂志， 68, 58-76. ISSN No: 1399-3054. (影响因子 – 5.081)

3.Bhavana Sharma, Shaweta Arora, Dinabandhu Sahoo and Renu Deswal (2019)，印度沙棘的脂肪酸比较分析显示了海拔梯度物种特异性变化，植物生理学与分子生物学杂志，26, 1-9. ISSN No : 0974-0430 (影响因子 – 3.023)

4.Bhavana Sharma, Ravi Gupta, Dinabandhu Sahoo and Renu Deswal 2019)， 从沙棘幼苗中纯化具有水解和抗冻活

rhamnoides seedlings. Journal of Proteins & Proteomics,10, 69-81. ISSN No : 2524-4663. (Impact factor – 1.0**).

5.Bhavana Sharma andRenu Deswal(2018). Single pot synthesised nanoparticles using Hippophaerhamnoides leaf & berry extract showed shape dependent differential nanobiotechnological application. Artificial Cell, Nanomedicine, & Biotechnology, 1-11. ISSN No : 1399-3054. (Impact factor – 6.355).

6.Bhavana Sharma, Dinabandhu Sahoo andRenu Deswal(2018). Single - step purification & characterization of antifreeze proteins from leaf & berry of a freeze tolerant shrub seabuckthorn (H. rhamnoides). Journal of Separation Science, 41, 3938-3945.ISSN No : 1615-9314. (Impact factor – 3.614).

7.Prakriti Kashyap and Renu Deswal (2017). A novel class I Chitinase from Hippophaerhamnoides: Indications for participating in ICE-CBF cold stress signaling pathway. Plant Science 259, 62-70.(Impact factor – 5.363).

8.Ravi Gupta and Renu Deswal (2016). Identification And Functional Annotation of Apoplastic Phosphoproteins of Hippophaerhamnoides Seedlings. Journal of Proteins & Proteomics 7 (4), 279-296.

性的双重功能几丁质酶，蛋白质与蛋白质组学杂 志， 10, 69–81. ISSN No : 2524–4663. (影响因子 – 1.0**)

5.Bhavana Sharma and Renu Deswal (2018)， 利用沙棘叶片和果实提取物单罐合成的纳米颗粒显示出形状依赖性差异的纳米生物技术应用，人工细胞、纳米医学和生物技术杂志，1–11. ISSN No : 1399–3054。(影响因子 – 6.355)

6.Bhavana Sharma, Dinabandhu Sahoo and Renu Deswal (2018). 耐冻灌木沙棘叶片和果实中抗冻蛋白质的单步纯化和表征，分离科学杂志，41, 3938–3945.ISSN No : 1615–9314. (影响因子 – 3.614)

7.Prakriti Kashyap and Renu Deswal (2017)，来自沙棘的新型 I 类几丁质酶：参与 ICE–CBF 冷胁迫信号通路的迹象，植物科学杂志，259, 62–70. (影响因子 – 5.363)

8. Ravi Gupta and Renu Deswal (2016)，沙棘幼苗表皮磷蛋白的鉴定和功能注释 , 蛋白质与蛋白质组学杂志，7 (4), 279–296

9.Bhavana Sharma,Ravi Gupta andRenu Deswal(2016). Mining the Protein Repertoire of a Himalayan Shrub, H. rhamnoides for Antifreeze Proteins. Journal of Proteins & Proteomics, 7(2) 199-211. ISSN No: 2524-4663.#Research work highlighted on cover page of journal.

9.Bhavana Sharma, Ravi Gupta and Renu Deswal (2016)，从喜马拉雅灌木沙棘的蛋白质中寻找抗冻蛋白质，蛋白质与蛋白质组学杂志，7(2) 199–211. ISSN No: 2524–4663

10.YaiphabiSougrakpam, and Renu Deswal(2016). Hippophaerhamnoides N-glycoproteome Analysis - A Small Step Towards Seabuckthorn Proteome Mining. Physiology and Molecular Biology of Plants 22(4) 473-484(Impact factor – 3.023).

10.Yaiphabi Sougrakpam, and Renu Deswal (2016)，沙棘 N– 糖蛋白组分析—迈向沙棘蛋白质组挖掘的一小步，植物生理与分子生物学杂志，22(4) 473–484(影响因子 – 3.023)

11.Ravi Gupta and Renu Deswal(2014). Antifreeze proteins enable plants to survive in freezing conditions. Journal of Biosciences, 39(5), 931-944 (Impact factor – 1.65).

11.Ravi Gupta and Renu Deswal (2014)，抗冻蛋白使植物能够在冷冻条件下生存， 生物科学杂志 , 39(5), 931–944 (I影响因子 – 1.65)

12.Ravi Gupta and Renu Deswal (2014). Refolding of β-stranded class I chitinases of Hippophaerhamnoides enhances the antifreeze activity during cold acclimation. PloS One, 9(3), e91723. (Impact factor – 3.752)

12. Ravi Gupta and Renu Deswal (2014). 沙棘 β – 链 I 类几丁质酶的重折叠增强了寒冷适应过程中的抗冻活性，PloS One, 9(3), e91723. (影响因子 – 3.752)

13.Bhavana Sharma andRenu Deswal(2014). Antifreeze Proteins In Plants : An Overview with an Insight into the Detection Techniques including Nanobiotechnology. Journal of Proteins & Proteomics, 5(2), 89-107. ISSN No : 2524-4663.

13.Bhavana Sharma and Renu Deswal (2014)，植物中的抗冻蛋白：包括纳米生物技术在内的检测技术综述，蛋白质与蛋白质组学杂志，5(2), 89–107. ISSN No: 2524–4663

14.Ravi Gupta and Renu Deswal (2012). Low temperature induced secretome analyses and purification of antifreeze protein from Hippophaerhamnoides, a Himalayan wonder plant. 2012, Journal of Proteome Research, 11(5), 2684-2696. (Impact factor - 5.37)

14.Ravi Gupta and Renu Deswal (2012)，喜马拉雅神奇植物沙棘的低温诱导分泌组分析和抗冻蛋白纯化，蛋白质组研究杂志，11(5)，2684-2696.（影响因子 - 5.37）

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Our laboratory has been engaged in seabuckthorn research from past two decades and the following are broad areas of our research on seabuckthorn:

1.Morphological and microsatellite based biodiversity analysis of seabuckthorn (*Hippophae rhamnoides*, *Hippophae salicifolia*, and *Hippophae tibetana*) natural populations, from distinct geographical regions of Indian Himalayas (Union Territory of Ladakh, Himachal Pradesh, Uttarakhand, and Arunachal Pradesh).

我们实验室在过去的二十年里一直从事沙棘研究，以下是我们关于沙棘研究涉及的广泛领域：

1. 对印度喜马拉雅山脉拉达克联邦直辖区、喜马偕尔邦、北阿坎德邦和阿鲁纳恰尔邦（备注：为我国藏南地区，下同）不同区域的沙棘（鼠李沙棘 *Hippophae rhamnoides*, 柳叶沙棘 *Hippophae salicifolia*, 和西藏沙棘 *Hippophae tibetana*）自然种群进行形态学和微卫星基因多样性分析。

Figure 1 :Two major species of seabuckthorn growing in India
图 1. 印度生长的两个主要沙棘种类

Fig. 2 Major regionsfrom where seabuckthorn wild population samples were collected
图 2. 采集沙棘野生种群样本的主要地区

2.Construction of EST database and transcriptome assembly of seabuckthorn (*Hippophae rhamnoides* L.)

2. 沙棘(鼠李沙棘 *Hippophae rhamnoides* L.) EST 数据库的构建和转录组组装

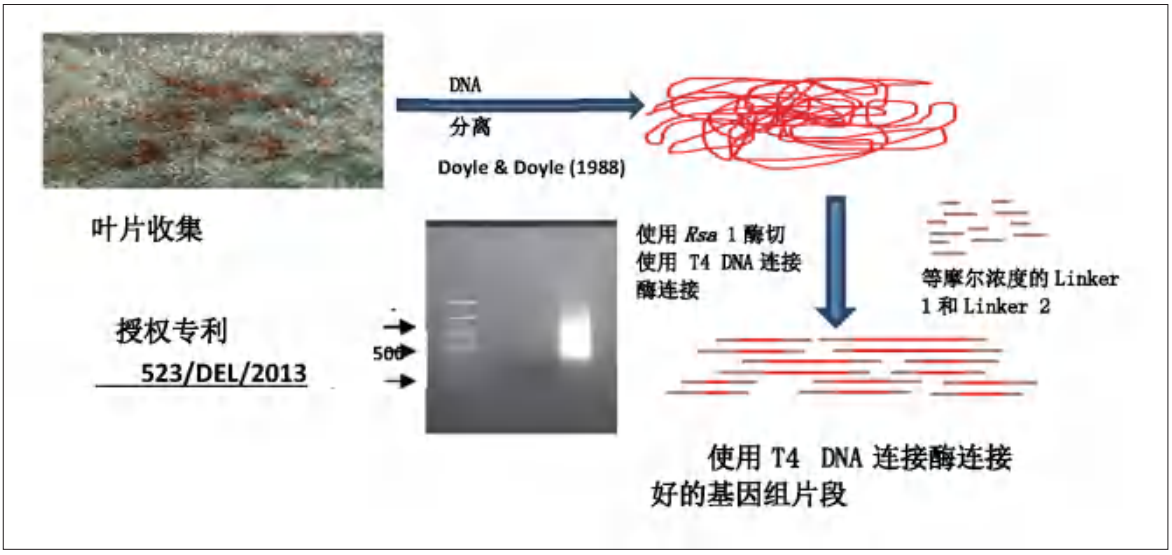


Fig. 3 Schematic diagram, representing steps followed for construction of microsatellite enriched library
图 3 展示构建微卫星富集文库所遵循的步骤的示意图

3. Transcriptome profiling and identification of genes for cold tolerance in seabuckthorn (*Hippophae sp.*)

3. 沙棘属（*Hippophae*）耐寒性的转录组分析和基因鉴定

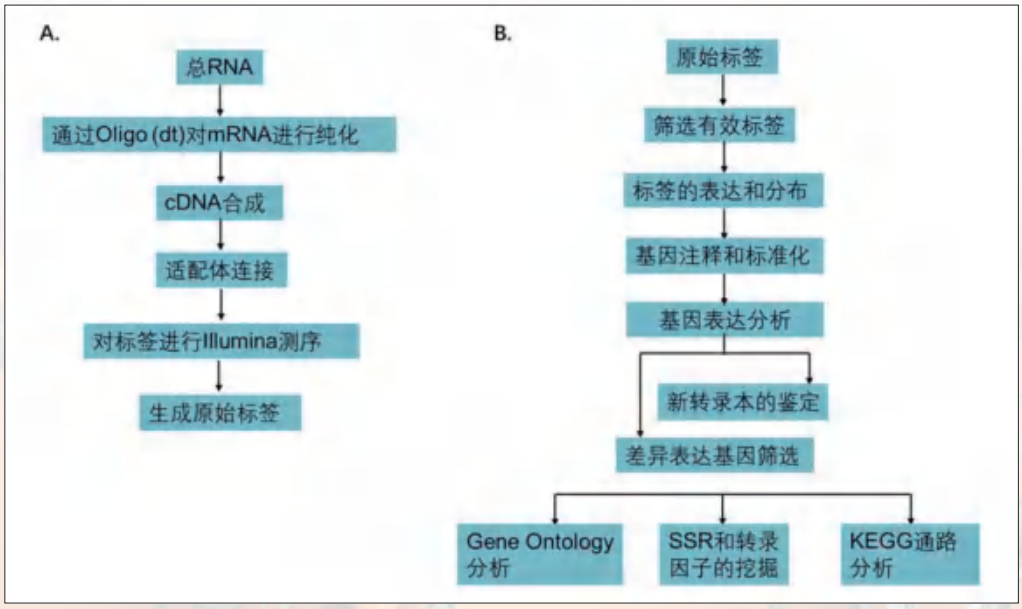


Fig. 4 Schematic diagram, representing steps followed for transcriptome profiling
图 4. 展示转录组分析实验步骤的示意图

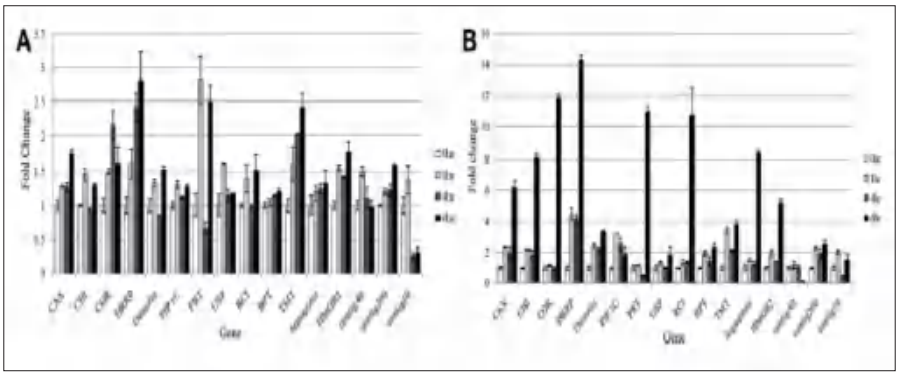


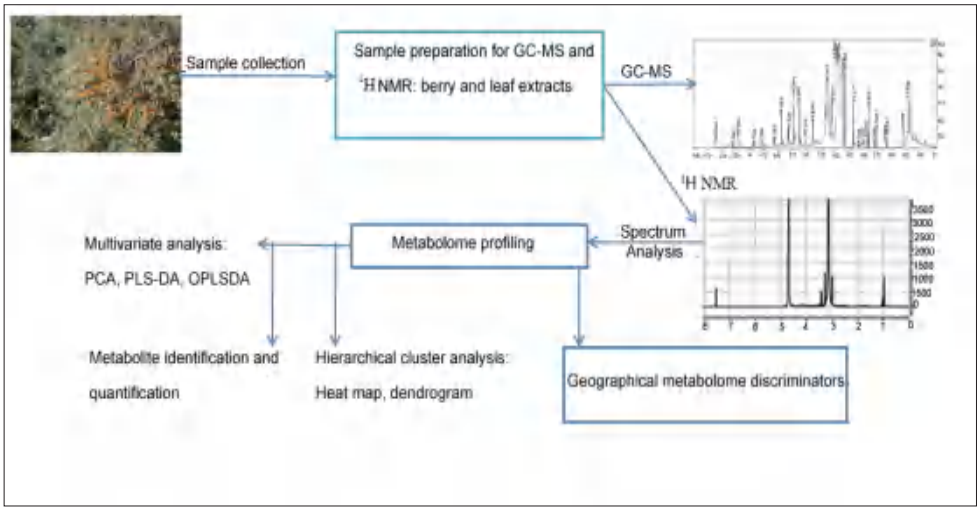
Fig. 5 Identification and expression analysis of temperature stress responsive genes
图 5. 温度胁迫响应基因的鉴定和表达分析

4.Gender-based molecular markers identification and validation in seabuckthorn (*Hippophae rhamnoides* and *Hippophae salicifolia*)

4. 基于雌雄的分子标记鉴定和验证鼠李沙棘（*Hippophae rhamnoides*）和柳叶沙棘（*Hippophae salicifolia*）

5.Metabolomic diversity analysis utilizing the GC-MS and 1H-NMR approach

5. 利用 GC-MS 和 1H-NMR 方法进行代谢组多样性分析



6.Functional validation of miRNA target genes in abiotic stress in Hippophae salicifolia

6. 非生物胁迫条件下柳叶沙棘 (Hippophae salicifolia) 中 miRNA 靶基因的功能验证

7.NGS based construction of transcriptome assembly of *Hippophae salicifolia* male and female plants

7. 基于 NGS 测序技术构建柳叶沙棘 (*Hippophae salicifolia*) 雄性和雌性植株的转录组组装

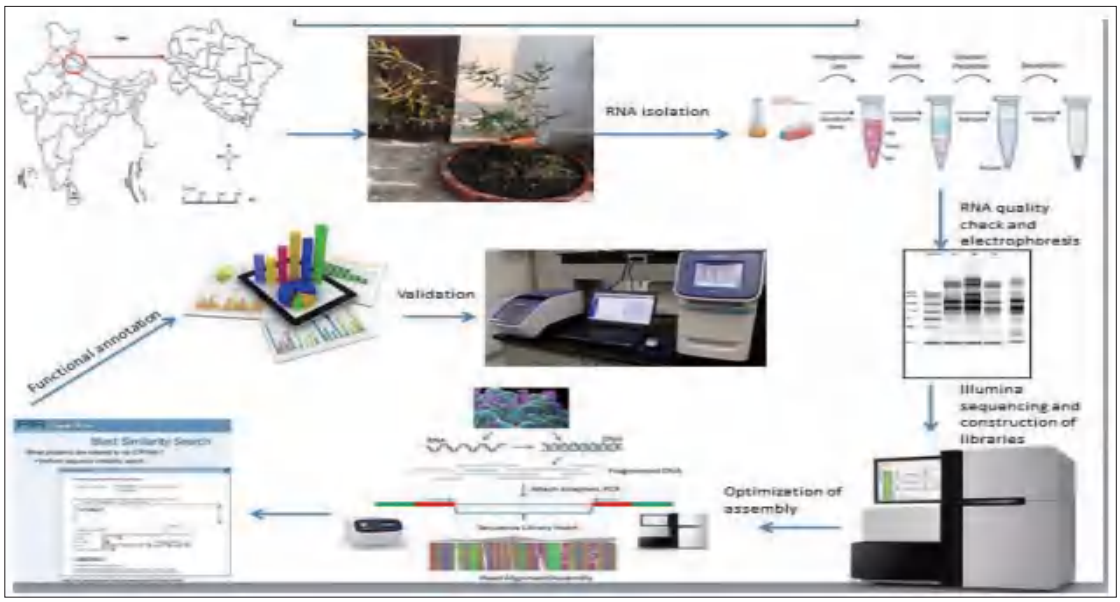


Fig. 6 NGS–based transcriptome profiling of male and female seabuckthorn
图 6. 基于 NGS 测序技术对沙棘雄性和雌性植株进行转录组分析

In our recent work, we have generated whole transcriptome profile of male and female Hippophae salicifolia leaf samples using the NGS approach, to discriminate the data and analysis the mechanism responsible for the gender discrimination. The transcriptome assembly was exploited for microsatellites distribution, presence of various transcription factors, functional annotations of the whole assembly,in silicodifferential expression of genes and their experimental validations.

在我们最近的研究中，我们利用 NGS 技术对柳叶沙棘雄性和雌性叶片样本进行了全转录组分析，以区分数据并分析性别鉴定的机制。我们对转录组组装进行了微卫星分布分析，检测了各种转录因子的存在，对整个组装进行了功能注释，并进行了基因的体外差异表达分析以及实验验证。

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1.Singh, S. and Sharma, P. C. (2021). GC-MS based biochemical profiling of Seabuckthorn (*H. rhamnoides L.*) growing in different geographical regions of Indian Himalayas. Phytochemical Analysis doi: 10.1002/pca.3081

2.Singh, S.and Sharma, P. C. (2021). GC-MS based biochemical profiling of Seabuckthorn (*H. rhamnoides L.*) growing in different geographical regions of Indian Himalayas. Phytochemical Analysis doi: 10.1002/pca.3081

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四 National Institute of Pharmaceutical Education & Research (NIPER), Mohali, Punjab, India 印度国家制药教育与研究所（NIPER）沙棘研究

Prof. P.C. Sharma
Project title: Development of herbal formulations from Seabuckthorn
Funding agency: DBT-India (BT/PR9116/NDB/39/390/2013)
Project Coordinator: Dr. Inder Pal Singh (Professor), National Institute of Pharmaceutical Education & Research (NIPER) – Mohali, Punjab

项目名称：沙棘草药配方的开发
资助机构：印度生物技术部（DBT-India），
项目编号：BT/PR9116/NDB/39/390/2013
项目协调员：印度国家制药教育与研究所（NIPER）Inder Pal Singh 博士（教授）

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Indian Patent Application No.: 202311020107
Title: *"PHYTOSOMES OF POLYPHENOL ENRICHED EXTRACTED FRACTION OF HIPPOPHAE RHAMNOIDES L. FRUIT AND SOYABEAN LECITHIN"*

印度专利申请号：202311020107，“富含多酚的沙棘（*Hippophae rhamnoides L.*）果实和大豆卵磷脂的植物体”。

Comparative quantitative analysis of Seabuckthorn (*Hippophae rhamnoides*) fruit oil by qNMR, FTIR and GC-MS. Chinese Herbal Medicines 2023 (accepted for publication)

发表论文：通过 qNMR、FTIR 和 GC-MS 进行沙棘（*Hippophae rhamnoides*）果实油的定量比较分析，中国草药药物学，2023 年（已被接受发表）

Summary of studies on seabuckthorn

关于沙棘研究的总结

We have developed an extraction method that can use Seabuckthorn (SBT) fruits for preparation 70% ethanolic extract followed by preparation of oil and from same plant material. We have analyzed sea buckthorn oil by NMR and qNMR method, which revealed that the SBT fruit oil mainly comprised TAGs containing a mix of different acyl groups and did not contain free omega fatty acids. SBT fruit oil TAG contains palmitoleate/palmitate/oleate as major acyl functionalities, while linoleate and linonelate comprised minor fraction. Six marketed samples were also analyzed by qNMR and the results suggested that one of the samples was fruit oil while the others were seed oil or a mix of fruit oil and seed oil although the labels except one did not mention if it was a fruit oil or seed oil.

我们已经开发了一种提取方法，可以利用沙棘（SBT）果实制备 70% 乙醇提取物，随后从果渣中制备沙棘果油。我们使用 NMR 和 qNMR 方法对沙棘果实油进行了分析，结果显示 SBT 果实油主要由含有不同酰基的三酰甘油（TAGs）组成，不含游离的 ω- 脂肪酸。SBT 果实油的 TAG 主要包含棕榈油酸 / 棕榈酸酯 / 油酸酯作为主要的酰基官能团，而亚油酸酯和亚麻油酸酯则占较小部分。我们还对六个市售样品进行了 qNMR 分析，其中一个样品是果油，而其他样品是籽油或果油与籽油的混合物，尽管除一个样品外，标签并未说明是果油还是籽油。

Seabuckthorn fruit oil (IPHRFH) showed good wound healing activity and was therefore developed into nanoemulsion loaded Cream and Gel formulation. Cream and gel formulation of H. rhamnoides fruits oil showed 78.96 % and 72.59 % wound contraction at 8th day respectively compared with 62.29 shown by the positive control soframycin. IPHRFH

沙棘果实油（IPHRFH）表现出良好的促进伤口愈合的活性，因此被开发成纳米乳霜和凝胶配方。在处理第 8 天，阳性对照药沙弗霉素处理组的伤口收缩率为 62.29%，沙棘果实油乳霜和凝胶配方处理组分别显示出 78.96%和 72.59%的伤口收缩率。为了进行抗高脂血症活性研究，沙棘果油（IPHRFH）还被制成液固分散体。从 70%乙醇提取的沙棘（*H. rhamnoides*）富含多酚的提取物（IPHRFPPEF）被制成磷脂复合物（植物体）

was also developed into liquid solid dispersion for antihyperlipidemic activity. Polyphenol enriched fraction from 70% ethanolic extract of *H. rhamnoides* (IPHRFPPEF) was developed into phospholipid complex (Phytosomes) for anti - inflammatory activity using carrageenan-induced rat paw edema. The polyphenolic enriched fraction from *H. rhamnoides* fruits at 100 mg/Kg showed 60.49 % inhibition at 5th hr compared with indomethacin 25 mg/ Kg (86 %). Phytosomes at 50 mg/kg body weight showed 66.93% inhibition at 5th hour.

Our studies also gave deeper insights using the Type 2 Diabetes induced dyslipidemia model, offering a newer perspective on the therapeutic role of SBT 70% ethanolic extract, polyphenol enriched fractions and phytosomes prepared from fractions. SBT formulations have shown ameliorative effects on morphological, biochemical and oxidative stress parameters. It significantly decreased the elevated blood glucose levels, blood lipid levels, AST, ALT and oxidative stress. The treatment group administered 200 mg/ kg of Phytosomes demonstrated remarkable antihyperlipidemic activity compared to the ethanolic extract and fraction. The results of this study imply that seabuckthorn formulations have antihyperlipidemic activity, improving the dyslipidemia caused by type 2 diabetes.

以进行抗炎活性研究，使用海藻酸诱导的大鼠爪肿胀模型。100 mg/kg 剂量的沙棘果油富含多酚提取物，在第 5 小时显示出 60.49%的抑制作用，而消炎症药吲哚美辛 25mg/kg 剂量显示出 86%的抑制作用。50mg/kg 体重的 Phytosomes 在第 5 小时显示出 66.93%的抑制效果。

我们的研究还使用了 2 型糖尿病诱导的血脂异常模型，对 SBT 70%乙醇提取物、富含多酚的分离物和从分离物制备的磷脂复合物的治疗作用提供了更深入的研究。SBT 制剂显示出对形态学、生化和氧化应激参数的改善效果，显著降低了升高的血糖水平、血脂水平、AST、ALT 以及氧化应激。与乙醇提取物和分离物相比，给药 200mg/kg 的磷脂复合物的治疗组表现出显著的抗高脂血症活性。本研究结果暗示了沙棘制剂具有抗高脂血症活性，可以改善 2 型糖尿病引起的血脂异常。

In acute oral toxicity a dose of 5000 mg/kg bw and in repeated dose 28 day oral toxicity study at 1000 mg/kg, the phospholipid complex of IPHRFPPEF in male and female Sprague dawley (SD) rats from the present investigations did not show any toxicity.

在急性口服毒性实验中，给予雄性和雌性斯普拉格 · 道利 (SD) 大鼠 5000 mg/kg 体重剂量的 IPHRFPPEF 磷脂复合物，在重复剂量为 1000mg/kg 的 28 天口服毒性研究中，显示没有显示出任何毒性。

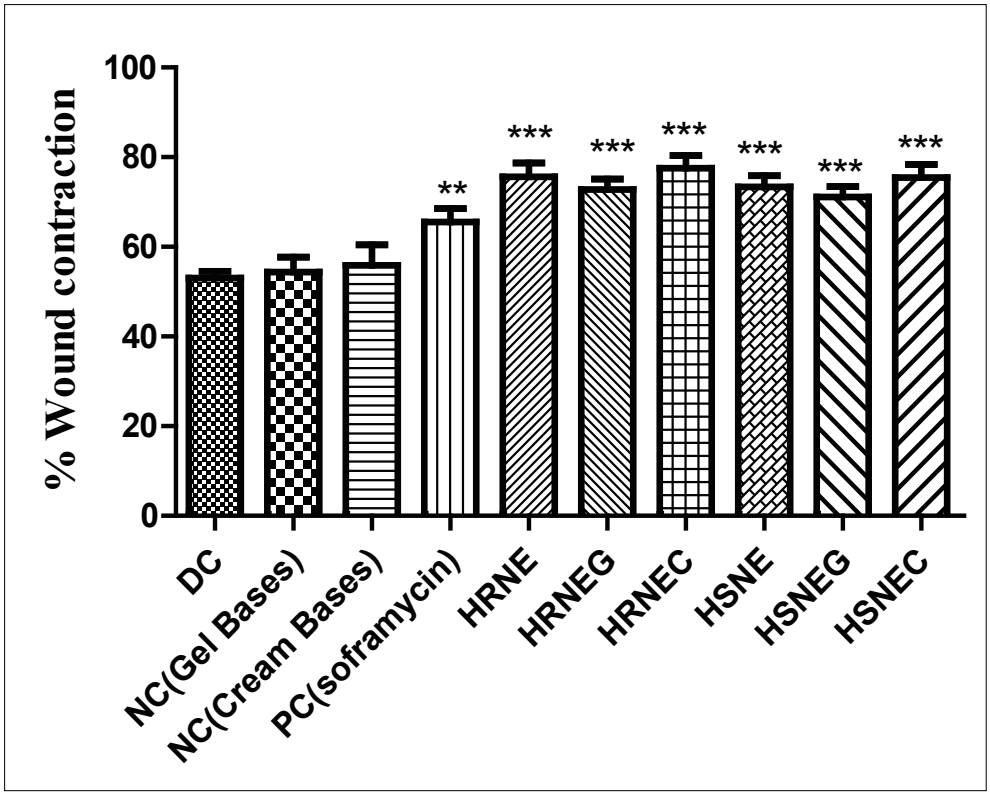

Figure 1: Percentage wound contraction in *H. rhamnoides* and *H salicifolia* fruit oils formulations–treated wound tissue after 8 days of topical treatment. Statistical comparison was performed using analysis of variance (one-way ANOVA) followed by Tukey's test. ***p<0.001 and **P<0.01 vs disease control; Values are represented as mean ±SEM.

图 1 在经过 8 天的局部治疗后，H. rhamnoides 和 H. salicifolia 果油制剂处理组的伤口组织的愈合收缩率 . 使用方差分析（单因素方差分析）进行统计比较，随后进行 Tukey 的测试 . ***p<0.001 和 **P<0.01 与疾病对照组相比；数值表示为平均值 ± 标准误差（SEM）

Table 1: anti–inflammatory activity of IPHRFPPEF and Phytosomes
表 1 IPHRFPPEF 和磷脂复合物的抗炎活性

试剂	剂量 (mg/kg)	爪肿胀的体积			% 肿胀抑制率	
		0 h	3 h	5 h	3 h	5 h
蒸馏水	1 mL	0.68	1.9404	1.9378	–	–
布洛芬	50	0.80 ± 0.01	0.72 ± 0.05	0.822 ± 0.07	57.64 ± 4.13	65.97 ± 5.59
IPHRFPPEF	100	0.80 ± 0.04	0.66 ± 0.07	0.75 ± 0.05	53.02 ± 5.93	60.49 ± 4.61
磷脂复合物	50	0.74 ± 0.05	0.51 ± 0.05	0.83 ± 0.07	47.05 ± 5.40	66.93 ± 5.72
磷脂复合物	100	0.82 ± 0.02	0.69 ± 0.07	0.87 ± 0.07	55.85 ± 5.87	70.67 ± 5.90

数值为平均值 ± 标准误差；n = 5

五 Chandigarh Agritech Pvt. Ltd. (Seaberry), Baddi, H.P.

Chandigarh Agritech 私人有限公司（沙棘）介绍

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Chandigarh Agritech Pvt. Ltd. (Seaberry) located at Himalayan foothills (Baddi) of Himachal Pradesh (INDIA) is manufacturing highly Biologically Active, Pure & Natural Seabuckthorn oil (for Nutraceutical & Cosmetic products) by using state of the art Supercritical CO^2 extraction technology.

Chandigarh Agritech 私人有限公司（Seaberry）位于印度喜马偕尔邦（H.P.）的喜马拉雅山脚（Baddi）。该公司（Seaberry）采用先进的超临界 CO2 萃取技术生产高度生物活性、纯净和天然的沙棘油（用于保健食品和化妆品）。

Company has standardized and developed the first of its kind Global leading Seabuckthorn oil > 50% Omega-7 (rarely available) which powerfully addresses the dreaded metabolic syndrome; responsible for life threatening diseases like- Heart, Diabetes, Cancer etc. The Company is exporting FDA, NOP registered Organic Seabuckthorn oil and first of its kind Veggie softgels of Unique formulation (Seabuckthorn oil-Vitamin D3-DHA) in bulk.

该公司已经标准化并开发了首款全球领先的沙棘油 >50% Omega-7（十分难得），该产品有效治疗令人恐惧的代谢综合征；该综合征与危及生命的疾病，如心脏病、糖尿病、癌症等密切相关。该公司出口 FDA 和 NOP 注册的有机沙棘油，并批量生产首款独特配方的 Veggie 软胶囊（沙棘油 – 维生素 D3–DHA）。

*Company has recently been granted Patent on Vegetarian Composition of Vitamin D3 in Seabuckthorn Oil.
公司最近获得了有关在沙棘油中含有素食维生素 D3 的专利

六 Biosash Pvt. Ltd., Faridabad, HR, India Biosash 私人有限公司介绍

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Ladakh was known as " the last Shangri la " by western travelers in the 19th and 20th centuries. Western travelers in the 1930's recorded their impressions in various books and once they reached there on foot , they were in a world which had not changed for many centuries. They were struck by Leh bazaar and the relative harmony in which various communities lived. Ladakh those days was important because of its strategic location at the crossroads of important trade routes running north to Yarkand the ancient Buddhist kingdom , east to Tibet and then to China, south into India and west to Kashmir. Since Indian independence in 1947, Leh in Ladaakh has become more accessible but the climate and land are still very harsh and the standard of living of the local inhabitants is still very low. Biosash started its journey with Wild -

在 19 世纪和 20 世纪，拉达克被西方旅行者称为“最后的香格里拉”。在 1930 年代，西方旅行者在各种书籍中记录了他们对这个地方的印象，一旦他们徒步到达那里，就进入了一个许多世纪都没有改变的世界。他们被列城 Leh 集市和各个社区之间相对和谐的生活所震撼。拉达克在当时因其战略位置而重要，位于重要的贸易路线交汇处，北通古代佛教王国叶尔羌，东至中国西藏，南至印度，西至克什米尔。自 1947 年印度独立以来，拉达克的 Leh 在交通上变得更加便捷，但气候和土地仍然非常恶劣，当地居民的生活水平仍然很低。

Biosash 公司创建于 2004 年，以喜马拉雅野生沙棘为主要原料，如今是印度最大的沙棘产品制造公司，拥有超过 100 种沙棘产品。该公司每年的营业额约为 6 亿卢比，主要来自沙棘产品（图 1）。

Himalayan seabuckthorn in 2004 and is the largest manufacturing company of seabuckthorn products in India with over 100 life changing seabuckthorn products today. Biosash Business Pvt. Ltd. is a company with turnover of approximately Rs 600 million annually mainly in Seabuckthorn products (Fig. 1).

Biosash 公司鼓励当地居民采集沙棘浆果，并通过政府认可的合作社组织居民进行沙棘浆果的采集。在 2005 年，当时的拉达克和列城 Leh 仍然没有常规的电力供应，印度军队的发电机每天只供应几个小时的电力。我们在当地广播电台和报纸上做广告，甚至支付了不同村庄的村长差旅费来参加我们的会议，在会上我们向当地社区宣传，通过采摘沙棘浆果可以获得的收入。

Fig. 1. Seabuckthorn products of Bioasash Pvt.Ltd.
图 1. Biosash 私人有限公司的沙棘产品 .

Through pioneering efforts Biosash encouraged the locals to take up collection of Seabuckthorn berries and organized the same through the Government recognized co operative societies way back in 2005 when there was still no regular electricity supply to leh and Ladakh and the Indian Army generators supplied electricity for a few hours every day. We advertised in the local radio

我们以小规模的方式为提高当地社会经济状况做出了贡献。我们从一开始就通过当地合作社定价来支付采集费，确保了当地居民在严酷的环境中（温度降至零下 40 摄氏度）采摘沙棘浆果时能得到公平的报酬。自 2005 年以来，我们一直遵循这个制度，现在当地居民都期待着收获季节，他们可以赚到足够的钱度过严冬，

and newspapers and even paid the headmen of different villages travel expenses to attend our meetings where we used to explain what income could be earned by local communities if they harvested the seabuckthorn berries.
We make in a small way our contribution to lift up the socio economic condition of the locals. The rate we pay for collection has since the beginning been fixed by the local cooperative societies and this ensures that the locals get a fair wage for their efforts for collection of seabuckthorn berries in the harsh land where temperatures fall to minus 40 C . We have been following this system since 2005 and now the locals wait for the harvest season where they can make enough money to take them through the harsh winter when the source of income from tourism also is at its lowest as Ladakh gets cut off and remains inaccessible by road for approx. 3 to 4 months during the winters.

We also use sustainable techniques of harvesting by shaking the ripe berries of the bushes rather than cutting off the entire branches , which ensures that the wild seabuckthorn forests rejuvenate quickly. Biosash has also applied for a process innovation patent on a special Seabuckthorn process of manufacture of Seabuckthorn Juices developed through pioneering research for targeting of lifestyle induced conditions through Special Seabuckthorn Juices with herbal extracts. Biosash has received immense success in its seabuckthorn

因为在这个时候，来自旅游业的收入也处于最低谷，拉达克在冬季断路，大约有 3 到 4 个月无法公路通行。

我们还采用可持续的采摘技术，通过震荡摇落成熟的沙棘浆果而不是剪去整个枝条，以确保野生沙棘林迅速恢复。Biosash 公司还申请了一项关于特殊沙棘制汁工艺的专利，该工艺开创性的针对由生活方式引起的疾病，通过加入草药提取物生产出特殊的沙棘汁。Biosash 公

range of natural wellness juices, Super critical CO2 herbal extracts in capsules, natural cosmetics, and in food products all based on seabuckthorn targeted to enhance healthy living.

Biosash already has products from Natural Juices , tea , toothpaste and green tea, Supplement capsules , jam . sauces to creams and oils for daily use and when anyone uses any product once they do not change the product ever again. Biosash is working on a healthy anti cancer diet using seabuckthorn juices and extracts and hopes to release the same for trials in the near future. Biosash has exported its products to USA , UK, and UAE. Biosash's pioneering ethos has led to recognition through the development of over 50 FIRST IN THE WORLD products – Namely. Eighteen different Seabuckthorn Juices for lifestyle induced conditions such as Type 2 Diabetes, Heart conditions, Ulcers, poor Immunity, and for sportsmen and athletes and women.

Super critical CO2 Oil extracts in Vegetarian Capsules from the Seabuckthorn Seed and the Seabuckthorn Berry. Seabuckthorn Chawanprash or Chawan prash based on the goodness of Seabuckthorn. Numerous face care Cosmetics, body scrubs, Soaps, and oils including rejuvenating massage oils , The world's first Seabuckthorn Lipsticks ,TALCUM POWDER with Seabuckthorn, SEABUCKTHORN Toothpaste, Hand wash , Hand Sanitiser,

司在其沙棘系列天然保健汁、超临界 CO_2 草本提取物胶囊、天然化妆品和以沙棘为基础的食品产品方面取得了巨大成功，这些产品旨在促进健康生活。

Biosash 公司已经拥有从天然果汁、茶、牙膏和绿茶、补充剂胶囊、果酱、调味酱到日常使用的乳霜和油等产品。一旦有人使用了这些产品，就不会再用其他产品。Biosash 公司正在研究使用沙棘汁和提取物制作健康的抗癌饮食，并希望在不久的将来进行试验。Biosash 公司已将其产品出口到美国、英国和阿拉伯联合酋长国。Biosash 公司的开拓性理念已经获得认可，通过开发 50 多种世界首创的产品，包括 18 种不同的沙棘汁，用于生活方式引起的多种疾病，如 2 型糖尿病、心脏病、溃疡、免疫力差，也可针对运动员和女性。

超临界 CO2 油提取自沙棘种子和沙棘浆果，以沙棘的优点为基础，将其制成沙棘软胶囊（Seabuckthorn Chawanprash）。另 外 还

Mosquito repellants, Seabuckthorn Trimfit Tea for a slimmer fitter body, Seabuckthorn Honey Corn Flakes, Seabuckthorn Tomato Chilli Sauce, Seabuckthorn Liquid Laundry Detergent, Floor Cleaner, Dish wash, Multipurpose household Cleaner And research is on for many many more to come.

Biosash invests greatly in research and development , and in manufacturing infrastructure in order to manufacture pioneering products for the benefit of mankind and is fortunate to have been recognised and has received many awards for its efforts.
Arjun Khanna, MD, Biosash believes that the only way to prevent and even correct the serious lifestyle disorders such as cancer, heart attacks, strokes, and diabetes not to mention the lesser conditions is through the proper supplementation of our diet through Biosash seabuckthorn Juices and supplements for a enhanced quality of life and good health.

有许多面部护肤品、磨砂产品、香皂和油，包括具有复原功能的按摩油，世界上首款沙棘口红，含有沙棘的爽身粉，沙棘牙膏，洗手液，洗手消毒剂，驱蚊剂，瘦身茶以获得苗条健康的体形，沙棘蜜糖玉米片，沙棘番茄辣椒酱，沙棘液体洗衣液，地板清洁剂，洗碗液，多用途家用清洁剂，还有许多其他产品正在研究中。Biosash 在研究和开发以及制造基础设施方面投入巨大，以生产造福人类的开拓性产品，这些产品得到了广泛认可，并获得了许多奖项。

Biosash 的董事长 Arjun Khanna 博士认为，唯一的方法是通过正确的饮食补充以预防甚至矫正严重的生活方式疾病，如癌症、心脏病、中风和糖尿病，使用 Biosash 公司的沙棘汁和补充剂，可有效提高人们生活质量和健康水平。

7. Country Report of Latvia

拉脱维亚沙棘发展报告

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Country Report of Sea Buckthorn Development in LATVIA in 2022

2022 年拉脱维亚沙棘开发报告

The total area of sea buckthorn plantations in Latvia in 2022 was about 1200 ha, 170 ha of them have been certified as organic. The total production of sea buckthorn fruits in Latvia in 2022 was about 800 tons. There are no natural stands of the sea buckthorn in Latvia, though records of the fossil pollen show the presence of sea buckthorn after the last glacier retreat 12 thousand years ago.

截止 2022 年，拉脱维亚全国有沙棘种植面积约 1200 公顷，其中 170 公顷为有机种植园。全国沙棘鲜果产量约 800 吨。拉脱维亚没有天然沙棘分布，尽管化石花粉考古研究显示，在一万两千年前最后一次冰川褪去时有沙棘植物存在。

Most of the plantations in Latvia are not large, varying from 2 to 5 ha. There is a group of five growers with larger orchards, 20 – 40 ha each, joined within a cooperative “Baltic berry gardens”. They jointly export harvested fruits to other countries. Fruits are harvested by the cut/freeze/shake/clean method.

在拉脱维亚，大多数沙棘种植园面积不大，介于 2–5 公顷，其中有 5 个种植面积为 20–40 公顷的大种植园主联合组建一个合作社“波罗的海浆果园”，联合起来向其他国家出口鲜果。沙棘果实采收采用“剪枝 – 冷冻 – 震荡 – 分拣”方法。

Varieties are grown in Latvia, which are suitable for a temperate seaside climate and have adapted to winters with unstable temperatures and frequent thaws. The most popular one is Mary, although Tatjana, Botanicheskaya, Ljubitelskaya and Eva as well are grown. Their weight of 100 fruits ranges from 70 to 100 g, brix from 7 till 10, the content of biochemical substances is moderate.

在拉脱维亚种植的都是适应当地温带海洋气候、冬季寒冷和霜冻频繁环境条件的沙棘品种。推广种植最多的沙棘品种是 Mary, 还有 Tatjana, Botanicheskaya， Ljubitelskaya 和 Eva，其特点是百果重达 70–100g，固形物为 7–10%，生化成分含量中等水平。

There are four processing companies of sea buckthorn in Latvia. One of them is a research-level pilot plant with the CO2 extraction unit, making both seed and pulp oils. The seed oil is marketed as a residual remedy used for patients after the cardiovascular main treatments, whereas the pulp oil goes to cosmetics. Two more small enterprises produce drinks, jams and sweets mostly for the local market and the fourth one sells mostly drinks

在拉脱维亚总共有四家沙棘加工企业。其中一家是采用 CO_2 提取沙棘果油和种子油的研究示范企业，其种子油销往市场用于心血管病人辅助治疗，果油用于化妆品生产。还有两家小型企业生产沙棘饮料、果酱、糖果，主要销往国

locally and abroad. The total amount of processed sea buckthorn fruits in mentioned companies is about 100 tons per year.

内市场。第 4 家企业主要从事国内外沙棘饮料销售。上述四家企业全年沙棘鲜果加工量约为 100 吨。

The total personnel involved in seabuckthorn research, manufacturing, marketing planting and public management in Latvia is about 150 persons.

在拉脱维亚，全国从事沙棘研究、产品开发、市场营销、种植、公共管理领域的人员共有约 150 人。

Projects on various topics related to sea buckthorn have been started and continued in Latvian scientific institutions. The most important projects.

在拉脱维亚，有关科研机构已经启动或继续开展几个领域的沙棘研究项目。最受关注的项目包括：

1.Comparing Vital Capitals: An anthropological analysis of the global value chains of sea buckthorn and raspberries (ongoing)
https://www.rsu.lv/en/project/comparing-vital-capitals-anthropological-analysis-global-value-chains-sea-buckthorn-and

项目 1. 比较首要资本：沙棘和树莓全球价值链的人类学分析（在研项目）。详见：https://www.rsu.lv/en/project/comparing-vital-capitals-anthropological-analysis-global-value-chains-sea-buckthorn-and

This research project combines economic and political anthropology with studies of infrastructures and agrifoods. It advances our knowledge of political-economic rural transformations and thereby strengthens the scientific profile of both RSU and of the project leader. Furthermore, it contributes to the Latvian Smart Specialization Strategy (S3) by offering social scientific advice on a knowledge-intensive agri-economic sector with significant quantitative and qualitative growth potential.

该研究项目利用基础设施和农业食品研究，兼顾了经济和政治人类，丰富了我们有关农村政治经济转型方面的知识。因此，项目有助于拉脱维亚“智慧专业化战略”（3“S”）实施，向具有显著数量与质量增长潜力的知识密集型农业经济部门提供科学的社会性建议。

2.Developing of a waste less processing technology of sea buckthorn berries (ongoing)

项目 2. 面向减少废料的沙棘果实加工技术开发（在研项目）

The goal of the project is to develop a technology for the zero-residue processing of sea buckthorn berries using a complex of innovative methods that include enzymatic hydrolysis under controlled conditions (using a universal double-wall vacuum mixer), separation technology for separating pulp

该项目旨在开发一种沙棘果实的零废料加工技术。该技术采用全新的综合方法，包括控制条件下酶水解（采用通用双壁真空搅拌罐）、从

oil and sediment from juice (using a three-fraction centrifuge) and juice treatment with Ultra high temperature (UHT).

3.Using innovative methods for promotion of productivity and berry quality of sea buckthorn plantations (continued)

Two topics were considered and studied in this project:
1) Possibilities of green manure treatments and use effects on plants;
2) Possibilities of using a feeding attractant to control *Rhagoletis batava*.

Back of the project

The project was supported by the state via Rural Support Service, Republic of Latvia. The project started in 2020 and ended in February 2023. Primarily, project funding was intended for farms, which also managed the project, promoting cooperation with scientists from Institute of Horticulture. All studies took place on farms in sea buckthorn plantations.

A brief outline of the project's research

1) Possibilities of green manure treatments and use effects on plants
Green manure treatment trials were conducted to check whether it is possible to improve the sea buckthorn yield using non-traditional agricultural techniques. This is the first time such studies have been carried out in sea buckthorn orchards in Latvia.Seven farms were involved in this study. In each farm, four green manure treatments were used:naturally growing grass as a control; 3 treatments of different perennial and annual plant mixtures in between sea buckthorn rows

The selected plant mixtures used differed among farms, because of variability in soil granulometric composition, pH, and nutrient supply levels in farms. The following plant seed mixture variants were used:

果汁中分离果油与果渣的分离技术（采用三级离心分离）和超高温（UHT）果汁处理。

项目 3. 采用创新方法促进沙棘种植园的果实质量和产量（延续项目）。

该项目关注两个重点研究方向：
1) 绿肥处理可行性及其对沙棘的施用功效；
2）施用饲料引诱剂防治沙棘果蝇（*Rhagoletis batava*）的可行性。

项目背景

本项目由拉脱维亚政府农业支持署资助，2020 年启动、2023 年 2 月结束。项目资金主要直接投向农场，由农场主负责项目管理、促进与园艺研究所的专家合作，所有的研究均在沙棘种植园开展。

项目研究框架简介

1) 绿肥处理可行性及其对沙棘施用功效研究
绿肥处理试验的目的在于检验采用非传统农业技术提高沙棘果实产量的可行性。这是首次在拉脱维亚沙棘果园开展此类研究。该研究涉及 7 个种植农场，每个农场均开展 4 种绿肥处理方式。其中第一种作为对照，为自然生长的杂草绿肥；其余 3 种处理为不同的一年生与多年生植物混合绿肥。绿肥施用在沙棘林行间。

考虑到不同农场存在土壤团粒结构、PH 值、营养供给水平的差异性，因而选用不同植物混合绿肥。研究中采用了以下 4 种不同的植物种子混合绿肥：

S1—annual plant seed mixture of Raphanus raphanistrum subsp. sativus (30 %), Sinapis alba (20 %), Lolium multiflorum (15 %), and Pisum sativum (35 %) intended for deep soil cultivation

第一种 S1：一年生植物种子混合物 Raphanus raphanistrum subsp. sativus (30 %), Sinapis alba (20 %), Lolium multiflorum (15 %) 和 Pisum sativum (35 %)，用于土壤深层施肥；

G5—a perennial plant seed mixture of *Trifolium pratense* (7 %), *Trifolium repens* (7 %), *Festuca pratensis* (20 %), *Lolium ×boucheanum* (20 %), *Lolium perenne* (20 %), *Phleum pratense* (10 %), *Festuca rubra* (10 %) and *Poa pratensis* (6 %) intended for different types of soils

第二种 G5：多年生植物种子混合物 *Trifolium pratense* (7 %), *Trifolium repens* (7 %), *Festuca pratensis* (20 %), *Lolium boucheanum* (20 %), *Lolium perenne* (20 %), *Phleum pratense* (10 %), *Festuca rubra* (10 %) 和 *Poa pratensis* (6 %)，用于不同土壤类型；

N2—perennial plant seed mixture of *Trifolium pratense* (20 %), *Onobrychis* sp. (20 %), *Vicia sp*. (15 %), *Phleum pratense* (25 %), and *Festuca pratensis* (20 %) intended for light mineral soils to fulfill greening requirements

第三种 N2：多年生植物种子混合物 *Trifolium pratense* (20 %), *Onobrychis sp.* (20 %), *Vicia sp*. (15 %), *Phleum pratense* (25 %) 和 *Festuca pratensis* (20 %)，适用于高矿物质土壤的绿肥需要；

P2—seed *mixture of Trifolium pratense* (27 %), *Festuca pratensis* (23 %), *Lolium ×boucheanum* (23 %) and *Phleum pratense* (27 %) for high -quality forage, intended for mowing, also suitable for poorer soils.

第四种 P2：植物种子混合物 ***Trifolium pratense*** (27 %), ***Festuca pratensis*** (23 %), ***Lolium boucheanum*** (23 %) 和高品质饲料 ***Phleum pratense*** (27 %)，适用于饲料地或较贫瘠土壤。

Perennial grasses were grown to a height of at least 40 cm and mowed once before seeding in August. The one-year green manure was sown every year, and mowed in the second half of summer (August).

多年生草生长到至少 40 厘米高，在 8 月份结籽前收割一次。一年生草绿肥每年播种一次，于夏季后半期（8 月）收割。

The results were different by region and by sea buckthorn orchards age. The most significant

试验结果因地点、沙棘果园不同而不同。果实增产变化最显著的是位于 Zemgale 地区一处

increases in the new farms (whose orchards are not older than five years) were observed in one of the farms in the Zemgale region in the variant when the grass mixture G5 was used; but in the Vidzeme region when grass mixture where P2 and N2. In five- to fifteen-year-old orchards, the significant increases were in the variant with the grass mixture G5. The highest sea buckthorn fruit yield obtained also differed between variants and farms. In one farm, the best fruit yield was in the variant when grass mixture S1 was used. The highest mass of 100 fruits was in variants with grass mixtures G5 and N2.

新建不到 5 年的沙棘种植园，其施用的是 G5 类型绿肥。但是，在 Vidzeme 地区，增产最显著的却是施用 P2 和 N2 绿肥类型的种植园。对于建成 5–15 年的果园，施用 G5 类型绿肥后其结果显著增加。沙棘果实产量最高值也因绿肥、农场的变化而不同。在一处农场，施用 S1 绿肥时沙棘果实产量最高，施用 G5 和 N2 类型绿肥的沙棘百果重达到最大值。

Although in certain variants in the three-year study showed good indicators, it is still necessary to continue the experiments for a longer period - time in the future.

尽管在三年的绿肥研究试验中取得较好效果，今后仍需要继续开展更长时期的试验。

2) Possibilities of using a feeding attractant to control *Rhagoletis batava*

2）施用饲料引诱剂防治沙棘果蝇（*Rhagoletis batava*）的可行性研究

The problems caused by the sea buckthorn fruit fly (*Rhagoletis batava*), since this fruit-fly species was first found in 2011, continue to persist. Fluctuations in damage were observed in certain years or - certain regions, with the amount of damage caused by flies being low in cooler and rainier summers. However, due to repeated hot summers, as well as in warmer places/localities, the amount of damage caused by fruit flies has been significant until now. In some years, crop losses exceed even 90 %. No effective chemicals are available in Latvia to control these fruit flies. On the other hand, such plant protection products are not even allowed in organic farming systems. Rhagoletis batava, like other species of this genus, is attracted by yellow sticky glue traps. However, it was necessary to check whether the number of fruit flies caught by the sticky glue traps can be increased in the conditions of Latvia by additional attraction of fruit flies using a food attractant.

自 2011 年沙棘果蝇在拉脱维亚首次发现以来，其危害一直延续至今。同时观察到，不同年份、不同地区沙棘果蝇的危害呈现波动现象，在气温凉爽和夏季多雨年份，对果实产量减产影响较轻。然而，由于当地多年炎热夏季和地处温暖地区，沙棘果实受果蝇影响减产十分明显，并持续至今。在一些年份，减产达 90% 以上，目前在拉脱维亚还没有有效控制沙棘果蝇的化学制剂。另一方面，由于沙棘有机种植体系要求，不容许施用化学农药。目前，在拉脱维亚采用带粘合胶的黄色扑蝇器来捕杀沙棘果蝇及其同属的其他种害虫。这就需要研究在拉脱维亚的自然条件下，通过施用食物引诱剂是否可以增加扑蝇器捕杀沙棘果蝇的数量。

Therefore, during the project, an attractant produced in Hungary (*CSALOMON*®) for attracting fruit flies of this genus was tested on several farms. Environmentally friendly paper traps made in Sweden are chosen as sticky glue traps. Considering that the traps need to be changed once a week, paper traps reduce the amount of plastic waste.

为此，本项目在几个农场试验了一种产自匈牙利的引诱剂 (*CSALOMON*®) 来捕杀沙棘果蝇，并选用一种产自瑞典的环境友好型、带粘合胶的纸质扑蝇器。由于扑蝇器每周要更换一次，采用纸质的就可以减少塑料浪费。

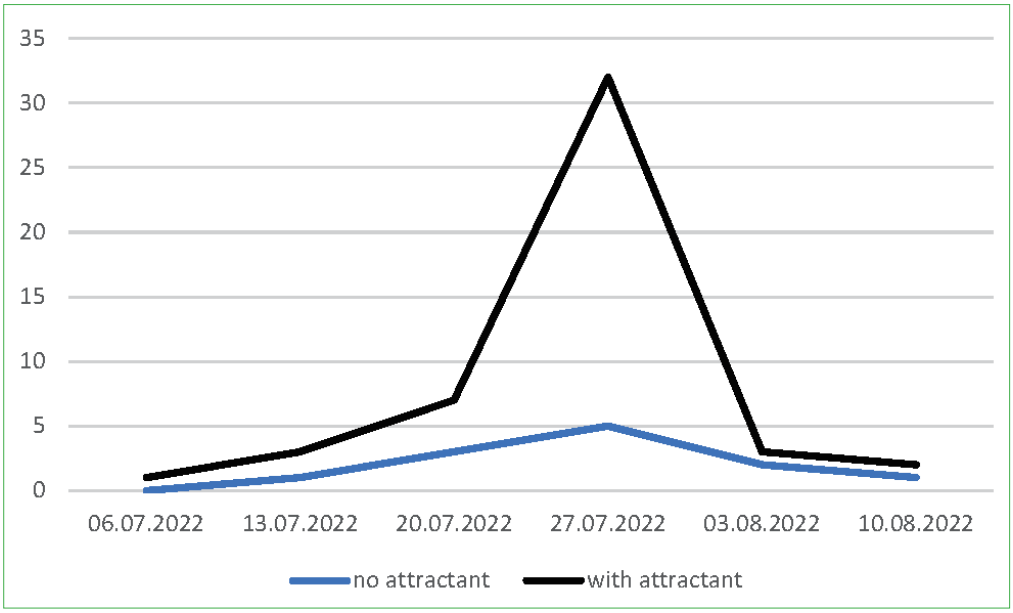
Considering that not all sea buckthorn orchards had a harvest (due to the dominance of new plantings), it was not possible to obtain the results of all years, which would allow comparing the results between years. However, the first results obtained in this project show a tendency that the number of fruit flies caught is higher in sticky glue traps (although there was one orchard where there were more caught fruit flies in the control variant without attractant). However, the effect of the attractant does not seem to be observed at the beginning or the end of the flying period of the fruit flies. From the point of view of fruit-fly biology, the highest fruit-fly catches coincide with the time when flies are most actively laying eggs.

考虑到并非所有沙棘种植园都能结果实（比如新种植的沙棘幼林），不可能观测到历年的结果，因此也就无法进行年际比较。但本项目初步结果显示，带粘合胶的扑蝇器捕杀了更多的果蝇（只有一处种植园中没有施用引诱剂的对照捕杀了更多的果蝇）。在果蝇生活周期的初期和末期，引诱剂似乎对果蝇不起作用（备注：在拉脱维亚，沙棘果蝇于炎热夏季的 6 月下旬或凉爽多雨的 7 月上旬开始出土）。根据果蝇生物学特性，捕杀数量最高值的时间段正好是果蝇产卵活跃期。

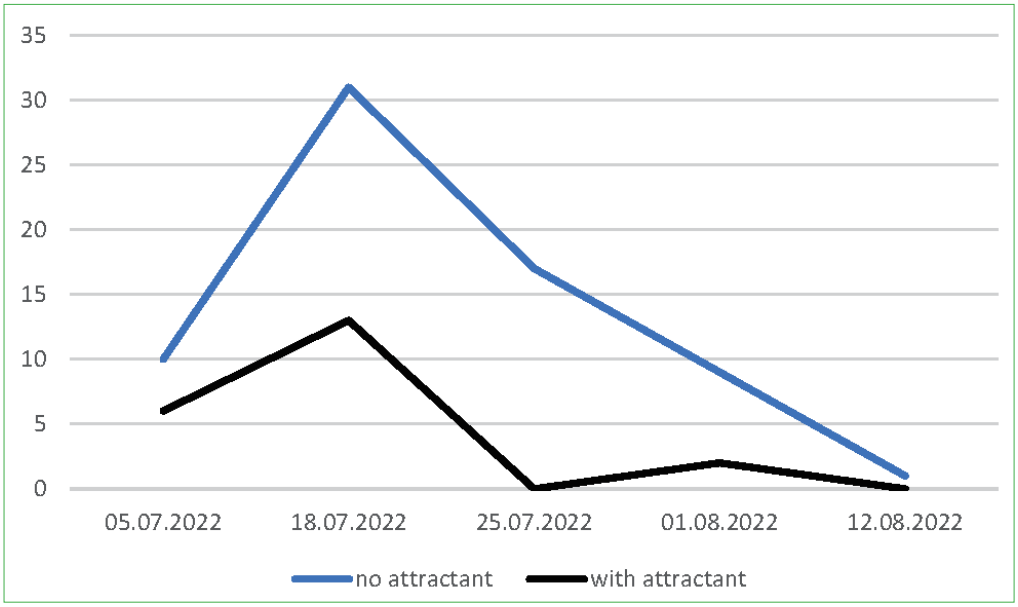
The preliminary results also show that the use of an attractant to control *Rhagoletis batava* can be recommended to farmers. However, it would still be necessary to continue regular stable monitoring in various regions of Latvia in the following years. This is necessary because during the study there was a low fruit-fly population density in sea buckthorn plantations. As can be seen in the graphs, the number of fruit flies caught is below 100 in each count (on 7 traps in total). Such a density of fruit flies does not allow for obtaining sufficiently convincing results. However, as the graphs show, using an attractant tends to attract more flies[1].

初步研究结果显示，施用引诱剂防控沙棘果蝇的方法值得向农户推荐使用。当然，今后在拉脱维亚不同地区仍需要继续开展固定的常规监测。在本项目研究期，种植园中的沙棘果蝇种群密度相对较小，从附图可以看出，每个点的 7 个扑蝇器捕杀果蝇总数不到 100 只，在如此低的果蝇种群密度下，还不足以得到令人信服的结论。当然，附图显示，施用引诱剂可以捕杀更多的果蝇。

[1] In Latvian conditions, the first sea buckthorn fruit-flies emerge from the ground in the last decade of June in hot summers or in the first decade of July in cool and rainy summers.



Seabuckthorn fruit flies caught with sticky glue traps (sum of 7 traps), Farm 1



Seabuckthorn fruit flies caught with sticky glue traps (sum of 7 traps), Farm 2

4.Technological solutions for growing sea buckthorn according to the principles of organic farming, considering three main aspects: control of the sea buckthorn fly Rhagoletis batava, fertilization and watering in commercial sea buckthorn plantations.

This project is still in progress, involving experts from the Latvian University of Life Sciences and Technologies, Latvian Plant Protection Research Centre, and several sea buckthorn farmers. The main task of the project is control of the sea buckthorn fly by using organic food attractants and fertigation of plantations by organic liquid fertilizers. The project has been started in 2022 and should be finished in 2024.

项目 4. 基于有机种植方式的沙棘栽培技术路径，面向三个方面：沙棘商业化种植园中的沙棘果蝇防控、施肥 、灌溉（在研项目）

本项目属于在研项目，参与的专家来自拉脱维亚生命科学技术大学、拉脱维亚国家植物保护中心和几个沙棘种植户。项目主要任务是通过施用有机食物引诱剂防控沙棘果蝇，使用有机液体肥料的水肥措施灌溉果园。项目于 2022 年启动、将于 2024 年结束。

Scientific papers

1.Kristîne Drevinska and Inga Moročko-Bičevska (2022) SEA BUCKTHORN DISEASES CAUSED BY PATHOGENIC FUNGI. PROCEEDINGS OF THE LATVIAN ACADEMY OF SCIENCES. Section B, Vol. 76 (2022), No. 4 (739), pp. 393–401. DOI: 10.2478/prolas-2022-0062
https://www.biorxiv.org/content/10.1101/2022.07.27.501707v1.full

2.Janceva, S.; Andersone, A.; Lauberte, L.; Bikovens, O.; Nikolajeva, V.; Jashina, L.; Zaharova, N.; Telysheva, G.; Senkovs, M.; Rieksts, G.; Ramata-Stunda A.; Krasilnikova J. (2022) Sea Buckthorn (Hippophae rhamnoides) Waste Biomass after Harvesting as a Source of Valuable Biologically Active Compounds with Nutraceutical and Antibacterial Potential. Plants 2022, 11, 642. https://doi.org/10.3390/plants11050642
https://www.mdpi.com/2223-7747/11/5/642

New generation in seabuckthorn orchard 沙棘果园里的新一代

Introduction of Russian SBT varieties in Latvia 俄罗斯沙棘品种引种到拉脱维亚

国际沙棘协会（中国）企业委员会会长单位 —— 高原圣果沙棘制品有限公司

Conseco Seabuckthorn Co., Ltd. was founded in 1998 under China National Administration Center for Seabuckthorn Development. The headquarters is in Beijing, and seabuckthorn resources processing base are in Ordos.

Conseco has its own improved seedling breeding base, raw material processing base and marketing system. Conseco has six health products with batch numbers, such as seabuckthorn flavonoids soft capsule, seabuckthorn oil soft capsule and Qingyan capsule, which are of excellent quality and high technical content among the similar health products and are well received by the majority of consumers.

Conseco has passed the health registry of food exporting, the international certificate of ISO9001, HACCP and Kosher, and the certificate of organic food in EU, United States and Japan. The processes including picking, sorting, processing, packing, storage and transportation are strictly followed these international standards. Conseco produced series of seabuckthorn products which be sold all over China and other countries in the world.

In 2019, Conseco was awarded the “President unit of the International seabuckthorn Association”. In 2021, Conseco was honored and became an excellent member of the International Sea-buckthorn Association.

高原圣果沙棘制品有限公司创建于 1998 年，是水利部沙棘开发管理中心为推动沙棘事业投资创办的国家级沙棘产业示范企业。公司总部在北京，在内蒙古鄂尔多斯建有沙棘资源基地及原料加工基地。

公司拥有自己的良种苗木繁育基地、原料加工基地以及市场销售体系。并且拥有沙棘黄酮软胶囊、沙棘油软胶囊、清妍胶囊等六款保健品批号产品，在同类保健品中品质优良，技术含量高，受到广大消费者的好评。

公司先后通过了国家的食品出口卫生注册、ISO9001 质量管理体系国际认证、HACCP 食品安全体系国际认证、Kosher 认证、欧盟、美国及日本的有机食品认证。产品加工过程从采果地认证 – 采果 – 分选 – 加工 – 包装 – 保鲜 – 储运等，各项工序严格遵照国际标准进行。开发生产系列沙棘产品，业务遍及中国和世界很多地区。

2019 年，高原圣果沙棘制品有限公司被授予“国际沙棘协会企业委员会会长单位”。2021 年，高原圣果沙棘制品有限公司荣获“国际沙棘协会优秀会员企业”称号。

国际沙棘协会（中国）企业委员会副会长单位 —— 北京宝得瑞健康产业有限公司

Beijing Powdery Health Industry Co., Ltd. has been operating for more than 20 years，It has a high reputation in the ingredient industry of functional food. The company focuses on the industrial chain model from the base to the products. Controllable raw materials, excellent technology, product stability are the foundation of the company. The company has one-stop capability of the choice of product direction, product research and development, industrialization. Currently The products mainly include fruit and vegetable powders, plant extracts, functional high-end health oils, powdered oils, functional liquid drinks and solid drinks etc. More than 20 invention patents have been authorised. With the development of the company, we have set up independent legal entities in Jingmen City, Hubei Province and Zhangjiakou City, Hebei Province in order to realize the main raw materials from our own planting bases.

● Powdery (Hebei) Health Industry Co., Ltd. mainly focuses on sea buckthorn business. The company has 40,000 hm2 of Hippophae rhamnoides subsp. sinensis, of which 7333 hm2 have been certified as organic. Sea buckthorn products cover the whole range, including sea buckthorn puree, sea buckthorn clear juice, sea buckthorn concentrated juice, sea buckthorn seed oil, sea buckthorn fruit oil, sea buckthorn juice powder, sea buckthorn seed oil powder, sea buckthorn fruit oil powder, sea buckthorn peel powder, sea buckthorn leaf powder. The company is a national high-tech enterprise, which has powder product production line, CO2 supercritical production line, sea buckthorn juice production line, glass bottle oral liquid production line, softgel production line, tablet candy production line, etc and has 11 sea-buckthorn related invention patents covering the whole process of products.

北京宝得瑞健康产业有限公司运营 20 多年，在功能食品原料行业具有很高的知名度。公司专注从基地到原料的产业链模式，原料可控、工艺优良、产品稳定是公司的立身之本，公司耕耘果蔬粉、植物提取物、功能性高端保健油脂、粉末油脂、功能性液体饮料、功效性固体饮料等，从产品方向选择到产品研发、产业化一条龙实现。公司拥有 20 项发明专利，伴随着公司的发展，公司在湖北荆门市和河北张家口市成立了独立法人公司，实现主原料基地化生产。

宝得瑞（河北）健康产业有限公司主要围绕沙棘业务展开，公司拥有中国沙棘资源 60 万亩，其中 11 万亩进行了有机认证；沙棘产品覆盖全，包括沙棘汁、沙棘清汁、沙棘浓缩汁、沙棘籽油、沙棘果油、沙棘果汁粉、沙棘籽油粉、沙棘果油粉、沙棘果皮粉、沙棘叶粉等；公司有粉状产品生产线、CO_2 超临界生产线、沙棘果汁生产线、玻璃瓶装口服液生产线、软胶囊生产线、压片糖果生产线等；公司沙棘相关发明专利 11 项，覆盖产品的全过程，是国家级高新技术企业。

国际沙棘协会（中国）企业委员会副会长单位 —— 布尔津县汇源生物科技有限公司

In 2011, the Burqin Huiyuan Biotech Co., Ltd. which is an agricultural project affiliated with Huiyuan Group.

2011年，成立新疆布尔津汇源生物科技有限公司（隶属于汇源集团的农业项目）。

After the establishment of the company, not only it focused on carrying out projects such as the breeding of improved sea buckthorn seeds, and the construction of 50,000 acres of standardized desertification grassland ecological demonstration plantations, but also focused on the comprehensive processing utilization of 100,000 tons, and developing production of a series of sea buckthorn high-tech products. It has keep getting continue to improve sea buckthorn deep processing capabilities which has developed more than 10 kinds of sea buckthorn products, included sea buckthorn puree, sea buckthorn compound juice, sea buckthorn drinks, sea buckthorn tea, sea buckthorn seed oil, liquid supplement.

公司成立后，重点开展沙棘良种繁育、5万亩标准化荒漠化草场生态示范治理种植园建设、10万吨沙棘果综合加工利用、开发生产沙棘系列高新技术产品等项目，持续提升沙棘深加工能力，已开发出沙棘原浆、沙棘复合果汁、沙棘饮料、沙棘茶、沙棘籽油、沙棘果油凝胶糖果等10余种沙棘产品。

The agricultural resources are the core, tourism functions are the goal display and builds a green ecological park with ecological development as the purpose. And integrating planting, breeding, tourism and leisure, science popularization, and regional culture. It's committed to creating an integration of production, academia, research and highly integrated primary, secondary and tertiary industries industrial chain.

并以农业资源为核心依托，以旅游功能为核心展示，建设以生态开发为宗旨，集种植、养殖、旅游休闲、科普、地域文化为一体的绿色生态园，致力打造产、学、研一体，一、二、三产业高度融合的产业链。

It has great changes have taken place in the past more than 10 years, Huiyuan's sea buckthorn industry has received attention and recognition from all walks of life. It has won honors such as "Green Model of the 2021 Corporate Social Responsibility Summit" and "Key Leading Enterprise in Sinkiang Altay Region in 2022", and has become an enterprise of the International Seabuckthorn Association (China) Committee Vice Chairman Unit. In September 2023, it also successfully hosted the "2023 Annual Meeting of the International Seabuckthorn Association (China) Enterprise Committee and the National Sea buckthorn Academic Exchange Conference".

经过10余年深耕，汇源沙棘产业受到社会各界的关注与认可，荣获“2021年度企业社会责任峰会绿色榜样”、“2022年新疆阿勒泰地区重点龙头企业”等荣誉，并成为国际沙棘协会（中国）企业委员会副会长单位。2023年9月，还成功承办“国际沙棘协会（中国）企业委员会2023年年会暨全国沙棘学术交流会”。

国际沙棘协会（中国）企业委员会副会长单位 —— 河北神兴沙棘研究院

Hebei Shenxing Seabuckthorn Research Institute, founded in 2000, located in Shijiazhuang, capital of Hebei Province, which is a technology-based private enterprise dedicated itself in the application of advanced technology for research, development, and industrialization of seabuckthorn products, complemented by related technical services.

As the vice chairman of the Enterprise Committee（China）of the ISA, the company actively participates in the work of the association, and has successively become the sponsor of the eighth and ninth International Seabuckthorn Association conferences in 2018 and 2023 respectively.

With over two decades of experience, the institute has accumulated extensive expertise in beverages, health food, and pharmaceuticals. It possesses a range of core technologies, including supercritical CO2 extraction, macroporous resin adsorption, and membrane separation techniques.

Under the institute's technical guidance, Shenxing seabuckthorn industry cluster has obtained 26 drug approvals and 8 health food registration licences, the dosage forms include soft capsule, tablet, oral liquid, raw materials cover seabuckthorn fruit oil, seabuckthorn seed oil, flavonoids, fruit powder, OPC, pulp, concentrate juice, etc. Additionally, there is 1 certificate of invention patent for Seabuckthorn Wine and over 40 kinds of scientific research reserve projects related to seabuckthorn, abundant achievements in scientific research have been made.

河北神兴沙棘研究院，坐落于河北省省会石家庄市。公司成立于 2000 年，是一家科技型民营企业。公司目前经营业务为：运用高新技术，从事沙棘系列产品的研究、开发及产业化，同时开展有关的技术服务。公司从组建之初，就坚持以“实施名牌战略，发展沙棘事业”为使命，以“奉献生态效益、造福人类健康”为目的，以高新技术为先导，创立中国沙棘保健品新体系，开创沙棘新药新体系。

2014 年以来，公司与河北医科大学药学院签订了共建实验室协议。2017 年，公司与山西省林业和草原科学研究院签订战略合作协议。2019 年，公司被授予“国际沙棘协会（中国）企业委员会副会长单位”。同年，国家林业和草原局沙棘工程技术研究中心功能食品研发中心在河北神兴沙棘研究院挂牌成立。2018 年与 2023 年，公司连续成为第八届、第九届国际沙棘协会大会赞助单位。

经过二十年的发展，公司在饮料、保健食品、药品等研究领域积累了丰富的经验，拥有了一系列核心技术：超临界 C02 萃取技术、大孔树脂吸附技术、膜分离技术。

在研究院的技术支持下，神兴沙棘产业集群先后取得 26 个药品批号（其中国家一类新药 1 个，国家二类新药 1 个，国家 6 类新药 2 个），沙棘系列保健食品批号 8 个（产品型态丰富，涉及软胶囊、片剂、口服液，原料涵盖沙棘果油、沙棘籽油、黄酮、果粉、花青素、原浆、浓缩汁等），酒品专利 1 个，并拥有 40 多个沙棘科研储备项目，相关课题先后通过河北省重大科技攻关项目、自然科学基金及多个石家庄市级科研项目鉴定，取得了丰硕的学术成果。

There are dozens of product categories which include seabuckthorn raw material,seabuckthorncon, Seabuckthorn beverage, seabuckthorn con, seabuckthorn seed, seabuckthorn fruit, seabuckthorn seed oil, seabuckthorn fruit oil, seabuck-thorn frozen dry fruit,seabuckthorn fruit dry skin, seabuckthorn dry fruit and seabuckthorn bis-cuit which are sold to places all over the country. The market share of terminal products main-tains 90% in north China. Seabuckthorn juicedrink, tinned seabuckthorn, seabuckthorn seed, seabuckthorn fruit,seabuckthorn seed oil,seabuckthorn fruit oil, dried seabuckthorn, dried sea-buckthorn skin and seabuckthorn dry fruit areexported to countries such as Japan, Korea and Germany. The sales ratio of products reaches 100%. The company buys more than 10,000 tons of seabuckthorn from farmers each year in theway of subscription agreement,which raises the income of more than 5,000 farming families with an average family income over 16,000 Yuan. Accordingly, the economic income of famers in mountain area is improved and the develop-ment of rural economy is promoted.

BUSINESS CATEGORY

seabuckthorn beverage
seabuckthorn fruit oil
seabuckthorn dry fruit
seabuckthorn seed oil
seabuckthorn seed
seabuckthorn raw fruit
seabuckthorn oil capsule
abuckthorn fruit dry skin
seabuckthorn forzen dry fruit
seabuckthorn biscuit
seabuckthorn tea
seabuckthorn chewable tablets

主要产品有沙棘原料、沙棘口服液、沙棘饮料、沙棘罐头、沙棘籽、沙棘果肉、沙棘籽油、沙棘果油、沙棘干果、沙棘干果皮、沙棘果皮粉、沙棘饼干等几十个品种，产品销售网络逼布全国各地。终端产品在华北地区保持90%的市场覆盖率。沙棘原果汁、沙棘罐头、沙棘籽、沙棘果肉、沙棘籽油、沙棘果油、沙棘干果、沙棘干果皮、沙棘果皮粉等出口日本、韩国、德国等国家。产品销售率达到100%。公司每年以收购协议方式向农民收购沙棘10000吨以上，直接带动山区5000多名农民采收户，户均收入可达16000元以上。改善了山区农民的经济收入，促进了农村经济产业化的发展。

经营类目

沙棘汁饮料 沙棘果油 沙棘干果 沙棘籽油 沙棘籽 沙棘原浆 沙棘油胶囊沙棘干果皮 沙棘果皮粉沙棘饼干 沙棘茶叶 沙棘咀嚼片。

国际沙棘协会（中国）企业委员会副会长单位 ——吉林吉隆东北沙棘产业有限责任公司

Jilin jilong DongBei Seabuckthorn Industry Co.,LTD was established in 2017, based in Da'an City Jilin Province,the company develop seabuckthorn and Chinese herbal medicine compound planting and processing in salt-alkali sand, such as ecological fragile zone. The company's mission is to promote the development of Chinese herbal medicine industry of Sea-buckthorn, and to achieve the purpose of rural revitalization and prosperity of the people through integration of the three industries", that is, the close combination of ecological green economy and health industry.

吉林吉隆东北沙棘产业有限责任公司成立于 2017 年，公司致力于以大安市为基地，在盐碱风沙等生态脆弱地带，发展大果沙棘和中药材复合种植与加工，通过生态绿色经济和大健康产业，实现“三产融合”全产业链紧密结合，促进沙棘中药材产业的发展，达到乡村振兴产业富民的目的。

With a total investment of 450 million yuan, the project includes planting 20 thousand mu of eco-economic forest of sea-buckthorn and 15 thousand mu of Chinese medicinal materials such as rhizome attrium, building processing and production bases of sea-buckthorn and Chinese medicinal materials, and promoting rural employment. After completion of the project, the annual output value is expected to be 300 million yuan, and provide employment for more than 1,000 people.

项目规划总投资 4.5 亿元，种植大果沙棘生态经济林 2 万亩和苍术板蓝根等 1.5 万亩，建设占地 5 万平方米的综合加工生产基地，带动农户种植大果沙棘和中药材 5 万亩，项目建成后预计年产值 3 亿元，提供就业 1000 余人。

Company build a research platform for Chinese medicinal materials planting has been rated as provincial leading enterprise of forestry industrialization,Jilin Provincial Demonstration Base of high-quality and Authentic Medicinal materials Science and Technology,Baicheng Demonstration Base of Chinese Medicinal Materials Planting,etc. The company is now the construction unit of Jilin Provincial Engineering and Technology Research Center,and the vice president unit of National Sea-buckthorn Entrepreneurs Association.

公司在吉林省各级领导支持下被评为省级林业产业化龙头企业、吉林省农民工等人员返乡创业基地、吉林省优质道地药材科技示范基地、白城市农业产业化龙头企业、白城市中药材种植示范基地等，担任吉林省林业草原沙棘工程技术研究中心的建设单位，全国沙棘企业家协会副会长单位。

The sea-buckthorn multiple-producing factory was basically completed and went into service in 2023, 1000 tons of fruit will be harvested and produced to raw pulp beverage,oil and other products afterward.

2023 年沙棘综合加工厂基本建成投入使用，采收沙棘果实 1000 吨，生产的沙棘原浆、沙棘饮料、沙棘油等产品投放市场。

国际沙棘协会（中国）企业委员会副会长单位 —— 上海容邦企业集团有限公司

Shanghai Rongbang Enterprise Group, founded in 2006, is an environmentally friendly healthy food enterprise focusing on the development and production of organic agriculture and seabuckthorn industry products. The company has nearly 500 employees, with 21 offline stores operating and tens of thousands of products sold. The company adopts the service mode of combining online self-run small programs + live broadcast + online and offline physical stores to provide intimate services for more than 10 million customers.

In terms of organic products, there are five farms, namely Zhouzhuang Farm, Taizhou Farm, Nanzhang Farm, Hainan Farm and Nanxiang Farm, without using chemical pesticides, fertilizers, hormones and genetically modified in the production process. Shangshanyuan always adheres to building high standard and high quality organic agriculture, and has been identified as the provincial key leading enterprise of agricultural industrialization in Jiangsu Province, the municipal leading enterprise of agricultural industrialization in Taizhou City, and the director unit of Shanghai Organic Special Committee.

In the field of seabuckthorn products, food source pay attention to product research and development and innovation, to user demand as the guidance, constantly optimize the products, with strong technical strength and advanced equipment, and advanced talent service team, seabuckthorn, successfully developed a series of products, such as seed oil, Seabuckthorn probiotics, Seabuckthorn and thistle, original pulp, etc., and consumers love and trust, has won the international association of excellent member enterprises, the international association, vice President of the unit.

上海容邦企业集团成立于 2006 年，是一家以有机农业和沙棘产业产品研发生产为主的环保型健康食品企业。公司在职员工近 500 人，目前已有 21 家线下门店正在营业，所售产品有上万种，公司采用线上自营小程序 + 直播 + 实体门店线上线下相结合的服务模式，为用户提供贴心服务。

在有机产品方面，拥有周庄农场、泰州农场、南漳农场、海南农场以及南翔农场共五大农场，在生产过程中不使用化学农药、化肥、激素、转基因。上膳源始终坚持打造高标准、高品质有机农业，先后被认定为江苏省农业产业化省级重点龙头企业、泰州市农业产业化市级龙头企业、上海有机专委会主任单位。

在沙棘产品领域，上膳源注重产品的研发与创新，以用户需求为导向，不断优化产品，凭借强大的技术实力和先进的设备，以及高精尖人才服务团队，成功开发出一系列沙棘产品，如沙棘籽油、沙棘益生菌、沙棘水飞蓟、沙棘原浆等，深受广大消费者的喜爱和信赖，先后荣获国际沙棘协会优秀会员企业、国际沙棘协会副会长单位。

国际沙棘协会（中国）企业委员会副会长单位 —— 陕西海天制药有限公司

Shaanxi Haitian Pharmaceutical Co. , Ltd. is a high-tech enterprise integrating R & D, production and sales of medicine, Hippophae rhamnoides series health food, health care products and female beauty care products. It was established in 2001, headquartered in Xixian new area, Shaanxi Province, the existing drug production base of three, two seabuckthorn processing plants and 40,000 mu of seabuckthorn Chinese medicine planting base, more than 10 Chinese medicine formulation production lines, can produce more than 90 million boxes of Chinese medicine; The production line can process 6,000 tons of Chinese medicinal materials annually, and the equipment imported from Germany can produce more than 100 tons of sea buckthorn seed oil Supercritical fluid extraction year.

陕西海天制药有限公司是一家集药品、沙棘系列健康食品、保健产品和女性美容护理用品研发、生产和销售于一体的高新技术企业，2001 年成立，总部位于陕西省西咸新区，现有药品生产基地三处、两个沙棘加工厂和 4 万亩沙棘中药材种植基地， 10 余条中药剂型生产线，可年产中药成药 9000 多万盒；全自动化控制提取生产线可年处理各类中药材 6000 吨，德国原装进口的二氧化碳超临界萃取生产设备可年产沙棘籽油百余吨。

The company has more than 100 drug numbers, and its main products are Siji antivirus mixture (capsule) , Mozhen capsule, compound seabuckthorn seed oil suppository, seabuckthorn dry emulsion, Baihe Gujin oral liquid and Xindakang tablets, etc. , among them, there are 5 exclusive varieties, 4 patented varieties, 2 exclusive dosage forms, and 6 traditional Chinese medicine varieties with Hippophae rhamnoides as the main raw material. It is also the enterprise with the largest number of hippophae rhamnoides as raw material in China, the annual demand of Hippophae rhamnoides is about 7000 tons.

企业拥有药品文号 100 多个，主要产品有四季抗病毒合剂（胶囊）、蛾贞胶丸、复方沙棘籽油栓、沙棘干乳剂、百合固金口服液和心达康片等，其中独家品种 5 个，专利品种 4 个，独家剂型品种 2 个，以沙棘为主要原料的中药品种 6 个，也是国内拥有沙棘为原料药品文号最多的企业，年沙棘需求量约 7000 余吨。

The company has more than 4200 employees, of which more than 3000 full-time sales team, covering more than 30 regions in the country's 236 offices. Enterprises adhering to the“People-oriented, science and technology-oriented, loyal service to human health cause” purpose, adhere to the integrity of business, according to tax, corporate responsibility, it has won more than 100 honours at various levels in China, the provinces and the municipalities.

企业拥有员工已超过 4200 多人，其中 3000 多人的专职销售团队，遍布于全国 30 多个地区的 236 个办事处。企业秉承“以人为本、以科技为先导，忠实服务于人类健康事业”的宗旨，坚持诚信经营、依法纳税，履行企业责任，已荣获中、省、市各级荣誉 100 多项。

国际沙棘协会（中国）企业委员会副会长单位 —— 青海康普生物科技股份有限公司

General Health Group, established in May 2002, It is engaged in organic cultivation, intensive processing and product development of characteristic plant resources of Qinghai-Tibet Plateau, especially sea buckthorn and wolfberry, We have focused on human nutrition and health business for over 20years, and have been identified by the government of National High-tech Enterprise,National Innovation-oriented Enterprise,NationalSRDI(specialized,refinement,differential,innovation)Little Giant Enterprise,National Key Leading Forestry Enterprise,National Key Leading Enterprise in Agriculture Industrialization,National Model Agro - processing Enterprise, National Green Factory.

康普集团创立于 2002 年 5 月，从事青藏高原特色植物资源尤其是沙棘、枸杞的有机种植、精深加工和产品研发，专注于人类营养健康事业二十年的国家级高新技术企业、国家级创新型企业、国家级专精特新小巨人企业、国家林业重点龙头企业、农业产业化国家重点龙头企业、全国农产品加工示范基地、国家级绿色工厂。

We have taken the lead in setting up the first leading academician workstation in the industry. Our R&D Center, established the cooperation of manufacturing and science between the enterprise and more than 20 top scientific research institutions, has been identified of National and Local Joint Engineering Laboratory.

率先成立行业首家院士工作站，研发中心被认定“国家地方联合工程实验室”，与国内 20 多所顶级科研院校建立了产学研合作关系。

We have got certificate of ACCP,ISO9001,ISO14001, ISO45001.We have got Chinese,EU, USDA,AND JAS Organic certification.We have got the CMA qualification certification.Full-chain traceability management system has been ensured.High quality material has been ensured and provided by our organic plantation.Reliable products have been ensured and provided by our industry-leading manufacturing technique.

企业通过 HACCP/ISO9001/ISO14001/ISO45001 认证；中国、欧盟、美国、日本有机认证；CMA 资质认证；保证全链可追溯管理。有机基地确保优质原料，行业领先的生产工艺平台为您提供放心产品。

国际沙棘协会（中国）企业委员会副会长单位 —— 新疆康元生物技术集团股份有限公司

Xinjiang Kangyuan Biotechnology Group Co., LTD., founded in June 2009, has a registered capital of 61.2 million yuan and total assets of 180 million yuan. Registered in Xinjiang Habahe Industrial Park, it is a joint-stock enterprise integrating the cultivation, research and development, deep processing and sales of small berries with big fruit sea-buckthorn as the main. It has a senior management team composed of famous experts from investment bank, forest fruit, sea buckthorn and other industries. The group has become a national high-tech enterprise, a leading enterprise in Xinjiang's key agricultural industrialization, a leading enterprise in Xinjiang's key poverty alleviation, a small giant enterprise in Xinjiang, and one of hundreds of companies to be listed in Xinjiang's key cultivation. It is a model to highlight the "ecological, social and economic" benefits and practice the "Clear waters and green mountains are as valuable as mountains of gold and silver."

新疆康元生物技术集团股份有限公司，始建于 2009 年 6 月，集团注册资金 6120 万元，总资产 1.8 亿元。注册地为新疆哈巴河工业园区，是集以大果沙棘为主的小浆果种植、研发、深加工、销售为一体的股份制企业，拥有来自于投行、林果、沙棘等业内著名专家组成的高层管理团队。集团现已成为国家级高新技术企业、新疆重点农业产业化龙头企业、新疆重点扶贫龙头企业、新疆专精特新小巨人企业，新疆重点培育百家拟上市公司之一。是彰显“生态、社会、经济”效益和践行“绿水青山也是金山银山”的典范。

The Group's own demonstration planting base of sea-buckthorn has obtained the organic certification of China, the European Union and the United States and the record of export base of Xinjiang Inspection and Quarantine Bureau. It has also passed the certification of HACCP, ISO22000 food safety management and ISO9001:2015 quality management system.

集团自有的大果沙棘示范种植基地，获得了中国、欧盟、美国有机认证和新疆检验检疫局的出口基地备案，也通过了 HACCP、ISO22000 食品安全管理、ISO9001：2015 质量管理体系认证。

The company is the world's first manufacturer of vacuum freezing and low-temperature drying technology, and has launched the concept and series products of sea-buckthorn whole fruit powder, sea-buckthorn fruit pulp powder, sea-buckthorn mixed functional fruit powder, Wolfberry whole fruit powder, sea-buckthorn original pulp, sea-buckthorn juice, sea-buckthorn milk beverage and sea-buckthorn whole fruit oil, creating a unique sea-buckthorn big fruit industry chain.

全球首创真空冷冻、低温干燥技术，首发沙棘全果粉、沙棘果浆粉、沙棘复配功能果粉、枸杞全果粉、沙棘原浆、沙棘原汁、沙棘乳饮料、沙棘全果油概念及系列产品，打造独一无二的大果沙棘产业链。

国际沙棘协会（中国）企业委员会副会长单位 —— 广州达尔尤力生物有限公司

With the vision of "creating a global platform for seabuckthorn to benefit all mankind", Dahluly is committed to creating a seabuckthorn full industry chain service platform, connecting key links in the industry chain such as planting, processing, research and development, branding, sales, and supply chain finance, providing full industry chain services from source to end, gradually forming ecological agriculture, ecotourism, high-end themed health, brand incubation bases, and product research and development clusters Six major sectors of high standard mass production.

达尔尤力以“创沙棘全球平台，让沙棘造福全人类”为愿景，致力于打造沙棘全产业链服务平台，打通种植、加工、研发、品牌、销售、供应链金融等产业链关键环节，提供从源头到终端的全产业链服务，逐步形成生态农业、生态旅游、高端主题康养、品牌孵化基地、产品研发集群、高标准量产六大板块。

Guangzhou Dahluly Biotechnology Co., Ltd. is the operation and sales platform of Xinjiang Dahluly Biotechnology Co., Ltd., with the Guangdong Hong Kong Macao Greater Bay Area, the Yangtze River Delta Economic Belt, and the Beijing Tianjin Hebei region as the core, radiating nationwide sales channels. Starting from building a comprehensive sales platform, it has built multiple sales runways including online direct sales, private distribution, enterprise procurement, channel customization, and urban agency. The core team is composed of core executives from listed companies, Engaged in commercial operations for over 20 years, possessing rich integrated marketing capabilities, integrating the advantages of Xinjiang's origin with the commercial operation advantages of coastal areas, forming a strong combination of advantages.

广州达尔尤力生物有限公司是新疆达尔生物科技有限公司的运营和销售平台，以粤港澳大湾区、长三角经济带、京津冀为核心，辐射全国销售渠道，从搭建综合性销售平台切入，构建包括线上直销、私域分销、企业采购、渠道定制、城市代理等多条销售跑道，核心团队都是来自上市公司的核心高管，从事商业运作超过 20 余年，拥有丰富的整合营销能力，将新疆的产地优势与沿海地区的商业运营优势融会贯通，形成强大的优势组合。

Dahluly focuses on people who value health and anti-aging, with a dual track of health and beauty anti-aging product lines. Currently, it has launched products such as seabuckthorn puree, seabuckthorn freeze-dried powder, and seabuckthorn oil.

达尔尤力锁定重视健康和抗衰的人群为核心，以保健康养和美容抗衰产品线双轨并行，目前已经推出沙棘原浆、沙棘冻干粉、沙棘油等产品。