SOUTH CHINA BOTANICAL GARDEN CHINESE ACADEMY OF SCIENCES 2018 ANNUAL REPORT

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ANNUAL REPORT | 2018

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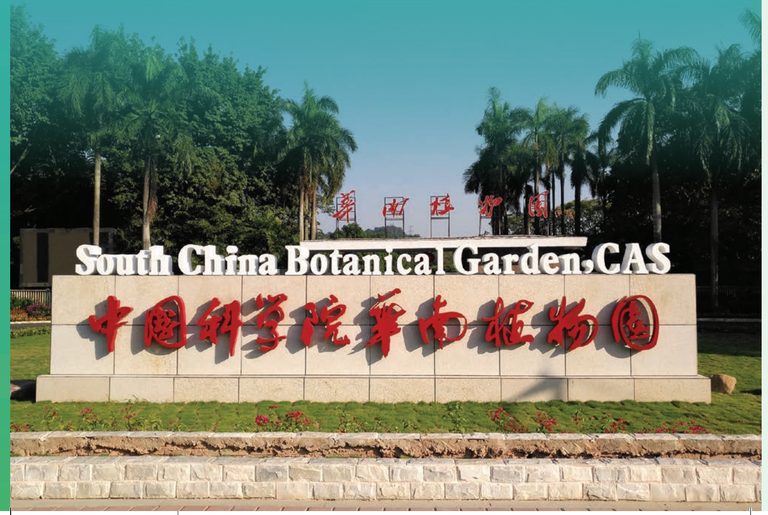


Headlines

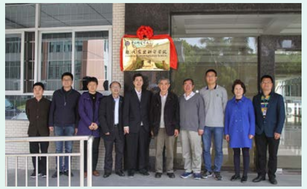
➤ January 15th, BAI Chunli, the president of CAS, investigated the vegetation restoration program of SCBG.

➤ February 14th, HUANG Ningsheng, the deputy governor of Guangdong Province, inspected SCBG for preparation work on the Spring Festival tourism boom.

➤ February 14th, LU Yongxiang, the former vice chairman of the standing committee of the National People's Congress and former president of CAS, investigated SCBG.

➤ February 28th, XIANG Libin, the vice president of CAS, investigated SCBG.

From March 19 to 22, the Workshop for Mango Fruit Quality in the Asia-Pacific Region was held in Guangzhou.

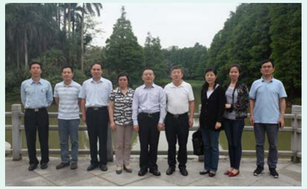


March 21st, the College of Advanced Agricultural Sciences (Guangzhou) of the University of the Chinese Academy of Sciences (UCAS) was established.

From March 22 to 23, SCBG held the first South China Nature Education BBS.

March 22nd, SCBG was jointly awarded the title of National Research and Popularization Base by CAS and the Ministry of Science and Technology.

From April 16 to 21, the International Long Term Ecological Research Network (ILTER) Workshop was held in Dinghushan.



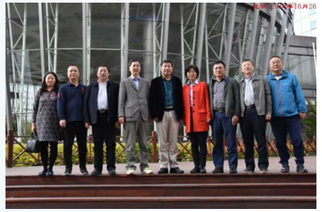
May 9th, SUN Yegang, the leader of Discipline Inspection and Supervision Group of the Central Commission for Discipline Inspection in CAS, investigated SCBG.

May 17th, HOU Jianguo, the vice president of the CAS, investigated SCBG.

September 21st, ZHANG Yaping, the vice president of CAS and JIANG Yueming, the deputy director of SCBG, visited San Marcos University in Peru and signed bilateral agreements.

Headlines

From October 8 to11, International Conference on Tropical Biodiversity 2018 was co-organized by SCBG in Malaysia.



From October 26 to27, the symposium on the plan for establishment of core botanical gardens of CAS was held in Kunming.

From November 22 to 23, the experts symposium for the authorization of the first-level discipline of horticulture in UCAS as well as the seminar on graduate course setting in horticulture was organized.

From November 26 to 28, ZHANG Fusheng, the secretary of the party committee and the discipline inspection committee of SCBG, led the team to contact the project in Dengzhou City of Henan Province.

December 25th, the Personnel Bureau of CAS and Guangzhou Branch organized the assessment meeting for the expiration of the term of administrative leadership of SCBG.

December 29th, SCBG successfully held art performance to celebrate the New Year of 2019 and the 40th Anniversary of "Spring of Science".

“One-Three-Five” Strategic Planning

1.One clearly-defined development strategy

Based on Southern China, we are committed to plant conservation, scientific research and knowledge dissemination at national and international regions with the same latitude. SCBG will develop into a high level research institution in the fields of botany, ecology, conservation and sustainable utilization of plant resources, and will be developed into a world-class botanical garden in five years.

2.Three major R&D breakthroughs

1) The theory and technology of rapid vegetation restoration on the tropical coral islands

2) Current pattern and changing trend of carbon pools in forest ecosystems in China

3) Large-scale application of fresh-keeping logistics technology for fruits and vegetables

3.Five top priorities

1) The compilation of Ex Situ Cultivated Flora of Chinese Botanical Gardens

2) The plant diversity evolutionary mechanism of the important family and genera at the south subtropical evergreen broad-leaved forest

3) Response and adaptation of subtropical monsoon evergreen broad-leaved forest ecosystem to global change

4) Exploration and industrialization of high value economic crops (Wolfberry, Dendrobium, Licorice, etc.)

5) Gene cloning for crop safety and quality and application of high efficiency transformation technologies

Director's Foreword

Dr. REN Hai

It has been another diligent but productive year for the South China Botanical Garden (SCBG) personnel as discussed in the contents of this annual report. On the occasion of ringing out the old year and ringing in the new year, on behalf of all the staff of SCBG, I would like to express my cordial gratitude and utmost respect to the leaders, colleagues and friends who have been concerning and supporting the development of SCBG.

In 2018, centered with the implementation of the "One-Three-Five Plan", SCBG has achieved the overall goal of "Taking the Lead in Action Plan", which includes entirely entering into the core botanical gardens of the Chinese Academy of Sciences (CAS), partly entering into the South China Sea Ecological and Environmental Engineering Innovation Research Institute and Seed Innovation Research Institute. The College of Advanced Modern Agricultural Sciences (Guangzhou) of the University of the Chinese Academy of Sciences (UCAS) was established and SCBG is in charge of the Department of Horticulture Science. The Tianhe Campus of Guangzhou College of UCAS will receive a joint investment about 980 million Yuan from Guangzhou Municipality and Tianhe District. The low cost and the high ecological effect of Tropical Coral Island vegetation restoration has been highly praised by the users. Two scientists were funded by The National Science Fund for Distinguished Young Scholars. Two staff members were evaluated as Scientific and Technological Innovation Leading Talents of WRJH, Young and Middle-aged Scientific and Technological Innovation Leading Talents of the Ministry of Science and Technology, respectively. Two staff members were awarded as Outstanding Members and Key Technical Talents of CAS Youth Innovation Promotion Association, respectively. One doctoral student won the Dean's Award for Excellence. SCBG made great progress in scientific research. For two consecutive years (from 2017 to 2018), the annual contract funding for new and innovative scientific research projects has exceeded 200 million Yuan. About 337 SCI papers were published, including 13 papers with the IF>9. SCBG ranked 23rd among the 69 CAS institutes listed in the global top 1% of ESI related disciplines in 2018. In the aspect of living collection, SCBG has a collection of 17560 taxa, which is ranked as the First in the Asia and Fourth in the global botanical gardens. SCBG also achieved great progress in the public education and sustainable utilization of plant resources (Santalum album was widely cultivated in Malaysia and Cambodia).

In terms of party building, we paid special attention to "Three Meetings and One Class", "Two Studies and One Action", the annual performance assessment on party building, strengthening of party divisions, and modeling of public organizations. The integration of the party committee's work and the research center's work was promoted by organizing the seminars to discuss the main challenges confronted by SCBG and participating in the decision-making, etc. The construction of innovation culture promoted the implementation of "One-Three-Five Plan".

In 2019, SCBG will face many challenges, including the construction of core botanical gardens and the Tianhe Campus of Guangzhou College of UCAS, the change of the affiliation of Dinghushan National Nature Reserve, the development and balance of different disciplines and , etc. However, SCBG will always adhere to the concept and philosophy "Democratic Management, Open Innovation and Talent-based Development" proposed by the Party Group of CAS, with the "Taking the Lead in Action Plan" as the main line, adjusting the management system and mechanism, focusing the human and financial resources to comprehensively promote various key works of the "One-Three-Five Plan".

The year 2019 marks the 70th anniversary of the People's Republic of China and SCBG will also celebrate its 90th birthday. SCBG has gone through difficulties and hardships for 90 years. The staff of SCBG will push forward the development of SCBG step by step, with rock-firm confidence, the energy of seizing every minute, and indomitable perseverance.

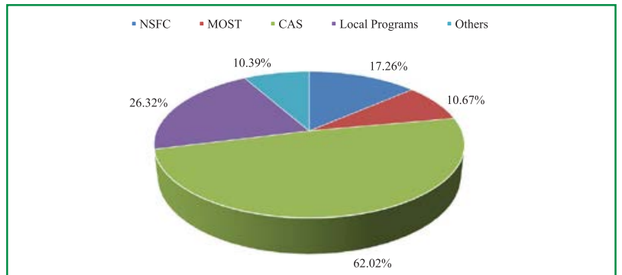
Dr. REN Hai
The Director of SCBG

Contents

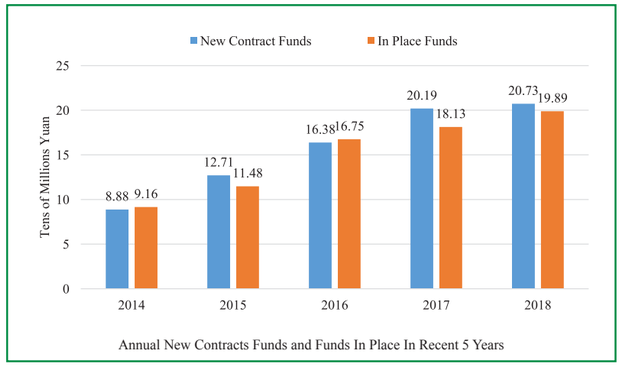
Research Achievements and Project Overview

In 2018, funds from newly contracted scientific projects reached 207.3 million Yuan. Funds in place reached 198.9 million Yuan.

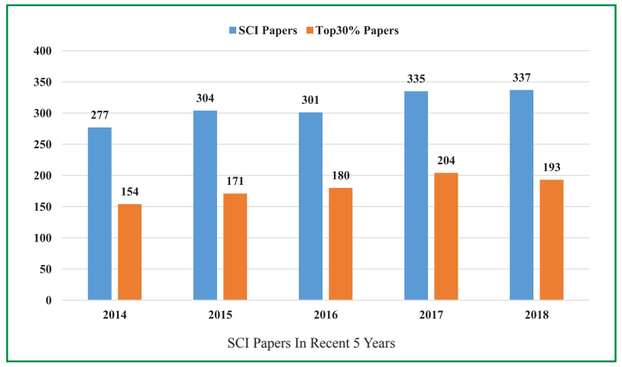
In 2018, SCBG published 337 SCI papers, of which 193 papers were listed as Top 30%, and 13 papers with the IF>9. In total, 45 patent applications were granted and 52 were submitted, 26 new cultivars were granted,16 monographs were published.



New Contract Funds In 2018



Annual New Contracts Funds and Funds In Place In Recent 5 Years



SCI Papers In Recent 5 Years

Highlighted Scientific Research Progress

1. Biotic and abiotic carbon sequestration processes and its response to environmental changes in tropical and subtropical region (The First Prize of Guangdong Provincial Science and Technology Awards)

Terrestrial net ecosystem carbon exchange (NEE) currently absorbs the equivalent of about 25% of all anthropogenic CO2 emissions and plays a significant role in regulating the variability of the global carbon cycle. Although most scientists believe that the atmospheric CO2 can be absorbed by land surface processes, exactly how much and where remained unclear until recently. On the continents, two major processes act as sinks for atmospheric carbon: the uptake of CO2 during photosynthesis and transformation to biomass organic matter in ecosystem, and the uptake of CO2 during rock weathering and transformation to dissolved inorganic carbon in continental waters.

Based on experiments and long-term observations, the project achieved the following findings: (1) Underground and belowground contributed about equally to the total net primary productivity in forest ecosystems or the total carbon uptake by karst water in tropical and subtropical regions; (2) Carbon uptake by forest ecosystems is greater in dry periods than that in wet periods, while carbon uptake by karst waters is greater in wet periods than that in dry periods. Rainfall was suggested a fundamental driver of seasonal variation of carbon sequestration in the subtropical and tropical forest ecosystems or karst waters; (3) Responses of carbon uptake by forest ecosystems or karst waters to nitrogen addition and rainfall pattern were significant, but were not significantly affected by rising atmospheric CO2 and global warming in the subtropical and tropical regions.

2. Research and application of key technologies for industrialization and utilization of characteristic plant resources in Guangdong Province (The First Prize of Guangdong Provincial Science and Technology Awards)

With the diversification of plant utilization types, the abundant plant resources in Guangdong Province have become the foundation of their industrialization application. However, diversities of plant species in some areas of Guangdong are not clear, which will seriously restrict their rational exploitation and utilization, even delay project implementation. Led by the Species Conservation Working Group of SCBG, collaborating with other 5 organizations, plants species and their distribution patterns in Guangdong were investigated and cleared up. According to close integration of basic research and application, some characteristic plants have been successfully finished evaluation and industrialization utilization.

Major investigation were focused on the biodiversity of plant resources in key areas such as Nanling Mountain, Yunkai Mountain, Pearl River Delta Region and Danxia landform. 26 new species were discovered in total. Meanwhile, some plants with high economic value such as *Michelia guangdongensis* were continuously traced and excavated. So far, 10 new varieties of *M. guangdongensis* and *Camellia azalea* have been successfully bred and formed local characteristics of new varieties in Guangdong.

In addition, specialized research on some worldwide families such as *Rosaceae* and *Magnoliaceae* was conducted. According to the ornamental and ecological characteristics of plants in these families, 62 new excellent plants were

dug out and considered fit for landscaping. Problems in the cultivation, propagation and conservation of *Cerasus* and *Santalum album* were solved. Regarding to ecological restoration, evaluations of suitable plants for special habitats were carried out, then 42 kinds of plants were screened out. And some key technologies such as ecological restoration of rock and mine slopes, soil improvement and water pollution purification were overcome.

Totally, 16 monographs and 230 research articles (including 95 SCI) were published. Besides, we own 69 authorized patents, 10 new national authorized varieties, 14 Guangdong high-tech products and five local standards. The above patents, new varieties and key technologies were quoted and adopted for industrialized technology research and demonstration in more than 20 provinces. About 140 million seedlings were produced, 220 thousand mu plantation area was extended and total 10.4 billion Yuan were earned.

3. What explains high plant richness in East Asia? Time and diversification in the tribe *Lysimachieae (Primulaceae)*

What causes the disparity in biodiversity among regions is a fundamental question in biogeography, ecology, and evolutionary biology. Evolutionary and biogeographic processes (speciation, extinction, dispersal) directly determine species richness patterns, and can be studied using integrative phylogenetic approaches. However, the strikingly high richness of East Asia relative to other Northern Hemisphere regions remains poorly understood from this perspective. Here, for the first time, we test two general hypotheses (older colonization time, faster diversification rate) to explain this pattern, using the plant tribe *Lysimachieae* (*Primulaceae*) as a model system. We generated a new time-calibrated phylogeny for *Lysimachieae* (13 genes, 126 species), to estimate colonization times and diversification rates for each region and to test the relative importance of these two factors for explaining regional richness patterns. We find that neither time nor diversification rates alone explain richness patterns among regions in *Lysimachieae*. Instead, a new index that combines both factors explains global richness patterns in the group and their high East Asian biodiversity. Based on our results from *Lysimachieae*, we suggest that the high richness of plants in East Asia may be explained by a combination of older colonization times and faster diversification rates in this region.

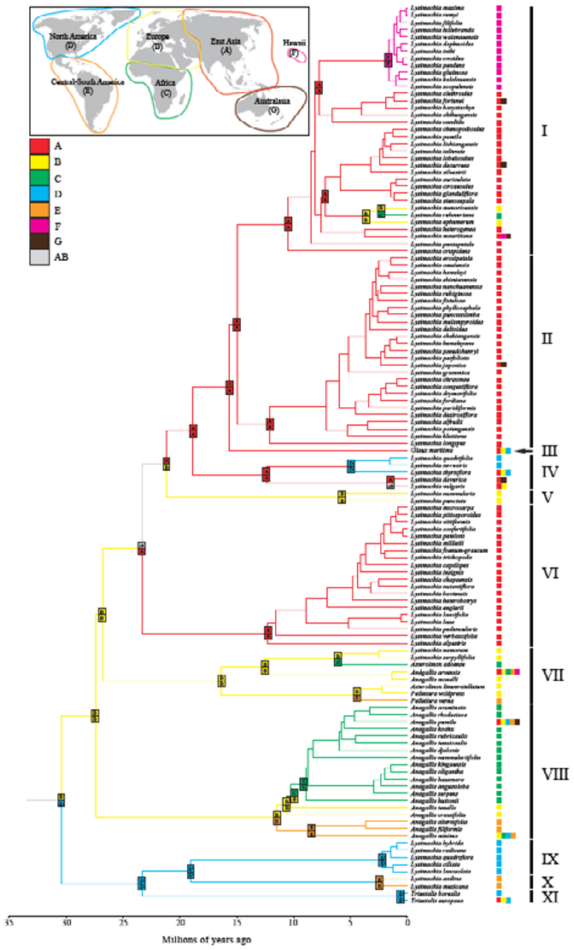


Figure 1. Phylogeny and biogeographic reconstructions for *Lysimachieae*.

This research was published in *New Phytologist*, 2018, 219: 436-448.

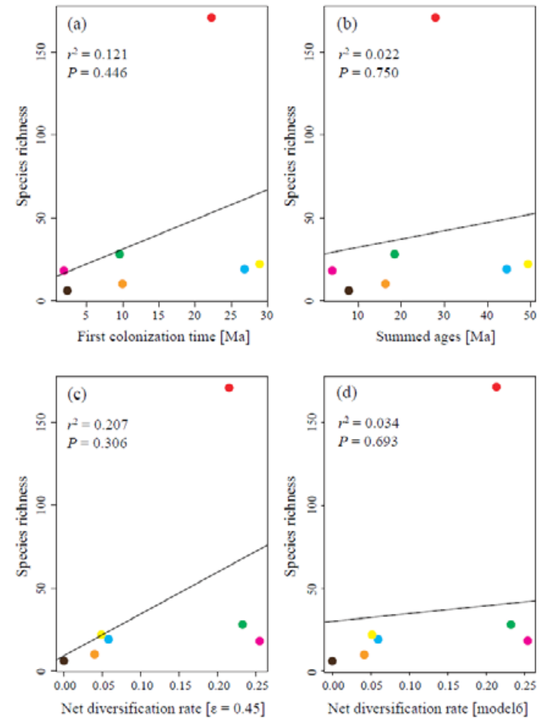


Figure 2. Time and diversification separately fail to explain species richness of *Lysimachieae* across seven regions.

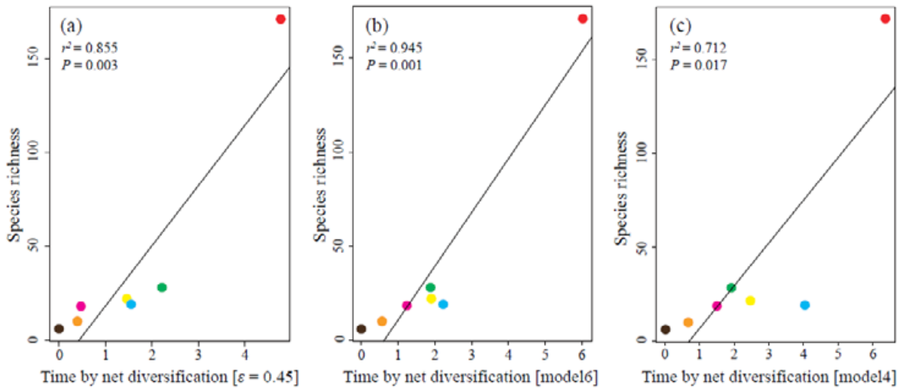


Figure 3. Time and diversification rates together explain species richness of *Lysimachieae* across seven regions.

4. Homeologue-specific expression divergence in the recently formed tetraploid *Capsella bursa-pastoris (Brassicaceae)*

Following allopolyploid formation, extensive genome evolution occurs, with the eventual loss of many homeologous gene copies. Although this process of diploid ization has occurred many times independently, the evolutionary forces determining the probability and rate of gene loss remain poorly understood. Here, we conduct genome and transcriptome sequencing in a broad sample of Chinese accessions of *Capsella bursa-pastoris*, a recently formed allotetraploid. Our whole genome data reveals three groups of these accessions: an Eastern group from low-altitude regions, a Western group from high-altitude regions and a much more differentiated Northwestern group. Population differentiation in total expression was limited among closely related populations; in contrast, the relative expression of the two homeologous copies closely mirrors the genome-wide SNP divergence. Consistent with this, we observe a negative correlation between expression changes in the two homeologues. However, genes showing population genomic evidence for adaptive evolution do not show an enrichment for expression divergence between homeologues, providing no clear evidence for adaptive shifts in relative gene expression. Overall, these patterns suggest that neutral drift may contribute to the population differentiation in the expression of the homeologues, and drive eventual gene loss over longer periods of time.

This research was published in *New Phytologist*, 2018, 220: 624-635.

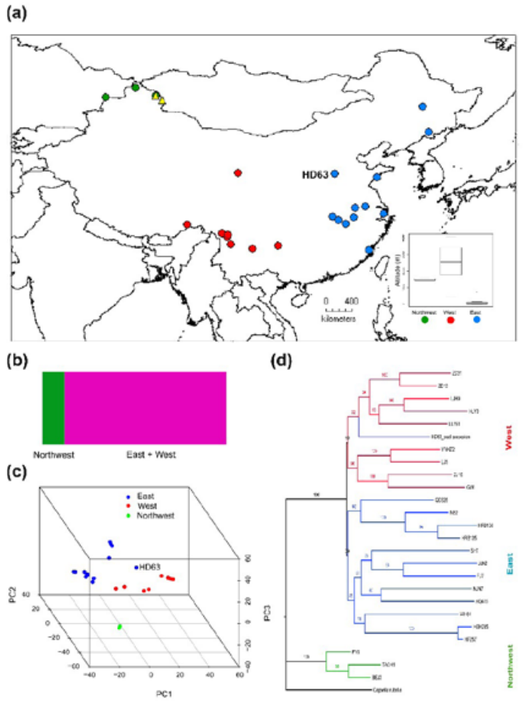


Figure 1. Geographical distribution and genetic structure of *Capsella bursa-pastoris* in China.

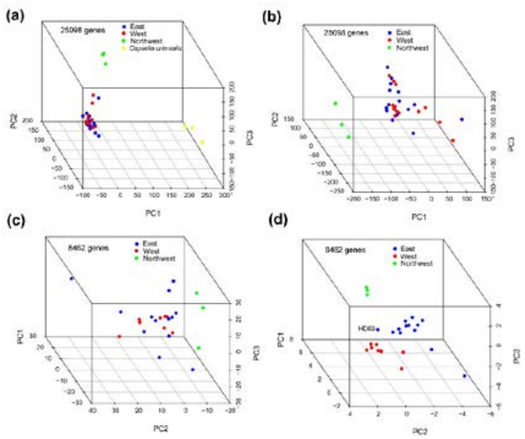


Figure 2. Principal components analyses (PCA) on expression datasets in *Capsella*.

5. The largest early-diverging angiosperm family is mostly pollinated by ovipositing insects and so are most surviving lineages of early angiosperms

Insect pollination in basal angiosperms is assumed to mostly involve "generalized" insects looking for food, but direct observations of ANITA grade (283 species) pollinators are sparse. We present new data for numerous *Schisandraceae*, the largest ANITA family, from fieldwork, nocturnal filming, electron microscopy, barcoding and molecular clocks to infer pollinator/plant interactions over multiple years at sites throughout China to test the extent of pollinator specificity. *Schisandraceae* are pollinated by nocturnal gall midges that lay eggs in the flowers and whose larvae then feed on floral exudates. At least three *Schisandraceae* have shifted to beetle pollination. Pollination by a single midge species predominates, but one species was pollinated by different species at three locations and one by two at the same location. Based on molecular clocks, gall midges and *Schisandraceae* may have interacted since at least the Early Miocene. Combining these findings with a review of all published ANITA pollination data shows that ovipositing flies are the most common pollinators of living representatives of the ANITA grade. Compared to food reward-based pollination, oviposition-based systems are less wasteful of plant gametes because (1) none are eaten and (2) female insects with herbivorous larvae reliably visit conspecific flowers.

This research was published in *Proceedings of the Royal Society Biological Sciences*, 2018, 285: 20172365.

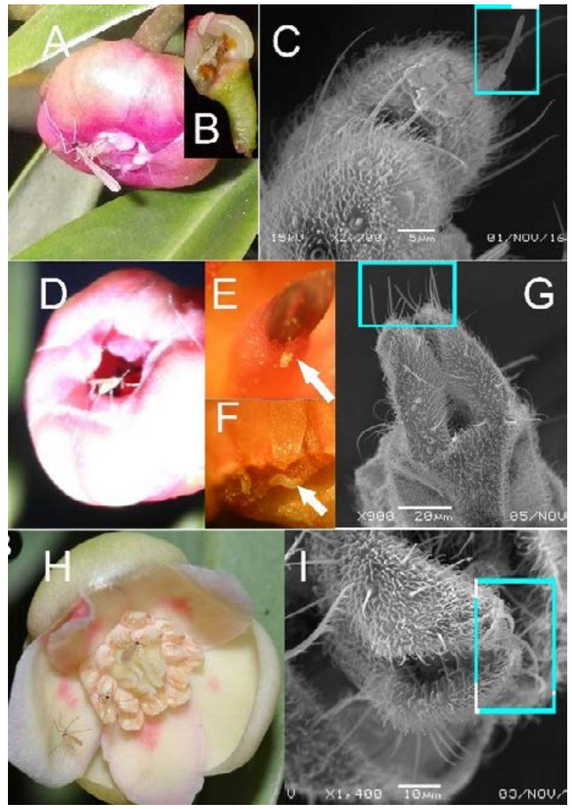


Figure. Llicium flowers, pollinators and abdominal cerci under SEM.

6. Recent progress on the evolution of sexual systems in *Mussaenda*

The evolution of dioecy (production of male and female flowers by separate plants) has interested evolutionary biologists from Darwin onwards. Although dioecy is widely scattered in angiosperms families, only 7-8% are dioecious. Dioecious clades are often at the tips of phylogenies, and often have significantly lower species richness than hermaphroditic sister groups. Therefore, dioecy has been described as an evolutionary dead-end in flowering plants.

The species of *Mussaenda L. (Rubiaceae)* are important horticultural plant resources. In this genus, species have diverse sexual systems, providing an attractive model to explore the evolutionary appearances and transitions between sexual systems and growth forms. The phylogenetic and reproductive biology research group have been studying about the life-type and sexual systems in *Mussaenda* for 14 years, and completed the related research for more than half species. We studied the evolution of the sexual systems in *Mussaenda* using a robust phylogeny based on eight plastid regions to explore its evolutionary pathways and assess the evolutionary correlation between dioecy and climbing habit and their respective influences on diversification rates. Our character reconstruction analyses revealed distyly as the most likely ancestral state in *Mussaenda*. Distyly has broken down at least three times and gave rise to dioecy, short-styled floral monomorphism, and long-styled floral monomorphism. Dioecy has evolved independently at least four times from distyly, and two reversals back to homostylous hermaphroditism. A significant correlation between dioecy and climbing

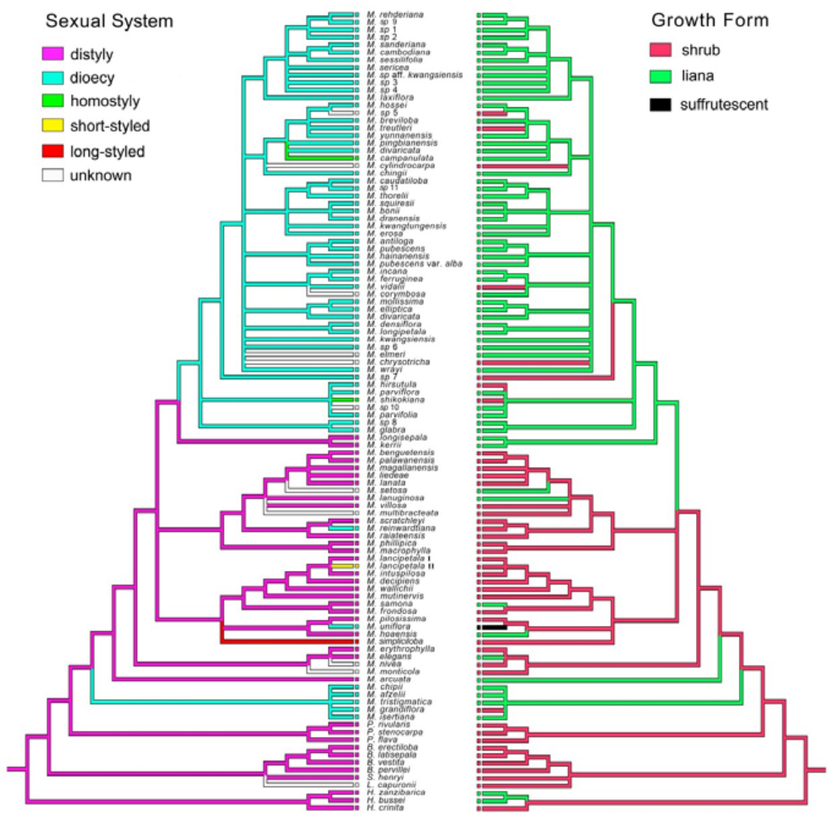


Figure 1. The evolution of sexual systems (left) and growth forms (right) as inferred from a Bayesian majority-rule tree for 106 taxa.

growth form was substantiated in *Mussaenda*. Finally, possibly a strong association between high net diversification rates and dioecy, but not climbing habit, exist in *Mussaenda*. The study refutes the hypothesis that dioecious is an "evolutionary dead end" from two aspects, and also provides a solid theoretical basis for the development and utilization of the horticultural resources in *Mussaenda*.

This research was published in *Molecular Phylogenetics and Evolution*, 2018, 123: 113-122.

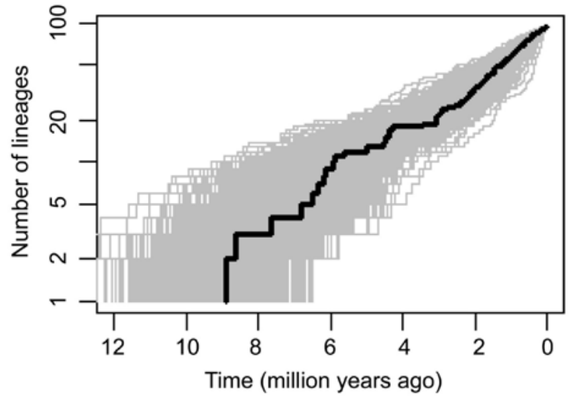


Figure 2. Lineage through time plots (with 95% confidence intervals) of *Mussaendeae*. The bold line corresponds to the maximum credibility tree from the BEAST analyses.

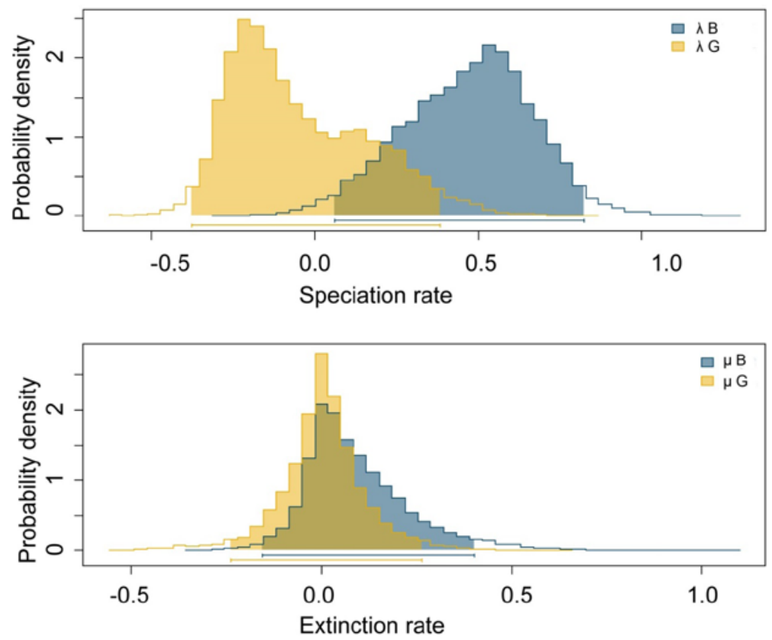


Figure 3. Posterior probability distributions for the effects of sexual systems (dark blue) and growth forms (light yellow) on speciation rate (λ) and extinction rate (μ) in *Mussaendeae*. Ninety-five present credibility intervals are shown as whiskered lines beneath each curve.

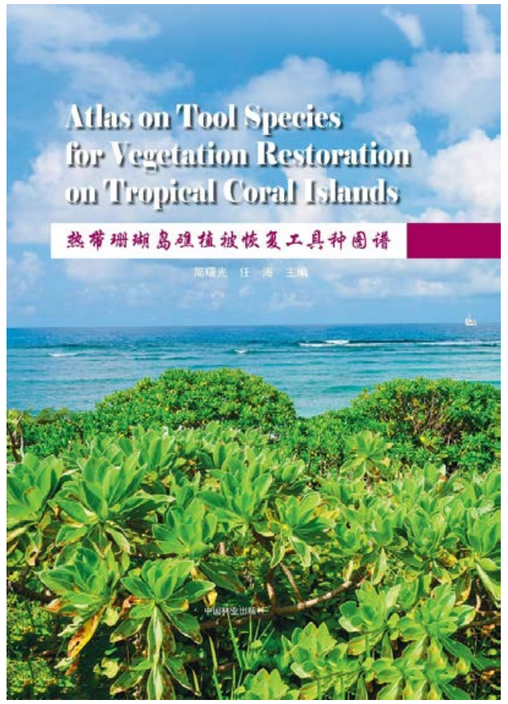
7. The compilation of *Ex Situ Cultivated Flora of China* has been made steady progress

The collection of living plants is not only the core mission of scientific research, popular science education and ex-situ conservation of botanical garden, but also the scientific connotation and social responsibility of the botanical gardens. The compilation of *Ex Situ Cultivated Flora of Botanical Gardens*, the National Science and Technology Infrastructure Program of China, has been officially launched in 2015. There are about 23 volumes initiated, such as *Magnoliaceae*, *Myrsinaceae*, *Ericaceae*, *Orchidaceae*, *Acanthaceae*, *Lauraceae*, *Liliaceae*, *Theaceae*, *Gesneriaceae* and so on. Steady progress has been made with some living collections based monographs published by Science Press: *Ex Situ Cultivated Flora of China,* volume *Myrsinaceae*; *Encyclopedia of Chinese Garden Flora*, volumes 4, 8. This project will take the common garden approach to contribute to the field observation of adaptively morphological traits, growth and development, phenology, cultivation and propagation, and disease and insect pests control of living plants, which is significant to provide complete, accurate and rich information for the further study of plant taxonomy and basic botany but also to improve the *ex situ* management, information records and data sharing of living collections, and to promote the effective conservation and utilization of plant resources.

8. The theory and technology of rapid vegetation construction on the tropical coral islands

During the theoretical and technical researches on rapid vegetation and ecosystem construction on tropical coral islands, SCBG undertook projects funded by the Strategic Priority Research Program of CAS, the National Key Research and Development Program of China, NSFC-Guangdong Joint Fund and other projects (total funding is about 200 million Yuan). Based on investigations and researches, we found that the “soil” is the main limiting factor for vegetation growing on tropical coral islands. To overcome the problem of poor soil conditions, some soil improvement technologies have been developed and four kinds of soil ameliorant/fertilizer have been invented. We have introduced more than 100 plant species suitable to grow on coral islands and established the germplasm bank. We discovered the mechanisms of high efficient utilization of both water and nutrients of suitable plant species. Based on the evaluation results, we selected 100 tool plant species for vegetation restoration on coral islands. We established large-scale rapid propagation technology systems for more than 40 tool plant species and 10 fruit or vegetable species, and produced about 600,000 seedlings of these plant species. We developed the ecological planning on vegetation construction of

tropical coral islands, and the integrated techniques on planting and maintenance for tool plant species, and fruit or vegetable species. We also developed construction technologies for 6 kinds of close-to-nature, economical and functional plant communities (e.g. green land for wind prevention and sand fixation, etc.). We finished six technical guides or manuals on vegetation construction, vegetable cultivation and maintenance. We constructed a total of 120,000 m^2 experiment or demonstration vegetation (including fruits and vegetables) zones, which have been highly praised because of the high plant diversity, high vegetation coverage and good ecological landscape. SCBG has participated in sci-tech consultation and technical guidance during the planning and construction of vegetation and ecological landscape on coral islands. We have published 35 papers or books, applied for 33 relevant patents (five have been authorized), and submitted three relevant consulting reports, one of which has been instructed by General Secretary Xi. Relevant outcomes have been selected into the 12th Five-Year Achievement Exhibitions of CAS, the Civil-military Integration Achievement Exhibition, and the advanced case of Civil-Military Integration in the Ministry of Science and Technology. Overall, SCBG has provided important scientific and technological supports for vegetation and ecosystem construction on coral islands.



9. Carbon pools in China’s terrestrial ecosystems: New estimates based on an intensive field survey

China’s terrestrial ecosystems have functioned as important carbon sinks. However, previous estimates of carbon budgets have included large uncertainties owing to the limitations of sample size, multiple data sources, and inconsistent methodologies. In this study, we conducted an intensive field campaign involving 14,371 field plots to investigate all sectors of carbon stocks in China’s forests, shrublands, grasslands, and croplands to better estimate the regional and national carbon pools and to explore the biogeographical patterns and potential drivers of these pools. The total carbon pool in these four ecosystems was 79.24 ± 2.42 Pg C, of which 82.9% was stored in soil (to a depth of 1 m), 16.5% in biomass, and 0.60% in litter. Forests, shrublands, grasslands, and croplands contained 30.83 ± 1.57 Pg C, 6.69 ± 0.32 Pg C, 25.40 ± 1.49 Pg C, and 16.32 ± 0.41 Pg C, respectively. When all terrestrial ecosystems are taken into account, the country’s total carbon pool is 89.27 ± 1.05 Pg C. The carbon density of the forests, shrublands, and grasslands exhibited a strong correlation with climate: it decreased with increasing temperature but increased with increasing precipitation. Our analysis also suggests a significant sequestration potential of 1.9–3.4 Pg C in forest biomass in the next 10–20 years assuming no removals, mainly because of forest growth. Our results update the estimates of carbon pools in China’s terrestrial ecosystems based on direct field measurements, and these estimates are essential to the validation and parameterization of carbon models in China and globally.

This research was published in *PNAS*, 2018, 115: 4021-4026.

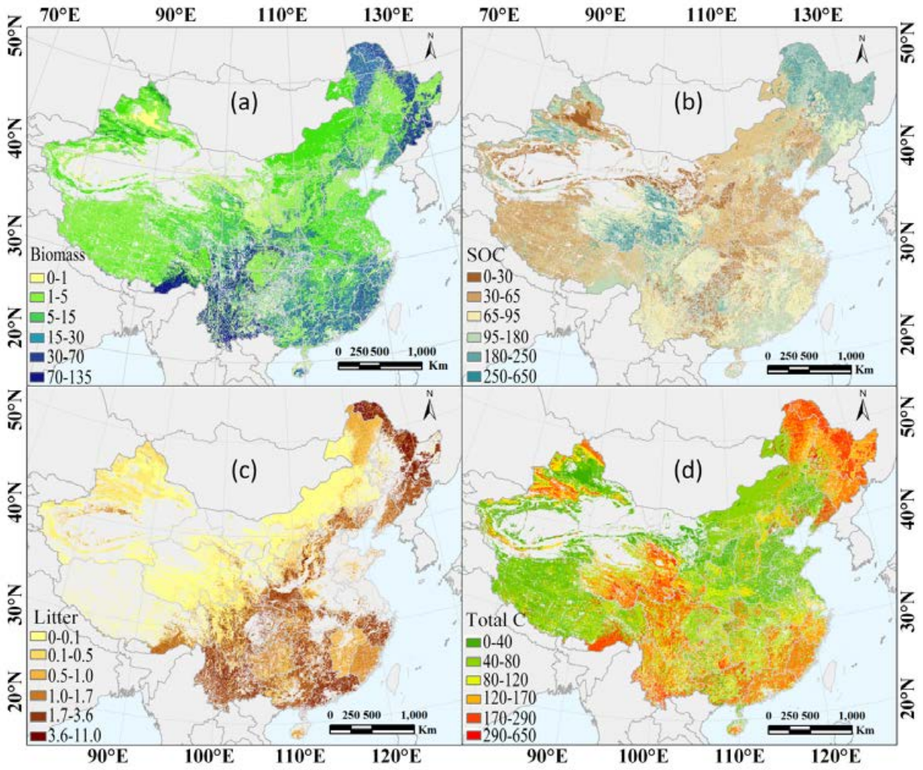


Figure. Spatial distribution of ecosystem carbon density (Mg C ha−1) in forests, shrublands, grasslands, and croplands in China. (A) biomass carbon. (B) Soil organic carbon (up to 1 m in depth, where applicable). (C) Litter carbon. (D) Total ecosystem carbon. The site-averaged carbon density of each biome in each province was assigned to the corresponding polygons of the China Cover map. (For details on the China Cover map and associated vegetation biomes, see ref. 5. Please note that we did not investigate the carbon pools in Taiwan, Hong Kong, Macao, and the South China Sea Islands.)

10. A new hypothesis on plant acclimation developed

Anthropogenic nitrogen (N) deposition has accelerated terrestrial N cycling at regional and global scales, causing nutrient imbalance in many natural and semi-natural ecosystems. How added N affects ecosystems where N is already abundant, and how plants acclimate to chronic N deposition in such circumstances, remains poorly understood. Dr. LU Xiankai and his colleagues conducted an experiment employing a long-term N addition to examine ecosystem responses and plant acclimation to added N in an N-rich tropical forest. They monitored plant growth dynamics, forest nutrient status, plant water-use, and water losses from the ecosystem for a decade. They found that plants can acclimate and maintain nutrient balance by altering hydrological cycling.

Based on these findings, Dr. LU et al. suggested a hypothesis that cation-deficient plants can adjust to elevated N deposition by increasing transpiration and thereby maintaining nutrient balance in N-rich ecosytems. These results demonstrate that while elevated N deposition to already N-rich tropical forests may have minor effects on forest growth,

it can exert a detectable influence on hydrological dynamics. If it is a widespread feature of N-rich tropical forests, continued development by present pathways could have substantial effects on municipal water supply in rapidly-developing tropical regions.

This research was published online in *PNAS*, 2018, 115: 5187-5192.

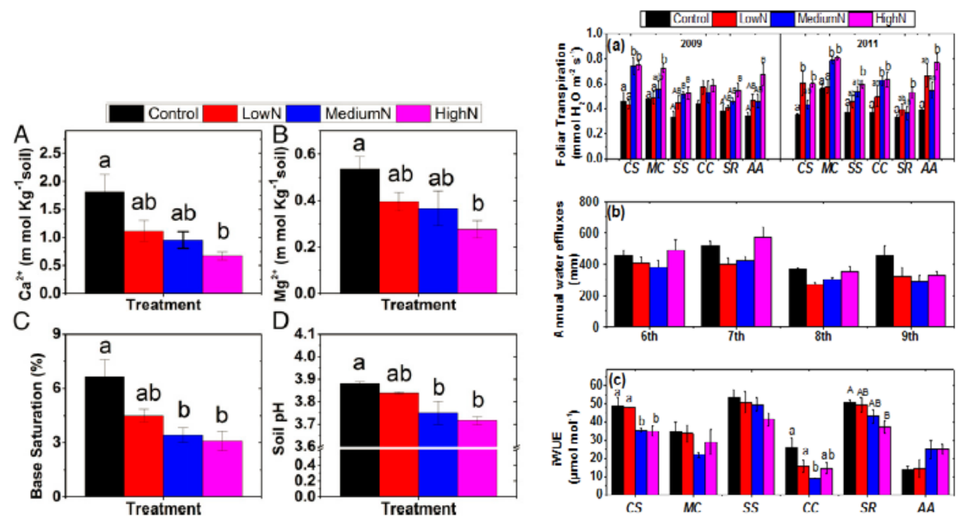


Figure. Effects of long-term N addition on soil-exchangeable Ca2+ (A) and Mg2+ (B), base saturation (C), and pH (D) in the mature tropical forest of southern China. The different lowercase letters indicate significant differences at P < 0.05 level (Tukey's HSD test) among N treatment levels. Values are mean with SE.

11. Climatic Effects on Global Soil Phosphorus Dynamics and Availability

The ongoing changes of climate such as temperature and rainfall will have a profound impact on terrestrial biogeochemical cycle. Much have been known about how climate change will affect terrestrial carbon and nitrogen cycles; in contrast, far less have been known about how climate change will affect terrestrial phosphorus cycle, despite of a worldwide phosphorus limitation on plant growth. Soil phosphorus dynamics, as a key component of terrestrial phosphorus cycle, directly determines soil phosphorus supply (or soil phosphorus availability) and regulates terrestrial net primary productivity and biodiversity. Dr. HOU Enqing, Dr. WEN Dazhi and others built the latest global database of phosphorus fractions in natural soils (*Scientific Data*, 2018, 5, 180166), examined the pathways of soil phosphorus transformations (*Global Biogeochemical Cycles*, 2016, 30: 1300-1309), and explored climatic effects (i.e. mean annual temperature, MAT; mean annual precipitation, MAP); and aridity index on soil phosphorus fractions, dynamics and availability at the global scale (Global Change Biology, 2018, 24, 3344-3356). Our recent findings showed that: (1) MAT negatively affected soil phosphorus availability through decreasing soil organic phosphorus and primary mineral phosphorus pools; (2) MAP had a minor net effect on soil phosphorus availability, though it negatively affected soil primary mineral phosphorus pool and positively affected soil organic phosphorus pool; (3) Climate and soil texture interactively controlled global soil phosphorus dynamics and availability; (4) Climatic factors explained a comparable proportion of the variations in global soil phosphorus dynamics and availability with soil type and key soil physiochemical properties such as soil organic carbon content and soil texture.

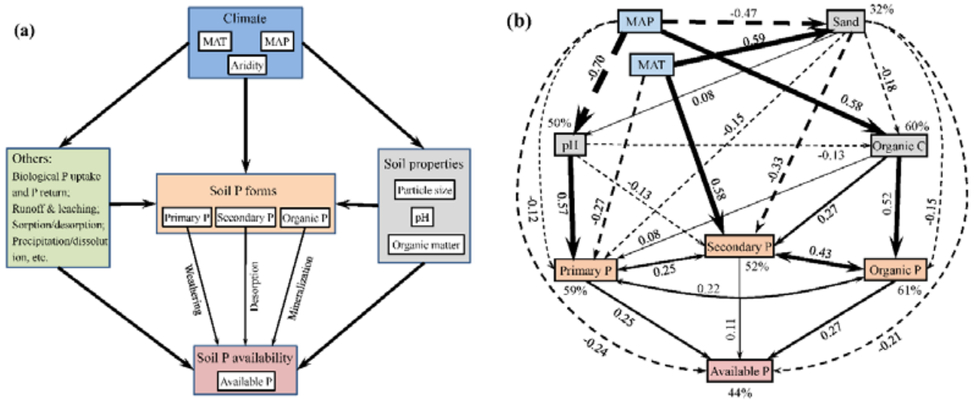


Figure. Pathways of climatic effects on soil phosphorus availability. (a) Theoretical model; (b) Structural equation model.

12. Stoichiometry controls asymbiotic nitrogen fixation in a nitrogen-saturated forest

Lowland tropical forests with chronic nitrogen (N) deposition and/or abundant N-fixing organisms are commonly rich in N relative to other nutrients. The tropical N richness introduces a paradoxical relationship in which many tropical forests sustain high rates of asymbiotic N fixation despite the soil N richness and the higher energy cost of N fixation than of soil N uptake. However, the mechanism underlying this phenomenon remains unclear. Dr. ZHENG Mianhai and his colleagues, under the guidance of Prof. MO Jiangming, conducted a chronic N-addition experiment in a N-saturated tropical forest in southern China and measured the N fixation rates, carbon (C), N, and phosphorus (P) concentrations, and stoichiometry in different substrates (soil, forest floor, mosses, and canopy leaves). They found that total N fixation rates were high (10.35−12.43 kg N ha^{-1} yr^{-1}; Fig. 1) in this N-saturated forest because of the high substrate C:N and N:P stoichiometry (which explained 13-52% of the variation in N fixation; Fig. 2). Atmospheric N deposition (34−50 kg N

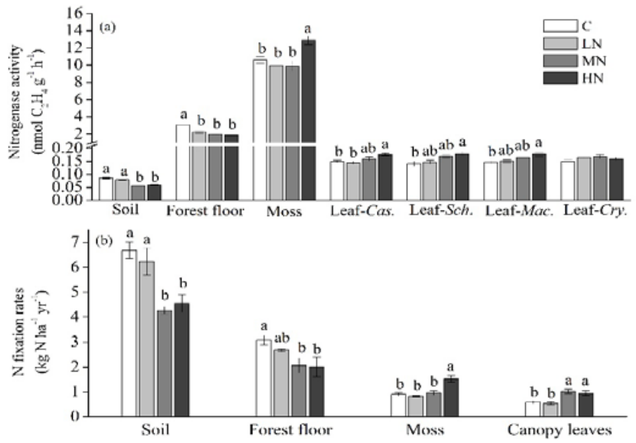


Figure. Effects of chronic N addition on asymbiotic N fixation in the N-saturated forest.
(C: control; LN: low N addition; MN: medium N addition; HN: high N addition)

ha^{-1} yr^{-1}) failed to down-regulate asymbiotic N fixation in this forest. They further found the insensitivity of N fixation in all the tested substrates to low N addition (50 kg N ha^{-1} yr^{-1}); however, medium and high N addition (100−150 kg N ha^{-1} yr^{-1}) stimulated the moss and foliar N fixation because of the increases in substrate C:N stoichiometry (which explained 30-34% of the variation in N fixation). These results emphasize the importance of substrate (particularly mosses and foliage) stoichiometry as a driver of asymbiotic N fixation and sustained N richness in lowland tropical forests.

This research was published online in *Ecology* (2018, 99, 2037–2046).

13. Biosyntheses and regulation of flavor compounds in tea (*Camellia sinensis*)

Research Group for Plant Metabolomics currently focuses on the biosyntheses and regulation of flavor compounds including amino acids and aroma compounds in tea (*Camellia sinensis*), as well as the practical applications for the improvement of tea quality during the cultivation and manufacturing processes. In 2018, we obtained several important findings. (1) L-Theanine is a specialized metabolite in tea leaves that contributes to tea function and quality. Yellow tea leaves (albino) generally have higher L-theanine contents than green tea leaves (normal), but the reason is unknown. The objective of our study was to investigate why L-theanine is accumulated in yellow tea leaves. We compared original normal leaves (green) and light-sensitive albino leaves (yellow) of cv. Yinghong No. 9. The L-theanine content was significantly higher in yellow leaves than in green leaves ($p \leq 0.01$). After supplementation with [$^2H_5$]-L-theanine, yellow leaves catabolized less [$^2H_5$]-L-theanine than green leaves ($p \leq 0.05$). Furthermore, most plants contained the enzyme catalyzing L-theanine conversion to ethylamine and L-glutamic acid. In conclusion, L-theanine accumulation in albino-induced yellow tea leaves was due to weak L-theanine catabolism. The differential accumulation mechanism differed from the L-theanine accumulation mechanism in tea and other plants. (Fig. 1; Be published in *Food Chemistry*, 2019, 276: 93-100). (2) Aromatic aroma compounds contribute to flavor of tea and they are mostly derived from L-phenylalanine *via trans*-cinnamic acid or directly from L-phenylalanine. The objective of our study was to investigate whether an alternative pathway derived from L-phenylalanine *via* phenylpyruvic acid is involved in formation of aroma compounds in tea. Enzyme reaction with phenylpyruvic acid showed that benzaldehyde, benzyl alcohol, and methyl benzoate were derived from phenylpyruvic acid in tea leaves. Feeding experiments using [$^2H_8$]L-phenylalanine indicated that phenylpyruvic acid was derived from L-phenylalanine in a reaction catalyzed by aromatic amino acid aminotransferases (AAATs). CsAAAT1 showed higher catalytic efficiency towards L-phenylalanine ($p \leq 0.001$) while CsAAAT2 showed higher catalytic efficiency towards L-tyrosine ($p \leq 0.001$). Both CsAAATs were localized in the cytoplasm of leaf cells. In conclusion, an alternative pathway for the formation of aromatic aroma compounds derived from L-phenylalanine *via* phenylpyruvic acid occurred in tea leaves.(Fig. 2; Be published in *Food Chemistry*, 2019, 270: 17-24).

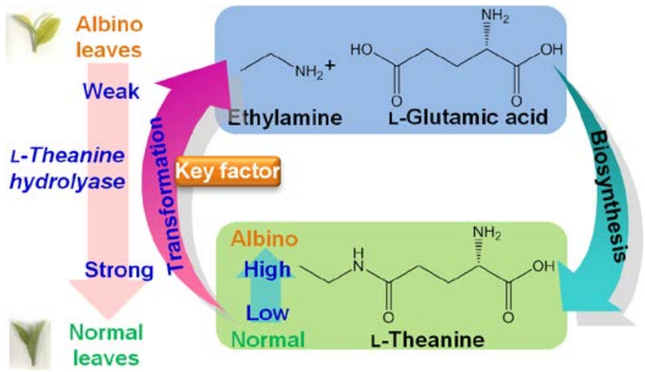


Figure 1. Differential accumulation of L-theanine in *C. sinensis* cv. Yinghong No. 9 (normal green leaves) and its yellow mutant (albino-induced yellow leaves).

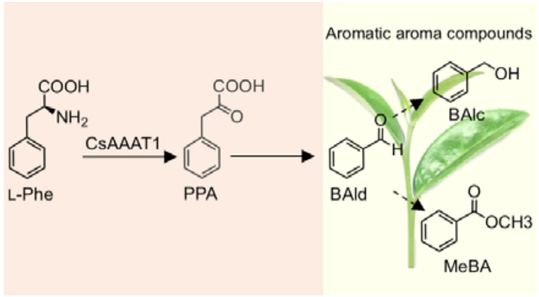
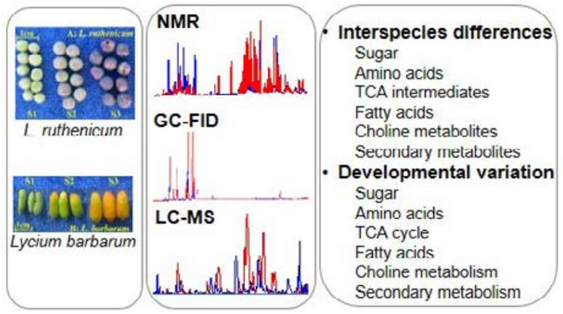


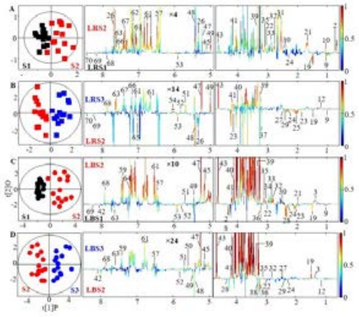
Figure 2. Proposed biosynthesis pathway of benzaldehyde, benzyl alcohol, and methyl benzoate from L-phenylalanine *via* phenylpyruvic acid in tea leaves.

14. Rimary metabolites differentially profiled in fruits of *Lycium barbarum* and *L.ruthenicum*

Lycium ruthenicum is a close relative of *L. barbarum*. *L. ruthenicum* fruits (LRFs) accumulate abundantly anthocyanins while *L. barbarum* fruits (LBFs) contain high level of carotenoids. However, the relevant distinct mechanisms of metabolic network regulation in the two species are still unclear. Metabolomics studies were carried out by using NMR, LC-MS/MS and GC-FID/MS with fruits from different developmental stages of LRFs and LBFs. Our results showed that the fatty acids of LRFs and LBFs were mainly composed of unsaturated fatty acids such as linoleic acid, oleic acid and linolenic acid, which increase in LRFs and decrease in LBFs during developmental process. The polyamines in LRFs is mainly composed of spermidine (N,N-bis-diCaf-SPD), which remains unchanged after S2 stage. Meanwhile the major component of LBF polyamine is spermidine-disaccharide such as N,N-Caf,dhc SPD-diHex, N,N-bis-dhc SPD-diHex, and N,N-bis-Caf SPD-diHex, which is increased during fruit development. Asparagine, aspartic acid and glutamine are the main amino acids in *Lycium* fruits, which was significantly higher in LBFs than that of LRFs. The contents of glucose and fructose in LBFs were significantly higher than those in LRFs, while the content of LBF betaine was significantly lower than that in LRFs.

This research was published in *Journal of Proteome Research*, 2018, 17(9): 3223-3236.





15. Sulfoxidation regulation of Musa acuminata Calmodulin (MaCaM) influences the functions of MaCaM-binding proteins

Sulfoxidation of methionine in proteins by reactive oxygen species can cause conformational alteration or functional impairment, and can be reversed by methionine sulfoxide reductase (Msr). Currently, only a few potential Msr

substrates have been confirmed in higher plants. Here, Research Group for Postharvest Biology of Fruit and Vegetable investigated Msr-mediated sulfoxidation regulation of calmodulin (CaM) and its underlying biological significance in relation to banana fruit ripening and senescence. Expression of MaCaM1 and MaMsrA7 was up-regulated with increased ripening and senescence.

We verified that MaCaM1 interacts with MaMsrA7 in vitro and in vivo, and sulfoxidated MaCaM1 could be partly repaired by MaMsrA7 (MaMsrA7 reduces oxidized residues Met77 and Met110 in MaCaM1). Furthermore, we investigated two known CaM-binding proteins, catalase (MaCAT1) and MaHY5-1. MaHY5-1 acts as a transcriptional repressor of carotenoid biosynthesis-related genes (MaPSY1, MaPSY2 and MaPSY3) in banana fruit. MaCaM1 could enhance the catalytic activity of MaCAT1 and the transcriptional repression activity of MaHY5-1 toward MaPSY2. Mimicked sulfoxidation in MaCaM1 did not affect the physical interactions of the protein with MaHY5-1 and MaCAT1, but reduced the catalytic activity of MaCAT1 and the transcriptional repression activity of MaHY5-1. Our data suggest that sulfoxidation modification in MaCaM1 by MaMsrA7 regulates antioxidant response and gene transcription, thereby being involved in regulation of ripening and senescence of banana fruit.

This research was published in *Plant and Cell Physiology*, 2018, 59(6): 1214–1224.

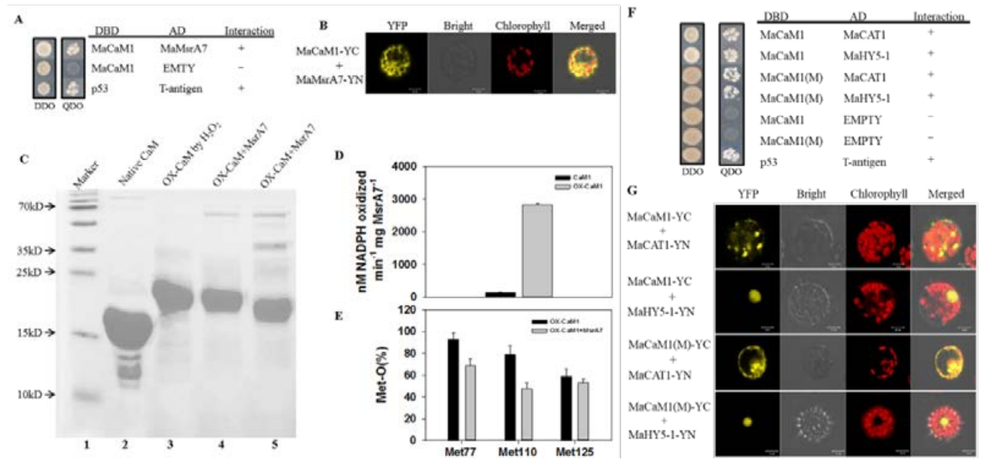


Figure 1. Interaction between MaMsrA7 and MaCaM1, MaCaM1/MaCaM1(M) and MaCAT1/MaHY5-1 in vitro and in vivo.

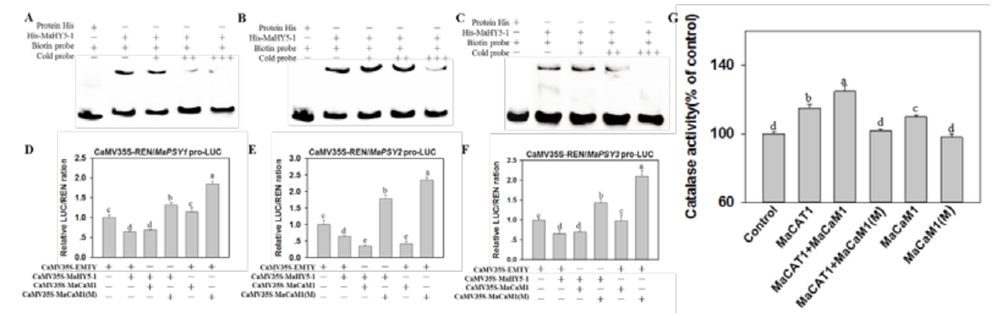


Figure 2. Methionine oxidation in MaCaM1 affects the catalytic activity of MaCAT1 and the transcriptional regulatory activity of MaHY5-1.

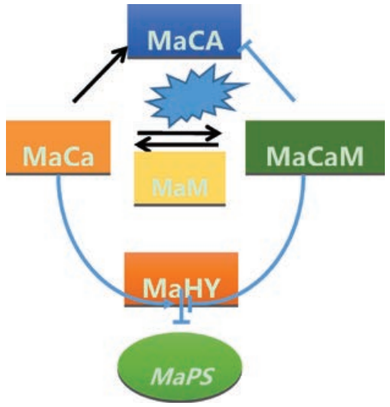


Figure 3. Proposed model of the involvement of MaMsrA7-mediated redox modifications of methionine in MaCaM1 in regulating the ripening and senescence of harvested banana fruit.

16. Chymotrypsin inhibitory cyclodepsipeptides produced by a soil-derived *Streptomyces* Strain

Four new cyclodepsipeptides, dinghupeptins A–D (1–4), possessing a rare N5-(2-hydroxylethyl) glutamine moiety, were isolated from the cultures of the soil-derived *Streptomyces* sp. SC0581. Their structures were elucidated by spectroscopic and advanced Marfey's amino acid analysis and their 3D structures were established by theoretical conformational analysis. Compounds 1 and 2, containing an Ahp unit, displayed selective inhibition of chymotrypsin with IC_{50} values of 2.1 and 1.1 μM, respectively. Enzyme kinetic analysis and molecular docking experiments revealed they are competitive inhibitors binding to the active site of chymotrypsin.

Ahp containing cyclodepsipeptides have attracted great interest from researchers in organic chemistry, medicinal chemistry, and chemical biology because many of them display potent inhibition of serine proteases with various selectivity characteristics. The study from Research Group for Phytochemical Resources Biology provided a new method for 3D structure elucidation of this family of compounds and new insights into the SARs of Ahp containing cyclodepsipeptides in inhibition of serine proteases.

This research was published in *Journal of Natural Products* (2018, 81: 1928–1936) and was selected as an "editor's choice" article.

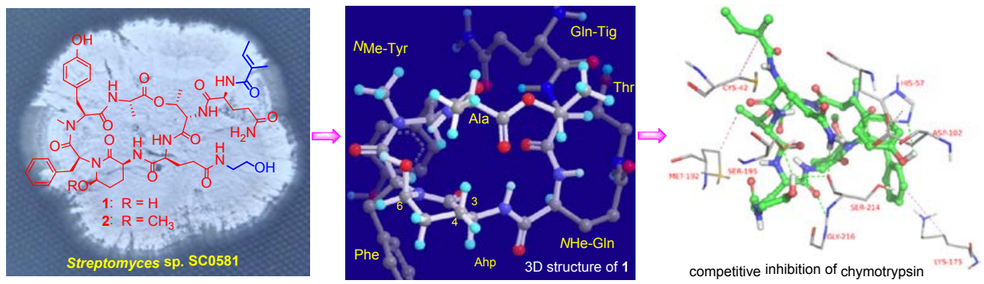


Figure. Structures of dinghupeptins A and B and their binding mode with chymotrypsin.

17. The GDP-mannose transporter gene (*DoGMT*) is critical for mannan polysaccharide biosynthesis in *Dendrobium officinale*

Dendrobium officinale is a precious traditional Chinese medicinal herb for abundant mannose-containing polysaccharides (MCPs) in its stems. GDP-mannose transporter (GMT), which translocates GDP-mannose into the Golgi lumen, is indispensable for the biosynthesis of MCPs. Three *GMT* genes (*DoGMT1-3*) were identified in *D. officinale*, which exhibited the highest transcript level in stem that an organ for MCPs storage. All three DoGMT proteins were targeted to Golgi apparatus, and had a GDP binding domain (GXL/VNK) that was homologous to a specially characterized GMT protein GONST1 in *Arabidopsis thaliana*. Moreover, *DoGMT1*, *DoGMT2* and *DoGMT3* complemented a GDP-mannose transport-defective yeast mutant (*vrg4-2*), meanwhile they also demonstrated a higher GDP-mannose uptake activity. Therefore, Research Group for Biotechnology Breeding concludes that *DoGMT1*, *DoGMT2* and *DoGMT3* are able to transport GDP-mannose while the expression patterns of these genes correspond to the accumulation of MCPs in *D. officinale*. These findings support the importance of *GMT* genes from *D. officinale* in the biosynthesis of MCPs. This research was published in *Journal of Plant Science*, 2018, 277:43-54.

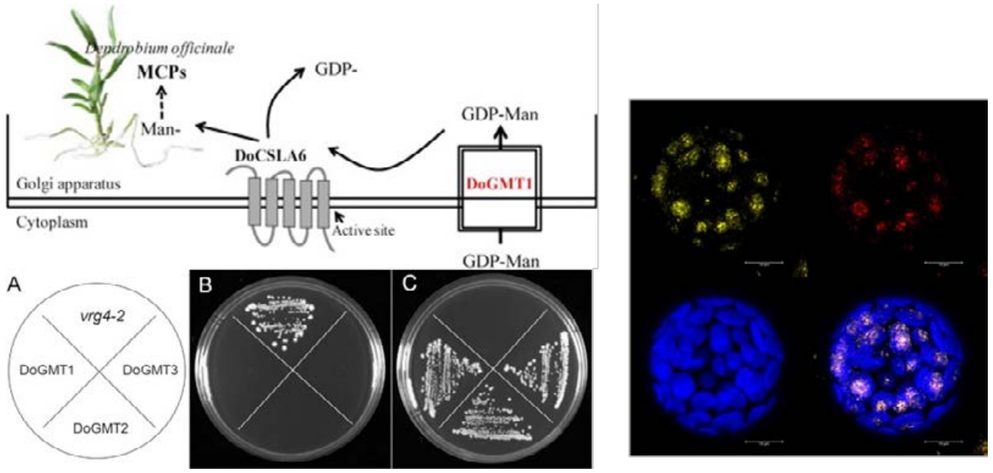


Figure. The GDP-mannose transporter (DoGMP3) from *Dendrobium officinale* is a Golgi-loca.lized proteins and plays a critical role in mannan biosynthesis.

18. Application of recombinase-mediated site-specific gene stacking on cotton and soybean

Recombinase-mediated site-specific gene stacking solves a major problem in gene transfer, the problem of random insertions of DNA that creates additional genetic loci. Stacking DNA keeps the number of transgenic loci to a minimal which expedites the conversion of traits from laboratory to field varieties. This gene stacking system can also be used for academic research but because it was developed intentionally with the freedom to operate, it is well suited for the commercial development of transgenic crops. In 2018, through support from the Nation Key Research Program by MOST (2016YFD0101900), Plant Gene Engineering Center has been implementing this gene stacking system for soybean and cotton, and the project passed mid-term evaluation in 2018. The highlight of 2018 research is that recombinase-mediated site-specific integration has been shown to work in soybean and cotton. DNA can be directed precisely into designated target sites in the soybean and cotton genome at a rate that is sufficiently high for creating site-specific transgenic lines (Fig. 1-3). In cotton, we can regenerate plants from the site-specific events, but in soybean,

more work is needed to induce the regeneration of plants from transgenic callus. \In 2018, a patent was issued on earlier work on developing rice lines with target sites for gene stacking (Patent No.: ZL 2015 1 0032720.0，Fig. 4). This means that our soybean and cotton target lines can likewise receive intellectual property protection. We are contemplating how to make these resources available to the public, and one possibility is to develop a service center for transgene gene stacking, so that it will provide a transformation platform for crop improvement.

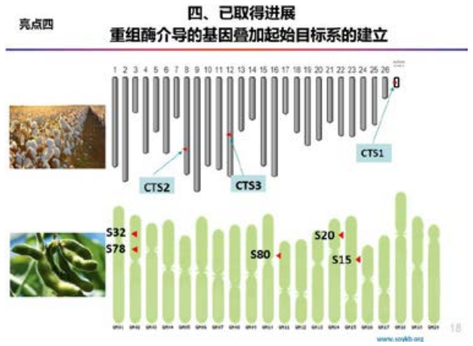


Figure 1. Establishment of target lines in cotton and soybean.

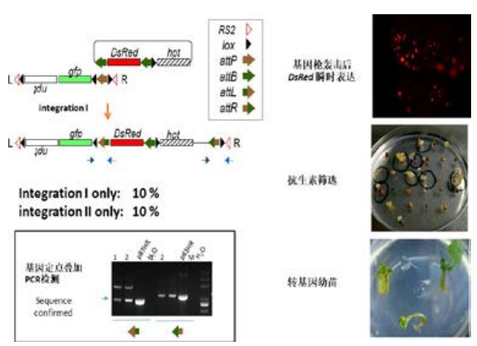


Figure 2. Establishment of site-specific integration system in cotton.

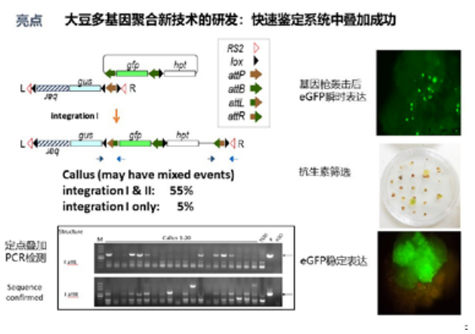


Figure.3 Establishment of site-specific integration system in soybean.

Figure 4. The patent for a vector suitable for site- specific gene stacking.

19. Resources development and utilization of oil crop of tiger nut

Tiger nut (*Cyperus esculentus*) is a kind of highly adaptive perennial C4 plant and native to the countries along the Mediterranean coast in semi-arid desert areas. It has been known as the most potential oil crop that accumulates large amounts of edible oil in tuber organs. Tiger nut was introduced and planted in China from 1960s to 1970s, but it was not widely applied due to varieties and harvesting techniques. Supported by the Key Programs of CAS, Members of Research Group for Energy Plant have collected more than 20 germplasm resources in the world. Planting and selection of the tiger nut varieties had been carried out in Hainan, Yunnan, Xinjiang, Gansu, Ningxia and Guangzhou. According to the agronomic traits such as grain weight, oil content and yield, eight lines with specific fine traits were selected. Among them, six lines were chosen for a Pilot scale cultivation experiment in Yinchuan and we found that the maximum yield (fresh weight) per ha was more than 18,000 kg. Moreover, rapid propagation system of tiger nut was established and several dozen tetraploids and chimeras have been obtained. Meanwhile, nearly ten thousand mutants were obtained by heavy ion and ^{60}Co radiation.

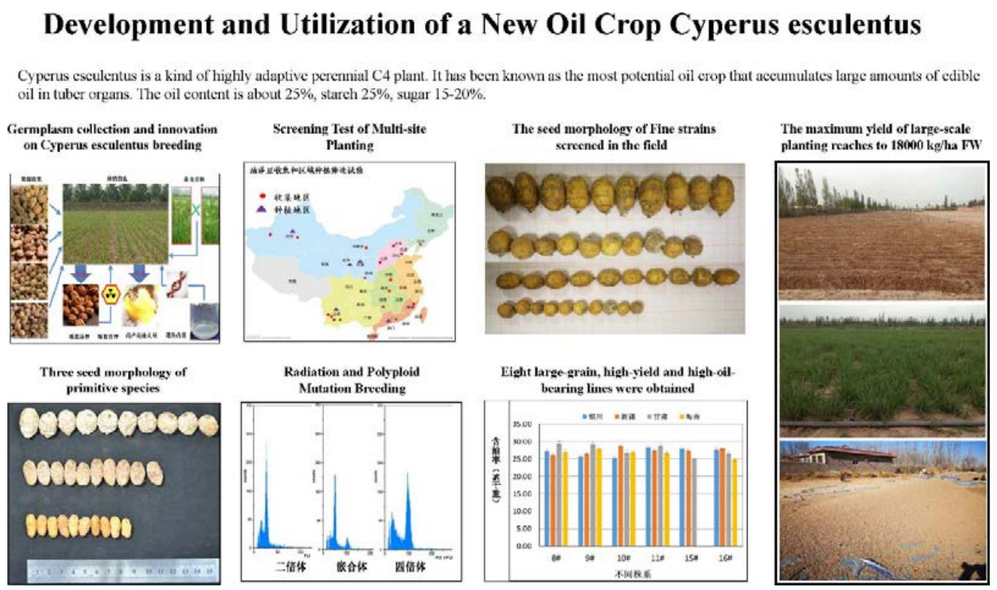


Figure. Germplasm collection and innovation on *Cyperus esculentus* breeding.

20. Formation of Protein Disulfide Bonds Catalyzed by *OsPDIL1;1* is Mediated by microRNA5144-3p in Rice

Correct folding of proteins in the endoplasmic reticulum is important for their stability and function under stress. Protein disulfide isomerase (PDIs) *OsPDIL1;1* is a key protein-folding catalyst in rice (*Oryza sativa* L.). In 2018, Research Group for Plant Nutrition Physiology found that microRNA5144 (osa-miR5144-3p) mediates the formation of protein disulfide bonds via targeting *OsPDIL1;1* mRNA in rice seeds and seedlings during development and under conditions of abiotic stress, respectively. Expression analysis of transgenic rice and identification of cleavage sites showed that *OsPDIL1;1* mRNA is a target of osa-miR5144-3p. Expression of osa-miR5144-3p and *OsPDIL1;1* were shown to be inversely regulated in developing organs and under abiotic stress. The transgenic rice down-expression of osa-miR5144-3p or overexpression of *OsPDIL1;1* showed increased total protein-disulfide bond content, compared to the wild type. This indicates that protein-disulfide bond formation is enhanced by down-regulation of osa-miR5144-3p or overexpression of *OsPDIL1;1*. These transgenic rice plants also displayed strong resistance to salinity and mercury stress, in comparison to the wild type. In contrast, the transgenic rice plants overexpressing osa-miR5144-3p or down-expressing *OsPDIL1;1* resulted in a lower protein-disulfide bond content; they were susceptible to abiotic stress and produced abnormal grains with small and loosely packed starch granules. These results indicate that protein-disulfide bond formation catalyzed by *OsPDIL1;1* is modulated by osa-miR5144-3p in rice during development and is involved

in resistance to abiotic stress.

This research was published in *Plant Cell and Physiology*, 2018, 59: 331-342.

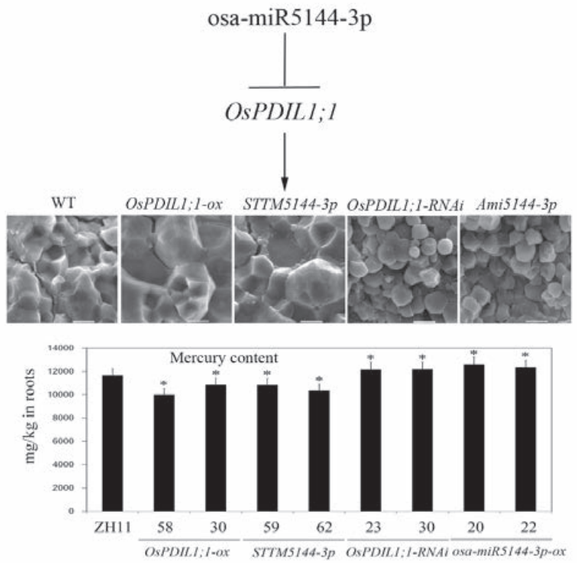
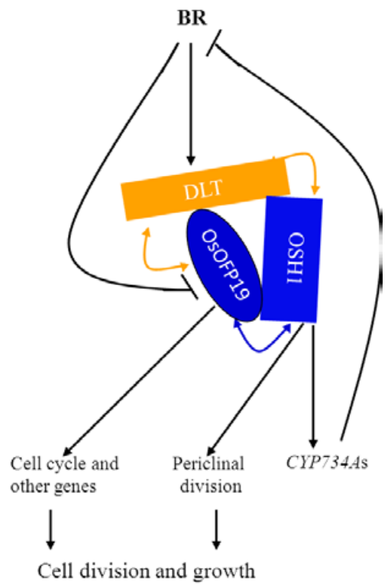


Figure. Rice microRNA5144-3p mediates expression of protein disulfide isomerase and plays a role in mercury accumulation of seed.

21. *OsOFP19* modulates plant architecture by integrating the cell division pattern and brassinosteroid signaling

Characterization of OVATE family proteins (OFPs) has revealed that they exert functions by interacting with different types of transcription factor. However, the molecular bases of these processes are poorly understood. Here, Research Group for Plant Pathology reports that *OsOFP19* negatively modulates brassinosteroid (BR) response and integrates it with the cell division pattern to affect plant architecture, including grain shape, through interaction with both DWARF AND LOW-TILLERING (DLT) and Oryza sativa homeobox1 (OSH1). Overexpression of *OsOFP19* caused a semi-dwarf stature with thicker leaves and stronger culms and roots, which result from an increase in cell layers in the sub-epidermal tissue. Further studies revealed that *OsOFP19* interacts with OSH1, and that this interaction mutually enhances the transcriptional activity of these proteins and leads to a transition from anticlinal to periclinal cell division. Furthermore, DLT interacts with both *OsOFP19* and OSH1 and acts as an antagonist in the two interactions. Therefore, *OsOFP19*, OSH1 and DLT form a functional complex which plays a pivotal role in modulating BR signaling and determining the cell division pattern during plant growth and development.



22. Gibberellins play an essential role in late embryogenesis of *Arabidopsis*

The plant hormone gibberellin (GA) plays key roles in almost all aspects of plant development, but its detailed function and underlying regulatory mechanism in embryo development are not yet clearly defined. Research Group for Phytohormone Regulation discovered an essential role of GA in late embryogenesis of Arabidopsis. Bioactive GAs showed a distinct synthetic peak during the cotyledon and embryonic axis expansion stage. During this period, deficiency in GA biosynthesis or signaling results in an abnormal embryo phenotype characterized by less-developed cotyledons and shortened embryo axis. In contrast, GA overdose leads to a significantly larger mature embryo. DELLA proteins are the negative regulators in the GA signaling pathway. They revealed that DELLA interact with LEAFY COTYLEDON1 (LEC1), the key regulator in late embryogenesis. Further analyses found that GA triggers the degradation of DELLAs to relieve their repression on LEC1, thus promoting auxin accumulation to facilitate embryo development. Taken together, these findings not only uncover a spatio-temporal specific role of GA in regulating late embryogenesis through the GA–DELLA–LEC1 signaling cascade, but also provide us with a novel mechanistic understanding of how phytohormones regulate embryogenesis.

This research was published in *Nature Plants*, 2018, 4: 289-298.

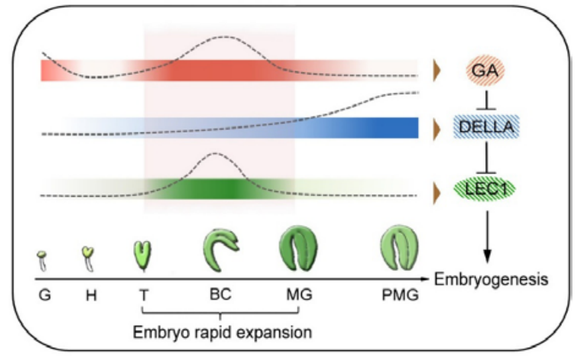


Figure. The model of GA-mediated late embryogenesis of *Arabidopsis*.

Team Building and Talent Training

Team Building

In 2018, under the leadership of the higher authorities, guided by Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era and the Spirit of the 19th CPC National Congress., we firmly established the "Four Consciousnesses", strengthened the "Four Confidence", placed cadres under the party's supervision, actively promoted the construction of talent system engineering surrounding the 13th Five-Year scientific and technological development goals and talent demand and made new progress in the work of personnel.

Overall situation of the talent team: We continued to promote the 13th Five-Year Talent Introduction and Training System Project, adhered to the combination of introduction and training as well as incentives and mobility initiatives, focused on the introduction of high-level talents urgently needed and attached importance to the training of young and middle-aged talents. Through intensified publicity and open recruitment at home and abroad, 21 talents have been recruited in 2018. By the end of December 2018, there were 448 employees in SCBG.

Assessment of the leadership team: The administrative leadership team of SCBG was established in January 2014. According to relevant regulations, the current team will be expired in 2018. The assessment was successfully completed on December 25, 2018 by the assessment team, which was composed of the personnel from CAS and the relevant departments of the Guangzhou Branch.

Figure 1. Assessment meeting

Progress in talent training and promotion: Innovative working methods was applied in the all-round management and service of talent training and promotion. In 2018, one new WRJH leader was recruited; one new member of the Young and Middle-aged Scientific and Technological Innovation Leading Talents was added; one person passed the communication review of the National Top Young Talents of WRJH, and breakthrough was expected; one new national government special allowance was added and one new Outstanding Members of CAS Youth Promotion Association was admitted. One new Key Technical Talents of CAS was elected for the first time. Two young talents received the Guangdong Provincial Special Support Program.

Postdoctoral work: The doctoral workstation of SCBG was officially established after the selection and expert review organized by the Ministry of Human Resources and Social Security of Guangdong Province. The main function of the doctoral workstation was to absorb the doctoral and postdoctoral talents and to develop a talent service platform. In 2018, the postdoctoral management work of SCBG was remarkable. There were 17 people entered the station, 15 people finished their postdoctoral work, and at present, there were 43 people stayed in the station. A new national "BoXin plan" was added, and a new postdoctoral project was introduced to the Guangdong Zhujiang Talents Program. In total 16 funds were awarded, including postdoctoral science funds, national youth projects, and Guangdong provincial funds, and 41 papers were published. With the first signature unit and the first author of SCBG, 13 SCI papers were published and two patents were granted.

Figure 2. Postdoctoral defense

Post employment status: In accordance with the rules and regulations of CAS and SCBG concerning post employment, the employment of three series of posts (professional, staff and skilled post) were organized and a total of 59 people successfully competed for higher-level positions.

Figure 3. Post employment meeting

Talent Training

In 2018, 422 graduate students studied in SCBG, reaching the highest number in history. This talent team includes 170 doctoral students (including 12 foreigners) and 252 master students (including five foreigners, 12 ethnic minority cadres, six retired soldiers, two students from Hong Kong and Macao, 19 students trained jointly by SCBG and Zhongkai University of Agriculture and Engineering). Meanwhile, there were 107 master and doctoral supervisors worked in SCBG.

Recruitment and training: In 2018, 39 doctoral students and 85 master students were enrolled, and this number was the highest in history. Various kinds of government-sponsored oversea education programs for students were well organized in 2018 and six students were qualified to study aboard. Scientific diathesis general courses, academic reports, mental health and career planning guidance reports were launched actively. To strengthen graduate academic training, the 11th SCBG Graduate Academic Forum was organized and more than 200 teachers and students participated in this forum. A total of 10 master students and 11 doctoral students gave presentations. Outstanding students were recommended to participate in the National Plant Science Graduate Academic Forum and the 2018 Guangzhou Education Base Academic Report Meeting. In 2018, 87 students graduated and 86 graduate students received the degree.

Figure 4. Scientific general education courses and various lectures

Figure 5. The 11th SCBG Graduate Academic Forum

Figure 6. Group photo of graduates and supervisors in 2018

Talent Awards: In 2018, one doctoral student was awarded the Dean's Excellence Award of CAS, four doctoral students and four master students were awarded national scholarships; one doctoral student and two master students won the DiAo Pharmaceutical Science and Technology Award; two doctoral students and three master students received BIOMIGA scholarships. A total of six master students were awarded the first, second and third prizes of the Pubang Garden Scholarship. Two doctoral students were selected to the National Plant Science Graduate Academic Forum and won the third prize. Three graduate students were awarded the first, second and third prizes of the Guangzhou Education Base Academic Report. One doctoral student won the Outstanding Female Scientist Award awarded by the Plant Biology Female Scientists Branch of the Chinese Society of Plant Physiology and Plant Molecular Biology.

Figure 7. HU Yilong won the Dean's Excellence Award of CAS

Construction of disciplines and tutors: SCBG played a leading role in the application for the first-level doctoral discipline of horticulture in the University of Chinese Academy of Sciences (UCAS). The experts symposium for the authorization of the first-level discipline of horticulture in UCAS as well as the seminar on graduate course setting in horticulture was organized in SCBG. Among the 13 experts in the argumentation, there were six members from the horticultural discipline appraisal group of the State Council and one member from the professional degree teaching steering committee. The expert group unanimously voted to pass the argumentation report. By the graduate tutor selection and teacher qualification recognition, eight associate professors were qualified, and the result was reported to UCAS for record. 23 tutors were promoted to apply for the qualification of teachers in higher education institutions of the People's Republic of China, and the annual number of applicants is the highest in history. At present, a total of 79 fellows have passed the teachers qualification recognition in SCBG. Tutors were organized to participate in the training of prevention and intervention of psychological crisis of UCAS. LIU Qing, ZHAO Ping, MO Jiangming and YANG Bao were awarded the honorary title of Outstanding Graduate Tutor of Guangzhou Education Base in 2018.

Figure 8-1. Symposium on the first-level doctoral discipline of horticulture

Figure 8-2. Symposium on the first-level doctoral discipline of horticulture

Integration of science and education: SCBG played a leading role in the construction of the horticulture department in UCAS. The first seminar on the development plan of the horticulture department was organized, and the College of Advanced Agricultural Sciences (Guangzhou) of UCAS was funded in SCBG. Teachers of SCBG has served as the directors of three teaching and research sections (five sections in total) of the horticulture department and one master's enrollment quota was gained. Some teachers have already started related courses at the horticulture department. In order to strive for outstanding students, the 6th Beauty of SCBG Summer Camp was successfully organized and 10 outstanding campers were planed to be enrolled as the 2019 master' students in SCBG. The 2018 CAS Student Practice Training Program was conducted smoothly, and three students would be admitted as master students in SCBG. The Elite Class of Ecology and Environment was jointly established with Xiamen University and the first batch of undergraduate students in this class completed a one-month scientific research training in SCBG.

Figure 9. Foundation of the College of Advanced Agricultural Sciences (Guangzhou) of UCAS

Figure 10-1. The 6th Beauty of SCBG Summer Camp

Figure 10-2. The 6th Beauty of SCBG Summer Camp

Figure 11. Jointly established Elite Class of Ecology and Environment with Xiamen University

Daily management: We paid close attention to students' physical and mental health, kept abreast of students' learning, life and scientific research and solved students' practical problems on time. In addition, we also organized a number of cultural and sports activities, such as welcome party, spring and autumn tours, social practice, various ball games, winter games, English corner activities and so on. Furthermore, we strived to do a good job in communication and service for graduate alumni. In 2018, SCBG received a donation of 200,000 Yuan, and established Fenghua Scholarship in the education foundation of UCAS , which specially for the outstanding doctoral students of SCBG.

Figure 12. Cultural and sports activities

Figure 13. Fenghua Scholarship donation ceremony

International Cooperation and Academic Exchanges

International Cooperation

Building and maintaining international collaborations can be very effective way to share and advance knowledge. SCBG raised its international cooperation through international meetings/ workshops, international talents programs and S&T exchange activities. In 2018, SCBG personnel made more than 133 outbound international person-visits and received more than 200 international person-visits. In addition, the number of international research collaborations continues to rise in SCBG since it is easier than ever to connect with overseas colleagues based on the Belt and Road Initiative and the globalization environment.

1. Progress of the International Cooperation in South America, Southeast Asia and Africa

Vice President ZHANG Yaping and the International Bureau of CAS visited Peru and Colombia to promote the collaborations of SCBG in September, 2018. In October, SCBG organized research groups to attend the XII Latin American Botanical Congress (LABC) in Ecuador. And also SCBG team visited The Universidad Nacional Mayor de San Marcos, Peru to promote the field investigation. In December, SCBG was invited to attend the book presentation ceremony organized by INTA and Argentina IABG Council Member.

SCBG conducts very good research projects cooperation with Vietnamese institutions and universities until now. 42 SCI papers and 6 CSCD papers co-published by SCBG and Vietnamese research institutions until 2018. From 2005-2018, 15 Vietnamese students enrolled in SCBG for doctoral and master study, 8 of them have got Ph. D Degree. Since 2009-2018, one PIFI fellowship awardee and 14 young scientists trained in SCBG, and about 70 Vietnamese scientists visited SCBG.

SCBG also carries on the research activities in Africa. Research teams of SCBG made very good progress in Kenya. MOU signing consideration will be promoted in 2019.

Figure 1. Vice President ZHANG Yaping visited San Marcos University

Figure 2. Book Presentation Ceremony

2. The Highlights of International Symposiums and Workshops

Workshop for Mango Fruit Quality in the Asia-Pacific Region was held in Guangzhou from March 19-22, 2018 organized by SCBG and Australian Center for International Agriculture Research.

We received more than 45 participants from eight countries. The openness of the Workshop brings the scientists together for increasing the productivity and quality of mango to meet international standards and increase its availability for the domestic as well as export market, developing efficient and effective production systems and supply chains, identifying and capturing new market opportunities and enhancing communication, collaboration and capacity development. The Workshop also provided a great opportunity for innovation and development of Mango fruit quality and researches and technologies, and strengthen our partnership and collaboration for the future.

Figure 3. Mango Fruit Quality in the Asia-Pacific region

Sponsored by Chinese Ecosystem Research Network (CERN), organized by SCBG, and co-organzied by the secretariat of the scientific committee of CERN, the International Long Term Ecological Research Network (ILTER) Next Generation Workshop was held from April 16-21, 2018 in Zhaoqing of Guangdong Province. Professor Michael Mirtl, Academician FU Bojie, and Professor ZHOU Guoyi served as the chairmen of the conference organizing committee.

Participants consisted of about 30 representatives from USA, Australia, France, Finland, Japan, South Africa and other countries. The workshop focused on the bottleneck problems in long term ecological research, participants have shared recent ten years' experiences and lessons on the operation and management of different research platforms and discussed issues on the construction, maintenance, data management of long term ecological research platforms as well as the integration of ecological observation, experimental facilities and scientific research.

As modern technology advances, and continues to explore our limited and precious diversified biomes, we anticipate a growing awareness around the world on the conservation of biodiversity. The Centre for Biodiversity Research of Universiti Tunku Abdul Rahman (UTAR), together with their co-organizers organized the International Conference on Tropical Biodiversity 2018 in Ipoh, Malaysia.

Figure 4. International Long Term Ecological Research Network (ILTER) Next Generation Workshop

Figure 5. SCBG delegation in Tropical Biodiversity 2018

Four main themes included Fundamentals of biodiversity, Agriculture and horticulture, Biodiversity and human health, and Biodiversity in modern living during the conference. 11 delegates of SCBG attended the conference and presented one keynote report and eight oral presentations in Symposium 1: Fundamentals of biodiversity, Symposium 2: Sustainable agriculture and food security, Symposium 3: Biodiversity and human health and Symposium 4: Biodiversity in modern living. Dr.KONG Hanghui of SCBG was awarded the Best Oral Winner and Prof. WANG Ying the Second Runner Up. Prof. XIA Nianhe and KANG ming, and Ms. YU Yan of Project Management & Foreign Affairs Department were the organizing members of the conference, and this was the first time for SCBG co-organized the oversea conference.

In 2018, SCBG accepted 6 International Training Workshops included 162 members from all over the world. SCBG special collection gardens study and field trip to Dinghushan Nature Reserve were arranged for the workshop participants, which deepened the cooperation with the Belt and Road Initiative countries.

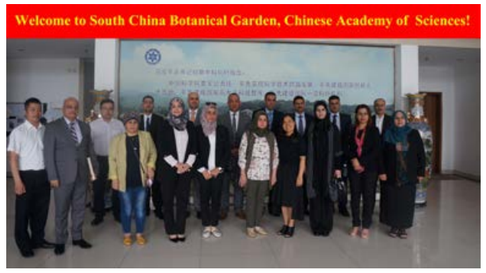


Figure 6. The Iraqi delegation visited SCBG

3. Advances in International Talents

Four excellent foreign scientists won funding from CAS President's International Fellowship Initiative（PIFI）in 2019 and they are :Prof. Rossi Sergio from Université du Québec à Chicoutimi, Dr. Karina Vera Rosa Schaefer from Rutgers University, USA, Dr. Chang Sui Kiat from International Medical University, Malaysia and Dr. Humaira Shaheen from COMSATS Institute of Information Tech., Pakistan and five foreign scientists employees work in SCBG and 18 international graduate students study in 2018. In 2018 we initiated short-term employee project for distinguished foreign scientists from Australia, USA and UK. These three foreign scientists will lead a new research team each and co-supervised graduate students in SCBG. More than 160 young staff from 21 countries though the workshops and research projects has been funded in SCBG for scientific research promotion.

4. International MOU/Agreement Signing

SCBG established new partnership Between Italy and China for General International University Co-Operation Agreement for Educational and Scientific Purposes. We signed the extended memorandum/agreement with the Vietnam National Museum of Nature, Vietnam Academy of Science and Technology, Universidad Nacional Mayor de San Marcos and Institute of Ecology and Biological Resources of Vietnam Academy of Sciences and Technology this year. We also are striving for the cooperation with universities in Ecuador and Brazil.

Academic Exchanges and Academic Society Activities

1. Chun Woon-young Lectures Series

Chun Woon-young Lectures Series (CWLS) was initiated in 2009 and has been a very important academic exchange platform in SCBG. In 2018 CWLS was held 13 times and 17 famous scientists came to SCBG to share their research progress and scientific experience. Besides CWLS, there were more than 50 lectures delivered by scientists both from China and abroad to promote academic exchange.


Figure 7. Academician ZHANG Ci report


Figure 8. Academician CHEN Yong report


Figure 9. Professor Hans Lambers report


Figure 10. Royal Academician Peter Crane report


Figure 11. Academician SHAO Mingan report

2. Academic Society Activities

Ecological Society of Guangdong Province (ESGP)

The 9th Members Representative Assembly and Annual Meeting opened on December 8-9, 2018 to elect the 9th Board of Council of ESGP. Prof. ZHOU Guoyi of SCBG was elected as the new Chairman of ESGP. During the annual meeting of ESGP, wonderful academic reports were presented for about 150 participants.

Figure 12. The 9th Members Representative Assembly and Annual Meeting of ESGP Guangdong Society of Plant Physiology (GDSPP)

The 2018 Annual Meeting of GDSPP was held in Meizhou City from Novmber15-18, 2018. About 130 Representatives from universities, research institutions and other companies in Guangdong Province joined in the meeting. And the Council Members meeting also organized to review the annual report of GDSPP and the work plan of the next year.

Figure 13. The 2018 Annual Meeting of GDSPP Guangdong Botanical Society (GBS)

The Annual Meeting of GBS opened on December 29, 2018 in South China Agriculture University (SCAU). Professors from SCAU, Sun Yat- sen University and graduate students from different universities and research institutions presented their research progress.

Figure 14. The Annual Meeting of GBS Moreover, public education activities of these three societies are very fruitful in 2018.

Technology Transfer

According to the national rural revitalization and eco-industrial development strategy, focusing on the development plan of the feature institute, and under the correct guidance of the leaders as well as the joint efforts of the fellows from SCBG, the Science and Technology Development Center (STDC) innovated working ideas and methods, carried out group cooperation and system integration cooperation in the fields of ecological restoration, characteristic agriculture, health industry and engineering project development, and achieved good results in industrialization and technology transfer. In 2018, 18 contracts were signed, and one project was applied. The new contract amount was about 19.19 million Yuan.

1. The technology transfer system of SCBG has been constructed and made substantial progress.

In 2018, SCBG has successfully signed a strategic cooperation agreement with four county-level people's governments (national poverty-stricken counties of Henan Province: Tongbai County, Huaibin County, Guangshan County, and Dengzhou City), and fully participated in the local science and technology development strategy, economic and ecological planning, the whole industrial chain planning of important economic plants, and major construction projects (national reserve forest, etc.) as the leading unit of technical consultation, consultant and service subject, which created a comprehensive integration of "Social capital party + Government + Scientific research unit + Enterprise", and a

Figure 1. Secretary Zhang Fusheng led the team to inspect the National Reserve Forest Project of Henan Province.

Figure 2. Secretary Zhang Fusheng led the team to contact the project in Dengzhou City of Henan Province.

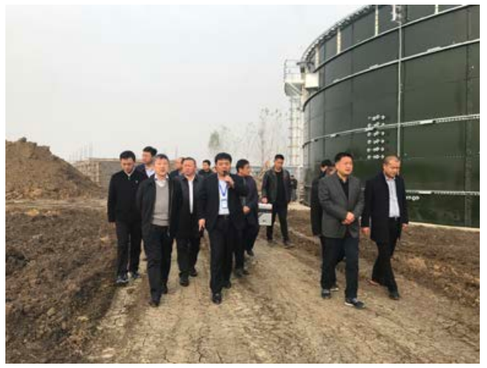


Figure 3. Secretary Zhang Fusheng led the team to investigate the Circular Economy Project of Dengzhou City and Dengzhou Botanical Garden Project.

new cooperation mode of scientific and technological achievements transformation in the face of economic market demand. Under the framework of the strategic cooperation agreement, work in the form of specific project cooperation agreements created a new situation in the transformation of scientific and technological achievements. At present, the contract for the plant resource inspection project of Guangshan County has been implemented for 1.45 million Yuan; the identification of Chinese herbal medicines and the comparative analysis of active ingredients in Dengzhou City have been confirmed by the county magistrate, and the contract is under negotiation; the forestry project of Tongbai County has been confirmed by the county people's government to entrust SCBG as a technical service consultant to participate in the project implementation. Organized by STDC, the preliminary investigation of Tongbai County, Dengzhou City and Huaibin County has been completed, and the data of each county was being organized to further sort out the actual needs and the key nodes of scientific and technological services of each county, sequentially to implement specific projects.

2. Substantial progress has been made as a technical service and advisory unit for the local government to build botanical gardens.

The technical service contract for the conceptual design stage of the Nanchang Ganpo Botanical Garden (NGBG) has been signed, with a contractual amount of 260,000 Yuan. Due to the excellent service of the work team, the partner has confirmed that the technical service of the construction and post-management of NGBG will be directly entrusted to SCBG, and the cooperation contract is being drafted. In addition, the plant collection project of Aristolochia Plant Specialized Garden in NGBG has been confirmed and the contract is being drafted. Tongbai County People's Government has entrusted SCBG as technical advisory unit to provide whole process technical services from the site selection stage to the later management and maintenance for Tongbai County Botanical Garden. The service contracts for each stage will be specifically negotiated in the implementation process. The technical service project of Dengzhou Botanical Garden and Guangshan County Germplasm Resources Park is under negotiation.

Figure 4. Cooperation negotiation with NGBG.

3. Substantial progress has been made in the construction project of the Yunan Research and Demonstration Base.

Under the leadership and promotion of STDC, the Yunan Economic Plants Joint Development Project signed by SCBG and the Tongbai County People's Government developed smoothly. Tongbai County People's Government attached great importance to this cooperation, thus has provided an office building (including a standardized factory area of 6,400 square meters), project start-up funding of 3 million Yuan, 500 acres of demonstration base (the base has issued a red line map and be free to use), and established Tongbai County Yunan Economic Plants Joint Development Project Construction Leading Group to cooperate with the project. During the promotion of the project, the Tongbai County People's Government highly recognized the scientific connotation of SCBG and the efficiency and attitude of the researchers, therefore entrusted SCBG to participate in the Tongbai County Huaihe Source National Reserve Forest Project and Huaihe Source Plant Germplasm Resource Collection and Ex-situ conservation Project, and provide technical consulting services.

4. Strengthen overall coordination and external investment management.

Through business development, SDTC actively promoted new business and projects for Guangdong Zhongke Qilin Co., Ltd (Qilin Co.) to drive the company's profitability. The revenue of Qilin Co. in 2018 was 128.7 million Yuan, with a total profit of 4.31 million Yuan and a net profit of 3.22 million Yuan. According to the requirements of SCBG Affairs Meeting, STDC carried out equity reform of Qilin Co. (CAS was included in the national unified regulatory reform pilot), reappraised company's stocks and assets and reported the relevant materials to Bureau of Facility Support and Budget CAS. At present, the approval of stocks and assets verification has been given, and the transfer of shares was pending the approval of the asset department of the ministry of finance. According to the latest reform plan of CAS, effective supervision for Qilin Co. would be continued and strengthened in the future.

Horticulture and Public Education

Horticulture and ex situ conservation

The Garden issued a new living collection policy, actively explored the standardized management of species conservation and horticulture, implemented gardening volunteer service, and made new progress in species conservation and landscape gardening.

Plant acquisition and conservation

The annual goals were completed in plant acquisition, species identification, new cultivar breeding and monograph research in 2018. 2,565 new accessions with 730 wild accessions were collected from nine countries and 13 provinces in China. Totally 40,300 plants of 964 species were propagated, 7,228 plants of 322 species were transplanted, 1,258 species' plant phenology were observed, 404 species were verified. A preliminary inventory reviewed 10,647 species (including infraspecific taxa) and 17,560 taxa (including cultivars) of 3,017 genera and 288 families cultivated and 7,697 accessions were unidentified in the Garden. Five new cultivars were authorized by National bureau of Forestry and Grass. Seven monographs based on living collections were published. 288 accessions of 86 species were provided for scientific research.

Figure 1. Wild plant exploration

Figure 2. Plant conservation

Garden landscape and horticulture

About 2000 M^2 grass planting were restored for the main road tree landscape. Timely repaired and maintained living collections and specific gardens, and the garden buildings, greenhouse facilities and irrigations to ensure conservation, display and tour services. Made full use of the plants from acquisition and propagation to create four strip-shaped perennial borders around the Tourist Center, the peripheral area of the Conservatories, along the lakeshore of the Palm Garden and the forest edge of the Central Lawn. Each specific collection and garden completed local landscape

improvement combined its own situation, special collection features and transplantation. In response to the typhoon "Mangosteen" disaster, effective measures had be taken to complete the post-disaster reconstruction, innovative use of fallen trees to create fences, benches, stepping-stone walk, wooden landscape walls, etc., to increase the landscape highlights reflecting the characteristics of the botanical garden.

Figure 3. Orchid border.

Figure 4. Fallen tree fences.

Knowledge Dissemination and Science Tourism

The Garden carried out botanical garden featured scientific activities and education courses, strengthen media communication and popular science publicity, tourism service management and education volunteer service, hosted more than 1.08 million visitors including 200,000 teenagers, and the tickets and events income was 23.29 million Yuan.

Science Activities and Education Programs

The Garden developed five series 98 education courses, including "Natural history", "Class of nature", "Press flower art", "Nature investigator" and "Plant science", and launched 141 times of science activities and events, including school/community activities as well as summer and winter camps. Hosted the 2018 Guangzhou National Science Day ceremony and Popular Science Carnival, and participated in large events organized by CAS and local governments, including scientific activities of the 49th World Earth Day in Tianhe District, and the 14th Public Science Day & 2018 Science and Technology Week of Chinese Academy of Sciences.

Figure 5. Scientific inquiry of Winter Camp

Figure 6. Class of nature

Media communication and science publicity

WeChat Official Accounts of SCBG regularly publish articles about “Blooming information”, “Scientific education courses”, “Plant stories” and “Scientific progress” to provide information and navigation services for tourists and the public. In 2018, released a total of 53 times of education activities and events in the newspapers, TVs and radios, launched 377 pieces of tourism information and 39 times of reports in all kinds of networks, and released 176 pieces of official information in micro-blog and 277 articles in WeChat account. 52 flower-blooming articles and 18 times of monthly blooming boards were released. The Garden was ranked forefront for popular science publicity in the CAS.

Figure 7. Annual meeting of volunteer service

Figure 8. National Scientific Research and Education Base

Popular science projects and awards

The Garden successfully passed the five-year evaluation review of national A-level tourist attractions. About 1.26 million Yuan funding supports for five science projects and activities were received. SCBG was awarded Guangzhou Science and Technology Popularization Base (2018-2021) by Guangzhou Science and Technology Innovation Committee (January); Top Ten Best Scenic Spots in Guangdong Province by Guangdong Scenic Industry Association (March); National Scientific Research & Science Popularization Base by CAS and Ministry of Science and Technology (March); National Bio-safety Publicity and Education Base by Guangdong Entry-Exit Inspection and Quarantine Bureau; The most popular brand park scenic spot in 2017 by Guangzhou Tourist Scenic Area Association and Guangzhou Park Association (April). Three staff got excellent achievements in 2018 Tianhe District & Guangzhou Science Interpretation Competition (April) and Excellent Interpreter in Guangzhou Tourism Area (December).

Dinghushan National Nature Reserve

Guided by XI Jinping Thought on Socialism with Chinese Characteristics for a New Era and the Spirit of the 19th CPC National Congress, according to the annual work plan, focused on natural conservation, scientific research and monitoring, popular science publicity, platform management and service, Dinghushan National Nature Reserve concentrated on the crucial points, worked hard, and made new progress.

Construction of infrastructural facilities: The reparative project of “7.12” flood in Dinghushan was completed, and the related constructions were re-estimated on security. The first standard boundary vectorgraph of Dinghushan was drawn. One implementary scheme for surveying and indicating the borderline was worked out. The tea shop, canteen, nursery field, the ground for sightseeing bus were released and their rental income reached 200,000 Yuan annually.

Focus on the safety management, eliminated the potential hazard: Many difficulties resulted from the typhoon “Ewiniar” and “Mangosteen” were dealt well, which ensured the operation of daily work inside the nature reserve. The forest fire prevention propaganda was produced and 32 warning signs, 280 colorful flag/slogans and 32 banners were replaced or set up. Some internal management regulations were emended. The annual forest fire prevention work conference and the forest fire drill extermination was organized. Some special safety measure were taken on the festival days. Some illegalities, such as trespass (18 times), detinue (one time), poach and entomb (four times), gathering (two times), were prevented. There were no forest fires all year round.

Figure 1. Surveyed typhoon damage condition

Figure 2. Dealt with the difficulties resulted from typhoon

Figure 3. Forest fire extermination Training

Continued to play the role of the scientific research platform: A total of 839 students in six batches from different universities took field teaching practice, and a total of 201 researchers from Sun Yat-Sen University, University of Hong Kong and so on in 56 batches performed field research or survey. A total of 6,547 visitors in 63 batches visited the theme exhibition hall. The registration platform for scientific research or investigation was established to realize paperless registration.

Persisted in monitoring: The investigation on endemic plants in Dinghushan was finished. The infrared camera monitoring of animals in Dinghushan was continued, and one new animal species was recorded in Dinghushan. One investigation on amphibian in Dinghushan was cooperated with Nanjing Normal University and one new snake species was recorded. The *Dinghushan Bird Monitoring Report (2015-2017)* and the *Dinghushan Butterfly Monitoring Report (2016-2017)* were written.

Figure 4. Sinomicrurus kelloggi--a new snake species record in Dinghushan.

Advanced popular science publicity and correlative activities: The project on the study and practice education of primary and secondary school students, supported by the Ministry of Education, was well performed in Dinghushan, and 12 educational courses for research activities were compiled. 24 messages was reported and 11 of which were published by newspapers such as *Xijiang Daily* and broadcasted by Zhaoqing TV Channel. *The Window of Dinghushan* was published twice. The WeChat Official Accounts of Guangdong Dinghushan National Nature Reserve was opened, with a total of 21,604 readings and a total of 13,870 readers. Two special reports on Dinghushan, one titled *Who Can Not Know Dinghushan,* another titled *Fan Zongji: The Guardian of Dinghushan Wild Animals*, were published respectively in *Chinese Green Times* and *Xijiang Internet*. Some stories related to Dinghushan were compiled into the different TV programs, such as *Crossing the Tropic of Cancer*, *The Man and Biosphere in China* (CCTV-7)*, Who Doesn't Say Our Hometown good* (Phoenix Satellite Television). Show Window used for the popularization of science was updated four times.

Figure 5. Scientific research activities

Recruited 12 ecological photography volunteers, 45 bird watching volunteers for teachers in Zhaoqing city. Recruited and trained 300 volunteers for popular science teaching.

Other important work:

Complete the supervision and inspection of the Green Shield Action 2018 and achieved desired result. The basic information was fully gathered for the national protected area census. The recommendations of International Advisory Council for Man and Biosphere Plan (MAB-IAC) about China Dinghushan Biosphere Reserve from a periodic review were fulfilled and a series of action were taken, including expanding the area of Dinghushan Biosphere Reserve, carrying out new functional zoning, signing Dinghushan World Biosphere Reserve Community Co-construction & Co-management Agreement, establishing Management Coordination Committee of Dinghushan World Biosphere Reserve and convening the first meeting. Two books, named the *Wild Plants in Dinghushan* and *The illustrated handbook to common birds in Dinghushan* were compiled and planned to print in 2019.

Figure 6. Leaders of Guangdong provincial forestry bureau investigated Dinghushan protected area.

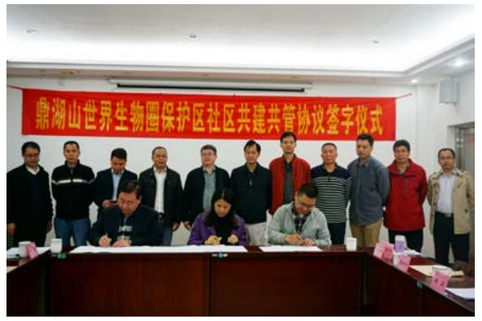


Figure 7. Signing ceremony of Dinghushan World Biosphere Reserve Community Co-construction & Co-management Agreement

Figure 8. The first meeting of Management Coordination Committee of Dinghushan World Biosphere Reserve

Party Building and Innovative Culture

There was 12 party branches and 470 party members of CPC in SCBG, two new members were recruited in 2018. SCBG has won 103 honours respectively from the state, CAS, Guangzhou City and so on throughout the year. The party committee of SCBG has made solid efforts to carry out "Two Studies and One Action", and to promote the standardization of "Three Meetings and One Class", so as to provide strong political guarantee and ideological motivation for the reform and innovation of "One-Three-Five Plan" , and make a good function of party organizations as battle bastions.

Laid emphasis on the integration of party committee's work and SCBG's central work to serve the central work

The party committee attached importance to study. The studies focus on Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era and the Spirit of the 19th CPC National Congress. The party committee invited the representative of the 19th CPC national congress EN Yunfei to deliver a keynote speech on *Sail for A New Era to A New Journey*, organized 11 party members who are cadres at or above the division level to participate in the training of the Spirit of the 19th CPC National Congress, seriously hold Party Committee Central Group Learning Sessions and Party Committee Meetings to study the spirit of the 19th CPC National Congress, the speeches spirit of XI Jinping and other party and state leaders during the inspections of CAS and the spirit of the congress of academicians of the Chinese academy of sciences and the Chinese academy of Engineering, strengthen the study of party members by reinforcing party branches deployment. In 2018, seven Party Committee Central Group Learning Sessions were held not only to study the theory but also integrate with practice to discuss the development issues of SCBG, for example, studied the relevant laws and regulations of nature reserves, studied general secretary XI Jinping's important speech during the inspection of Guangdong, discussed the management system and mechanism of Dinghushan National Nature Reserve, discussed issues about institutional mechanism reform, talents introduction and training, construction of Guangdong-Hong Kong-Macao Greater Bay Area ,etc. Through study and research, the sessions unified thoughts, built consensus and gathered the wisdom of the collective to promote the development of SCBG.

Figure 1. The representative of the 19th CPC national congress EN Yunfei to deliver a keynote speech.

To standardize party committee's rules of order for "Three-Importance and One-Large". The party committee has printed and distributed *The Contents and Scope of "Three-Importance and One-Large"*, revised *Party Affairs Conference System*, further standardized the deliberation and decision-making mechanism of the party committee meetings and promoted the decision-making of executive leadership to be more scientific, standardized and democratic. The above approaches have been recognized by CAS Shanghai branch and learned by many institutions.

Laid emphasis on party branch construction to strengthen the foundation for party construction

Integrated "Two Studies and One Action" and "Three Meetings and One Class" into the daily work. The secretary of the party committee and the discipline inspection committee ZHANG Fusheng and the staffs of party committee office frequently conducted investigations in party branches, guided the branches to carry out "Two Studies and One Action" , supervised the implementation of "Three Meetings and One Class" and guided the rectification of weak parts. They also leaded the branch to combine party construction with work, inspired the branch committee members and party group leaders to work with initiative, motivated innovation and work enthusiasm of the party members. For example, the party members from first and second scientific research branches set up a temporary party branch to facilitate party construction on the Coral Island, in this way to drive party members to enhance the awareness of hardship and patriotic dedication; the party members from horticulture center branch actively fought against destruction due to the super typhoon "Mangosteen" and voluntarily resumed production on weekends. SCBG individualized the education and training of party work cadres by diversifying the training forms, which contained observation, intercommunion, discussion, party class, special tutoring and so on. For example, party construction seminar of "Three Garden" (SCBG, Xishuangbanna Tropical Botanical Garden, Wuhan Botanical Garden) contained not only the observation and comments of spot branch theme party class, but also work exchange and "Three Meetings and One Class" standing book check, etc. In 2018, more than 250 backbones of party members were organized to attend training sessions at all levels.


Figure 2. Horticulture center branch carried out post practice activity.

Improved the branch performance appraisal. SCBG printed and distributed The Annual Performance Appraisal Plan of Party Branches, in which the appraisal object and method, the establishment of the appraisal group, the appraisal time, and the application of the appraisal result were standardized and implemented. Finally, one of the three grades, "Outstanding, Good, General" , would be given to the branch according to the appraisal plan. So far, SCBG's performance appraisal and work report mechanism of the party committee, the discipline inspection committee, the party branches and the party members has been established and tending toward perfection.

Laid emphasis on improving the party's work style and building clean department to create a positive environment

With the assist of discipline inspection committee, the party committee carried out Discipline Education & Learning Month Activities under the theme of *Strengthen the Party's Political Construction and Create Positive Political Ecology*. ZHANG Fusheng preached the newly revised *Regulations on disciplinary actions of the communist party*

of China, and given a class on the theme of *Contrast the Inspection Requirements of CAS Leading Party Group and Make Up Weakness to Strengthen Party Construction.* The other members of the party committee also given classes about integrity education to the contacted branches. SCBG carried out warning education by taking a case study of violation expenditure of conference fees. The party branches carried out party day activity on the theme of *I Take the Lead in Incorruptible Employment*. In order to improve the efficiency of management on science work, and combined with the reform of "Streamline Administration, Delegate Powers and Improve Regulation and Services" , SCBG adjusted approval authorities of meeting organization, personnel allowance and employment. Throughout the year, SCBG has gave disciplinary warnings, admonishing or remind conversations to seven employees, improved the internal control system on 37 aspects, took back irregular funds 112,600 Yuan by internal audits and special inspections, accomplished personal declarations by all the cadres at or above the division level, established communication mechanism between discipline inspection office and financial assets division. Leading group members took the lead in self-respect, introspection and self-policing, and educated party members and cadres to strengthen consciousness of rules to create positive work environment.

Figure 3. One of the thematic learning activity in Discipline Education & Learning Month.

Laid emphasis on culture of innovation and construction of United Front, Returned Overseas Chinese Federation and Mass organizations

The party committee organized SCBG 90th anniversary anthology compilation, interviewed five senior scientists including ZHANG Qiming and WU Huimin for the column *Oral History*, carried out advanced example learning activities to learn from "Primate Somatic Monkey Cloning" research team, Model of The Times-NAN Rendong and advanced examples from SCBG, such as famous plant physiologist and former director of SCBG GUO Junyan and March 8 Red Flag Bearer-ZENG Bilu, etc. The articles about GUO Junyan and his great deeds of devoting to the construction of our motherland have been publicized in many mainstream media. Through the learning activities，the excellent cultural traditions of SCBG have been developed and expanded. JIANG Yueming, a member of Chinese Peasants and Workers Democratic Party, was elected as a member of Guangdong Provincial Political Consultative Conference and a standing committee of Guangdong Provincial Committee of Peasants and Workers Democratic Party. KANG Ming and other two members of the Jiusan Society served in the Special Committee of Guangdong Provincial Committee of Jiusan Society. GONG Liang was elected as the new chairman of Peasants and Workers Democratic Party Branch. Returned Overseas Chinese Federation carried out research and other activities to serve the central work. The Labor Union and the Congress of Workers and Staff conducted public inquiry on SCBG affairs, held annual and regular meetings, organized basketball games between institutions in Guangzhou Branch, held fun sports meeting and National Fitness Day activities. The Labor Union and Youth League Committee jointly organized knowledge contest on theme of *Remain True to Our Original Aspiration and Keep Our Mission Firmly in Mind, Follow the Party's Words and Loyalty to the Party.* Throughout the year, more than 180 person-times of various personnel such as those who were hospitalized or living in elderly homes were visited, totally 125,700 Yuan of consolation money and goods were distributed, and many employees were visited. Help to reduce economic burden by at least 135,000 Yuan for five employees whose children studied at Changban elementary school.

Figure 4. Newly built party construction activity room.

Figure 5 .Interviewed senior scientists for the column Oral History.

Figure 6. SCBG art performance.

BGCI China Programme

Established in 1987, BGCI currently links more than 500 botanic gardens and conservation organizations in over 100 countries, working together to secure plant diversity for the well-being of people and the planet. In China, there are about 50 botanic gardens conservation organizations, members including five Patron Gardens: SCBG, Xishuangbanna Tropical Botanical Garden, Shenzhen Fairylake Botanical Garden, Shanghai Botanical Garden, and Shanghai Chenshan Botanical Garden. Directors of those five botanical gardens are members of BGCI's International Advisory Council (IAC), who provide good suggestions for the strategic development of BGCI. In 2018, three new botanical gardens joined BGCI. Two botanical gardens including Beijing Botanical Garden and Beijing Medicinal Plants Garden are in the process of joining A category and B category members respectively.

Figure 1. Group photo of parts of IAC members.

1. Central to BGCI's mission is working with you, our members and other partners to save plants.

The **Global Tree Assessment (GTA)** has rapidly accelerated with 5,300 species conservation red list assessments in 2018, the number of which was a five-fold as in 2017! Additionally, funding secured to complete the assessment of all unassessed tree species by 2020. Similarly, the Global Trees Campaign (GTC) has grown significantly and BGCI disbursed USD 2,209,000 to 73 botanic gardens or other institutions in 41 countries to save 120 threatened tree species, in which nine botanic gardens or institutions with about USD 112,000 saving 11 threated tree species are in China in 2018. More than 450,000 seedlings were raised by BGCI GTC projects this year, in which 170,000 seedlings were raised by BGCI China projects. BGCI has been working with botanical gardens, forest departments, plant conservation organizations, as well as local community and apply integrated conservation approach, integrating *ex situ*, *in situ* conservation and reintroduction, to save threatened plant species in the globe. In 2019, BGCI will expand this work by launching a Global Botanic Garden Fund that all BGCI members can apply to for funding.

Figure 2. 2018 BGCI China project locations.

Figure 3-4. Experts inspecting and guiding BGCI China conservation projects.

2. BGCI's work sharing knowledge within and outside our community of botanic gardens is primarily manifested in our vocational training programmes.

In 2018, BGCI training events were attended by 689 people from 220 institutions in 54 countries, in which 205 people of 20 institutes are in China. More than 100 local villagers were also trained on the techniques of propagation, cultivation, cultivation, as well as harvesting in China, accompanied by the distribution of about 300 training materials. To raise the awareness of plant conservation for local authorities, local people, and students, BGCI China office organized three stakeholder workshops with about 200 stakeholders participation and held 6 educational activities in local primary schools for about 1,000 students, accompanied with the distribution of about 1,000 outreach materials, exhibition panels, 280 book marks with the theme of threatened plants.

Figure 5. Training local people propagation technique of Rhododendron plants.

Figure 6. Public education lecture in Hunan Botanical Garden.

3. Measuring and improving the impact of public engagement by botanic gardens was a strong theme of BGCI's 10th International Congress on Education in Botanic Gardens, which was held in Warsaw in September.

Connecting people is one of BGCI's most important purposes, and nearly 300 delegates from 50 countries attended this conference for a week of stimulating discussions and presentation, in which 28 participants were from China.

Figure 7. BGCI's 10th International Congress on Education in Botanic Gardens.

4. Launched in 2018, BGCI's Accreditation Scheme aims to recognise and maintain professional standards in botanic gardens.

BGCI Botanic Garden Accreditation was launched in May, and BGCI Conservation Practitioner Accreditation was launched in August. A third accreditation – BGCI Advanced Conservation Practitioner – is currently being tested for launch in early 2019. Some Chinese botanic gardens will apply for BGCI's Accreditation Scheme in 2019. Apply for Accreditation Scheme at: http://www.bgci.org/accreditation/

Figure 8. BGCI's Accreditation Scheme.

5. WEN Xiangying took any opportunity and used various media to promote botanic gardens and their role in plant conservation.

Invited by the leader of Wildlife Conservation Department of National Forestry and Grassland Administration (NFGA), WEN Xiangying gave a lecture in the training course on the wildlife conservation technique for representatives from forestry departments of provinces, autonomous regions and municipality directly under the Central Government. Invited by National Aflorestation Environmental Protection Commission, WEN Xiangying attended the National Voluntary Planting Tree activity in Chengdu of Sichuan province, devoting herself to the beauty of China.

Figure 9. WEN Xiangying attended the National Voluntary Planting Tree activity in Chengdu of Sichuan province.

Figure 10. WEN Xiangying gave a lecture in the training course on the wildlife conservation technique.

Research Platform

Key Laboratories

1. Key Laboratory of Plant Resources Conservation and Sustainable Utilization, CAS

The key laboratory aims to meet the needs of national development strategy, with the researches focusing on the conservation and sustainable utilization of plant resources. Using multidisciplinary methods from gene, individual to population and community levels, the laboratory carries out both basic and applied basic research in the following three fields: the mechanism of biodiversity formation and maintenance, the conservation and sustainable utilization of plant diversity, as well as the utilization of germplasm, genetic and chemical resources. The laboratory also aims to provide a theoretical and technological basis for the protection and sustainable utilization of important plant resources.

The director of the laboratory is Professor JIANG Yueming, the deputy director is Professor KANG Ming, and the chair of the academic committee is Professor HUANG Hongwen. At present, the laboratory has 16 research groups with 92 staff, including 72 scientific researchers, 26 of them are professors, two of them are selected personnel of the Millions of Leading Engineering Talents, one of them received the fund from National Natural Science Funds for Distinguished Young Scholar, one of them was selected as the leading scientist of WRJH, three of them belong to selected personnel of BRJH, one of them received the fund from Guangdong Provincial Natural Science Funds for Distinguished Young Scholar, three of them were supported by Pearl River S&T Nova Program of Guangzhou, four of them were selected as specially-hired researchers of CAS Distinguished Research Fellow Program, and six of them were selected as members of CAS Youth Innovation Promotion Association. In 2018, Professor JIANG Yueming was selected as a member of the 12th Guangdong Provincial Committee of the Chinese People's Political Consultative Conference (CPPCC); Professor JIANG Yueming won the 2018 China industry-university-research cooperation innovation award; Professor QIU Shengxiang was appointed visiting professor of Foshan Hospital of Traditional Chinese Medicine; YANG Bao and LIU Qing were awarded the honorary title of Excellent Graduate Tutors of Guangzhou Education Base in 2018; Zhang Dandan was selected as Key Technical Talents of CAS; Four of them were promoted to associate professor.

In 2018, the key laboratory received 112 million Yuan funds with 131 scientific research projects. A total of 105 new scientific research projects were launched with funds above 96 million Yuan. There were 35 national project (Including national funds) with funds of 43.24 million Yuan, which contained one project of the National Key Research and Development Program and one key project of the National Natural Science Foundation of China; 19 CAS projects with funds of 29.75 million Yuan.

The staff in the laboratory published 100 SCI papers, in which 38 papers were listed as top 30 and 21 papers were listed as top 10. Moreover, the laboratory published eight monographs and two CSCD papers. 11 invention patents were applied, and 11 invention patents were authorized. One new cultivar was cultivated. The laboratory affiliated 63 Ph.D. candidates and 95 master students. There were 10 Ph.D. candidates and 19 master students were awarded for corresponding degree. Two graduate students won the Pubang Garden Scholarship; three graduate students were awarded BIOMIGA Scholarship at SCBG; three graduate students won national scholarships.

In October 2018, the SCBG delegation participated in the International Conference on Tropical Biodiversity 2018 in Malaysia, more than 100 delegates from Malaysia, Britain, Indonesia, Singapore, China, Taiwan and other countries and regions attended the meeting. In November 2018, the China Botanical Garden Union 2018 Live Plant Collection and Ex situ Conservation Management Training, sponsored by China Botanical Garden Union and undertaken by SCBG, was held in Ningbo Botanical Garden as scheduled.

Figure 1. SCBG delegation participated in the International Conference on Tropical Biodiversity 2018.

Figure 2. Group photo of the training class.

2. Key Laboratory of Vegetation Restoration and Management of Degraded Ecosystems, CAS

In the year of 2018, the Key Laboratory of Vegetation Restoration and Management of Degraded Ecosystems, CAS, received 81.85 million Yuan funds from 221 projects, including one grant supported by 973 Program, 63 from National Natural Science Foundation of China (NSFC), 97 from Minstry of Science and Technology (MST) and CAS, 59 from other agencies. There were 115 papers published in international journals, with 97 of which were published in top 30 journals of the related fields. There were two national patents authorized in 2018. In total, 29 postgraduates earned their

Figure 3-4. Annual meeting of the key laboratory in 2018

Ph.D. or M.S. degrees. Dr. YE Qing and Dr. YAN Junhua won The National Science Fund for Distinguished Young Scholars of 2018.

3. Key Laboratory of South China Agricultural Plant Molecular Analysis and Genetic Improvement, CAS

Key laboratory of South China Agricultural Plant Molecular Analysis and Genetic Improvement comprises 10 research groups with 52 researchers. The director of the key laboratory is prof. WANG Ying, and the academic committee director is prof. FANG Rongxiang. In 2018, funds from newly contracted research projects were more than 19.41 million Yuan, and funds in place reached 18.83 million Yuan. There were 46 papers published in international journals, of which 14 papers were listed as Top 10% and 26 papers were listed as Top 30%. In addition, the key laboratory obtained one international invention patent, authorized 23 invention patents, nine utility models, 12 new varieties, and 16 new international varieties. The achievements won one first prize of Guangxi Science and Technology Progress Award and one National Patent Excellence Award.

Representative research: Exploring of genetic resources for abiotic stresses and identification of salt/drought-related genes by FOX hunting system with yeast functional screening approach from Ipomoea pes-caprea

Ipomoea pes-caprae is a seashore halophytic plant and therefore can be considered as a good model for studying the molecular mechanisms underlying salt and drought stress tolerance in plant research. In our project, we performed Full-length cDNA Over-eXpressor (FOX) gene hunting, with a functional screening of a cDNA library using a salt-sensitive yeast mutant strain AXT3 to isolate the salt-stress related genes of I. pes-caprae (IpSR genes). We finally isolated 38 candidate salt stress-related full-length cDNA clones from the I. pes-caprae cDNA library. The genes are predicted to encode proteins involved in water deficit, reactive oxygen species (ROS) scavenging, cellular vesicle trafficking, metabolic enzymes and signal transduction factors (ZHANG et al., 2018).

Combining with the cDNA library screening work and quantitative RT-PCR analyses results, an abscisic acid, stress and ripening (ASR) gene, IpASR, and a dehydrin gene, IpDHN, were picked out and performed further functional research. Our result indicated that, the induced expression of IpASR and IpDHN in Escherichia coli showed that these two proteins can notably enhance abiotic stresses tolerance in E. coli; after heterologous over-expression of IpASR and IpDHN in model plant Arabidopsis, the transgenic Arabidopsis plants showed a significant enhancement in tolerance to salt/drought stresses, as well as less accumulation of ROS (ZHENG et al., 2018; ZHANG et al., 2018). This approach provides a rapid assay system for the large-scale screening of I. pes-caprae genes involved in the salt stress response, and supports the identification of genes responsible for the molecular mechanisms of salt tolerance.

4. Key Laboratory of Digital Botanical Garden of Guangdong Province

According to the annual general plan of the laboratory, the Key Laboratory of Digital Botanical Garden of Guangdong Province focused on the informationization of botanical gardens and the management of botanic science data in ex situ plants, established the China Botanical Plant Information Management System, also known as “PIMS” on the Windows platform, and completed the launching and testing of the new functions of BioSurveyor App, which currently applied to more than 30 botanical gardens nationwide. The establishment of this system greatly facilitates the management of the botanical gardens, effectively raising the digital informationization level within botanical garden, and enabling botanic management of the Chinese botanical gardens to enter the era of information. On this basis, the 2018 Live Botanic Collection and Ex situ Conservation Management Training Course sponsored by the Chinese Botanical Garden Alliance was hosted, during which plant introduction, collection, live botanic conservation and management practices and site surveys were carried out. The development work of Guangzhou Ornamental Plant Germplasm Resources and Live Botanical Record Management System

and African Botanical Information Management System was also completed. In 2018, the total funding from CAS and the China Botanical Garden Alliance were close to 1.91 million Yuan. With the assistance of the Botanical Data Editing and Writing Platform developed by the laboratory, researchers from the lab completed two volumes of *Chinese Ex situ Cuitivation of Plant Encyclopedia* and three volumes of *Chinese Ex situ Cuitivation and Plants*. The *Chinese ex situ cultivation of plant encyclopedia* series (a total of 13 volumes) has been published. Under the joint efforts of the backbone members and technicians of the laboratory, 16 graduate students were graduated in 2018. 12 books and 23 SCI papers had been published, four invention patents and one new cultivar plant license had been obtained.

5. Key Laboratory of Applied Botany of Guangdong Province

Key laboratory of Applied Botany of Guangdong Province comprises 32 research groups with 148 researchers. The director of the key laboratory is prof. REN Hai, and the academic committee director is Academician. WU Weihua. In 2018, funds from newly contracted research projects were greater than 177 million Yuan, and funds in place reached 164 million Yuan. There were 134 papers published in international journals, of which four papers were listed as Top 1% and 34 papers were listed as Top 10%. In addition, the key laboratory published five monographs; 48 patent applications were submitted, in which 40 applications were granted; 25 new cultivators were granted; 71 postgraduates were awarded master or doctor degrees.

Figure 5. Acceptance Meeting

Figure 6. Certification of Opening Project

Figure 7. Opening Projects in 2018

Figure 8. Annual Report

Research Stations

1. Dinghushan National Field Research Station of Forest Ecosystem

Dinghushan National Field Research Station of Forest Ecosystem (hereafter referred to as Dinghushan station) is one of the Chinese Ecosystem Research Network (CERN) members, and one of the national public research platforms of the Chinese National Ecosystem Research Network (CNERN), it is an Excellent Ecological Field Station. Dinghushan station is oriented to the national demands, the development of ecological system ecology and the frontier scientific issues, systematically studies the succession processes and natural course of the zonal forest ecosystem including structure and function, pattern-process relationships. The station has been exploring the tropical and subtropical forest ecosystem, its responses, adaptations and mechanisms of key processes such as carbon, nitrogen, phosphorus, water cycle, and their coupling to global change.

Dinghushan station has its unique location advantage, well improved platform basement, and abundant research accumulation; it has become an important ecological research station in China and abroad. For a long time, the station has offered scientific platforms for more than 10 institutes and universities for long term scientific researches, including a batch of important projects such as international cooperation projects, National Basic Research Program of China (973 Program), the key program of NSFC, the Distinguished Young Scholar Program of NSFC, BRJH of CAS. During the period of these projects launched at Dinghushan station, the projects were benefitted from field sites, research facilities, observation data, background data, and staff assistance, respectively. All those research activities embodied the strongest supporting function of the station.

Figure 1. Group photo at the International Long-term Ecological Research Network Strategy Seminar for the Next Decade.

Figure 2. Representative of academic degree assessment committee of University of Chinese Academy of Sciences in front of the gate of Dinghushan station.

Currently there are 18 scientific research staff members, five technical support staffs and nine project employees at Dinghushan station. The station is equipped with a series of monitoring facilities including one meteorological automatic observation station, four microclimate automatic observation towers, one forest climate observation tower in an evergreen monsoon forest, one forest water vapor flux observation tower in a mixed conifer-broadleaf forest. There are many long-term experimental forest sites, such as one permanent integrated experimental observation site, five permanent auxiliary observation sites. Along with these permanent sites, so far Dinghushan station has set up more than 50 various sites for long-term experiments (observations), such as forest ecosystems transplanted along an elevation gradient experimental site, simulated acid deposition experiment site, nitrogen addition experiment site, sap flow measurements site, providing researchers with perfect platform support for all kinds of ecological researches.

In 2018, 20 new projects were launched at Dinghushan station, in which two projects were funded by the Distinguished Young Scholar Program of NSFC, and funds from newly contracted scientific projects reached 18 million Yuan. In this year, 52 papers were published by the Dinghushan staff, 36 of which were published in the SCI journals such as *Nature Communications* (one paper), *PNAS* (five papers), the total impact factor reached 184. 16 papers were published by Chinese Science Citation Database journals. As chief or a key editor, Dinghushan station staff have participated two monographs, respectively. Guest researchers published 16 papers, and six of them are SCI papers. In the case of intellectual property, three patents were granted.

In talent training, Dinghushan station has made great breakthroughs in this year. Professors YAN Junhua and YE Qing were funded by the Distinguished Young Scholar Program of NSFC. Prof. ZHANG Deqiang has been awarded The Third China Ecosystem Research Network Science and Technology Contribution Award, Prof. MO Jiangming was awarded the honorary title of Excellent Supervisor in 2018.

2. Heshan National Field Research Station of Forest Ecosystem

Heshan National Field Research Station of Forest Ecosystem (hereafter referred to as Heshan station), also known as the Heshan Hilly Land Interdisciplinary Experimental Station of CAS, is a member station of the Chinese National Ecosystem Research Network (CNERN) and the China Ecosystem Research Network (CERN). As a field research and demonstration platform, Heshan station provides supports to researchers for experimental sites, research facilities and long-term ecological data related to hydrologic cycles, soil properties, atmospheric chemistry and biological resources. The main research area in the Heshan station involves forest restoration and management of degraded ecosystems in lower subtropical China. Heshan station has 23 research staff and seven technical support staffs. At present, there are 23 ongoing research projects, with the total funds of about 1.63 million Yuan, being carried out in the station. In 2018, Heshan station has accommodated more than 330 visiting scholars. There were 8 graduate students fulfilled their doctoral or master degree programs in the year. Dr. SHEN Weijun received the financial support from WRJH.

In 2018, excellent progress has been made in assessing the effects of climate on soil phosphorus (P) cycling and availability in natural terrestrial ecosystems, which has been largely under studied compared to those of carbon and nitrogen cycles.

Good progress has also been made in the improvement of the infrastructure of the station. Supported by the renovation programs from CAS in recent years, the office and laboratory buildings, research facilities and sanitation environment have been largely improved. The station now can provide accommodations for about 40 researchers at the same time to support their living and research activities.

Figure 3. Aerial view of heshan station

Figure 4. Living area of Heshan station

Figure 5. The appearance of heshan station

3. Xiaoliang Research Station of Tropical Coastal Ecosystem, CAS

Xiaoliang Research Station of Tropical Coastal Ecosystem (hereafter referred to as Xiaoliang Station) was established in 1959 and situated in Maoming city, Guangdong province. It is one of the most early field stations oriented at restoration ecology. The station carries out the researches in restoration of degraded land and remediation of contaminated paddy field, establishment of coastal foster plantation, carbon sequestration in coastal wetland (blue carbon), ecosystem stability and function of coastal forests under the background of global change. The station now has several field research platform including effect of N/P addition on forest ecosystem (began in 2009), effect of rainfall pattern change on forest (began in 2012) and soil and water erosion in different plantations.

The station has 19 staffs, among which six are professors and four are associate professors. In 2018, the station got 23 new projects with a total fund of 16.85 million Yuan. Among the projects, one with fund of five million Yuan is granted from Guangdong provincial government, which targets at restoration ecology and the environmental issues in Guangdong-Hong Kong-Macao Greater Bay Area. A project of international cooperation totaling at 1.5 million Yuan is granted to Prof. HUANG Jiangguo by NSFC, a key member of the station. The scientists at Xiaoliang station publishes 30 SCI papers and six authorized patents, among which four papers in *Global Change Biology*, one in *Functional Ecology*. Two PhD students and eight master students graduated in 2018. There are 16 enrolled PhD students and 20 master students.

Herbarium

1. New Measures for Co-construction and Sharing

In December 2018, the Herbarium of Guangdong Academy of Forestry has been integrated into our herbarium as a whole in the form of a special collection. It contains more than 8,300 specimens of 2,362 species, belonging to 214 families, 977 genera, collected and preserved in the past 60 years.

Prior to that, we have established co-construction and cooperation with several nature reserves. In 2016, the first special collection of the Guangdong Zijin-Baixi Nature Reserve and was officially established. Later, we cooperated with Guangzhou Linfang Eco-technology Co., Ltd. to build another special collection.

On the way of development, we are constantly exploring and innovating, cooperated with the nature reserves, the ecological companies, and the small herbaria. The new measure of co-construction and sharing provides a new route for the development of herbaria.

Figure 1. The herbarium of Guangdong Academy of Forestry has been integrated into our herbarium as a whole.

2. The First Top Course of Continuing Education in Our Garden

From August 17 to 22, Training Course on Plant Specimen Collecting and Identification was successfully held in Dinghushan National Nature Reserve. More than 70 trainees from over 30 units in China participated in the training.

In response to the current situation that the Nature Reserves pay more attention to the popularization of science and the relative lack of popular science skills, we have increased the training content of popular science ability in addition to the

training of classified knowledge. In this training course, invited experts are not only well-known taxonomists in China, but also Internet Celebrities and popular scientists. They include Professor PENG Hua from Kunming Institute of Botany of CAS, Dr. GU Lei from Beijing Normal University who is the main author of *Species Calendar* of guokr.com, Dr. LIU Yang who is one of the founders of guokr.com, Ms. WU Jianmei from Tongya Seed Hall in Shenzhen, etc.

Figure 2. 2018 Training Course on Plant Specimen Collecting and Identification

In 2013, we pioneered in the training of plant collecting and identification in CAS. Up to now, seven training courses have been held in six years, and more than 300 trainees, mainly from South China, have been trained. From the elementary class to the advanced class, and then to the top-quality course, Training Course on Collection and Identification of Plant has become a business card of the Herbarium IBSC.

3. Supporting the National and Local Demands by Developing New Facilities

Over the past 10 years, rosewood industry has become the fastest growing area in forestry, wood processing, furniture and other industries in the southern Chinese provinces such as Guangdong, Guangxi and Fujian, and formed a large number of industrial towns with an annual output value of hundreds of billions Yuan. However, with the rapid growth of demand, and the gradual reduction of high-quality authentic rosewood raw materials, so the phenomenon of "sub-optimal" and "false" is very common. A few years ago, our garden's rosewood identification platform came into being as the times require.

The main raw materials of rosewood industry are sandalwood and rosewood of leguminous plants, which are the main traditional research groups in SCBG. After years of investigation and collection, we have collected more than 30 species and over 50 samples of rosewood. We intend to establish the Wood Herbarium in our garden to provide strong support services for the identification platform of rosewood in SCBG.

The Wood Herbarium took the opportunities to collect wood specimens from wind-damaged trees. After the super typhoon "Mangosteen" on September 16, 2018, 92 wood specimens were collected from Dinghushan National Nature Reserve and the exhibition zone in our garden. So far, we have collected nearly 150 wood specimens for the soon-to-be established wood herbarium.

Public Laboratory

In 2018, 32 sets of instruments in Public Laboratory have provided analysis and testing services for 351 researchers inside or outside SCBG. The average utilization rate of 32 sets of instruments in the whole laboratory is 135%, the total sharing efficiency is 97%, the total effective working time was 58,430 hours and 68,888 samples were measured altogether.

In 2018, Public Laboratory is researching four large instrument functional development projects of CAS, has completed three open projects of Guangzhou Regional Center for Instruments Life Science, participated in one large instrument development project of CAS, published eight papers, and obtained one authorized patent.

There were 58 persons to attend 37 training and technical exchange activities and obtain 28 certificates; Public Laboratory has organized 19 technical lectures and trainings for 470 students, has hosted six times management trainings on certification with 60 participants and has held two sessions of the popular science teaching with 50 participants.

Public laboratory has completed two repairing and purchasing project of CAS in 2016 and 2017, which are Biological Resources Microscopic Structure and Function Analysis Platform ($6.59 million) and Biological Molecules Structure and Functions Analysis Platform ($5.8 million). The two projects had passed the acceptance smoothly respectively on January 11and on December 28 in 2018.

The project of Biological Resource Ecological Protection Experimental Platform (with a total value of 7.7 million Yuan) has been successfully implemented in 2018. The repairing and purchasing project of Biological Resource Microstructure and Function Analysis Platform was funded by the Ministry of Finance with a total of 4.5 million Yuan in 2019.

The revised qualification certification system has passed the re-evaluation of CNAS in December 2018, indicating that the technical level and management level of Public Laboratory have been further recognized by relevant national departments.

Director XU Xinlan was appointed as director of China Electronic Microscope Society, deputy director of Agriculture and Forestry Committee of China Electronic Mirror Society, vice chairman of Guangdong Electronic Mirror Society, director of Guangdong Analytical Testing Society, member of Tianhe District People's Congress Standing Committee and other social positions. She has been invited to make reports in the industry technology and management exchange meeting, thus maximizes the visibility and influence of Public Laboratory outside SCBG, and strives for more

Figure 1. Technical training and communication

Figure 2. The review meeting of CNAS

Figure 3. High resolution double pressure linear ion trap-orbitrap-liquid chromatography - mass spectrometry

Figure 4. Honor certificate

resources for the Public Laboratory. She also actively participated in the political discussion and served for community construction. The Microstructure and Function Analysis Platform was awarded the outstanding platform by the Public Technical Service Center of CAS, and public laboratories were awarded "Meritorious Women" by CAS in 2018.

JIA Yongxia who responsible for Chromatography mass spectrometry unit, YOU Xiaoying who responsible for Elemental analysis unit and PAN XiaoPing who responsible for management unit obtained outstanding awards of Guangzhou Regional Center for Instruments Life Science.

Supporting Center

Library

In 2018, the Library has been continuing focusing efforts on establishing and enriching the information resources of publications. We have been more practically adjusting the ratio of hard-copies over the electronic publications with the goal of increasing the portion of electronic publications. During 2018, subscription of eight hard-copy periodicals was cancelled, we subscribed their exclusive electronic version instead. Meanwhile, considering the lack of publication collection in the Chemistry and its interdisciplinary fields, we selectively built a "Chemical Journal Database", which includes all papers published in the past 15 years from six Journals. Through the efforts from all the staff members in the Library, we were able to accomplish all kinds of goals including purchase, catalogue, storage and delivery, etc. The tables below shows the statistics of literature construction in 2018.

Table 1. 2018 Data on the construction of print publications (The prices of books without list price were estimated)

	Books						Periodicals				
	language	Species	Subtotal	Volumes	Subtotal	Acquisition expenses (CNY)	Species	Subtotal	Volumes	Subtotal	Acquisition expenses (CNY)
Purchase	Chinese	81	150	83	152	48,276.55	63	102	813	1240	351,781
	Foreign Languages	69		69			39		427		
Present and Exchange	Chinese	72	91	125	145	27,900*	79	112	334	420	
	Foreign Languages	19		20			27		86		
Cataloged	Chinese	151	232	195	289		Periodical Volumes Collected and Sorted		Chinese	Foreign Languages	Total
	Foreign Languages	81		94					1147	513	1660

Table 2. Data on purchased electronic publications

Databases (Species)	Electronic Periodicals (Species)	Subscription costs (CNY)
13	27	830,564

In terms of the database building, in addition to the literature catalogue database, we have been continuing the uploading data to the "Institutional Repository (IR)", which is required for the Informatization Evaluation Projects of the Chinese Academy of Sciences. We totally uploaded more than 1,800 items of information to the IR, which includes full text research papers, research reports, PPT presentations and pictures of plants, etc. We also have established a document delivery database. It will be the bank of all sorts of information, such as papers, thesis, books transmitted from other institutions.

In 2018, the Library hosted 1,340 visitors. There were 425 person-times of readers, who checked out 701 books. And there were 433 person-times of readers, who returned 706 books. In the inter-library loan program, we borrowed over 100 books from other libraries. Through the QQ platform, E-mail or other interlibrary exchanges, we received 825 document claims of 678 person-times, supplied 702 PDF full text, reaching an 85% satisfying rate. Within these transmitted documents, there were 75 thesis papers and 59 books or various standards. In terms of searching for literatures indexing and citation, we successfully completed 20 reports, which were asked by scientists or post graduates of our institution.

Office of *Journal of Tropical and Subtropical Botany*

In 2018, we published *Journal of Tropical and Subtropical Botany*, Vol. 26 (issue 1-6). Total 251 manuscripts were received and 92 papers with 1.35 million words altogether were selected for publication after peer review. Among them, 91 papers were supported by research funds, which accounting for 98.0% of the total; and 40 of them were supported by the state level research funds.

According to Chinese Academic Journal Comprehensive Citation Report Statistics, our journal has an impact factor 0.794, with total 1,907 citations and 38 thousand internet downloads.

Computer Network Center

The ARP（Academic Resource Planning）system had migrated to Chinese Academy of Science Cloud platform. Users can easily access internet, mail system and the accounting system under the ARP platform, by getting authentication from the identity management unit in CAS headquarter in Beijing. An extra 288TB data storage capability expansion had been added to server room of experiment building No.4, double data backup in administration building server room has been put to service. Campus internet bandwidth had also increased 200MB (the total bandwidth reaches 438MB). IPV6 services is ready for users. By using the resources from the newly established campus virtual cloud platform and cloud notepad, our users can easily access Super Computing System and data storage services.

South China Plant Identification Center

In 2018, we updated the identify process and the web content of South China Plant Identification Center (SCPIC) (http://scpic.scbg.ac.cn/). This year, SCPIC has provided more than 95 batches plant identification services for public security, customs, court and medicine food and universities. According the suggestion of Department of Forest of Guangdong Province, the scientists of SCBG also provided free identification services for 12 police stations in the North and North-west Guangdong. These professional identification services are very helpful for them to complete their cases in the first time. Our specialists' professional identification has received high recognition from the society.

Appendix 1. Main Papers

No.	Title	Journal Name	Issue Volume	Start	Stop	Impact Factor	Authors
1	Gibberellins play an essential role in late embryogenesis of Arabidopsis	NATURE PLANTS	4	289	298	11.471	Hu YL, Zhou LM, Huang MK, He XM, Yang YH, Liu X, Li YG, Hou XL*
2	RNA polymerase II activity revealed by GRO-seq and pNET-seq in Arabidopsis	NATURE PLANTS	4	1112	1123	11.471	Zhu JF，Liu M，Liu XB，Dong ZC*
3	Plant acclimation to long-term high nitrogen deposition in an N-rich tropical forest	PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	115	5187	5192	9.504	Lu XK, Vitousek PM*, Mao QG, Gilliam FS, Luo YQ, Zhou GY, Zou XM, Bai E, Scanlon TM, Hou EQ, Mo JM*
4	Carbon pools in China's terrestrial ecosystems: New estimates based on an intensive field survey	PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	115	4021	4026	9.504	Tang XL, Zhao X, Bai YF, Tang ZY, Wang WT, Zhao YC, Wan HW, Xie ZQ, Shi XZ, Wu BF, Wang GX, Yan JH, Ma KP, Du S, Li SG, Han SJ, Ma YX, Hu HF, He NP, Yang YH, Han WX, He HL, Yu GR, Fang JY*, Zhou GY*
5	Plant diversity enhances productivity and soil carbon storage	PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	115	4027	4032	9.504	Chen SP, Wang WT, Xu WT, Wang Y, Wan HW, Chen DM, Tang ZY, Tang XL, Zhou GY, Xie ZQ, Zhou DW, Shangguan ZP, Huang JH, He JS, Wang YF, Sheng JD, Tang LS, Li XR, Dong M, Wu Y, Wang QF, Wang ZH, Wu JG, Chapin FS, Bai YF*
6	Patterns of plant carbon, nitrogen, and phosphorus concentration in relation to productivity in China's terrestrial ecosystems	PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	115	4033	4038	9.504	Tang ZY, Xu WT, Zhou GY, Bai YF, Li JX, Tang XL, Chen DM, Liu Q, Ma WH, Xiong GM, He HL, He NP, Guo YP, Guo Q, Zhu JL, Han WX, Hu HF, Fang JY*, Xie ZQ*
7	HMOD: An Omics Database for Herbal Medicine Plants	MOLECULAR PLANT	11	757	759	9.326	Wang X, Zhang JJ, He SM, Gao YN, Ma XQ, Gao Y, Zhang GH, Kui L, Wang W, Wang Y*, Yang SC*, Dong Y*
8	Contributions of insects and droughts to growth decline of trembling aspen mixed boreal forest of western Canada	GLOBAL CHANGE BIOLOGY	24	655	667	8.997	Chen L, Huang JG*, Dawson A, Zhai LH, Stadt KJ, Comeau PG, Whitehouse C

No.	Title	Journal Name	Issue Volume	Start	Stop	Impact Factor	Authors
9	Effects of climate on soil phosphorus cycle and availability in natural terrestrial ecosystems	GLOBAL CHANGE BIOLOGY	24	3344	3356	8.997	Hou EQ*, Chen CR, Luo YQ, Zhou GY, Kuang YW, Zhang YG, Heenan M, Lu XK, Wen DZ*
10	Spring phenology at different altitudes is becoming more uniform under global warming in Europe	GLOBAL CHANGE BIOLOGY	24	3969	3975	8.997	Chen L, Huang JG*, Ma QQ, Hanninen H, Rossi S, Piao SL, Bergeron Y
11	A brassinosteroid responsive miRNA-target module regulates gibberellin biosynthesis and plant development	NEW PHYTOLOGIST	220	488	501	7.433	Gao J, Chen H, Yang HF, He Y, Tian ZH*, Li JX*
12	Homeologue-specific expression divergence in the recently formed tetraploid Capsella bursa-pastoris (Brassicaceae)	NEW PHYTOLOGIST	220	624	635	7.433	Huang HR, Liu JJ, Xu Y, Lascoux M, Ge XJ*, Wright SI*
13	What explains high plant richness in East Asia? Time and diversification in the tribe Lysimachieae (Primulaceae)	NEW PHYTOLOGIST	219	436	448	7.433	Yan HF, Zhang CY, Anderberg AA, Hao G, Ge XJ*, Wiens JJ*
14	New insights on bioactivities and biosynthesis of flavonoid glycosides	TRENDS IN FOOD SCIENCE & TECHNOLOGY	79	116	124	6.609	Yang B*, Liu HL, Yang JL, Gupta VK*, Jiang YM*
15	A Bioinspired Cascade Sequence Enables Facile Assembly of Methanodibenzo[b,f][1,5]dioxocin Flavonoid Scaffold	ORGANIC LETTERS	20	546	549	6.492	Liu HX, Wang Y, Guo XY, Huo LQ, Xu ZF, Zhang WM, Qiu SX, Yang B*, Tan HB*
16	Optimized paired-sgRNA/Cas9 cloning and expression cassette triggers high-efficiency multiplex genome editing in kiwifruit	PLANT BIOTECHNOLOGY JOURNAL	16	1424	1433	6.305	Wang ZP, Wang SB, Li DW, Zhang Q, Li L, Zhong CH, Liu YF*, Huang HW*
17	Temporal-Specific Interaction of NF-YC and CURLY LEAF during the Floral Transition Regulates Flowering	PLANT PHYSIOLOGY	177	105	114	5.949	Liu X, Yang YH, Hu YL, Zhou LM, Li YG, Hou XL*
18	OsOFP19 modulates plant architecture by integrating the cell division pattern and brassinosteroid signaling	PLANT JOURNAL	93	489	501	5.775	Yang C, Ma YM, He Y, Tian ZH*, Li JX*
19	Bamboo vs. crops: An integrated emergy and economic evaluation of using bamboo to replace crops in south Sichuan Province, China	JOURNAL OF CLEANER PRODUCTION	177	464	473	5.651	Lu HF, Cai CJ, Zeng XS, Campbell DE, Fan SH*, Liu GL*
20	Reconsidering the phosphorus limitation of soil microbial activity in tropical forests	FUNCTIONAL ECOLOGY	32	1145	1154	5.491	Mori T, Lu XK, Aoyagi R, Mo JM*
21	Using functional trait diversity patterns to disentangle the scale-dependent ecological processes in a subtropical forest	FUNCTIONAL ECOLOGY	32	1379	1389	5.491	Zhang H, Chen HYH, Lian JY, John R, Li RH, Liu H, Ye WH, Berninger F, Ye Q*
22	Site-selective phenol acylation mediated by thioacids via visible light photoredox catalysis	ORGANIC CHEMISTRY FRONTIERS	5	1312	1319	5.455	Shi LL, Liu HX, Huo LQ, Dang YQ, Wang Y, Yang B, Qiu SX*, Tan HB*
23	A global dataset of plant available and unavailable phosphorus in natural soils derived by Hedley method	SCIENTIFIC DATA	5	180166		5.311	Hou EQ*, Tan X, Heenan M, Wen DZ*

No.	Title	Journal Name	Issue Volume	Start	Stop	Impact Factor	Authors
24	Complete genome sequencing of the luminescent bacterium, Vibrio qinghaiensis sp Q67 using PacBio technology	SCIENTIFIC DATA	5	170105		5.311	Gong L, Wu Y, Jian QJ, Yin CX, Li TT, Gupta VK, Duan XW*, Jiang YM
25	Structure identification of an arabinogalacturonan in Citrus reticulata Blanco 'Chachiensis' peel	FOOD HYDROCOLLOIDS	84	481	488	5.089	Yang JL, Wen LR, Zhao YP, Jiang YM, Tian MM, Liu HL, Liu J, Yang B*
26	Structure characterisation of polysaccharides in vegetable "okra" and evaluation of hypoglycemic activity	FOOD CHEMISTRY	242	211	216	4.946	Liu J, Zhao YP, Wu QX, John A, Jiang YM, Yang JL, Liu HL, Yang B*
27	Study of the biochemical formation pathway of aroma compound 1-phenylethanol in tea (Camellia sinensis (L.) O. Kuntze) flowers and other plants	FOOD CHEMISTRY	258	352	358	4.946	Zhou Y, Peng QY, Zeng LT, Tang JC, Li JL, Dong F, Yang ZY*
28	Comparative analysis of pigments in red and yellow banana fruit	FOOD CHEMISTRY	239	1009	1018	4.946	Fu XM, Cheng SH, Liao YY, Huang BZ, Du B, Zeng W, Jiang YM, Duan XW, Yang ZY*
29	Changing rainfall frequency rather than drought rapidly alters annual soil respiration in a tropical forest	SOIL BIOLOGY & BIOCHEMISTRY	121	8	15	4.926	Deng Q, Zhang DQ, Han X, Chu GW, Zhang QF*, Hui DF*
30	Responses of soil microbial community to continuous experimental nitrogen additions for 13 years in a nitrogen-rich tropical forest	SOIL BIOLOGY & BIOCHEMISTRY	121	103	112	4.926	Wang C, Lu XK*, Mori T, Mao QG, Zhou KJ, Zhou GY, Nie YX, Mo JM
31	Cooperation of earthworm and arbuscular mycorrhizae enhanced plant N uptake by balancing absorption and supply of ammonia	SOIL BIOLOGY & BIOCHEMISTRY	116	351	359	4.926	He XX, Chen YQ, Liu SJ, Gunina A, Wang XL, Chen W, Shao YH, Shi LL, Yao Q, Li JX, Zou XM, Schimel JP, Zhang WX*, Fu SL*
32	Nitrogen addition reduces soil bacterial richness, while phosphorus addition alters community composition in an old-growth N-rich tropical forest in southern China	SOIL BIOLOGY & BIOCHEMISTRY	127	22	30	4.926	Wang H, Liu SR*, Zhang X, Mao QG, Li XZ, You YM, Wang JX, Zheng MH, Zhang W, Lu XK, Mo JM*
33	The largest early-diverging angiosperm family is mostly pollinated by ovipositing insects and so are most surviving lineages of early angiosperms	PROCEEDINGS OF THE ROYAL SOCIETY B-BIOLOGICAL SCIENCES	285	20172365		4.847	Luo SX*, Zhang LJ, Yuan S, Ma ZH, Zhang DX, Renner SS*
34	Stoichiometry controls asymbiotic nitrogen fixation and its response to nitrogen inputs in a nitrogen-saturated forest	ECOLOGY	99	2037	2046	4.617	Zheng MH, Zhang W, Luo YQ, Li DJ, Wang SH, Huang J, Lu XK, Mo JM*
35	Canopy and understory nitrogen addition increase the xylem tracheid size of dominant broadleaf species in a subtropical forest of China	SCIENCE OF THE TOTAL ENVIRONMENT	642	733	741	4.61	Jiang XY, Liu N, Lu XK, Huang JG*, Cheng J, Guo XL, Wu SH
36	Effects of simulated N deposition on foliar nutrient status, N metabolism and photosynthetic capacity of three dominant understory plant species in a mature tropical forest	SCIENCE OF THE TOTAL ENVIRONMENT	610	555	562	4.61	Mao QG, Lu XK*, Mo H, Gundersen P, Mo JM
37	Leaf nitrogen assimilation and partitioning differ among subtropical forest plants in response to canopy addition of nitrogen treatments	SCIENCE OF THE TOTAL ENVIRONMENT	637	1026	1034	4.61	Liu N*, Wu SH, Guo QF, Wang JX, Cao C, Wang J
38	Ammonium nitrogen content is a dominant predictor of bacterial community composition in an acidic forest soil with exogenous nitrogen enrichment	SCIENCE OF THE TOTAL ENVIRONMENT	624	407	415	4.61	Nie YX, Wang MC, Zhang W, Ni Z, Hashidoko Y, Shen WJ*
39	Interspecific variation in growth responses to tree size, competition and climate of western Canadian boreal mixed forests	SCIENCE OF THE TOTAL ENVIRONMENT	631-632	1070	1078	4.61	Jiang XY, Huang JG*, Cheng J, Dawson A, Stadt KJ, Comeau PG, Chen HYH
40	Microbial adaptation to long-term N supply prevents large responses in N dynamics and N losses of a subtropical forest	SCIENCE OF THE TOTAL ENVIRONMENT	626	1175	1187	4.61	Han XG, Shen WJ*, Zhang JB, Muller C
41	Temperature enhances the affinity of soil alkaline phosphatase to Cd	CHEMOSPHERE	196	214	222	4.427	Tan XP, Machmuller MB, Wang ZQ, Li XD, He WX*, Cotrufo MF, Shen WJ*
42	Evolution of sexual systems and growth habit in Mussaenda (Rubiaceae): Insights into the evolutionary pathways of dioecy	MOLECULAR PHYLOGENETICS AND EVOLUTION	123	113	122	4.412	Duan TT, Deng XF, Chen S, Luo ZL, Zhao ZT, Tu TY, Khang NS, Razafimandimbison SG, Zhang DX*
43	Pollination niche availability facilitates colonization of Guettarda speciosa with heteromorphic self-incompatibility on oceanic islands	SCIENTIFIC REPORTS	8	13765		4.122	Xu YQ, Luo ZL*, Gao SX, Zhang DX*
44	Regulation of Signaling Pathways Involved in the Anti-proliferative and Apoptosis-inducing Effects of M22 against Non-small Cell Lung Adenocarcinoma A549 Cells	SCIENTIFIC REPORTS	8	992		4.122	Yuan Y, Wu JW, Li BL, Niu J, Tan HB*, Qiu SX*
45	Rapid Shifts of Peak Flowering Phenology in 12 Species under the Effects of Extreme Climate Events in Macao	SCIENTIFIC REPORTS	8	13950		4.122	Zhang JH, Yi QF*, Xing FW, Tang CY, Wang L, Ye W, Ng II, Chan TI, Chen HF, Liu DM
46	Photosynthesis of subtropical forest species from different successional status in relation to foliar nutrients and phosphorus fractions	SCIENTIFIC REPORTS	8	10455		4.122	Zhang GH, Zhang LL, Wen DZ*
47	Selection and Validation of Novel RT-qPCR Reference Genes under Hormonal Stimuli and in Different Tissues of Santalum album	SCIENTIFIC REPORTS	8	17511		4.122	Yan HF, Zhang YY, Xiong YP, Chen QW, Liang HZ, Niu MY, Guo BY, Li MZ, Zhang XH*, Li Y, da Silva JAT*, Ma GH*
48	Contributions of precipitation and temperature to the large scale geographic distribution of fleshy-fruited plant species: Growth form matters	SCIENTIFIC REPORTS	8	17017		4.122	Zhao Y, Cao HL, Xu WB, Chen GK, Lian JY, Du YH*, Mai KP

No.	Title	Journal Name	Issue Volume	Start	Stop	Impact Factor	Authors
49	Phylogenetic and Functional Structure of Wintering Waterbird Communities Associated with Ecological Differences	SCIENTIFIC REPORTS	8	1232		4.122	Che XL, Zhang M, Zhao YY, Zhang Q, Quan Q, Moller A, Zou FS*
50	Protection from Disulfide Stress by Inhibition of Pap1 Nuclear Export in Schizosaccharomyces pombe	GENETICS	210	857	868	4.075	Chen Y, Zhang Y, Dong ZC, Ow DW*
51	Sulfoxidation Regulation of Musa acuminata Calmodulin (MaCaM) Influences the Functions of MaCaM-Binding Proteins	PLANT AND CELL PHYSIOLOGY	59	1214	1224	4.059	Jiang GX, Wu FW, Li ZW, Li TT, Gupta VK, Duan XW*, Jiang YM
52	Formation of Protein Disulfide Bonds Catalyzed by OsPDIL1;1 is Mediated by MicroRNA5144-3p in Rice	PLANT AND CELL PHYSIOLOGY	59	331	342	4.059	Xia KF, Zeng X, Jiao ZL, Li ML, Xu WJ, Nong QD, Mo H, Cheng TH, Zhang MY*
53	Reduced geographical variability in spring phenology of temperate trees with recent warming	AGRICULTURAL AND FOREST METEOROLOGY	256	526	533	4.039	Ma QQ, Huang JG*, Hanninen H, Berninger F
54	Responses of Tree Transpiration and Growth to Seasonal Rainfall Redistribution in a Subtropical Evergreen Broad-Leaved Forest	ECOSYSTEMS	21	811	826	4.03	Hu YT, Zhao P*, Shen WJ, Zhu LW, Ni GY, Zhao XH, Zhang ZZ, Rao XQ, Ouyang L, Zeng XM, Sun D, Lin YB
55	Eco-exergy based self-organization of the macrobenthic faunal assemblage during mangrove succession in Zhanjiang, China	Ecological Indicators	95	887	894	3.983	Chen Q, Zhao Q, Chen PM, Lu HF*, Jian SG*
56	Alterations in leaf nitrogen metabolism indicated the structural changes of subtropical forest by canopy addition of nitrogen	ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY	160	134	143	3.974	Liu N*, Wang JX, Guo QF, Wu SH, Rao XQ, Cai XA, Lin ZF
57	Characterization and subcellular localization of histone deacetylases and their roles in response to abiotic stresses in soybean	BMC PLANT BIOLOGY	18	226		3.93	Yang C, Shen WJ, Chen HF, Chu LT, Xu YC, Zhou XC, Liu CL, Chen CM, Zeng JH, Liu J, Li QF, Gao CJ, Charron JB, Luo M*
58	High cryptic species diversity is revealed by genome-wide polymorphisms in a wild relative of banana, Musa itinerans, and implications for its conservation in subtropical China	BMC PLANT BIOLOGY	18	194		3.93	Wu W, Ng WL, Yang JX, Li WM, Ge XJ*
59	The structure changes of water-soluble polysaccharides in papaya during ripening	INTERNATIONAL JOURNAL OF BIOLOGICAL MACROMOLECULES	115	152	156	3.909	John A, Yang JL, Liu J, Jiang YM, Yang B*
60	Characterization and immunological activity of polysaccharides from Ixeris polycephala	INTERNATIONAL JOURNAL OF BIOLOGICAL MACROMOLECULES	113	804	812	3.909	Luo B, Dong LM, Xu QL*, Zhang Q, Liu WB, Wei XY, Zhang X, Tan JW*
61	Dinghupeptins A-D, Chymotrypsin Inhibitory Cyclodepsipeptides Produced by a Soil-Derived Streptomyces	JOURNAL OF NATURAL PRODUCTS	81	1928	1936	3.885	Yang L, Li HX, Wu P, Mahal A, Xue JH, Xu LX, Wei XY*
62	China's progress towards sustainable land development and ecological civilization	LANDSCAPE ECOLOGY	33	1647	1653	3.833	Sun XF, Gao L, Ren H*, Ye YQ, Li A, Stafford-Smith M, Connor JD, Wu JG, Bryan BA
63	The WT1/MVP-Mediated Stabilization on mTOR/AKT Axis Enhances the Effects of Cisplatin in Non-small Cell Lung Cancer by a Reformulated Yu Ping Feng San Herbal Preparation	FRONTIERS IN PHARMACOLOGY	9	853		3.831	Lou JS, Xia YT, Wang HY, Kong XP, Yao P, Dong TTX, Zhou ZY*, Tsim KWK*
64	Solubility of phosphorus in subtropical forest soils as influenced by low-molecular organic acids and key soil properties	GEODERMA	313	172	180	3.74	Hou EQ*, Tang SB, Chen CR, Kuang YW, Lu XK, Heenan M, Wen DZ*
65	Soil pH predominantly controls the forms of organic phosphorus in topsoils under natural broadleaved forests along a 2500 km latitudinal gradient	GEODERMA	315	65	74	3.74	Hou EQ*, Wen DZ, Kuang YW, Cong J, Chen CR, He XJ, Heenan M, Lu H, Zhang YG*
66	Responses of soil phosphorus availability to nitrogen addition in a legume and a non-legume plantation	GEODERMA	322	12	18	3.74	Chen H, Chen ML, Li DJ, Mao QG, Zhang W, Mo JM*
67	Host genotype strongly influences phyllosphere fungal communities associated with Mussaenda pubescens var. alba (Rubiaceae)	Fungal Ecology	36	141	151	3.736	Qian X, Duan TT, Sun X, Zheng Y, Wang YL, Hu ML, Yao H, Ji NN, Lv PP, Chen L, Shi MM, Guo LD**, Zhang DX*
68	Proteomic profiling of 24-epibrassinolide-induced chilling tolerance in harvested banana fruit	JOURNAL OF PROTEOMICS	187	1	12	3.722	Li TT, Yun Z, Wu QX, Zhang ZK*, Liu SM, Shi XQ, Duan XW, Jiang YM
69	The GDP-mannose transporter gene (DoGMT) from Dendrobium officinale is critical for mannan biosynthesis in plant growth and development	PLANT SCIENCE	277	43	54	3.712	Yu ZM, He CM, da Silva JAT, Luo JP, Yang ZY, Duan J*
70	Understanding and exploiting the roles of autophagy in plants through multi-omics approaches	PLANT SCIENCE	274	146	152	3.712	Liu F, Marshall RS, Li FQ*
71	Functional Identification of Salt-Stress-Related Genes Using the FOX Hunting System From Ipomoea pes-caprae	INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES	19	3446		3.687	Zhang M*, Zhang H, Zheng JX, Mo H, Xia KF, Jian SG*
72	Ipomoea pes-caprae IpASR Improves Salinity and Drought Tolerance in Transgenic Escherichia coli and Arabidopsis	INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES	19	2252		3.687	Zheng JX, Zhang H, Su HX, Xia KF, Jian SG, Zhang M*
73	Differential Accumulation of Anthocyanins in Dendrobium officinale Stems with Red and Green Peels	INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES	19	2857		3.687	Yu ZM, Liao YY, da Silva JAT, Yang ZY, Duan J*

No.	Title	Journal Name	Issue Volume	Start	Stop	Impact Factor	Authors
74	Functional Characterization of An Allene Oxide Synthase Involved in Biosynthesis of Jasmonic Acid and Its Influence on Metabolite Profiles and Ethylene Formation in Tea (Camellia sinensis) Flowers	INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES	19	2440		3.687	Peng QY, Zhou Y, Liao YY, Zeng LT, Xu XL, Jia YX, Dong F, Li JL, Tang JC, Yang ZY*
75	Formation and Change of Chloroplast-Located Plant Metabolites in Response to Light Conditions	INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES	19	654		3.687	Chen YY, Zhou B, Li JL, Tang H, Tang JC*, Yang ZY*
76	Analysis of Transcriptional Responses of the Inflorescence Meristems in Jatropha curcas Following Gibberellin Treatment	INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES	19	432		3.687	Hui WK, Wang Y, Chen XY*, Zayed MZ, Wu GJ*
77	Antagonistic Regulation of ABA and GA in Metabolism and Signaling Pathways	FRONTIERS IN PLANT SCIENCE	9	251		3.677	Liu X, Hou XL*
78	Overexpression of a Phosphate Starvation Response AP2/ERF Gene From Physic Nut in Arabidopsis Alters Root Morphological Traits and Phosphate Starvation-Induced Anthocyanin Accumulation	FRONTIERS IN PLANT SCIENCE	9	1186		3.677	Chen YB, Wu PZ, Zhao QQ, Tang YH, Chen YP, Li MR, Jiang HW, Wu GJ*
79	Molecular Cloning and Functional Characterization of the Dehydrin (IpDHN) Gene From Ipomoea pes-caprae	FRONTIERS IN PLANT SCIENCE	9	1454		3.677	Zhang H, Zheng JX, Su HX, Xia KF, Jian HG, Zhang M*
80	Differential Responses of Stomata and Photosynthesis to Elevated Temperature in Two Co-occurring Subtropical Forest Tree Species	FRONTIERS IN PLANT SCIENCE	9	467		3.677	Wu GL, Liu H, Hua L, Luo Q, Lin YX, He PC, Feng SW, Liu JX, Ye Q*
81	Intra-annual Dynamics of Xylem Formation in Liquidambar formosana Subjected to Canopy and Understory N Addition	FRONTIERS IN PLANT SCIENCE	9	79		3.677	Zhang SK, Rossi S, Huang JG*, Jiang SW, Yu BY, Zhang W, Ye Q
82	Tree Species with Photosynthetic Stems Have Greater Nighttime Sap Flux	FRONTIERS IN PLANT SCIENCE	9	30		3.677	Chen X, Gao JG, Zhao P*, McCarthy HR, Zhu LW, Ni GY, Ouyang L
83	Dominant Species in Subtropical Forests Could Decrease Photosynthetic N Allocation to Carboxylation and Bioenergetics and Enhance Leaf Construction Costs during Forest Succession	FRONTIERS IN PLANT SCIENCE	9	117		3.677	Xiao YH, Liu SR*, Tong FC, Chen BF, Kuang YW*
84	De novo Transcriptome Characterization of Rhodomyrtus tomentosa Leaves and Identification of Genes Involved in alpha/beta-Pinene and beta-Caryophyllene Biosynthesis	FRONTIERS IN PLANT SCIENCE	9	1231		3.677	He SM, Wang X, Yang SC, Dong Y, Zhao QM, Yang JL, Cong K, Zhang JJ, Zhang GH, Wang Y*, Fan W*
85	New insights on the phylogeny of Tectaria (Tectariaceae), with special reference to Polydictyum as a distinct lineage	JOURNAL OF SYSTEMATICS AND EVOLUTION	56	139	147	3.657	Dong SY*, Chen CW, Tan SS, Zhao HG, Zuo ZY, Chao YS, Chang YH
86	Soil organic matter is important for acid buffering and reducing aluminum leaching from acidic forest soils	CHEMICAL GEOLOGY	501	86	94	3.57	Jiang J, Wang YP, Yu MX, Cao NN, Yan JH*
87	Flavonoids, a Potential New Insight of Leucaena leucocephala Foliage in Ruminant Health	JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY	66	7616	7626	3.412	Xu YC, Tao ZR, Jin Y, Yuan YF, Doug TTX, Tsim KWK, Zhou ZY*
88	Biosynthesis of Jasmine Lactone in Tea (Camellia sinensis) Leaves and Its Formation in Response to Multiple Stresses	JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY	66	3899	3909	3.412	Zeng LT, Zhou Y, Fu XM, Liao YY, Yuan YF, Jia YX, Dong F, Yang ZY*
89	Intra-annual wood formation of subtropical Chinese red pine shows better growth in dry season than wet season	TREE PHYSIOLOGY	38	1225	1236	3.389	Huang JG*, Guo XL, Rossi S, Zhai LH, Yu BY, Zhan SK, Zhang MF
90	Effects of long-term nitrogen deposition on phosphorus leaching dynamics in a mature tropical forest	BIOGEOCHEMISTRY	138	215	224	3.265	Zhou KJ, Lu XK*, Mori T, Mao QG, Wang C, Zheng MH, Mo H, Hou EQ, Mo JM
91	Cucurbitacin B acts a potential insect growth regulator by antagonizing 20-hydroxyecdysone activity	PEST MANAGEMENT SCIENCE	74	1394	1403	3.249	Zou CS, Liu GF, Liu SN, Liu SM, Song QS, Wang J, Feng QL, Su YL*, Li S*
92	The Plant Circadian Clock and Chromatin Modifications	GENES	9	561		3.191	Yang P, Wang JH, Huang FY, Yang SG*, Wu KQ*
93	Assembly of a Complete Mitogenome of Chrysanthemum nankingense Using Oxford Nanopore Long Reads and the Diversity and Evolution of Asteraceae Mitogenomes	GENES	9	547		3.191	Wang SB, Song QW, Li SS, Hu ZG, Dong GQ, Song C, Huang HW, Liu YF*
94	Flavonoids isolated from the fresh sweet fruit of Averrhoa carambola, commonly known as star fruit	PHYTOCHEMISTRY	153	156	162	3.186	Jia XC, Xie HH*, Jiang YM, Wei XY
95	ON THE RECOGNITION OF GYMNOSPHAERA AS A DISTINCT GENUS IN CYATHEACEAE	ANNALS OF THE MISSOURI BOTANICAL GARDEN	103	1	23	3.185	Dong SY*, Zuo ZY
96	Soil erosion and water retention varies with plantation type and age	FOREST ECOLOGY AND MANAGEMENT	422	1	10	3.169	Sun D, Zhang WX, Lin YB, Liu ZF, Shen WJ, Zhou LX, Rao XQ, Liu SP, Cai XA, He D, Fu SL*
97	Responses of seedling performance to altered seasonal precipitation in a secondary tropical forest, southern China	FOREST ECOLOGY AND MANAGEMENT	410	27	34	3.169	Wang J, Sun ZY, Hui DF, Yang L, Wang FM, Liu N, Ren H*
98	Drought tolerance traits predict survival ratio of native tree species planted in a subtropical degraded hilly area in South China	FOREST ECOLOGY AND MANAGEMENT	418	41	46	3.169	Zhu SD, He PC, Li RH, Fu SL, Lin YB, Zhou LX, Cao KF, Ye Q*

No.	Title	Journal Name	Issue Volume	Start	Stop	Impact Factor	Authors
99	Shifts in functional trait-species abundance relationships over secondary subalpine meadow succession in the Qinghai-Tibetan Plateau	OECOLOGIA	188	547	557	3.127	Zhang H, John R, Zhu SD, Liu H, Xu QY, Qi W, Liu K, Chen HYH, Ye Q*
100	L-Cysteine hydrochloride delays senescence of harvested longan fruit in relation to modification of redox status	POSTHARVEST BIOLOGY AND TECHNOLOGY	143	35	42	3.112	Li TT, Wu QX, Zhou YJ, Yun Z, Duan XW*, Jiang YM
101	6-Benzylaminopurine improves the quality of harvested litchi fruit	POSTHARVEST BIOLOGY AND TECHNOLOGY	143	137	142	3.112	Zhang DD, Xu XF, Zhang ZK, Jiang GX, Feng LY, Duan XW*, Jiang YM
102	Jasmonate-Elicited Stress Induces Metabolic Change in the Leaves of Leucaena leucocephala	MOLECULES	23	188		3.098	Xu YC, Tao ZR, Jin Y, Chen SY, Zhou ZY*, Gong AGW, Yuan YF, Dong TTX, Tsim KWK
103	Occurrence of Functional Molecules in the Flowers of Tea (Camellia sinensis) Plants: Evidence for a Second Resource	MOLECULES	23	790		3.098	Chen YY, Zhou Y, Zeng LT, Dong F, Tu YY, Yang ZY*
104	Differential Accumulation of Aroma Co mpounds in Normal Green and Albino-Induced Yellow Tea (Camellia sinensis) Leaves.	MOLECULES	23	2677		3.098	Dong F, Zeng LT, Yu ZM, Li JL, Tang JC, Su XG*, Yang ZY*
105	Transfer RNA-derived small RNAs in plants	SCIENCE CHINA-LIFE SCIENCES	61	155	161	3.085	Zhu L, Ow DW, Dong ZC*
106	Plant geographic phenotypic variation drives diversification in its associated community of a phytophagous insect and its parasitoids	BMC EVOLUTIONARY BIOLOGY	18	134		3.027	Yu H*, Liang D, Tian EW, Zheng LN, Kjellberg F
107	Spring drying and intensified summer rainfall affected soil microbial community composition but not enzyme activity in a subtropical forest	APPLIED SOIL ECOLOGY	130	219	225	2.916	Zhao Q, Shen WJ, Chen Q, Helmisaari HS, Sun QQ, Jian SG*
108	Biotic- and abiotic-driven variations of the night-time sap flux of three co-occurring tree species in a low subtropical secondary broadleaf forest	AOB PLANTS	10	ply025		2.821	Wang Q, Gao JG, Zhao P*, Zhu LW, Ouyang L, Ni GY, Zhao XH
109	Dietary strategies to reduce the oral bioaccessibility of cadmium and arsenic in rice	ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	25	33353	33360	2.8	Zhuang P*, Sun S, Su F, Li F, Zhou XF, Mao P, Li YW, Li ZA*, Zhang CS
110	The sap flow-based assessment of atmospheric trace gas uptake by three forest types in subtropical China on different timescales	ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	25	28431	28444	2.8	Chen X, Zhao P*, Hu YT, Zhao XH, Ouyang L, Zhu LW, Ni GY
111	A revised classification of Chinese Davalliaceae based on new evidence from molecular phylogenetics and morphological characteristics	PLOS ONE	13	e0206345		2.766	Ma XD, Wang AH, Wang FG*, He CM, Liu DM, Gerstberger P, Xing FW
112	Phylogeography and conservation genetics of the rare and relict Bretschneidera sinensis (Akaniaceae)	PLOS ONE	13	e0189034		2.766	Wang MN, Duan L, Qiao Q, Wang ZF, Zimmer EA, Li ZC, Chen HF*
113	Stand-scale transpiration of a Eucalyptus urophyllaxEucalyptus grandis plantation and its potential hydrological implication	ECOHYDROLOGY	11	UNSP e1938		2.755	Ouyang L, Zhao P*, Zhou GS, Zhu LW, Huang YQ, Zhao XH, Ni GY
114	RNA-Seq analysis reveals the distinctive adaxial-abaxial polarity in the asymmetric one-theca stamen of Canna indica	MOLECULAR GENETICS AND GENOMICS	293	391	400	2.734	Tian XY, Zou P, Miao MZ, Ning ZL*, Liao JP*
115	(2635) Proposal to conserve the name Senecio saluenensis (Asteraceae) with a conserved type	TAXON	67	816	+	2.68	Li HM, Ren C*
116	A new Annonaceae genus, Wuodendron, provides support for a post-boreotropical origin of the Asian-Neotropical disjunction in the tribe Miliuseae	TAXON	67	250	266	2.68	Xue BN*, Tan YH*, Thomas DC, Chaowasku T, Hou XL, Saunders RMK
117	Changes in the benthic protozoan community during succession of a mangrove ecosystem in Zhanjiang, China	ECOSPHERE	9	e02190		2.671	Chen Q, Li J, Zhao Q, Jian SG*, Ren H
118	Asperimides A-D, anti-inflammatory aromatic butenolides from a tropical endophytic fungus Aspergillus terreus.	Fitoterapia	131	50	54	2.642	Liao GF, Wu P, Xue JH, Liu L, Li HX*, Wei XY
119	Cerrenins A-C, cerapicane and isohirsutane sesquiterpenoids from the endophytic fungus Cerrena sp	FITOTERAPIA	129	173	178	2.642	Liu HX, Tan HB, Chen K, Chen YC, Li SN, Li HH, Zhang WM*
120	Hydroquinone and terpene glucosides from Leontopodium leontopodioides and their lipase inhibitory activity	FITOTERAPIA	130	89	93	2.642	Gou P*, Xiao YY, Lv L, Xie HH*
121	Brachyanins A-C, pinene-derived meroterpenoids and phloroglucinol derivative from Leptospermum brachyandrum	FITOTERAPIA	130	184	189	2.642	Zou ZX, Tan GS, Huang Q, Sun HH, Huo LQ, Zhong WQ, Zhao LY, Liu HX*, Tan HB*
122	Isolation and characterization of a salt stress-responsive betaine aldehyde dehydrogenase in Lycium ruthenicum Murr	PHYSIOLOGIA PLANTARUM	163	73	87	2.58	Liu YL, Song YL, Zeng SH, Patra B, Yuan L, Wang Y*
123	Effect of exotic cordgrass Spartina alterniflora on the eco-exergy based thermodynamic health of the macrobenthic faunal community in mangrove wetlands	ECOLOGICAL MODELLING	385	106	113	2.507	Chen Q*, Zhao Q, Chen PM, Lu HF*
124	Structural optimization and antibacterial evaluation of rhodomyrtosone B analogues against MRSA strains	MEDCHEMCOMM	9	1698	1707	2.342	Zhao LY, Liu HX, Huo LQ, Wang MM, Yang B, Zhang WM, Xu ZF, Tan HB*, Qiu SX*
125	DNA barcoding the flowering plants from the tropical coral islands of Xisha (China)	ECOLOGY AND EVOLUTION	8	10587	10593	2.340	Li SC, Qian X, Zheng ZX, Shi MM, Chang XY, Li XJ, Liu JF, Tu TY*, Zhang DX
126	Biodiversity explains maximum variation in productivity under experimental warming, nitrogen addition, and grazing in mountain grasslands	ECOLOGY AND EVOLUTION	8	10094	10112	2.34	Liu JJ, Liu DT, Xu K, Gao Lm, Ge XJ*, Burgess KS, Cadotte MW

No.	Title	Journal Name	Issue Volume	Start	Stop	Impact Factor	Authors
127	Sodium dichloroisocyanurate delays ripening and senescence of banana fruit during storage	CHEMISTRY CENTRAL JOURNAL	12	131		2.284	Wu QX, Li TT, Chen X, Wen LR, Yun Z, Jiang YM*
128	Gaolejeunea, a new genus from China and new member of subtribe Echinolejeuneinae (Lejeuneaceae, Marchantiophyta)	BRYOLOGIST	121	41	48	2.264	Ye W, Zhu RL*
129	Seasonal drought may alter N availability but not water use efficiency of dominant trees in a subtropical forest	GLOBAL ECOLOGY AND CONSERVATION	16	e00475		2.174	Tang SB, Xu YM, Lin YB, Hou EQ,Shen WJ, Wang J, Kuang YW*
130	Oral Bioaccessibility and Exposure Risk of Metal(loid)s in Local Residents Near a Mining-Impacted Area, Hunan, China	INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH	15	1573		2.145	Zhuang P*, Sun S, Li YW, Li F, Zou B, Li YX, Mo H, Li ZA*
131	Shifts in community composition and co-occurrence patterns of phyllosphere fungi inhabiting Mussaenda shikokiana along an elevation gradient	PEERJ	6	e5767		2.118	Qian X, Chen L, Guo XM, He D, Shi MM, Zhang DX*
132	Effects of size and microclimate on whole-tree water use and hydraulic regulation in Schima superba trees	PEERJ	6	e5164		2.118	Zhao XW, Ouyang L, Zhao P*, Zhang CF
133	LjCOCH interplays with LjAPP1 to maintain the nodule development in Lotus japonicus	PLANT GROWTH REGULATION	85	267	279	2.081	Liu YC, Lei YW, Liu W, Weng L, Lei MJ, Hu XH, Dong ZC*, Luo D*, Yang J*
134	Acremotins A-D, peptaibiotics produced by the soil-derived fungus Acremonium persicinum SC0105	JOURNAL OF ANTIBIOTICS	71	927	938	2.033	Wang C, Wu P*, Yao L, Xue JH, Xu LX, Li HX, Deng WQ, Wei XY

Appendix II. Organizational Structure

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Science and Technology Development Center
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Director: YE Qing
Deputy Directors: MO Jiangming, OUYANG Xuejun

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Director: CHEN Zhenhuan

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