青藏高原生物资源持续利用学科团组

1、研究内容

围绕特色生物资源的持续利用，开展资源品质的多因素综合评价，探索工程化资源繁育技术体系，解决资源开发利用中的关键技术，力争在资源地道性评价模式、资源规模化生产、浆果类资源综合高效利用技术模式等方面有所突破。

2、研究目标

成为具有国际影响力的知名团队，建立原始创新技术1-2项，研发新产品1-2个，在高原特色生物资源评价技术与持续利用等方面发挥重要的创新、引领与科技支撑作用。

3、学科团组内学科组名称

生物资源与环境生态研究

青藏资源植物生理生化研究

青藏高原生态经济植物资源研究与开发

藏药新药研究与开发

资源植物遗传与繁育技术

青藏高原特色植物化学成分研究

青藏高原药用植物资源与植被恢复

药材GAP生产与质量标准研究

4、研究进展

品质特征评价：开展了多种资源种类（如锁阳、五脉绿绒蒿等）品质特征分析及评价工作，对评价方法进行了有效地尝试性探索研究。

资源繁育与示范基地建设：建立规范化栽培示范基地11处（计2700余亩），育成新品种“青微2号”1个，制定国家标准1项，开展7个药材资源的生态抚育工作。

资源开发利用关键技术：开发了多种新型衍生试剂，引进、改良、创建了多种特色资源中的活性成分检测技术，有效地提升了检测能力。制备了多种标准物质，填补了部分标准物质缺乏的空白。

新产品研发：研发新产品1项（昆仑1号），降压复方藏药研发取得新进展。

产业化推进：以成果的形式推进产业化进程，获得青海省科技进步一等奖两项。

生物资源与环境生态研究学科组

学科组长:彭敏
邮箱:pengm@nwipb.cas.cn

学科组长：彭敏，研究员，中国科学院大学教授，博士生导师。1982年毕业于兰州大学。现任中国科学院西北高原生物研究所特色生物资源研究中心主任，任中国自然资源学会理事、青海省第九届药学会副理事长、中国药学会中药和天然药物专业委员会委员等学术兼职。长期从事资源生态学及环境生态学方面的研究。近年来通过对藏药材资源调查及部分药材资源种类分布、储量以及品质等方面的调查研究，提出了系列的资源保护利用对策体系，为青藏高原特色资源种类的可持续利用提供了重要的科学依据，并在藏药发展战略方面提出了较为系统的观点和看法，得到众多同行专家的认同；通过对我国青藏高原及整个西北地区和西南地区植被的多年考察，对考察涉及区域植被分布规律及演替方向有深刻了解，其研究工作为青藏高原生态保护建设、高原特色生物资源保护与可持续利用等提供了重要的科学依据和理论基础。先后主持与承担了多项国家及省部级科研项目，目前承担国家科技支撑计划课题和青海省重点实验室建设等项目。

学科组主要研究方向

主要开展资源生态学及环境生态学方面的研究。资源生态学方面以青藏高原特色中藏药材资源为研究对象，重点开展药用植物资源与生态环境的关系、道地药材形成的机理及其品质综合评价等方面的研究工作；环境生态学方面主要研究青藏高原植被的群落特征及其演替规律，以及气候变化、鼠害和放牧管理模式角度探讨高寒草甸生态系统退化机理和恢复技术的研究等。

2013年代表性研究成果

1.出版专著《三江源地区生态补偿机制研究》

三江源区属于我国境内长江、黄河、澜沧江等重要河流的源头地区，以其丰富的水源供给滋养着中下游的广袤地区，素有“中华水塔”之称。由于其重要的地理区位与环境特点，三江源区承载着保护与调蓄水源、涵养水源、保持水土和防风固沙等极为重要的生态功能，生态战略地位十分重要，具有“生态源”的重要地位，甚至被称为“生命源”。

为深入开展青海省三江源区生态补偿问题的系统研究，在青海省科技厅的委托与资助下，中国科学院西北高原生物研究所、中国环境科学研究院、青海省环境科学研究院、青海省生态环境遥感监测中心的部分科技人员，联合开展实施了《三江源区生态补偿机制研究》的科技攻关项目。通过数年努力，取得一些进展和具有一定价值的研究结果。本书的出版将吸引更多国人与有识之士踊跃参与对三江源区生态环境保护与建设、科学构建三江源区生态补偿机制等重大科学问题的深入思考与讨论，以期能为三江源区的生态环境保护与建设、维护我国的整体生态安全等贡献微薄之力。

2.出版专著《青海常见野生植物识别手册》

青海省地处青藏高原，区域内高山纵横，湖泊星罗棋布，造就了丰富而独特的高原植物类群。可以说，青藏高原是我国生物多样性较为丰富的地区之一，也是世界上生物多样性保护的关键和研究热点地区之一。据有关资料记载，青海分布有野生植物近3000种（含种以下等级）。

《青海常见野生植物识别手册》裸子植物门按照郑万钧系统（1977年）排列，被子植物按照恩格勒（Engler）系统1936年）排列，科内的属和种按植物学名拉丁字母顺序排列。本书图文并茂地详实记录了65科370种（含种以下等级）常见野生植物，含其中文名、拉丁学名、别名、形态特征、分布生境，具有科普性和实用性。该书的出版对野生植物的引种、扩繁、科研和教学等方面的工作具有重要参考价值，将对野生植物的保护和利用起到重要指导作用。

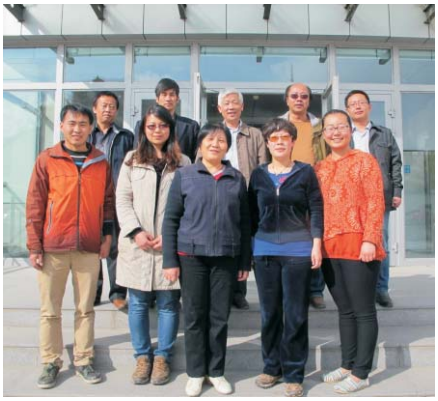
论文（部分）

[1] Jianzhong ZHAO, Wei LIU, Rongrun YE, Xuefeng LU, Yubi ZHOU, Yueqin YANG, Min PENG*, 2013. Responses of Reproduction and Important Value of Dominant Plant Species in Different Plant Functional Type in Kobresia Meadow to Temperature Increase. Russian Journal of Ecology. 44(6): 484-491.

[2] Demei LIU*, Guichen CHEN, Zhongping LAI, Haicheng WEI, Guoying ZHOU and Min PENG, 2013. Late Glacial and Holocene Vegetation and Climate History of an Alpine Wet Land on the Qinghai–Tibetan Plateau. Geological Quarterly, 57 (2): 261–268.

[3] Aide Sun, Qingcai Xu, Shujian Xu, Xuehui Shangguan, Hongyuan Shen, and Jing Sun*, 2013. Determination of Boron Using Headspace Liquid Phase Micro-Sublimation Coupled with Inductively Coupled Plasma Optical Emission Spectrometry. Analytical Letters, 46: 2610–2619.

Biologic Resource and Environment Ecology Research Group



学科组成员

卢学峰(副研究员)　叶润蓉(副研究员)
刘伟(副研究员)　孙菁(副研究员)
周玉碧(副研究员)　彭立新(六级职员)

博士研究生

孙胜男

硕士研究生

舍莉萍　赵庆师　邓腾

Group Leader: Min Peng, Research fellow, Professor of Graduate University of Chinese Academy of Sciences and Doctoral Tutor. In 1982, he had graduated from Lanzhou University of the Biology Department, and was assigned to Northwest Institute of Plateau Biology in the same year. Now he was appointed as the Director of Research Center of Tibetan Medicine of NWIPB of CAS, Director of China Society of Natural Resources, Associate Director of the ninth Qinghai Pharmaceutical Association, Commissioner of Committee of Traditional Chinese Medicine & Natural Medicine, Chinese Pharmaceutical Association, and other experts. He was engaged in the research of resource ecology and environment ecology for a long time. Recently, according to the investigation of Tibetan medicine resources, distribution, reserves and quality evaluation of part important medicinal resources, a series of theoretical system in protection and utilization were brought up, which could provide important scientific basis for the sustainable utilization of characteristic biology resources in Qinghai-Tibet Plateau. Meanwhile, a comparative systematic point at the aspect of strategy of the Tibetan Medicine Development was also established, and accepted by many peer experts. For many years, according to the vegetation investigation throughout Qinghai-Tibet Plateau, Northwest and Southwest region of China, the regular vegetation distribution pattern and succession trend was better explained and discussed. This work provided the scientific and theoretical foundation for protection and sustainable utilization of Qinghai-Tibet Plateau Biological Resources, and regional ecological protection and construction. In recent years, a number of scientific research item from national and provincial departments were took on, and now projects of the National Key Technology Support Program and Key Laboratory Development Foundation of Qinghai were also undertook.

Research Interests

Research in the field of Resource Ecology and Environment Ecology now was developed. At the aspect of Resource Ecology Research, Traditional Chinese Medicine and Tibetan Medicine in Qinghai-Tibet Plateau were studied, dealing with the relationship between medicinal plant resources and the ecological environments, mechanism of formation of genuine medicine and quality evaluation, while at the aspect of Environment Ecology Research, majored in the research of community character of vegetation and succession trend in Qinghai-Tibet Plateau, and the mechanism of alpine meadow ecosystem degradation and restoration by climate change, rodent (plateau pika) and grazing management.

Research Progress in 2013

1. The book of "Study on the Eco-compensation Mechanism of the Three Rivers Source Area"

To carry out systematically further study of the eco-compensation in the Three Rivers Source Area, scientists and researchers from Northwest Institute of Plateau Biology, Chinese Academy of Sciences, Chinese Research Academy of Environmental Sciences, Qinghai Research Academy of Environmental Sciences, and Qinghai Ecological and Environmental Remote Sensing Monitor Center, jointly implemented the scientific research project of "Study on the Eco-compensation Mechanism of the Three Rivers Source Area" in commission and foundation of Department of Science and Technology of Qinghai Province. Through several years of efforts, researchers have made some progress and got some valuable results. We hope to attract more scholars and experts to join in the major scientific issues of protection and construction of the natural environment of the Three Rivers Source Area, and establishment of scientific eco-compensation mechanism of this region, through official publishment of this book, to make some contributions to the ecological protection and construction of the Three Rivers Source Area, as well as to preserve the whole ecological security of our country.

2. The book of "Identification Manual of Common Wild Plant in Qinghai"

Qinghai Province, Located in the Qinghai-Tibet Plateau, is abundant with mountains and rivers, creating plentifully unique plateau plants. Qinghai-Tibet Plateau is one of the most abundant biodiversity regions of China, as well as the most attractive biodiversity conservation areas of the world. According to historical records, nearly 3,000 wild plant species (including grades below species) distributed in Qinghai Province. Gymnospermae in the manual is ordered according to Zheng Wanjun system (1977), Angiosperm is ordered by Engler system (1936). The genus and species under a family are ordered in accordance with the Latin alphabet of the plant scientific names.

The book recorded 370 genus (containing grades below genus) common wild plants belonging to 65 families detailedly with words and photographs, as well as their Chinese name, Latin name, alias, morphology characteristics, and distribution of habitats. The manual is of science popularization and practicability. The publication of the book has important reference value to the work of introduction of wild plants, propagation, research and teaching, and will play an important role in guiding protection and utilization of wild plants.

青藏资源植物生理生态生化研究学科组

学科组长:韩发
邮箱: hanfa@nwipb.ac.cn

学科组长：韩发，研究员、博士生导师。1989年 - 2010年历任中科院西北高原生物研究所生态研究室支部书记、所纪委书记、工会主席、党委副书记、副所长等职。现任中科院湖州高原生物资源产业化创新中心主任、国家二级研究员、中科院研究生院教授。兼任国家科学技术奖评审专家、国家自然科学基金评委、北京市、浙江省和山东省自然科学基金评委、中国博士后科学基金评审专家、中国植物生理与植物分子生物学学会理事、国家濒危物种科学委员会专家、《植物生理学报》、《湖北农业科学》和《食品安全质量检测学报》等编委、青海省自然科学学科带头人、青海省植生学会理事长、政协青海省第九届、第十届委员、研究所学术委员会和学位委员会委员等职务。

一直从事高原植物生理生态生化领域和青藏高原特色生物资源研究开发与持续利用方面的科研工作36年。已承担完成各类科研项目课题20余项，获得国家级和省部级等奖项12项；取得国家和省部级科技完成成果鉴定11项；申请国家发明专利6项、授权2项；研发产品5项；培育成功特种药用植物新品种2个、新品系3个；完成编制地方标准、技术规范和产业发展规划6项；出版专著1部、发表科研论文140余篇；培养研究生21名。

学科组主要研究方向

以青藏高原特色资源植物为研究对象，野外实验与室内分析研究相结合，宏观与微观研究相结合，探讨高原植物的生理生态学、高寒植物抗性生理学、植物生物化学、高寒草甸退化植被恢复生态学、保护生物学。在此基础上进行高原特色野生资源植物的引种驯化与持续利用、品种培育及培植技术创新，坚持青藏高原特色生物资源的研发与关键技术研究，促进高原生物资源的产业化发展。

2013年代表性研究成果

1、特种药用资源—微孔草新品种—“青微3号”培育成功并通过鉴定

以EMS（甲基磺酸乙酯）为化学诱变剂，处理采自青海省湟源县寺寨沟乡草原村地区的野生微孔草种子，从其后代中选择变异优株，经多年驯化选育而成。2013年12月4日青海省第八届农作物品种审定委员会第三次会议审定通过，定名为“青微3号”。目前已在适种地区种植示范。

2、斑唇马先蒿天然产物的提取、分离和活性成分的药理研究

研究选取斑唇马先蒿、唐古特大黄和独一味三种传统藏药材资源为研究对象，建立高效快速的高速逆流（HSCCC）分离纯化方法和体系，并对分离得到的高纯度单体化合物进行纳米介导的抗癌活性研究。

3、藏药迷果芹化学成分和活性成分提取工艺研究。

在化学成分研究方面，不但对藏药迷果芹的基本化学成分进行了全面分析，而且对它的脂溶性成分进行了气相色谱-质谱联用分析。在活性成分提取工艺研究方面，对藏药迷果芹的多糖和总皂苷的提取工艺进行了研究，为工业化生产提供了理论基础。

成果：

1.成果名称：农作物新品种“青微2号” 获得新品种证书，培成的微孔草新品种“青微3号”，2013年12月4日通过省农作物品种审定委员会的审定，并已颁发品种合格证书。

完成单位：中科院西北高原生物研究所、青海互丰农业科技集团公司、湖州上体生化科技有限公司

2、成果名称：微孔草新品种《青微2号》，青海省科技成果批准日期：2013年9月25日，成果登记号：9632013P0257

完成单位：中科院西北高原生物研究所、青海互丰农业科技集团公司、湖州上体生化科技有限公司

申请/授权的专利:

微型无剪切力多功能膜分离设备，公开号：CN203043846U，赵晓辉，禹磊.

完成单位：中科院西北高原生物研究所

制定地方标准及规划：

1.青海省农作物种子标准：微孔草《青微2号》2013年8月30日，通过青海省质量技术监督局的审定。

完成单位：中科院西北高原生物研究所、青海省海北州农业科研所、青海省种子管理站、湖州上体生化科技有限公司

2.《青海省冬虫夏草产业发展规划》（2014-2030），2013年12月9号，通过了由省发改委和省经贸委组织专家组的评审，上报省政府。

完成单位：中科院西北高原生物研究所/中科院湖州高原生物资源产业化创新中心

Plant Ecophysiology and Biochemistry Group

学科组成员

李以康(副研究员) 皮立 (助理研究员)

赵晓辉(助理研究员) 程大志(研究员，返聘)

博士研究生

赵晓辉 李以康 皮立

硕士研究生

韩涛 王晓虹

Group Leader：Prof. Fa Han is supervisor doctoral students. He was filled successively the posts of the Institute´s Ecology Laboratory´s Party Branch, Secretary of the Discipline Inspection Commission, Chairman of the Trade Union, Vice Secretary of CPC Committee, and Deputy Director from 1989 to 2010. Now, Prof. Han is the director of Huzhou Plateau Biological Resource Centre of Innovation, Northwest Plateau Institute of Biology, Chinese Academy of Sciences; Professor of University of Chinese Academy of Sciences at present. While the evaluation expert of the State Science and Technology Awards, reviewer of NSFC, reviewer of Natural Sciences Foundation in Beijing Zhejiang and shandong, Council Member of Plant Physiological Society of China, expert of CITES, an editorial member of "Plant Physiology Communications"、 " Hubei Agricultural Sciences" and "Journal of Food Safety and Quality", academic leader of Natural Science Subject in Qinghai Province, Director-General of Plant Physiological Society of Qinghai Province, member of Academic Committee and Academic Degrees Committee of the Institute, member of the Ninth and Tenth CPPC of Qinghai Province.

Prof. Han has been engaged 36 years on the research of plant ecophysiology and biochemistry in Plateau, and the development and utilization of Qinghai-Tibet Plateau characteristic biotic resource. Prof. Han had finished all kinds of scientific research subject more than 20 items one after another, won 12 national and provincial-level awards, gained 11 national and provincial-level appraising Sci/Tech. Achievements, applied for 6 China Invention Patent, Has acthorized 2 patents for invention, researched and developed 5 new products, 3 new strains, established 6 local standards and technical specification, published about 140 papers and edited 1 books, cultured 21 graduate students. and Huzhou city hall set up Northwest Plateau Institute of Biology, Chinese Academy of Sciences Huzhou Plateau Biological Resource Centre of Innovation from 2011 to 2013. At present He takes charges of the scientific research projects like special project of National Science and Technology Servicing Company, Chinese Natural Foundation, the state's strategic new support industry plan of Graduate University of Chinese Academy of Sciences.

Research Interests

The Research Group Choose characteristics of plants in the Qinghai Tibet plateau as the subject investigated, combining Field experiment with Analysis of indoor and of combining macrovisual study with microscopic study, explores Plateau Plant Physiology and Ecology, Psychrophytes Physiology of Resistance, Phytobiochemistry, Restoration ecology of vegetation degradation on alpine meadow, conservation biology. Based on this, carried out Artificial domestication and cultivation technology of wild plant, sustainable utilization, breed of variety and Cultivation technology innovation. Strengthen Development and key technology research of the features of the Tibetan Plateau biological resources, promote industrialization development of the biological resources of the plateau.

Research Progress in 2013

1、Cultivate new specie of Microula sikkimensis "QingWei 3"

using various breeding methods were introduced and domesticated and breeding of Microula sikkimensis. Selection of EMS chemical mutagens (ethyl methane sulfonate), has collected treatment from Qinghai the Huangyuan wild Microula seeds, by the hard breeding breeding trials, and from their offspring in the selection mutation excellent strains are domesticated and bred. Breeding Microula new specie of "QingWei 3",2013 Crop Variety Approval Committee of Qinghai Province validation of new varieties.

2、Research on the separation of active components from two traditional Tibetan medicine plant and its antitumor activities

3、Study on chemical components and active components extraction process of tibetan medicine Sphallerocarpus gracilis（Bess.）K.–Pol.

Publications

[1] Zhao Xiao–Hui, Han Fa, Li Yu–Lin, Zhou Guo–Ying, *Yue Hui–Lan. Semi–preparative separation and purification of three flavonoids from pedicularis longiflora var. Tubiformis (klotzsch) p. C. Tsoong by hsccc .journal of liquid chromatography & related technologies, 36(13): 1751–1761.

[2] Xiao–Hui Zhao , Fa Han , Yu–Lin Li, Hui–Lan Yue.（2013）. Preparative Isolation and Purification of Three Stilbene Glycosides from the Tibetan Medicinal Plant Rheum tanguticum Maxim. Ex Balf. by High–speed Counter–current Chromatography Phytochemical Analysis，（24）2:171–175.

[3] Xiao–Hui Zhao , Hui–Lan Yue，Li Ping,Zeng Xin,Zhang Gen.（2013）.evaluation of the antitumor activityby cdte qds with verbascoside. nano，8（3）:1–8.

[4] Chen Chen, Xiao–Hui Zhao , Yu–Lin Li, Hui–Lan Yue,Chen Tao.（2013）.Separation of Phenylpropanoid Glycosides from a Chinese Herb by HSCCC, Journal of Chromatographic Science,5:1–5.

[5] Li Pi, Yuxiu Xing, Fengzu Hu, Xiaofeng Chi, Yikang Li, Xiaohui Zhao, Tao Han, Fa Han*. Determination and Evaluation Mineral Elements in Microula sikkimensis from the Qinghai–Tibet Plateau. Spectroscopy letters , 2013,accepted.

[6] Pi Li，Han Fa，Hu Feng–Zu，Han Tao，Li Yi–Kang，Cheng Da–Zhi. Analysis of the Nutritional Components of Microula sikkimensis seeds. ACTA nutrtimenta sinica，2013,35(6):620–621,624.

青藏高原生态经济植物资源研究与开发学科组

学科组长:索有瑞
邮箱:yrsuo@nwipb.cas.cn

学科组长：索有瑞，博士、研究员、博士生导师，生于1960年7月。1998年享受国务院政府特殊津贴。1985-1986年期间获得全国五一劳动奖章、全国新长征突击手、边陲优秀儿女金质奖章；1999年获得青海省青年科学家奖等荣誉称号。先后主持国家“863”计划、星火计划、国家科技攻关计划，青海省重点科技攻关计划等多项研究课题，取得了丰硕的研究成果。2007年获得国家科技进步二等奖、2006年获得青海省科技进步一等奖、获得青海省科技进步二等奖2项、科技进步三等奖2项、国土资源部科技三等奖1项、西宁市科技进步一等奖1项。2012年获得青海省科技进步一等奖。取得省级科技成果40余项、申请国家发明专利70项(25项已授权)。出版专著2部；发表论文220余篇。培养硕士研究生12名，博士研究生10名。其中培养的3名博士2004年-2007年以优异的成绩3次获得中国科学院“西部之光”人才培养计划资助项目；4名博士2006年、2007年和2008年获得科学院院长优秀奖学金，另有硕士生4次获得地奥奖学金，多人获得三好学生、优秀毕业生等称号。

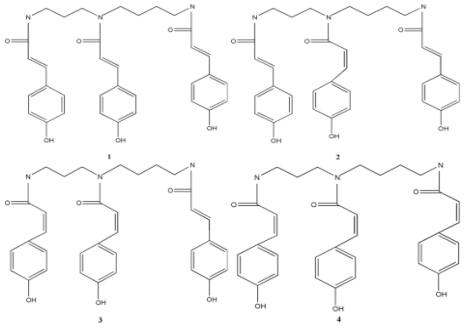
学科组主要研究方向

主要从事青藏高原生态经济植物资源的研究与开发工作，包括天然药物化学、生物分析化学、生物资源可持续利用、传统藏药现代化改造和特色保健食品开发等方面的研究。

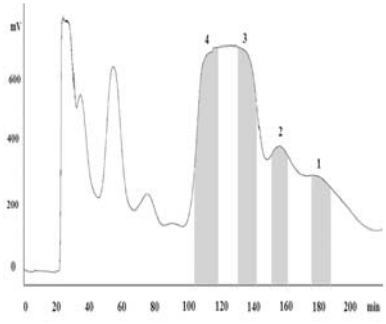
2013年代表性研究成果

红花中四种精胺类化合物的高速逆流色谱制备

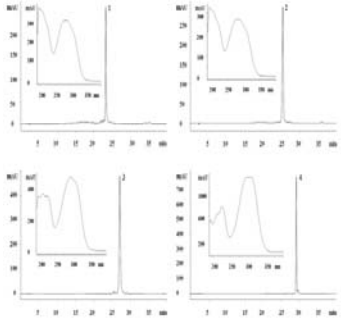
利用高速逆流色谱法分离纯化红花干燥花中的四个精胺类化合物。溶剂系统为氯仿-甲醇-水 (1:1:1, *V/V*)，下相作为固定。经过 210 min 分离，从100 mg 待分离样品中一次性分离制备得到1.3 mg N^1,N^5,N^{10}-(E)-tri-p-coumaroylspermidine (EEE), 4.4 mg N^1(E)-N^5-(Z)-N^{10}-(E)-tri-p-coumaroylspermidine (EZE), 7.2 mg N^1(Z)-N^5-(Z)-N^{10}-(E)-tri-p-coumaroylspermidine (ZZE), 11.5 mg N^1,N^5,N^{10}-(Z)-tri-*p*-coumaroylspermidine (ZZZ)。



化合物1： N^1,N^5,N^{10}-(E)-tri-*p*-coumaroylspermidine (EEE)；
化合物2： N^1(E)-N^5-(Z)-N^{10}-(E)-tri-*p*-coumaroylspermidine (EZE)
化合物3： N^1(Z)-N^5-(Z)-N^{10}-(E)-tri-*p*-coumaroylspermidine (ZZE)
化合物4： N^1,N^5,N^{10}-(Z)-tri-*p*-coumaroylspermidine (ZZZ)



粗提物的HSCCC色谱图



四种目标化合物的HPLC色谱图

授权专利

[1] 一种枸杞鲜果制干方法，索有瑞，韩丽娟，叶英，王洪伦。ZL 201310015817.1.
[2] 枸杞干果抗板结方法，索有瑞，叶英，韩丽娟。ZL 201310015816.7.
[3] 枸杞种子细胞快速破壁及籽油提取工艺，索有瑞，李国梁，王洪伦。ZL 201110004255.1.

Qinghai-Tibet Plateau Ecological and Economic Plant Resources Research and Development Research Group

学科组成员

白波(百人计划 研究员)　王洪伦(研究员)

丁晨旭(副研究员)　赵云峰(博士后)

杨黎彬(博士后)　李刚(博士后)　赵强(博士后)

博士研究生

李春婷　陈向明　叶英　胡娜　何彦峰

杨芳　杨永晶　韩丽娟　吕欢欢

硕士研究生

欧阳健　张秋龙　王煜伟　周文娜　马涛

Group Leader: Professor Yourui Suo, the supervisor of Ph.D students. He earned Ph.D in Natural Product Chemistry from Lanzhou Institute of Chemical Physics, Chinese Academy of Science in 2004. Between September and December of 2006, he became a senior visiting-scholar of Canadian SUF University. He won the National Scientific and Technological Progress Award second class in 2007, the Scientific and Technological Progress Award of Qinghai Province in 2006, the Scientific and Technological Progress Award two second and third class of Qinghai Province in 2006, the Scientific and Technological Progress Award third class of the Ministry of Land and Resources in 2006, the Scientific and Technological Progress Award first class of Qinghai Province in 2012. 41 national patents (21 ones have been authorized) have been acquired. And more than 211 papers have been published.

Research Interests

The natural medicinal chemistry, bio-analytical chemistry, the sustainable use of characteristic biotic resources of Qinghai-Tibet Plateau, modernization reform of the traditional Tibetan medicine and characteristic exploitation of health hood.

Research Progress in 2013

High–speed counter–current chromatography (HSCCC) was successfully applied to isolate and purify four cis–trans isomers of coumaroylspermidine analogs from Safflower. HSCCC separation was achieved with a two–phase solvent system composed of chloroform–methanol–water (1:1:1, v/v/v) with the upper phase as the mobile phase. In a single run, a total of 1.3 mg of compound N1,N5,N10–(E)–tri–*p*–coumaroylspermidine (EEE), 4.4 mg of compound N1(E)–N5–(Z)–N10–(E)–tri–*p*–coumaroylspermidine (EZE), 7.2 mg of compound N1(Z)–N5–(Z)–N10–(E)–tri–*p*–coumaroylspermidine (ZZE), and 11.5 mg of compound N1,N5,N10–(Z)–tri–*p*–coumaroylspermidine (ZZZ) were obtained from 100 mg of crude sample.

Publications

[1] Li Wencong, Wang Xiaoyan, Lin Pengcheng, Hu Na, Zhang Qiulong, Suo Yourui, Ding Chenxu*. Preparative separation and purification of four cis–transisomers of coumaroylspermidine analogs from safflower by high-speed counter-current chromatography , Journal of Chromatography B , 2013, 93(1)75−79.

[2] Yang Libin, Liu Shangjing, Wang Honglun, Suo Yourui. A new diterpenoide from Isodon lophanthoides var. gerardianus. Journal of Chemical Research. 2013, (2) 28-29.

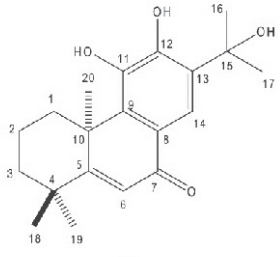


Fig. 1 Chemical structure of compound 1.

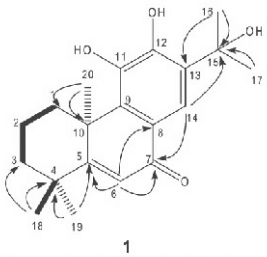


Fig. 2 The key ^{1}H-^{1}H COSY (H–H) and HMBC (H→C) correlations of 1.

藏药新药研究与开发学科组

学科组长:陶燕铎
邮箱:taoyanduo@163.com

学科组长：陶燕铎，研究员，博士生导师，1985毕业于西北农林科技大学，现任“中国科学院藏药研究重点实验室”副主任，“青海省藏药研究重点实验室”主任，2011年享受国务院政府特殊津贴。主要从事青藏高原特有生物资源高值开发、藏药新药创制及相关的基础和应用研究工作。作为主要完成人开发了国家动物类中药一类新药材“塞隆骨”（新中国成立以来第一个动物类新药材），主持完成了国家级新药的研制，取得国药准字批号3个，卫生部保健食品批号2个。作为项目负责人，主持完成了国家计划委员会高新技术产业化重大专项“藏药雪隆系列产品高技术产业化示范工程建设”项目，已通过药品GMP认证。主持了科技部“十一五”科技支撑计划“高原特色生物资源高值开发关键技术示范”项目、国家重大基础研究前期研究专项、中国科学院知识创新工程领域前沿项目及青海省重点科技攻关计划等20余项科研项目。先后在国内外学术刊物上发表论文120余篇，申报发明专利35项，其中授权专利16项，制定地方标准1项；取得省级科技成果10项。

主要研究方向：

1. 青藏高原特色生物资源有效化学成分提取分离及分析鉴定；
2. 青藏高原特色生物资源化合物库的构建；
3. 天然产物及其衍生物的活性筛选及新药研发。

2013年代表性研究成果

1. 黑果枸杞组培体系建立

建立了黑果枸杞组培再生体系，研究了不同浓度赤霉素对打破黑果枸杞种子休眠的影响。结果表明，赤霉素对打破黑果枸杞种子休眠有显著效果，同时还对黑果枸杞遗传转化做了初步的研究，将最新分离到的一功能未知基因（*Ps16F11*）转入黑果枸杞，以探讨该基因的功能。

2. 黑果枸杞遗传多样性及分子标记

建立了黑果枸杞SRAP-PCR反应体系，为了确定PCR反应中5个因素(Taq DNA聚合酶，Mg^{2+}，模板DNA，dNTPs，引物)的最佳水平，采用正交设计L25（56）在五个水平上进行试验。获得最佳SRAP-PCR反应体系。

利用SRAP分子标记研究不同种群黑果枸杞遗传多样性，利用SRAP分子标记对来自我国西北部地区（包括新疆、甘肃、青海、宁夏）黑果枸杞群体遗传多样性进行了研究。利用31对SRAP引物进行扩增得到468个清晰的片段，其中398个片段是多态的，占扩增总片段的85.04%，对扩增结果分析发现，遗传变异主要来自群体内，占84.45%，群体间的遗传多样性较低，占15.55%，群体间的遗传分化中等(Gst=0.2155)，基因流Nm为1.8199。Mantel test检验结果表明遗传多样性与地理分布存在显著相关性（r=0.303，P=0.004）。

3. 黄绿蜜环菌抗癌活性成分提取分离

黄绿蜜环菌子实体经过提取，利用工业制备色谱分离纯化得到14个组分，其中第7、第8号组分经过体外肺癌抗肿瘤活性筛选证明其为活性组分。现今已完成活性组分的物质基础与其体外抗肺癌活性研究。

4. 从高山植物中分离单体化合物40多个

从独一味中分离苯丙素苷类化合物5个，环烯醚萜苷类化合物7个；从斑唇马先蒿中分离苯丙素苷类化合物4个；从唐古特铁线莲中分离出11个化合物，包括甾体、黄酮及萜类化合物；从密花角蒿中分离出20个化合物，包括甾体、黄酮、生物碱、苯乙醇苷、环烯醚萜苷类化合物。

授权专利：

一种活性枸杞叶蛋白粉的制作方法ZL201110364812.0. 陶燕铎，毕宏涛，江磊，于瑞涛，党军，刘增根，邵赟，梅丽娟，2011.11.17.

申请专利（部分）：

[1] 一种黄绿蜜环菌的深层发酵及其应用201310138985.X，王启兰，王瑛，党军，梅丽娟，陶燕铎，邵赟，2013.4.22.

[2] 一种利用响应曲面法优化菊芋秸秆绿原酸的提取方法201310278951.0，邵赟，毕宏涛，刘增根，岳会兰，于瑞涛，梅丽娟，2013.7.4.

[3] 一种菊芋秸秆微贮饲料的制作方法201310278952.5，梅丽娟，毕宏涛，岳会兰，于瑞涛，邵赟，陶燕铎，2013.7.4

[4] 一种从牛蒡子中快速制备牛蒡子苷元的方法201310447928.X，于瑞涛，陶燕铎，梅丽娟，邵赟，苑祥，史强强，2013.9.27.

[5] 独一味中五种苯丙索苷类单体化合物的分离制备方法201310305644.7，岳会兰，邵赟，梅丽娟，王启兰，2013.7.19.

Research and Development of Tibetan Medicine Group

学科组成员

邵赟（研究员） 梅丽娟（副研究员）

王启兰（副研究员） 于瑞涛（副研究员）

岳会兰（助理研究员） 文怀秀（助理研究员）

周志军（工程师） 孙策（工程师）

博士研究生

党军 刘增根 江磊 文怀秀

硕士研究生

张琳 王瑛 牛江进 于民丰 苑祥 史强强

Group Leader： Yanduo Tao, Professor, Doctoral tutor, was graduated from Northwest A & F University with bachelor degree in 1985, and now is Deputy Director of the key laboratory of Tibetan medicine research of CAS, Director of the key laboratory of Tibetan medicine research of Qinghai province, and received special government allowances of State Council from 2011. He mainly engaged in basic and applied research of Plateau biological resources, new drug development. As the principal contributor, he has developed the "Theron bone" (the first new animal medicine since the founding of the People's Republic of China), and developed 3 new drugs and 2 health foods. The studies were supported by 20 projects, including the Major Projects of High-Tech industrialization of National Planning Commission, the National Sci-Tech Support Plan, the Special Foundation for State Major Basic Research Program, the Frontier Program of Knowledge Innovation Project of Chinese Academy of Sciences, and the Qinghai Major Technological Program, etc. Until 2013, more than 120 papers and 30 patents have been published and applied, 16 patents have been granted, one local standards has been formulated, and 10 provincial-level scientific and technological achievements have been achieved.

Research Interests:

1.Extraction, separation and identification of the effective constituents of the unique biological resources in Qinghai-Tibet Plateau

2.Construction of the compound library of the unique biological resources in Qinghai-Tibet Plateau

3.Activity screening of natural product and its derivatives, and new drug development.

Research Progress in 2013

1. Tissue culture system of Lycium ruthenicum

The aseptic seedlings were cultured through seed germination of L. ruthenicum. The propagation by tissue culture were studied, including 200 mg/L gibberellin pretreatment for seed, different explants (young leaves and stem segments) induction and proliferation, callus induction and differentiation, root induction of plantlets of L. ruthenicum. In the establishment of the genetic transformation system of L. ruthenicum mediated by Agrobacterium tumefaciens (EHA105), the fragment (Ps16F11) was constructed to the pBI121 plasmid of eukaryotic expression vector. And it can explore the function of this fragment.

2. Genetic diversity of Lycium ruthenicum and the molecular marker

Sequence-related amplified polymorphism (SRAP) markers were used to assess the genetic diversity and population genetic structure in fourteen wild populations of L. ruthenicum from Northwestern China. Thirty-one selected primer combinations produced 468 discernible bands, with 398 (85.04%) being polymorphic, indicating relatively high genetic diversity at the species level. Analysis of molecular variance showed that the genetic variation was found mainly within populations (84.45%), but variance among populations was only 15.55%. And there was a moderate genetic differentiation (Gst = 0.2155) among populations.

3. Extraction and separation of anticancer constituents from Armillaria luteo-virens

The sporocarp of Armillaria luteo-virens was extracted, and then separated into 14 fractions. Among the 14 fractions, the seventh and eighth fractions were proved to be active fractions by lung cancer activity screening in vitro. Now, the material basic and anti-lung cancer activity study in vitro of active fractions have completed.

4. More than 40 compounds were separated from alpine plants.

Five phenylpropanoid glycosides compounds and seven iridoid glycoside compounds were separated from Lamiophlomis rotate. Four phenylpropanoid glycosides compounds were separated from Pedicularis longiflora var. tubiformis. 11 compounds including sterides, flavone, terpene were separated from Clematis tangutica. 20 compounds including sterides, flavone, alkaloid, phenylethanoid glycosides, iridoid glycoside were separated from Incarvilla compacta.

青藏高原特色植物化学成分研究学科组

学科组长:尤进茂
邮箱:jmyou6304@163.com

学科组长：尤进茂，教授，博士生导师。1988年获中国科学院兰州化学物理研究所硕士学位；1999年获中国科学院兰州化学物理研究所博士学位；1999-2001年在中国科学院大连化学物理研究所做博士后研究工作；2008年入选为中国科学院西北高原生物研究所“百人计划”，2010年获中国科学院“百人计划”择优支持；2009受聘为山东大学环境科学与工程学院分析化学专业合作博士生导师。现担任山东省“生命有机分析重点实验室”主任、山东省“绿色天然产物与医药中间体开发”高校重点实验室主任；长期从事新型分子探针的开发应用，先后开发了70余种高灵敏荧光探针，绿色天然产物与医药中间体开发借助探针分子携带的高活性官能团，在复杂基质环境下选择性识别目标分子，通过与现代色谱、质谱和电泳技术相结合，实现多种生物活性物质及代谢物的快速、灵敏、准确测定。2007-2013年先后在国内外重要学术刊物上发表论文180余篇。其中被SCI 收录论文超过100篇。

学科组主要研究方向

新型高灵敏荧光标记试剂的开发及其应用；
新型质谱探针的开发及其在蛋白质组学中的应用；
青藏高原特色药用植物资源活性成分分析。

2013年代表性研究成果

以苯并吖啶酮-5-乙酸酰肼(BAAH)为柱前衍生试剂，建立了羌活多糖组成单糖的高灵敏柱前衍生液相色谱荧光分析方法。通过在单糖分子中引入具有优异荧光性能的BAAH荧光基团，一方面使得单糖的液相色谱灵敏度得到很大提高，另一方面使单糖分子和反相色谱柱的作用力大大加强。因此使得具有类似化学性质的单糖分子得到有效的色谱分离。同时还采用乙酸酐和七氟丁酸酐为衍生试剂，建立了两种GC–MS单糖分析方法作为液相色谱的辅助方法，进行了羌活多糖化学成分的进一步鉴定。

研究结果表明羌活多糖是一种杂多糖，主要有葡萄糖、半乳糖、阿拉伯糖、甘露糖、鼠李糖、岩藻糖、木糖和果糖组成，其中葡萄糖和半乳糖含量最高。西羌和川羟多糖的组成单糖种类相同，含量不同；川羟多糖的组成单糖中半乳糖含量最高，而西羌多糖的组成单糖中葡萄糖含量最高。对青海地区羌活植物体的分析结果显示羌活根、茎和叶多糖的组成单糖种类相同，根部多糖中葡萄糖含量最高，而茎和叶多糖中半乳糖含量最高。

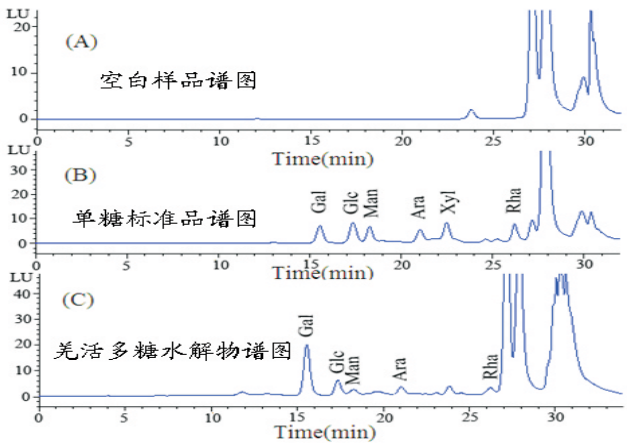


图. 单糖标准品及羌活多糖水解单糖衍生物色谱图

专利

渠凤丽，尤进茂，丁露。一种聚苯乙烯包覆二茂铁微球的制备方法及其应用（申请号：201310274516.0）

Qinghai-Tibet Plateau Characteristic Plant Chemical Ingredients Research Group

学科组成员
王小艳(助理研究员)
博士研究生
陈光 张世娟 纪仲胤
硕士研究生
王爱红 吴宏亮 孙亚男

Group leader: Professor Jinmao You, the supervisor of Ph.D students. He received his bachelor's degree from Lanzhou Institute of Chemical Physics, Chinese Academy of Science in 1988. He then earned his doctor's degree in 1999 from Lanzhou Institute of Chemical Physics, Chinese Academy of Science. From 1999-2001, he worked as postdoctoral in Dalian Institute of Chemical Physics, Chinese Academy of Science. He was awarded "Hundred-Talent Award Program" from Chinese Academy of Science in 2008 and preferentially supported by this program in 2010. In 2009, he became a doctoral supervisor of Shandong University. He is the director of "Shandong Province Key Laboratory of Life-Organic Analysis" and "Key Laboratory of Pharmaceutical Intermediates and Analysis of Natural Medicine". His research focuses on the study and application of new labeling reagents. More than 70 kinds of labeling reagents possessing special structure, high sensitivity and excellent fluorescence or ultraviolet properties have been synthesized and applied to the analysis of natural product and biological metabolites. More than 180 papers have been published in important journals home and abroad, among which 100 articles have been indexed by SCI.

Research Interests

Synthesis and application of new and sensitive fluorescence labeling reagent; Application of new mass enhancing labeling reagents in proteome research; Analysis of active ingredients of plants in Qinghai-Tibet Plateau.

Research Progress in 2013

A sensitive pre-column derivatization method was developed for analysis of carbohydrates by HPLC with fluorescence detection. The introduction of 2-(12-benzo[b]acridin-5(12H)-yl)-acetohydrazide (BAAH) with excellent fluorescence property into the molecules of monosaccharides greatly enhanced the HPLC sensitivity of the analytes. Meanwhile, derivatization with BAAH also greatly increased the hydrophobicity of the monosaccharides and made them elute at increased retention times. The monosaccharides with similar properties therefore could be completely separated due to the increased interaction between the analytes and the column. Component monosaccharides of the polysaccharides obtained from the roots, stems and leaves of Notopterygium forbesii Boiss (NF) were analyzed by the developed method. Gas chromatography and mass spectrometry method (GC–MS) was also applied to the analysis of the components of the polysaccharides of NF. Two derivatizing reagents were applied in GC–MS analysis.

The results indicated that NF polysaccharides were heteropolysaccharides. The main neutral monosaccharides of NF polysaccharides were Gal, Glc, Man, Rha, Xyl, Fru and Ara. The contents of Gal and Glc were higher than those of other monosaccharides. For the root polysaccharides of Sichuan province, the Gal content was higher than those of other monosaccharides, while for the root polysaccharides obtained from Qinghai or Gansu province, the Glc content was the highest among the monosaccharides studied in this study. The highest content of Gal was found in the polysaccharides obtained from the leaves of NF, while the highest content of Glc was found in root polysaccharide.

Publications

[1] Shijuan Zhang, Jinmao You*, Shujing Ning, Cuihua Song, You-Rui Suo. Analysis of estrogenic compounds in environmental and biological samples by liquid chromatography–tandem mass spectrometry with stable isotope-coded ionization-enhancing reagent. Journal of Chromatography A, 1280, 84-91, 2013

[2] Shijuan Zhang, Chunli Li, Guoying Zhou, Guodong Che, Jinmao You*, Yourui Suo. Determination of the carbohydrates from Notopterygium forbesii Boiss by HPLC with fluorescence detection. Carbohydrate Polymers, 97, 794-799, 2013

[3] Shijuan Zhang, Cuihua Song, Guang Chen, Lian Xia, Xiaoyan Wang, Jinmao You*, A sensitive high-performance liquid chromatography method with fluorescence detection for the determination of fatty acids as exemplified for Dendrobium species. European Journal of Lipid Science and Technology, 115, 1155-1163, 2013

[4] Guoliang Li, Guang Chen, Liu, Jinmao You*, A sensitive and selective HPLC-FLD method with fluorescent labeling for simultaneous detection of bile acid and free fatty acid in human serum, Journal of Chromatography B, 859, 191-195, 2013

[5] Aihong Wang, Guoliang Li, Lihua Dong, Jinmao You*, A new fluorescent derivatization reagent and its application to free fatty acid analysis in pomegranate samples using HPLC with fluorescence detection, Journal of Separation Science, 24, 3853-3859, 2013.

资源植物遗传与繁育技术学科组

学科组长:李毅
邮箱:liyi@nwipb.cas.cn

学科组长：李毅，研究员、博士生导师。1987年获武汉大学遗传学专业学士学位，同年分配到中国科学院西北高原生物研究所。青海省生物学学科带头人，青海省农作物品种审定委员会委员，国家濒危物种科学委员会协审专家。主要从事青藏高原特有濒危植物的组织培养及有效成分变化与调控、植物资源的可持续利用与保护研究。近年来，发表论文40多篇（SCI论文6篇），完成省部级以上成果8项，授权专利3项，申请专利3项。主持国家科技支撑计划课题、国家农业科技成果转化项目、中国科学院、中组部“西部之光”人才培养计划项目、中国科学院仪器设备功能开发技术创新项目等多项。

学科组主要研究方向

利用生物技术手段开展青藏高原特色植物资源的可持续利用与保护研究，近期主要研究包括以下几个方面：

1. 青藏高原特色植物快速繁育与定向分化；
2. 水母雪莲细胞大规模培养、遗传转化及有效成份的积累与调控；
3. 特色植物种质资源、遗传多样性分析。

2013代表性研究成果

开展了祁连山地区湿地群落结构调查和用于遗传结构分析的样品采集工作。共调查了28个样地，采集植物种20个，采集样品数3043个。

研究湿地重要建群种植物（华扁穗草、藏嵩草、杉叶藻等）的遗传多样性和遗传变异。

开展柴达木盆地本地枸杞品种快速繁育及野生枸杞种质资源研究的工作。对唐古特大黄种质资源、有效成份关键基因遗传特征研究。

继续对水母雪莲毛状根次生代谢调控，暗紫贝母鳞茎培养等的研究。

成果

1、唐古特大黄种子检验规程，登记号: 9632013B0174 李毅、胡延萍、王莉等。

2、唐古特大黄种子质量分级，登记号: 9632013B0173 李毅、王莉、胡延萍等。

3、甘蓝型杂交油菜品种纯度鉴定ISSR操作规程，登记号: 9632013B0172 李毅、胡延萍、王莉等。

论文

[1] 谢小龙，李毅. 陇西栽培蒙古黄芪生物学性状的多元统计分析[J]. 中国科学院大学学报，2013，30（4）：478-484.

[2] 谢小龙，李毅. 蒙古黄芪2种表型种子的可溶性蛋白电泳分析[J]. 种子，2013，32（2）：67-68.

[3] 谢小龙，李毅. 蒙古黄芪2种表型种子的酯酶同工酶差异性研究[J]. 河南农业科学，2013，42（6）：116-120.

Plant Biotechnology Group

学科组成员

王莉(副研究员)

胡延萍(助理研究员)

王溪(助理研究员)

陈伟民(工程师)

硕士研究生

石琳

Group Leader: Professor Yi Li received his Bachelor's degree in Genetics from Wuhan University in 1987. From then on, he has worked in Northwest Institute of Plateau Biology, CAS. He is an academic leader in Biology of Qinghai Province, one of the members of Qinghai Crop Variety Approval committee, and assistant review expert of endangered species scientific commission of China. His research focuses on the tissue culture, regulation and control of active constituents, and conservation and sustainable utilization of threatened plants endemic to Qinghai-Tibetan Plateau. More than 40 scientific papers including 6 cited by SCI were published, 5 achievements were accomplished and 3 patents were authorized to him. He has taken part in many research projects as a Principle Investigator such as National Key Technology R&D Program, Agriculture Science Technology Achievement Transformation Fund, West Light Foundation of the Chinese Academy of Sciences, the Function and Technology Innovation Projects of Instrument Equipment of the Chinese Academy of Sciences and other programs of Qinghai Province.

Research Interests

1. Cell, tissue and organ culture and secondary metabolites of special medicinal plants on Qinghai-Tibetan Plateau.

2. *Agrobacterium rhizogenes* mediated transformation of Saussurea medusa and regulation of secondary metabolites of hairy root.

3. Genetic diversity and germplasm resources of medicinal and wetland plants on Qinghai-Tibetan Plateau.

Research Progress in 2013

We focus on the investigation plant community of wetlands in Qilian Mountains area and used for sample collection of genetic structure analysis. Wetland plant species in 28 certain areas have been investigated, and 3043 samples have been collected. Plant regeneration of Lyciumchinense growing in the Chaidamu area was established. Genetic analysis of Lyciumchinense and Rheum tanguticum Maxim were going on.

We are working on the regulation of secondary metabolites of hairy root, and subculture bulbs of Fritillaria unibracte.

Scientific research achievements of Qinghai Province

1. Rules for Rheum tanguticum seed testing Registration NO. 9632013B0174 Yi Li, Yanping Hu, Li Wang et al.

2. Quality grading of Rheum tanguticum seed Registration NO. 9632013B0173 Yi Li, Li Wang, Yanping Hu et al.

3. Operating procedure of purity identification in hybrid variety of Brassica napus with ISSR markers Registration NO. 9632013B0172 Yi Li, Yanping Hu, Li Wang et al.

Publications

［1］Xiaolong Xie, Yi Li. Multivariate analyses on biological characters of Astragalus membranaceus var. mongholicus Hsiao cultivated in Longxi county [J]. Journal of University of Chinese Academy of Sciences. 2013, 30(4): 478-484.

［2］Xiaolong Xie, Yi Li. Analysis of soluble proteins in two seed phenotypes of Astragalus membranaceus var . mongholicus by polyacrylamide gel electrophesis [J]. Seed. 2013, 32(2): 67-68

［3］Xiaolong Xie, Yi Li. Studies on esterase isozymic differences between two phenotypes of Astragalus membranaceus var. mongholicus seeds [J]. Journal of Henan Agricultural Sciences. 2013, 42(6): 116-120.

药材GAP生产与质量标准研究学科组

学科组长:马世震
邮箱:szma@nwipb.cas.cn

学科组长：马世震，副研究员，硕士生导师。1984年青海大学毕业，获学士学位，2002年-2003年中国科学院兰州化学物理研究所2002年天然药物学春季博士班学习。2011年1月-7月苏黎世大学University of Zurich 高级访问学者。国家濒危物种保护委员会专家；国家自然科学基金委评审专家；《兰州大学学报》期刊审稿人；青海省三江源生态环境保护专家委员会委员；国家环保部环境影响评价评审专家，青海省第四批自然科学与工程技术学科带头人。自2001年开始，重点开展了中国科学院院地合作项目，先后在甘肃、四川、西藏和青海等省、区与当地企业联合攻关，取得了30多项应用性研究成果并推广，成果推广应用累计经济效益达到27700万元，为甘肃、青海、西藏和四川等省区的中藏药材产业发展做出了积极贡献。目前承担企业委托白刺与黑果枸杞深加工关键技术研究、国家科技部中小型创新企业资金项目-黑果枸杞深加工技术与产品生产等。

学科组主要研究方向

主要从事地道药材 GAP 生产技术与药材质量标准研究。对青藏高原及毗邻地区地道药用植物资源分布特征调查，遴选优质种源进行引种驯化。利用 HPLC、GC-MS 等测试技术手段测试不同地区野生与栽培药材活性成分等表征性指标（指纹图谱）和其他辅助性指标，确定各项指标的阈值范围，从而制定能够系统评价和反映药材质量的标准体系。

2013年代表性研究成果

完成“枸杞生态专用肥开发技术与示范”科技成果一项，2013年4月通过省级成果鉴定，成果登记号：2013（033号）。

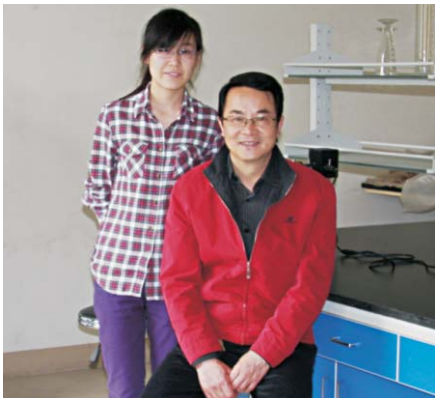
申请专利、成果

[1]开发产品一项（白刺果红色片），已经获得生产批号（QS 630113010008）。中国科学院西北高原生物研究所研制，青海康健生物科股份公司生产。

[2]申请《一种含有白刺果红色素的保健食品》发明专利一项，申请号201410080286.9。

[3]申请《一种含有藏灵菇苦味素的保健食品》发明专利一项，申请号201410110399.9。

Medicinal GAP Products and Quality Standard Group



学科组成员

冯海生 副研究员

硕士研究生

张宇霞

Group Leader: Associate Professor Shizhen Ma was graduated form Qinghai University with Bachelor Degree in Grassland science, China, in 1984. Form 2002 to 2003, he was Studied at the Lanzhou Institute of Chemical Physics Chinese Academy of Sciences in natural medicine science. Form January to July in 2011, he as a visiting Scholar studied at the University of Zurich.Shizhen MA was Expert of the National Endangered Species Protection Committee and Evaluation expert of the National Natural Science Foundation of China. He also was Peer reviewers of Lanzhou University journal and Expert of The sources of Rivers Ecological Environmental Protection Committee of Qinghai. Since 1998, he was engaged Expert of Environmental Protection Environmental Impact Assessment evaluation of Ministry of Environmental protection The People's Republic of China, he also was Academic leader of natural sciences and engineering of Qinghai Province. Since 2001,Shizhen Ma focus on the Chinese Academy of Sciences Cooperation with enterprises project worked in Gansu, Sichuan, Tibet and Qinghai regions, and enterprises of joint research, a more than 30 numbers of applied research results and promotion. At present, the results of popularization and application of the cumulative economic benefits yielded reached 277 million Yuan of economic returns. Made a positive contribution to Tibetan medicine industry development such as Gansu, Qinghai, Tibet and Sichuan provinces.

Research Interests

Studied on Qinghai–Tibet Plateau and adjacent areas of medicinal plants resource distribution characteristics investigation, the selection good quality seed source introduction and domestication.As well as medicinal biology and medicinal effectiveness of the composition between wild and cultivated medicinal herbs samples using HPLC, GC–MS test techniques test herbs active ingredient characterization index (fingerprint) and use other complementary indicators, and statistical analysis to determine the threshold range of indicators. So as to formulate able to systematically evaluate and reflect medicinal plants quality standard system, and provide practical techniques standards for the establishment of herbs GAP base.

Research Progress in 2013

Research and demonstration development technology of Chinese wolfberry ecological fertilizer.Major Scientific and Technological Projects of Qinghai Province (PI).

A research and development products (Production Permit No: 630113010008)

青藏高原药用植物资源与植被恢复学科组

学科组长:周国英
邮箱:zhougy@nwipb.cas.cn

学科组长：周国英，博士，研究员，硕士生导师。1998年获西北农林科技大学林学专业学士学位，2005年获中国科学院西北高原生物研究所生态学专业硕士学位，2010年获中国科学院西北高原生物研究所生态学专业博士学位。2010年2月-8月美国University of Oklahoma高级访问学者。任国家自然科学基金委评审专家，国家濒危物种保护委员会协审专家。青海省第六批自然科学与工程技术学科带头人。目前承担国家科技支撑课题、国家基础性工作专项课题、国家“973”项目专题、国家自然科学基金项目、中国科学院 “西部之光”人才培养项目（后续择优）等。

学科组主要研究方向

1.青藏高原珍稀药用植物资源繁育与可持续利用：筛选优质种源和选择适宜生境，进行引种驯化、植物细胞和组织培养、药效物质和生态环境关系研究。

2.青藏高原脆弱区域植被恢复研究与示范：采用生态学和相关学科的研究手段和方法，对重大工程迹地植被自然恢复的生态学过程及其冻土演变的关系进行研究。

2013年代表性研究成果

珍稀藏药桃儿七的离体快繁与种苗繁育关键技术研究：针对珍稀濒危药用植物桃儿七的离体快繁体系、种子萌发特性、优良种苗繁育技术等的关键问题，开展了桃儿七组织培养离体快速繁殖工作，通过外植体的筛选、不同培养基的选择、激素浓度和种类的配比、培养温度等工作，成功建立诱导愈伤组织形成、诱导芽分化、诱导根生成、成功驯化移栽的成熟技术体系，这为保护濒危植物桃儿七探索了一条有效途径，为扩大药源、解决药材紧缺的实际问题奠定了基础；开展了桃儿七种子萌发特性研究，确定桃儿七种子存在休眠现象，通过种子整粒萌发、切种萌发、种胚萌发实验，解决了桃儿七种子萌发困难的问题；在湟中县群加乡、上新庄镇、湟源县大华镇3个样点完成桃儿七育苗试验，出苗率达80%以上；在乐都县马营乡建立大田栽培示范田10亩；通过成分分析表明栽培3年生桃儿七药材根部的活性成分含量超出野生药材的含量，得出栽培药材完全能够代替野生药材。

专著：

《柴达木生态环境保护与循环经济》，青海人民出版社，2013年8月出版。

主编：谢长礼、陈孝全、苟新京、周国英

发表论文（部分）：

[1] Zhang Shijuan, Li Chunli, Zhou Guoying, Che Guodong, You Jinmao, Suo Yourui. Determination of the carbohydrates from Notopterygium forbesii Boiss by HPLC with fluorescence detection. CARBOHYDRATE POLYMERS, 2013,97(2): 794-799

[2] Hu Yan Feng, Zhou Guoying, Na Xiao Fan, Yang Lijing, Nan Wen Bin, Liu Xu, Zhang Yong Qiang, Li Jiao Long, Bi Yu Rong.Cadmium interferes with maintenance of auxin homeostasis in Arabidopsis seedlings. JOURNAL OF PLANT PHYSIOLOGY, 2013,170(11):965-975

[3] Liu Demei, Chen Guichen, Lai Zhongping, Wei Haicheng, Zhou Guoying, Peng Min. Late Glacial and Holocene vegetation and climate history of an alpine wetland on the Qinghai-Tibetan Plateau.GEOLOGICAL QUARTERLY, 2013,57(2):261-268

[4] 刘卫根，周国英*，徐文华，丁栋，李璠，钟泽兵，超临界CO_2法萃取羌活挥发油及其成分的GC-MS分析，光谱实验室，2013,30（1）：33-38（*通讯作者）

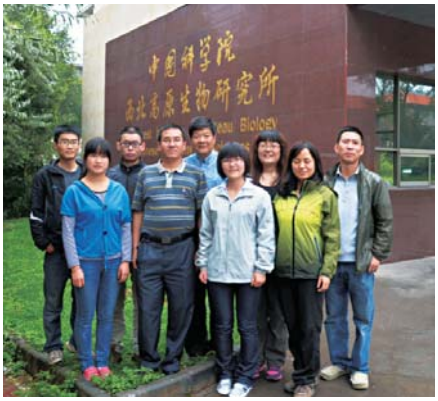
[5] 杨路存，钟泽兵，刘何春，宋文珠，徐文华，周国英*.高寒山生柳灌丛的群落特征研究，植物研究，2013，33（6）：653-658（*通讯作者）

[6] 杨路存，周国英*，聂学敏.濒危植物宽叶羌活天然居群cpDNA非编码区多态性分析，西北植物学报，2013，33（8）：1535-1543（*通讯作者）

[7] 李璠，周国英*，杨路存，徐文华，钟泽兵，宋文珠.围栏封育对青海湖流域主要植物群落多样性与稳定性的影响.2013，20（4）：135-140（*通讯作者）

[8] 刘何春，谭亮，徐文华，宋文珠，臧黎黎，周国英*.大黄种子中蛋白质、多糖和淀粉含量的测定，光谱实验室，2013，30（6）：3114-3120(*通讯作者)

Research Group of Medicinal Plant Resources and Vegetation Restoration of Qinghai-Tibetan Plateau Group



学科组成员　徐文华(副研究员)　杨路存(助理研究员)
宋文珠(助理研究员)　张庆云(七级职员)
硕士研究生　钟泽兵　刘何春　李长斌　李艳玲　宁祎

Group Leader: Guoying Zhou, Ph.D., Professor, Master Tutor. He graduated from NorthwestAgriculture & ForestryUniversity with Bachelor Degreee in Agriculture, in1998. He obtained his M.D. and Ph. D. in Ecology in Northwest Institute of Plateau Biology, CAS, in 2004 and 2010. And in 2010, as a senior visiting scholar he studied in University of Oklahoma in the United States of America.He serves as the following work: the evaluation expert of the National Natural Science Fund Committee, assistant expert of the National protection of endangered species committee, and the discipline leader of the Sixth Batch of natural science and engineering of Qinghai Province.Dr. Zhou has been carrying out medicinal plants resources and vegetation restoration of Qinghai–Tibetan Plateau for many years. These programs are listed as follows: The National Natural Science Foundation of China program; The Major State Basic Research Development Program of China (973 Program);The National Natural Science Foundation of China program;The West Light Foundation of the Chinese Academy of Sciences program.

Research Interests

1.Breeding and sustainable utilization of QTP rare medicinal plant resources（Introduction and domestication, plant cell and tissue culture, and the relationship between efficacy material and ecological environment were studied to screening high quality provenance and choosing suitable habitat

2.Vegetation restoration research and demonstration of the Qinghai–Tibetan Plateau fragile region：(The relationship between the ecology process of natural recovery of vegetation and permafrost evolution was studied using the ecology and related discipline research means and methods.)

Research Progress in 2013

The key technology research of rapid propagation in vitro and breeding seedling on rare medicine of Sinopodophullum hexandrum: tissue culture of rapid propagation in vitro work of Sinopodophullum hexandrum was carried out aimed at the key problems of its rapid propagation in vitro, seed germination characteristics and good seedling breeding technology.

And mature technical system was successfully established such as induction of callus formation, induction bud differentiation, induction root generation and successful domestication transplanting through the work of screening of explants, the choice of different medium, hormone concentrations and matching of types and culture temperature, which explored an effective way to protect endangered plants of Sinopodophullum hexandrum and laid a foundation for solving practical problems such as expanding pharmaceutical and the shortage of medicinal material. Seed germination characteristics of Sinopodophullum hexandrum was conducted, which determined that the seed of Sinopodophullum hexandrum existed dormancy phenomenon. Seed germination difficult problem of Sinopodophullum hexandrum was solved through the experiment of seed whole grain germination, cutting seed germination and the embryo germination. Seedling test was completed on three sample of Qunjia and Shangxinzhuang village of Huangzhong county and Dahua village of Huangyuan county, and the germination rate was more than 80%. 10 mu field cultivation was established on Maying village of Ledu county. Through the composition analysis indicated that active ingredient content in the root of 3 years cultivated Sinopodophullum hexandrum was exceeded than that of wild medicinal materials, which concluded that wild medicinal materials could completely replace by the cultivated medicinal materials

Book: “Ecological environment protection and circular economy in Qaidam of Qinghai Province”, Qinghai people's publishing house, 2013, 8. Editor in chief: Xie Changli, Chen Xiaoquan, Gou Xinjing, Zhou Guoying.

Publications

[1] Zhang Shijuan, Li Chunli, Zhou Guoying, Che Guodong, You Jinmao, Suo Yourui. Determination of the carbohydrates from Notopterygium forbesii Boiss by HPLC with fluorescence detection. CARBOHYDRATE POLYMERS, 2013,97(2): 794-799

[2] Hu Yan Feng, Zhou Guoying, Na Xiao Fan, Yang Lijing, Nan Wen Bin, Liu Xu, Zhang Yong Qiang, Li Jiao Long, Bi Yu Rong.Cadmium interferes with maintenance of auxin homeostasis in Arabidopsis seedlings. JOURNAL OF PLANT PHYSIOLOGY, 2013,170(11):965-975

[3] Zhao Xiao-Hui, Han Fa, Li Yu-Lin, Zhou Guo-Ying, Yue Hui-Lan. Semi-preparative separation and purification of three flavonoids from pedicularis longiflora var. tubiformis(Klotzsch) P. C. tsoong by HSCCC.JOURNAL OF LIQUID CHROMATOGRAPHY & RELATED TECHNOLOGIES, 2013,36(13):1751-1761

[4] Liu Demei, Chen Guichen, Lai Zhongping, Wei Haicheng, Zhou Guoying, Peng Min. Late Glacial and Holocene vegetation and climate history of an alpine wetland on the Qinghai-Tibetan Plateau.GEOLOGICAL QUARTERLY, 2013,57(2):261-268

[5] Liu Weigen, Zhou Guoying*, Xu Wenhua, DingDong, LiFan, Zhong Zebin, GC-MS Analysis of Extracted Essential oil Constituents of Notopterygium incisum by Supercritical CO_2, Chinese Journal of Spectroscopy Laboratory, 2013, 30（1）: 33-38 (*Corresponding author)

[6] Yang Lucun, Zhong Zebing, Liu Hechun, Song Wenzhu, Xu Wenhua, Zhou Guoying*, Structure Characteristics and biomass of Alpine shrub, Salix oritrepha, Bulletin of Botanical Research, 2013, 33（6）:653-658. (*Corresponding author)

高寒草地对全球气候变化的响应学科团组

1、研究内容

开展高寒草地物种对全球变化的响应与适应机制，生物地球化学循环，气候变化背景下高寒草地的演变过程及稳定性维持机制，为保障青藏高原的生态安全提供理论依据。

2、研究目标

发表SCI论文80篇。

3、学科团组内学科组名称

高寒草地生物地球化学过程学科组

高寒生态系统与全球变化学科组

陆地生态系统过程和功能对全球变化的响应和适应学科组

高山植物的光合及生理生态适应研究学科组

小哺乳动物种群调节及有害鼠类生物防治学科组

4、研究进展

天然高寒草地碳的固持及发生机制：完成了青海片区、西藏片区400个野外样点样品的全部采样工作；进行了全部土壤-植物体系碳氮及生产力等的分析测试工作，完成了青海加强点固碳速率、机制和潜力的调查，构建了青藏高原高寒草地碳增储潜力数据库。为先导专项“应对气候变化的碳收支认证及相关问题”课题的顺利实施，提供了基础保证。高寒草地健康与适应性管理：进行了青海黄南州、果洛州、海北州及藏北高原的高寒草地现状调查，结合以往调查数据，构建了高寒嵩草草甸退化演替模式，进行了成果申报。提出了高寒嵩草草甸不同演替状态划分的定量化判别指标。对处于不同退化演替状态草地，进行了恢复措施试验。

高寒草地生物地球化学过程学科组

学科组长:曹广民
邮箱:caogm@nwipb.cas.cn

学科组长：曹广民，博士，研究员，博士生导师。任生态中心主任，青海海北高寒草甸生态系统国家野外科学观测研究站站长。中国生态学会第八届理事，中国土壤学会第十二届理事。1986年7月获西北农业大学土壤农化专业学士学位，2010年12月获甘肃农业大学草业科学博士学位。长期从事高寒草地生态系统生物地球化学过程的研究工作。

在高寒草地与全球变化研究方面，进行了高寒草地碳储的空间分异特征及其高寒草甸主要植物类群对大气甲烷的行为分异特征研究，高寒矮嵩草草甸、垂穗披碱草人工草地和金露梅灌丛植物群落表现出了大气甲烷源，金露梅灌丛植物群落大气甲烷汇。人工草地的开垦会增加植物群落甲烷排放量；发现硝化作用是高寒草甸N_2O排放的主要过程，在年际尺度上，通过DNDC模型进一步定量土壤硝化和反硝化作用强度，表明硝化作用略高于反硝化作用强度。建立了多元回归模型，可以准确拟合高寒草甸土壤N_2O通量特征，土壤温度和草地生产力是影响其排放速率的关键因子。研究了自然、人为干扰下高寒草甸碳储生态服务功能的演变过程，发现矮嵩草草甸是退化演替系列中碳储能力、经济生产服务能力及生态系统稳定性配比最合理的时期，为适宜碳容管理阶段。近5年内发表学术期刊论文70余篇，其中SCI 16篇，目前承担的在研项目包括国家自然科学基金、国家科技支撑和中科院先导性项目共计6项。

学科组主要研究方向

高寒草地对自然与人类活动干扰的响应过程与发生机制；高寒草地碳储的空间分异特征及碳的增储潜力；高寒草地水源涵养功能对人类活动干扰的响应；高寒草地主要植物种对大气温室气体的行为分异特征。

2013年代表性研究成果

1. 高寒草甸植被类型对甲烷排放影响特征

高寒矮嵩草草甸、垂穗披碱草人工草地和金露梅灌丛植物群落表现出了大气甲烷源，其甲烷平均通量分别为：16.83 $\mu g.m^{-2}.h^{-1}$(-49.3–107.8)、28.49 $\mu g.m^{-2}.h^{-1}$(-55–96.2)和20.91 $\mu g.m^{-2}.h^{-1}$(-31.9–145.8)。金露梅灌丛植物群落甲烷通量为 -33.5±13.6 $\mu g.m^{-2}.h^{-1}$，表现为大气甲烷的汇。人工草地的甲烷通量显著高于天然高寒草地（$P<0.05$），说明在实验进行的海北地区人工草地的开垦会增加植物群落甲烷排放量。室内沙培实验中大部分的草本植物观测到了持续的甲烷排放现象，表明植物的甲烷排放与植物种类有很大的关系。

2. 高寒草甸N_2O排放过程研究

通过乙炔抑制方法发现在生长季时，高寒草甸硝化-反硝化、反硝化土壤N_2O 排放潜势分别为2.91±0.46 和1.97±0.58 $\mu g\ m^{-2}\ hr^{-1}$，表明硝化作用是高寒草甸N_2O排放的主要过程。在年际尺度上，通过DNDC机理模型进一步定量土壤硝化和反硝化作用强度分别为 52.85%和47.15%，硝化作用略高于反硝化作用强度。建立了高寒草甸N_2O排放通量多元回归模型，可以准确拟合土壤N_2O通量特征($r^2=0.663$), 土壤温度和草地生产力是影响其排放速率的关键因子。

3. 人类活动对高寒矮嵩草草甸的碳容管理分析

随着草地退化程度的加剧，地上植物有机碳储量逐渐降低，最高值出现在禾草 - 矮嵩草草甸，为145.9±6.7g m^{-2}；土壤有机碳储量和土壤 - 植物系统有机碳储量均先增高后降低，最高值均出现在矮嵩草草甸，其土壤及植物 - 土壤系统有机碳储量分别为14023.1±289.5g m^{-2}和18555.7±879.7 g m^{-2}。对极度退化的高寒矮嵩草草甸（黑土滩 - 杂类草次生裸地）进行人工草地建植，随着建植年限的增加，地上植物、土壤及植物 - 土壤系统有机碳储量较建植前有不同程度提高。说明矮嵩草草甸是该退化演替系列中碳储能力、经济生产服务能力及生态系统稳定性配比最合理的阶段，是该退化演替系列的适宜碳容管理阶段，可以明显提高草地的生态及生产服务能力，是该类草地的适宜碳容管理方式。

Global Change and Alpine Ecosystem Research Group

学科组成员

杜岩功(副研究员)

李茜(助理研究员)

张法伟(工程师)

林丽(工程师)

博士研究生

郭小伟 刘淑丽

硕士研究生

欧阳经政

Group Leader: Professor Guangmin Cao received his bachelor degree in soil agrochemical from Northwest Agriculture and Foresting University. He then got his Ph.D. in Pratacultural science from Gan Su Agriculture University. He main studies are on the biogeochemical cycling in alpine grassland in Northwest Institute of Plateau Biology, Chinese Academy of Sciences from 1986. He was the director of the eighth ecological society and the tenth soil science society.Focus in his research was global climate change in alpine meadow. Emission source were found among natural alpine meadows (NM), Elymus nutanspasture (EP), and herbaceous community in shrub (HS), respectively. Methane emission rate from EP was significantly higher than from NM during the growing season. Result of the sand culture experiment showed that some plant species emitted methane in an aerobic. The potential nitrification might be the dominant process in the alpine meadow during the growing season. N_2O flux could be well captured considering the main affecting factors by a linear regression model, which demonstrated that soil temperature and biomass play a large part in N_2O emission.Anther one was Spatial distribution characteristics of carbon sink in alpine meadow. Humilis meadow was the degradation of the carbon storage capacity of successional series of economic production capabilities and ecosystem stability ratio most reasonable stage. In the past five years, more than 70 papers published in academic journals, among which there were 16 science articles. He is the director of the National Natural Science Foundation, National Science and Technology Support Project and Pilot Project of Chinese Academy of Sciences.

Research Interests

The researches are distributed in alpine grassland , the first research interest is to study the biochemistry process in alpine grassland succession process in order to discovery the succession process and mechanism by human interference and climate change, establish the discrimination quantitative index system of alpine grassland degradation succession stages. The second research interest is to explore alpine grassland water conservation function, organic carbon increasing sink potentiality capacity and its reserve. The third research interest is to study the characteristics and theory of plants CH_4 release and absorption characteristics in alpine grassland ecosystem.

Research Progress in 2013

Aerobic methane emission from plants in the Qinghai–Tibet Plateau: comparative study of different communities and plant species

Average methane emission rates were estimated to be 16. 83μg.m^{-2}.h^{-1} (range−49. 3–107. 8), 28. 49 μg.m^{-2}.h^{-1} (range−55–96. 2) and 20. 91μg.m^{-2}.h^{-1} (range−31. 9–145. 8) for natural alpine meadows (NM), Elymus nutanspasture (EP), and herbaceous community in shrub (HS), respectively. Methane emission rate from EP was significantly higher than from NM during the growing season. The reclaim of grassland would enhance the methane emission in this aera through this one year`s measurement, but whether this conclusion suit to the whole Tibet Plateau, it remains further longer time and larger spatial scale experiments to verify it. The result of the sand culture experiment showed that some plant species emitted methane in an aerobic,non−microbial environment, most of herbaceous speciesshowed a methane emission characteristic, the methane emission from plant may have a species dependent characteristic.

Dominant process and mechanism of nitrous oxide flux in an alpine meadow on the Tibetan plateau

Nitrous oxide emission (N_2O) and its main process in a Kobresia humillis meadow were measured by acetylene inhibition during the growing season in 2009, and the DNDC model was validated by the N_2O fluxes of 2004 and 2005. The average fluxes were 2.91±0.46 and 1.97±0.58 μg m^{-2} hr^{-1} from nitrification-denitrification and soil denitrification process, thus indicating that the potential nitrification might be the dominant process in the alpine meadow. DNDC model also revealed that nitrification contributed 52.85% to N_2O flux, while denitrification contributed about 47.15%. The N_2O flux could be well captured considering the main affecting factors by a linear regression model (r^2=0.663), which demonstrated that soil temperature and biomass play a large part in N_2O emission, while biomass, soil organic matter, and mineral nitrogen concentration can also simulate the emission. Nevertheless, warming and increasing precipitation would mitigate the emission.

Carbon storage administration in alpine Kobresia humilis meadow in relation to influence of human activity

The organic carbon storage in aboveground plant parts significantly decreased from 145.9±6.7 g m^{-2} to 85. 9±5. 5 g m^{-2} ($p<0.05$), while that the highest aboveground parts was in Kobresia humilis community. Soil organic carbon and system of soil−community increased firstly, and then these decreased. The peak flux was found in Kobresia humilis community. Furthermore, these were 14023. 1±289. 5g $m^{-2}$and 18555.7±879. 7 g m^{-2} respectively. The aboveground plant, soil and plant - soil organic carbon storage were elevated than the former prior to planting in extreme degradation of alpine meadow (Black Beach - forbs secondary bare land) artificial grass planting. This was revealed that humilis meadow was the degradation of the carbon storage capacity of successional series of economic production capabilities and ecosystem stability ratio most reasonable stage, the degradation of successional series suitable carbon content management stage, that could significantly improve the grass ecology and production services capabilities, and it was suitable for carbon capacity management class grass.

高寒生态系统与全球变化学科组

学科组长:贺金生
邮箱:jshe@nwipb.cas.cn

学科组长：贺金生，博士，研究员，博士生导师，国家杰出青年基金获得者，2009年入选中科院西北高原生物所百人计划。1988毕业于兰州大学生物系，1998年在中国科学院植物研究所获得博士学位，1999-2002年在哈佛大学进化生物学系从事博士后研究。主要从事草地碳循环、化学计量生态学、以及高寒生态系统对全球变化响应和适应的研究。

近年来在以下方面取得了重要进展：(1)在植物功能属性方面，发现叶片形态结构和生理功能(如最大光合速率等)之间存在统一的权衡关系，这种权衡不因植物的生活型和研究区域而发生变化(Ecology 2009)；发现青藏高原极端环境下植物生态属性之间的关系遵循热带、温带地区的规律，证明植物生态属性之间存在趋同演化关系(New Phytologist 2006)；(2)在化学计量生态学方面，系统研究并阐明了我国草地优势植物C、N、P化学计量特征及其控制因子，发现中国草地优势植物C:N和N:P 比率相对稳定，其调控因素是物种组成而不是气候的直接作用(Oecologia 2006, 2008)；(3)在生物多样性方面，证明野外观察到的生物多样性-生产力的正相关关系是生物多样性、生产力随环境梯度独立变化的表观现象，而非本质的联系(Global Ecology & Biogeography 2010)。他有关中国草地的研究得到了国内外同行的高度评价，被聘为包括Frontiers in Ecology and the Environment 在内的4个国际重要专业期刊的编委。承担包括973课题、国家自然科学基金项目在内的各类主要科研任务10余项，发表国际主流期刊文章90余篇。

学科组主要研究方向

1、高寒草地对全球变化的响应与适应；
2、高寒湿地温室气体排放及其对全球变化的反馈；
3、青藏高原草地生态系统固碳现状、速率、机制和潜力；
4、高寒草地碳、氮循环模式及调控。

2013年代表性研究成果

1）在内蒙古草原和青藏高原草地，采集了84个样点151个物种的植物和土壤样品，测定了叶片总酚类物质、紫外吸收物质的含量以及叶片氮、磷以及比叶面积，研究了内蒙古草地和青藏高原植物叶片总酚物质和紫外吸收物质含量的差异，并利用结构模型在空间尺度上分析了植物总酚类物质含量变化的驱动因子（例如紫外辐射强度、温度、降雨及土壤养分），并且探讨植物酚类物质与叶片功能属性之间的关系。结果发现：（1）青藏高原草地植物叶片的总酚类和紫外吸收物质含量显著高于内蒙古草原植物，并且这种差异不受植物系统发育的影响；（2）在大空间尺度上，紫外辐射强度是植物叶片总酚类物质含量变化的主要驱动力；（3）植物叶片总酚类物质和紫外吸收物质与叶片功能属性（比叶面积、叶片氮、磷以及氮磷比值）之间具有显著的相关关系，并且这些关系在低海拔的内蒙古草原植物中表现的更强。因此，较高的叶片酚类物质含量有利于植物对青藏高原强紫外线辐射环境的适应，而且叶片酚类物质含量可能影响了植被的属性特征进而间接地影响了生态系统的功能。该研究结果发表在Ecology and Evolution上(Chen et al. 2013)。

2）利用传统手动静态箱法，连续自动箱式法以及涡度相关法三种手段对海北生态系统定位站高寒湿地CH4通量进行了监测，研究发现，在CH_4通量的季节动态上三种方法的测定存在很好的一致性，但是连续自动箱式法以及涡度相关法测定的日动态存在差异。连续自动箱式法测定的CH_4日排放通量的变异与土壤温度正相关，而涡度相关法测定的CH4排放通量的变异白天与太阳辐射以及CO_2净排放通量相关，夜晚与土壤温度相关。传统手动静态箱法早晨9:00-12:00之间测定的CH_4通量要比连续自动箱式法以及涡度相关法测定值分别高出25.3%以及7.6%，本研究结果发表在Environmental Pollution上（Yu et al. 2013）。

Global Change and Alpine Ecosystem Research Group

学科组成员

Daniel Flynn(博士，外籍青年科学家)

张振华(助理研究员)　陈立同(助理研究员)

博士研究生

杨晓霞　米兆荣　朱文琰　任飞

硕士研究生

汪浩　武丹丹

Group Leader: Dr. Jin-Sheng He, winner of the National Fund for Distinguished Young Scientists, and Hundred Talents Program of Chinese Academy of Sciences. Dr. He was graduated from Department of Biology, Lanzhou University in 1988. He obtained his Ph.D. in Institute of Botany, Chinese Academy of Sciences in 1998. He pursued postdoctoral research with Dr. Fakhri Bazzaz in Department of Organismic and Evolutionary Biology, Harvard University from 1998 to 2002. In 2002, Dr. He joined the Department of Ecology, Peking University, dedicating to studies on carbon stocks and dynamics, C:N:P stoichiometry across Chinese grassland biomes, and the response and adaptation of alpine ecosystem to global change. Dr. He joined Northwest Institute of Plateau Biology, Chinese Academy of Sciences in 2009 as senior scientist of Hundred Talents Program.

In recent years, Dr. He's group has made considerable progress in following areas: (1) Plant functional traits: They found consistent trade-offs between leaf productivity and persistence which are independent of plant life form and research regions (Ecology 2009). They reported that co-variations of leaf traits on the Tibetan Plateau were consistent with those on the global scale, demonstrating convergent evolution in plant functioning (New Phytologist 2006). The paper was regarded as one of the cutting-edge international research in New Phytologist (Woodward and Slater 2007); (2) Ecological Stoichiometry: They conducted a systematic census of foliar C:N:P stoichiometry and examined factors regulating the grassland foliar stoichiometry. Although the grasslands of China are widely distributed, the ratios of C:N and N:P in dominant species are relatively constant. Species composition, rather than direct climatic variables, is the major determinant of grassland foliar stoichiometry (Oecologia 2006, 2008); (3) Biodiversity and ecosystem functioning: they revealed that the positive Species Richness-ANPP relationship across large-scale environmental gradients was mostly likely the result of climatic variables influencing SR and ANPP in parallel. There is no direct relationship between SR and ANPP (Global Ecology & Biogeography 2010).

Research Interests

(1) Responses and adaptations of alpine grassland to global climate change; (2) Alpine wetland GHGs emissions and their feedback to global climate change; (3) Rate, mechanism and potential of carbon sequestration in the grassland ecosystems on the Tibetan Plateau; (4) Carbon and nitrogen cycling and their regulation mechanisms in alpine grasslands.

Research Progress in 2013

(1) We measured leaf total phenolics, ultraviolet-absorbing compounds (UVAC), and corresponding leaf N, P, and specific leaf area (SLA) in 151 common species. These species were from 84 sites across the Tibetan Plateau and Inner Mongolian grasslands of China. Overall, leaf phenolics and UVAC were all significantly higher on the Tibetan Plateau than in the Inner Mongolian grasslands, independent of phylogenetic relationships between species. Regression analyses showed that the variation in leaf phenolics was strongly affected by climatic factors, particularly UVR, and soil attributes across all sites. Structural equation modeling (SEM) identified the primary role of UVR in determining leaf phenolic concentrations, after accounting for colinearities with altitude, climatic, and edaphic factors. In addition, phenolics correlated positively with UVAC and SLA, and negatively with leaf N and N: P. These relationships were steeper in the lower-elevation Inner Mongolian than on the Tibetan Plateau grasslands. Our data support that the variation in leaf phenolics is controlled mainly by UV radiation, implying high leaf phenolics facilitates the adaptation of plants to strong irradiation via its UV-screening and/or antioxidation functions, particularly on the Tibetan Plateau. Importantly, our results also suggest that leaf phenolics may influence on vegetation attributes and indirectly affect ecosystem processes by covarying with leaf functional traits (Chen et al. 2013)

(2) We compared three approaches, the traditional discrete Manual Static Chamber (MSC), Continuous Automated Chamber (CAC) and Eddy Covariance (EC) methods of measuring the CH4 fluxes in an alpine wetland. We found a good agreement among the three methods in the seasonal CH_4 flux patterns, but the diurnal patterns from both the CAC and EC methods differed. While the diurnal CH_4 flux variation from the CAC method was positively correlated with the soil temperature, the diurnal variation from the EC method was closely correlated with the solar radiation and net CO_2 fluxes during the daytime but was correlated with the soil temperature at nighttime. The MSC method showed 25.3% and 7.6% greater CH_4 fluxes than the CAC and EC methods when measured between 09:00 h and 12:00 h, respectively (Yu et al. 2013).

Publications

[1] Chen LT, Niu KC, Wu Y, Geng Y, Mi ZR, Flynn DFB, He J-S* 2013. UV radiation is the primary factor driving the variation in leaf phenolics across Chinese grasslands. Ecology and Evolution 3: 4696-4710.

[2] Yu LF, Wang H, Wang GS, Song WM, Huang Y, Li S-G, Liang NS, Tang YH, He J-S* 2013. A comparison of methane emission measurements using eddy covariance and manual and automated chamber-based techniques in Tibetan Plateau alpine wetland. Environmental Pollution 181: 81-90.

[3] Zhang ZH, Duan JC, Wang SP*,Luo CY, Zhu XX, Xu B, Chang XF, Cui SJ 2013. Effects of seeding ratios and nitrogen fertilizer on ecosystem respiration of common vetch and oat on the Tibetan plateau. Plant and Soil 362: 287-299.

陆地生态系统过程和功能对全球变化的响应和适应学科组

学科组长:李英年
邮箱:ynli@nwipb.cas.cn

学科组长：李英年，研究员，硕士生导师，1982.8-1990.2，在青海省气象局从事大气监测、预报等工作。1990.3-至今，在中国科学院西北高原生物研究所/海北高寒草甸生态系统国家野外科学观测研究站从事气象监测及生态学研究工作，涉及气象学、生态气象学、环境、全球变化等领域。多年来主持和参加中国科学院知识创新工程重大项目、国家重点基础研究发展规划项目（973）计划课题、中日合作项目、国家自然基金项目、中国科学院战略性先导科技专项等项目9项。曾被青藏研究会评为第三届青藏研究优秀青年科技工作者；研究成果“高寒草甸生态系统与全球变化”获得青海省科技进步奖一等奖（7完成人），“三江源湿地变化与修复研究与示范”获青海省科技进步二等奖（7完成人）。先后发表论文和参与编写著作180多篇（部），其中SCI收录有近20余篇。

学科组主要研究方向

全球变化生态学：1）生态系统碳通量；碳氮水热耦合；固碳潜力；2）不同土地利用方式对高寒草地的影响；3）典型地区植物多样性保护和水源涵养等功能变化过程与机制。

2013年代表性研究成果

1）海北高寒草甸不同封育年限植被现存碳密度表现出封育16年 > 封育1年 > 封育6年，但差异不显著。土壤碳密度垂直分布明显，随土层深度增加土壤有机碳密度明显下降，土壤容重上升；不同封育年限之间0-40cm层次土壤碳密度和土壤容重差异性均不显著，但仍可表现出土壤碳密度封育1年 > 封育6年 > 封育16年；同时，土壤容重随封育时间延长而下降。对7月下旬到10月上旬净生态系统CO_2交换率监测来看，封育1年植被土壤碳吸收速率显著高于封育16年；而排放率与封育16年样地接近，差异不显著。

2）基于静态箱式法和生物量评估海北金露梅灌丛草甸碳收支发现，高寒金露梅灌丛草甸生态系统呼吸、土壤呼吸和植物呼吸年总量分别为886.28gC/m^2、444.93gC/m^2和441.36gC/m^2；呼吸与5cm地温具有极显著的指数关系，R2在0.83以上，温度敏感系数（Q10）分别为4.13、4.40和3.16；8年平均而言生态系统年均净固碳量为27.19gC/m^2，即高寒金露梅灌丛草甸生态系统为碳汇。

3）祁连山南坡夏季牧场的高寒杂草类草甸生态系统呼吸速率与5cm日均地温具有极显著的指数关系，轻牧、中牧和重牧条件下生态系统呼吸对温度的敏感性系数（Q10）分别为4.28、4.16和4.43，土壤呼吸的Q10分别为3.33、3.24和3.44；生态系统呼吸和土壤呼吸均表现出冬季低，夏季高。轻牧、中牧和重牧梯度下生态系统年呼吸碳量分别为854.64、909.79和811.70g·m^{-2}·a^{-1}，而土壤呼吸碳量分别为564.24、606.92和534.56 g·m^{-2}·a^{-1}。随着放牧强度增大，净初级生产碳量（分别为766.65、707.75和570.36 g·m^{-2}·a^{-1}）和生态系统碳汇能力（分别为351.93、261.98和177.76 g·m^{-2}·a^{-1}）逐渐减弱，但均表现为强碳汇区。

4）基于涡度相关法研究了2003—2011年海北高寒灌丛草甸生态系统的蒸散量变化特征及水分收支状况。结果表明：2003—2011年，研究区蒸散量的季节变化明显,最大值一般出现在生长旺季的7—8 月，达4. 4 ~5. 7 mm·d^{-1}；最小值多出现在1 月或12 月(0. 09±0. 04 mm·d^{-1})。 蒸散量的年际动态明显，为451. 3 ~681. 3 mm，其中，生长季占70%以上。年蒸散量与年降水量之比的平均值为1. 06±0.17，表明该生态系统的年水分收支状况基本平衡，几乎所有的降水都以蒸散的形式消耗.

5）氮添加能显著促进植物生长，改变土壤充水孔隙度，但短期内没有改变土壤有机氮储存。与对照相比，低水平的氮添加，显著降低甲烷气体的季节排放。土壤的甲烷通量主要由土壤孔隙度决定，其次由可利用的有机氮决定。氮添加增强了土壤充水孔隙度、pH和硝态氮。氮添加导致的甲烷排放量的减少可能主要是因为物质扩散的减少，而对甲烷氧化菌的抑制作用是较弱的。结果表明土壤有机氮是甲烷排放的调节物质，它对甲烷的促进或抑制取决于氮的状态。

Response and Adaptability of the Terrestrial Ecosystem Processes and Functions to Global Change Group

学科组成员

李红琴

硕士研究生

吴启华　毛绍娟

Group Leader: Yingnian Li, professor, 1982.8–1990.2, worked at meteorological agency in Qinghai province before 1990. From March 1990 until now, has been working at Northwest Institute of Plateau Biology, Chinese academy of sciences / Haibei Alpine Meadow Ecosystem Research Station and engaged in meteorological monitoring and ecology research involving meteorology, ecological meteorology, environment and global change, etc. So far, He has hosted 9 projects including the Knowledge innovation project of the Chinese academy of sciences, National key basic research program of China (973), Sino–Japanese cooperation project, National natural science foundation of China, Strategic pilot science and technology projects of Chinese Academy of Sciences and so on. Once, was honored with "Outstanding youth science and technology workers of the Tibetan research". In May, 2010, "alpine meadow ecosystem and global change" won the first prize of Qinghai province progress prize in science and technology (7 persons involved). In May, 2012, "Research and demonstration of changes and repairation of three rivers' wetland" won the second prize of Qinghai province progress prize in science and technology (7 persons involved). Has published and participated in more than 180 articles, 20of which were included by SCI.

Research Interests

Global change ecology: 1) Carbon flux of ecological system; Coupling of Carbon–nitrogen–water–heat; Carbon potential; 2) Adaptability and response of vegetation productivity to global change. 3) Influence of the different land use patterns on the alpine grassland.

Research Progress in 2013

1) In the south of the Qinghai province, the carbon densities of alpine meadows vegetation of the mild, moderate, severe and extreme severe degeneration are 228.046 gC/m^2, 339.329 gC/m^2, 911.354 gC/m^2 and 1073.355 gC/m^2 respectively, more than that in the north of the province, and the 0-40cm soil carbon densities of them are 3.545 kgC/m^2, 4.160 kgC/m^2, 5.946 kgC/m^2 and 7.359 kgC/m^2, respectively, more than that in the north of the province, which show that the southern alpine meadows vegetation has more potential for carbon sequestration.

2) Research on carbon budget of *Alpine Potentilla* fruticosa Shrubland based on comprehensive techniques of static chamber and biomass harvesting was carried out and the results were that the annual carbon accumulations of the soil, vegetation and ecosystem respiration rates were 444.93, 441.36, and 886.28 g C/m^2, respectively. The respiration rates of the shrub, grass, and exposed field plots correlated exponentially and significantly with the soil temperature at a depth of 5 cm (R^2=0.94, 0.95, and 0.83, respectively). Respiration entropy, Q10 (the magnitude of the respiration rate change with a 10 °C change in temperature), of the treatments was 4.13, 4.40, and 3.16, respectively. The alpine shrubland ecosystem acted as weak carbon sink and on average absorbed 27.19 gC/m^2 per year from the atmosphere.

3) Soil particulate organic carbon (POC) in the alpine meadow mainly accumulated in the top 10 cm and accounted for more than 64% of the total soil organic carbon (SOC) content, reflecting the lability and poor stability of the soil organic matter. Three-year N addition significantly changed the contents of soil coarse particulate organic carbon (CPOC), fine particulate organic carbon (FPOC) and mineral associated organic carbon (MOC). N addition tended to increase soil POC contents in the peak of the growing season, while significantly reducing them in the early and end of the growing season. However, soil MOC content responded insensitively to N addition. N addition also significantly lowered the top soil POC/MOC ratio in the early growing season, suggesting an increase in the stability of SOC.

4) The responses to grazing of individual traits and PFTs were analyzed along a grazing gradient in an alpine shrub meadow on the Qinghai-Tibet Plateau, China. We have demonstrated that a minimum set of PFTs resulting from optimal individual traits can provide consistent prediction of community responses to grazing in this region. This approach provides a more accurate indicator of change within a changing environment than do univariate measures of species diversity.

高山植物的光合及生理生态适应研究学科组

学科组长:师生波
邮箱:sbshi@nwipb.cas.cn

学科组长：师生波，研究员，博士，博士生导师。主要从事高山植物的光合生理和极端环境的生理生态适应性研究。近年来，针对青藏高原强太阳可见光和UV-B辐射的特点，开展了高山植物对强太阳光的适应性研究，在过剩激发能的非辐射耗散、光合电子传递活性、光合机构的光抑制等方面做了大量探索。阐明了叶片光形态结构变化，紫外线吸收物质和抗氧化系统在强光胁迫中的作用，提出强UV-B辐射“促进”叶片光合色素含量的升高是一种表象的观点。已主持国家自然科学基金，国际科技合作重点项目计划（纳入973计划）等项目。曾在中科院上海植物生理研究所和北京植物研究所做国内访问研究，并多次到日本、瑞典、英国进行交流和访问进修，与国际知名学者Lars Olof Björn等一直保持有较好的联系。迄今，已在国内外各学术刊物发表研究论文近60余篇。现任中国植物生理学会第十届理事会理事，并担任中国植物生理学会西部开发工作委员会副主任委员，青海省自然科学与工程技术学科带头人。

学科组主要研究方向

研究工作主要集中在典型高山植物对高原逆境胁迫的驯化适应等方面，开展了高原极端环境下典型高山植物的生理生态适应机理研究；同时，以青藏高原强太阳UV-B辐射为切入点，在高寒矮嵩草草甸开展了系列UV-B辐射的试验，从群落结构、物种多样性、植物叶片的光形态结构、光合生理等方面探讨了高原情UV-B辐射对草地生态系统和主要高山植物的影响。

2013年代表性研究成果

论文：

[1] 朱鹏锦, 杨莉, 尚艳霞, 师生波, 韩发. 青藏高原几种高山植物的光合生理特性.草业科学, 2013, 30(6): 886-892.

[2] 朱鹏锦, 杨莉,师生波, 韩发. 不同海拔高山植物美丽风毛菊生理生化特性的研究.绿色科技, 2013, 7:54-57.

[3] 杨莉, 师生波, 贺金生. 青海省玛沁县冬虫夏草适生地植物群落及土壤理化性质分析.草地学报, 2013, 21(3):467-473.

美丽风毛菊

冬虫夏草

Adaptation and Photosynthesis of Alpine Plants Group

硕士研究生

李妙　孙亚男

Group leader: Professor Shengbo Shi is a plant eco-physiologist and his main research is on the physiological adaptability of photosynthetic apparatus in alpine plants. For a long time, he worked in Haibei Alpine Meadow Ecosystem Station, CAS, and performed a series of experiments. In recent years, based on strong solar visible and UV-B radiation in the Qinghai-Tibet plateau, the adaptive characteristics of alpine plants to strong solar light was researched. A lot of explored jobs were made such as radiation energy dissipation, photosynthetic electronic transfer activity, and photoinhibition of photosynthetic apparatus. The results indicated that changes of the leaf photomorphology, UV-B-absorbing compounds and antioxidant system play the main role against strong light stress, and proposed that strong UV-B radiation "promotion" the increasing of concentration of photosynthetic pigments is an image idea and not an intrinsically view. He already have presided over some funds from national natural science and key international technology cooperation plan (belong to 973 plan) and other projects, and has published nearly 60 articles in related fields. As visiting scholar, he has visited and studied in Sweden, Japan, and Britain in recent years, and finished several related researches.

Research Interests

Recently, my research interesting was mainly focused on the adaptability of alpine plants to harsh environmental factors and increased UV-B radiation caused by depletion of stratospheric ozone layer over Qinghai-Tibet region. In natural field site of alpine meadow, photosynthetic gas metabolism and the chlorophyll fluorescence method were used on main alpine plants, together with the physiological and biochemical analysis in the laboratory, a number of eco-physiological adaptation researches were carried out in plateau harsh environmental condition. At the same time, based on strong solar UV-B radiation in Qinghai-Tibet plateau, simulating increased solar UV-B intensity as global climate change background, physiological effect of photosynthetic apparatus were studied in some native alpine plants.

Research Progress in 2013

Base on the early researches in alpine plants, we carried out a series of explored measurements on Saussurea superba and Anisodus tanguticus in these two years. The researches were focused on the response of different developed leaves to strong solar light. We try to find the physiological differences of photosynthetic apparatus during the period of leaf expansion, and try to identify the differences in acclimation to strong light. We already finished one paper named “Changes in photosynthesis of alpine plant Saussurea superba during the periods of leaf expansion”. These measurements were useful for detective evolutionary of alpine plants to harsh environmental condition.

Publications

[1] ZHU Peng-jin, SHANG Yan-Xia, YANG Li, SHI Sheng-bo, HAN Fa. Comparison of photosynthetic pigment contents and the chlorophyll fluorescence of characteristics of different plant leaves in alpine meadow of Tibet plateau. Pratacultural Science, 30(6): 886-892

[2] YANG Li, SHI Sheng-bo, HE Jin-sheng. Analysis of Plant Community and Soil Physicochemical Properties in Ophiocordyceps sinensis Adaptive Area in Maqin County of Qinghai Province. Acta Agrestia Sinica, 21(3):467-473

小哺乳动物种群调节及有害鼠类生物防治学科组

学科组长:边疆晖
邮箱:bjh@nwipb.cas.cn

学科组长：边疆晖，博士，研究员，博士生导师。1985年毕业于甘肃农业大学，1998年在中科院西北高原生物研究所获动物生态学硕士学位，2001年在中科院西北高原生物研究所获动物生态学博士学位。2003年在浙江大学生命科学学院博士后流动站从事博士后研究2年。兼任《兽类学报》编委、中国生态学会动物生态专业委员会委员、中国动物学会兽类学分会理事等职。主要从事小哺乳动物种群生态学及鼠害防治的研究。先后参加国家七五科技攻关项目、中国科学院八五重大项目题等，主持国家自然科学基金5项，以及西北之光联合学者项目、国家科技支撑项目子专题、中国科学院知识创新工程重要方向项目、中国科学院院长择优基金和中国博士后基金等各1项。发表论文40余篇，作为主要参加者，1991年获中国科学院科技进步二等奖1项，以及1998年方树泉奖学金一等奖1项。

学科组主要研究方向

本课题组以青藏高原小哺乳动物为研究对象，采用种群生态学、神经生物学和免疫学的方法和技术手段，整合研究动物生理和行为及种群统计参数的功能及其近因和远因，探讨动物种群调节机理及有害啮齿动物的生物防治途径。主要研究兴趣包括：小哺乳动物种群的调节机理；有害啮齿动物的生物防治。

2013年代表性研究成果

母体密度应激与当前环境对根田鼠种群繁殖效应及其适应性研究

密度引起的母体对子代HPA轴的程序化可导致种群较低的补充率、繁殖状态比率及体重，并延迟了第二繁殖季节的繁殖启动时间，其越冬存活率与其补充率呈负相关关系。对F2代而言，出生于母体应激（即早期经历高密度的F1代雌体）的子代（F2代）有较高的FCM含量、较低的越冬存活率及体重。来自母体高密度F1代所组成的低密度子代种群，在整个实验期间一直维持较低的种群数量。说明，密度引起的母体应激导致了对F1代HPA轴的程序化，继而导致了F1代的繁殖抑制。由于在成体高密度环境中，F1代可通过抑制当前繁殖而增加来年存活（越冬存活），该繁殖抑制是对当前高密度环境的适应性繁殖对策，反之，则是一种非适应性对策。认为，在成体子代处于不同环境条件下，母体程序化对其适合度的不同效应可能是影响种群波动的一个重要的内部调节因子。

论文

何慧，曹伊凡，陈黎林，堵守杨，聂绪恒，边疆晖* 根田鼠粪便皮质酮的检测效能。兽类学报，33 (2)，164 -171，2013.

Population Regulation for Small Mammal Population and Biological Control Group

学科组成员
曹伊凡 (副研究员)
博士研究生
堵守杨
硕士研究生
聂绪恒 杨彦宾 张鑫

Group leader: Jianghui Bian was graduated from Gansu Agricultural University with Bachelor Degree. In 2011, he obtained his M.D and ph. D. in animal ecology in Northwest Institute of Plateau Biology, Chinese Academy of Sciences. In 2003, he was Postdoctoral fellow in College of Biology, Zhejiang University. He is Editorial member of Acta Theriologica Sinica, member of the Division of Animal Ecology, China Ecological Society, and member of the Division of Mammalogy, China Zoological Society. His research interests were population ecology and biological rodent control. In recent years, he take charge of Project supported by the National Natural Science Foundation of China , West Light Foundation of The Chinese Academy of Sciences, Knowledge Innovation Program of the Chinese Academy of Sciences, The National Key Technology R&D Program et al.

Research Interests

Population ecology, Mechanism of population self-regulation and rodent pest management.

Research Progress in 2013

The hypothesis that maternal effects may act as an adaptive bridge in translating maternal environments into offspring phenotypes and affect the population dynamics is not well understood, largely due to lack of sufficient field studies. Most notably, the process of maternal translations and the fitness of offspring phenotype alterations remain to be empirically explored in well controlled fields. In this study, the effects of maternal population density on offspring stress axis function, reproduction traits and population dynamics were studied in root voles (Microtus oeconomus). Maternal density stressed and unstressed offspring were obtained from predator prevented enclosures with high (initial density, 30 adults/sex/enclosure) and low (6/sex/enclosure) densities, respectively and subsequently introduced into their assigned enclosures following complete trapping the parental populations. Four offspring enclosures were established for each source origin, with 2 for each of 2 density treatments used for parental populations. Fecal corticosterone metabolites (FCM) levels, offspring reproduction traits and population dynamics were tested following repeated live trapping. Significant different characteristics in population fluctuations were observed between maternal density stressed and unstressed offspring. Population size in maternally unstressed offspring enclosures changed significantly across trapping sessions, and reached the similar levels in the two density treatment groups at the end of the first trapping season. In contrast, population size in maternally stressed groups was maintained relatively stable, and in the low density populations the level was sustained until end of experiment. Maternal density stress was associated with persistent elevations of FCM levels in both parents and offspring, and reproduction suppression, retarded growth and decreased body mass at sexual maturity in offspring. The FCM elevations and reproduction suppression were independent of offspring environment contexts and correlated with the decreased offspring quality. These findings indicate that intrinsic state alterations induced by maternal stress impair offspring capacity in response to immediate environment, and these alterations are likely mediated by maternal stress system. Our results suggest that maladaptive reproductive suppression seen in low density populations of maternally stressed offspring is one of ecological factors generating delayed density-dependent effects.

Publications

HE Hui, CAO Yifan, CHEN Lilin , DU Shouyang , NIE Xuheng, BIAN Jianghui. 2013. The utility of detecting corticosterone levels in feces of root vole (Microtus oeconomus), Acta Theriologica Sinica, 33 (2):164 -171