

The Annual Report of International
Seabuckthorn Development
For the Year of 2019
国际沙棘发展报告
(2019 年度)



International Seabuckthorn Association (ISA)
Management Center for Seabuckthorn Development
Ministry of Water Resources, CHINA
December of 2020

国际沙棘协会
水利部沙棘开发管理中心
2020 年 12 月

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Preface

For the purpose of information exchange, data sharing among member countries and to improve attraction globally from all members, 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 2019 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.

By the December of 2020, we have received the Country Report of China, Finland, Germany, India, Latvia, Pakistan and Russia respectively. All these reports have been translated into Chinese or English for further bilingual printing with assistances from the Board and Scientific Committee of ISA.

For the update information exchange, it is the plan of ISA Secretariat next year to collect Country Reports by the end of March and print before June with kind supports from global seabuckthorn experts.

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

The Editing Committee

Appendix

The Recommended Format/Framework for ISA Member Country Report of Seabuckthorn Development in the Year of 2019

1. The national-wide seabuckthorn resources of plantations and berry yield.
 - 1-1. The total area of seabuckthorn resources up to the year of 2019 including the natural stands and the artificial plantations, and the increased areas in the year of 2019.
 - 1-2. The harvested and the estimated qualities of total production of seabuckthorn berries in your country in the year of 2019.
 - 1-3. A brief introduction of main seabuckthorn plantations
2. Genetic and variety resources
 - 2.1 Introduction of genetic resources including natural seabuckthorn species and subspecies of Hippophae.
 - 2.2. Names of newly bred seabuckthorn varieties and introduced cultivars from other countries and their performance including morphological/biochemical features.
3. Enterprises and production
 - 3.1. In the year of 2019, The number of seabuckthorn enterprises, the gross output and the total value of seabuckthorn products in your country.
 - 3.2. A brief introduction of main enterprises and their main products of seabuckthorn.
4. Research and institutes
 - 4.1 The status of seabuckthorn scientific institution in your country in terms of the number of institutes and their scientists, and their research field.
 - 4.2. A brief introduction of main research institutes/universities and enterprisers, the main research programs and updated achievements on seabuckthorn.
5. Organization and practitioners
 - 5.1. The total personnel involved in seabuckthorn research, manufacturing, marketing planting, public management, etc. in your country
 - 5.2. The members of National Seabuckthorn Association if provided, including institutional and individual members.
 - 5.3. A brief introduction of successful institutional members of seabuckthorn Association if provided.
6. Introduction of important activities, key events, successful stories and advanced persons in your country in the year of 2019.
7. The policies, documents related with seabuckthorn and research papers in the year of 2019 in your country.

序 言

为加强国际沙棘协会各成员之间的信息交流，分享世界各国沙棘种植、加工、销售和科学研究等方面的基础数据和成功经验，国际沙棘协会秘书处根据 2020 年度工作计划安排，成立了《国际沙棘发展报告》编印专门工作组，起草了报告编写框架（见附录），于 2020 年 5 月组织邀请了国际知名沙棘专家撰写其所在国家的 2019 年度沙棘发展报告。截止 2020 年 12 月，我们已经收到来自中国、芬兰、德国、印度、拉脱维亚、巴基斯坦和俄罗斯 7 个国家的报告，并组织翻译成中文（或英文）。现将 7 个国家的报告汇编《国际沙棘发展报告》，用中英文双语印制成册。

今后，国际沙棘协会秘书处将在协会技术委员会的指导下，继续组织更多专家提供其所在国家的沙棘最新进展，于每年 6 月前编辑上一年度的《国际沙棘发展报告》，与中外广大沙棘工作者分享。

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
2020 年 12 月

2019 年度国家沙棘发展报告编写框架

1. 全国沙棘资源总面积（含天然林和人工种植、工业原料种植园）、当年果实总产量及采收量。主要种植区（种植工程、种植园）简要介绍。
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



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Seabuckthorn Development in China in the Year of 2019

2019 年中国的沙棘发展报告

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 berry yield, e.g. the total area of seabuckthorn resources up to the year of 2019 including the natural stands and the artificial plantations, and the increased areas in the year of 2019 and the harvested and the estimated qualities of total production of seabuckthorn berries in the country in the year of 2019.

China has the richest and largest area of seabuckthorn natural stands and artificial plantation. By the year of 2019, including 1,600,000 ha of artificial ones, there were in total 2,350,000 ha of seabuckthorn resources, accounting around 94% of the global resources. In China, seabuckthorn distributes naturally in 12 provinces (or autonomous regions, or municipality) e.g. Beijing, Hebei, Shanxi, Inner Mongolia, Sichuan, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang. And it has been planted in 4 provinces e.g. Liaoning, Jilin, Heilongjiang and Shandong. In 2019, around 100,000 ha of seabuckthorn was planted for ecological and economic purposes.

The northeastern, northwestern and northern China and the Loess Plateau are the concentrated regions of seabuckthorn resources. In estimation for the year of 2019, there were around 500,000 to 600,000 tonnes

1. 全国沙棘资源总面积及当年新增面积（含天然林和人工种植生态林、经济林种植园）、当年（估算）鲜果实总产量及采收量。主要种植区（种植园）简要介绍。

中国是天然沙棘林和人工种植沙棘面积最大的国家。截止 2019 年，全国有沙棘人工林约 160 万公顷（2400 万亩），加上天然沙棘林，总面积约 235 万公顷（3540 万亩），约占世界沙棘总面积 250 万公顷的 94%。全国 12 个省、自治区、直辖市（北京、河北、山西、内蒙古、四川、云南、西藏、陕西、甘肃、青海、宁夏、新疆）有沙棘天然分布，还有 4 个省（辽宁、吉林、黑龙江、山东）人工种植沙棘。其中在 2019 年，全国新增加约 10 万公顷沙棘林（约 150 万亩）。

中国三北地区和黄土高原是全国沙棘之乡。据估算，2019 年产沙棘鲜果约 50 万 -60 万吨，可采收约 20 万 -30 万吨，实际采收加工利用约 8 万 -10 万吨，主要原因是沙棘在中国多分

of yielding seabuckthorn berries, 200,000 to 300,000 tonnes of harvesting available and 80,000 to 100,000 tonnes of harvested. Because of the unconvinience caused by thorny and remote mountainous location, the practical harvesting rate was about 15% of the total yields. During the harvesting season, seabuckthorn companies rushed for berry purchase. Some of them had to reduce production due to short of rough materials. In the following Table 1, showed the resources of seabuckthorn provincially in China.

布在大山沟深地区，并且沙棘有刺，不便采收，造成沙棘资源浪费，虽然每年收获季节，国内客商云集到此竞相收购，但多年供不应求，致使国内许多企业因原料不足半年生产、半年停产。下表为我国主要沙棘产区沙棘产量与分布表（表1）。

Table 1. Total area in 2018 and the increased area of seabuckthorn in 2019 in China (unit: 10,000 mu, 1 ha is equal to 15 mu)

表 1. 2019 年中国主要省新增沙棘资源面积 (万亩, 1 公顷 =15 亩)

产区 Province	截至 2018 年 As of 2018	新增沙棘生态林 Ecological purpose	新增经济林 Economic purpose
河北 Hebei	110	3	1
山西 Shanxi	570	15	7
内蒙古 Inner Mongolia	580	10	15
辽宁 Liaoning	30	3	10
吉林 Jilin	15	3	10
黑龙江 Helongjiang	70	3	8
四川 Sichuan	60	1	5
云南 Yunnan	5	3	1
西藏 Tibet	70	2	3
陕西 Shaanxi	370	6	7
甘肃 Gansu	540	4	4
青海 Qinghai	500	3	6
宁夏 Ningxia	170	3	5
新疆 Xinjiang	135	3	10
其他地区 Other provinces	约 around 20		
合计 in total	3400	62	92

2. Introduction of genetic resources including natural seabuckthorn species and subspecies of Hippophae and names of newly bred seabuckthorn varieties and introduced cultivars from other countries and their performance including morphological/ biochemical features.

2. 沙棘种质资源情况，天然分布的种类（种、亚种），培育的新品种名称、从国外引种的沙棘品种名称及其形态学、生化学性状。

Seabuckthorn is found in 52 countries in the world. China has the most abundant

全球约 52 个国家有沙棘分布。中国是世

natural seabuckthorn germplasm resources in the world. According to the classification by Professor LIAN Yongshan, Chinese taxonomic scientist, there are globally 6 species and 12 subspecies of seabuckthorn. Among them, located in China 6 species and 8 subspecies e.g. *Hippophae rhamnoides* ssp. *sinensis*, *Hippophae rhamnoides* ssp. *Yunnanensis*, *Hippophae rhamnoides* ssp. *Turkestanica*, *Hippophae rhamnoides* ssp. *Mongonica*, *Hippophae salicifolia*, *Hippophae tibetana*, *Hippophae gyantsensis*, *Hippophae neurocarpa* ssp. *Stellatopilosa*, *Hippophae neurocarpa* ssp. *neurocarpa*, *Hippophae goniocarpa*, *Hippophae goniocarpa* ssp. *Litangensis*, *Hippophae goniocarpa* ssp. *Goniocarpa*.

China has introduced from Russia, Mongolia, Germany, Finland dozens of improved seabuckthorn varieties with good economic properties of big berry, reliable yield, high content of seed oil, less thorn or thornless, convenience for harvesting and processing.

3. In the year of 2019, the number of seabuckthorn enterprises, the gross output and the total value of seabuckthorn products in the country and a brief introduction of main enterprises and their main products of seabuckthorn.

Chinese seabuckthorn industry started in 1980's and in rapid development in early 21st century. Following the national R&D, China is leading in the utilization and production of seabuckthorn juice, leaf, lipid, pharmaceutical application of flavonoids etc. At the present, around 80,000 to 100,000 tonnes of fresh seabuckthorn berries be harvested and processed annually.

China is currently the country with the most seabuckthorn products developed and applied, covering more than 200 varieties in 8 categories such as food, medicine, health care products and cosmetics. After 35 years of development, there are more than 4,000 sea-buckthorn enterprises in China, among which more than 200 are processing enterprises with sea-buckthorn as the main product,

世界上天然沙棘种质资源最丰富的国家。按照我国沙棘植物学家廉永善的分类法,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)、中亚沙棘(亚种)、蒙古沙棘(亚种)、密毛肋果沙棘(亚种)、肋果沙棘(亚种)、理塘沙棘(亚种),棱果沙棘(亚种)。

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、易采摘和加工。

3. 目前全国沙棘企业总数、总产量、总产值。主要生产企业及产品简要介绍。

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。近年来沙棘高科技产品不断出现,在沙棘果汁、叶、油脂、黄酮药用等研究开发利用领域已处于国际先进水平。中国目前每年生产加工约 8 万 -10 万吨沙棘果实。

中国是目前开发应用沙棘产品最多的国家,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 35 年的发展,全国现有各类沙棘企业 4000 余家,其中以沙棘为主要产品的加工企业由 200 多家,生产年产值

with an annual production value of about 26 billion yuan. Gaoyuan Shengguo Sea-buckthorn products Co., LTD., Beijing Baodui Health Industry Co., LTD., Shaanxi Haitian Pharmaceutical Co., LTD., Shanxi Luliang Yeshanpo Food Co., LTD., Hebei Shenxing Sea-buckthorn Research Institute are among the outstanding ones, and have achieved good economic and social benefits.

In terms of food processing, sea-buckthorn can be used as raw material 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, eliminating phlegm, benefiting lung, nourishing stomach, strengthening spleen, promoting blood circulation and removing blood stasis, burning and scalding, knife injury and frostbite, etc. Sea-buckthorn also shows its unique value in light industry and other aspects. Developed skin care products and cleanses that nourish skin, promote cell metabolism, promote epithelial tissue regeneration, have anti-allergy, antibacterial, strong penetrability and protect skin's natural color. Seabuckthorn stems have hard wood and can be used as raw materials for building materials such as plywood.

In recent years, sea-buckthorn seed oil, fruit oil, fruit powder, procyanidin, flavone, dietary fiber and so on are the main extracts of sea-buckthorn in the domestic and foreign markets. Seabuckthorn seed oil and fruit oil, as intermediates and raw materials of drugs, cosmetics and functional foods, have broad application fields and huge market potential. The demand for various natural sea-buckthorn extracts and fruit juices, such as seabuckthorn concentrate juice, fruit powder, oil, flavonoids, etc., has doubled. Some well-known enterprises at home and abroad, such as Nestle, Procter & Gamble, have launched or developed a number of sea-buckthorn related products. According to statistics, there are more than 200 kinds of sea-buckthorn 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)

达 260 亿元左右。其中高原圣果沙棘制品有限公司、北京宝得瑞健康产业有限公司、陕西海天制药有限公司、山西吕梁野山坡食品有限公司、河北神兴沙棘研究院等都是其中的佼佼者，取得了较好的经济社会效益。

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美国雀巢公司、美国宝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 applicaton of seabuckthorn in China
表 2. 沙棘应用情况

应用领域 Application sections	应用范围 Function subjects	相关产品 Products
食品加工 Food production	饮料、果酒、果醋、果酱、糕点、奶制品 drink,wine, vinegar, jam, pastry, dairy products, etc.	沙棘醋、沙棘酒、沙棘茶 seabuckthorn vinegar, wine, tea
医药保健 Medicine & healthcare product processing	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 Wuweise seabuckthorn power, seabuckthorn compounds with gingseng and jaundicen
轻工业及其他方面 Daily stuffs processing	化妆品、洗涤用品 cosmetic, detergent etc,	沙棘护肤产品 seabuckthorn products for skin protection

According to incomplete statistics, from 2016 to 2019, the sales revenue of sea-buckthorn extract products alone in China was 560 million yuan, 940 million yuan, 1.56 billion yuan and 2.1 billion yuan, respectively. It is estimated that the output value of downstream industries such as drugs, cosmetics and health products corresponding to sea-buckthorn plant extract products is about 1:22.

Sea-buckthorn enterprises in China have developed more than 200 products in eight categories, including food, beverage, medicine and health care, daily chemicals, feed and bait, with an annual output value of more than 26 billion yuan. Sea-buckthorn products not only promote the rational use of resources, mobilize the enthusiasm of the masses to plant sea-buckthorn, but also create a new way for people in poor mountainous areas to get rid of poverty and get rich. In China's sea-buckthorn planting areas, farmers rely on fruit and leaves harvest and development to raise sheep and cattle, with an average income of 200 yuan.

Seabuckthorn extract products, seabuckthorn seed oil and seabuckthorn fruit oil are currently the most exuberant products in the market, the market is in short supply. Seabuckthorn fruit powder, as a new functional product additive or raw material, is now being recognized and accepted by relevant industries and markets in China. In recent years, the market demand has grown particularly rapidly.

据不完全统计，2016年至2019年，全国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。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。

全国沙棘企业已经开发出了食品、饮料、医药保健、日化、饲料、饵料等八大类约200多种产品，年产值260亿元以上。沙棘产品不仅促进了资源的合理利用，调动了群众种植沙棘的积极性，而且为贫困山区人民脱贫致富创出了一条新路，在中国沙棘种植区农民靠采果和叶及发展养羊、养牛，人均增收达200元。

沙棘提取物产品中，沙棘籽油和沙棘果油是目前市场需求最为旺盛的产品，市场处于供不应求的状态；沙棘果粉作为新兴功能产品添加剂或原辅料，目前正在被中国相关行业和市场所认识并接受，近年来，市场需求增长尤为迅速。

4. The status of seabuckthorn scientific institution in the country in terms of the number of institutes and their scientists and their research field, and a brief introduction of main research institutes/universities and enterprisers, the main research programs and updated achievements on seabuckthorn.

4.1. Seabuckthorn Research Center, Chinese Academy of Forestry Science, Beijing, CHINA.

The center focuses on the research of seabuckthorn genome sequencing, molecular mechanism of functional characters of seabuckthorn, sea-buckthorn genetic breeding, seabuckthorn high-yield cultivation and so on. For the past nearly 30 years, financially supported by National Bureau of Forestry and Grassland, Ministry of Science and Technology, Ministry of Water Resources, Ministry of Agriculture, etc., dozens of national seabuckthorn scientific research projects have been implemented on *Hippophae rhamnoides ssp. sinensis* geographic provenance variation and provenance selection, introduction of foreign seabuckthorn varieties for ecological adaptability, ecological-economic purposes hybrid breeding, good varieties of large-scale propagation technology. The national network for scientific research experiment and demonstration covering major cultivation regions has been built up. The research results have been directly popularized and applied in the projects of returning farmland to forests and the ecological projects of preventing and controlling desertification in Heilongjiang, Liaoning, Inner Mongolia, Gansu and Xinjiang. According to statistics, over the past 20 years, more than 50 million seedlings of excellent seabuckthorn varieties have been provided to planting entities and 5 million mu of good quality plantations have been popularized, laying a solid resource foundation for the industrialization development of sea-buckthorn in China and achieving remarkable economic, ecological and social benefits.

4.2. Seabuckthorn Engineering Technology Research Center, National Bureau for Forestry and Grassland, CHINA

4. 全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。

4.1. 中国林业科学研究院林业研究所沙棘中心。

该中心重点开展沙棘基因组测序、沙棘功能性状分子机理、沙棘遗传育种、沙棘丰产栽培等研究。近 30 年来承担了国家林业和草原局、科技部、水利部、农业部等数十项国家级沙棘科研项目, 在中国沙棘亚种 (*Hippophae rhamnoides ssp. sinensis*) 地理种源变异及优良种源选择、引进国外优良沙棘品种生态适应性区划、生态经济型优良杂种的选育、优良品种规模化繁育技术等方面取得了重大创新性成果, 构建起了遍布全国各主要栽培区的科研试验示范基地网络。研究成果已在黑龙江、辽宁、内蒙、甘肃、新疆等省区退耕还林工程和防沙治沙生态工程建设中直接推广应用。据统计, 近 20 年累计向生产单位提供优良沙棘品种苗木 5000 余万株, 推广良种造林 500 万亩, 为中国沙棘的产业化发展奠定了坚实资源基础, 取得了显著的经济、生态和社会效益。

4.2. 国家林业和草原局沙棘工程技术研究中心 (山西省林业科学研究院)。

In 2019, Seabuckthorn Engineering Technology Research Center (hereafter as Center) has undertaken 7 projects, and has carried out seabuckthorn scientific research, technical services, and achievements transformation and promotion.

In the aspect of seabuckthorn scientific research, The Center has carried out seabuckthorn breeding research, artificial seabuckthorn demonstration garden construction, extraction method research and equipment development of seabuckthorn active substances. In seabuckthorn breeding research, introduction experiments and excellent individual plant selection were carried out. Six seabuckthorn varieties including Shenqiu hong, Wuchixiong, Shiyou 1, Nordic 1, Shengguo 1, and Zhuangyuanhuang were introduced. In the natural distribution area of *Hippophae rhamnoides* ssp *sinensis* in Shanxi Province, 110 excellent individuals of different types were selected and propagation with high yield, large fruit, and few thorns, a total of 114.5 mu of test forest was established in the experimental base of Shanxi Academy of Forestry Sciences; 66 mu of artificial seabuckthorn demonstration garden was built with different densities of *Hippophae rhamnoides* ssp *sinensis*. And the extraction method and equipment development of seabuckthorn active substances were studied, the drying process of fruit residue was tested and the parameters of mechanical drying were determined.

In terms of innovation achievements. Three patents were obtained. Among them, Drying and Mixing Mechanism of Seabuckthorn Fruit Residue, Mixing and Drying Tank Device of Seabuckthorn Fruit Residue are utility model patents, and Drying Machine of Seabuckthorn Fruit Residue is appearance patent. Two local standards e.g., Determination Method of Total Flavonoids Content of Seabuckthorn Leaves and Technical Specification for Selection of High Yield Individual of Seabuckthorn were formulated and preliminarily examined. Three papers were published.

该中心的主要任务是围绕全国沙棘产业的发展需求，实施产学研联合攻关，着力解决良种选育、丰产栽培、高效提取、综合利用等产业发展重大关键性和共性技术难题，为加快全国沙棘产业发展提供强有力的技术支撑。2019 年，沙棘工程中心共承担了 7 个项目和课题，围绕这些项目和课题，开展了沙棘科学研究、技术服务、成果转化推广等方面工作。

沙棘科学研究方面，分别开展了沙棘育种研究、人工沙棘示范园营建和沙棘活性物提取方法研究及设备研制。在沙棘育种研究中开展了引种试验和优良单株选择，引进了深秋红、无刺雄、实优 1 号、北欧 1 号、圣果 1 号、状圆黄等 6 个沙棘品种和无性系，在山西省中国沙棘天然分布区，以丰产、大果、少刺为指标，选择不同类型优良单株 110 株，并采集了繁殖材料进行扩繁，在山西省林科院试验基地共建立测试林 114.5 亩；利用中国沙棘不同密度营建人工沙棘示范园 66 亩；在沙棘活性物提取方法研究及设备研制中，进行了果渣干燥工艺试验，确定了机械干燥工艺参数。

在创新成果方面，一是获得专利 3 项。其中“沙棘果渣烘干搅拌机构”、“沙棘果渣搅拌烘干罐体装置”为实用新型专利；“沙棘果渣烘干机”为外观专利。二是制订了《沙棘叶总黄酮含量的测定方法》和《沙棘丰产单株选择技术规范》2 项地方标准，并经过了初审。三是发表论文 3 篇。

In terms of technical services, combined with the implementation of the Shanxi provincial talent support plan and forestry science and technology promotion project, four technical trainings were conducted for forest farmers in Pianguan County, Daixian County, Ningwu county and Lanxian County, Shanxi Province, with a total of 450 trainees.

In the aspect of achievement transformation and promotion, transformation and promotion of scientific and technological achievements was carried out while strengthening scientific and technological innovation of seabuckthorn, which increased scientific and technological support for the development of seabuckthorn industry. Hualinbei forest farm of Datong City has successfully declared for the demonstration project of forestry science and technology promotion by the central governtal finance in 2020, and utilized the local standards of Technical Regulations for Sowing and Seedling Raising of Seabuckthorn and Technical Regulations for Cutting and Seedling Raising of Seabuckthorn formulated by the Center.

In terms of economic and social benefits and organizational management effectiveness, breeding and cultivation technology of seabuckthorn were popularized and disseminated after the series of technical demonstration trainings, which improved the labor skills of forest farmers, and laid a foundation for artificial management of seabuckthorn.

4.3. Institute of Plant Resources, Dalian Minzu University, CHINA

In 2019, we focused on the biosynthesis mechanism of sea buckthorn oil and flavonoid, the breeding of new cultivars. We have published six papers, including three SCI papers (one and two papers were collected in SCI-1 and 2 respectively) and one EI paper. Based on mRNA-miRNA high-throughput sequencing and proteomic researches, we first found that 19 miRNAs and 18 transcription factors involved in regulating the sea buckthorn oil and fatty

在技术服务方面, 结合“三区”人才支持计划和林业科技推广项目的实施, 分别在山西偏关县、代县、宁武县、岚县等地, 对林农开展沙棘良种选育、栽培技术、病虫害防治等技术培训 4 次, 累计培训人数 450 人次。

在成果转化推广方面, 沙棘工程技术中心在加强沙棘科技创新的同时, 积极开展科技成果转化和技术推广, 加大了对沙棘产业发展的科技支撑。基层林业生产单位大同市桦林背林场利用沙棘工程技术中心制订的《沙棘播种育苗技术规程》和《沙棘扦插育苗技术规程》地方标准, 成功申报了 2020 年中央财政林业科技推广示范项目。

在经济、社会效益和组织管理效力方面, 通过一系列技术示范培训, 推广了沙棘养殖栽培技术, 提高了林农的劳动技能, 为沙棘的人工管理奠定了基础。

4.3. 大连民族大学植物资源研究所

2019 年主要开展沙棘油脂、黄酮合成机理及新品种选育等研究工作。发表论文 6 篇, 其中 SCI 论文 3 篇 (1 区 1 篇, 2 区 2 篇), EI 论文 1 篇。首次利用 mRNA-miRNA 测序和蛋白质组研究发现, 19 个 miRNA 和 18 个转录因子参与调控沙棘油脂和脂肪酸合成积累, 如 novelmiRNA215 和 miR168b 分别负调控 WRI1 和 $\Delta 9D$ 基因, 影响沙棘种子含油率和

acid biosynthesis, such as the contents of seed oil palmitoleic acid were regulated by WRI1 and $\Delta 9D$ genes targeted by novel miRNA215 and miR168b respectively; and the DGAT, PDAT and GPAT were the key enzymes during the oil biosynthesis of sea buckthorn fruit; the high expression of ACP- $\Delta 9D$ and CoA- $\Delta 9D$ genes coordinated with low expression KASII gene increased the accumulation of palmitoleic acid in berry pulp. We have coordinated four projects funded by national and departmental projects including National Natural Science Foundation Study on molecular mechanism of synthesis, accumulation and allocation of bioactive oils in different organs of sea buckthorn berries (31570681), Study on the mechanism of miR168b targeting $\Delta 9D$ gene regulates high accumulation of palmitoleic acid in sea buckthorn pulp (31800574). We were awarded the First prize of Liaoning Forestry Science and Technology Award with Study on screening technology of high oil germplasm resources of sea buckthorn (2019-1-01). The National Forestry and Grassland Administration authorized four new seabuckthorn cultivars, Chaoyang (20190346), Wanxia (20190341), Wanhuang (20190342) and Gaoyou No.1 (20190345).

4.4. Sea-buckthorn has been successfully popularized and applied in soil erosion control in the soft rock area of the Loess Plateau. Since 1998, Management Center for Seabuckthorn Development, Ministry of Water Resources has planted sea-buckthorn ecological forests on a large scale in Inner Mongolia, Shanxi and Shaanxi provinces, which are located on the Loess Plateau, with a total planting area of more than 7.5 million mu, of which 50,000 mu was newly planted in 2019.

4.5. New product research and development

The research and industrial development of decolorization process of seabuckthorn oil, the research and application of high-quality seabuckthorn fermented wine, the development and utilization of seabuckthorn fruit residues, the extraction and industrial development of procyanidins from seabuckthorn seeds, and

棕榈油酸含量; DGAT、PDAT 和 GPAT 等是沙棘果实油脂合成过程中的关键酶; ACP- $\Delta 9D$ 、CoA- $\Delta 9D$ 高表达协同 KASII 基因低表达与沙棘果肉高积累棕榈油酸密切相关。主持承担国家级、地厅级科研项目 4 项, 其中国家自然科学基金面上项目 1 项“沙棘果不同器官油脂合成、积累与分配的分子机制研究”(31570681)、青年科学基金项目 1 项“miR168b 介导 $\Delta 9D$ 基因调控沙棘果肉高积累棕榈油酸的机理研究”(31800574)。主持获得辽宁林业科学技术一等奖 1 项“沙棘高油种质资源筛选技术研究”(2019-1-01-01)。获得国家林业和草原局颁发的沙棘植物新品种权 4 个“朝阳”(20190346)、“晚霞”(20190341)、“晚黄”(20190342)、“高油 1 号”(20190345)。

4.4. 沙棘在黄土高原砒沙岩区水土流失治理中成功推广应用。1998 年以来, 水利部沙棘开发管理中心在地处黄土高原的内蒙古、山西、陕西省大规模人工种植沙棘生态林, 累计种植面积 750 多万亩, 其中, 2019 年新种了种植面积 5 万亩。

4.5. 新产品研究与开发

沙棘油脱色工艺的研究与产业化开发、高品质沙棘发酵酒的研究与应用、沙棘果渣的开发利用研究、沙棘籽原花青素的提取及产业化开发、高效提取沙棘油新技术等成果相继提出, 被各沙棘相关公司产业研发并投入市场。

the new technology of efficient extraction of seabuckthorn oil have been successively proposed and developed by various sea-buckthorn related companies and put into the market.

In addition, outstanding achievements have been made in the development and application of medical and ecological products. Chinese scholar Zhang Yumei et al. studied the effects of seabuckthorn juice and white finch wood alcohol on fat and sugar metabolism in rats. The results showed that seabuckthorn juice had positive effects on type 2 diabetes and hyperlipidemia rats. Alba alcohol plays a major role in the metabolism of fat and sugar in rats with type 2 diabetes and hyperlipidemia. Alkanol prevents chronic inflammation by lowering body weight.

Researchers from Gansu Agricultural University tested the inhibitory effect of isorhaminol and myricetin in sea-buckthorn flavone on the proliferation of human cervical cancer cells (in vitro test). They also tested the bacteriostatic effect of ethanol - aqueous extracts from seabuckthorn fruit in vitro experiments. It was found that the extract had a high bacteriostatic effect on a variety of bacteria.

In recent years, seabuckthorn enterprises or experts in China have applied for more than 10,200 patents for sea-buckthorn inventions, the ones that have been authorized are listed in the following Table 3 -Table 5.

此外，在医疗和生态产品研发应用上也取得突出成就。中国学者张玉梅等研究了沙棘汁和白雀木醇对大鼠的脂肪和糖代谢的作用。结论表明，沙棘汁对 2 型糖尿病及高血脂病的大鼠有正面的影响；白雀木醇对 2 型糖尿病及高血脂病的大鼠的脂肪和糖代谢起主要作用；白雀木醇通过降低体重来防治慢性炎症。

甘肃农业大学学者试验了沙棘黄酮中的异鼠李素与杨梅素对人宫颈癌细胞（体外试验）的增殖有抑制作用。他们还试验了沙棘果实的乙醇 - 水溶液提取物对体外试验的抑菌作用。发现了这种提取物对多种细菌有很高的抑菌作用。

近年来，在中国的沙棘企业或专家累计申请的沙棘发明专利共 10200 多条专利，已授权的如下：



4.5.1. The approved patents for pharmaceutical products are listed in Table 3.

4.5.1. 已授权的药品方面专利详见附表 3。

Table 3. Lists of approved patents for pharmaceutical products
表 3. 已授权的药品方面专利表

专利名称 Name of patent	申请单位 / 个人 Host of patent	用途 Function
复方沙棘籽油栓 seabuckthorn seed oil compound suppository	陕西海天制药有限公司 Shanxi Haitian Pharmaceutical Co.Ltd	宫颈糜烂、阴道炎 cervical erosion, vasoditis
一种修复胃黏膜的中药 A Chinese medicine for gastric mucous membrane repair	内蒙古宇航人高技术产业有限责任公司 Inner Mongolia Yuhangren High-tech Industrial Co.Ltd	修复胃黏膜 gastric mucous membrane repair
调节血脂、保护肝脏的产品及其制备工艺 products and the process for blood lipid regulation and liver protection	内蒙古元和药业股份有限公司 Inner Mongolia Yuanhe Pharmaceutical Co.Ltd	调节血脂、保护肝脏 blood lipid regulation and liver protection
希露消疣液 Xilu wart elimination liquid	王志理 WANG Zhili	治疗尖锐湿疣的药物 treatment of severe warts
一种调节妇女内分泌功能的药物 A medicine for female endocrine function	中国医学科学院西安分院医药生物技术研究所 Medicinal Bio-tech Institute, Xian Branch of Chinese Academy of Medicinal Science	妇女更年期综合症 female menopausal syndrome
一种治疗癌症的藏药及其制备方法 A tibetan medicine and the process for cancer treatment	尕玛扎西 GAMAZHAXI	对癌细胞具有杀死和可增强机体免疫力 to kill tumor cell and strengthen human immunity
清血丸 Qingxue Pill	白玛加措 BAIMAJIACUO	治疗心脑血管疾病 treatment of cardiovascular disease
沙棘药用基质油的低温制取生产技术 Technology of low temperature procesing for medicinal seabuckthorn media oil	王俊霞 WANG Junxia	

4.5.2. The approved patents for healthcare products are listed in Table 4.

4.5.2. 已授权的保健品的专利详见附表 4。

Table 4. List of approved patents for healthcare products
表 4. 已授权的保健品方面专利表

专利名称 Name of patent	申请单位 Host of patent	用途 Function
芦荟米酒及其制作工艺 Aloe rice wine and its production process	李明芳, 杨静 LI Mingfang, YANG Jing	提高免疫力 Improve immunity
天然滋补膏的制造工艺 menufecrure process of natural tonic cream	石富成 SHI Fucheng	软化血管 softening blood vessels
雪灵芝保健饮料 snow Ganoderma lucidum healthcare drink	西藏自治区太阳能研究示范中心 Tibetan Solar Energy Research Center	增强免疫抗病能力、抗疲劳能力 improve immunity, anti-fatigue
沙棘粉油软胶囊保健食品及其生产方法 seabuckthorn oil & podwer capsule healthcare foodstuff and process method	高原圣果沙棘制品有限公司 Gaoyuanshengguo Seabuckthorn Co.Ltd	
一种减肥茶 A tea for lose weight	重庆市康尔寿保健食品研究所 Chongqing Kangershou Healthcare Product Research Insititute	减肥、保健、降低血脂 lose weight, healthcare, lower blood lipd
参棘软膏及其制备方法 seabuckthorn-ginseng ointment and its processing method	赤峰万泽制药有限责任公司 Chifeng Wangze Pharmaceutical Co.Ltd	黄褐斑、老年斑 chloasma, aging sopt
具有心血管保健及延缓衰老功效的口服组合物 oral compounds of cardiovascular healthcare and anti-aging	成都瑞翔生物技术有限公司 Chengdu Ruixiang Bio-tech Co. Ltd	心血管保健及延缓衰老功效 cardiovascular healthcare and anti-aging activity
一种大黄果酸口服制剂及其制备工艺 seabuckthorn oral liquid and its production process	青海普兰特药业有限公司 Qinghai Pulante Pharmaceutical Co.Ltd	习惯性便秘，久治不愈的顽固性便秘，青春痤疮，黄褐斑等疾病 habitual constipation, acne, chilasma

专利名称 Name of patent	申请单位 Host of patent	用途 Function
具有美容、养颜功能的保健食品及其制备方法 beauty healthcare foodstuff and its processing method	聂承和 NIE Chenghe	抑制皮肤色斑产生 skin spot suppression
一种保暖、御寒、抗疲劳、温胃的茶及其制备方法 A tea for warming,anti-fatigue, stomach protection and its processing method	陈国荣 CHEN Guorong	保暖、御寒、抗疲劳、温胃 warming,anti-fatigue, stomach protection
离子交换法减除沙棘果汁原料中重金属铅含量的方法 Ion exchange method of Pd abatment for seabuckthorn juice material	青海康普生物科技股份有限公司 Qinghai Kangpu Bio-tech Co. Ltd	沙棘果汁原料中重金属铅含量的减除 Pd abatment for seabuckthorn juice material
一种荞麦保健醋的制备方法 manufacture process for buckwheat seabuckthorn healthcare vinegar	陕西省微生物研究所 Shaanxi Biological Research Institute	
具有延缓衰老作用的沙棘营养剂及其制备工艺 seabuckthorn nutritional compounds for anti-aging and its manufacture process	武汉天天好生物制品有限公司 Wuhan Tiantianhao Bio-product Co.Ltd	调节机体代谢平衡, 提高机体免疫力 metabolism regulation, immunity improvement
具有心血管保健及延缓衰老功效的口服组合物 oral compounds of cardiovascular healthcare and anti-aging	成都瑞翔生物技术有限公司 Chengdu Ruixiang Bio-tech Co. Ltd	有心血管保健及延缓衰老功效 cardiovascular healthcare and anti-aging activity
一种大黄果酸口服制剂及其制备工艺 seabuckthorn oral liquid and its production process	青海普兰特药业有限公司 Qinghai Pulante Pharmaceutical Co.Ltd	习惯性便秘, 久治不愈的顽固性便秘, 青春痤疮, 黄褐斑等疾病 habitual constipation, acne, chilasma
具有美容、养颜功能的保健食品及其制备方法 beauty healthcare foodstuff and its processing method	聂承和 NIE Chenghe	抑制皮肤色斑产生 skin spot suppression
一种保暖、御寒、抗疲劳、温胃的茶及其制备方法 A tea for warming,anti-fatigue, stomach protection and its processing method	陈国荣 CHEN Guorong	保暖、御寒、抗疲劳、温胃 warming,anti-fatigue, stomach protection
离子交换法减除沙棘果汁原料中重金属铅含量的方法 Ion exchange method of Pd abatment for seabuckthorn juice material	青海康普生物科技股份有限公司 Qinghai Kangpu Bio-tech Co. Ltd	沙棘果汁原料中重金属铅含量的减除 Pd abatment for seabuckthorn juice material
一种荞麦保健醋的制备方法 manufacture process for buckwheat seabuckthorn healthcare vinegar	陕西省微生物研究所 Shaanxi Biological Research Institute	
具有延缓衰老作用的沙棘营养剂及其制备工艺 seabuckthorn nutritional compounds for anti-aging and its manufacture process	武汉天天好生物制品有限公司 Wuhan Tiantianhao Bio-product Co.Ltd	调节机体代谢平衡, 提高机体免疫力 metabolism regulation, immunity improvement

4.5.3. The patents after review and to be effective are listed in Table 5.

4.5.3. 实质审查生效的专利详见附表 5。

表 5. 实质审查生效的专利表
Table 5. List of patents after review and to be effective

专利名称 Name of patent	申请单位 Applicant of patent	用途 Function
一种改善睡眠的保健食品 A healthcare food for sleeping improvement	北京中科雍和医药技术有限公司 Beijing Zhongkeyonghe Pharmaceutical Co. Ltd	改善睡眠 Sleeping improvement
具有降血压和改善心脑血管功能的营养保健品及制备方法 A nutritional healthcare product and processing method for blood pressure lowering and cardiovascular function improvement	北京中科雍和医药技术有限公司 Beijing Zhongkeyonghe Pharmaceutical Co. Ltd	平肝潜阳、升阳清心、清热活血之功效, 对于高血压及所致的头痛、眩晕、耳鸣, 高血脂、心血管病等疾病具有一定的保健作用, 适用于高血压人群 Treatment in blood pressure inducrd headache, dizzy, tinnitus, and high blood lipid, cardiovascular disease

5. The total personnel involved in seabuckthorn research, manufacturing, marketing planting, public management, etc. in the country, and the members of National Seabuckthorn Association, including institutional and individual members.

Nearly 30 years, China has established a powerful seabuckthorn expert team, with around 15,000 professionals, covering forestry, agriculture, water and soil conservation, gardening, medicine, food industry, etc. In recent years, we have included many qualified experts who are both professional and proficient in English communication, and served as chairman or the co-chairman in the academic exchange session at the International Seabuckthorn Association Conference, showing the active role of global seabuckthorn activities.

The Enterprise Committee (China) as a sub-organization of International Seabuckthorn Association, was established in May 2017, with 63 group members by the end of 2019. (See Table 6)

5. 全国沙棘从业人员情况，全国性协会会员总数（集体会员、个人会员）。主要沙棘会员单位简要介绍。

近 30 多年来，中国建立了强大的沙棘专家团队，专家团队技术专业领域广泛，全国沙棘从业人员约 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。近年来，培养了一些既懂专业又熟练掌握英语交流能力的知名专家，担任国际大会学术交流环节的联合主席，展示出我国的沙棘大国风范。

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 2019 年底有团体会员 63 个。（详见附表 6）

表 6. 国际沙棘协会（中国）企业委员会团体会员名单
Table 6. Namelist for Member of Chinese Enterprise Committee of ISA

序号	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 Gaoyuanshengguo Seabuckthorn Co. Ltd	会长单位 Chairman	卢健 LU Jian	总经理 General Manager
2	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 Lekai	董事长助理 Assistan to Chairman
3	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
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	北京宝得瑞健康产业有限公司 Beijing Powder Health Industrial Co. Ltd	副会长单位 Vice Chairman	王辉斌 WANG Huibin	总经理 General Manager
6	黑龙江圣宝泰农业有限公司 Helongjiang Shengbaotai Agriculture Co. Ltd	理事单位 Board member	赵胜臣 ZHAO engcheng	董事长 Chairman
7	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
8	新疆康元生物科技股份有限公司 Xinjiang Kangyuan Bio-tech Co. Ltd	理事单位 Board member	刘宗浩 LIU Zonghao	董事长 Chairman
9	甘肃艾康沙棘制品有限公司 Gansu Aikang Seabuckthorn Co. Ltd	理事单位 Board member	马静 MA Jing	总经理 General Manager
10	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

序号	名称 Name of member	备注 Title in Committee	联系人 Contact person	职务 Title
11	青海康普生物科技股份有限公司 Qinghai Kangpu Bio-tech Co. Ltd	理事单位 Board member	孙允武 SUN Yunwu	总经理 General Manager
12	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
13	黑龙江省八面通林业局 Bamiantong Forestry Bureau of Helongjiang Province	理事单位 Board member	段国庆 DUAN Guoqing	副局长 Deputy Head
14	内蒙古吉隆生态科技有限责任公司 Inner Mongolia Jilong Eco-tech Co. Ltd	理事单位 Board member	刘三利 LIU Sanli	董事长 Chairman
15	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
16	黑龙江延寿县鼎鑫生物工程有限公司 Helongjiang Yanshou County Dingxin Bioengineering Co. Ltd	理事单位 Board member	张建东 ZHANG Jiandong	总经理 General Manager
17	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
18	黑龙江众源冬果沙棘开发有限公司 Helongjiang Zhongyuan Dongguo Seabuckthorn Development Co. Ltd	理事单位 Board member	杜中元 DU Zhongyuan	董事长 Chairman
19	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
20	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
21	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
22	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
23	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
24	青海久实虫草生物科技有限公司 Qinghai JIushichongcao Bio-tech Co. Ltd	会员单位 Member	曾静 ZENG Jing	经理 Manager
25	山东清香茗泽农业科技有限公司 Shandong Qingxiangmingze Agri-tech Co. Ltd	会员单位 Member	于海洋 YU Haiyang	总经理 General Manager
26	新疆博拓进出口贸易有限公司 Xinjiang Botuo Import-Export Trade Co. Ltd	会员单位 Member	刘毓梅 LIU Yumei	经理 Manager
27	上海容邦投资管理有限公司 Shanghai Rongbang Investment Management Co. Ltd	理事单位 Board Member	李相军 LI Xiangjun	董事长 Chairman
28	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
29	山西省山地阳光食品有限公司 Shanxi Shandi Sunshine Food Co. Ltd	会员单位 Member	姜瑞林 JIANG Ruilin	总经理 General Manager
30	山西科林生物技术开发有限公司企业 Shanxi Kelin Bio-tech Development Co. Ltd	会员单位 Member	宁聚保 NING Jubao	董事长 Chairman
31	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 Haiii	董事长 Chairman
32	山西汇源献果园生物科技有限公司 Shanxi Huiyuan Bio-tech Co. Ltd	会员单位 Member	曹满 CAO Man	总经理 General Manager
33	青海清华博众生物技术有限公司 Qinghai Qinghua Bozhong Bio-tech Co. Ltd	会员单位 Member	费楠 FEI Nan	副总经理 Vice General Manager
34	内蒙古蒙鑫农林产业科技有限公司 Inner Mongolia Mengxin Agri-forestry Industrial Technical Co. Ltd	会员单位 Member	陈国香 CHEN Guoxiang	总经理 General Manager
35	内蒙古大沙棘实业(集团)有限公司 Inner Mongolia Big Seabuckthorn Industrial Co. Ltd	会员单位 Member	陈驿达 CHEN Yida	董事长 Chairman
36	辽宁东宁药业有限公司 Liaoning Dongning Pharmaceutical Co. Ltd	会员单位 Member	孔东宁 KONG Dongning	董事长 Chairman Chairman
37	辽宁传奇之果生物科技有限公司 Liaoning Chuanqizhiguo Bio-tech Co. Ltd	会员单位 Member	郝晓然 HAO Xiaoran	董事长 Chairman

序号	名称 Name of member	备注 Title in Committee	联系人 Contact person	职务 Title
38	黑龙江省长乐山大果沙棘开发有限公司 Helongjiang Changleshan Seabuckthorn Development Co. Ltd	会员单位 Member	王忠校 WANG Zhongxiao	董事长 Chairman
39	鄂尔多斯市天骄资源发展有限责任公司 Erdos Tianjiao Resource Development Co. Ltd	会员单位 Member	李云飞 LI Yunfei	董事长 Chairman
40	承德宇航人高山植物应用技术有限责任公司 Chende Yuhangren Mountainous Plant Application Technical Co. Ltd	会员单位 Member	姚玉军 YAO Yujun	经理 Manager
41	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
42	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	董事长 Chairman
43	吉林修养堂药业保健品有限公司 Jilin Qiuyangtang Pharmaceutical & Healthcare Product Co. Ltd	会员单位 Member	李晓光 LI Xiaoguang	经理 Manager
44	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	经理 Manager
45	乌苏市佳禾畜牧科技有限公司 Wusu Jiahe Livestock-tech Co. Ltd	会员单位 Member	宋悦恒 SONG Yueheng	董事长 Chairman
46	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	经理 Manager
47	甘肃甘农生物科技有限公司 Gabsu Gannong Bio-tech Co. Ltd	会员单位 Member	傅雨萌 FU Yumeng	总经理 General Manager
48	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	董事长 Chairman
49	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	经理 Manager
50	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 Yogguo	总经理 General Manager
51	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	经理 Manager
52	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 Yunitan	总经理 General Manager
53	新疆中科沙棘科技有限公司 Xinjiang Zhongke Seabuckthorn Tech Co. Ltd	理事单位 Member	徐均 XU Jun	董事长 Chairman
54	内蒙古吉文林业局 Inner Mongolia Jiwen Forestry Bureau	会员单位 Member		
55	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
56	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
57	内蒙古大杨树林业局 Inner Mongolia Dayangshu Forestry Bureau	会员单位 Member		
58	新疆清雅丰健康科技有限公司 Xinjiang Qingyafeng Health Tech Co. Ltd	会员单位 Member	田丰 TIAN Feng	总经理 General Manager
59	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 Fuchang	总经理 General Manager
60	南京蔓努尔国际贸易有限公司 Nanjing Mannuer International Trade Co. Ltd	会员单位 Member		
61	新疆先农伯益生物科技有限公司 Xinjiang Xiannongboyi Bio-tech Co. Ltd	会员单位 Member	王军扬 WANG Junyang	董事长 Chairman
62	延寿县御禄园茶业有限公司 Yanshou County Yuluyuan Tea Co. Ltd	会员单位 Member	李承捷 Li Chengjie	董事长 Chairman
63	黑龙江盛农食品有限公司 Helongjiang Shengnong Food Co. Ltd	会员单位 Member	姚忠华 YAO Zhonghua	总经理 General Manager

6. Introduction of important activities, major events, successful stories and advanced persons in the country in the year of 2019.

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

In December of 2018, The Ministry of Water Resources of China appointed Mr. ZHAO Dongxiao as the Director General of Management Center for Seabuckthorn Development, Mr. LU Shunguang and Mr. WANG Wengchang as Deputy Directors General, and Mr. CAI Jianqin as Chief Engineer.

Chinese government attaches great importance to ecological progress and has put forward the "Belt and Road" development strategy. Sea-buckthorn is a kind of efficient soil and water conservation plant, which can improve ecological environment construction and promote economic development. Sea-buckthorn has great ecological value and economic value. It is the good opportunity for seabuckthorn development in conjunction with the "Belt and Road" strategy, to promote bilateral and multilateral sea-buckthorn exchanges and cooperation. Along the Belt and Road 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. have a solid base for seabuckthorn cultivation and industrial development.

International Seabuckthorn Association as

6. 当年全国有关沙棘的重要活动、重大事项介绍。

目前, 中国已初步建立了与俄罗斯、德国、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、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。

2018年12月, 中国水利部任命赵东晓先生为水利部沙棘开发管理中心主任, 任命卢顺光先生、王愿昌先生为副主任, 任命蔡建勤先生为总工程师。

中国政府高度重视生态文明建设, 提出“一带一路”发展战略。沙棘是一种高效的水土保持植物, 可以改善生态环境建设, 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”战略相结合, 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, 由全球积极开展沙棘研究与开发的企事业单位、个人和其他

an international non-governmental, non-profit organization, and with members from seabuckthorn enterprises, research institutes and individuals was proposed by international seabuckthorn experts from China, Germany, Russia, Finland, India, etc. and launched in 2001. 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.

On October 15, 2019, at the General Assembly of International Sea-buckthorn Association held in Berlin, Germany, 13 members from 7 countries, including China, Germany, Russia, Finland, Latvia, India and Canada, were elected as the second board of directors. Mr. ZHAO Dongxiao, Director General of Management Center for Sea-buckthorn Development, Ministry of Water Resources, and Mr LU Shunguang, Deputy Director General were elected as Chairman and Secretary General of International Sea-buckthorn Association respectively. Mr. Veli-markku Korteniemi from Finland, Jorg-Thomas Morsel from Germany and 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 Sea-buckthorn Association. (See in detailed in Table 7)

On December 17, 2019, H.E. LU Guihua, Vice Minister of Water Resources of The People's Republic of China, chaired a special meeting for the long term development of the International Sea-buckthorn Association. Comments and suggestions in support of ISA have been presented by attendants from departments of the Ministry. The meeting agreed that International Seabuckthorn Association was an important platform for international cooperation of water conservancy. It was strongly emphasized that departments of Ministry of Water Resources should pay more attention to and support the development of the ISA and its Secretariat. The medium and long-term development plan of ISA should be drafted and put into practice. In the workplan, seabuckthorn

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。

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 13 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 Morsel、俄罗斯的 Yury A. Zubarev 分别当选为副主席。芬兰图尔库大学杨宝如 Baoru YANG 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 7)

2019 年 12 月 17 日,中国水利部副部长陆桂华主持召开专题会议,听取国际沙棘协会有关情况汇报,研究国际沙棘协会发展问题,提出了支持协会的思路和建议。会议认为,国际沙棘协会是水利国际合作的一个重要平台、一张名片,为服务中国水利外事工作、服务水土保持生态建设发挥了积极作用。要求水利部有关司局要更加关心和支持协会的发展,根据职责分工,支持协会的挂靠单位水利部沙棘中心的发展,帮助沙棘中心指导协会科学定位、做好顶层设计、编制中长期发展规划。会议强调,沙棘及国际沙棘协会具有独特的优势。国际沙棘协会要全面贯彻习近平新时代外交思想,统筹国内国际两个大局、两种资源,利用沙棘的生态、经济特性,发挥协会自身的专业优势,

standards, new technology research and extension, international visit and training, business collaboration should be highly strengthened to serve Belt and Road strategy.

着力开展沙棘国际标准、援外项目、新技术研究推广、考察培训等业务, 尽快做大做强, 更好服务中国特色大国外交战略、服务“一带一路”建设。

表 7. 国际沙棘协会理事会成员名单
Table.7. Namelist for Board members of International Seabuckthorn Association

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	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 Daliija 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

7. The policies and documents related with seabuckthorn, and research papers in the year of 2019 in the country.

The development of the sea-buckthorn industry has received strong support from the Central government of China. It was included by National Development and Reform Commission in the guiding catalogue of industrial restructuring to encourage projects and enjoy relevant preferential tax policies. In 1999, the State Forestry Administration formulated The Development Plan of Sea-buckthorn for 1999-2000, which implemented the task of afforestation of sea-buckthorn into six key forestry construction projects. In 2002, Ministry of Public Health issued a regulation as The Notice on Further Management of Healthcare Food Raw Materials. Seabuckthorn was included in the name lists of plant resources as both food and medicine, for the legal development and utilization of seabuckthorn resources.

Because most of seabuckthorn resources distribution in China's western provinces, the implementation of the national western development strategy for the western provinces and regions characteristic economy development brings unprecedented opportunities. As announced in 11th Five-year Plan for Local Economic and Social Development of Qinghai Province, formulated and issued by the Qinghai provincial government, The specific resources including seabuckthorn should be utilized in developing local economy. Development Plan of Qinghai Seabuckthorn and Lycium barbarum Industry, which is being compiled, has also made special plans for the development of seabuckthorn and Lycium barbarum industry. In June of 2017, The Guideline of Industrial purpose seabuckthorn plantation for promotion of poverty alleviation was jointly issued by Shanxi Provincial Forestry Bureau and Shanxi Provincial Office for Poverty Alleviation.

In 2019, the International Sea-buckthorn Association issued and implemented Seabuckthorn Flavone Standard.

7. 当年全国颁布有关沙棘的主要政策文件、技术标准，发表的研究论文等。

沙棘行业的发展得到了中国中央政府的大力支持。国家发展和改革委员会产业结构调整指导目录中将其列入鼓励项目并享受相关的税收优惠政策；1999 年国家林业局制定了《1999-2000 年沙棘发展规划》，把沙棘造林任务落实到六大林业重点建设工程中；卫生部 2002 年公布《关于进一步规范保健食品原料管理的通知》中，对药食同源物品、可用于保健食品的物品和保健食品禁用物品做出具体规定，将沙棘列入既是食品又是药品的植物资源名单，为沙棘资源的开发利用确立了法定地位。

由于沙棘大部分的资源分布在中国西部各省，国家西部大开发战略的实施为西部各省区特色经济发展带来前所未有的契机，比如青海省政府制定的《青海省国民经济和社会发展十五规划纲要》中就提出，要紧紧围绕沙棘等特色资源，大力发展地方特色经济；正在编制的《青海省沙棘枸杞产业发展规划》也针对沙棘、枸杞产业发展做了专项规划。2017 年 6 月，山西省林业厅和陕西省扶贫办公室联合发布《山西省关于沙棘工业原料林脱贫攻坚产业发展的指导意见》，沙棘等特色产业发展必将迎来一个崭新的未来。

2019 年，国际沙棘协会新制定和实施了《沙棘黄酮》团体标准。

In 2019, Chinese researchers published many seabuckthorn research papers in academic journals, 250 research articles/papers are selectively listed as in Table 1.

1.ZHONG S.P.,ZHONG Y. F.,ZHONG S.,XIE C. Y.,ZENG D.,LIU H.Q.), The clinical research of seabuckthorn pulp oil on severe oral ulcers treatment, Journal of South Jiangxi Medical College, 2019

2.ZHANG H.Y.,FANG H.A.,GU Y.F.,WANG Z.Z. et al, The research of seabuckthorn enzymes metabolites and its anti-oxidant effect, Food Industry Science,2019

3.YANG Y.,LANG W.K.,YANG M.,LIU W.Y., The anti-bacterial effect of seabuckthorn leaf extractives with n-butanol, Grain Science and Economy, 2019

4.WU J.Y., The application of HACCP system in seabuckthorn jam with milk production, Jiangsu Food and Additives, 2019

5.ZHANG D.,FU M.Z.,WU G.D., The content measurement of Quercetin, Kaempferol, Isorhamnetin by HPLC, Magazine of Chinese Nationality Medicines, 2019

6.GONG H.T.,XIA J.F.,FANG Y.Z. et al, The impact of seabuckthorn pulp taking to the gastrointestinal tract of patients suffered from sugar regulation illness, Chinese Food and Nutrition, 2019

7.HAO G.,YANG R.,XIN L.Y.et al, R & D of seabuckthorn functional drink and pig blood hemolysin extraction, Drink Industry, 2019

8.SHI W.B.,The experiential research of seabuckthorn seed oil and jujube seed oil on anti-depression, Chinese medicines and clinical, 2019

9.CHENG X.D., Seabuckthorn development for anti-poverty, Shanxi Soil Conservation Science and Technology, 2019

2019 年度，中国科研人员在公开学术期刊发表了许多沙棘研究论文，收录了 250 篇，详见附件 1。

附件 1: 2019 年度中国学者发表的沙棘论文

1. 钟胜频, 钟元芾, 钟声, 谢存焱, 曾东, 刘海桥; 沙棘果油治疗重型复发口腔溃疡的临床研究, 赣南医学院学报。

2. 张浩然, 范昊安, 顾逸菲, 王珍珍, 沙如意, 毛建卫; 沙棘酵素发酵过程中代谢产物及抗氧化活性研究, 食品工业科技。

3. 杨阳; 郎文凯; 杨茂; 刘文英; 沙棘叶正丁醇萃取物的抑菌活性, 粮食科技与经济。

4. 吴君艳; HACCP 体系在沙棘果酱酸奶中的应用; 江苏调味副食品。

5. 张东; 付铭哲; 邬国栋; HPLC 法同时测定沙棘黄酮中槲皮素、山柰酚和异鼠李素的含量; 中国民族医药杂志。

6. 宫会婷; 夏静芳; 范煜桢; 毛帅; 钟无限; 张玉梅; 随餐服用沙棘全果浆对糖调节受损人群胃肠道的影响; 中国食物与营养。

7. 郝刚; 杨润; 辛乐仪; 陈润; 猪血血红素的提取及其沙棘铁功能强化饮料的研制; 饮料工业。

8. 史文斌; 沙棘籽油配伍酸枣仁油抗抑郁作用实验研究; 中国药物与临床。

9. 程晓东; 发展沙棘林 推进脱贫攻坚; 山西水土保持科技。

10. ZHOU W., HU N., LIU X.T. et al, The RNA-Seq transcription group analysis of seabuckthorn male and female leaves, *Genomics and Applied Biology*, 2019
11. CAO Y., XUE Q.Q., QI J.Y., et al, The impact of transmission rate to soil insect community in artificial seabuckthorn forest, *Shanxi Agricultural Science*, 2019
12. ZHANG X., ZHANG X.J., WANG X.L., et al, The measurement of gallic acid content of three varieties seabuckthorn leaves, *Shanxi Agricultural Science*, 2019
13. LIU Z.Q., LI G.L. SUI P.C. et al, Seabuckthorn plantation mode for ecological & economic purposes, *Modern Rural Science and Technology*, 2019
14. ZHANG D.W., WANG H.J., ZHANG H.W., The optimised propagation and cultivation technology of seabuckthorn variety in western Liaoning province, *Applied Technology for Soil and Water Conservation*, 2019
15. ZHAO Z.L., WANG Y., Analysis of e-business marketing and promotion of seabuckthorn products in Shaanxi province, *Rural Science and Technology*, 2019
16. LIU H. Y., WANG R. M., GAO Z.H., Research of processing techque for seabuckthorn yogurt mixed with *Eleocharis tuberosa*, *Journal of Shanxi Datong University*, 2019
17. LI W., LI B.G., JIANG Y R., et al, The optimization of palmlyoic acid processing for seabuckthorn pulp oil by method of Urea Wrapping, *Chinese Oil*, 2019
18. JIANG Z.R., ZHANG T., WANG T., et al, Research on property and anti-oxidant activity of seabuckthorn pulp oil nono emulsion, *Chinese Oil*, 2019
10. 周武; 胡娜; 刘晓彤; 王煜伟; 索有瑞; 中国沙棘雌雄株叶片 RNA-Seq 转录组分析; 基因组学与应用生物学。
11. 曹悦; 薛琪琪; 祁靖宇; 柳春雨; 王磊; 门丽娜; 张志伟; 林内透光率对人工沙棘林大型土壤动物群落组成的影响; 山西农业科学。
12. 张欣; 张雪娟; 王小莉; 郭海利; 姚莹; 张小民; 3 种不同品种沙棘叶中没食子酸含量的测定; 山西农业科学。
13. 刘增庆; 李贵林; 隋鹏超; 深秋红大果沙棘生态经济型水土保持林建设模式; 现代农村科技。
14. 张东为; 王洪江; 张海旺; 辽西地区大果沙棘优化繁殖及栽培技术; 水土保持应用技术。
15. 赵佐龙; 王艳; 陕西省沙棘产品网络营销推广分析; 乡村科技
16. 刘海燕; 王润梅; 高志慧; 葶苈沙棘复合酸奶加工工艺研究; 山西大同大学学报(自然科学版)。
17. 李伟; 李保国; 姜元荣; 周盛敏; 尿素包合法富集沙棘果油棕榈油酸的工艺优化; 中国油脂。
18. 蒋忠荣; 张涛; 王涛; 常明; 刘睿杰; 金青哲; 王兴国; Re 沙棘果油纳米乳液的性质与抗氧化活性研究; 中国油脂。

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20. NAN J.B., DANZENG NIMA, LIN L., Research on photosynthesis property with drought stress for three species of seabuckthorn in Tibet. Plateau Agriculture, 2019
21. CHE F. B., LI Y.H., The pest and insect control technology of seabuckthorn in Xinjiang, Rural Science and Technology, 2019
22. WANG Z.Z., The high yield purpose cultreue technology of Russian seabuckthorn variety, Practical Technology and Information of Fruit Trees, 2019
23. NING Z.M., WU J., YU X. F., et al, The key technologies of seabuckthorn seedling in spring, Green Science and Technology, 2019
24. WU C.J., HAO Z., CAO M.J., et al, Research on impact of seabuckthorn planting to the micro-structrue of tailing substites, Environmental Protection and Recycle Economy, 2019
25. LI Y.H., NUERMAIMAITI AIMAITI, XIAREPATI QIMAN, et al, Comparision of cold resistant for seabuckthorn varieties in Xinjiang, Xinjiang Agricultural Science, 2019
26. WANG Y.S., Research of degradaed seabuckthorn plantation reformation and its effects, Shanxi Forestry Science and Technology, 2019
27. ZHANG S., WANG D., Research on repair effect of seabuckthorn flavonoids and selenium for rat uterine injury, Chinese General Medicines, 2019
28. LIN Z.G., The preliminary research of seabuckthorn planting density in south-eastern Heilongjiang Province, Forestry Survey and Design, 2019
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21. 车凤斌；李永海；新疆大果沙棘主要病虫害防治技术；农村科技。
22. 王梓贞；俄罗斯大果沙棘林地丰产栽培技术；果树实用技术与信息。
23. 宁忠梅；武剑；于晓辉；董海春；孟庆利；杨越新；张国芹；沙棘春播育苗技术要点；绿色科技。
24. 吴超君；郝喆；曹明杰；邓焱；植物修复对尾矿基质微结构的影响研究；环境保护与循环经济。
25. 李艳红；努尔麦麦提·艾麦提；夏热帕提·艾则孜；齐曼·尤努斯；新疆不同沙棘品种的抗寒性比较；新疆农业科学
26. 王永胜；退化沙棘林改造及其效益研究；山西林业科技。
27. 张爽；王冬；沙棘黄酮+硒对大鼠子宫缺血再灌注损伤的修复作用研究；中国全科医学。
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39. 游娜;新品种新技术推动沙棘产业健康发展;中国林业产业。
40. 王兴平;孙晶明;沙棘良种育苗浸种试验;果树实用技术与信息。
41. 史伟新;沙棘糖浆治疗小儿呼吸道感染的作用浅析;世界最新医学信息文摘。
42. 左阳;陈娟;沙棘糖浆、氨溴特罗口服液联合治疗小儿支气管炎的体会;世界最新医学信息文摘。
43. 刘艳丰;唐淑珍;王文奇;王承敏;超声波法提取沙棘叶黄酮的参数优化;草食家畜。
44. 张爽;王冬;沙棘黄酮在大鼠子宫缺血再灌注损伤中的作用研究;中国现代药物应用。
45. 徐海祥;殷玲;谷青青;侯逸秋;陈辉阳;蜂王浆沙棘复合乳饮料的研制;保鲜与加工。
46. 常应九;高庆超;曹效海;王树林;刘欣;沙棘活性成分及其对胃肠微生物影响的研究进展;包装工程。
47. 周莉;朱海华;平洋;谭静;任钊;沙棘牛油果益生菌酸乳的配方优化及其抗氧化性;中国食品添加剂。

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247. 李宝东;3种大果沙棘生理特性对水分胁迫响应研究;林业科技通讯。

248. 赵二劳;杨洁;赵三虎;范建凤;沙棘叶黄酮提取工艺及功能活性研究进展;分子植物育种。

249. 李贺;阮成江;李景滨;王莉;田兴军;沙棘果实发育阶段苹果酸代谢关键基因的表达分析;分子植物育种。

250. 李贺;阮成江;王莉;李景滨;郭海;田兴军;基于RNA-Seq SSR标记的沙棘种质遗传多样性和群体结构分析;分子植物育种。



2. Country Report of Finland



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Sea Buckthorn Activities in Finland in 2019

2019 年芬兰沙棘发展报告

CULTIVATION

关于沙棘种植

In 2019 in Finland there were 2019 grower and they had total area 118 ha - 72 ha in such stage that it was possible to get crop total crop was 119 tons what means average 319 kg per hectare. The hectares in cultivation were nearly the same as in 2018 but crop was very much higher in 2018 (88 tons)

In addition to growers there are many small home cultivation with some bushes, which are not included in statistics. In the coastal area of Finland there are wild sea buckthorn bushes and people have right to pick berries. The wild crop is not included in statistics either.

Aromtech Ltd has started 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 will take several years and results will be informed

在 2019 年，芬兰有 2019 名沙棘种植者，种植总面积为 118 公顷。其中，在这个阶段有 72 公顷已经结果，总产量为 119 吨，也就是说平均每公顷产量 319 公斤。人工栽培总面积与 2018 年基本相同，但产量要高得多 (2018 年为 88 吨)。

除了种植者，还有许多小型家庭种植一些沙棘灌木，这并不包括在统计中。在芬兰的沿海地区有野生沙棘灌木，人们有权采摘沙棘浆果。野生沙棘资源也不包括在上述统计数据中。

芬兰芳香科技有限公司 (Aromtech) 已经开始与拉普兰 (Lapland) 地区的职业学院合作，以促进芬兰北部沙棘的种植，方法是教育与试点栽培相结合。由 Aromtech 公司投资沙棘种植，学院的学生在开始在自家地里种植之前，可以获得种植、采收、处理和销售的经验。这个试验阶段将需要数年时间，结果将会公布。

PROCESSING

关于沙棘果实加工

In Finland the biggest volumes in sea buckthorn products are juices and beverages. Because cultivation is so small, berries and juice are mainly imported. In 2019, about 500 tons of frozen berries were imported.

在芬兰，最大数量的沙棘产品是果汁和饮料。由于当地沙棘种植面积太小，沙棘鲜果和果汁原料主要靠进口。2019 年，大约进口有 500 吨冷冻沙棘浆果。

Also in Finland there is production of special products based on sea buckthorn such as sea buckthorn oil and various products for health care and personal care using sea buckthorn ingredients. The biggest sea buckthorn oil production in Finland is based on supercritical fluid extraction process by Aromtech Ltd. Use of sea buckthorn material is up to thousands of tons calculated as weight of fresh berries.

芬兰还生产以沙棘为原料的特殊产品，如沙棘油，以及使用沙棘成分的各种保健和个人护理产品。芬兰最大的沙棘油生产商是 Aromtech 公司，采用超临界流体萃取工艺生产沙棘油，每年加工达数千吨的沙棘鲜果原料。

RESEARCH

科学研究

Finland has been active in sea buckthorn research for several decades. In 2019, four original scientific publications were published in high quality peer-reviewed internal journals, focusing composition and quality, processing, and health effects of sea buckthorn. Some of the published research has been a result of collaboration between academia and industry.

几十年来，芬兰一直在积极开展沙棘的研究。2019 年，在同行评议的高质量内部期刊上发表了四篇原创科学论文，重点关注沙棘的成分和质量、加工以及对人体健康的影响。以下一些已发表的研究成果是学术界和产业界合作的结果。

1. Markkinen, N, Laaksonen, O, Nahku, R, Yang, B (2019) Impact of lactic acid fermentation on sugars, acids, sugars alcohols, and selected phenolic compounds in sea buckthorn (*Hippophaë rhamnoides*) and black chokeberry (*Aronia melanocarpa*) juices. *Food Chem.* 286, 204–215.

1. Markkinen, N, Laaksonen, O, Nahku, R, Yang, B(2019), 乳酸发酵对沙棘 (*Hippophaë rhamnoides*) 和黑草莓 (*Aronia melanocarpa*) 果汁中糖、酸、糖醇及其酚类化合物的影响。《食品化学》(*Food Chem*) , 286 期 , 204-215。

2. Larmo P, Järvinen R, Laihia J, Löyttyniemi E, Maavirta L, Yang B, Kallio H, Sandberg-Lall M. (2019) Effects of a sea buckthorn oil spray emulsion on dry eye. *Contact Lens & Anterior Eye*, 42, 428-433.

2. Larmo P, Jarvinen R, Laihia J, Loytyniemi E, Maavirta L, Yang B, Kallio H, Sandberg-Lall M. (2019), 沙棘油喷雾乳剂对干眼症的影响。《隐形眼镜与前眼》(*Contact Lens & Anterior Eye*) , 42 期 , 428 -433。

3. Larmo P, Löyttyniemi E, Yang B, Kallio H, Erkkola R (2019) Effects of a sea buckthorn oil cream on vulvovaginal atrophy. *Maturitas* 124, 145-146.

3. Larmo P, Loytyniemi E, Yang B, Kallio H, Erkkola R(2019), 沙棘油霜剂对外阴阴道萎缩 (*vulvovaginal atrophy*) 的疗效, 《成熟度》(*Maturitas*) , 124 期 , 145 - 146。

4. Ma X, Yang W, Marsol-Vall A, Laaksonen O, Yang B (2019). Analysis of sensory-related compounds and prediction of sensory properties in sea buckthorn (*Hippophaë rhamnoides* L.) berries. Intern. J. Food Sci. Technol. doi:10.1111/ijfs.14442.

4. Ma X, Yang W, Marsol-Vall A, Laaksonen O, Yang B(2019), 沙棘果实中感官相关化合物的分析及感官特性预测。《国际食品科学与技术》(Intern. J. Food Sci. Technol), doi: 10.1111 / ijfs.14442。

In addition to the published research, University of Turku has on-going research on the impact of the latitudes of the growth locations the composition of sea buckthorn berries and leaves by comparing the berries and leaves harvested from plantations in Southern and Northern Finland.

除了已发表的研究,土尔库大学正在进行研究,通过比较从芬兰南部和北部的种植园采集的沙棘鲜果和沙棘叶,研究种植地的纬度对沙棘浆果和树叶组成的影响。



SEA BUCKTHORN IN MANAGEMENT OF ENVIRONMENT

沙棘在环境治理中的作用

Sea buckthorn plantations to reduce phosphorus leakage into the Finnish Archipelago Sea via the outlet-rivers – TYRNIRAKI

实施“种植沙棘减少磷通过河流出海口进入芬兰 Archipelago 群岛海域”(TYRNIRAKI - tyrniä ravinteiden kierrätykseen 蒂尔尼拉基 - 利用沙棘吸收营养)项目。

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.

由图尔库大学组织、为期十年的“蒂尔尼拉基”沙棘项目已在芬兰西南部开始实施,目的是减少农田中磷、氮和其他营养物质渗漏到当地河流中。Archipelago 群岛海域遭受严重的富营养化,每年蓝藻泛滥不再只是一个视觉问题。降雨量的增加和冬季积雪的缩短,明显是由于气候变化,使情况更加恶化。



(1) The Finnish Archipelago Sea

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 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, sea buckthorn to harvest nutrients)

(2) The action plan

The first sea buckthorn (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 herbicides/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. (Figure 1.)

This brings along additional business opportunities for the farmers and the goal is to multiply the SB plantations according to the upcoming results. (Figures 2 and 3.)

芬兰 Archipelago 群岛海域

芬兰群岛海是北欧国家最宝贵的自然资源之一，拥有 4 万个岛屿和小岛的海洋是在 1 万年前冰河时代末期，当地的冰盖融化之后开始形成的。这个内陆海很浅，盐含量很低，与大西洋的连接非常狭窄。这就是为什么养分的泄漏会造成一个紧迫的问题，我们必须减少从我们耕种的田地流入河流和进一步流入大海的径流（养分）。整个生态系统遭到破坏，我们的生活条件越来越差。我们需要几个选项来解决这个问题，“TYRNIRAKI”项目就是其中之一。(TYRNIRAKI – tyrniä ravinteiden kierrätykseen 利用沙棘吸收营养)

行动计划

2020 年 5 月，在芬兰西南部的 5 个河床（两岸）和海滨田种植了第一批沙棘幼苗。这四个沙棘品种都属于芬兰种源。与农民签订的十年协议为土尔库大学研究和后续行动使用沙棘灌木林的适当管理提供了保障。沙棘林地吸收了养分和固碳，土壤质量得到改善，生物多样性增加。试验地既不使用化肥，也不使用除草剂/杀虫剂。当地河流和海洋的养分渗漏减少了，通过作物收割和田间处理，磷和氮被去除了。（图 1）。这为农民带来了额外的商业机会，目标是根据预期结果扩大沙棘种植园。（图 2 及图 3）

(3) The functional model from China

The Ministry of Water Resources (China) has over 30 years of experience on the topic. The International Seabuckthorn Association (ISA, SCISA), run by the Ministry, is an international organization, and the University of Turku has joined the activities since 1989.

Sea buckthorn seedlings have been planted in wide areas, e.g. at the Huang He River Plateau to bind soil, to produce berries and to make the reforestation possible. SB is a significant and increasing line of business, as well in China as in Finland. Among the plants tested, SB is the best one to bind soil and to reduce erosion caused by water, wind and frost. As a heritage from this long-term co-operation, the University of Turku has a wide knowledge of SB as well, with more than 100 scientific international publications.

(4) 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

来自中国的有效模式

中国水利部在这方面有 30 多年的经验。由该部管理的国际沙棘协会及其科技委员会 (ISA、SCISA) 是一个国际组织，芬兰图尔库大学自 1989 年起就加入了该活动。

沙棘苗木被广泛种植在中国的黄土高原，以保持水土、生产浆果，并使绿化造林成为可能。沙棘在中国和芬兰都是一项重要且正在增长的业务。在已有研究的植物中，沙棘是一种保持土壤和减少水、风、霜造成的侵蚀的一种最好的植物。作为长期合作的成果，图尔库大学对沙棘也有广泛的了解，在国际上发表了 100 多篇科学论文。

制定实施芬兰国家计划（项目）

该计划（项目）目的是扩大认识，但它需要改变国内的农业耕作法规，特别是与防护林有关的法规。此外，来自政府的重要财政和政治支持是必要的。这是一个长期的项目，要在短于 10 年内快速取得重大的成果是不现实的。农民们采取了积极的态度。必须采取自然科学、技术、营养、农业科学以及企业家和工业领域的多学科、多领域合作。从农田中除去磷比从海洋中除去磷更有效。

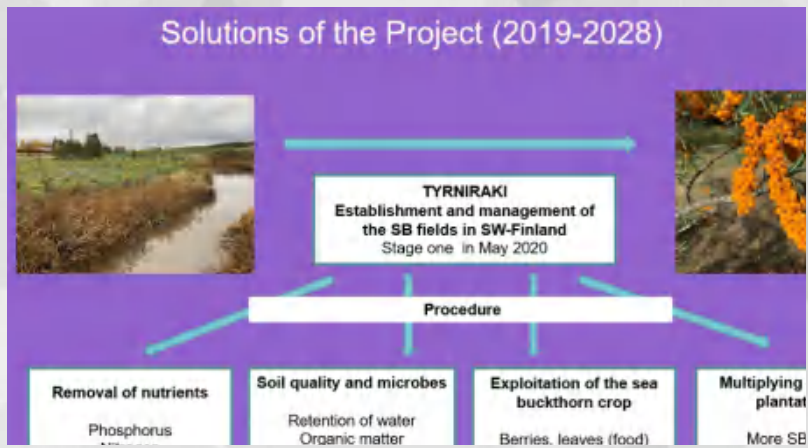


Figure 1. 图 1. TYRNIRAKI 项目目标 (2019-2028 年)

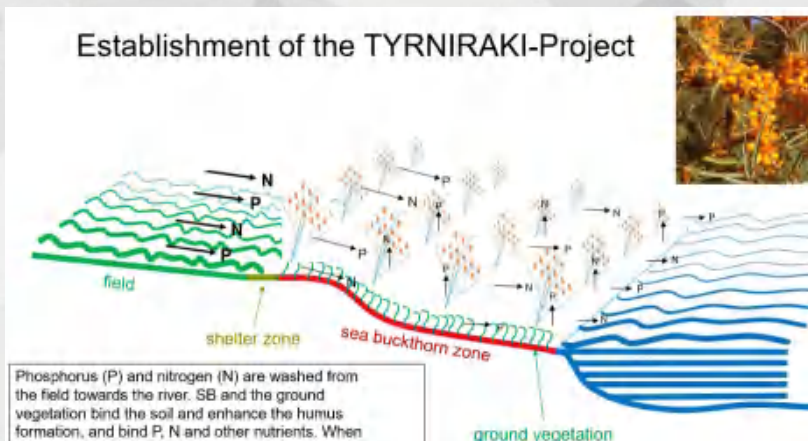


Figure 2- 图 2 TYRNIRAKI 项目主要内容

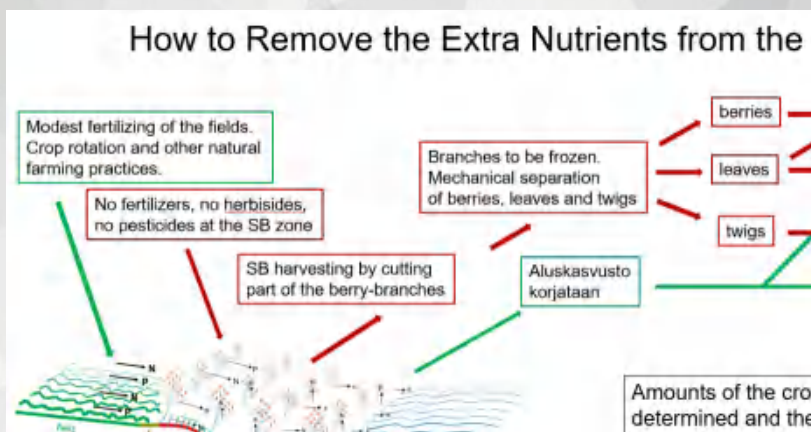


Figure 3. 图 3 如何去除土壤中多余的养分

3. Country Report of Germany



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Seabuckthorn Development in Germany in the Year of 2019

2019 年德国沙棘发展报告

General situation when growing sea buckthorn

沙棘种植总体情况

In 2019, the acreage in Germany increased further. At the same time, we had to contend with significant influences from climatic changes in the conditions in the plantations. The years 2018 and 2019 were characterized by the fact that we had significantly lower amounts of precipitation on the one hand and up to 15% more hours of sunshine on the other. Both of these factors mean that the systems are subject to considerable stress. Without being able to name the exact cause at the moment, we have to state that we are experiencing considerable losses of plants in some plantations. This death of the sea buckthorn plants cannot be logically explained by conditions of the location or the varieties. There seems to be some clustering in the north. The Hergo variety is particularly affected, whereas the Leikora variety is less affected. However, there are also inland plantations, i.e. not near the Baltic Sea, where such observations can be made. It should also be noted that these systems were partly irrigated, but partly operated without pollution. A direct correlation to the supply situation with additionally given water cannot be determined directly.

What is striking is the fact that we have observed in many plants that the berries on the sunny side show clear traces of fading.

An additional key observation is that we had practically no periods of frost in the winters of 2017/18 and 2018/19. This may suggest that the plants never really hibernated.

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.

2019 年，德国的沙棘资源面积继续增加。同时，我们不得不面对气候变化对沙棘种植园的明显影响，2018–2019 年，一方面德国连续遇到降雨的显著减少，另一方面日照时数增加 15%，两个因素叠加在一起后更加剧了困境。目前还无法解释具体原因，但现实是一些种植园沙棘产量明显减少。沙棘植株的死亡逻辑上很难从种植地或品种上解释，似乎更多发生在北部地区，尤其是 Hergo 品种受影响更严重，而 Leikora 品种轻微些。但是，一些不靠近波罗的海的内地的沙棘种植园，也有此类现象发生。需要指出的是，这是有部分灌溉条件、部分无污染的，其结果与灌溉水供给的直接相关性似乎难以确定。

很明显，我们在很多沙棘植株上观察到一个现象，即向阳面的沙棘果实有明显褪色的痕迹。

还有一个关键的观测记录就是，2017–2018 年和 2018–2019 年间实际上没有无霜期。这也许是导致沙棘植株一直没有休眠的原因。

综合来看可以得出一个结论，产生上述结果可能是综合因素，而不是单一原因。

Research work

沙棘研究工作

The main research focus was on horticulture. As described above, an attempt was made to determine the causes of the death of sea buckthorn plants. Above all, the question of plant diseases played an essential role. In particular, the infestation with bacteria and possibly viruses was taken into account. Final results are not available. There is also no correlation to the known problems (Verticillium).

In processing technology, research work has been carried out on the recycling of waste in the production of sea buckthorn juice. The main goal is to use leaves and pomace. There are different directions of research. For example, the development of tea or the utilization of extracts from leaves should be a possible option. Difficulties arise in this case, in particular, from the fact that the food legislation classifies products that were previously not in the diet as so-called novel foods and these are subject to an approval procedure. 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 sea buckthorn weather has been used in the past to make tea. Extracts from leaves or from the residues of oil extraction from the kernels of the sea buckthorn berries are, however, a little more difficult to classify.

Medical studies on the effects of sea buckthorn products, extracts and other products that can be produced on the basis of sea buckthorn have only been carried out to a limited extent.

研究的重点在沙棘栽培。如前所述，研究的一个目的是确定沙棘植株死亡的原因。总之，植物病害是主要原因，特别是细菌感染和有关病毒要引起关注。目前还没有最终结论，与已知的轮枝孢菌 (Verticillium) 引起的枯萎病应没有直接关系。

在加工技术方面，重点在沙棘果汁加工中的废料循环利用上，主要目的是沙棘叶和沙棘果渣的开发利用。有几个研究方向，比如，沙棘茶的开发和沙棘叶提取物利用可能是一个选择方向。困难也随之而来，特别是在以往的食品法规中，沙棘不在所谓的新食品类别中，需要履行审批程序。对于小领域的沙棘来说，一般很难得到批准，这是一个明显的障碍。对沙棘茶来说，问题相对简单，因为目前大家已经认识到，沙棘在先前已经用于制茶。但是，沙棘叶提取物，或沙棘种子油提取后的果渣提取物，在归类上就比较困难。

在医药研究方面，只限于沙棘产品、提取物及其制品功效研究的有限程度。



Situation in cultivation 沙棘栽培

The built-up area with sea buckthorn is essentially divided into wild stocks and plantations. The wild stocks are mainly found on the coasts of the North Sea and the Baltic Sea. They cover around 100-200 ha. Of course, large amounts of 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. In particular, the use of cutting technology is only possible to a very limited extent. **Plantation in total has currently acreage of around 600-800 ha in Germany.** The areas are slowly but steadily increasing. Due to the problems with the death of sea buckthorn plants in 2018 and 2019, the willingness of farmers to replant has been somewhat reduced. The annual increase should be in the order of 50-100 ha. It should be noted that in principle there is no statistical recording of the plantations planted with sea buckthorn. 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 sea buckthorn.

德国的沙棘资源包括野生林的和人工种植园。野生沙棘主要集中分布在北海和波罗的海沿岸，面积约 100-200 公顷，当然。还有很大数量零星分布的野生沙棘值得关注，因为这些沙棘发挥固定海岸沙丘等其他功能，并受到特殊保护。并非所有沙棘资源都完全得到采收，剪枝采收技术应用有一定的限制条件。目前。在**德国**有沙棘种植园总面积约 600-800 公顷，而且面积在慢慢、稳步增加。由于 2018-2019 年沙棘植株死亡问题，一定程度影响了果农继续发展新种植沙棘的意愿，每年新增沙棘面积的节奏保持 50-100 公顷。需要说明的是，目前并没有人工沙棘种植面积的严格统计，只是由于果农人工种植这些沙棘需要申请政府补助时进行统计的。因此，目前无法准确说到底人工种植了多少沙棘



四

Use of sea buckthorn 沙棘加工

The processing capacities have grown further. Currently, there is a phase in the balance between selling juice and selling oil when there is an excess of oil. Such fluctuations are not new to us and usually change in relatively short periods of time. About 50% of the processed quantities of sea buckthorn 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, China, and the Russian Federation.

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 biogas.

德国的沙棘加工能力逐年增长。目前的沙棘果汁和沙棘油销量基本均衡，沙棘油略微多于沙棘汁，这一波动对我们来说并不稀奇，而且时常在较短时期内发生变化。目前，德国加工企业的沙棘原料 50% 来自国内，另外 50% 通过国际采购。主要的原料供应国家包括 罗马尼亚、匈牙利、捷克和波罗的海国家。此外，也从蒙古、中国等亚洲国家和俄罗斯购买。

实际上，沙棘加工并不是只开发利用其中某一个部分（成分）。通常，沙棘果汁和沙棘油一起加工生产，剩下的果渣用于继续深加工，种子用于提取油。果实压榨后的果皮、种子压榨提油后的果渣用于循环利用。即使这样，估计只是利用了 1/3 的生物量，剩余的残渣通常用于生物能源，即出售给有关企业生产沼气。

五

Activity of the German Seabuckthorn Association 德国沙棘协会相关活动

Our company held various events in 2019. This also included very interesting lecture conferences devoted to the field of wild fruit and sea buckthorn. In addition, excursions were carried out. Some of our members have organized events themselves, including celebrations with high publicity and the like.

2019 年，德国沙棘协会（备注：UBF GmbH 公司）举办了一系列活动，包括针对野生浆果和沙棘果实方面有趣的学术会议，以及实地考察。一些会员单位也组织本单位的活动，包括宣传推广、庆祝等。

六

Summary

总结

Overall, the development in the area of sea buckthorn 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 sea buckthorn and all of its derivatives in a stable manner. Compared to other fruits, sea buckthorn 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. Sea buckthorn 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.

总之，德国的沙棘发展稳步进行，产品生产和销售逐步增长，发展速度正常、适当，不存在因发展速度过快而产生损失的风险，目标是以稳健方式开发利用沙棘及其衍生产品。与其他水果相比，将来沙棘在德国仍将是小众产品。尽管投资人有可能从第一眼好印象激发兴趣，大规模开发沙棘产品，从生产企业角度看也更加有兴趣，因为开发出的是小众产品，反而更有营利性。这些产品在市场上可以更高的价格出售，因而对沙棘种植者和加工者同时有经济上的吸引力。沙棘同时对被称为德国“边缘产业”（sideline）的农业产业发展起到重要作用，毕竟沙棘果树栽培并不是作为农业的主要任务。一些沙棘种植园由其主业与沙棘相去甚远的人经营管理，但其产量却相当可观。



4. Country Report of India



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Report on Seabuckthorn Development in India

2019 年印度沙棘发展报告

National Conference on Seabuckthorn

全国性沙棘会议

Delhi University Botanical Society and Department of Botany of Delhi University organized 3rd National Conference of Seabuckthorn Association of India on "Seabuckthorn: Translating Research into sustainable Utilization and Conservation on December 19-20, 2019. Mr. Siddhanta Das, Director General and Special Secretary of Ministry of Environment, Forest and Climate Change, Government of India inaugurated the Conference. There were over 110 delegates from various universities and institutes, government officials and representative of private sector companies present in the conference.

2019 年 12 月 19 日至 20 日，德里大学植物学会和德里大学植物系组织了主题为“沙棘，将研究转化为可持续利用和保护”印度全国沙棘协会第三届会议。印度政府环境、森林和气候变化部总干事兼特别秘书 Siddhanta Das 先生为会议开幕，来自各大学和研究所的 110 多名代表、政府官员和私营企业代表出席了会议。

Oil processing unit

沙棘油加工车间

Private sector company Chandigarh Agritech established Co2 based supercritical oil extraction unit at Baddi, Himachal Pradesh. It is 3rd such oil extraction unit of India based on Co2 extraction method. The unit has started functioning and extracting oil from seabuckthorn fruit, besides turmeric and other plants.

私营企业 Chandigarh Agritech 在喜马偕尔邦的 Baddi 建立了二氧化碳超临界萃取装置。这是印度第三个以 CO2 萃取法加工沙棘油企业。该装置已经开始运作，并从沙棘果实、姜黄和其他植物中提取油脂。

Leaf drying unit

沙棘叶干燥设备

Indian Institute of Technology, Delhi has established a seabuckthorn leaf drying unit at Jhalma village in Lahaul-Spiti in Himachal Pradesh. Seabuckthorn leaf tea is emerging as a popular tea in some pockets especially in Delhi and NCR.

德里印度理工学院在喜马偕尔邦 Lahaul-Spiti 的 Jhalma 村建立了一个沙棘叶干燥装置。沙棘叶茶在一些地区正成为一种受欢迎的茶，尤其是在德里和北印度地区。

四

Marketing of seabuckthorn health products

沙棘保健品的销售

There are about 120 seabuckthorn health products which include juice, jam, jellies, beverages, bakeries, tea and oil capsules, being manufactured by about 5 major private sector companies. The total annual turnover is just 8-10 million US dollars only.

印度有沙棘保健产品约 120 种，包括果汁、果酱、果冻、饮料、面包店、茶和油胶囊，由大约 5 家大型私营企业生产。年营业额只有 800-1000 万美元。

五

Advancement in research on seabuckthorn

沙棘的研究进展

(1) CSK Himachal Pradesh Agricultural University, Palampur

在喜马偕尔邦农业大学 Palampur

The evaluation studies are being carried out on the adaptation and growth behaviour of 10 Russian seabuckthorn varieties raised at Research Station at Kukumseri in Lahaul-Spiti, Himachal Pradesh. Three varieties have shown better performances than others.

目前，正在对喜马偕尔邦 Lahaul-Spiti 的 Kukumseri 研究站引种的 10 个俄罗斯沙棘品种的适应和生长状况进行评价研究。有三个品种的表现优于其他品种。

Palampur university improved the propagation method of seabuckthorn from softwood cuttings under controlled conditions in poly-houses. The 2-3 months old green shoots with 20 cm length, treated with 500 ppm IBA gave best results of rooting at 22°C and 90% humidity in poly-house. The cuttings were planted on the sand: VC (95:5 ratio) 20 cm layer raised on well ploughed 10 cm deep soil layer.

Palampur 大学改进了在温室条件下沙棘嫩枝插枝繁殖的方法。生长 2-3 个月、20cm 长、500ppm IBA 处理的幼苗在 22°C、90% 湿度的温室大棚中生根效果最佳。插穗种植在沙地上：VC (95:5) 20cm 土层，耕翻 10cm 土层。

Palampur university has been sanctioned research project entitled “Mass propagation and cultivation of seabuckthorn cultivars for livelihood improvement in cold deserts of Himachal Pradesh” for Rs. 36.70 lakhs for 3 years.

Palampur 大学已经批准了一项题为“喜马偕尔邦寒冷沙漠地区沙棘品种大规模繁殖和种植以改善民生”的研究项目，为期 3 年，总经费 3670 万卢比。

(2) TERI, New Delhi

A total 256 seabuckthorn accessions from five Himalayan states were studied to assess the level and distribution of genetic diversity using GBS-SNP markers. Using a mock reference, a total of 10374 GBS-SNPs were called across the 256 accessions of *H. rhamnoides* and *H. salicifolia*. The genetic diversity within accessions from Himachal Pradesh was highest among all the states. There was higher genetic diversity in *H. rhamnoides* than *H. salicifolia*. There was also higher genetic diversity in *H. rhamnoides* growing in Ladakh than Himachal Pradesh.

在新德里 Teri

利用 GBS-SNP 标记, 研究了来自喜马拉雅山地区 5 个邦共 256 份沙棘样本的遗传多样性水平和分布。利用模拟参考 mock reference 方法, 在 256 份鼠李沙棘 *H. rhamnoides*、柳叶沙棘 *H. salicifolia* 中总共完成了 10374 个 GBS-SNPs 标记。喜马偕尔邦的沙棘遗传多样性在所有邦中最高。鼠李沙棘的遗传多样性高于柳叶沙棘。拉达克地区的鼠李沙棘的遗传多样性也高于喜马偕尔邦。

(3) DIHAR (DRDO), Leh

Improved method of propagation from one-year-old micro-cuttings of seabuckthorn with less than 3 mm diameter without treatment of any hormone with 97% success rate. Rooting rates improved in hardwood cuttings in open nursery covered with polythene mulch over night. The institute is engaged in research on selection of high yielding forms of seabuckthorn.

The institute has also conducted detail studies on the effect of different parts of seabuckthorn on health conditions of different domestic animals. There was significant increase in weight gain, milk yield and physio-biochemical indices in seabuckthorn fed animals at high altitude animals.

DIHAR (印度国防研究所 DRDO), Leh

改良扦插繁殖方法 (微枝扦插)。用 1 年生直径小于 3mm 的沙棘硬枝, 不加任何激素处理, 繁殖成功率达 97%。在夜间覆盖聚乙烯覆盖的露天苗圃中, 硬木插枝的生根率有所提高。该研究所从事沙棘高产品种的选优研究。

该研究所还就沙棘不同部位对不同家畜健康状况的影响进行了详细研究。以沙棘为食的高海拔动物, 其增重、产奶量和生理生化指标均有显著提高。

(4) DIHAR (DRDO), Leh

Single dose (30 mg/kg body weight) of seabuckthorn leaf extract rendered 90 percent survivors of mice population when administered

INMAS (印度国防研究所 DRDO), 德里 Delhi

在照射小鼠 30 分钟 (10Gy Co-gamma 伽马射线) 前, 使用单剂量 (30 mg/kg 体重) 沙棘

30 minutes before 30 minutes before Co-gamma-irradiation (10 Gy). The mode of protection was by normalizing oxidative stress, promoting antioxidants level, countering injuries to brain, liver, spleen and bone marrow. Further, effect of this preparation was studied on tissue micro-biodata caused by whole body irradiation.

(5) DIPAS (DRDO), Delhi

Administration of seabuckthorn leaf extract protected the animals from hypoxia under high altitude conditions by decreasing AOPP, protein carbonylation and endothelin-1 levels. Its efficacy was comparable to a chemical ER stress inhibitor 4-PBA. CHOP, which is a marker of ER associated with cell death was considerably lowered, signalling a possible mechanism behind cardio-protection activity of seabuckthorn extract.

The institute also developed the seabuckthorn based adaptogen derived from its oil and leaf extract. The leaf extract showed more than 80% resistance in fall of rectal temperature as compared to 30-40% in case of oil under high altitude conditions. The polyphenolic rich fraction (PRF) of leaves shown 66.6% resistance at four times lower dose than whole leaf extract.

(6) University of Patanjali, Haridwar

Seabuckthorn oil showed anti-inflammatory and anti-psoriasis efficacies in Wistar rats. There was significant reduction in ear edema, ear biopsy weights, epidermal thickness and skin lesions. The mode of action of seabuckthorn oil was found through inhibition of RNS and down regulation of NF-kB protein and pro-inflammatory cytokines.

叶提取物，取得 90% 的存活率。其保护方式是通过调节氧化应激，提高抗氧化剂水平，对抗脑、肝、脾和骨髓的损伤。还进一步研究了该制剂对全身照射引起的组织微生物数据的影响。

DIPAS (印度国防研究所 DRDO), Delhi

沙棘叶提取物通过降低 AOPP、蛋白质羧基化和内皮素 -1 水平，保护动物在高海拔条件下免于缺氧。它的功效与化学内质网应激抑制剂 4-PBA 相当。CHOP 是内质网中与细胞死亡相关的一种标志物，其含量显著降低，这表明沙棘提取物可能具有心脏保护作用。

该研究所还开发了以沙棘为基础的 adaptogen，它是从沙棘的油和叶提取物中提取的。在高海拔条件下，叶提取物对直肠温度下降的抗性为 30-40%，对直肠温度下降的抗性为 80% 以上。叶片的多酚部分 (PRF) 表现出 66.6% 的抗性，其剂量比全叶提取物低 4 倍。

帕坦加利大学，哈里瓦尔

沙棘油对 Wistar 实验大鼠有抗炎、抗银屑病作用。耳部水肿、耳部活检重量、表皮厚度和皮肤病变明显减少。作用模式是沙棘油通过抑制 RNS，降低 NF-kB 蛋白和促炎细胞因子。

5. Country Report of Latvia



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Country Report of Seabuckthorn Development in LATVIA in 2019

2019 年拉脱维亚沙棘发展报告

Seabuckthorn resources, species 沙棘资源、品种情况

The total area of sea buckthorn plantations in Latvia in 2019 was about 800 ha, 120 ha of them have been certified as organic. All of them are artificial, there are no natural stands in Latvia. The annual increase of planted areas is about 80 ha. The total production of sea buckthorn fruits in Latvia in 2019 was about only 400 tons, as most of the fruits have been damaged by sea buckthorn fly *Rhagoletis batawa*. The average size of plantations is about 3 ha, though there are several plantations of 20 – 30 ha. Watering systems are installed only in the largest plantations. There are no certain regions of Latvia with intense development of plantations, they are evenly distributed all over the country. Harvest is performed by cut, freeze and shake of the whole branches, though there is a specific gentle cut of bushes, developed and recently used only in Latvia. Most of the harvested fruits are exported to EU countries, just 20% - 25% remain for local processing.

There are no native stands of sea buckthorn in Latvia, though the fossil pollen analysis show that sea buckthorn have been present there after the last ice-age. The introduction of cultivars have been started at the beginning of the 1980s. The best results were obtained by the group of varieties bred by Tit Trofimov, Botanical garden of the Moscow State University. Most of varieties grown in the orchards of Latvia are crossings among

截止 2019 年，拉脱维亚全国沙棘总面积约 800 公顷，其中 120 公顷通过了有机认证。所有这些都是人工种植的，在拉脱维亚没有天然沙棘资源。种植面积每年增加约 80 公顷。2019 年拉脱维亚沙棘果实总产量约为 400 吨，大部分果实受沙棘果蝇 *Rhagoletis batawa* 影响。每处种植园规模平均面积约为 3 公顷，但也有几处 20–30 公顷。只在最大的种植园安装由灌溉系统。在拉脱维亚，没有某一地区的沙棘种植园非常集中，而是分布在全国各地。沙棘采收是通过对整个树体进行剪枝、冷冻和脱粒来完成的，不过也有一种特殊的轻微剪枝采摘方式，这是拉脱维亚最近才开发和使用的。大部分收获的沙棘鲜果都出口到其他欧盟国家，只有 20%–25% 留在当地加工。

尽管化石花粉分析表明，沙棘在最后一个冰河时代之后就出现在拉脱维亚，但在拉脱维亚并没有沙棘天然林。沙棘品种的引进从 20 世纪 80 年代开始，从莫斯科国立大学植物园的 Tit Trofimov 培育的一组品种取得了最好的引种结果。在拉脱维亚的沙棘果园中生长的大多数品种是蒙古沙棘亚种 *H.rhamnoides ssp. mongolica*，海滨沙棘亚种 *H.rhamnoides ssp. rhamnoides* 和溪生沙棘 *H.rhamnoides ssp. fluviatilis* 的杂交品种。最重要的引种

bred varieties of the *H.rhamnoides ssp. mongolica*, *H.rhamnoides ssp. rhamnoides* and *H.rhamnoides ssp. fluviatilis*. The most important criterion of selection is tolerance to volatile weather conditions of the Baltic winters. There are four female varieties (Botanicheskaya Ljubitel'skaya, Prozrachnaya, Marija Brūvele, Tatjana), a hybrid from Archangelsk, provided by Natalia Demidova, and a male variety Lord grown in the commercial orchards of Latvia. All mentioned female varieties achieve the most required quality properties – the weight of fruit over 0,8g and soluble solids over 80 Brix.

选择标准是对波罗的海冬季多变天气条件的抗性能力。有四个来自莫斯科国立大学植物园雌株品种 (Botanicheskaya Ljubitel'skaya, Prozrachnaya, Marija Brūvele, Tatjana) 和一个来自俄罗斯 Archangelsk、由 Natalia Demidova 提供杂交品种。一个名为“大王” Lord 的雄株品种种植在拉脱维亚的商业化果园。所有上述的雌性品种都达到了最需要的品质特性—果实单果重量超过 0.8 克，可溶性固形物超过 80 Brix。

Seabuckthorn processing 沙棘加工情况

There are three main processors of sea buckthorn fruits in Latvia (Satori Alpha, Very Berry and Dienvidi Plus) with the gross output 100 tons of processed fruits with a total value of products 700 000 €. Their assortment of products include juice, mixed drinks, sweets and vine.

拉脱维亚有三家主要的沙棘水果加工商 (Satori Alpha, Very Berry 和 Dienvidi Plus)，总产量为 100 吨，产品总产值为 70 万欧元。产品种类包括沙棘果汁、沙棘混合饮料、糖果和果酒。

Research status of seabuckthorn 沙棘研究情况

There are no state institutions in Latvia doing solely the sea buckthorn research. Observations, trials and recommendations about growing and harvesting are performed by private enterprises. Development of processing is done by both scientific organizations and private companies. The research of sea buckthorn chemical content is managed mostly by scientific institutes, partly in accordance to specific commercial orders of private companies. Overall, the sea buckthorn research in Latvia in 2019 has been performed by 3 institutions involving 10 persons, incl. students, supervisors and technical staff.

拉脱维亚没有专门对沙棘进行研究的国家机构。关于种植和采收的观测、试验和建议是由私营企业进行的。产品研发加工由科研机构 and 私人公司共同完成。沙棘化学成分的研究主要由科研机构进行，部分工作以订单形式委托民营企业进行。总体而言，2019 年，拉脱维亚沙棘的研究由 3 个机构开展，涉及 10 人，包括学生、主管和技术人员。

最新沙棘研究是在拉脱维亚生命科学和技术大学 University of Life Sciences and Technologies (网

Recent research has been done in the Latvia University of Life sciences and Technologies, <https://www.ltu.lv/en>, Institute of Horticulture, <https://www.darzkopibasinstituts.lv/en/about-institute-of-horticulture> and Latvia

Sea buckthorn fruits, press remains and oil have been used for developing of new products within the bachelor and master thesis. There is a collaboration project between Institute of Horticulture and private enterprises about the preparing of technical documentation of the local sea buckthorn seed and pulp oil. In addition, the new research on the development of new sea buckthorn leaf extracts for the cosmetics industry has been started in the Institute of Horticulture.

The total personnel involved in sea buckthorn research, manufacturing, marketing planting, public management during 2019 in Latvia was about 250 persons. Most of the sea buckthorn commercial growers are members of the Latvian Fruit Growers Association, department of the sea buckthorn growing.

The year of 2019 was significant, as the sea buckthorn has reached the position of the third most grown fruit crop in Latvia. The sea buckthorn breeder and grower Andrejs Brūvelis has been announced as a Fruit Grower of The Year and awarded a medal of the state fruit growing branch.

址 <https://www.ltu.lv/en>）、拉脱维亚园艺研究所（网址 <https://www.darzkopibasinstituts.lv/en/about-institut-of-horticulture>）和拉脱维亚大学（网址 <https://www.ltu.lv/en/>）这三个机构开展的。

本科和硕士论文成果研究了沙棘果实、压榨残渣和沙棘油用于新产品的开发。拉脱维亚园艺研究所和私营企业之间有一项合作项目是关于编写当地沙棘种子油和果肉油的技术文件（注：技术标准）。此外，园艺研究所开展了用于化妆品工业的沙棘叶新提取物的开发新研究。

2019年,拉脱维亚参与沙棘的研究、生产、销售、种植、公共管理的总人数约为 250 人。大多数沙棘商业种植户都是拉脱维亚果农协会沙棘种植部的成员。

2019 年是重要的一年，沙棘已经成为拉脱维亚第三大水果作物。国际沙棘协会理事会成员、沙棘育种与种植专家 Andrejs Brūvelis 获得“拉脱维亚果农协会 2019 年度国家奖章”。



Research paper in Latvia, 2019 2019 年在拉脱维亚的研究论文

“Sea buckthorn extracts obtained by supercritical CO₂ extraction: Comparative analysis of different berry varieties”. Performed by the University of Latvia, financed by EU funds.

“Evaluation of precious compounds, incl. serotonin, in the by-products of sea buckthorn growing and processing”. Performed by the State Institute of Wood Chemistry, ordered and financed by Andrejs Brūvelis.

1. 《超临界 CO₂ 萃取法提取沙棘提取物：不同浆果品种的比较分析》。由拉脱维亚大学主持，由欧盟基金资助。

2. 《沙棘种植和加工副产物中包括血清素 serotonin 在内的珍贵化合物的评价》。由国家林木化学研究所主持，Andrejs Brūvelis 批准和资助。

6. Country Report of Pakistan



Country report for International Sea buckthorn Association By

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Seabuckthorn Research and Development in Pakistan in the Year of 2019

2019 年度巴基斯坦沙棘研究与开发报告

Distribution 沙棘资源分布

Sea buckthorn is distributed throughout Gilgit Baltistan & Chitral (GBC) with 5700 hectares of natural populations. In Pakistan, it is mostly found in Gilgit, Ghizar, Ganche, Astore, Skardu, shigar valley and Hunza with most of the locations consisting of patches of Sea buckthorn thickets away from residential areas, used and harvested to only a limited extent about (285 ha; ~5%). There is not a single Sea buckthorn orchard established on commercial scale in Pakistan. The naturally occurring populations are found on river belts, mountains and roadsides in Gilgit, Hunza, and Baltistan. There is only one subspecies of Sea buckthorn i.e Turkestanica reported in Pakistan. There was an introduction of Chinese genotype Sinensis in very small areas of Baltistan but it has no significant area and yield to report. However this variety has been established in Rawalakot, Azad Jammu and Kashmir on experimental stage. There is not an increase in Sea buckthorn cultivation area for the year 2019 in Pakistan.

在巴基斯坦，沙棘天然林分布 Gilgit Baltistan & Chitral (GBC) 地区，总面积 5700 公顷。通常分布在 Gilgit, Ghizar, Ganche, Astore, Skardu, Shigar, Hunza 的河谷地区，大多呈块状灌丛分布，因远离居民区，其采收利用的面积很有限，只有 5%（258 公顷）。目前，巴基斯坦还没有商业意义上的沙棘种植园。文献报道中唯一的天然沙棘林种群中亚沙棘亚种分布在 Gilgit, Hunza, and Baltistan 地区的河边、路边和山区。在 Baltistan 地区小面积引种过中国沙棘亚种（类型），但是，也没有沙棘产量和推广的有关报道，该植物材料在 Rawalakot, Azad Jammu and Kashmir（查谟与克什米尔）地区处于试验阶段。2019 年，巴基斯坦没有新增沙棘种植面积。



Fig-1 (a) and (b) Sea buckthorn is found in Gilgit Baltistan and main areas of Sea buckthorn populations in Gilgit Baltistan

图 1- (a)、(b)：沙棘种群在巴基斯坦 Gilgit Baltistan 的主要分布区



Berry Yield

沙棘果实产量

The annual production of fresh berries has been estimated 3000 tons for the year 2019. However, there are many wild forests of Sea buckthorn which are still unexplored and data has not been recorded from such wild populations established in distant areas of Karakorum Mountains. There was 800 tons harvested for the year 2019 from Northern Areas of Pakistan. The rest of plant populations are not harvested due to lesser market value, non availability of market, laborious harvesting methods, lack of training and storage of berries.

据估计，2019年巴基斯坦沙棘鲜果总产量约3000吨。但是，由于许多野生沙棘资源未被利用，该数据不包括地处喀喇昆仑山区的野山沙棘。2019年，在巴基斯坦北部地区，采收了800吨，其余的因为市场价格低、或远离市场、人工采收方法不当、缺乏技术培训和保鲜条件等原因，没有采收。



Fig: 2 (a) and (b) Sea buckthorn plant populations and fruit in Northern areas of Pakistan. (Shah, 2005).
图 2- (a)、(b): 在巴基斯坦北部地区的沙棘种群和果实 (Shah, 2005 年)



Genetic Resources

沙棘种质资源

Multiple studies have provided the evidence of significant genetic diversity among the Sea buckthorn plantations in Pakistan. This genetic diversity has been reported on the basis of morphological, biochemical and molecular level (Shah et al., 2007, 2009), (Nawaz et al., 2018).

基于其形态学、生物化学和分子水平的许多研究表明，巴基斯坦的沙棘种群具有重要的遗传资源多样性 (Shah et al., 2007, 2009), (Nawaz et al., 2018)。由于缺乏商业栽培沙

Since there is no commercial variety available and recorded information about the establishment of Sea buckthorn as crop in these areas, the genetic diversity has been sustained and conserved in these natural populations. It has been observed that genotypes vary in berry size, color, plant height, leaves shape and size etc. The biochemical contents in berries and leaves vary among the plant populations. The AFLPs study (Shah et al., 2009) revealed that geographic distance had least impact on genetic diversity of Sea buckthorn plant populations.

棘品种和建立沙棘作经济作物种植园的有关资料，这些沙棘遗传资源尚在自然状态之中。通过“扩增片段长度多样式”（AFLPs）研究 (Shah et al., 2009) 表明，地理因素对巴基斯坦的沙棘植物种群遗传资源多样性影响甚微。



Fig: 3 (a) and (b) *Turkestanica* berries from Skardu and plantation of UK Sea buckthorn in AJK (Pictures provided by Dr. Asad Hussain Shah)

图 3- (a)、(b)：Skardu 地区的中亚沙棘和在 AJK 地区人工种植来自英国的沙棘

However, the nutritional value increased or decreased with the variation of altitudes and areas. This biochemical diversity can be based on environmental factors. There is another Chinese species *Sinensis* with negligible plant populations in Skardu and Rawalakot, Azad Jammu and Kashmir. There are 300-500 plants at Rawalakot with moderate fruit set.

沙棘的营养成分随分布区的海拔变化而变化，其生物化学多样性因环境因素决定。在 Skardu, Rawalakot, Azad Jammu and Kashmir 地区种植一小块的中国沙棘（亚种），其中，在 Rawalakot 地区有 300-500 株，结实状况适中。



Fig: 4 (a) and (b)Subspecies *Sinences* being propagated through seeds and cuttings at Rawalakot (Asad Shah)

图 4-(a)、(b): 在 Rawalakot 地区中国沙棘（亚种）种子繁殖和扦插繁殖育苗

The Subspecies *Sinensis* was brought from China in late 1990s in a project run by Ministry of National Food Security and Research. The plant populations and nursery was developed at Muree Pataryata area of Northern Rawalpindi but unfortunately the plant populations could not be maintained. Sea buckthorn *Turkestanica* was transported from Skardu and 5000 plants were planted in Rawalakot and Baloch areas of AJK by University of Poonch and local NGO Sukhi Development Foundation. Unfortunately the plants did not survive. A small plant population of Sea buckthorn was established in Baloch Azad Jammu and Kashmir from UK's Sea buckthorn seeds by Department of Biotechnology, University of Kotli Azad Jammu and Kashmir. However this population was burnt in forest fire and there is not a single plant survived of this variety. It was observed that plant health and leaves were showing promising growth as compared to plants of *Turkestanica* in AJK.

中国沙棘（亚种）是 1990 年代通过巴基斯坦粮食安全与研究部实施项目引进的，当时的沙棘种群和苗圃建在 Rawalpindi 北部的 Muree Pataryata 地区。很遗憾的是，这些种群没有保存下来。中亚沙棘（亚种）移栽到了 Skardu 地区，其中 5000 株由 Poonch 大学和当地的非政府组织 Sukhi 发展基金会种植在 AJK 的 Rawalakot 和 Baloch 地区，很可惜，也没有存活下来。Kotli Azad Jammu and Kashmir 大学生物技术系在 Baloch Azad Jammu and Kashmir 建立了小规模来自英国的沙棘种群，可惜被一场森林大火烧得一株不留。根据在 AJK 地区的观察，与中亚沙棘（亚种）相比，中国沙棘（亚种）植株和叶片生长健康状况良好。



Fig:5 (a) and (b) Sea buckthorn sub species *sinensis* bearing fruit at Rawalakot. and collection of leaves from *Sinensis* plant population at Rawalakot for analysis. (Pictures courtesy of Dr. Asad Hussain Shah
图 -5 -(a)、(b): 中国沙棘亚种在 Rawalakot 地区结实情况和采集中国沙棘叶片做分析。



Breeding of Sea buckthorn in Pakistan 沙棘育种

There have been few proposals submitted to Pakistan Science Foundation and Higher Education Commission by Department of Biotechnology, University of Kotli Azad Jammu and Kashmir however the proposals have not been funded. The basic study to characterize the genotypes on the basis of morphological, nutritional and molecular markers has been made and germplasm for breeding local Sea buckthorn genotypes has been selected. This gene pool needs to be used for cultivar development soon.

It can be concluded that there is not a single project being carried out on Sea buckthorn breeding.

Kotli Azad Jammu and Kashmir 大学生物技术系曾经向巴基斯坦科学基金会和高等教育委员会申报过项目，但是没有获得经费资助。已经开展的基础研究包括基于形态学、营养学和分子标记的基因型特征，以及以选育当地沙棘品种为目标的种子资源。这一基因库需要很快应用于培育沙棘新品种。总之，巴基斯坦还没有开展沙棘育种项目。

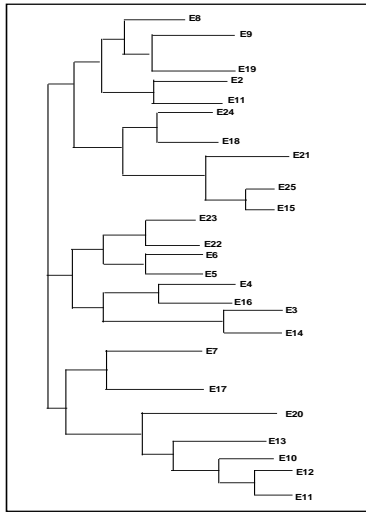


Fig: 6 (a) and (b) Dendrographic representation of Sea buckthorn Germplasm from Pakistan Using AFLP(Shah et al., 2009) and Sea buckthorn micropropagation in University of Kotli AJK.

图- 6-(a)、(b): 利用 AFLP 分析巴基斯坦沙棘种子资源的树状图及 Kotli AJK 大学开展的沙棘微繁殖。

五

Sea buckthorn Annual harvest and Market 沙棘年产量及市场

China is the leading producer and exporter; a total annual yield of about one hundred thousand t has been reported to lead to revenues of 1.43 billion US\$ (Ecue et al.,2011). Mongolia is the second leading producer with 13,500 ha (wild collection) and 6000 ha (cultivated) leading to an annual yield of between 1200–1600 t earning 5 million US\$ (Bartish et al., 1999,2000). In India, the species is only marginally utilized with 13,000 ha (wild collection) and a total annual yield of 600 t (Raun 2004). Pakistan in contrast harvests a comparatively low share on approximately 5700 ha harboring an estimated 12 million individuals. These populations are mainly concentrated in the northern region of Gilgit-Baltistan where most of this area consists of patches of sea buckthorn thickets away from residential areas, used and harvested to only a limited extent (about 285 ha; ~5%; (Rongsen Lu, 1992).The total berry production per anum is 2500 tons and annual harvest is 800-1000 ton. The annual business is estimated 80 million rupees

中国是沙棘生产与出口的领先国家，截止 2019 年，中国的沙棘果实年产量约 10 万吨，产值约 14.3 亿美元 (Ecue et al.,2011)。蒙古国紧随其后，由天然沙棘资源 13500 公顷和人工栽培 6000 公顷，年产沙棘果 1200–1600 吨，产值 500 万美元 (Bartish et al., 1999,2000)。在印度，13000 公顷天然沙棘资源只是少部分得到利用，年产沙棘果 600 吨 (Raun 2004)。相比在巴基斯坦，沙棘果实采收比例较低，大约总的资源面积 5700 公顷、1200 万株沙棘。这些资源主要集中分布在 Gilgit-Baltistan 北部地区，大多呈块状灌丛分布，因远离居民区，其采收利用面积只有 5% (285 公顷) (Rongsen Lu, 1992)。每年鲜果产量约 2500 吨，实际采收量 800–

or 0.5 million US dollars which is very less to its business potential. However due to awareness campaigns by local and international NGOs the export of dry berries has been increased from 500 tons to 750 tons in the year 2019. The reasons for this low use are manifold: First, the utilization as a food crop seems to be rather recent as it is unknown to the traditional local cuisine. Second, the thorny nature of the plants makes easy harvest within the stand thickets difficult. Third, alternating bearing behavior prevents a reliable annual yield; this may be partly related to the effects of harsh environmental conditions. Fourth, there are areas with a high share of male plants that do not bear fruits at all, though they are important reservoirs of genetic diversity. Fifth, fruit sale revenues are generally low due to the oligopoly of a few middlemen and for value added products due to low customer demand. Sixth, knowledge on suitable stand management as well as harvesting and post-harvesting practices are lacking on a broad scale, though some training units are offered by non-government organizations (NGOs) and extension services.

Apart from the limited use of berries in Gilgit-Baltistan, harvesting and handling techniques also differ significantly among villages. Sophisticated harvesting and handling techniques have been rather recently introduced and promoted by local NGOs, foremost the Agha Khan Rural Support Program (AKRSP). In conclusion the reported and expected annual production is approximately 2500 tons with only 800 tons are used for drying the berries for export and making products like jams, juices, pulp, restaurant cuisines etc on small scale. There are few local small enterprises named, Pak Sea buckthorn International, Hunza Organic, Pakistan Hunza Sea buckthorn Enterprises limited, Sea buckthorn berry Islamabad, Awan nutraceuticals, Munawwar Enterprises Lahore and few more with limited aspect of Sea buckthorn business.

1000 吨，年产值约 8000 万卢比（约合 50 万美元），远低于其潜在商业价值。得益于当地和国际非政府机构的大力宣传，2019 年沙棘干果出口由 500 吨增长为 750 吨。造成目前沙棘资源利用率的原因是多方面的，第一是由于对沙棘的传统食用价值认识不足，作为粮食作物应用只是近期的事。第二，沙棘刺多，进入沙棘块状林采果困难。第三，也许因为部分受恶劣生长环境影响，沙棘结果大小年现象造成年产量不稳定。第四，一些区域雄株所占比例过高，尽管雄株是沙棘遗传多样性的重要组成部分。第五，因市场需求不旺盛，一些中间商市场垄断导致沙棘果及附加值产品的销售收入普遍较低。第六，尽管一些非政府组织和推广服务机构提供有关培训，仍然缺乏实用的沙棘林管理知识，采收加工规模不大。

除了 Gilgit-Baltistan 地区沙棘果实的有限利用，在不同乡村的沙棘采收和处理方法也天差地别。最近，由“阿加汗乡村扶持计划”Agha Khan Rural Support Program (AKRSP) 等非政府机构引进和推广了沙棘采收和处理技术。总之，有报道和预计的巴基斯坦每年沙棘果实总产量大约为 2500 吨，只有 800 吨用于加工成干果出口，或小规模加工成果酱、果汁、果浆和餐饮食品等产品。以下是巴基斯坦的几家小规模沙棘企业：Pak Sea buckthorn International, Hunza Organic, Pakistan Hunza Sea buckthorn Enterprises limited, Sea buckthorn berry Islamabad, Awan nutraceuticals, Munawwar Enterprises Lahore 等。



Figure:7 Sea buckthorn plant population in Skardu
图 7: 生长在 Skardu 地区的沙棘



Figure 8. Different harvesting and drying methods and their effects on sea buckthorn berry quality during 2017–2018 in Gilgit-Baltistan, Pakistan. (a) Simple, non-standardized harvesting tools including a wooden stick and a plastic bag; (b) threshing of sea buckthorn berries from semi-dried branches cut prior and transported home; (c) spread of berries on the roof of a house; cloth between clay surface and berries reduces contamination by foreign particles; (d) spread of berries on concrete floor in an experimental green house; (e) physical quality reduction through browning and dust particles; (f) rancidness of sea buckthorn berries (black spots) due to improper storage. (Nawaz et al., 2020)

图 8：2017 - 2018 年在巴基斯坦 Gilgit-Baltistan 地区不同采收和干燥方法对沙棘果实质量的影响。(a) 简单、非标准化采收工具：木棍敲打加塑料袋包装；(b) 剪枝、运回家中后，从半干果枝脱粒；(c) 在水泥屋顶铺垫布，晾晒沙棘果实，减少外部杂物污染；(d) 在试验日光温室水泥地面晾晒沙棘果实；(e) 通过风吹除尘提高沙棘果实物理品质；(f) 因储存不当导致沙棘果实腐败（黑斑）。

六

Sea buckthorn Products in Pakistan

巴基斯坦生产的
沙棘产品介绍

Sea buckthorn in Pakistan has not been exploited to its potential in Pakistan. However few of the products being used in local and national market are as follows.

6-1. Sea buckthorn pure pulp: The pure pulp extracted by Pak Sea buckthorn International and Mountain Areas Farmers Organization in Gilgit Baltistan is sown in local and national market. This pulp is diluted in water and used as drink in Pakistan.

6-2. Sea buckthorn Seeds: Sea buckthorn seeds are dried and sold for extraction of oil in Pakistan.

6-3. Sea buckthorn Jam: The berry juice is used to make Sea buckthorn jam being used in local market and tourists also purchase the local products but still there is no utilization of Sea buckthorn Jam on national level in Pakistan.

6-4. Sea buckthorn Oil: The crude oil extracted from Sea buckthorn berries and seeds is packed and sold in local and national market.

6-5. Sea buckthorn Tea: This tea is made from Sea buckthorn leaves and sold in local market.

6-6. Sea buckthorn dried berries: Sun or air dried berries are exported from Pakistan. There were 20 containers of dried berries exported from Pakistan in the year 2019.

6-7. Sea buckthorn Juice Powder:

尽管巴基斯坦的沙棘资源优势尚未开发出来，还是生产了以下沙棘制品推向当地和全国市场。

6-1. 沙棘原浆: Pak 沙棘国际公司和 Gilgit Baltistan 山区农民组织开发，深受当地和全国市场欢迎。沙棘原浆兑水后作为饮料。

6-2. 沙棘种子: 干燥后售卖给沙棘油加工企业。

6-3. 沙棘果酱: 沙棘果加工成果汁、果酱在当地市场销售，或卖给游客。目前，还没有巴基斯坦全国范围的产品。

6-4. 沙棘油: 从沙棘种子和果实中初步提取的毛油，包装后在当地和巴基斯坦国内市场销售。

6-5. 沙棘茶: 沙棘叶制成沙棘茶后在当地销售。

6-6. 沙棘干果: 通过阳光或空气干燥的沙棘干果出口到其他国家。2019 年，巴基斯坦共出口 20 个标准集装箱的沙棘干果。

6-7. 沙棘果粉:



Figure: 9. Sea buckthorn products developed in Pakistan
图 9: 巴基斯坦开发的沙棘产品

7 Seabuckthorn Research in Pakistan 沙棘研究

7-1. Institutes working on Sea buckthorn:

There are no specific institutes for exclusive research on Sea buckthorn in Pakistan

7-1. 巴基斯坦从事沙棘研究的机构

目前, 巴基斯坦没有专门完全从事沙棘研究的机构。

7-2. Scientists working on Sea buckthorn in Pakistan.

7-2. 巴基斯坦从事沙棘研究的专家

7-2-1. Dr. Asad Hussain Shah, Associate Professor, Department of Biotechnology, University of Kotli Azad Jammu and Kashmir

7-2-1. Asad Hussain Shah 博士, Kotli Azad Jammu and Kashmir 大学生物技术系副教授

Dr. Asad Hussain Shah has been working on Sea buckthorn from last 17 years and earned his Ph.D on Sea buckthorn research with the title of “Genetic Characterization of Sea buckthorn (*Hippophae rhamnoides* ssp *turkestanica*) genotypes from Northern Areas of Pakistan in relation to valuable Biochemical Constitutes”

A- Publications: Dr. Shah has published more than 10 research papers on Sea buckthorn research on multiple areas of research ranging from genetic, biochemical, molecular, environmental and health aspects. The research has been based in following main areas.

A-1- Genetic Characterization of Sea buckthorn using Morphological, Biochemical and Molecular Markers

A-2- Nutritional Profiling of Sea buckthorn Genotypes from Pakistan.

A-3- Genetic improvement experimentation for New Sea buckthorn Cultivar in Pakistan and isolation of Vitamin C and Iron genes from Sea buckthorn for biofortification of Cereals.

A-4- Anti oxidants, anti-coagulant and anti-diabetic potential of Sea buckthorn pulp and leaves.

A-5- Effect of Sea buckthorn on brain disorders with collaboration in University of Karachi, Pakistan.

A-6- Optimizing and Developing Sea buckthorn Products in AJK.

A-7- Introduction of Germplasm from UK and China and broadening the genetic base to evolve cultivars.

A-8- Creating awareness using electronic and print media in masses and governmental organizations.

Asad Hussain Shah 博士从事沙棘研究 17 年，并以沙棘研究论文“巴基斯坦北部地区中亚沙棘遗传特性及基因型与其珍贵生物化学组分关系研究”（Genetic Characterization of Sea buckthorn (*Hippophae rhamnoides* ssp *turkestanica*) genotypes from Northern Areas of Pakistan in relation to valuable Biochemical Constitutes）获得博士学位。

A- 主要研究领域

Shah 博士已经发表了 10 多篇有关沙棘研究的论文，涉及遗传学、生物化学、分子学、环境与健康等，重点领域包括：

A-1- 利用形态学、生物化学和分子标记分析沙棘遗传特性。

A-2- 巴基斯坦沙棘基因类型的营养成分分析。

A-3- 巴基斯坦沙棘优良类型遗传改良试验和沙棘维生素、铁基因分离及强化谷物。

A-4- 沙棘果和沙棘叶的抗氧化、抗凝结、抗糖尿病潜力研究。

A-5- 与巴基斯坦卡拉奇大学合作研究沙棘对大脑疾病的效果。

A-6- AJK 地区沙棘产品研发与优化。

A-7- 从英国和中国引进沙棘种子资源，扩大遗传基础，培育沙棘新品种。

A-8- 通过政府组织和电子、纸质媒介大规模宣传沙棘知识。

A-9- Establishing Sea buckthorn in barren and steep slopes of Azad Jammu and Kashmir

A-9- 在 Azad Jammu and Kashmir 地区进行荒山沙棘造林。

A-10- Micro-propagation of Sea buckthorn for somacolonial variations in Sea buckthorn.

A-10- 利用沙棘体细胞群体变异进行沙棘微繁殖。

In addition, He has visited UK twice for developing collaborative research projects on Sea buckthorn and developed international linkages with University of Sussex, Aberystwyth University, TARRC UK and Dania Nationality Universities of China

B- 发表的部分论文

B- Few publications are mentioned below:

B-1- Biochemical and nutritional evaluations of sea buckthorn (*Hippophae rhamnoides* L. spp. *Turkestanica*) from different locations of Pakistan, *Pak. J. Bot* 39 (6), 2059-2065

B-1- 巴基斯坦不同分布区中亚沙棘的生物化学和营养学评价, *Pak. J. Bot* 39 (6), 2059-2065

B-2- Evaluation of phylogenetic relationship among Sea Buckthorn (*Hippophae rhamnoides* L spp. *turkestanica*) wild ecotypes from Pakistan using amplified fragment length polymorphism ...*Pak J Bot* 41 (5), 2419-2426

B-2- 应用扩增片段长度多态性 (AFLP) 方法对巴基斯坦中亚沙棘不同自然生态型的系统繁育相关性评价, *Pak J Bot* 41 (5), 2419-2426

B-3- Chemical and nutritional constituents of sea buckthorn (*Hippophae rhamnoides* ssp. *turkestanica*) berries from Pakistan, *Italian journal of food science* 17 (4), 455

B-3- 巴基斯坦中亚沙棘果实化学和营养成分分析, *Italian journal of food science* 17 (4), 455

B-4- Oral supplementation of Sea buckthorn (*Hippophae rhamnoides* L. spp. *Turkestanica*) fruit extract modifies haloperidol induced behavioral deficits and increases brain serotonin. *Journal of Food and Drug Analysis* 17 (4), 257-263

B-4- 口服中亚沙棘果实提取物减轻氟哌啶醇 (haloperidol) 诱发功能缺失、提高大脑血清素 (5-羟色胺 serotonin) 研究, *Journal of Food and Drug Analysis* 17 (4), 257-263

B-5- Determination of optimum harvesting time for Vitamin C, oil and mineral elements in berries sea buckthorn (*Hippophae rhamnoides*), *Pak J Bot* 42 (5), 3561-3568

B-5- 基于维生素 C、油和微量元素含量的沙棘果实采摘时间优化, *Pak J Bot* 42 (5), 3561-3568

B-6- Evaluation of antidepressant-like effects of aqueous extract of sea buckthorn (*Hippophae rhamnoides* L. spp. *turkestanica*) fruits in experimental models of depression, *Pak. J. Bot* 43 (3), 1595-1599

B-6- 中亚沙棘果实水溶性提取物抗抑郁效果实验模型研究, *Pak. J. Bot* 43 (3), 1595-1599

B-7- Possible anxiolytic profile of aqueous fruit extracts of a medicinal plant sea buckthorn (*Hippophae rhamnoides* L. spp. *Turkestanica*) in experimental models ,F Batool, AH Shah, SD Ahmed, ZS Saify, DJ Haleem, Pakistan Journal of Botany 41 (6), 2791-2800

B-8- Protective effects of aqueous fruit extract from Sea Buckthorn (*Hippophae rhamnoides* L. spp. *Turkestanica*) on haloperidol-induced orofacial dyskinesia and neuronal alterations ..., F Batool, AH Shah, SD Ahmed, ZS Saify, DJ Haleem, Medical Science Monitor 16 (8), BR285-BR292

B-9- Molecular cloning and transcript profiling of ascorbate oxidase gene at different growth development stages from therapeutically important plant Sea buckthorn *Hippophae rhamnoides*, Pak. J. Bot 49 (3), 1143-1154

7.2-2. Dr. Syed Dilnawaz Ahmed Gardezi: Professor and Vice Chancellor, University of Kotli Azad Jammu and Kashmir.

Dr. Gardezi initiated the research on Sea buckthorn in Azad Jammu and Kashmir and brought Chinese variety *Sinensis* to establish at Rawalakot which are growing successfully. Dr. Gardezi has been working professor emeritus in University of Poonch Rawalakot AJK. He has published quite a few papers and had also completed one research project of Sea buckthorn improvement in Pakistan.

7-2-3. Dr. Farhat Batool: Professor Biochemistry: Department of Biochemistry, University of Karachi Pakistan.

Being involved in neuro science research Dr. Farhat Batool has been involved in using Sea buckthorn against neurological degradation and diseases. She has published more than 5 research papers on Sea buckthorn and has used Sea buckthorn pulp and oil successfully to mediate the brain disorders.

B-7- 中亚沙棘果实水溶性提取物的抗焦虑实验模型研究, Pakistan Journal of Botany 41 (6), 2791-2800

B-8- 中亚沙棘果实水溶性提取物对氟哌啶醇 (haloperidol) 诱发运动障碍和神经元改变 (orofacial dyskinesia and neuronal alterations) 的保护作用研究, Medical Science Monitor 16 (8), BR285-BR292

B-9- 沙棘植物不同生长发育阶段抗坏血酸氧化酶 (ascorbate oxidase) 的基因分子克隆和转录分析, Pak. J. Bot 49 (3), 1143-1154

7-2-2. Syed Dilnawaz Ahmed Gardezi 博士, Kotli Azad Jammu and Kashmir 大学副校长、教授

Syed Dilnawaz Ahmed Gardezi 博士 开创了 Azad Jammu and Kashmir 的沙棘研究, 并把中国沙棘亚种成功引种到巴基斯坦 Rawalakot 地区。Dr. Gardezi 博士曾是 Poonch Rawalakot AJK 大学终身教授, 他发表了一系列沙棘研究论文, 并主持完成了一项有关沙棘改良的研究项目。

7-2-3. Farhat Batool 博士, 巴基斯坦卡拉奇大学生物化学系教授

Farhat Batool 博士长期从事神经科学研究, 并应用沙棘治疗神经功能退化疾病。她发表了 5 篇以上沙棘研究论文, 并成功运用沙棘果肉和沙棘油缓解大脑疾病。

7-2-4. Dr. Syed Mubasher Sabir: Associate Professor, University of Poonch Rawalakot Azad Jammu and Kashmir.

Dr. Syed Mubasher Sabir has been engaged in analyzing Sea buckthorn biochemical profiling and nutritional analysis and has published multiple papers on Sea buckthorn.

7-2-5. Dr. Alam Zeb, University of Malakand Chakdara, Pakistan

Mr. Alam Zeb is working on Biochemical diversity of Pakistani Sea buckthorn.

7-2-6. Dr. Arsalan Nawaz, has worked on Diversity of Sea buckthorn from Northern Pakistan. Though working in University of Kassel in Germany but he has published his research on Pakistani Sea buckthorn.

In addition to the above mentioned scientist, there are quite a few scientists who have published their work on Sea buckthorn in Pakistan but Dr. Asad Hussain Shah from Department of Biotechnology, University of Kotli Azad Jammu and Kashmir and Dr. Farhat Batool, from Department of Biochemistry, University of Karachi are engaged in Research and Development on Sea buckthorn in Pakistan.

7-3. Pakistan Council for Scientific and Industrial Research (PCSIR) is a governmental organization involved in pulp and oil extraction at Sakardu but it has to build more capacity and develop diverse range of marketable products. There are few NGOs involved in trainings of Sea buckthorn cultivation and harvesting in Northern Pakistan.

7-4. Agha Khan Rural Support (AKRSP) has helped the residents of Northern Areas of Pakistan a great deal for establishing Sea buckthorn as enterprises.

7-5. Pak Sea buckthorn International has played an important role for developing products from Sea

7-2-4. Syed Mubasher Sabir 博 士 : Poonch Rawalakot Azad Jammu and Kashmir 大学副教授

Syed Mubasher Sabir 博士曾经从事沙棘生化成分、营养成分分析，并发表了多篇沙棘研究论文

7-2-5. Alam Zeb 博 士 ， 巴 基 斯 坦 Malakand Chakdara

Alam Zeb 博士曾经从事分布在巴基斯坦的沙棘生物化学多样性研究。

7-2-6. Arsalan Nawaz 博 士 ， 从 事 巴 基 斯 坦 北 部 沙 棘 的 多 样 性 研 究 。 尽 管 他 身 处 德 国 Kassel 大 学 工 作 ， 他 仍 然 发 表 了 有 关 巴 基 斯 坦 沙 棘 研 究 的 论 文 。

除了上述沙棘研究人员，还有其他一些专家发表了沙棘研究论文。目前只有 Kotli Azad Jammu and Kashmir 大 学 生 物 技 术 系 的 Asad Hussain Shah 博 士 和 卡 拉 奇 大 学 生 物 化 学 系 的 Farhat Batool 博 士 仍 然 在 巴 基 斯 坦 从 事 沙 棘 研 究 和 开 发 。

7-3. 巴 基 斯 坦 科 学 与 工 业 研 究 理 事 会 ： 是 一 个 从 事 Sakardu 地 区 沙 棘 果 肉 、 沙 棘 油 提 取 的 政 府 机 构 ， ， 不 足 是 应 该 扩 大 产 能 ， 开 发 一 系 列 适 销 对 路 的 沙 棘 产 品 。 还 有 一 些 非 政 府 组 织 从 事 巴 基 斯 坦 北 部 地 区 沙 棘 种 植 和 采 收 技 术 培 训 。

7-4. 阿 加 汗 农 村 帮 扶 组 织 (AKRSP) ： 已 经 极 大 帮 助 巴 基 斯 坦 北 部 地 区 居 民 建 立 沙 棘 加 工 企 业 。

buckthorn in Northern Pakistan. Mr. Ghulam Nabi Shigri the chairman of this company has the credit to establish the market of Sea buckthorn products in local areas and also exporting the dry berries from Pakistan.

7-6. Hunza Organics: A company in Hunza is exporting the dry berries of Sea buckthorn from Northern Pakistan and also making local products for national market.

7-7. Munawar Industries Enterprises Lahore is exporting the dry berries of Sea buckthorn from Pakistan from more than 10 years. There is an increased market of export for the year 2019. Due to Covid-19 pandemic the export has been reduced significantly in recent months.

7-5. Pak 国际沙棘公司：在巴基斯坦北部地区沙棘产品开发中发挥了重要作用。Ghulam Nabi Shigri 先生作为该公司董事长，在当地沙棘产品销售和沙棘干果出口到国外建立了良好声誉。

7-6. Hunza 有机食品公司：作为设在 Hunza 地区的企业，把沙棘干果从巴基斯坦北部地区出口到国外，在加工的沙棘产品销往全国。

7-7. 拉合尔 Munawa 实业公司：从事巴基斯坦沙棘干果出口业务 10 多年，2019 年出口市场规模有所增长。但由于新冠肺炎疫情影响，近期出口规模大幅减少。

八

Policy making for seabuckthorn 相关政策

There is no policy document or live project from Pakistani Government for establishment and processing of Sea buckthorn in Pakistan.

目前，没有巴基斯坦政府专门制定有关沙棘的政策，没有正在运行的由巴基斯坦政府资助建立的沙棘加工企业。

九

Conclusion 结论

Sea buckthorn is an important multipurpose plant in Pakistan with 5700 hectares of wild populations distributed in Northern Pakistan. Unfortunately the plant has been under utilized in Pakistan due to less awareness, poor planning and policy from government, non availability of improved cultivars, lack of research on Sea buckthorn breeding, poor harvesting practices, lack of training for processing and limited people and organizations involved in Research and Development in Pakistan. Following are the proposals for developing Sea buckthorn industry in Pakistan.

在巴基斯坦，沙棘是一种重要的多功能植物，有天然沙棘资源面积 5700 公顷，分布在巴基斯坦北部地区。很可惜的是，由于知名度不高、规划和政府优惠政策能力弱、缺乏优良品种、没有育种研究、采收技术落后、技工技术培训短缺，以及参与研究开发的人员有限等原因，沙棘在巴基斯坦没有得到有效利用。以下是针对巴基斯坦沙棘产业发展的设想。

9-1. Awareness about Sea buckthorn's importance for human health, nutrition, industry and environment in higher altitudes of Pakistan through electronic, print/social media, Universities, Schools and colleges.

9-2. Developing Sea buckthorn genotypes from selected germplasm from Pakistan. The plants with larger berry size should be crossed and hybrids should be evolved for improving yield per plant.

9-3. Maintaining the male and female plants ratio in balanced numbers to allow female plants to flourish more and using male plants only as pollinators and lesser in number.

9-4. Developing modern tools to harvest Sea buckthorn plants to allow more harvest and reduce the labor cost.

9-5. Developing Sea buckthorn fruit processing units in Northern Pakistan to develop diverse range of export quality products.

9-6. More oil expeller units should be installed in Pakistan to utilize the oil for export and market in country.

9-7. Involving beverages and food industries of Pakistan to make products from Sea buckthorn.

9-8. Cosmetic industry should bring in the business of Sea buckthorn products in cosmetics.

9-9. Air drying facilities can help to process the berries on scientific manner and more marketable berries can be exported or processed.

9-10. Government should provide funds to scientists working on Sea buckthorn breeding and genetic improvement and efforts should be made to establish Sea buckthorn in Azad Jammu and Kashmir to sustain the soil conservation and boost the economy on sustainable basis.

9-1. 通过纸质、电子文档和社会媒体、中小学、大学，向巴基斯坦政府高层宣传普及有关沙棘对人体营养健康、产业开发和环境保护的重大意义。

9-2. 从巴基斯坦沙棘种质资源圃选择优良基因类型，通过杂交育种培育具有果实大品种，提高果实产量。

9-3. 控制沙棘雌雄株比例，减少雄株比例以维持授粉需求，增加雌株开花结实。

9-4. 开发现代化沙棘果实采收设备，增加采收率，减少劳力支出。

9-5. 开发适于巴基斯坦北部地区沙棘果实加工的设备，加工满足出口质量标准的沙棘系列产品。

9-6. 在巴基斯坦增加沙棘油提取设备，生产更多用于出口和国内市场的沙棘油。

9-7. 吸引投资在巴基斯坦建立沙棘食品、饮料等产品加工企业。

9-8. 引进化妆品企业投资生产沙棘化妆品

9-9. 改进空气干燥设备，促进沙棘果实科学处理，以便适应沙棘干果出口和再加工的市场需求。

9-10. 政府应向从事沙棘育种与遗传改良的科学家提供资助，更加支持 Azad Jammu and Kashmir 地区的沙棘种植，促进当地水土保持和经济可持续发展。



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7. Country Report of Russia



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Country Report of Seabuckthorn Development in the Year of 2019 in RUSSIA

2019 年俄罗斯沙棘发展报告

The national-wide seabuckthorn resources of plantations and berry yield.
全国沙棘人工林资源丰富，浆果产量大

1.1. The total area of seabuckthorn resources up to the year of 2019 including the natural stands and the artificial plantations, and the increased areas in the year of 2019.

Preliminary estimation as follow:

—Industrial SBT plantations – 2500-3000 hectares.

—Wild SBT orchards – no available information.

As regards increasing of industrial sbt plantation it is necessary to note that actually nothing rising up significantly, despite of establishing of 400-500 hectares of new plantations annually. About the same amount of plantations are becomes old and removed from the orchards.

1.2. The harvested and the estimated qualities of total production of seabuckthorn berries in your country in the year of 2019.

Total amount of berries from industrial plantations is 2500-3000 t. It means that average productivity is 1 t/ha. The low productivity explained by the age of plantation... many of them are old, some of them are too young. Mean productivity of conventional industrial plantation in proper age is 5-6 t/ha.

Total amount of berries from wild SBT is 2500-3000 t.

1. 截止 2019 年沙棘资源的总面积，包括天然林分和人工人工林，以及 2019 年增加的面积。初步估算如下：

– 工业化沙棘种植 –2500–3000 公顷。

– 野生沙棘林 – 无资料

关于工业化沙棘种植的增加，需要注意的是，尽管每年新建 400–500 公顷的种植面积，但实际上并没有显著增加。大约同样数量的种植园沙棘树体老化，从果园中清除。

2. 全俄罗斯 2019 年沙棘浆果的收获量和总产量的估计

工业种植的浆果总量为 2500–3000 吨，平均产量为 1 吨 / 公顷。低生产力的原因是种植园树体年龄...它们中的很多老了,有些太年轻了。常规工业种植在适宜年龄时的平均产量为 5–6 吨 / 公顷。

野生沙棘果实总含量为 2500–3000 吨。

1.3. A brief introduction of main seabuckthorn enterprises and plantations

Company / Direction	Volumes of production / processing, t/year	Contacts
Lisavenko Research Institute of Horticulture for Siberia / Berries production	70–100 / 0	Kanarskiy Alexandr niiisavenko@yandex.ru +7 906 949 1304
Agrofirma “Cvety Altaya” / Berries production	70–100 / 0	Kenig Eduard cvetialtaya@mail.ru +7 903 992 97 78
Peasant Farm “Prishvin Vladimir Nikolaevich” / Berries production	20–30 / 0	Prishvin Vladimir +7 903 949 1583
“Sibirskoye” JSC / Berries production, berries processing to oil	700–1000 / 700–1000	Pipunrov Sergey +8 903 990 0112
“Sadovod Altaya” LLC / Berries production	50 / 0	Sobakin Oleg olegsobakin@yandex.ru +7 905 980 4573
“Alsu” LLC / Berries processing to oil, juice, powder	0 / 500	Surkov Alexandr surkovalex67@gmail.com +7 961 982 0858
“Yagodnoye” LLC / Berries production, berries processing to oil	400–600 / 800	Zotov Nikolay n-zotov@mail.ru +7 923 720 3914
Peasant Farm “Artemyev Dmitry Mikhailovich” / Berries production	300 / 0	Artemyev Dmitry +7 963 532 5065
“Altayvitaminy” JSC / Pharmaceutical direction	0 / ?	Koshelev Yury http://www.altayvitamin.ru/contact/
Peasant Farm “Zhdanov Sergey Vladimirovich” / Berries production	100 / 0	Zhdanov Sergey
“Altai-Zanddorn” LLC / Berries processing to oil, juice, powder	0 / 70–100	Baklanova Tatyana +7 913 099 4485
“Altayskiy Buket” LLC / Berries production, berries processing to oil, juice, bioadditives	30 / 100	Mukhortov Sergey +7 962 819 0507
“Yantarnoye” LLC / Berries production	30 / 0	Kaluzhnaya Elena 8–906–941–27–77
“Sava” LLC / Berries processing to oil, juice etc (Tomsk city)	0 / 1500	Nikitin Andrey +7 3822 609 725 add. 202 sava@tpksava.ru
“Sady Baraby” LLC / Berries production (Novosibirsk region)	40–50 / 0	Nevolina Nadezhda 8 (913) 722–11–13
“Sady Sibiry” LLC / Berries production (Novosibirsk region)	15–20 / 0	Lutov Vladimir 8 (913) 908–92–65
“Sadi Elizavety” LLC / Berries production (Uljanovsk region)	3 hectares of new plantations in 2019	Puzrakov Ilya +7 951 098 1001
Peasant Farm “Kuznetsov Igor Alexandrovich” / Berries production	10 hectares of new plantations in 2019	Kuznetsov Igor +7 905 980 83 86
“Stolypino” LLC / Berries production (Bashkiriya region)	10 hectares of new plantations in 2019	Radmir +7 927 311 4157
“Vetluga” LLC / Berries production (Nizniy Novgorod Region)	12 hectares of new plantations in 2019	Schavlev Sergey +7 (831) 281–98–02
Peasant Farm “Stakanovskiy Dmitry Nikolaevich” / Berries production	10 hectares of new plantations in 2019	Stakanovskiy Dmitry

3. 俄罗斯主要沙棘企业和种植概况 (表)

公司名称 / 主营方向	果实产量 / 加工量 (t/年)	联系人
西伯利亚 Lisavenko 园艺研究所 / 生产鲜果	70-100 / 0	Kanarskiy Alexandr niilisavenko@yandex.ru +7 906 949 1304
Agrofirma “Cvety Altaya” / 生产鲜果	70-100 / 0	Kenig Eduard cvetialtaya@mail.ru +7 903 992 97 78
农民农场 “Prishvin Vladimir Nikolaevich” / 生产鲜果	20-30 / 0	Prishvin Vladimir +7 903 949 1583
“Sibirskoye JSC / 生产鲜果 / 从浆果加工油	700-1000 / 700-1000	Pipunyrov Sergey +8 903 990 0112
“Sadovod Altaya” 有限公司 / 生产鲜果	50 / 0	Sobakin Oleg olegsobakin@yandex.ru +7 905 980 4573
“Alsu” 有限责任公司 / 浆果加工成油、汁、粉	0 / 500	Surkov Alexandr surkovalex67@gmail.com +7 961 982 0858
“Yagodnoye” 有限责任公司 / 生产鲜果、浆果加工至油	400-600 / 800	Zotov Nikolay n-zotov@mail.ru +7 923 720 3914
农场 “Artemyev Dmitry Mikhailovich” / 生产鲜果	300 / 0	Artemyev Dmitry +7 963 532 5065
“Altayvitaminy JSC / 制药方向	0 / ?	Koshelev Yury http://www.altayvitamin.ru/ contact/
农民农场 “Zhdanov Sergey Vladimirovich” / 生产鲜果	100 / 0	Zhdanov Sergey
“Altai-Zandorn” LLC / 浆果加工油、汁、粉	0 / 70-100	Baklanova Tatyana +7 913 099 4485
“Altayskiy Buket” 有限责任公司 / 生产鲜果, 浆果加工到油、果汁、生物添加剂	30 / 100	Mukhortov Sergey +7 962 819 0507
“Yantarnoye” LLC / 生产鲜果	30 / 0	Kaluzhnaya Elena 8-906-941-27-77
“萨瓦” 有限责任公司 / 浆果加工到油、果汁等 (托木斯克市)	0 / 1500	Nikitin Andrey +7 3822 609 725 add. 202 sava@tpksava.ru
“Sady Baraby” LLC / 生产鲜果 (新西伯利亚地区)	40-50 / 0	Nevolina Nadezhda 8 (913) 722-11-13
“Sady Sibiry” LLC / 生产鲜果 (新西伯利亚地区)	15-20 / 0	Lutov Vladimir 8 (913) 908-92-65
“Sadi Elizavety” 有限责任公司 / 生产鲜果 (乌尔扬诺夫斯克地区)	2019 年新增 3 公顷种植园	Puzrakov Ilya +7 951 098 1001
农民农场 “库兹涅佐夫伊戈尔亚历山德罗维奇” / 生产鲜果	2019 年新增 10 公顷种植园	Kuznetsov Igor +7 905 980 83 86
“Stolypino” LLC / 生产鲜果 (Bashkiria 地区)	2019 年新建 10 公顷种植园	Radmir +7 927 311 4157
“Vetluga” LLC / 生产鲜果 (下诺夫哥罗德地区)	2019 年 12 公顷新种植园	Schavlev Sergey +7 (831) 281-98-02
农民农场 “Stakanovskiy Dmitry Nikolaevich” / 生产鲜果	2019 年新增 10 公顷种植园	Stakanovskiy Dmitry

In the year of 2019, The number of seabuckthorn enterprises, the gross output and the total value of seabuckthorn products in your country. 关于沙棘种质资源和新品种培育

2.1 Introduction of genetic resources including natural seabuckthorn species and subspecies of Hippophae.

Hippophae rhamnoides ssp. mongolica mainly.

2.2. Names of newly bred seabuckthorn varieties and introduced cultivars from other countries and their performance including morphological/ biochemical features.

In 2019 new sbt variety Anastasia has been transferred to State Varieties Test Station. It distinguished for high hand picking efficiency combined with valuable biochemical composition and total productivity.

1. 天然沙棘种、沙棘亚种等遗传资源的介绍。
主要分布蒙古沙棘亚种

Hippophae rhamnoides ssp. mongolica。

2. 国外引进的沙棘新品种和品种名称及其性状表现（包括形态生化特征）。

2019 年，沙棘新品种阿纳斯塔西娅 Anastasia 转入国家品种试验站。它具有高的手工采摘效率和珍贵的生化成分、产量高等特点。

About seabuckthorn germplasm resources and breeding of new varieties
2019 年有关沙棘企业数量、沙棘产品、总产值、产值

3.1. In the year of 2019, The number of seabuckthorn enterprises, the gross output and the total value of seabuckthorn products in your country.

Refer to chapter 1.3.

3.2. A brief introduction of main enterprises and their main products of seabuckthorn.

Most of them are indicated at chapter 1.3.

请参阅第一部分。





4.1 The status of seabuckthorn scientific institution in your country in terms of the number of institutes and their scientists, and their research field.

Refer to chapter 4.2

4.2. A brief introduction of main research institutes/universities and enterprisers. The main research programs and updated achievements on seabuckthorn.

4.2.1. The Lisavenko Research Institute of Horticulture for Siberia – main Institution involve in sbt research in Russia. Field of interests: Selection and genetics, Propagation technologies, Cultivation technologies, Pest and disease control, Processing technologies, Biochemistry analyses.

4.2.2. Institute of Cytology and Genetics. Field of interest – Cultivation Technologies, focused on leaves productivity.

4.2.3. Biysk Technological Institute. Field of Interest – processing technologies.

4.2.4. Nizhnyi Novgorod Agricultural Academy – Selection.

4.2.5. Northern Research Institute of Forestry – Introduction.

4.2.6. Botanical Garden of Moscow University - Selection

4.2.7. East Siberia State University of Technology and Management – Processing technologies.

As regards Enterprisers refer to chapter 1.3

全国沙棘科研机构的数量、科研人员、研究领域的现状，主要研究机构/大学和企业简介。

1. 西伯利亚利沙文科园艺研究所 The Lisavenko Research Institute of Horticulture for Siberia。俄罗斯参与沙棘研究的主要机构。研究领域：沙棘选育与遗传学、繁殖技术、栽培技术、病虫害防治、加工技术、生物化学分析。

2. 俄罗斯细胞学和遗传学研究所 Institute of Cytology and Genetics。研究领域：栽培技术，专注于沙棘叶生产。

3. 比斯克 Biysk 技术研究所 Biysk Technological Institute。主要领域：沙棘加工技术。

4. 下诺夫哥罗德农业科学院 Nizhnyi Novgorod Agricultural Academy。主要领域沙棘选育。

5. 北方林业研究所 Northern Research Institute of Forestry。主要领域：沙棘引种试验研究。

6. 莫斯科大学植物园 Botanical Garden of Moscow University：主要领域：沙棘选育。

7. 东西伯利亚国立科技与管理大学 East Siberia State University of Technology and Management。主要领域：加工技术。

五

About seabuckthorn practitioners 关于沙棘从业人员

5.1. The total personnel involved in seabuckthorn research, manufacturing, marketing planting, public management, etc. in your country

Researchers – up to ten.
Industry – around 50-60.

5.2. The members of National Seabuckthorn Association if provided, including institutional and individual members.

There is no Russian Seabuckthorn Association.

5.3. A brief introduction of successful institutional members of seabuckthorn Association if provided.

Yury Zubarev - <https://www.oblepiha22.ru/zubarev-eng.html>

Natalia Demidova – <http://sevniilh-arh.ru/lab/Sotrudniki/demidova.php>

1. 全国从事沙棘研究、生产、销售、种植、公共管理等的人员总数。

科学研究人员：多达 10 人。
工业加工：大约 50 – 60 人。

2. 国家沙棘协会会员（如有），包括机构成员和个人成员。

俄罗斯没有全国沙棘协会。

3. 简要介绍沙棘协会知名成员。

Yury Zubarev – <https://www.oblepiha22.ru/zubarev-eng.html>

Natalia Demidova – <http://sevniilh-arh.ru/lab/Sotrudniki/demidova.php>

