SOUTH CHINA BOTANICAL GARDEN
CHINESE ACADEMY OF SCIENCES

SOUTH CHINA BOTANICAL GARDEN, CHINESE ACADEMY OF SCIENCES 2020 ANNUAL REPORT

# ANNUAL REPORT | 2020




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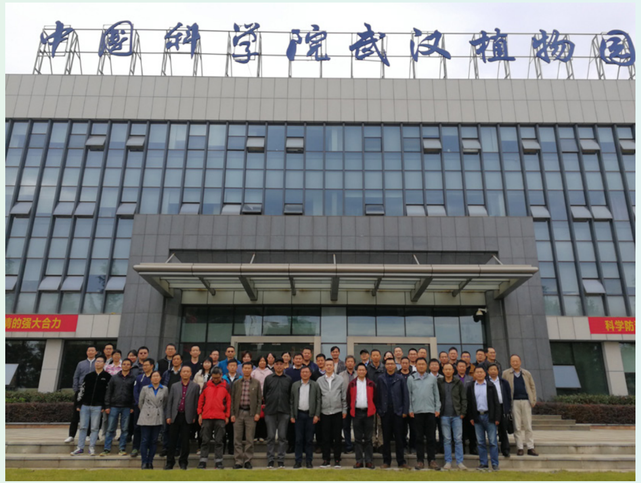
## Headlines

➢ On September 2nd, SCBG held a seminar on the whole garden system reform and the development strategy of the 14th five year plan

➢ On September 2nd, SCBG held a seminar on the whole garden system reform and the development strategy of the 14th five year plan- group discussion

# Headlines

From October 9th to 13th, the Symposium on species conservation standards & specifications and national living plant collection of the core botanical garden of CAS was held in Shenyang




From October 23th to 25th, the third symposium on the characteristic discipline of plant ecology for the core botanical garden of CAS was held in Wuhan Botanical Garden


On November 12th, the inaugural meeting and the first general meeting of Guangdong popular science education base alliance were held in SCBG


On December 1st, SCBG held the preparatory seminar of Guangdong plant integrated protection strategy and Guangdong-Hong Kong-Macao botanical garden alliance

On December 4th, SCBG held a party member election meeting of the Party Committee and Discipline Inspection

From December 30th to 31st, SCBG held the 2020 annual academic conference

On December 11th, Zhang Yaping, vice president of Chinese Academy of Sciences, investigated SCBG

# Director's Foreword


Dr. REN Hai

On the occasion of the new great moments, on behalf of the Party and the Administration leading group of South China Botanical Garden (SCBG), I would like to express my heartfelt thanks and high respect to all the staff, retired comrades and graduate students, as well as the leaders, alumni and friends from home and abroad who have been supporting the development of SCBG.

The year of 2020 was an extraordinary year. Under the guidance of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, the new leading group had conscientiously implemented the decisions and arrangements made by the Party Central Committee, the CPC Leading Group of the Chinese Academy of Sciences (CAS) and the provincial Party committee and government, and had promoted the reform and innovation of SCBG. Party's leadership had been strengthened to promote the integrated development of Party building and science and technology innovation. The 14th Five-Year Plan and the systemic reform program of SCBG had been schemed. SCBG had also actively participated in the construction of International Science and Technology Innovation Center in the Guangdong-Hong Kong-Macao Greater Bay Area, steadily promoted the construction of Mingzhu Science Park in Nansha district, as well as the establishment of research platforms such as Nanling National Park Research Institute. In addition, SCBG led the establishment of Guangdong Science Popularization Base Alliance, the Guangdong-Hong Kong-Macao Botanical Garden Alliance and the Integrated Plant Conservation System. SCBG had strived to play an irreplaceable role as a national strategic scientific and technological force.

The year 2020 was the closing year of the 13th Five-Year Plan. Our staff had overcome the adverse impact of the COVID-19 and made great achievements in science and technology innovation through the coordination of scientific research, conservation, public education, plant resources development and management. In the first phase evaluation of the "Taking the Lead in Action Plan" organized by CAS, two of our achievements were assessed as excellence, and one of them was selected as one of the 59 Major Scientific and Technological Achievements and Landmark Progress of CAS. The project which SCBG participated won the Second Prize of National Science and Technology Progress. In

2020, SCBG has published 446 SCI papers and was granted 210 million Yuan research funding. Both the number of high-level papers and research contract funding reached a record high. Total 16 talents have been recruited in the whole year. In 2020, SCBG took the lead in the implementation of the National Living Plant Collection Program and Core Botanical Garden Species Conservation Program. Currently, total 37,154 accessions, 17,168 taxa are *ex situ* conserved at SCBG. The garden open to the public all year round despite of COVID-19, with 800,000 visitors. Dinghushan National Nature Reserve had made new progress in biodiversity conservation and popular science education.

Last year had been a fruitful year, which was the result of the strong leadership of the Central and higher Party organizations, the strong supports from all walks of life. The achievements came from the wisdom and hard work of all the staff, retired comrades and graduate students of SCBG. Therefore, I would like to express my sincere thanks to them all again.

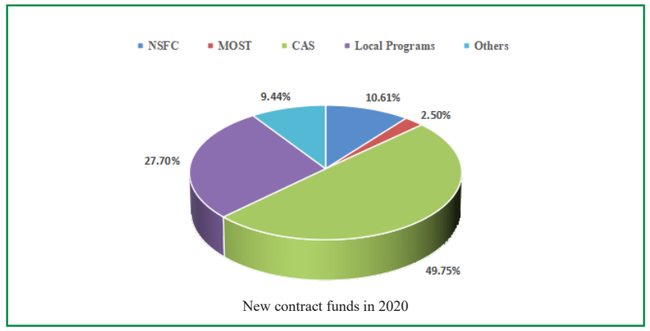
The year of 2021 is the first year of the 14th Five-Year Plan, and also a crucial year to start a new journey of building a modern socialist country and toward the second national centennial goal. Facing the new situation, new requirements and new journey, SCBG will always stick to the original mission of "Innovating Science and Technology Work, Serving the Country, Benefiting the People". We must focus on "National Affairs" and shoulder "National Responsibilities" as "National Team" and "National Person". We will promote the development of SCBG and celebrate the 100th anniversary of the founding of the Party with outstanding achievements!

Dr. REN Hai
May 2020

# Contents

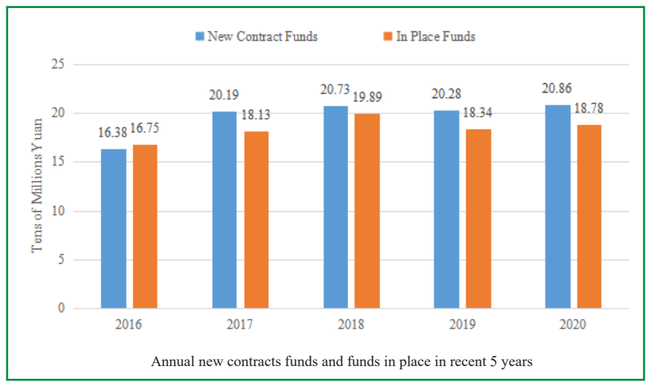
# Research Achievements and Project Overview

In 2020, funds from newly contracted scientific projects reached 208.60 million yuan. Funds in place reached 187.78 million yuan.

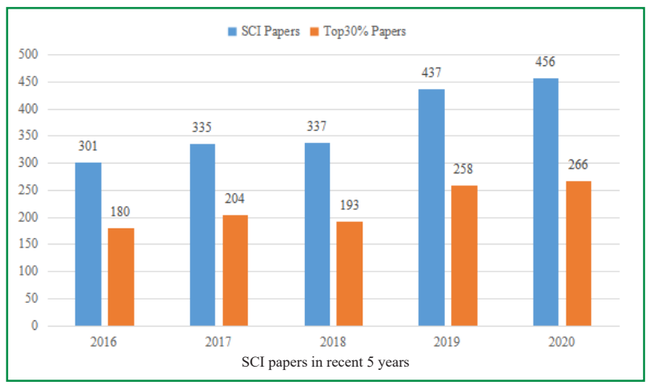


New contract funds in 2020

In 2020, SCBG published 456 SCI papers, of which 13 papers had the 5 year impact factor (IF) over 10. Totally 43 patent applications were granted, 26 new cultivars were registered; 13 volumes of monographs were published; and 2 computer software copyright registrations were obtained.



Annual new contracts funds and funds in place in recent 5 years



SCI papers in recent 5 years





# Highlighted Scientific Research Progress

## 1. Allopolyploid speciation accompanied by gene flow in a tree fern

Hybridization in plants may result in hybrid speciation or introgression, thus is now widely understood to be an important mechanism of species diversity on an evolutionary time scale. Hybridization is particularly common in ferns, as is polyploidy, which often results from hybrid crosses. Nevertheless, hybrid speciation as an evolutionary process in fern lineages remains poorly understood. WANG Jing and her colleagues from the Conservation Genetics Research Group (PI: Prof. KANG Ming) employ flow cytometry, phylogeny, genome-wide SNP datasets, and admixture and coalescent modeling to show that the scaly tree fern, *Gymnosphaera metteniana* is a naturally occurring allotetraploid species derived from hybridization between the diploids, *G. denticulata* and *G. gigantea.* Moreover, the research group detected ongoing gene flow between the hybrid species and its progenitors, and found that *G. gigantea and G. metteniana* inhabit distinct niches, whereas climatic niches of *G. denticulata* and *G. metteniana* largely overlap. Taken together, these results suggest either some degree of intrinsic genetic isolation between the hybrid species and its parental progenitors or ecological isolation over short distances may be playing an important role in the evolution of reproductive barriers. Historical climate change may have facilitated the origin of *G. metteniana*, with the timing of hybridization coinciding with a period of intensification of the East Asian monsoon during the Pliocene and Pleistocene periods in southern China. Our study of allotetraploid *G. metteniana* represents the first genomic-level documentation of hybrid speciation in scaly tree ferns and, thus, provides a new perspective on evolution in the lineage.

This research has been published in *Molecular Biology and Evolution*, 2020, 37: 2487–2502.

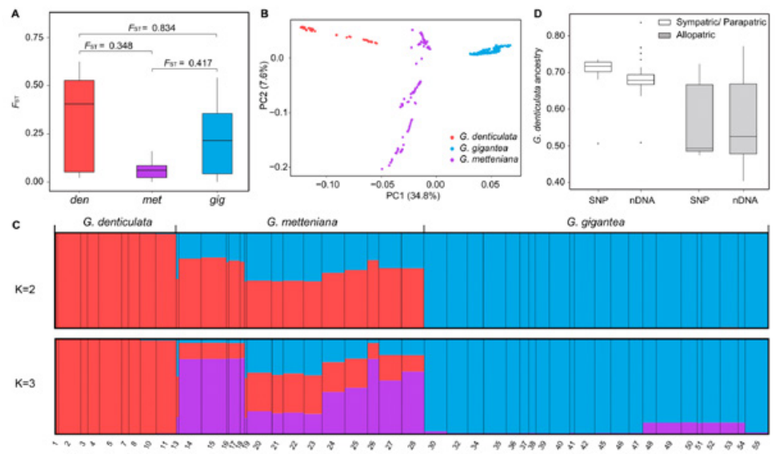


Figure. Genetic differentiation between *G. metteniana* and its progenitors *G. gigantea* and *G. denticulata*

## 2. The genome of a cave plant, *Primulina huaijiensis*, provides insights into adaptation to limestone karst habitats

Although whole genome duplication (WGD) has been suggested to facilitate adaptive evolution and diversification, the role of specific WGD events in promoting diversification and adaptation in angiosperms remains poorly understood. *Primulina*, a genus with more than 180 species associated with limestone karst habitat, constitutes an ideal system for studying the impact of WGD events on speciation and evolutionary adaptation. FENG Chao and other researchers from Conservation Genetics Research Group (PI: Prof. KANG Ming) sequenced and assembled a chromosome-level genome of the cave-dwelling species *Primulina huaijiensis* to study gene family expansion and gene retention following WGDs. And provide evidence that *P. huaijiensis* has undergone two WGDs since the γ triplication event shared by all eudicots. In addition to a WGD shared by almost all Lamiales (L event), the researcher identified a lineage-specific WGD (D event) that occurred in the early Miocene around a period at 20.6-24.2 Ma and that is shared by almost the entire subtribe Didymocarpinae. The research group found that gene retentions following the D event led to gene family proliferation (e.g. WRKYs) that probably facilitated adaptation to the high salinity and drought stress in limestone karst. This study highlights the role of lineage-specific WGD in species diversification and adaptation of plants from special habitats.

This research has been published in *New Phytologist*, 2020, 227: 1249–1263.

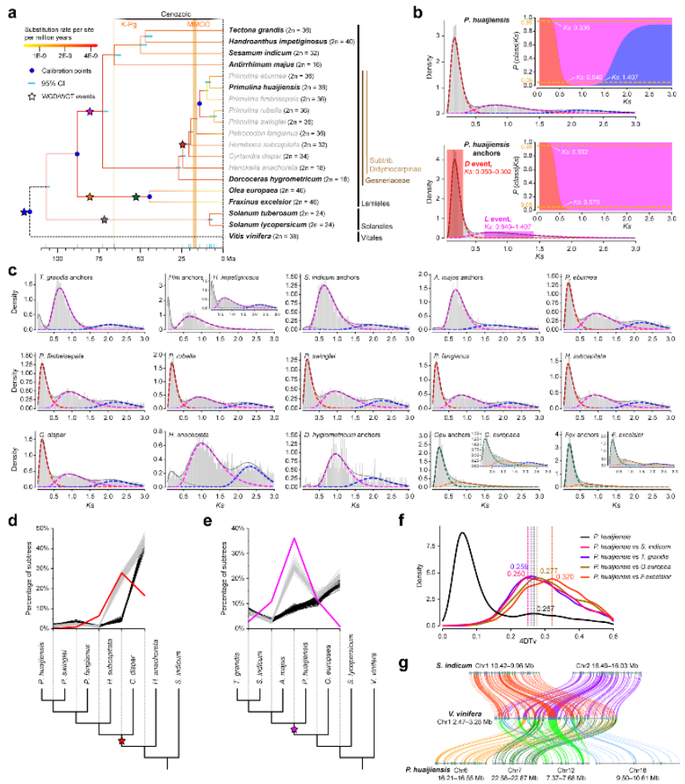


Figure. The identification and phylogenetic location of whole genome duplication (WGD) and whole genome triplication (WGT) events in *P. huaijiensis* and other Lamiales species

## 3. Global meta-analysis shows pervasive phosphorus limitation of aboveground plant production in natural terrestrial ecosystems

In terrestrial ecosystems, nitrogen (N) and phosphorus (P) have been considered as the most important limiting nutrients of aboveground plant production. P limitation, however, is usually assumed to occur mainly in the strongly weathered lowland tropical regions but rarely elsewhere. HOU Enqing, WEN Dazhi and other researchers from Environmental Ecology Research Group (PI: Prof. WEN Dazhi) reported that such P limitation was more widespread and much stronger than previously estimated. In our global meta-analysis, almost half (46.2%) of 652 P-addition field experiments revealed a significant P limitation on aboveground plant production. Globally, P additions increased aboveground plant production by 34.9% in natural terrestrial ecosystems, which was 7.0–15.9% higher than previously suggested. In croplands, in contrast, P additions increased aboveground plant production by only 13.9%, probably because of historical fertilizations. The magnitude of P limitation also differed among climate zones, regions, and was driven by climate, ecosystem properties, and fertilization regimes. In addition to confirming that P limitation was widespread in tropical regions, our study demonstrated that P limitation often occurred in other regions. This suggested that previous studies had underestimated the importance of altered P supply on aboveground plant production in natural terrestrial ecosystems.

This research has been published in *Nature Communications*, 2020, 11(1)637.

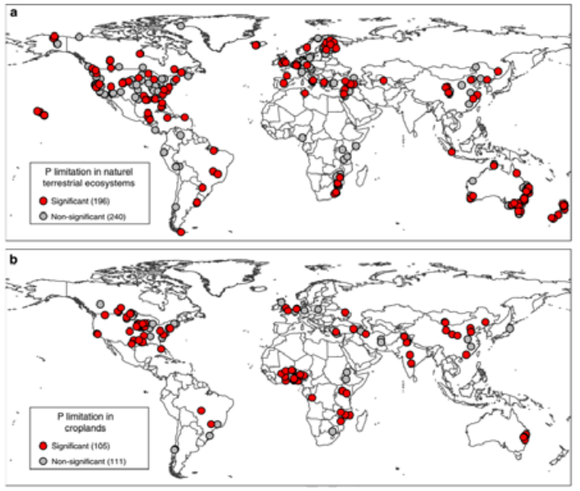



Figure 1. Locations of the 652 experiments in which the effect of P addition on aboveground plant production was assessed

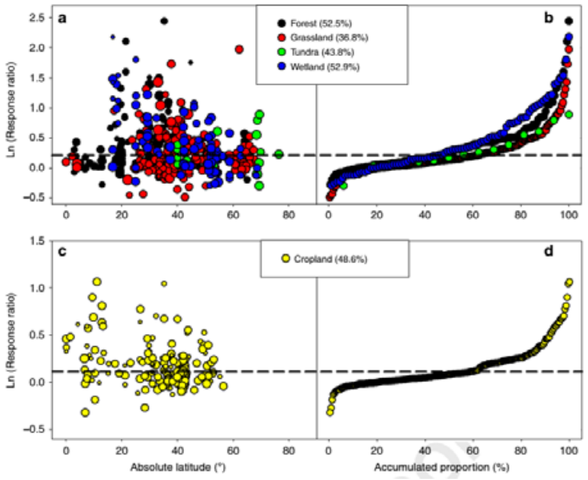



Figure 2. Consistent occurrence of significant P limitation in all types of ecosystems

## 4. Climatic-niche evolution is strikingly similar in plants and animals

Climatic niches describe where species can occur and are essential to determining how they will respond to climate change, which are critically important for answering many of the most fundamental and urgent questions in ecology and evolution. Given the fundamental biological differences in plants and animals, previous researches have proposed that plants may have broader environmental tolerances than animals but are more sensitive to climate. However, neither any data could provide solid evidence for this hypothesis, nor it considered the influences of evolutionary history on climatic niches.

Dr. LIU Hui from Global Change and Plant Functional Traits Research Group (PI: Prof. YE Qing) of SCBG, and Dr. John J. Wiens from University of Arizona, initiated the study on patterns of climatic-niche evolution and climatic-niche width across plants and animals. They tested ten predictions about climatic-niche evolution in plants and animals, using phylogenetic and climatic data for world-widely distributed 19 plant clades and 17 vertebrate clades (2087 species total). The main findings include: First, both plants and animals, rates of niche evolution were similarly slow (1.44 and 0.82 ° C per million years [Myr-1] for mean annual temperature; and 226.0 and 126.0 mm Myr-1 for annual precipitation, for plants and animals, respectively), and changed faster in younger (more recently diverged) clades (Fig. 1). Secondly, niche evolution rates based on the wettest quarter precipitation, was significantly higher than those based on the driest quarter precipitation, and other predictions. Overall, this study explains why biogeographic regions, diversity hotspots, life zones, and richness patterns are often similar between plants and animals, despite both showing enormous diversity.

This study confirmed that there are "general rules" of climatic-niche evolution that span plants and animals, which is important in predicting future species distribution and climatic-niche evolution under climate change scenarios.

This research has been published in *Nature Ecology & Evolution*, 2020, 4(5)753-763.

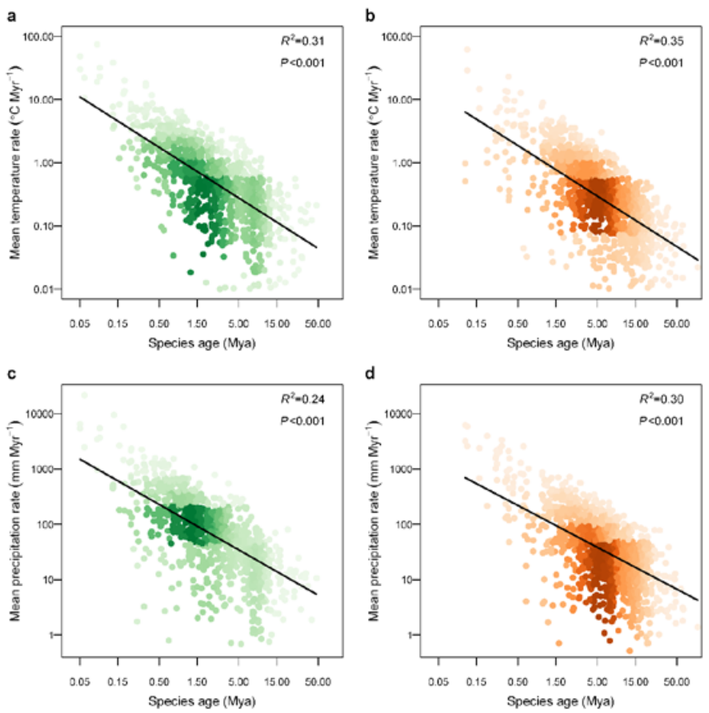



Figure. Relationships between rates of climatic-niche evolution and species age

## 5. A dominant role of photoperiod in triggering the onset of tree xylem formation uncovered

Using weekly data-based modeling of xylogenesis, the Forest Ecology and Simulation Research Group (PI: Prof. HUANG Jianguo) has revealed the mechanism by which photoperiod triggers secondary growth resumption (hereafter referred to as xylem formation onset) with support from international collaborators. The related research was published as a short commentary in *Proceedings of the National Academy of Sciences of the United States of America* in the form of Letter on December 15, 2020.

Compared with traditional experimental studies based on model plants such as *Arabidopsis* that reveal mechanisms underlying how photoperiod regulates plant growth, few mechanistic studies are reporting on how tree growth interacts with photoperiod in natural conditions.

In the current study, the researchers at SCBG have constructed process-based models that account for mean annual temperature, seasonal variation of temperature, and latitude, etc., to simulate and prove that photoperiod plays a dominant and irreplaceable role in driving the growth of xylem cell of woody plants in spring. In specific, the role of the photoperiod is mainly reflected in supplying photosynthetic energy and inducing cell divisions in the cambium through light sensing by leaves.

This research answers the question about whether the photoperiod can drive the development of tree xylem, and opens up a deeper vision of how the environment drives pervasive shifts in terrestrial forest dynamics under global warming.

This research has been published in *PNAS*, 2020, 117(34)20645-20652.

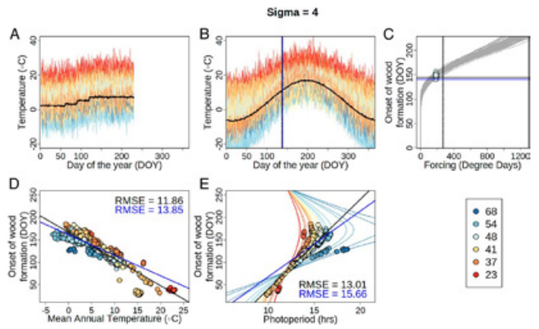



Figure 1. Simulated phenological data (adapted from Elmendorf and Ettinger), produced using mean annual temperature (MAT), latitude, and seasonal thermal trend (estimated for each site as the mean difference between July and January temperatures)

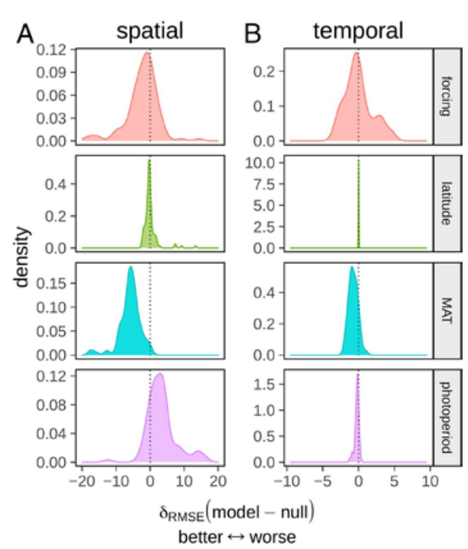



Figure 2. Predictive performance of the date of wood formation onset (DOYwf) based on Forcing, Latitude, mean annual temperature (MAT), and Photoperiod (adapted from Elmendorf and Ettinger )

## 6. Substrate stoichiometry determines nitrogen fixation throughout succession in southern Chinese forests

The traditional view holds that biological nitrogen (N) fixation often peaks in early- or mid-successional ecosystems and declines throughout succession based on the hypothesis that soil N richness and/or phosphorus (P) depletion become disadvantageous to N fixers. This view, however, fails to support the observation that N fixers can remain active in many old-growth forests despite the presence of N-rich and/or P-limiting soils. To address how forest succession regulates N fixation and explore the mechanisms underlying such regulation, Dr. ZHENG Mianhai and his colleagues from Ecosystem Management Research Group (PI: Prof. MO Jiangming ) conducted experiments in three successional forests and in six age-gradient forests in southern China. They measured the carbon (C), N, and P concentrations and stoichiometry and N fixation rates in the soil, forest floor, and moss.

They found increases in N fixation rates in the soil, forest floor, and moss throughout three successional forests and along six age-gradient forests. Using linear regression models and structural equation models, they found that the variation in N fixation was controlled by substrate C:N and C:(N:P) stoichiometry rather than by substrate N or P. Their findings offer an important line of evidence that N fixation rates increase throughout forest succession regardless of soil N richness and P limitation and renew our previous understanding of the highest N fixation rates occurring in early- or mid-successional forests. Moreover, their study uncovers a key mechanism driving N fixation throughout succession and stand age that labile substrate C increases rapidly compared to substrate N and N:P, which favors N fixers.

Overall, their findings help researchers understand the long-standing N paradoxical phenomenon that many lowland tropical forests rich in soil N sustain up-regulation of N cycling and highlight the utility of ecological stoichiometry in illuminating the mechanisms that couple forest succession and N cycling.

This research has been published in *Ecology Letters*, 2020, 23(2)336-347.

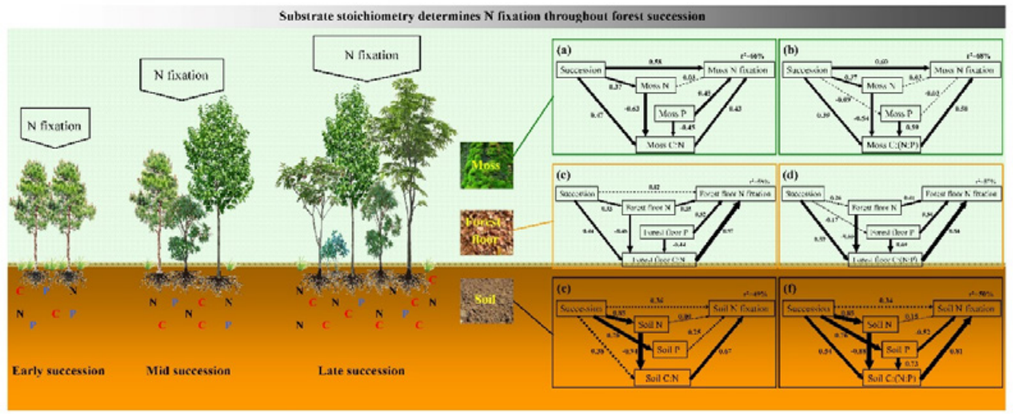



Figure. Substrate stoichiometry determines nitrogen fixation throughout forest succession

## 7. Transcriptome sequencing and metabolite profiling analyses provide comprehensive insight into molecular mechanisms of flower development in *Dendrobium officinale* (Orchidaceae)

*Dendrobium officinale* is a precious traditional Chinese herbal medicine. It has plenty flowers and blooms from March to June. However, a large amount of *D. officinale* flower resources were wasted, due to the lack understanding of its bioactive component composition. Therefore, a comprehensive analysis of bioactive component composition and their metabolism pathway were performed by Biotechnology Breeding Research Group (PI: Prof. DUAN Jun) using transcriptome and metabolome analysis to identify the bioactive compounds and screened the key metabolic genes. Our data showed that the *D. officinale* flowers are abundant in flavonoids, carotenoids and linolenic acid, which are valuable for human health. Interestingly, the main water-soluble polysaccharide in *D. officinale* flowers is mannan, which gradually accumulates during the flower development. The research group analyzed the transcriptional level of the mannan polysaccharide biosynthesis genes, including nucleotide sugar biosynthesis genes, nucleotide sugar transporter genes and cellulose synthase-like A (*CSLA*) genes. These genes were strongly correlated with the accumulation of mannan. The key genes involved in the biosynthesis of bioactive compounds were identified and the expression patterns of these genes were consistent with the accumulation of bioactive compounds.

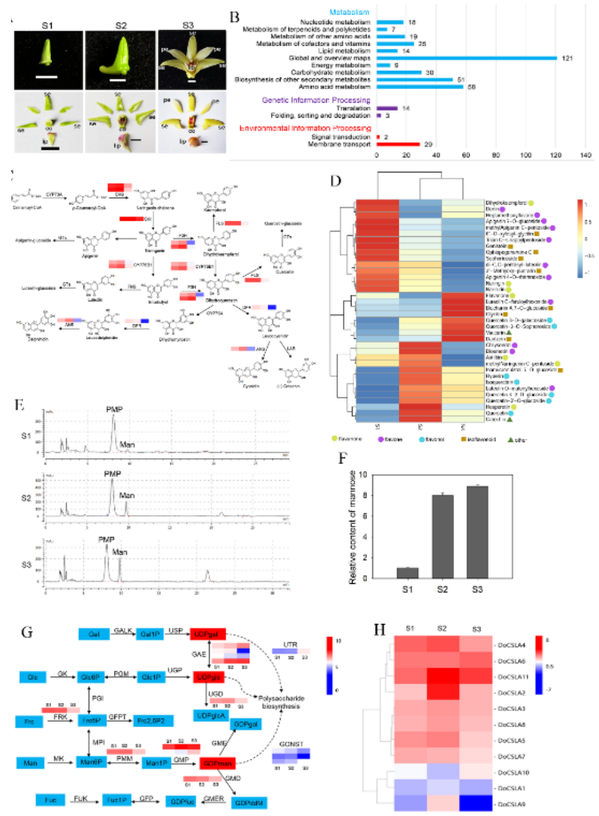



Figure: The changes of flavonoids and active polysaccharides during the flower development of *Dendrobium officinale*. The accumulation patterns were significantly correlated with the key biosynthetic genes.

In addition, the content of phytohormone auxin decreased during flower development, and its synthesis pathway genes also changed consistent accordingly. The abscisic acid increased gradually during flower development, and the expression level of key gene NCED for ABA synthesis was the highest in opened flowers. These results indicated that phytohormone auxin and ABA were involved in flower development in *D. officinale*. These work not only provide important scientific basis for the development and utilization of *D. officinale* flower products, but also provide important gene resources for the in-depth study of the metabolism of bioactive compounds, and provide ideas for the molecular mechanism of orchid flower development.

This research has been published in *Plant Molecular Biology*, 104, 529–548(2020).

## 8. Proteomic and ultrastructural analysis uncovering the distinct mechanism of fruit pigmentation in two Goji species

The fruits of *Lycium barbarum* (LBF) and its relative species *L. ruthenicum* (LRF) are only enriched in carotenoids and anthocyanins, respectively. However, the underlying mechanism remains unclear. The Molecular Genetics of Medicinal Plant Research Group (PI: Prof. WANG Ying) took the fruits of *L. barbarum*, *L. ruthenicum* and their hybrid for comparatively proteomic and subcellular structure analysis. Ultrastructural analysis showed that the endoplasmic reticulum of LRF successfully developed and was significantly vigorous than that of LBF during fruit development and ripening. The chromoplast development of LBF was successful and robust while the LRF chromoplast development failed during fruit ripening. The endoplasmic reticulum and chromoplast are respectively the biosynthesis sites of anthocyanins in LRF and carotenoids in LBF, which implies that the subcellular structure regulates the biosynthesis of the two pigments in *Lycium* genus. The proteomic results indicated that during fruit development and maturity, the expression of LRF proteins related to anthocyanin biosynthesis and storage were upregulated while the abundance of LRF proteins involved in carotenoid biosynthesis and storage were downregulated. The expression pattern of anthocyanin- and carotenoid-related proteins in LBF had opposite results compared to those in LRF. In summary, our results indicated that the ultrastructural development is an important regulatory factor contributing to the difference in fruit pigmentation between the two closely related *Lycium* species.

This research has been published in *Industrial Crops and Products*, 2020, 147:112267.

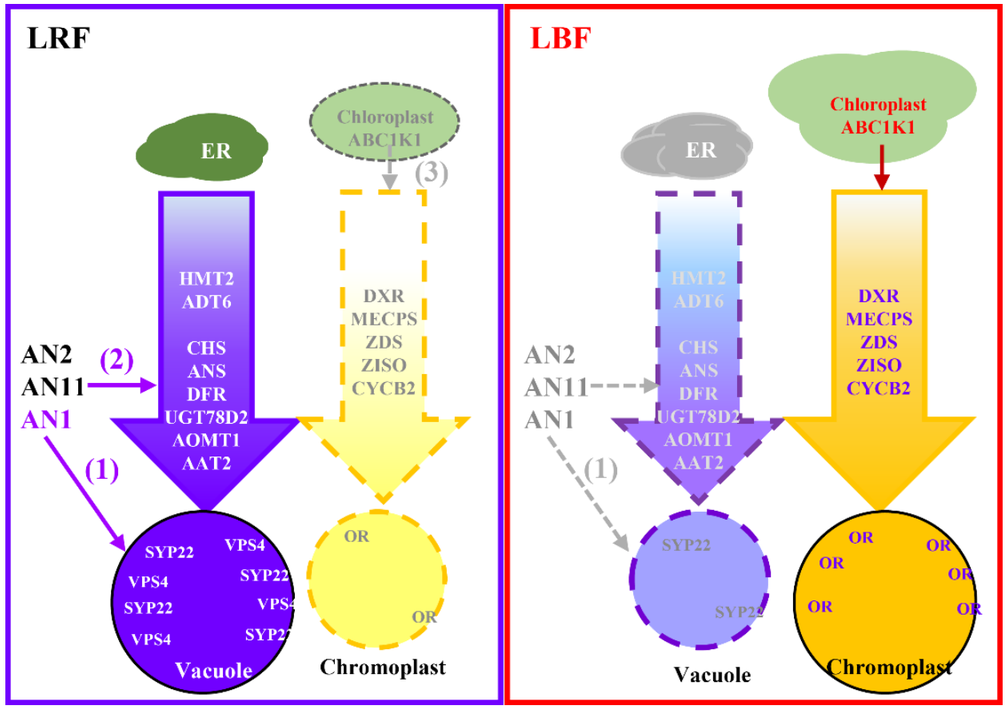



Figure. The distinct regulatory mechanism of fruit pigmentation in two *Lycium* species

## 9. Histone demethylase SlJMJ6 promotes fruit ripening by removing H3K27 methylation of ripening-related genes in tomato

Histone methylation is an important epigenetic modification that plays key roles in plant growth, development and responses to stress. However, little is known about the involvement of histone demethylases in regulating fruit ripening. Based on tomato genome, the Postharvest Biology Research Group（PI: Prof. JIANG Yueming）identified 25 histone demethylases, which are mainly localized in the nucleus. RT - pPCR analysis showed that expression of SlJMJ1 2/3/4/6/7/8 10/12/16/17 are significantly upregulated in tomato during fruit ripening, suggesting that they might play a role in regulation of fruit ripening. The researchers further illuminated the underlying mechanism of the involvement of SlJMJ6 in regulating tomato fruit ripening. And found that the tomato SlJMJ6 encodes a histone lysine demethylase that specifically demethylates H3K27 methylation. Overexpression of SlJMJ6 accelerates tomato fruit ripening, which is associated with the upregulated expression of a large number of ripening-related genes. Integrated analysis of RNA-seq and ChIP-seq identified 32 genes directly targeted by SlJMJ6 and transcriptionally upregulated with decreased H3K27m3 in SlJMJ6-overexpressed fruit. Numerous SlJMJ6-regulated genes are involved in transcription regulation, ethylene biosynthesis, cell wall degradation, and hormone signaling. Eleven ripening-related genes including RIN, ACS4, ACO1, PL, TBG4, and a DNA demethylase DML2, were confirmed to be directly regulated by SlJMJ6 through removing H3K27me3. These results demonstrated that SlJMJ6 is a ripening-prompting H3K27me3 demethylase that activates the expression of the ripening-related genes by modulating H3K27me3, thereby facilitating tomato fruit ripening. The researchers' work also revealed a novel link between histone demethylation and DNA demethylation in regulating fruit ripening. To our knowledge, this is the first report of the involvement of a histone lysine demethylase in the regulation of fruit ripening.

This research has been published in *New Phytologist* 2020，227（4）：1138-1156.

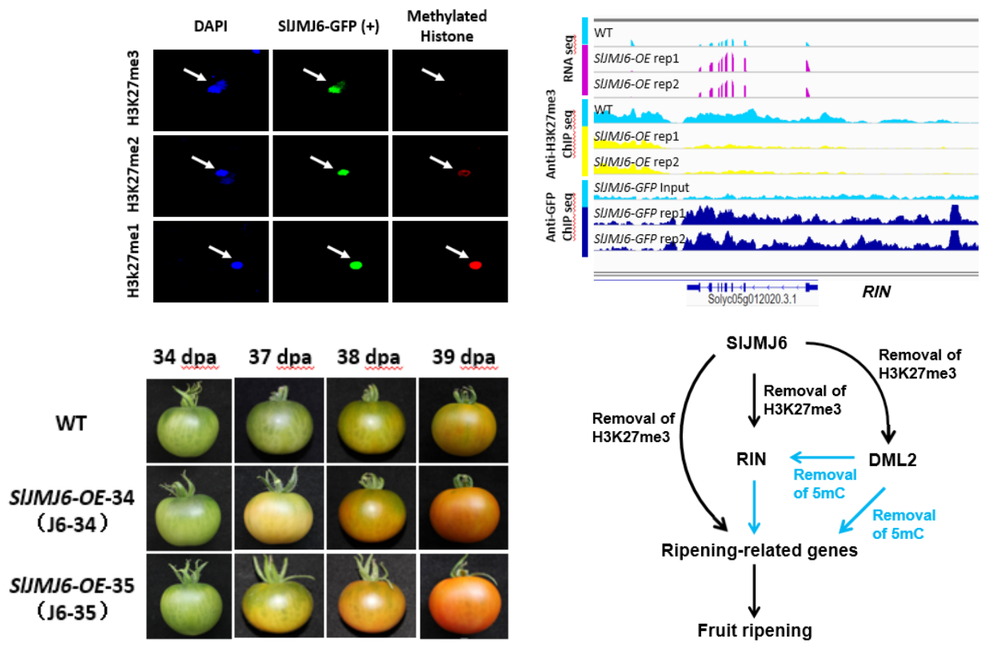



Figure. SlJMJ6 promotes tomato fruit ripening by reducing the level of histone H3K27Me3

## 10. Research progress on *Paphiopedilum armeniacum* seed coat lignin biosynthesis and asymbiotic germination

*Paphiopedilum* is an important genus of the orchid family Orchidaceae with high ornamental value. The wild populations are under threat of extinction because of over-collection and habitat destruction. Mature seeds of most *Paphiopedilum* species are difficult to germinate, which severely restricts their germplasm conservation and commercial production.

Many orchid seeds including *Paphiopedilum* are tiny and contain no endosperm (Figure1). In contrast, most angiosperm seeds have well-developed embryos. *Paphiopedilum* seeds are generally unable to germinate on their own. They form a mycorrhizal relationship that help with the nourishment of emerging seedling. Even with the additional nutrients, mature seeds of most *Paphiopedilum* species still have difficulty in germinating, which severely restricts their conservation and large-scale production. However, the factors inhibiting germination are still unknown.

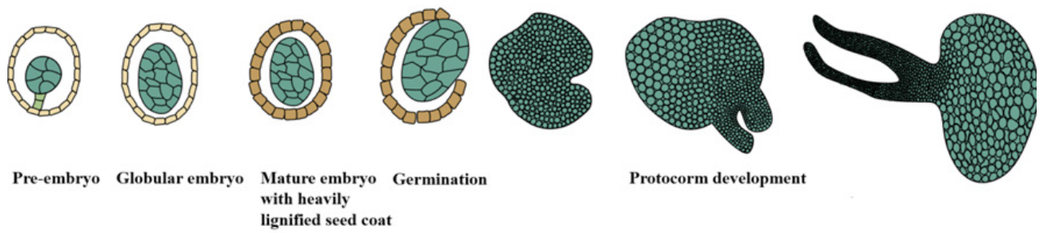



Figure 1. *Paphiopedilum armeniacum* embryo development and seed germination

The question that needs to be addressed is what is the main cause for the germination inhibition? Plant hormones such as abscisic acid generally play essential roles in seed development and germination performance. The Rare and Endangered Plant Propagation and Conservation Research Group（PI: Prof. ZENG Songjun) first investigated the role of plant hormones in germination, and the results showed that abscisic acid can only inhibit the germination of immature seeds. For the heavily lignified mature seeds, reduction in endogenous ABA level is irrelevant to the increase in the germination rate. Lignin accumulation in the seed coat imposes physical dormancy.

The researchers discovered large amounts of non-methylated lignin accumulated during seed maturation of *Paphiopedilum armeniacum*, which negatively correlates with the germination rate. The transcriptome profiles of *P. armeniacum* seed at different development stages were compared to explore the molecular clues for non-methylated lignin synthesis. Kyoto Encyclopedia of Genes and Genomes (KEGG) enrichment analysis showed that a large number of genes associated with phenylpropanoid biosynthesis and phenylalanine metabolism during seed maturation were differentially expressed. Several key genes in the lignin biosynthetic pathway displayed different expression patterns during the lignification process. *PAL*, *4CL*, *HCT*, and *CSE* upregulation was associated with C and H lignin accumulation. The expression of *CCoAOMT*, *F5H*, and *COMT* were maintained at a low level or down-regulated to inhibit the conversion to the typical G and S lignin (Figure 2).

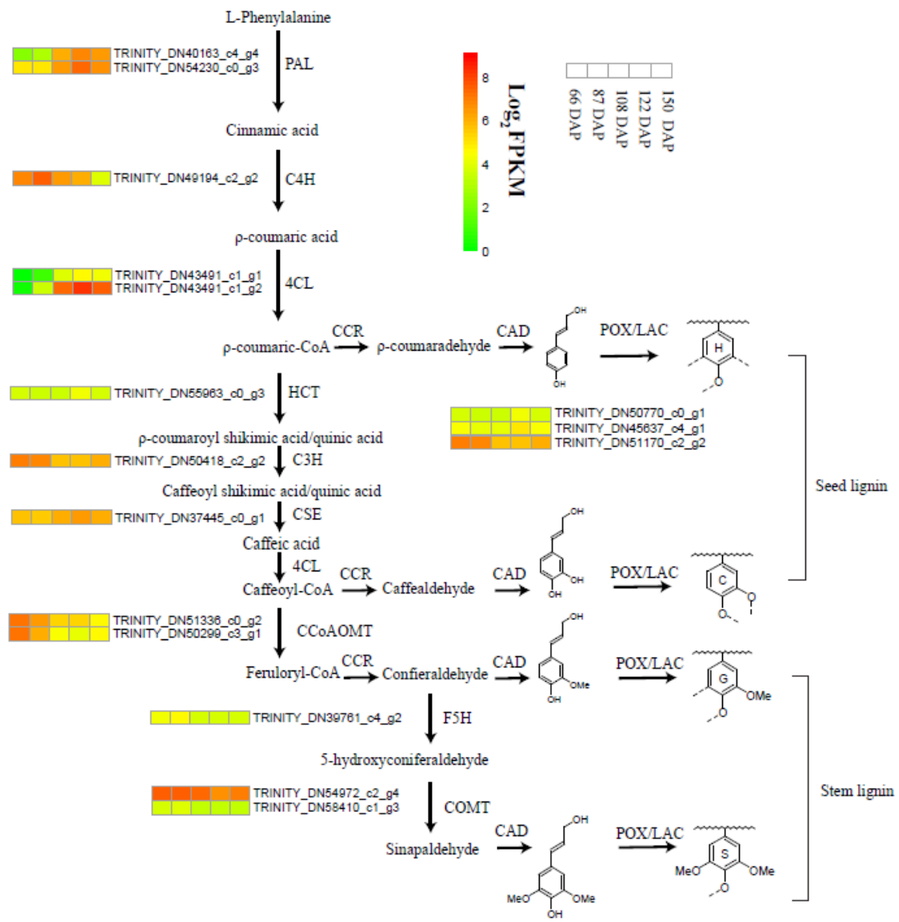



Figure2. Lignin biosynthesis pathway in *P. armeniacum*

What’s the biological significance of the accumulation of the non-methylated lignin in seed coat? For *Paphiopedilum*, a compatible mycorrhizal association is a requirement for seed germination under natural conditions. Seed coat specific non-methylated lignin is extremely stable, which can only be degraded by fungi. Therefore, the researchers propose that the accumulation of non-methylated lignin serve as one of the strategies for adaption to fungal symbiosis.

This research has been published in *BMC genomics* (2020, 21:524) and *International Journal of Molecular Sciences* (2020, 21:9561) respectively.

## 11. Low temperature synergistically promotes wounding-induced indole accumulation in *Camellia sinensis*

Environmental stress factors, such as temperature changes, drought, salinity, and herbivore attack, generally affect plant growth. To survive, plants must cope with these stress factors individually or, more commonly, in combination. Defense volatiles, including terpenoids and green-leaf volatiles, are commonly induced in plants by different abiotic and biotic stresses. In tea tree (*Camellia sinensis*), these volatiles also contribute greatly to tea quality. Therefore, it will be an effective way to improve tea aroma by using proper environmental stresses. In the process of tea tree growth and tea manufacturing, multiple stresses participate in the formation of tea aroma. The Plant Metabolomics Research Group（PI: Prof. YANG Ziyin）found that indole, a characteristic volatile of oolong tea, was maintained at a higher content and for a longer time under dual stresses compared to wounding alone. CsMYC2a, a jasmonate responsive transcription factor, was the major regulator of *CsTSB2*, a gene encoding a tryptophan synthase β-subunit essential for indole synthesis. During the recovery phase after tea wounding, low temperature helped to maintain a higher JA level. Further study showed that CsICE2 interacted directly with CsJAZ2 to relieve inhibition of CsMYC2a, thereby promoting the JA biosynthesis and downstream expression of the responsive gene *CsTSB2* ultimately enhancing the indole biosynthesis. These findings shed light on the role of low temperature in promoting plant damage responses and improve knowledge of the molecular mechanisms by which multiple stresses coordinately regulate plant responses to the biotic and abiotic environment.

This research has been published in *Journal of Experimental Botany*, 2020, 71(6): 2172-2185.

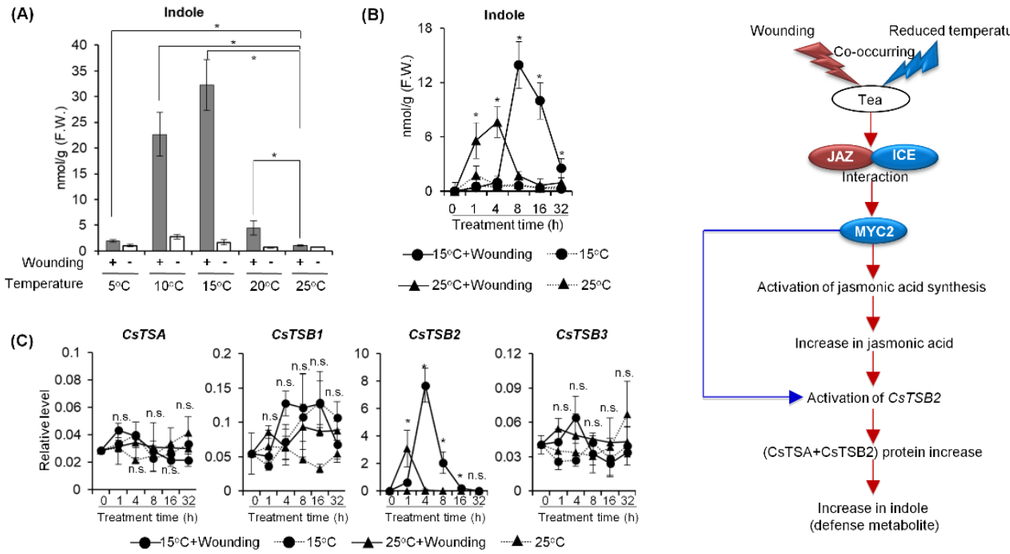



Figure: The proposed model of JA and indole formation in tea leaves exposed to dual stresses (wounding and low temperature).

## 12. Progress in gene identification on high nitrogen use efficiency, grain yield and resistance to bacterial blast of rice

1. The Plant Nutrition Physiology Research Group (PI: Prof. ZHANG Mingyong) found that *OsATG8b*-mediated autophagy is involved in N recycling to grains and contributes to the grain quality, indicating *OsATG8b* may be a potential gene for molecular breeding of rice（Front in Plant Sci, 11:588）.

2. The research group also found that rice *OsCYP15G1* encodes an obtusifoliol 14α-demethylase for the phytosterols biosynthesis and possible without affecting the biosynthesis of downstream BRs. Overexpression of *OsCYP51G1* could improve grain yield of rice（Biochem Biopsy Res Comm, 529: 91-96）.

3. CRISPR/Cas9 was utilized to disrupt the function of *OsSWEET14* by modifying its coding region in rice cv. Zhonghua 11 (CR-S14). Our findings demonstrate that knockout of *OsSWEET14* in Zhonghua 11 background is able to confer strong resistance to multiple *Xoo* strains, including pathotype IV, V and IX, which are virulent in South China（BMC Plant Biol, 20, 313）.

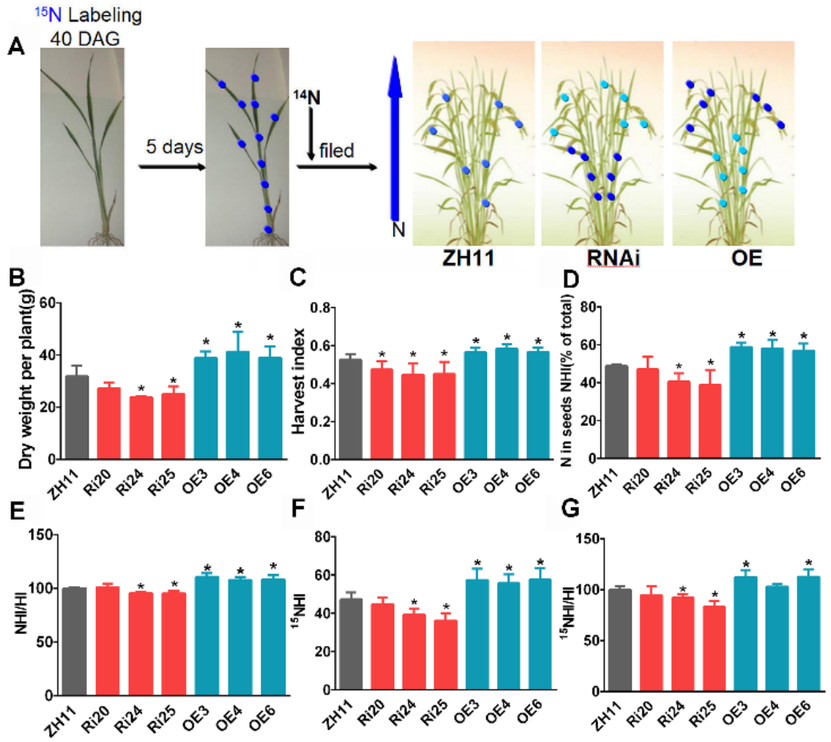



Figure. *OsATG8b* autophagy gene of rice involved in N recycling

## 13. Progress in regulatory mechanism of plant immunity

Plants have evolved a set of highly sophisticated mechanisms to deal with environmental stresses and to survive in a cost-efficient manner. To date, extensive researches on how plants recognize and respond to pathogens have made advances, but the molecular mechanisms underlying fine-tuning of the plant immune system remain elusive.

Here, The Plant Hormone Regulation Research Group (PI: Prof. HOU Xingliang) reported a mechanism of how the key regulator EDS1 distribution in cell is fine-tuned. A combination of molecular, biochemical, and genetic approaches is used to reveal the important role of EIJ1, an EDS1-interacting chaperone-like protein, in the plant immune system, and a model on how it regulates EDS1-dependent plant basal resistance was proposed (Figure. 1). Under normal conditions, EIJ1 is mainly localized in chloroplasts. When plants are invaded by pathogens, EIJ1 is rapidly released from the chloroplast to the cytoplasm, where it interacts with EDS1 and prevents cytoplasmic EDS1 from shuttling into the nucleus. Thus, the nuclear activity of EDS1 is attenuated. When plants suffer continuous stimuli from invading pathogens, EIJ1 is gradually degraded, leading to an increased nuclear accumulation of EDS1 and the subsequent promotion of SA biosynthesis and expression of resistance-related genes, mounting a complete immune response. In this way, plants fine-tune the strength of their immune response and avoid unnecessary cost due to over-reaction of the immune system. These findings illustrate an essential repressive role of EIJ1 during the early host response to pathogen invasion.

Notably, eij1 loss-of-function mutant plants shows normal growth, and EIJ1 gene is widely distributed among monocotyledonous and dicotyledonous plants. It provides a potential target for resistant crop breeding.

This research has been published online in *The Plant Cell*, 2020.

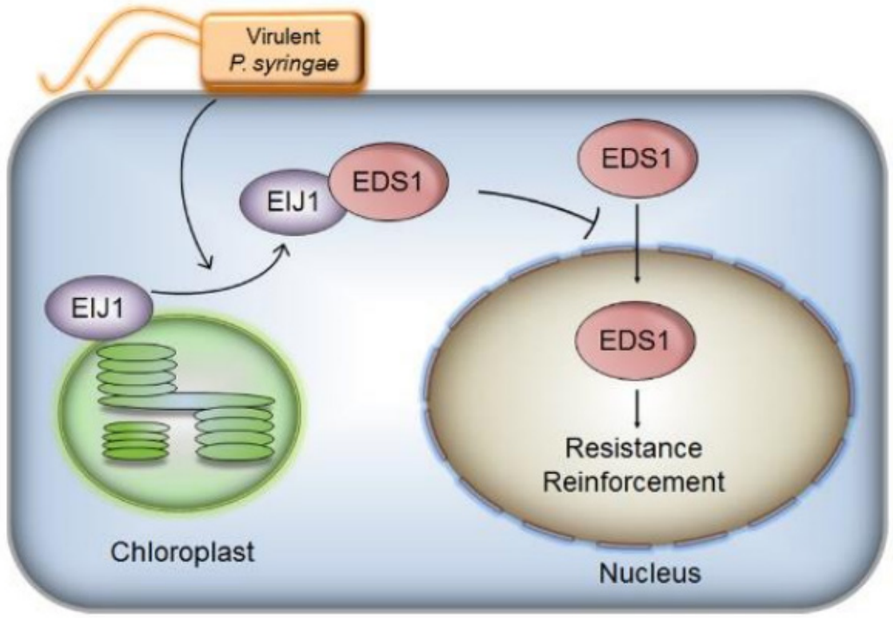



Figure . Hypothetical model of EIJ1 regulating EDS1-dependent plant basal resistance





## 14. Progress in plant cytoderm and resistance

The Plant Cell Wall and Stress Resistance Research Group (PI: Prof. YANG Haibin) has focused research on plant cell walls and resistance, by studying the molecular mechanism of plant cell adhesion and its application in biomass conversion in poplar wood (Yang et al., Plant Biotechnology J. 2020). The researchers developed an effective method to generated single cells from biomass and a patent based on this method has been approved and authorized. In addition, they also studied and revealed the unique role of lignin, RG-I and xylan in cell-cell adhesion in poplar wood. In the aspect of organic solid waste utilization, the research group developed a method of dissolving cellulose with trifluoroacetic for the production of new materials from solid waste fibers. They obtained highly efficient lignin degrading enzymes and studied the mechanism of lignin polymerization and depolymerization in plants. And also effectively separated cells in woody biomass using combination of catalytic deligninifation, RG-I lyase and xylanase treatments to facilitate biomass degradations and utilization.

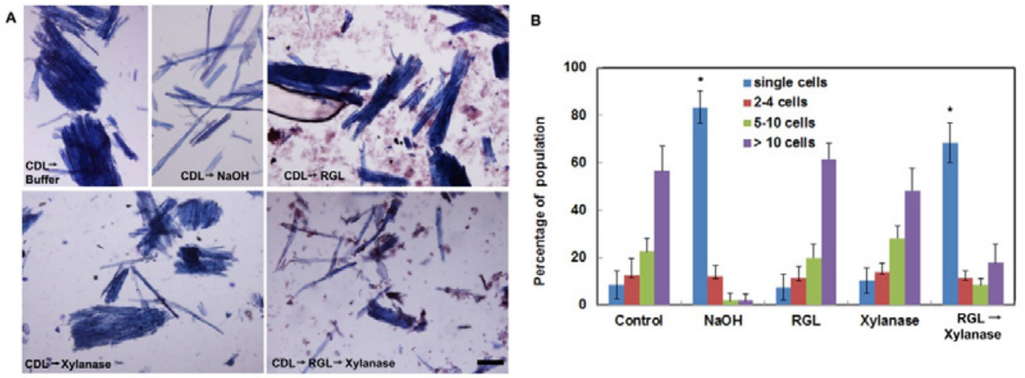



Figure. Cell–cell separation of Catalytically De-Lignified (CDL) WT Poplar wood particles after dilute alkali or enzyme treatments. A. Bright-field micrographs of Toluidine Blue-stained WT particles following treatment with Ni/C catalyst to remove lignin, RG-I lyase and xylanase digestion. B. Percentages of single cells (blue) or cell clusters of 2-4 cells (red), 5–10 cells (green) and> 10 cells (purple) were determined from >1000 cells counted per treatment.

## 15. Exploring the roles of transcription elongation factor in transcription initiation

Generally, transcription serves as the fundamental step to convert the DNA coded genetic information into RNA molecules, which either directly play functional roles or provide template for protein synthesis. During transcription, RNA polymerases or transcription machinery will be first recruited at transcription starting sites and followed by waiting suitable signals to enter progressive transcription. Relative to elongation and termination, extensive researches have focused on transcription initiation including the precise selection of initiation sites, cis elements and trans factors in transcription regulation, and the regulation of nucleosome arrangement at promoter-proximal regions. Among those fields, nucleosome barrier especially the occupancy of histone around transcription starting sites (TSS) gradually becomes the hotspot to reveal the fine regulation of transcription at early stage. One of the major regulators of chromatin structure is chromatin remodeler, which take advance the released energy to alter the chromatin through histone sliding, replacement, and eviction. However, how to recruit chromatin remodeler in transcription initiation still needs to be illustrated. Here, the primary results from The Regulation of Plant Adaptivity Research Group (PI: Prof. CHEN chen)

shown that the loss of transcription elongation factor, SPT6L, is companioned with the alternation of nucleosome arrangement at TSS and +1 nucleosome and this change is getting obvious at the highly transcribed genes. Further investigations have revealed the interaction and co-occupancy of chromatin remodeler with SPT6L at TSS, suggesting the potential role of SPT6L in the recruitment of chromatin remodeler around TSS during transcription initiation. At last, the research group carry out genetic and molecular approaches to demonstrate the genetic interaction of chromatin remodeler and SPT6L in early transcription and the dependency of chromatin remodelers on SPT6L around the TSS. This work provides a new mechanism to recruit chromatin remodelers during transcription. And, it also demonstrated the role of SPT6L in transcription initiation and shed light on the coordination of transcription initiation and elongation. This work was supported by National Natural Science Foundation of China.

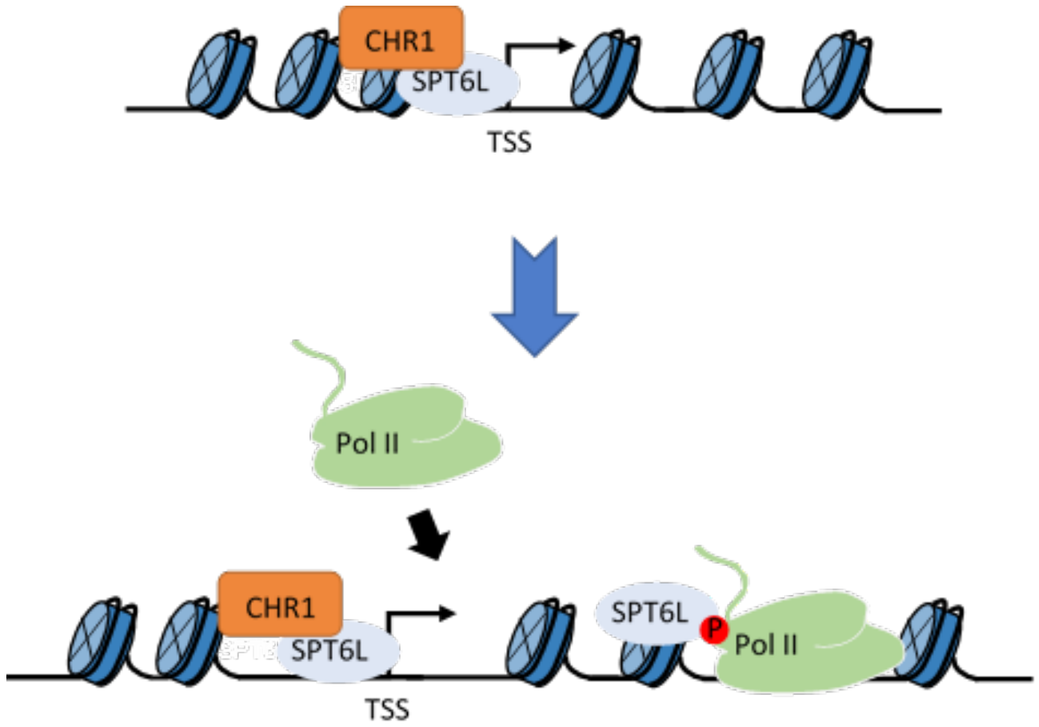



Figure. The proposed model of the role of CHR1 and SPT6L in transcription initiation.





# Talent Team Building and Postgraduate Training

## Talent Team Building

### 1. Comprehensive introduction

In combination with the goals of SCBG, and problems that be proposed during the inspection of CAS and self-examination of thematic education in 2019, the human resources department launched a series of systems that were compatible with the "1+3" talent policy of CAS. Those systems mainly including the introduction and training plan of talents, the stabilization and incentives of scientific research backbone talents, and negotiated salary system for superior talents. SCBG actively promoted the implementation of the Youth Promotion Association of CAS, the special research assistant system and the performance reward system, and made great progress in talent team building.

16 new employees joined SCBG in 2020. By the end of December 2020, there were 1517 documented staff, including 463 registered employees, 307 retirees, 442 graduate students, 78 postdocs, and 214 other employees.

## Brief Achievements

### 1. Continue to implement the talent introduction and training systematic program, and made new progress in the introduction and training of superior talents

In 2020, one new member (the first record for Plant Science Center) and one candidate of the CAS Talent Introduction Program were introduced to SCBG. One member was rewarded the Outstanding Member of the Youth Promotion Association and at least one member received this title for six consecutive years in SCBG. Get one more extra quota of Youth Promotion Association and three members were selected this year. Two members were selected as the Overseas Review Experts of CAS. One member was recommended to be the Young and Middle-aged Talent from the Ministry of Science and Technology by CAS and attended the recruitment meeting.

Figure 1. Recruitment meeting

### 2. The postdoctoral station got remarkable improvements and made new records

In 2020, the number of funded projects increased significantly. Increased one more member of the Special Research Assistant Program of CAS compared to last year, and two outstanding doctors obtained this funding after went through the procedure of autonomous declaration, centralized review and publicity. Meanwhile, including 8 doctors, totally 13 researchers of SCBG received funding from the National Natural Science Foundation of China Youth Fund Projects. 15 postdocs were funded by the China Postdoctoral Science Foundation, and the number of funded projects ranks first among all the units in Guangzhou Branch. One doctor were funded by the International Training Program for Outstanding Young Scientific Researchers in Guangdong Province.

Both the number of postdoctors in station and their published papers reached the highest records. Totally 85 SCI papers have been published, with 42 were published as the first affiliation and the first author of SCBG. By the end of December 2020, there were 78 postdocs in station (48 at the end of 2019).As a bunch of excellent doctors joined the postdoctoral station from home and abroad, the back-up talent team had been greatly strengthen in SCBG.

### 3. Successfully completed the promotion recruitment of Employee

Combined with suggestions put forward by employees, the personnel department summarized the problems during the process of post recruitment in recent years and further improved the "2020 Implementation Plan of Post Recruitment of SCBG" . According to the relevant regulations of CAS, the post competition plan has been optimized by increasing the ratio of senior positions, canceling the limit on quotas for junior and elementary positions, and employees can apply yearly instead of twice a year. In 2020, 165 staff participated in the competition and 103 staff were promoted to higher posts.


Figure 2. Employee post recruitment meeting

Figure 3. Recruitment meeting for Junior technicians

### 4. Improved the construction of employee evaluation system

According to the requirements of CAS, the personnel department re-formulated the annual assessment and salary system for three series of posts, included post of research, administration and support. Carried out the classified assessment and evaluation system by different groups, different levels and different grades, and re-set the rules of merits distribution. Increased reward for yearly outstanding employees, made the graded assessment and evaluation be more fairly.

### 5. Continuing education and training for employees made good improvements

By strengthening daily management and supervision, the completion rate of continuing education for all employees reached 92.64% (83.78% in the previous year). Among the 15 departments of SCBG, 14 reached 100% in completion rate. In 2020, the personnel department organized the continuing education premium courses (plant specimen collection and identification), the annual conference of the botany continuing education base, and two online trainings on EXCEL and PPT performance. The training programs were very popular and welcomed by employees, and further improve the management skills and service level of the administration department.

Figure 4. The annual conference of the botany continuing education base

## Postgraduate Training

### 1. Comprehensive introduction

In 2020, 442 postgraduates studied in SCBG, reaching record high. There were 167 doctoral students (including 6 foreigners and 2 ethnic minority cadres) and 275 master students (including 11 foreigners and 16 ethnic minority cadres, 9 veterans, 22 students jointly trained by SCBG and Zhongkai University of Agriculture and Engineering, as well as Gannan Normal University). There were 112 postgraduate supervisors in SCBG.

### 2. Recruitment and training

In 2020, 39 doctoral students and 93 master students were enrolled in SCBG, reaching record high. Organized government-sponsored overseas education programs for students and 13 students were recruited. We continued to standardize and deepen the General Education Course for Scientific Quality, and organized academic forums, thematic reports, mental health and career planning guidance reports at different levels, which gained good feedbacks. To strengthen postgraduate academic training, the 13th SCBG Postgraduate Academic Forum was held, 9 master students and 8 doctoral students made presentations. Outstanding presentations were recommended to the Graduate Academic Forum of Guangzhou Education Base and awarded first, second, and third prizes respectively. In 2020, 109 students graduated and 110 students received the degree (48 received doctoral degree and 62 received master degree). A total of 83 academic papers were published by postgraduates in 2020, including 62 SCI papers, and three papers have been published on *Global Change Biology* (IF: 8.555).

### 3. Appraising and Awards

In 2020, two doctoral dissertations won the Outstanding Doctoral Dissertations of CAS; three doctoral students won the Dean's Excellence Award; two doctoral students were rewarded the Zhuliyuehua Excellent Doctor Scholarship of CAS; one doctoral student and two master students won the Di'ao Scholarship; two doctoral students won the BHPB Scholarship of CAS; one doctoral student was awarded the UCAS Outstanding International Graduate. Both the level and number of the received awards ranked first in history. And two supervisors were awarded CAS Outstanding Postgraduate Supervisors.

### 4. Construction of disciplines and supervisors team

SCBG played a leading role in managing the “Double First Class” dynamic monitoring and construction work of the forestry discipline of UCAS, and got 800,000 yuan funded by UCAS. The forestry discipline of UCAS also underwent the 5th round of discipline evaluation organized by the Ministry of Education.

Selection and qualification accreditation of postgraduate supervisors were carried out in 2020. Three professors and four associate professors were granted the doctoral supervisor qualification and the master supervisor qualification respectively. This result has been reported to the UCAS for record.

### 5. Integration of science and education

In order to strive for outstanding students, the 8th Summer Glamor Camp of SCBG was successfully organized, and 18 outstanding campers were planned to be enrolled as the 2020 master students in SCBG. We also successfully held the 2020 CAS Student Practice Training Program, with 54 undergraduates enrolled from 24 teams of 11 universities including Beijing Forestry University.

Figure 5. The 8th Summer Glamor Camp of SCBG

### 6. Daily management

The personnel department 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. Besides, various cultural and sports activities were organized, such as welcome party for new students, spring and autumn social practice tour, ball matches and winter games, English corner and so on. And also encouraged psychological committee members, psychological liaison officers, and psychological counselors to participate in the online training of the Psychological Center in UCAS. Two offline mental health lectures were launched. And mainly focus on giving instant helps for students who have psychological problems.


Figure 6. SCBG’s New Year Party
Figure 7. The farewell football match of graduates
Figure 8. Psychological lectures





# International Cooperation and Academic Exchanges

Although COVID-19 pandemic has brought devastating impacts of International Cooperation and Academic Exchanges in 2020. However, SCBG still made some achievements, developed video meetings, signed new MOU with other research institutions and initiated ANSO Botanical Gardens Union (Group B) to deepen the international cooperation.

## International Cooperation

### 1. Initiate ANSO Botanical Gardens Union (Group B)

Through the cooperation with IABG and BGCI, Botanical Gardens Union (Group B) has been founded under the framework of ANSO by SCBG and Lushan Botanical Garden in June, 2020. Through the cooperation and exchange of plant information, personnel and young students, the Asian, South American and other regional offices of ANSO Botanical Gardens Union will effectively promote cooperation in plant resource protection, scientific research, public education, and sustainable utilization of plant resources, aiming to meet the future challenges in public health and agricultural and industrial development.

### 2. International Cooperation network

SCBG jointly signed the cooperation agreements for Educational and Scientific Purposes with Pakistan, South Korea and other countries in 2020.

### 3. International Talents program

In 2020，four international talents programs cooperated with SCBG were approved, including Foreign Experts Program of Guangdong Province, Retired Experts Program and TWAS project.

### 4. International Training and International Conference

Fund by International Cooperation Bureau of CAS, SCBG was supposed to hold the international training workshop in Guangzhou in November 2021, and prepared to hold the Annals of Botany International Academic Symposium on Polyploidy and Evolution in Plants (PEP2021) in Guangzhou in September 2021.

# Academic Exchanges and Academic Society Activities

## 1. Academic Exchanges

CHUN Woon-young Lectures Series (WCLS) was initiated in 2009 and became a critical academic exchange platform in SCBG. In 2020, four times of CHUN Woon-young Lectures Series were held and 5 famous scientists were invited to share their research progress and scientific experience.

Figure 1. Academician ZHANG Qifa gave report in WCLS

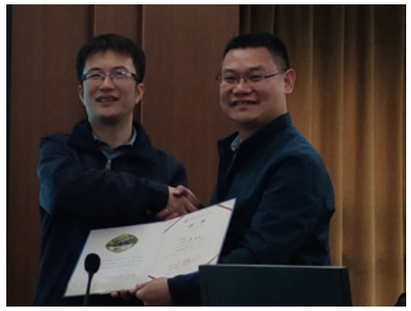


Figure 2. Professor XU Qiang gave report in WCLS

Figure 3. Professor DING Ke gave report in WCLS

Besides WCLS, SCBG organized the annual academic meeting in December, directors from the 3 CAS Key laboratories and 16 young scientist of SCBG contributed 19 excellent lectures to promote academic exchange.


Figure 4. Academic reports for the annual academic meeting

## 2. Academic Society Activities

### Guangdong Society of Plant Physiology (GDSPP)

The 1st Joint Annual Conference of Plant Physiological Society from five provinces was held on Nov.21st, 2020 in Chenzhou city, Hunan province. This conference was initiated by the Plant Physiological Society of Hunan Province, Hubei Province, Henan Province, Jiangxi Province and Guangzhou Province, and held jointly for the first time. This conference provided a high level communication platform for academic exchange. With the theme of "Plant Physiology and Rural Revitalization" , the conference was mainly to ensure food security, promote green development, build ecological civilization and boost rural revitalization. Five academicians, three invited experts, 36 plant physiologists & youth scientist speakers and 110 participants attended the Conference.


Figure 5. The 1st Joint Annual Conference of Plant Physiological Society from five provinces

### Guangdong Botanical Society (GBS)

The 1st Joint Annual Conference was co-organized by Guangdong Botanical Society and Guangxi Botanical Society held in Shenzhen, Guangdong. The joint annual meeting also offered a Video meeting to the public. There were about 130 participants from Guangdong and Guangxi scientific research institutions attended the conference with four speakers and nine youth reports, covering plant evolution, genomics, medicines and science popularization. The conference effectively promoted the interaction and communication between young scholars of plant science research from Guangdong and Guangxi, and provided a great communication platform for scientific research cooperation in order to handle major technical problems jointly.

### Ecological Society of Guangdong Province (ESGP)

SCBG hold High-level Forum of Ecological Civilization and Innovation in the Guangdong-Hong Kong-Macao Greater Bay Area in Guangzhou from Nov. 30th to Dec.1st, 2020, this forum was sponsored by Guangdong Association for Science and Technology and Department of Science and Technology of Guangdong Province. Academician HONG Deyuan, FU Bojie, and eight ecologists contributed excellent lectures to build-up exchange and cooperation platform for ecological environment quality improvement, new mode of green development realization. More than 150 representatives from universities and scientific research institutions of Guangdong province participated in the meeting.


Figure 6. 2020 Joint annual meeting of Guangdong and Guangxi Botanical Society

Furthermore, the online live broadcast received up to 280,000 hits.

SCBG undertook 19th Annual Conference of Ecological Society of China from Nov. 21st-22nd, 2020. With the theme of "The New Mission of Ecological Science: Promoting Harmony between Man and Nature", the conference was divided into 42 sessions. SCBG was in charge of two sessions included applied plant ecology. This conference played a positive role in promoting the development of ecology and its related disciplines, it also made favorable contribution for exchange and cooperation of ecologists.

Figure 7. Symposium on conservation and sustainable utilization of orchids in Guangdong





# Transfer and Transformation of Achievements

1. **In 2020.SCBG signed 13 achievement transfer and transformation contracts with 8.838 million yuan; and signed four cooperation projects with 4.8 million yuan ( in the account ); besides, there are four projects to be signed with 2.3 million yuan.**

Table 1. Achievements transfer and transformation contracts signed by Science and Technology Promotion Center from 2016 to 2020 (unit: 10000 yuan)

| Year | Contracts | Amounts |
|---|---|---|
| 2016 | 14 | 582.62 |
| 2017 | 25 | 1461.47 |
| 2018 | 18 | 1918.84 |
| 2019 | 11 | 836 |
| 2020 | 13 | 883.8 |
| Total | 81 | 5682.73 |

2. **Guangdong Zhongke Qilin Co., Ltd., the holding enterprise of SCBG, signed / won 26 projects in 2020, with a turnover of 170 million yuan, a total profit of 4.2 million yuan and a net profit of 3.2 million yuan, each increased 10% compared to 2019. According to the requirements of the Bureau of Facility Support and Budget of CAS and decisions made by garden administration conference, the Science and Technology Promotion Center ( STPC )continued to clean up non-performing branches and enterprises, and strengthened the effective supervision of Zhongke Qilin company.**

Form 2. 2016-2020 financial statements of Zhongke Qilin company (unit: 10000 yuan)

| Year | Main Income | Tax payment | Total Profit | Net Profit | Dividend distribution |
|---|---|---|---|---|---|
| 2016 | 12134.61 | 620.92 | 37.64 | 309.24 | |
| 2017 | 9639.03 | 752.83 | 410.90 | 307.18 | 100.00 |
| 2018 | 12870.82 | 1067.08 | 430.45 | 322.84 | 2120.00 |
| 2019 | 14470 | 1120.43 | 450 | 338 | 132 |
| 2020 | 17403 | 484.68 | 453 | 340 | |
| Total | 66517.46 | 4045.94 | 1781.99 | 1617.26 | 2352.00 |

**3. In 2020, SCBG's holding enterprise-the Science and Technology Consulting and Development Department had a revenue of 2.66 million yuan, a total profit of 6000 yuan and a net profit of 3000 yuan; The seed industry town project led by STPC get fund of 1.96 million yuan. At present, according to the requirements of CAS and the system reform plan of SCBG, the enterprise is undergoing corporate restructuring and industrialization reform.**

**4. According to the requirements of the Chinese Academy of Sciences and Superior unit, comprehensively started the clean-up of branches, platforms and companies founded by scientists of SCBG, and report the work plan for corporate reform of state-owned enterprises and the clean-up report of branches and bad enterprises etc. Audit and legal risk assessment had been conducted for Foshan center and Guizhou center as required. Guizhou center had been dismissed and cancelled, and Foshan center is going through the dismiss and cancellation procedures; Zhaoqing Dinghushan Zhongke guest apartment, Nanjing Branch of Guangdong Zhongke Qilin Garden Co., Ltd., Hainan and Huizhou branches had been cancelled. While canceling non-performing enterprises and branches, SCBG will continue to promote the construction of agricultural industrial parks, as well as the implementation of demonstration bases and targeted poverty alleviation projects.**

**5. Revised and issued the internal audit regulation *Management rules for internal audit of South China Botanical Garden, Chinese Academy of Sciences*; continuously and regularly carried out the authenticity and legitimacy audit of scientific research and economic business; undertake two internal economic responsibility audit projects; independently carried out the specific audit of Dinghushan National Field Research Station of Forest Ecosystem; supervised and urged the implementation of internal audit rectification; edited two audit cases; compiled a specific audit report and reported the internal control risk to SCBG leadership; participated in the economic responsibility audit for the leadership changes of Shenzhen Institute of advanced technology and Guangzhou Institute of geochemistry organized by Guangzhou Branch of CAS,.**

**6. Be responsible for the daily management of Guangdong characteristic plant resources engineering and technology development research center; Communicated for cooperation projects such as green city alliance and smart agriculture alliance of CAS, organized and coordinated matters related to the Conservation and Utilization Committee of Medicinal *Dendrobium* of China Wildlife Conservation Association, and participated in branch meetings of China Wildlife Conservation Association. Completed the accounting business, annual financial settlement and annual tax inspection of two provincial associations which were affiliated to SCBG.**

**7. Launched the intellectual property rights protection and anti-counterfeiting actions of SCBG, cooperated with lawyers to investigate and deal with violations, registered and protected SCBG's trademark, and completed the first stage work; Developed the implementation of intellectual property standards in SCBG according to the requirements of CAS.**





# Horticulture and Public Education

## *Ex situ* conservation and horticulture

The Garden continuously implemented the Living Collection Policy and the Core Botanical Garden Plan of the CAS, promoted the *ex situ* conservation network and horticulture practices, and made new progress in species conservation and landscape gardening.

### 1. Plant introduction and conservation

The garden implemented the national collections and species conservation plan, completed the annual goals of plant acquisition and *ex situ* conservation in 2020. Increased 1,097 new accessions including 424 species and 381 varieties from China and overseas. Totally propagated 6,338 pots/clusters of 488 taxa, transplanted 1,835 plants/clusters of 506 species, recorded phenology of 891 species, identified 200 species. Bred 4 new varieties of *Hibiscus* registered by International Hibiscus Society. Published 4 volumes of *Ex Situ Cultivated Flora of China.* Provided 30 batches of 808 species for scientific research. Currently the Garden holds 9197 species (including infraspecific taxa) and 17,168 taxa (including 7465 cultivars) in cultivation, of which 5341 accessions are unidentified.

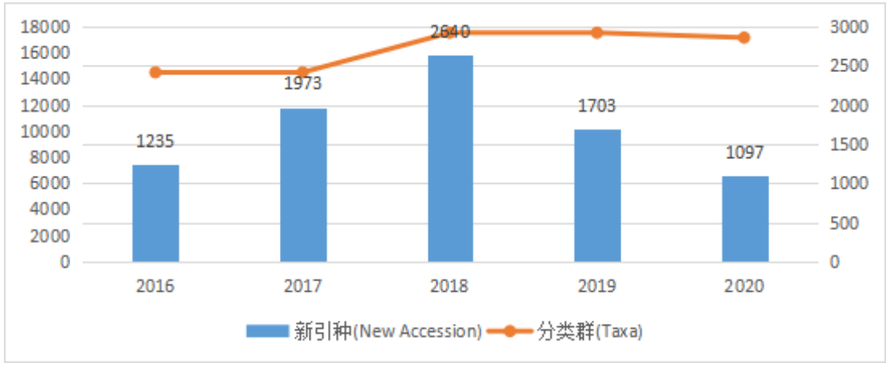



Figure 1.2016-2020 Living Collections of SCBG


Figure 2. Euphprbiaceae of *Ex Situ* Cultivated Flora of China


Figure 3. Acanthaceae of *Ex Situ* Cultivated Flora of China

Figure 4. *Hibiscus* 'SCBG Black Lips'

Figure 5. *Hibiscus* 'SCBG Carousel'

Figure 6. *Hibiscus* 'SCBG Fangfei'

Figure 7. *Hibiscus* 'SCBG Glaceon'





## 2. Garden management and horticulture

In order to help the public know more about the importance of plants for treatment of COVID-19, the Garden held exhibitions of anti-epidemic plants and major epidemic & plants in the history of human civilization, and implemented a number of garden management plans to improve the gardening level. The Monthly Flora Show was initially piloted and 12 themed gardens were upgraded in garden display and interpretations. The Succession Plan was implemented in more than 40 key areas of 16 themed gardens, added a batch of ornamental plants. The garden installed automatic irrigation in central garden area, and completed the extensional design of the biological garden & aromatic garden, carried out the construction and maintenance of exquisite lawn and year-round annual borders in the north entrance area, created perennial borders in more than 10 regions such as the palm garden lakeshore and the central lawn forest edge. And continuously implemented arboriculture management, organized training classes of handsaw and chain saw in cooperation with the local and Macao arboriculture teams, finished pruning and training of c. 200 trees, and set up a standard process of arboriculture operation including activity records, applications, registration and other workflow. In order to improve garden management, drafted out operation guideline for the maintenance of themed gardens and plant records, edited historic archive and interpretation of the orchid garden, promoted the use of garden machinery, and organized internal gardening forums.

Figure 7. Exhibitions of anti-epidemic plants

Figure 8. Major epidemic & plants in the history of human civilization

Figure 9-10 Perennial border

Figure 9-10 Perennial border

Figure 11. Cooperation with Macao arboriculture team

Figure 12. Tree pruning up in the tree

## Public education and tourism service

The Garden strictly complied with national and local regulations on the management of COVID-19 and launched a year-round open anti-epidemic, provided a diverse range of garden featured scientific activities and education courses, “Qilin Science Forum”, extensive media coverage, tourism service and volunteer programs, and hosted more than 767,800 visitors including ca. 100,000 teenagers, and the tickets and events income was 13.2404 million CNY.

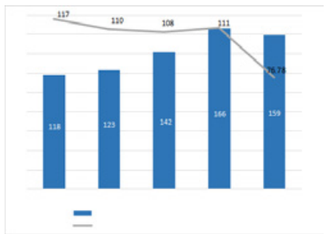



Figure 13. Statistics of education activities and tourists in 2016-2020

### 1. Science activities and education programs

The Garden provided a huge range of popular science activities, courses and lectures for the public to make the most out of their visit to enjoy the garden. Continuously carried out six series of natural education courses, including “Natural history” “Class of nature” “Press flower art” “Nature investigator” “Botanical illustration” and “Plant science”, with a total of 87 sessions. Hosted and participated in a total of 159 scientific activities and events of the CAS, Guangdong Province and Guangzhou, including “ Outreach Education workshop for campus, communities, countryside and enterprises in Guangzhou”, the 16th CAS Public Science Day & “Science and Technology Activity Week”, “Popular Science Carnival” on National Science Day, the 3rd “Science and Technology Festival of the CAS”, the Winter/Summer Camps etc. Launched 19 science lectures of “Qilin Science Forum”, with more than 2000 attendances in site and online


Figure 14. The 3rd Science and Technology Festival of the CAS and Youth Science Festival of Core Botanical Gardens held in SCBG

### 2. Media communication and science publicity

Regularly released “what’s on” at the Garden about “Blooming information”, “Scientific activities and education courses”, “Plant stories” and “Scientific progress” to welcome information and navigation services for tourists and the public. In 2020, released 49 times of education activities and events in the newspapers, TVs and radios, launched 113 pieces of tourism information and reports in all kinds of networks, released 350 articles in official WeChat with 89,677 subscribers, and 110 pieces of official information in micro-blog with 154,164 fans. Tik Tok of SCBG released 47 videos with 1760 fans. 25 flower-blooming articles, 12 times of monthly blooming and 6 times of conservatory blooming boards were released. The Garden was ranked forefront for popular science publicity in the CAS.


Figure 15. Tik Tok of South China Botanical Garden

### 3. Popular science projects and awards

In 2020, the Garden got 10 projects of science popularization with 2.569 million yuan funding and awarded five science popularization bases, including “Guangdong Science Popularization Education Base” “Guangdong primary and middle school students research and practice education base” “Guangzhou Social Science Popularization base” “the fifth batch of pilot units of national natural school capacity project” and “ecological science popularization education base of Chinese Ecology Society”. In January, awarded the title of “Specialized Park (Grade I)” by Guangzhou Municipal Bureau of forestry and landscape. Ms. Huang Ruilan was awarded “2020 outstanding individual of Guangzhou popular science” (September). Ms. Ren Duo and Ms. Chen Min won the first prize and the third prize in the 2020 Guangzhou “Science Talk and Science Popularization” competition respectively, and Ren Duo was awarded the title of “top ten science popularization commentators in Guangzhou” (August).


Figure 16. SCBG was authorized as “Popular Science Education Bases of Guangdong Province(2020-2024)”


Figure 17. The inaugural meeting and the first general meeting of Guangdong science popularization education base Alliance

# Dinghushan National Nature Reserve

In 2020,Dinghushan National Nature Reserve（Dinghushan Arboretum of CAS）made fruitful achievements on nature protection, scientific research monitoring, science popularization & publicity and platform management & service.

**Nature Conservation and Resource Management:** Besides kept on daily work such as stationing and patrolling, publicity of forest fire prevention and so on, the Arboretum also kept night patrols in order to discover fires promptly. Took effective measures to deal with the heavy forest fire prevention task, carried out professional fire-fighting practice and training to improve personnel’s skills and awareness, applied forest fire prevention codes for the first time, recorded data of visitors who entering the mountains and forests, thus could effectively prevent and control the fire caused by visitors. The major forest diseases and insect pests in LE area were investigated and appropriate measures were taken to clean up more than 200 pine-wood nematode trees and eliminate invasive species. At the same time, the Arboretum had completed tending projects of 20 km anti-fire forest line & forest belt and the natural forest boundary.


Figure 1. Fire-fighting practice

Figure 2. Pine wood nematodes control

**Construction and Monitoring of Science Platform:** Continue to carry out animal monitoring with infrared camera The Arboretum made effort to improve the service capacity construction of scientific research, science and education platform, provided help for various research institutions and teams to carry out scientific research in Dinghushan, assisted in field teaching and practice of colleges and universities, as well as the large-scale sample plot survey of 20 hectares of Dinghushan. In 2020, 89 research papers were published based on Dinghushan, including 65 in English and 24 in Chinese. A new fungus species (*Tricholomopsis rubroaurantiaca*) and a new bacteria species (*Pararobbsia silviterrae*) were discovered. Two new distribution records of birds (*Cyornis rubeculoides, Micropternus brachyurus*) and two new distribution records of insects (*Remelana jangala, Amata bivisa*) were found.





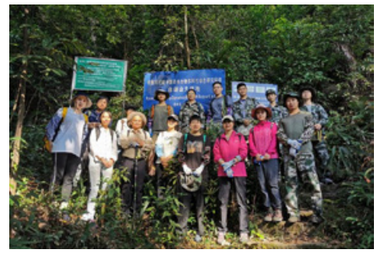


Figure 3. Large Sample Plot Survey of Dinghushan

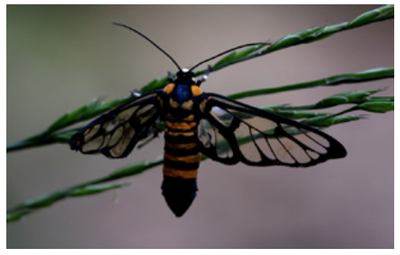


Figure 4. *Amata bivisa*

Figure 5. *Remelana jangala*

Figure 6.*Micropternus brachyurus*

Figure 7.*Cyornis rubeculoides*

**Scientific Popularization:** The arboretum carried out various popular science activities, among which 17 free popular science activities attracted 7,618 visitors, and seven online courses attracted more than 180,000 participants. In 2020, the arboretum designed nine experiential popular science courses, six civic science courses and 16 Dinghushan characteristic nature education courses, and was rated as “Guangdong Nature Education Base” by Guangdong Forestry Bureau and “Nature School Pilot Unit” by Ministry of Ecology and Environment Publicity and Education Center.

Frequently accepted interviews from medias such as Xijiang Daily and Zhaoqing TV Station, the reports delivered by official WeChat of Dinghushan National Nature Reserve were quoted and forwarded by other medias many times, such as Zhaoqing Release, Colorful Zhaoqing, National Park and Nature Reserve, and greatly enhanced the arboretum’s social influence. The arboretum designed and produced Dinghushan Introduction Manual, Dinghushan Common Plant Popularization Poker Cards, Five Senses Experience of Forest Tour Cards and Bird Badges, etc., and applied various ways to publicize the arboretum.


Figure 8. Popular science activities held in primary school of Zhaoqing


Figure 9. The Statistics data of Arboretum from 2018-2020

**Promoting community development:** Dinghushan Nature Reserve, as a part of Xinghu scenic spot, was granted as the national 5A scenic spot in 2020. Proposed by Dinghushan National Nature Reserve Administration, the concept "world's Dinghushan, scientific Dinghushan" was included in the tourism plan of Dinghushan by the local government. And the open area received 758071 tourists throughout the year.





# Party Building and Innovative Culture

SCBG thoroughly studied and implemented Xi Jinping's Thought on Socialism with Chinese Characteristics for a New Era, earnestly carried out the decisions and arrangements made by the CPC Central Committee and the Party Group of CAS, as well as the tasks and requirements of the Party under comprehensive strict governing, strengthened the party's leadership in scientific and technological work, firmly adhered to the work concept of 'focusing on central work and promoting innovation', promoted the integration and development of Party building and business work, in which party organizations and party members played important roles.

In 2020, SCBG had 12 party branches, 472 party members including 2 new members of CPC, and 8 probationary members were recruited. SCBG won 54 honorary titles from CAS, Guangdong Province and Guangzhou City throughout the year.

## Strengthening the study of political theory

Figure 1. Party committee theory center group (expanded) study meeting (August 17th, 2020)

SCBG has thoroughly studied and implemented Xi Jinping's Thought on Socialism with Chinese Characteristics for a New Era, the spirit of the 19th CPC National Congress, the fourth and fifth plenary sessions of the 19th CPC Central Committee, and the spirit of Xi Jinping's series of important speeches and instructions. Set up the youth theory study group. Four study meeting and five special topic study seminars were held for the Party committee theory center group (expanded).The major Party and Administration leaders gave party lessons/lectures 7 times. 92 person-times participated in the symposia/training classes on studying and implementing the spirit of the Fifth Plenary Session of the 19th CPC Central Committee organized by CAS and Guangzhou Branch of CAS. SCBG conscientiously implemented the new arrangements and requirements of the CPC Central Committee and the Party Group of CAS on scientific and technological innovation. Strengthened conscious of 'Four Consciousnesses' for the Party members and cadres, firmly attached to 'our self-confidence' and improved awareness of 'Two Maintenances'.

## Devote to improve leadership construction

The Party and the Administration leadership made a solemn commitment of ‘Loyalty and Responsibility, Justice and Service for the People, Diligence and Integrity’ to all staff of SCBG, and promised to be pioneer models and shoulder the responsibility. The leadership improved and implemented the meeting system, advocated rules for efficient meetings, and converted to high quality working style. SCBG also formulated rules for the work of Party Committee and upheld democratic centralism, clarified the list of ‘Three-Importance and One-Large’ issues and the decision-making process. About 12 decisions of “Three-Importance and One-Large” were made by the Party Committee in 2020.

## Push forward to resolve problems

Three feedback problems from the assessment of the leadership transition were handled. The theme education of ‘Remain True to Our Original Aspiration and keep our Mission Firmly in Mind’ was carried out. About 31 problems discovered during the Central Committee’s inspections and the special campaign to clean up the ‘Four Forms of Decadence’ were rectified, with 24 were corrected. Totally 16 rectification tasks about personnel work of cadres, liquidation of SCBG’s secondary institutions and so on were completed. Improved and implemented 11 items of cadre personnel compensation system. Some public concerned issues were resolved.

Figure 2. Deployment meeting for rectification work (April 26th, 2020)

## Carry out work of ‘Grass-roots Party Organization Construction Year’

According to the work requirements and standard procedures of superior Party organizations, SCBG perfectly completed the election of the Party committee and discipline inspection committee. The work of 11 Party branches were investigated, a new Party branch was established and the number of Party members in two Party branches was adjusted. According to the four steps work requirements of ‘Learning and Discussion, Self-inspection and Self-examination, Rectification and Implementation, Reach Standards and Make Summary’, inspection and supervision work of SCBG was strengthened, the Party branch secretary performance assessment and Party branch standard evaluation were accomplished. Completed the tasks of “Primary Party Organization Construction Year” and improved the political functions, as well as the Party construction work abilities of the grass-roots Party organizations.

Figure 3. The election meeting of the Party committee (December 4th, 2020)





## Effectively deal with COVID-19 epidemic prevention and control work

Under the guidance of the Party and the Administration leadership, SCBG clarified priorities and responsibilities. By improving the liaison and duty system of the Party organizations and supervising the implementation of prevention and control measures of COVID-19, SCBG ensured stable resumption of scientific research, administration work and daily life. Under the hard work of Party members and cadres, the horticulture Center open to the public all year round without any infection, and this advanced deeds were published in the journal of CAS.

Besides, SCBG carried out epidemic prevention works such as policy and protection knowledge publicity, psychological counseling, donations, etc. The Party members and cadres of SCBG donated more than 140,000 CNY voluntarily.

## Conducting In-depth Construction of a Clean and Honest Administration and Anti-corruption Campaign

SCBG implemented *the list of responsibilities to fulfill the principal responsibilities for comprehensively governing the Party with strict discipline by Party committees of affiliated units of CAS*, ‘Two Responsibilities’ and ‘Double responsibility for one post’. During the discipline Education Month, the leadership of the Party committee made guidance reports. The conference on anti-corruption warning education of CAS was conveyed and studied. The specific rectification task of CPC Central Committee’s ‘Eight Rules’ was carried out. The internal audit supervision was strengthened, The Discipline Inspection Commission deepening application of the ‘Four Forms’ was supported, the accountability of supervision and discipline enforcement were strengthened.

Figure 4. WEI Ping, the Party Secretary of SCBG gave the report (October 30th, 2020)


Figure 5. XU Hai, the secretary of committee for discipline inspection of SCBG, gave the report (October 30th, 2020)

## Carrying forward and enriching the scientist spirit and excellent traditional culture

SCBG implemented the provisions of the Central Committee, the State Council and the CPC Leadership of CAS on the construction of academic style, and improved the working mechanism for the construction of scientific research integrity. The Party Secretary made a report on ‘Carrying forward and Enriching the Scientist Spirit and Strengthen the construction of Academic Style’ for all the Party members, leading cadres and scientific research backbones. More than

200 audiences attended to the annual press conference of ‘Carrying forward the Scientist Spirit and being a Dreamer in the New Era’. The commemorate symposia for births of CHUN Woon-Young, CHEN Fenghwai and ZHANG Zhaoqian were held, and the book of *120th Birth Anniversary Commemorative Collection of Professor CHEN Fenghwai* was compiled. The application materials of two senior scientists joining the Party were selected into *Selected Book of Senior Scientists Joining the Party and Senior scientist volunteered to join the party.* One story of ‘Each Institute with one great case of one scientist’ was recommended to CAS. Start the construction of the education base for Party members with the theme ‘Rooted in South China, contribute with national and global views’.

Figure 6. The commemorate symposium for births of CHUN Woon-Young, CHEN Fenghwai and ZHANG Zhaoqian (December 29th, 2020)

## Uniting the strength of wisdom for reformation and development

SCBG strengthened the Party's leadership over the United Front, mass organizations, retirees and other work, concerned and supported their independent work. Seminars, investigations and interviews were conducted to gather wisdom. Four times Workers’ congress were held and 20 issues were deliberated and approved. SCBG overcame the adverse impact of the COVID-19 to successfully hold the Staff Sport Games. SCBG also completed the data submission of the United Front Platform of CAS. In 2020, 12 staffs were appointed in United Front Organizations, as well as 5 non-party personages. The policies and provisions of CAS about retired cadres were implemented. Throughout the year, SCBG expressed sincere solicitude 84 Party members, staffs, students, as well as senior comrades, senior leaders and senior experts who were in distress, and provided 95,500 CNY of condolence money or gifts.





# BGCI China Programme

## 1. The progress of BGCI practical conservation projects in China

Working with Chinese botanical gardens members and partners to save endangered Chinese plants is the core mission of BGCI China Programme Office. Since the establishment of the office in 2008, BGCI had funded 35 conservation and restoration projects for threatened woody plants in China (each project of 3-8 years), with more than 70 threatened tree species were protected, and established a scientific conservation model for rare and endangered woody plants in China. The main features of BGCI practical conservation projects in China include: with the active involvement of local communities, collaborating with scientists from botanical gardens and other plant conservation and research institutions (ensuring scientific conservation), implementing and promoting integrated conservation approach in practical conservation work, which included *in situ* conservation of wild populations in the wild (nature reserves) , *ex situ* conservation in botanical gardens and arboreta (including living plants collection and seeds banking), and combined with reintroduction and restoration. At the same time, through the organization of public education activities on the conservation of rare and endangered plants to raise the awareness of the stakeholders; through the provision of the latest plant conservation knowledge and skills training to enhance the skills of local communities and partners in implementing practical conservation projects. The BGCI Chinese Office also hoped to improve the livelihood of the local people while protecting plants. More than ten years of exploration and practice had proved that merging training and education activities into practical conservation project was the best way both in effectively conserving threatened plant species and promoting botanical gardens’ work, which had been gradually promoted in China.

In 2020, BGCI funded 11 practical conservation projects in China with about 90,000 GBP, with 14 threatened tree species being protected; several new populations of some targeted threatened species were discovered through comprehensive field surveys; a bunch of nurseries were set up and more than 41000 seedlings were propagated by local people through the trainings on propagation techniques provided by the projects.

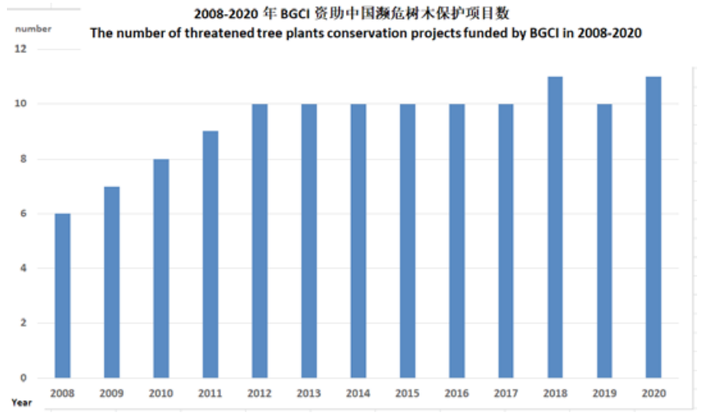



Figure 1. The data of threatened woody plants conservation projects funded by BGCI from 2008-2020

## 2. Publication of the book *Integrated Conservation of Rare and Threatened Woody Plants: Practice of and Perspectives from BGCI Programs in China (2010-2020)*

Edited by WEN Xiangying, the book *Integrated Conservation of Rare and Threatened Woody Plants: Practice of and Perspectives from BGCI Programs in China (2010-2020)* was published by China Forestry Publishing House. It summarized the work of Botanic Gardens Conservation International (BGCI) and its many Chinese member gardens and partners over the past 10 years, and included 23 typical cases of integrated conservation and restoration of rare and threatened woody plants, which provided a model for China and even in the world in the integrated conservation of threatened tree species. This book was not about BGCI, but about a community of plant specialists working in partnership with the custodians of those plants – national government authorities, local government authorities and local communities. The book covers the requisite policy instruments for effective plant conservation – in particular the China's Strategy for Plant Conservation (CSPC), an excellent framework based on the Global Strategy for Plant Conservation (GSPC) but modified specifically to meet China's needs. Most importantly, this book was about conservation action, which indicated what can be achieved through co-ordinate action. The book was also one of the important achievements made by China in biodiversity conservation, which would be present during the 15th Conference of the Parties (COP15) to the United Nations Convention on biological diversity (CBD) in Kunming in 2021.

By illustrating with vivid picture and words, this book provided value reference for plant conservation and restoration practitioners, inspired educational ideas for science educators and plant conservation decision-makers.

## 3. Publicity and capacity building

Combined with the implementation of these projects, the office and its partners trained more than 1300 technicians from over 40 institutions and local communities, focused on techniques of propagation, cultivation, reintroduction, as well as sustainable harvesting, and distributed about 1500 training materials. BGCI China office also organized a series of education activities in local primary schools for about 1,700 students, accompanied with the distribution of about 2000 outreach materials. These activities improved awareness and ability of plant conservation of stakeholders and students. In addition, it brought extra income for the local villagers who involved in the projects.

The China office was actively involved in many meetings related to plant conservation and botanical garden development and management, also shared successful case studies in plant conservation and sustainable utilization. The office had tried its best to promote the important role of botanical gardens in plant conservation through various media and platforms, and translated related materials of botanical garden and plant conservation to improve the ability of plant conservation, construction and management of Chinese botanical gardens.

## 4. The development and services for Chinese membership

Besides maintaining about 50 members including botanical gardens and institutions, six new general members were accept in 2020. To benefit Chinese members, some relative BGCI's materials were translated into Chinese. Launched out the translation work of BGCI's *Manual on Planning, Developing and Managing Botanic Gardens* into Chinese in 2019 and preliminarily completed in 2020. The final version will be available in BGCI website for free download in 2021.

Figure 2. Conservation technique trainings for the local people


Figure 3. Outreach materials distributed to the locals during the workshops

# Biological Resources Programme, CAS

DDue to the new demand of rapid economic and social development, the CAS launched the Biological Resources Programme (BRP-CAS) in 2016. Meanwhile, scientific advisory board and management board were established to provide guidance and management. The office of Management Board was affiliated to SCBG. With the support of BRP-CAS, nine resource platforms and information data centers of BRP-CAS had been approved to build National Resource Center, accounting for about 1 / 3 of all 30 National Biological Germplasm and Experimental Material Resource Centers. After years of accumulation, BRP-CAS had effectively promoted the collection, evaluation and utilization of biological resources, as well as the digitization and information construction of resources, provided a solid guarantee for the development of biotechnology and the rise of biological industry, and became the important cornerstone of national biosafety system.

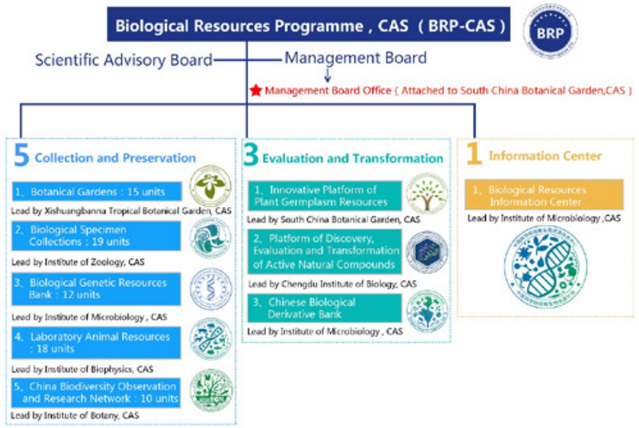



Figure 1. Organization structure of BRP


Figure 2. The development of BRP from 2016 to 2020





## 1. Compiled Annual Reports of the Five Resource Collection and Preservation Platforms

Completed data collection, typesetting, printing and publicity of the annual reports of 2020 for the five collection and preservation platforms. The annual reports introduced the general situation and the work progress of five collection and preservation platforms of CAS. The annual reports were given high prize by the institutes of biological field, which effectively improved the publicity of BRP. Meanwhile, the digital annual reports were reproduced and quoted by several official accounts.


Figure 3. Annual reports of collection and preservation platforms of BRP

## 2. Compiled *BRP Observation*

Supervised by BRP CAS, *BRP Observation* is a thematic bulletin, focus on developments of biological resources and biodiversity at home and abroad, as well as promote research progress of BRP CAS. SHAO Yunyun, the supervisor of the management board, compiled six issues of *BRP Observation* in 2020 and distributed to relevant platforms of CAS.


Figure 4. BRP Observation

### 3. Rated as excellent in the project evaluation of BRP and Chinese Union of Botanical Garden

In order to evaluate the implementation of BRP and CUBG comprehensively, scientifically and objectively, the Bureau of Facility Support and Budget of CAS conducted evaluation on BRP and CUBG from 2016 to 2019. The management board office offered efficient assistance for the evaluation working team in data collection and investigation. With overall investigation from the working group team and comprehensive evaluation from experts, BRP and CUBG got “excellent” grade with scores of 91.8.

### 4. Issued Catalogue of Biological Resources of the Chinese Academy of Sciences

On December 22th , 2020, the information center and the management board office officially released the Catalogue of Biological Resources of the Chinese Academy of Sciences on the symposium of the construction of biological resources information platform and its application, which was reported by Xinhuanet and People's Daily. This catalogue brought together more than 7 million pieces of biological resource data from 73 biological resource banks of 40 institutes of CAS. The major achievements of CAS in the application of biological resources were introduced systematically. All the biological resource data and related achievements were shared for public online, which effectively promoted the integration and sharing of biological resource data and gave great support for national biological industry.

### 5. Run the official website and Wetchat account of BPR, CAS

The management board office updated news on BRP official website (http://www.casbrc.org/home.jsp) and official Wetchat account (BRP CAS) all year round. In 2020, BRP official website established an integrated data management system for biological resource management based on unified standards, and formed a comprehensive catalogue covering all types of biological resources of CAS for the first time. The official Wetchat account issued five times a week on average, with totally 700 articles and 40,000 hits.

Figure 5. The evaluation working team investigated the germplasm base


Figure 6. Catalogue of Biological Resources of CAS


Figure 7. BRP official we-chat account





# Research Platform and Infrastructure Construction

## Key Laboratories

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

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

The director and deputy director of the laboratory are Prof. JIANG Yueming and Prof. KANG Ming, respectively, while the chairman of the academic committee is Prof. HUANG Hongwen. At present, the laboratory has 17 research groups with 119 staff, including 28 professors. In 2020, three staff were promoted as associate professors.

During 2016-2020, the laboratory's capability to undertake major national scientific research tasks was improved significantly. 469 scientific research projects had been granted with a total funding of 314 million Yuan (RMB). The staff had published 739 SCI papers, in which 304 publications were listed as top 30%. Compared to the last evaluation period, the research quantity and quality had remarkable improvements.

In 2020, the key laboratory obtained 338 research projects with a total budget of 244 million Yuan (RMB). Among these projects, 21 projects were from Ministry of Science and Technology or National Natural Science Foundation of China, 11 projects from CAS, 43 grants from Natural Science Foundation of Guangdong province and 11 grants from

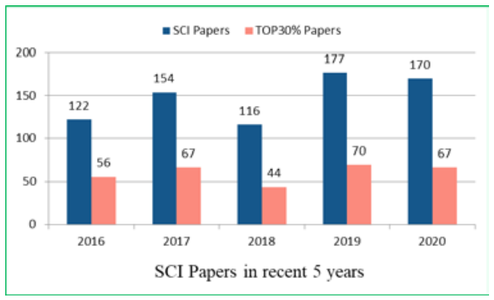




Table 1. Newly increased contract funds in 2020 and SCI thesis published in recent 5 years

local government. The staff had published 170 SCI papers, in which 67 and 27 publications were listed as top 30% and top 10%, respectively. In addition, six monographs had been published. The laboratory obtained 20 authorized national invention patents, one authorized US invention patent and two authorized Australian innovation patents. The laboratory supervised 57 PhD. candidates and 104 MSc. Candidates, with 10 PhD. and 25 MSc. graduated this year. Two graduate students were awarded BIOMIGA scholarship while five won the scholarships of Pu Bang Garden, and one won the National Scholarship.

## 2. The key laboratory of vegetation restoration and management of degraded ecosystems, CAS

Established in 2009, the key laboratory of vegetation restoration and management of degraded ecosystems, CAS has mainly focused on research with respect to the structure, function and processes of different ecosystems, the mechanism of ecosystem degradation, and vegetation restoration of the degraded ecosystem in southern China.

The key laboratory is consist of 13 research groups, 70 researchers including 25 professors and 18 associate professors. In total, there were 61 doctoral students and 62 master students in the key laboratory, with 25 doctoral candidates and 21 master candidates obtained their degree in 2020.

114 new scientific research projects were granted in 2020, including 6 National projects, 14 from National Natural Science Foundation of China (NSFC), 35 from CAS and 6 from Natural Science Foundation of Guangdong province. There were 101 papers published in international journals, with 82 were published in top 30% journals of the related fields. Four national patents were authorized and Dr. WANG Faming was awarded “Excellent Youth of Guangdong Scientific Committee Foundation” in 2020.

Figure 1. Annual meeting of the key laboratory in 2020

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

The mission of the laboratory is to carry out basic theoretical research and technical development on molecular analysis and genetic improvement of characteristic agricultural plants in South China. For the seamless connection between breeding and application, the laboratory established close cooperation with enterprises, provided the cultivated varieties and promoted the healthy development of modern regional agriculture.

The director of the laboratory is Prof. WANG Ying and the deputy director is Prof. ZHANG Mingyong, while the director of the academic committee is Academician ZHANG Qifa. At present, the laboratory has 83 researchers, including 24 professors and 20 associate professors; there are 22 post-doctors, 47 enrolled doctoral students and 79 enrolled master students; 10 doctoral students and 18 master students graduated in 2020.

In 2020, the laboratory received more than 31.96 million Yuan funds from 51 newly added research projects, and the total contract funds reached 124 million Yuan from 164 ongoing research projects. 72 SCI papers had been published in international journals, with 30 were listed as top 10% and 20 were listed as top 30%. In addition, the laboratory obtained one international invention patent, 19 national invention patents, 11 new varieties, 20 new international varieties and two software copyrights, as well as one second provincial prize.

## 4. Key Laboratory of Digital Botanical Garden of Guangdong Province

As the first key laboratory in China focused on the research of digitalization for botanical gardens, the laboratory was established in 2004.

The main research directions of the laboratory include: digital botanical garden technology and integration, botanical garden scientific data sharing and co-construction, digital herbarium, virtual botanical garden, protection innovation and utilization of plant resources, as well as ecological environmental resources monitoring. In October 2016, the laboratory passed the provincial key laboratory evaluation which was organized by the Department of Science and Technology of Guangdong Province and rated as good. The director of the laboratory is Prof. XIA Nianhe, and the director of the Academic Committee is Academician HONG Deyuan.

So far, the laboratory has 59 researchers, including 14 professors and 20 associate professors, with one doctoral students and 11 master students graduated in 2020.

The laboratory has 42 new scientific research projects with more than 20.46 million Yuan funds. Among these projects, two were from national projects, while six were from National Natural Science Foundation of China, eight were from CAS, three were from international cooperation projects and 17 were from local government and six were from other sources. The laboratory published 122 SCI papers and seven monographs, obtained six authorized invention patents in 2020.

The laboratory participated in the project of “Basic database of tropical and subtropical botany” and “Plant science data center of Chinese Academy of Sciences” . On the base of building 14 scientific databases such as “China island plant database” , “*Ex situ* conservation plant database” , “Evergreen broad-leaved forest database” and “Plant chromosome database” with 503213 data records and 330.13GB data volume, the laboratory provided sharing and remote service by establishing network platform and made it free for the public. The construction of platform integrated the data resources of plant species and *ex situ* conservation, promoted the development of Plant Science in China, and also provided data base support for the national development of biodiversity conservation strategy and action plan.

In 2020, continued to carry out the promotion of application of “Plant information management system” (PIMS) and the APP (Android) which were self-developed. So far, there are 45 major botanical gardens and scientific research institutions in China including the core botanical garden run this system and APP.

At the same time, based on the application experience of PIMS, the investigators of laboratory completed the program development of Wechat applet “Gardener Online”. On the basis of compatible with different mobile phone systems, the applet optimized the function of offline data acquisition. So far, the wechat app is under public beta test.

The Service interface of Wechat applet “Gardener”

### 5. The key laboratory of Applied Botany of Guangdong Province

The key laboratory of Applied Botany of Guangdong Province was established in 2013. It comprises 32 research groups with 148 permanent staff. The director of the key laboratory is prof. REN Hai, and the academic committee director is Academician WU Weihua.

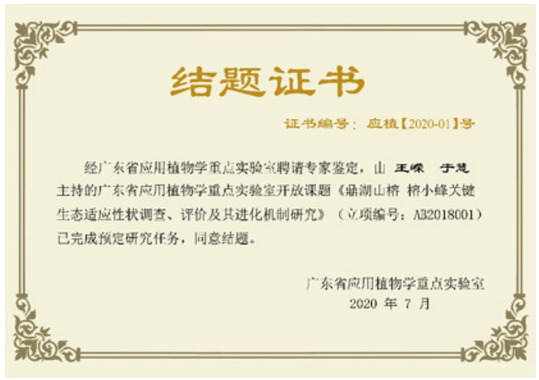
In 2020, funds of newly contracted research projects was more than 164 million Yuan (RMB), and funds in place reached 179 million Yuan. There were 161 papers published in international journals. In addition, the key laboratory published five monographs; 38 patents and 22 new cultivators were granted; Awarded as second Class Prizes of The State Scientific and Technological Progress, and get two Second Class Prizes of Guangdong Scientific and Technological Progress. In the triennial assessment of Guangdong Provincial Key Laboratory, the key laboratory was graded as excellent rating in 276 participating laboratories.

广东省科学技术厅

广东省科学技术厅关于公布2019年度
广东省重点实验室考评工作结果的通知

2019年评估优秀广东省重点实验室（学科类）

Figure 1. Assessment Result of Guangdong Provincial Key Laboratory



结题证书

证书编号：应植【2020-01】号

经广东省应用植物学重点实验室聘请专家鉴定，由 王峰 于超 主持的广东省应用植物学重点实验室开放课题《鼎湖山榕 榕小蜂关键生态适应性状调查、评价及其进化机制研究》（立项编号：AB2018001）已完成预定研究任务，同意结题。

广东省应用植物学重点实验室
2020 年 7 月

Figure 2. Certificate of Project Conclusion





## Field Research Station

### 1. Dinghushan National Field Research Station of Forest Ecosystem

Dinghushan National Field Research Station of Forest Ecosystem (referred 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). Aims for observation, research, demonstration and service, and oriented to the study of process, rule, structure and function of zonal forest ecosystem succession, Dinghusan 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. The objective is to build a national science and technology innovation, talent training, knowledge dissemination base, an international well-known ecosystem ecology comprehensive research platform, and provide scientific support for solving the ecological environment protection and sustainable development of the country and local areas.


Figure 1. Group photo for the acceptance meeting of integrated management system of Dinghushan station

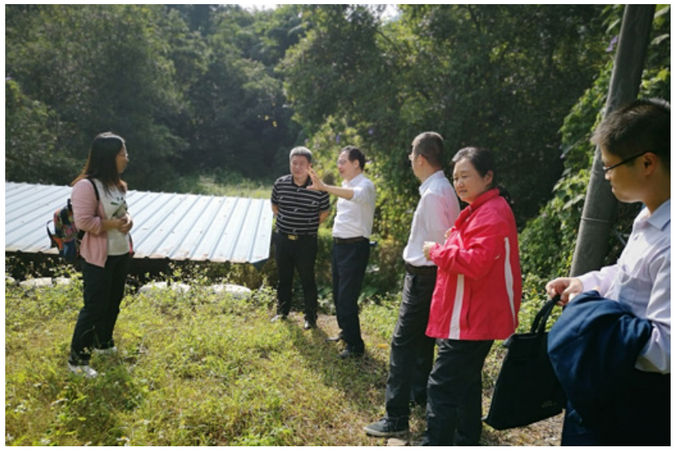


Figure 2. Fu Xiaofeng (The third from left), deputy director of the department of basic research of the Ministry of science and technology visited Dinghushan station.

Dinghushan station has offered scientific platforms for more than 10 institutes and universities for long term scientific researches. In 2020, most research group members were from Institute of Geographic Sciences and Natural Resources Research, CAS, Institute of Atmospheric Physics, CAS, Guangzhou Institute of Geochemistry, CAS, Sun Yat-sen University, Jinan University and SCBG. The researches were involved in a batch of important projects such as National Key R&D Program of China, the major and key program of NSFC, the Distinguished Young Scholar Program of NSFC. All these projects get all sorts of supports from the station including access to field sites, and supply of research facilities, observation data, background data, as well as staff assistance etc. All those research activities embodied the strongest supporting function of the station.

As the first station to launch informatization construction of ecological filed station in China, Dinghushan station was entrusted by the National Data Center for ecological sciences to successfully host the "Acceptance meeting of comprehensive information management system of the Dinghushan station and workshop on informatization construction of national field stations", and get high praise from the Departments and leadership of the basic research department of the Ministry of science and technology, ecological environment monitoring department of the Ministry of ecological environment, Bureau of science and technology for development, CAS, CERN Scientific Committee etc. The meeting indicated the Dinghushan station's prominent position of information construction in domestic field station. on the national public research platforms level of CNERN organized by the Ministry of Science and Technology.

Currently there are 19 researchers, 5 technicians, 15 postdocs, 12 project employees and 36 students pursuing master or PhD degree at Dinghushan station. About 14 graduate students completed their doctoral or master degree programs this year.

In 2020, supporting by the infrastructure of Dinghushan station, 46 projects (including the launched and approved) with 36.66 million Yuan were conduct. And 50 papers were published, of 39 papers were published in the Science Citation Index (SCI) top journals, 8 papers were published in SCI journals with impact factor higher than 8 (Table 1). Both the quantity and quality of papers reached a new record high. Participated in one monograph and contributed four papers for monographs. The Dinghushan station got one authorized patent and four under authorization.

Profs. YAN Junhua and YE Qing were selected as outstanding talents and leading talents of scientific and technological innovation in the 2019 Guangdong Special Support Program, respectively; Prof. LU Xiankai was awarded as the outstanding member of Youth Innovation Promotion Association，CAS; Prof. DENG Qi was prized as Young top talent of Pearl River Talent Plan of Guangdong Province; Dr. ZHENG Mianhai (graduated in 2018), his doctoral dissertation was included in the 2020 "Excellent Doctoral Dissertation of CAS". He was employed as associate professor soon after his accomplishment of post-doctoral job in April 2020.Then he was selected as "Class A candidate for the Young Talents Support Project" supported by the Chinese Ecological Society for the first time in December; Dr. LIU Hui (Associate professor) was elected as the member of Youth Innovation Promotion Association，CAS; And Dr. HE Pengcheng (graduated in 2020) was funded by the "Special Research Assistant of CAS".

Table 1. Papers published as the first or corresponding authors for the last five years (2016-2020)

| Year | CSCD | SCI | Total impact factor (IF) | Total number of papers | Total number of paper (IF>5) | Total factors(IF>5) |
|---|---|---|---|---|---|---|
| **2016** | 8 | 22 | 88.219 | 30 | 7 | 45.859 |
| **2017** | 6 | 20 | 70.238 | 26 | 1 | 6.265 |
| **2018** | 8 | 21 | 101.396 | 29 | 6 | 48.998 |
| **2019** | 12 | 30 | 135.420 | 42 | 8 | 70.733 |
| **2020** | 11 | 39 | 215.0 | 50 | 17 | 131.145 |
| **Total** | 45 | 132 | | 177 | 39 | |

Note: IF was the annual impact factor of the journal when the paper was published.

## 2. eshan National Field Research Station of Forest Ecosystem

Heshan National Field Research Station of Forest Ecosystem (referred to Heshan station) is the member of the Chinese Ecosystem Research Network (CERN), the Chinese National Ecosystem Research Network (CNERN) and Forestry Ecological station alliance. The station is located in the hilly red soil region of southern China and interlaced with the Pearl River Delta area with dense population and rapid economic development. It represents the man-made and secondary evergreen broad-leaved forest ecosystems. Long-term observational and experimental studies have been performed in Heshan station to reveal the mechanisms of ecosystem degradation and restoration. Major research fields include but not limit to restoration ecology, environmental ecology, global change ecology, and soil ecology. At present, there are 21 researchers, including six professors, seven associate professors, eight research assistants, and four technicians in Heshan station.

Ongoing projects: In 2020, 31 research projects were carried out in Heshan Station including a key project of National Natural Science Foundation of China, a sub-project of Chinese Academy of Sciences pilot project, an Innovative Talents Project of Ministry of Science and Technology , an Excellent Member Program of Chinese Academy of Sciences for Youth Promotion Association, three sub-projects of Key R & D projects of Ministry of Science and Technology, six general projects and five youth projects of National Natural Science Foundation of China. The total contract funds was 15.51 million Yuan. There were 23 newly granted projects in 2020 with contract funds of 10.015 million Yuan.

Figure 1. An interview of Cardamom propagation under the woods by Heshan TV station

Achievements: There were 53 papers published in international journals, including three papers with impact factor higher than 10. In addition, two monographs were published and three patents were authorized in 2020.

Postgraduate students and staffs: In 2020, 19 graduate students from Heshan Station completed their thesis and graduated from CAS, including 12 doctoral students and 7 master students. Five staffs went abroad as visiting scholars supported by the China Scholarship Fund in 2020.

Communication and service: The total number of independent IP visits to the Heshan Data Sharing Website (http://hsf.cern.ac.cn) reached 114,604. The website provided about 15.2 GB data downloads for scientific researchers in 2020, which ranked 14th in 54 Web service websites of CNERN stations. The station provided 50,000 sample test and analysis services for domestic institutions, and got 102 attendances for on/off-line academic conferences in 2020.

Table 1. Achievements of Heshan Station from 2016-2020

| Year | SCI papers | IF>4.0 SCI | Monographs | Patents | Research funds (Ten thousand yuan) | New increased funds(Ten thousand yuan) | Research projects | Newly increased projects |
|---|---|---|---|---|---|---|---|---|
| 2016 | 22 | 9 | 1 | 2 | 5123 | 642 | 40 | 9 |
| 2017 | 27 | 10 | 1 | 2 | 1799 | 212 | 28 | 4 |
| 2018 | 29 | 12 | 0 | 0 | 1917 | 323 | 25 | 9 |
| 2019 | 29 | 10 | 0 | 2 | 1507 | 221 | 28 | 9 |
| 2020 | 53 | 30 | 2 | 3 | 1551 | 1002 | 31 | 23 |

### 3. Xiaoliang Research Station of Tropical Coastal Ecosystem,CAS

In 2020, Xiaoliang Research Station got 18 million Yuan of newly increased research funding. The director, Prof. LI Zhi’an get 16 million Yuan funded by the Strategic Priority Research Program of CAS, the project run well this year and the final project report had been accepted. This year, the main members of the station participated in the Guangdong-Hong Kong-Macao Greater Bay Area Land Ecosystem Research Project of the Guangdong Marine Laboratory and provided solutions to the ecological and environmental problems of the Greater Bay Area coastal zone. The station also joined the Guangdong Forestry Field Ecological Monitoring Alliance.

The researchers published over 50 papers in various international academic journals, including top-level journals such as *National Science Review*, *PNAS*, *Global Change Biology*, and *Functional Ecology*. The research achievement on greenhouse gas and nitrogen emissions from rice fields completed by Prof. LI Xiaobo were published in *Global Change Biology*; Prof. HUANG Jianguo’s work revealed the environmental initiation and mechanism of the first cell development in the xylem of conifers in spring, and the research results were published in *PNAS*.

This year, the talent training work of the station had profound harvest. Prof. LIU Nan won the prize of outstanding member of the Youth Promotion Association of the CAS, which was the second outstanding member of the Youth Promotion Association of our station besides Prof. LU Hongfang. Prof. WANG Faming, the deputy station director, was awarded the member of the Youth Promotion Association of CAS, the young top talent of the National Forestry and Grass Administration, and funded by the Guangdong Provincial Outstanding Youth Fundation, which made him become the first provincial outstanding youth winner of Xiaoliang research station as well as the ecological center of SCBG. The core member, Prof. DENG Shulin, was awarded as the Pearl River Talents of Guangdong Province, and Dr. ZHANG Lulu was funded by the Pearl River Talents Postdoctoral Program of Guangdong Province.





## Herbarium

### 1. Cooperation and Exchanges

In August, the herbarium signed a cooperation agreement with Jinggangshan National Nature Reserve. The herbarium was the first one to initiate work with nature reserves to share their specimens since the end of 2016, which was highly admired by relevant leaders and experts of CAS. Since then, the number of specimens collected by sharing and exchange had remained more than 20% of annual new increase collection, and even exceeded the number of specimens collected in the field in 2018, accounting for 54%. So far, more than 23100 plant specimens had been collected by sharing and exchange.

Fig 1. The herbarium signed cooperation and joint *construction of specimen counter agreement* with Jinggangshan National Nature Reserve

Furthermore, the herbarium signed a memorandum of cooperation with Seodaemun Museum of Natural History, South Korea in September, to expand cooperation internationally.

### 2. Training Course on Collection and Identification of Plant Specimen

From August 25th to 28th , the training course on collection and identification of plant specimen was successfully held in Jinggangshan National Nature Reserve, which was the Boutique Training Program supported by Personnel Bureau of CAS. This year the herbarium co-organized the training course again with Chinese National Committee for Man and the Biosphere Program, UNESCO. More than 80 participants from 34 institutions including nature reserves, universities, scientific research institutes and botanical gardens attended the training course.

The training course had been held for nine times since 2013, and stepped into the nature reserves of Guangdong Province, Hengshan National Nature Reserve of Hunan Province and Houhe National Nature Reserve of Hubei Province with over 530 trainees.

Figure 2. Collection and Identification of Plant Specimen

### 3. Botanical Illustration

Since July this year, Guangdong Provincial Museum (Travelling museum section) had joined hands with the herbarium to select more than 60 paintings from the herbarium for the traveling exhibition of botanical illustration in Guangdong Province, which present the nature history of East and West, as well as the development of botanical illustration for public.

In early December, the herbarium carried out an elementary training course of botanical illustration for the first time in the 21st Century, and achieved remarkable rewards. Just a few hours after the announcement was delivered, more than 160 candidates across the country registered online. The feedback survey of this training course by the attendees was 100% excellent.

Botanical illustration, a special art with great achievements and fame in history was regretfully be neglected for long time, now once again stepped out of the palace of science and gradually be known by the public in recent years. And this was another leading move made by the herbarium in the herbarium system of CAS.

Figure 3. Elementary training course of botanical illustration





## Public Laboratory

With 33 sets of instruments, the public laboratory provided analysis and testing services for 376 subjects and 493 researchers inside and outside SCBG in 2020. The average utilization rate of 33 sets of instruments in the whole laboratory was 110%, while the total sharing efficiency was 99%, the total effective working time was 58,159 hours and 120,862 samples were measured altogether.

The Public Laboratory directed seven large instrument functional development projects of CAS and three open projects of Guangzhou Life Science Regional Center for Instruments, published 16 papers and applied for three patents.

Figure 1. Technical Training

There were 198 person times attended the management training, and participated in a number of online and on-site technical exchange activities, with a total of 833 online hours and 1186 on-site hours and awarded two certificates. The public laboratory organized 13 topics of technical lectures and 13 items including sample preparation technology and machine operation skills trainings for 513 students which lasted nine days. The public laboratory also hosted 11 training sessions on laboratory qualification certification management with 84 participants. At the end of 2020, the public laboratory passed the CNAS review.

Figure 2. CNAS Review

The public laboratory successfully completed the repairing and purchasing project of “Biological resource ecological protection experimental platform” of CAS funded in 2018, with total amount of 7.7 million Yuan, and accomplished the technical acceptance and project acceptance of the key equipment of “liquid (gas) stable isotope mass spectrometer” and “400M solid nuclear magnetic resonance spectrometer” .

The public laboratory perfectly completed the repairing and purchasing project of “biological resources microscopic structure and function analysis platform” of CAS funded in 2019, which was supported by The Central Financial Bureau with 4.5 million Yuan. The purchase of the instrument of frozen microanalysis field emission scanning electron microscope (SEM) cost 4.4758 million Yuan. The remaining funds（24,200 Yuan）was paid to purchase a small frozen centrifuge worth 24,800 Yuan, of which 6000 Yuan was self-raised by the laboratory. The laboratory had completed the improvement and determination of the laboratory decoration scheme and signed the contract. And now the laboratory was under construction.

The public laboratory successfully completed the second period project of “biological molecules structure and functions analysis platform” of CAS funded in 2020 and get funds of 4.0 million Yuan from The Central Financial Bureau and 9.66 million Yuan self-raised by the laboratory. This fund was for two instruments: “multi-functional automatic sample preprocessing and collection-gas chromatography-olfactory-triple quadrupole tandem mass spectrometer” and “gas chromatography-single quadrupole mass spectrometer” . The former one cost 326.21 million Yuan, of which 320 million Yuan was supported by The Central Financial Bureau and self-raised 6.21 million Yuan by the laboratory. The later one cost 83.45 million Yuan, of which 80 million Yuan from The Central Financial Bureau and 3.45 million Yuan from the laboratory.

The laboratory get funds from the third phase of the repairing and purchasing project “Experimental Platform for Microstructure and Function Analysis” of CAS in 2021, with 6.1 million Yuan (4.6 million Yuan from The Central Financial Bureau, 1.5 million Yuan was raised by the laboratory). The public laboratory was planning to purchase the instrument “plant tomography analyzer” .

Used self-raised funds of 2.51 million Yuan, the public laboratory purchased several instruments. The 3D continuous ultra-thin slicer (977500 Yuan), paraffin slicer (298900 Yuan), automatic sample processor (299200 Yuan), refrigerated centrifuge (149100 Yuan) and inductively coupled plasma emission spectrometer (784000 Yuan) were installed; acceptance of paraffin slicer, automatic sample processor, refrigerated centrifuge were completed and put into use; 3D continuous ultra-thin slicer and inductively coupled plasma emission spectrometer were installed in place.

Director XU Xinlan was appointed as director of China Electronic Microscope Society, deputy director of Agriculture and Forestry Committee of China Electron Microscope Society, vice chairman of Guangdong Electron Microscope Society, member of NPC Standing Committee of Tianhe district and deputy director of Guangdong Women’s Committee of Jiusan Society etc. She maximized the visibility and influence of the laboratory, and strived for more resources for the Lab. She also actively participated in the political discussion and served for community construction. Deputy director JIA Yongxia was elected as director of Guangdong Analytical Testing Society.

The Standardized Detection and Exploration Group won the “Outstanding platform” awarded by Guangzhou large-scale instrument regional center in 2020. DENG Rufang and MO Hui won the second and third prizes for technical experts of Guangzhou Regional Center for Large Instruments in Life Science respectively. The public laboratory and WU Tong were respectively awarded the SCBG Security Advanced Team and Individual.


Figure 3. New Instruments


Figure 4. Certificates of Honor

## Supporting Center

### The Library

Table 1. Statistics of literature resources from 2016-2020

| Items | New Arrival Books | | | | | | | Ordered periodicals | | | | Database | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | By purchase | | | By donation | | | Total | | | | | | |
| Year | Chinese | Foreign language | Subtotal | Chinese | Foreign language | Subtotal | | Chinese | Foreign language | Online | Total | Increased Data from IR construction | By purchase |
| 2020 | 29 | 17 | 46 | 39 | 3 | 42 | 88 | 57 | 25 | 28 | 110 | 1,100 | 13 |
| 2019 | 204 | 94 | 298 | 34 | 10 | 44 | 342 | 57 | 32 | 38 | 127 | 800 | 14 |
| 2018 | 81 | 69 | 150 | 72 | 19 | 91 | 241 | 63 | 39 | 27 | 102 | 1800 | 13 |
| 2017 | 175 | 108 | 283 | 69 | 12 | 81 | 364 | 75 | 47 | 20 | 122 | 100 | 13 |
| 2016 | 127 | 139 | 266 | 29 | 21 | 50 | 316 | 75 | 47 | 11 | 122 | 500 | 13 |





Table 2. Expenses on literature purchase from 2016-2020(Unit:10 thousand Yuan)

| Item | 2016 | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| | Expense | Expense | Growth rates (%) | Expense | Growth rates (%) | Expense | Growth rates (%) | Expense | Growth rates (%) |
| Prints | 54.9 | 52.1 | -5.20 | 46.2 | -11.27 | 47.5 | 2.75 | 35.1 | -26.14 |
| Database | 57.3 | 60.6 | 5.77 | 72.0 | 18.77 | 89.2 | 23.80 | 86.5 | -3.01 |
| 小计 | 112.2 | 112.7 | 0.40 | 118.2 | 4.89 | 136.7 | 15.57 | 121.6 | -11.05 |

Table 3. Library Service from 2016-2020

| Year | Book Loan | | Book Return | | Interlibrary loan | | Citation retrieval of paper collection(piece) | Consultation times | Document Delivery(piece/volumes) |
|---|---|---|---|---|---|---|---|---|---|
| | Person-time | Book numbers | Person-time | Book numbers | Person-time | Book numbers | | | |
| 2020 | 374 | 660 | 413 | 745 | 51 | 216 | 25 | 55 | 865 |
| 2019 | 565 | 972 | 572 | 972 | 63 | 189 | 36 | 79 | 915 |
| 2018 | 425 | 701 | 433 | 706 | 84 | 230 | 20 | 84 | 825 |
| 2017 | 509 | 1252 | 492 | 1276 | 74 | 194 | 29 | 87 | 790 |
| 2016 | 508 | 1254 | 453 | 1141 | 75 | 182 | 26 | 73 | 579 |

### Editorial Office of *Journal of Tropical and Subtropical Botany*

In 2020, the Editorial office published *Journal of Tropical and Subtropical Botany*, Vol. 28 (issue 1-6). Totally 283 manuscripts were received and 86 papers with 1.62 million words were published, with 99% (85 papers) were supported by research funds, and 43 papers were supported by national research funds.

According to “Chinese Academic Journal Comprehensive Citation Report Statistics”, the journal’s impact factor was 1.125, with 1488 times of citations and 50.9 thousand times of online download.

Table 4.The statistics data of periodical from 2017-2020

| Year | Publish papers | Fund subsidy rate | Journal Impact Factor | Total citations | Ranking of domestic Biological Journals |
|---|---|---|---|---|---|
| 2017 | 85 | 99.0% | 0.794 | 1907 | 53/93 |
| 2018 | 91 | 99.0% | 0.787 | 1607 | 55/95 |
| 2019 | 92 | 99.0% | 1.125 | 1448 | 34/94 |
| 2020 | 86 | 99.0% | | | |

## Internet Network Information Center

In 2020, the Internet network information center added video conference and telecommuting, purchased and upgraded the video conference system; Applied for free trial of WEBVPN, so employees catch news from SCBG Intranet timely; Network load balancing and online behavior audit equipment were purchased to further optimize the network environment and increase the network outlet bandwidth to 850m. In order to ensure high quality access for science and technology network, with the support of China Science and technology network Guangzhou Branch Center, a standby optical fiber link was added to ensure the science and technology network backbone system could run well from SCBG to Guangzhou Branch Center. With the support of the key laboratory project of Guangdong Digital Botanical Garden, four new servers were purchased, which increased the CPU of cloud computing environment to 800 cores, 6.2tb memory, and added 450tb storage space. 12 new cloud computing environments were opened for scientific researchers to provide scientific computing and storage services, giving full play to the advantages of our existing computing and storage resources.





# Appendix I. Main Rearch Achievements

Sorted in descending order by impact factors

| No. | Title | Journal | Issue Volume | Start Page | End Page | Impact Factor | Authors |
|---|---|---|---|---|---|---|---|
| 1 | Global meta-analysis shows pervasive phosphorus limitation of aboveground plant production in natural terrestrial ecosystems | NATURE COMMUNICATIONS | 11 | 637 | | 13.611 | Hou EQ*, Luo YQ, Kuang YW, Chen CR, Lu XK, Jiang LF, Luo XZ, Wen DZ* |
| 2 | Allopolyploid Speciation Accompanied by Gene Flow in a Tree Fern | MOLECULAR BIOLOGY AND EVOLUTION | 37 | 2487 | 2502 | 13.401 | Wang J, Dong SY, Yang LH, Harris A, Schneider H*, Kang M* |
| 3 | HY5-HDA9 Module Transcriptionally Regulates Plant Autophagy in Response to Light-to-Dark Conversion and Nitrogen Starvation | MOLECULAR PLANT | 13 | 515 | 531 | 12.744 | Yang C, Shen WJ, Yang LM, Sun Y, Li XB, Lai MY, Wei J, Wang CJ, Xu YC, Li FQ, Liang S, Yang CW, Zhong SW, Luo M*, Gao CJ* |
| 4 | Climatic-niche evolution follows similar rules in plants and animals | NATURE ECOLOGY & EVOLUTION | 4 | 753 | 763 | 12.561 | Liu H, Ye Q, Wiens JJ* |
| 5 | Transcriptional and Epigenetic Regulation of Autophagy in Plants | TRENDS IN GENETICS | 36 | 676 | 688 | 11.641 | Yang C, Luo M, Zhuang XH, Li FQ, Gao CJ* |
| 6 | Chinese oolong tea: An aromatic beverage produced under multiple stresses | TRENDS IN FOOD SCIENCE & TECHNOLOGY | 106 | 242 | 253 | 11.392 | Zeng LT, Zhou XC, Su XG, Yang ZY* |
| 7 | Photoperiod and temperature as dominant environmental drivers triggering secondary growth resumption in Northern Hemisphere conifers | PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA | 117 | 20645 | 20652 | 10.620 | Huang JG*, Ma QQ, Rossi S et al. |
| 8 | Photoperiod plays a dominant and irreplaceable role in triggering secondary growth resumption | PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA | 117 | 32865 | 32867 | 10.620 | Huang JG*, Campelo F, Ma QQ et al. |
| 9 | Substrate stoichiometry determines nitrogen fixation throughout succession in southern Chinese forests | ECOLOGY LETTERS | 23 | 336 | 347 | 10.562 | Zheng MH, Chen H, Li DJ, Luo YQ, Mo JM* |
| 10 | The response of soil respiration to precipitation change is asymmetric and differs between grasslands and forests | GLOBAL CHANGE BIOLOGY | 26 | 6015 | 6024 | 9.827 | Du Y, Wang YP, Su FL, Jiang J, Wang C, Yu MX, Yan JH* |

| No. | Title | Journal | Issue Volume | Start Page | End Page | Impact Factor | Authors |
|---|---|---|---|---|---|---|---|
| 11 | Long-term effects of 7-year warming experiment in the field on leaf hydraulic and economic traits of subtropical tree species | GLOBAL CHANGE BIOLOGY | 26 | 7144 | 7157 | 9.827 | Wu T, Tissue DT, Li X, Liu SZ, Chu GW, Zhou GY, Li YL, Zheng MH, Meng Z, Liu JX* |
| 12 | Effects of human disturbance activities and environmental change factors on terrestrial nitrogen fixation | GLOBAL CHANGE BIOLOGY | 26 | 6203 | 6217 | 9.827 | Zheng MH, Zhou ZH, Zhao P, Luo YQ, Ye Q, Zhang KR, Song L, Mo JM* |
| 13 | Global response patterns of plant photosynthesis to nitrogen addition: A meta-analysis | GLOBAL CHANGE BIOLOGY | 26 | 3585 | 3600 | 9.827 | Liang XY, Zhang T, Lu XK, Ellsworth DS, BassiriRad H, You CM, Wang D, He PC, Deng Q, Liu H, Mo JM, Ye Q* |
| 14 | Growing-season temperature and precipitation are independent drivers of global variation in xylem hydraulic conductivity | GLOBAL CHANGE BIOLOGY | 26 | 1833 | 1841 | 9.827 | He PC，Gleason SM，Wright IJ，Weng ES，Liu H，Zhu SD，Lu MZ，Luo Q，Li RH，Wu GL，Yan ER，Song YJ，Mi XC，Hao GY，Reich PB，Wang YP，Ellsworth DS，Ye Q* |
| 15 | The genome of a cave plant, Primulina huaijiensis, provides insights into adaptation to limestone karst habitats | NEW PHYTOLOGIST | 227 | 1249 | 1263 | 8.795 | Feng C, Wang J, Wu LQ, Kong HH, Yang LH, Feng C, Wang K*, Rausher M*, Kang M* |
| 16 | Histone demethylase SlJMJ6 promotes fruit ripening by removing H3K27 methylation of ripening-related genes in tomato | NEW PHYTOLOGIST | 227 | 1138 | 1156 | 8.795 | Li ZW, Jiang GX, Liu XC, Ding XC, Zhang DD, Wang XW, Zhou YJ, Yan HL, Li TT, Wu KQ, Jiang YM, Duan XW* |
| 17 | MicroRNA528, a hub regulator modulating ROS homeostasis via targeting of a diverse set of genes encoding copper-containing proteins in monocots | NEW PHYTOLOGIST | 225 | 385 | 399 | 8.795 | Zhu H, Chen CJ, Zeng J, Yun Z, Liu YL, Qu HX, Jiang YM*, Duan XW*, Xia R* |
| 18 | Understanding different regulatory mechanisms of proteinaceous and non-proteinaceous amino acid formation in tea (Camellia sinensis) provides new insights into the safe and effective alteration of tea flavor and function | CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION | 60 | 844 | 858 | 7.808 | Yu ZM*, Yang ZY* |
| 19 | Lignin Nanoparticles: Green Synthesis in a gamma-Valerolactone/Water Binary Solvent and Application to Enhance Antimicrobial Activity of Essential Oils | ACS SUSTAINABLE CHEMISTRY & ENGINEERING | 8 | 714 | 722 | 7.741 | Chen LH, Shi YF, Gao B, Zhao YL, Jiang YM, Zha ZG*, Xue W*, Gong L* |
| 20 | Redox Regulation of the NOR Transcription Factor Is Involved in the Regulation of Fruit Ripening in Tomato(1) | PLANT PHYSIOLOGY | 183 | 671 | 685 | 7.520 | Jiang GX, Zeng J, Li ZW, Song YB, Yan HL, He JX, Jiang YM, Duan XW* |
| 21 | Integrated emergy and economic evaluation of an ecological engineering system for the utilization of Spartina alterniflora | JOURNAL OF CLEANER PRODUCTION | 247 | 119592 | | 7.491 | Lu HF, Zhang HS, Qin P*, Li XZ*, Campbell DE |
| 22 | Supply and demand assessment of urban recreation service and its implication for greenspace planning-A case study on Guangzhou | LANDSCAPE AND URBAN PLANNING | 203 | 103898 | | 7.185 | Liu HX, Remme RP, Hamel P, Nong HF, Ren H* |
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| 27 | Histone tales: lysine methylation, a protagonist in Arabidopsis development | JOURNAL OF EXPERIMENTAL BOTANY | 71 | 793 | 807 | 7.011 | Cheng K，Xu YC，Yang C，Ouellette L，Niu LJ，Zhou XC，Chu LT，Zhuang F，Liu J，Wu HL*，Charron JB*，Luo M* |
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| 35 | Dissolved organic matter characteristics in soils of tropical legume and non-legume tree plantations | SOIL BIOLOGY & BIOCHEMISTRY | 148 | 107880 | | 6.767 | Ye QH, Wang YH, Zhang ZT, Huang WL, Li LP, Li JT, Liu JS, Zheng Y, Mo JM, Zhang W*, Wang JJ* |
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| 47 | Mikania micrantha invasion enhances the carbon (C) transfer from plant to soil and mediates the soil C utilization through altering microbial community | SCIENCE OF THE TOTAL ENVIRONMENT | 711 | 135020 | | 6.419 | Ni GY*, Zhao P, Huang QQ, Zhu LW, Hou YP, Yu YN, Ye YH, Ouyang L |
| 48 | Bioavailability and bioaccessibility of cadmium in contaminated rice by in vivo and in vitro bioassays | SCIENCE OF THE TOTAL ENVIRONMENT | 719 | 137453 | | 6.419 | Zhuang P*, Sun S, Zhou XF, Mao P, McBride MB, Zhang CS, Li YW, Xia HP, Li ZA |
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| 50 | Identification of two novel prenylated flavonoids in mulberry leaf and their bioactivities | FOOD CHEMISTRY | 315 | 126236 | | 6.219 | Wen LR, Shi DD, Zhou T, Tu JM, He M, Jiang YM, Yang B* |
| 51 | Anthocyanin and spermidine derivative hexoses coordinately increase in the ripening fruit of Lycium ruthenicum | FOOD CHEMISTRY | 311 | 125874 | | 6.219 | Yang XM, Lin S, Jia YX, Rehman F, Zeng SH*, Wang Y* |
| 52 | Detection of toxic methylenecyclopropylglycine and hypoglycin A in litchi aril of three Chinese cultivars | FOOD CHEMISTRY | 327 | 127013 | | 6.219 | Yang JL，Zhu XR，Zhang P，Wang YH，Xiao YY，Yang B，Qu HX，Jiang YM* |
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| 54 | Delaying the biosynthesis of aromatic secondary metabolites in postharvest strawberry fruit exposed to elevated CO2 atmosphere | FOOD CHEMISTRY | 306 | 125611 | | 6.219 | Li D, Zhang XC, Qu HX*, Li L, Mao BZ, Xu YQ, Lin XY, Luo ZS* |
| 55 | New insights into the evolution of host specificity of threePenicilliumspecies and the pathogenicity ofP. Italicuminvolving the infection of Valencia orange (Citrus sinensis) | VIRULENCE | 11 | 748 | 768 | 5.946 | Gong L, Liu YF, Xiong YH, Li TT, Yin CX, Zhao JN, Yu JL, Yin Q, Gupta VK, Jiang YM, Duan XW* |
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| 57 | Application of a trait-based species screening framework for vegetation restoration in a tropical coral island of China | FUNCTIONAL ECOLOGY | 34 | 1193 | 1204 | 5.541 | Wang C, Zhang H, Liu H, Jian SG, Yan JH, Liu N* |

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| 59 | Flowering phenology of a widespread perennial herb shows contrasting responses to global warming between humid and non-humid regions | FUNCTIONAL ECOLOGY | 34 | 1870 | 1881 | 5.541 | Song ZQ, Fu YSH, Du YJ*, Li L, Ouyang XJ, Ye WH, Huang ZL* |
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| 64 | Editorial: New Insights Into Mechanisms of Epigenetic Modifiers in Plant Growth and Development | FRONTIERS IN PLANT SCIENCE | 10 | 1661 | | 5.207 | Luo M*, Rios G, Sarnowski TJ, Zhang SD, Mantri N, Charron JB, Libault M* |
| 65 | Demographic Inference of Divergence and Gene Exchange Between Castanopsis fabri and Castanopsis lamontii | FRONTIERS IN PLANT SCIENCE | 11 | 198 | | 5.207 | Sun Y*, Wen XY* |
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| 77 | Shifts in fungal biomass and activities of hydrolase and oxidative enzymes explain different responses of litter decomposition to nitrogen addition | BIOLOGY AND FERTILITY OF SOILS | 56 | 423 | 438 | 4.790 | Tan XP, Machmuller MB, Cotrufo MF, Shen WJ* |
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| 97 | Synthesis of icariin in tobacco leaf by overexpression of a glucosyltransferase gene from Epimedium sagittatum | INDUSTRIAL CROPS AND PRODUCTS | 156 | 112841 | | 4.583 | Yang XM，Chen JJ，Huang WJ，Zhang YJ，Yan X，Zhou ZH，Wang Y* |
| 98 | Comparative proteomic and ultrastructural analysis shed light on fruit pigmentation distinct in two Lycium species | INDUSTRIAL CROPS AND PRODUCTS | 147 | 112267 | | 4.583 | Zeng SH*, Huang SS, Yang TS, Ai PY, Li L, Wang Y* |
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| 109 | Complete plastome sequencing resolves taxonomic relationships among species ofCalligonumL. (Polygonaceae) in China | BMC PLANT BIOLOGY | 20 | 261 | | 4.494 | Song F, Li T, Burgess KS, Feng Y*, Ge XJ* |

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| 110 | Increasing effectiveness of urban rooftop farming through reflector-assisted double-layer hydroponic production | URBAN FORESTRY & URBAN GREENING | 54 | 126766 | | 4.468 | Su YL, Wang YF, Ow DW* |
| 111 | Evaluation of the contribution of trichomes to metabolite compositions of tea (Camellia sinensis) leaves and their products | LWT-FOOD SCIENCE AND TECHNOLOGY | 122 | 109023 | | 4.385 | Li JL, Zeng LT, Liao YY, Tang JC*, Yang ZY* |
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| 113 | Enzyme Catalytic Efficiencies and Relative Gene Expression Levels of (R)-Linalool Synthase and (S)-Linalool Synthase Determine the Proportion of Linalool Enantiomers in Camellia sinensis var. sinensis | JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY | 68 | 10109 | 10117 | 4.290 | Zhou Y, Deng RF, Xu XL, Yang ZY* |
| 114 | Use of Dietary Components to Reduce the Bioaccessibility and Bioavailability of Cadmium in Rice | JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY | 68 | 4166 | 4175 | 4.290 | Sun S, Zhou XF, Li YW, Li YX, Xia HP, Li ZA*, Zhuang P* |
| 115 | In Vitro Digestion of Apple Tissue Using a Dynamic Stomach Model: Grinding and Crushing Effects on Polyphenol Bioaccessibility | JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY | 68 | 574 | 583 | 4.290 | Liu DJ, Dhital S, Wu P, Chen XD, Gidley MJ* |
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| 118 | Characterization of L-Theanine Hydrolase in Vitro and Subcellular Distribution of Its Specific Product Ethylamine in Tea (Camellia sinensis) | JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY | 68 | 10842 | 10851 | 4.290 | Fu XM, Cheng SH, Liao YY, Xu XL, Wang XC, Hao XY, Xu P, Dong F, Yang ZY* |
| 119 | Responses of Foliar Nutrient Status and Stoichiometry to Nitrogen Addition in Different Ecosystems: A Meta-analysis | JOURNAL OF GEOPHYSICAL RESEARCH-BIOGEOSCIENCES | 125 | | | 4.226 | Mao JH, Mao QG, Zheng MH*, Mo JM* |
| 120 | Inconsistent Responses of Transpiration of Different Canopy Layers to Simulated Canopy and Understory N Depositions in a Low-Subtropical Evergreen Broadleaf Forest | JOURNAL OF GEOPHYSICAL RESEARCH-BIOGEOSCIENCES | 125 | e2019JG005594 | | 4.226 | Li YQ, Zhao P*, Zhang ZZ, Zhu LW, Ouyang L, Ni GY |
| 121 | Deciphering the Metabolic Pathways of Pitaya Peel after Postharvest Red Light Irradiation | METABOLITES | 10 | 108 | | 4.097 | Wu QX, Gao HJ, Zhang ZK, Li TT, Qu HX, Jiang YM, Yun Z* |
| 122 | Transcriptome analysis provides insights into the non-methylated lignin synthesis in Paphiopedilum armeniacum seed | BMC GENOMICS | 21 | 524 | | 4.093 | Fang L, Xu X, Li J, Zheng F, Li MZ, Yan JW, Li Y, Zhang XH, Li L, Ma GH, Zhang AY, Lv FB, Wu KL*, Zeng SJ* |
| 123 | Revealing Further Insights on Chilling Injury of Postharvest Bananas by Untargeted Lipidomics | FOODS | 9 | 894 | | 4.092 | Liu J, Li QX, Chen JJ, Jiang YM* |
| 124 | Transcriptome sequencing and metabolite profiling analyses provide comprehensive insight into molecular mechanisms of flower development inDendrobium officinale(Orchidaceae) | PLANT MOLECULAR BIOLOGY | 104 | 529 | 548 | 4.065 | He CM, Liu XC, da Silva JAT, Liu N, Zhang MZ, Duan J* |
| 125 | Bioactive Polyhydroxanthones from Penicillium purpurogenum | JOURNAL OF NATURAL PRODUCTS | 83 | 1480 | 1487 | 3.990 | Xue JH, Li HX, Wu P, Xu LX, Yuan YF, Wei XY* |
| 126 | The First Racemic Total Syntheses of the Antiplasmodials Watsonianones A and B and Corymbone B | JOURNAL OF NATURAL PRODUCTS | 83 | 3 | 7 | 3.990 | Zhang X, Wu GY, Huo LQ, Guo XY, Qiu SX, Liu HX*, Tan HB*, Hu YJ* |
| 127 | Chemical composition of the cuticular membrane in guava fruit (Psidium guajava L.) affects barrier property to transpiration | PLANT PHYSIOLOGY AND BIOCHEMISTRY | 155 | 589 | 595 | 3.966 | Huang H，Lian QQ，Wang L，Shan YX，Li FJ，Chang SK，Jiang YM* |
| 128 | Characterization of a phytochelatin synthase gene from Ipomoea pes-caprae involved in cadmium tolerance and accumulation in yeast and plants | PLANT PHYSIOLOGY AND BIOCHEMISTRY | 155 | 743 | 755 | 3.966 | Su HX，Zou T，Lin RY，Zheng JX，Jian SG，Zhang M* |
| 129 | The complex phylogenetic relationships of a 4mC/6mA DNA methyltransferase in prokaryotes | MOLECULAR PHYLOGENETICS AND EVOLUTION | 149 | 106837 | | 3.886 | Harris AJ, Goldman AD* |
| 130 | A fossil-calibrated phylogeny reveals the biogeographic history of the Cladrastis Glade, an amphi-Pacific early-branching group in papilionoid legumes | MOLECULAR PHYLOGENETICS AND EVOLUTION | 143 | 106673 | | 3.886 | Duan L, Harris AJ, Su C, Ye W, Deng SW, Fu L, Wen J*, Chen HF* |
| 131 | Effect of nitrogen and phosphorus addition on litter decomposition and nutrients release in a tropical forest | PLANT AND SOIL | 454 | 139 | 153 | 3.880 | Zhang JF，Li J，Fan YX，Mo QF，Li, YW，Li YX，Li ZA，Wang FM* |
| 132 | Exploring candidate genes in a major QTL region associated with salinity tolerance in the skin of Nile tilapia based on transcriptomic analysis | AQUACULTURE | 526 | 735380 | | 3.592 | Qin H, Zhu ZX, Lin HR, Xia JH*, Jia YX* |
| 133 | Stand attributes or soil micro-environment exert greater influence than management type on understory plant diversity in even-aged oak high forests | FOREST ECOLOGY AND MANAGEMENT | 460 | 117897 | | 3.581 | Wei LP*, Archaux F, Hulin F, Bilger I, Gosselin F |
| 134 | Soil carbon dynamics in different types of subtropical forests as determined by density fractionation and stable isotope analysis | FOREST ECOLOGY AND MANAGEMENT | 475 | 118401 | | 3.581 | Luo XZ，Hou EQ，Zhang LL，Wen DZ* |

| No. | Title | Journal | Issue Volume | Start Page | End Page | Impact Factor | Authors |
|---|---|---|---|---|---|---|---|
| 135 | Divergent effects of a 6-year warming experiment on the nutrient productivities of subtropical tree species | FOREST ECOLOGY AND MANAGEMENT | 461 | 117952 | | 3.581 | Wu T, Liu SZ, Lie ZY, Zheng MH, Duan HL, Chu GW, Meng Z, Zhou GY, Liu JX* |
| 136 | Effects of winter chilling and photoperiod on leaf-out and flowering in a subtropical evergreen broadleaved forest in China | FOREST ECOLOGY AND MANAGEMENT | 458 | 117766 | | 3.581 | Song ZQ, Song XQ, Pan YQ, Dai K, Shou JJ, Chen Q, Huang JX, Tang XR, Huang ZL, Du YJ* |
| 137 | Species dominance rather than species asynchrony determines the temporal stability of productivity in four subtropical forests along 30 years of restoration | FOREST ECOLOGY AND MANAGEMENT | 457 | 117687 | | 3.581 | Yu QS, Rao XQ, Chu CJ, Liu SP, Lin YB, Sun D, Tan XP, Abu Hanif, Shen WJ* |
| 138 | Whole-plant water hydraulic integrity to predict drought-induced Eucalyptus urophylla mortality under drought stress | FOREST ECOLOGY AND MANAGEMENT | 468 | 118179 | | 3.581 | Chen X, Zhao P*, Ouyang L, Zhu LW, Ni GY, Schafer KVR |
| 139 | Soil organic carbon turnover following forest restoration in south China: Evidence from stable carbon isotopes | FOREST ECOLOGY AND MANAGEMENT | 462 | 117988 | | 3.581 | Xiong X, Zhang HL, Deng Q*, Hui DF, Chu GW, Meng Z, Zhou GY, Zhang DQ* |
| 140 | Deep RNA-seq analysis reveals key responding aspects of wild banana relative resistance to Fusarium oxysporum f. sp. cubense tropical race 4 | FUNCTIONAL & INTEGRATIVE GENOMICS | 20 | 551 | 562 | 3.449 | Li WM, Dita M, Rouard M, Wu W, Roux N, Xie JH, Ge XJ* |
| 141 | Dihydrochalcone C-glycosides from Averrhoa carambola leaves | PHYTOCHEMISTRY | 174 | 112364 | | 3.374 | Yang Y, Jia XC, Xie HH*, Wei XY |
| 142 | Synthesis and Cytotoxic Property of Annonaceous Acetogenin Glycoconjugates | DRUG DESIGN DEVELOPMENT AND THERAPY | 14 | 4993 | 5004 | 3.270 | Shi JF，Wu P，Cheng XL，Wei XY*，Jiang ZH* |
| 143 | The genetic basis of hybrid male sterility in sympatric Primulina species | BMC EVOLUTIONARY BIOLOGY | 20 | 49 | | 3.252 | Feng C, Yi HQ, Yang LH, Kang M* |
| 144 | The utility of DNA barcodes to confirm the identification of palm collections in botanical gardens | PLOS ONE | 15 | e0235569 | | 3.227 | Le DT, Zhang YQ, Xu Y, Guo LX, Ruan ZP, Burgess KS, Ge XJ* |
| 145 | The effects of Bidens alba invasion on soil bacterial communities across different coastal ecosystem land-use types in southern China | PLOS ONE | 15 | e0238478 | | 3.227 | Wang Y，Lian JY*，Shen H，Ni YL，Zhang RY，Guo Y，Ye WH |
| 146 | Using genetic markers to identify the origin of illegally traded agarwood-producing Aquilaria sinensis trees | GLOBAL ECOLOGY AND CONSERVATION | 22 | e00958 | | 3.202 | Wang ZF, Cao HL*, Cai CX, Wang ZM |
| 147 | Effects of 14-year continuous nitrogen addition on soil arylsulfatase and phosphodiesterase activities in a mature tropical forest | GLOBAL ECOLOGY AND CONSERVATION | 22 | e00934 | | 3.202 | Mori T, Zhou KJ, Wang C, Wang SH, Wang YP, Zheng MH, Lu XK, Zhang W*, Mo JM |
| 148 | Structural elucidation, total synthesis, and cytotoxic activity of effphenol A | ORGANIC & BIOMOLECULAR CHEMISTRY | 18 | 9035 | 9038 | 3.135 | Liu HX，Chen S，Zhang X，Dong CM，Chen YC，Liu ZM，Tan HB*，Zhang WM* |
| 149 | Assessment of the Nutrient Removal Potential of Floating Native and Exotic Aquatic Macrophytes Cultured in Swine Manure Wastewater | INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH | 17 | 1103 | | 3.127 | Xu L, Cheng SY, Zhuang P, Xie DS, Li SY, Liu DM, Li ZA, Wang FG*, Xing FW |
| 150 | Long-term phosphorus addition downregulates microbial investments on enzyme productions in a mature tropical forest | JOURNAL OF SOILS AND SEDIMENTS | 20 | 921 | 930 | 2.998 | Wang C, Mori T, Mao QG, Zhou KJ, Wang ZH, Zhang YQ, Mo H, Lu XK*, Mo JM |
| 151 | Species-specific transpiration and water use patterns of two pioneer dominant tree species under manipulated rainfall in a low-subtropical secondary evergreen forest | ECOHYDROLOGY | 13 | e2234 | | 2.975 | Ouyang L, Gao JG, Zhao P*, Rao XQ |
| 152 | Irregular adaxial-abaxial polarity rearrangement contributes to the monosymmetric-to-asymmetric transformation of Canna indica stamen | AOB PLANTS | 12 | plaa051 | | 2.918 | Tian XY，Li XR，Yu QX，Zhao HC，Song JJ，Liao JP* |
| 153 | Difference between emergent aquatic and terrestrial monocotyledonous herbs in relation to the coordination of leaf stomata with vein traits | AOB PLANTS | 12 | plaa047 | | 2.918 | Zhao WL, Fu PL, Liu GL, Zhao P* |
| 154 | Colletotryptins A-F, new dimeric tryptophol derivatives from the endophytic fungus Colletotrichum sp. SC1355 | FITOTERAPIA | 141 | 104465 | | 2.906 | Shao LL, Wu P, Xu LX, Xue JH, Li HX*, Wei XY |
| 155 | Eutyscoparols A-G, polyketide derivatives from endophytic fungus Eutypella scoparia SCBG-8 | FITOTERAPIA | 146 | 104681 | | 2.906 | Zhang WG，Wang MM，Zhang S，Xu KP，Tan GS，Qiu SX，Zou ZX*，Tan HB* |
| 156 | Cytochalasans from endophytic fungus Diaporthe sp. SC-J0138 | FITOTERAPIA | 145 | 104611 | | 2.906 | Yang XL, Wu P, Xue JH, Li HX, Wei XY* |
| 157 | Flavan-3-ols and 2-diglycosyloxybenzoates from the leaves of Averrhoa carambola | FITOTERAPIA | 140 | 104442 | | 2.906 | Yang Y, Xie HH*, Jiang YM, Wei XY |
| 158 | Transcriptome analyses provide insights into development of the Zingiber zerumbet flower, revealing potential genes related to floral organ formation and patterning | PLANT GROWTH REGULATION | 90 | 331 | 345 | 2.871 | Zhao T, Specht CD, Dong ZC, Ye YS, Liu HF*, Liao JP |
| 159 | Calibrating PhenoCam Data with Phenological Observations of a Black Spruce Stand | CANADIAN JOURNAL OF REMOTE SENSING | 46 | 154 | 165 | 2.826 | Zhang SK, Butto V, Khare S, Deslauriers A, Morin H, Huang JG*, Ren H, Rossi S |
| 160 | Conflicting phylogenetic signals in plastomes of the tribe Laureae (Lauraceae) | PEERJ | 8 | e10155 | | 2.810 | Xiao TW, Xu Y, Jin L, Liu TJ, Yan HF, Ge XJ* |

| No. | Title | Journal | Issue Volume | Start Page | End Page | Impact Factor | Authors |
|---|---|---|---|---|---|---|---|
| 161 | Comparative analysis of chloroplast genomes for five Dicliptera species (Acanthaceae): molecular structure, phylogenetic relationships, and adaptive evolution | PEERJ | 8 | e8450 | | 2.810 | Huang SA, Ge XJ, Cano A, Salazar BGM, Deng YF* |
| 162 | The complete chloroplast genome of Microcycas calocoma (Miq.) A. DC. (Zamiaceae, Cycadales) and evolution in Cycadales | PEERJ | 8 | e8305 | | 2.810 | Chang ACG, Lai Q, Chen T, Tu TY, Wang YH, Agoo EMG, Duan J*, Li N* |
| 163 | Comparative Analysis of Complete Chloroplast Genome Sequences of Wild and Cultivated Bougainvillea (Nyctaginaceae) | PLANTS-BASEL | 9 | 1671 | | 2.762 | Mary Ann C. Bautista, Yan Zheng, Zhangli Hu, Yunfei Deng*, Tao Chen* |
| 164 | Selection of Reference Genes for qRT-PCR Analysis in Medicinal Plant Glycyrrhiza under Abiotic Stresses and Hormonal Treatments | PLANTS-BASEL | 9 | 1441 | | 2.762 | Li YP，Liang XJ，Zhou XG，Wu ZG，Yuan L，Wang Y*，Li YQ* |
| 165 | Comparative Analyses of the Chloroplast Genomes of Patchouli Plants and Their Relatives in Pogostemon (Lamiaceae) | PLANTS-BASEL | 9 | 1497 | | 2.762 | Zhang CY，Liu TJ*，Mo XL，Huang HR，Yao G，Li JR，Ge XJ，Yan HF |
| 166 | Nitrogen addition to the canopy of Castanopsis chinensis(Sprengel) Hance promoted xylem formation in a subtropical forest in China | ANNALS OF FOREST SCIENCE | 77 | 56 | | 2.758 | Guo XL, Huang JG*, Li JY, Liang HX, Yu BY, Ma QQ, Jiang SW, Lu XK, Fu SL, Ye Q, Zhao P, Cai X |
| 167 | Warming effects on morphological and physiological performances of four subtropical montane tree species | ANNALS OF FOREST SCIENCE | 77 | 2 | | 2.758 | Li YY, Xu Y, Li YL, Wu T, Zhou GY, Liu SZ, Meng YQ, Wang JN, Ling LH, Liu JX* |
| 168 | SnRK1 regulates chromatin-associated OXS3 family proteins localization through phosphorylation in Arabidopsis thaliana | BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS | 533 | 526 | 532 | 2.75 | Xiao SM，Jiang L，Wang CH*，Ow DW* |
| 169 | Overproduction of plant nuclear export signals enhances diamide tolerance in Schizosaccharomyces pombe | BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS | 531 | 335 | 340 | 2.75 | Ma XL, Huang X, Jiao ZL, He LL, Li YQ, Ow DW* |
| 170 | Obtusifoliol 14 alpha-demethylase OsCYP51G1 is involved in phytosterol synthesis and affects pollen and seed development | BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS | 529 | 91 | 96 | 2.75 | Jiao ZL, Xu WJ, Zeng X, Xu XL, Zhang MY*, Xia KF* |
| 171 | In situ glacial survival maintains high genetic diversity ofMussaenda kwangtungensison continental islands in subtropical China | ECOLOGY AND EVOLUTION | 10 | 11304 | 11321 | 2.749 | Shi MM, Wang YY, Duan TT, Qian X, Zeng T, Zhang DX* |
| 172 | Leaf nonstructural carbohydrate concentrations of understory woody species regulated by soil phosphorus availability in a tropical forest | ECOLOGY AND EVOLUTION | 10 | 8429 | 8438 | 2.749 | Mo QF, Chen YQ, Yu SQ, Fan YX, Peng ZT, Wang WJ, Li ZA, Wang FM* |
| 173 | Ciceribacter ferrooxidans sp. nov., a nitrate-reducing Fe(II)-oxidizing bacterium isolated from ferrous ion-rich sediment | JOURNAL OF MICROBIOLOGY | 58 | 350 | 356 | 2.741 | Deng TC, Qian YF, Chen XJ, Yang XN, Guo J, Sun GP, Xu MY* |
| 174 | Interspecific variations in tree allometry and functional traits in subtropical plantations in southern China | FUNCTIONAL PLANT BIOLOGY | 47 | 558 | 564 | 2.729 | Zhu LW, Hu YT, Zhao P* |
| 175 | Using Steel Slag for Dissolved Phosphorus Removal: Insights from a Designed Flow-Through Laboratory Experimental Structure | WATER | 12 | 1236 | | 2.709 | Wang LH, Penn C, Huang CH, Livingston S, Yan JH* |
| 176 | Trend and Variance of Continental FreshWater Discharge over the Last Six Decades | WATER | 12 | 3556 | | 2.709 | Wang C，Zhang H* |
| 177 | The identification of an R2R3-MYB transcription factor involved in regulating anthocyanin biosynthesis in Primulina swinglei flowers | GENE | 752 | 144788 | | 2.702 | Feng C, Ding DH, Feng C*, Kang M |
| 178 | Diversity of Reproductive Phenology Among Subtropical Grasses Is Constrained by Evolution and Climatic Niche | FRONTIERS IN ECOLOGY AND EVOLUTION | 8 | 181 | | 2.555 | Li KX, Wang JY, Qiao L, Zheng RY, Ma YQ, Chen Y, Hou XB, Du YJ, Gao JG, Liu H* |
| 179 | (86) Request for a binding decision on whether the names Gymnostachys R. Br. (Araceae) and Gymnostachyum Nees (Acanthaceae) are sufficiently alike to be confused | TAXON | 69 | 621 | 622 | 2.505 | Lin ZL, Deng YF* |
| 180 | Circumscription and phylogenetic position ofLigulariasect. Stenostegia(Asteraceae: Senecioneae) based on morphological, cytological, and molecular phylogenetic evidence | TAXON | 69 | 739 | 755 | 2.505 | Ren C, Wang L, Illarionova ID, Yang QE* |
| 181 | (2759) Proposal to conserve the name Androsace bulleyana against A. coccinea (Primulaceae) | TAXON | 69 | 830 | 831 | 2.505 | Xu Y, Hu CM, Hao G* |
| 182 | (2760) Proposal to conserve the name Primula sinensis Sabine ex Lindl. against P. sinensis Lour. (Primulaceae) | TAXON | 69 | 831 | 832 | 2.505 | Xu Y, Deng YF, Hao G*, Hu CM |
| 183 | (27) Proposal to add Diels, Plantae Chinenses Forrestianae (in Notes Roy. Bot. Gard. Edinburgh 7: 1-410. 1912-1913) to the list of suppressed works in the Code Appendices | TAXON | 69 | 834 | 836 | 2.505 | Guo XQ, Wu X, Shao YY, Ren C* |
| 184 | (87-95) Requests for binding decisions on the descriptive statements associated with Diapensia brevistyla, Gentiana stragulata, G. tsarongensis, Leontopodium forrestianum, Rhododendron hardingii, R. humicola, R. lophogynum, R. meddianum var. atrokermesinum, and R. sericocalyx | TAXON | 69 | 837 | 839 | 2.505 | Wang L, Wu X, Guo XQ, Ren C* |

| No. | Title | Journal | Issue Volume | Start Page | End Page | Impact Factor | Authors |
|---|---|---|---|---|---|---|---|
| 185 | (2732) Proposal to conserve the name Senecio palmatisectus (Parasenecio palmatisectus) against S. pelleifolius (Asteraceae) | TAXON | 69 | 202 | 203 | 2.505 | Fei WQ, Tang M, Wu X, Ren C* |
| 186 | Effects of Elevated CO2 Concentration and Nitrogen Addition on Soil Respiration in a Cd-Contaminated Experimental Forest Microcosm | FORESTS | 11 | 260 | | 2.484 | Yao B, Hu QW, Zhang GH, Yi YF, Xiao MJ, Wen DZ* |
| 187 | Functional Composition Changes of a Subtropical Monsoon Evergreen Broad-Leaved Forest Under Environmental Change | FORESTS | 11 | 191 | | 2.484 | Zou S, Zhang QM, Zhou GY*, Liu SZ, Chu GW, Li RH, Ye Q, Zhang DQ, Tang XL, Liu JX, Huang CM, Li YL, Meng Z |
| 188 | Assessing Environmental Control of Sap Flux of Three Tree Species Plantations in Degraded Hilly Lands in South China | FORESTS | 11 | 206 | | 2.484 | Wang Q, Lintunen A, Zhao P*, Shen WJ, Salmon Y, Chen X, Ouyang L, Zhu LW, Ni GY, Sun D, Rao XQ, Holtta T |
| 189 | Molecular Cloning and Functional Characterization of Bisabolene Synthetase (SaBS) Promoter from Santalum album | FORESTS | 11 | 85 | | 2.484 | Yan HF, Xiong YP, da Silva JAT, Pang JH, Zhang T, Yu XC, Zhang XH, Niu MY, Ma GH* |
| 190 | Reduced Lignin Decomposition and Enhanced Soil Organic Carbon Stability by Acid Rain: Evidence from C-13 Isotope and C-13 NMR Analyses | FORESTS | 11 | 1191 | | 2.484 | Wu JP，Deng Q*，Hui DF，Xiong X，Zhang HL，Zhao MD，Wang X，Hu MH，Su YX，Zhang HO，Chu GW，Zhang DQ* |
| 191 | Role of the Dominant Species on the Distributions of Neighbor Species in a Subtropical Forest | FORESTS | 11 | 352 | | 2.484 | Wei SG, Li L, Lian JY*, Nielsen SE, Wang ZG, Mao LF, Ouyang XJ, Cao HL, Ye WH |
| 192 | Consistent effects of a non-native earthworm on soil microbial communities in three subtropical forests | PEDOBIOLOGIA | 79 | 150613 | | 2.422 | Zhang HZ, Shi LL*, Wen DZ*, Wang RJ |
| 193 | Can the anatomy of abnormal flowers elucidate relationships of the androecial members in the ginger (Zingiberaceae)? | EVODEVO | 11 | 12 | | 2.383 | Li XM, Fan T, Zou P, Zhang WH, Wu XJ, Zhang YX, Liao JP* |
| 194 | Linking vein properties to leaf biomechanics across 58 woody species from a subtropical forest | PLANT BIOLOGY | 22 | 212 | 220 | 2.371 | Hua L，He P，Goldstein G，Liu H，Yin D，Zhu S，Ye Q* |
| 195 | Medicinal chemistry of oxazines as promising agents in drug discovery | CHEMICAL BIOLOGY & DRUG DESIGN | 95 | 16 | 47 | 2.343 | Zinad DS, Mahal A*, Mohapatra RK, Sarangi AK, Pratama MRF |
| 196 | Integrated conservation forParakmeria omeiensis(Magnoliaceae), a Critically Endangered plant species endemic to south-west China | ORYX | 54 | 460 | 465 | 2.328 | Yu DP, Wen XY, Li CH, Xiong TY, Peng QX, Li XJ, Xie KP, Liu H, Ren H* |
| 197 | Streptovertimycins A-H, new fasamycin-type antibiotics produced by a soil-derived Streptomyces morookaense strain | JOURNAL OF ANTIBIOTICS | 73 | 283 | 289 | 2.301 | Yang L, Li XX, Wu P*, Xue JH, Xu LX, Li HX, Wei XY |
| 198 | Seasonal dynamic variation of pollination network is associated with the number of species in flower in an oceanic island community | JOURNAL OF PLANT ECOLOGY | 13 | 657 | 666 | 2.299 | Wang XP，Zeng T，Wu MS，Zhang DX* |
| 199 | An efficient micropropagation protocol for Metasequoia glyptostroboides Hu et Cheng from shoot segments of 2-year-old trees | TREES-STRUCTURE AND FUNCTION | 34 | 307 | 313 | 2.256 | Xiong YP, Chen SY, Guo BY, Niu MY, Zhang XH, Li Y, Wu KL, Zheng F, da Silva JAT, Zeng SJ, Ma GH* |
| 200 | Ecotypic differentiation of black spruce populations: temperature triggers bud burst but not bud set | TREES-STRUCTURE AND FUNCTION | 34 | 1313 | 1321 | 2.256 | Usmani A, Silvestro R, Zhang SK, Huang JG*, Saracino A, Rossi S |
| 201 | Ear photosynthetic anatomy effect on wheat yield and water use efficiency | AGRONOMY JOURNAL | 112 | 1778 | 1793 | 2.095 | Li YP, Li HB, Zhang SQ*, Wang Y* |
| 202 | Effects of moderate warming on growth and physiological performance of subtropical saplings in southern China | ACTA PHYSIOLOGIAE PLANTARUM | 42 | 164 | | 2.078 | Li YY, Xu Y, Zhou GY, Liu SZ, Li YL, Chen YS, Liu JX* |
| 203 | Effective breaking of dormancy of Scaevola sericea seeds with seawater, improved germination, and reliable viability testing with 2,3,5-triphenyl-tetrazolium chloride | SOUTH AFRICAN JOURNAL OF BOTANY | 132 | 73 | 78 | 2.061 | Liang HZ, Xiong YP, Guo BY, Yan HF, Jian SG, Ren H, Zeng SJ, Wu KL, da Silva JAT*, Xiong YH*, Ma GH* |
| 204 | Accumulation of Heavy Metals and As in the FernBlechnum orientaleL. from Guangdong Province, Southern China | WATER AIR AND SOIL POLLUTION | 231 | 342 | | 2.041 | Yu HL, Li SY, Wang AH, Kuang YW*, Wang FG*, Xing FW |

# Appendix II. Organizational Structure

## Leadership

**Committee of CPC**
**Secretary:**WEI Ping
**Deputy Secretary:** XU Hai
**Members:** YE Qing, REN Hai, YAN Junhua, YANG Ziyin, XU Hai, GONG Xiaoping, WEI Ping

**Directors**
**Director:** REN Hai
**Deputy Directors:** WEI Ping, YAN Junhua, YE Qing

**Disciplinary Committee of CPC**
**Secretary:** XU Hai
**Deputy Secretary:** FAN Dequan
**Members:** WANG Ruijiang, WEN Jun, FAN Dequan, HOU Xingliang, XU Hai

## Administration Departments

**General Office**
**Division Chief:** FAN Dequan
**Deputy Division Chief:** ZHENG Xiangci

**Scientific Research and Foreign Affairs Management Division**
**Division Chief:** CHEN Feng
**Deputy Division Chief:** YU Yan

**Personnel and Education Division**
**Division Chief:** GONG Xiaoping
**Deputy Division Chief:** LAI Zhimin

**Assets and Financial Services Division**
**Division Chief:** FAN Linxian (Retired since May)
**Deputy Division Chief:** KE Qiusheng

**Science and Technology Development Center**
**Division Chief:** WANG Keya

**Horticulture Center**
**Division Chief:** WANG Ying
**Deputy Division Chief:** LIAO Jingping, XIA Hanping

**Dinghushan Nature Reserve (Arboretum)**
**Division Chief:** FAN Dequan
**Deputy Division Chief:** MO Jiangming, OUYANG Xuejun

**Discipline Inspection and Supervision Audit Office**
**Division Chief:** CHEN Zhenhuan

## Research Teams

### Plant Sciences Center

**Director:** Prof. / Dr. KANG Ming
**Deputy Director:** Prof. / Dr. LUO Shixiao

**Plant Phylogenetics and Reproductive Biology**
**PI:** Prof. / Dr. ZHANG Dianxiang
**Members:** LUO Shixiao, LI Shijin, LUO Zhonglai, TU Tieyao, SHI Miaomiao, ZHAO Zhongtao, WANG Xiangping

**Plant Structural and Development Biology**
**PI:** Prof. / Dr. LIAO Jingping
**Members:** XU Fengxia, ZOU Pu, LIU Huanfang, KUANG Yanfeng

**Plant Molecular Systematics and Evolution**
**PI:** Prof. / Dr. WANG Ruijiang
**Members:** DONG Shiyong, XU Yuan

**Taxonomy of Seed Plants**
**PI:** Prof. / Dr. Yang Qin’er
**Members:** YUAN Qiong, REN Chen, WANG Long

**Conservation Genetics**
**PI:** Prof. / Dr. KANG Ming
**Members:** WANG Jing, KONG Hanghui, FENG Chao, YANG Lihua

**Plant Diversity and Conservation**
**PI:** Prof. / Dr. CHEN Hongfeng
**Members:** WANG Faguo, LIU Dongming, YI Qifei, YE Wen, FU Lin, DUAN Lei

**Plant Taxonomy and Resources**
**PI:** Prof. / Dr. XIA Nianhe
**Members:** CHEN Juan, TONG Yihua, BAI Lin

**Plant Taxonomy and Biogeography**
**PI:** Prof. / Dr. DENG Yunfei
**Members:** LIN Zheli

**Coevolution of Plant and Insect**
**PI:** Prof. / Dr. YU Hui

**Molecular Ecology**
**PI:** Prof. / Dr. GE Xuejun
**Members:** YAN Haifei, HUANG Huirun, LIU Jiajia, LIU Tongjian

**Evolution and Ecological Genomics**
**PI:** Prof. / Dr. WANG Baosheng
**Members:** YUAN Shuai, SHI Yong

**Plant Genome Evolution**
**PI:** Prof. / Dr. Pat Heslop Harrison
**Members:** LIU Qing

**Plant Orthodox Taxonomy and Species Diversity**
**PI:** Prof. / Dr. CHEN Yousheng
**Members:** SONG Zhuqiu

## Ecological & Environmental Sciences Center

**Director:** Prof. / Dr. YE Qing
**Deputy Director:** Prof. / Dr. HUANG Jianguo

**Ecosystem Ecology**
**PI:** Prof. / Dr. LIU Juxiu
**Members:** YAN Junhua, TANG Xuli, LI Yuelin

**Ecosystem Physiology**
**PI:** Prof. / Dr. ZHAO Ping
**Members:** OUYANG Lei, NI Guangyan, ZHU Liwei

**Global Change and Plant Functional Traits**
**PI:** Prof. / Dr. YE Qing
**Members:** LIU Hui, YIN Deyi, LIANG Xingyun

**Ecosystem Management**
**PI:** Prof. / Dr. MO Jiangming
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