

## Orchid Research Newsletter No. 63

It was my good fortune to be invited to speak at the 9<sup>th</sup> International Symposium on Diversity and Conservation of Asian Orchids, held 15-17 November at Fujian Agricultural and Forestry University in Fuzhou, China. As it was my first trip to China, I was not sure what to expect, but any fears I had concerning effective dialogue given my shameful ignorance of all but the most basic Mandarin were quickly dismissed when I learned that talks were to be given in English only (more about that later).

I was assigned two lovely student volunteers to guide and assist me. One, Meina Wang, works at the National Orchid Conservation Center in Shenzhen (Shandong Province), which I visited before going on to Fuzhou. The Center was established in 2006 and now has over 100 employees; all expenses are funded by the government and private companies. Its vast living collection is used for genome work as well as phytogeographic and pollination studies, artificial propagation and reintroductions. *Dendrobium officinale* Kimura & Migo (correctly *Dendrobium catenatum* Lindl.) is grown in profusion there for research into its medicinal properties. I was pleased to meet and have lunch with the Director of the Center, Zhong-Jian Liu, along with professors Ma Hong (Fudan University, Shanghai) and Luo Da (Sun Yat-Sen University, Guangzhou), and two distinguished representatives from wildlife conservation organizations based in Beijing, Liu Yawen and Yongfu Yu.

In Fuzhou my indefatigable student helper, Lin-Ying Zhang, gave me and fellow speaker Dennis Whigham (Smithsonian Environmental Research Center) a tour of the Orchid Garden run by the University and also some of the tourist sites in Fuzhou. She was by my side throughout the symposium, which was a model of efficiency that conferences in the West should try to emulate. On the last day we were all given hard-copy group photos, a booklet of registrants with contact information, and complimentary boxes of tea. The hospitality of our hosts was amazing.

There were 18 talks over the course of two days in sessions devoted to taxonomy and phylogeny, conservation and industry development, and biogeography and floras. Registrants were principally from China (including Hong Kong and Taiwan) but also from the US, India, Singapore, Korea, Malaysia, and Nigeria. Stephan Gale of the Kadoorie Farm and Botanic Garden promoted the resources of the website (<http://www.osgasia.org/eng/>) of the Orchid Specialist Group Asia, which I would encourage you to check out. Jiang-Yun Gao gave a startling and saddening presentation on conservation status and prospects in Xishuangbanna, China, which is in the Indo-Burma Hotspot. Roughly 16% of China's plant diversity is there, yet rubber plantations (where no orchids are found) already occupy more than 20% of the area. Sadly, there is now only one wild population of *Paphiopedium spicerianum* (Rchb.f.) Pfitzer left in China, with only 40 individuals remaining. Jun-Wen Zhai presented a talk on his discovery of the remarkable new genus *Danxiaorchis* (Calypsoeae) with large yellow flowers. Yong-hong Hu, Director of the Shanghai Chenshan Botanical Garden, outlined the mission of the Garden: to conserve plants in eastern China, find sustainable ways of using them, and share knowledge and enthusiasm. About 120 orchid genera and 600 species are maintained and protected there. Shanghai will be making a strong bid to host the World Orchid Conference in 2020.

As I mentioned earlier, I was surprised to learn that the symposium would be in English without simultaneous translation -- another of my preconceptions dashed. Chinese students begin learning English in middle school, about age 13, so I should not have been surprised to find that most students I met spoke English fluently.

The significant disparity between Chinese and Western students in not only language skills but also mathematics is readily apparent in their recent scores on the Programme for International Student Assessment (PISA) test, administered every three years by the Organization for Economic Cooperation and Development (OECD). As reported in the 3 December issue of the *Wall Street Journal*, a representative sample of 510,000 students took the exam in 65 countries and locales. Teenagers in the U.S. slipped from 25<sup>th</sup> to 31<sup>st</sup> in mathematics since 2009, from 20<sup>th</sup> to 24<sup>th</sup> in science, and from 11<sup>th</sup> to 21<sup>st</sup> in reading. The OECD average score was 494, matched by U.K. students. American students came in lower with a score of 481, just behind Russia (482). At the bottom were the students from Peru (368), Indonesia (375), Brazil (391), Mexico (413), and Turkey (448). The top five average scores? Shanghai (613), Singapore (573), Hong Kong (561), South Korea (554), and Japan (536). We could debate the reasons for the high scores and point fingers about the low scores, as I'm sure Western politicians are doing, but the bottom line is that the developed nations in Asia are apparently doing a better job of educating students than elsewhere in the world, as they have been for some time. Another line of evidence is the list of references in the *Orchid Research Newsletter* over the last several years, showing the excellent work in biotechnology and molecular biology issuing from those countries in particular. Science is surely on the ascendancy in China, and I was privileged to have been given a first-hand look.

**Alec Pridgeon**

### **News from Correspondents**

Please submit any news about newly completed research, future research plans and needs, change of address, upcoming or recent fieldwork, etc. to Alec Pridgeon ([a.pridgeon@kew.org](mailto:a.pridgeon@kew.org)). Graduate students are especially encouraged to share the subjects of their thesis or dissertation with the international community. We will print submissions in the format below. Many thanks to those who have contributed.

**Antonio Toscano de Brito** has been named Curator of the Orchid Research Center at Marie Selby Botanical Gardens. His duties will include researching selected orchid species, publishing scientific and popular articles, identifying plants, building Selby's living and preserved collections and giving lectures on plant research. Toscano began work at Selby Gardens on the Global Plants Initiative project, funded by the Mellon Foundation in April 2011. He is currently working under two grants studying orchids of Brazil. His research involves molecular work which is funded by the Institute for Museum and Library Services, and fieldwork partially supported by an individual grant from the National Geographic Society.

### **Upcoming Conferences**

We welcome any news about future orchid conferences for promotion here. Please send details to Alec Pridgeon ([a.pridgeon@kew.org](mailto:a.pridgeon@kew.org)) as far in advance of the event as possible, remembering that the *Orchid Research Newsletter* is published only in January and July of each year.

### **First International Symposium on Orchid Bees**

The 1st International Symposium on the Ecology, Evolution, and Conservation of Orchid Bees will be held at La Gamba Biological Station near Golfito, Costa Rica, March 12-15 in 2014. □ The symposium will provide a unique opportunity to bring together scientists interested in diverse aspects of the biology of euglossine bees, including chemical ecology and sensory biology, pollination biology, community ecology, systematics, and conservation biology. The symposium will have an informal format to promote discussions and enhance interactions among participants. There will be a limited number of talks, field exhibitions, and organized hikes. Participants will include scientists from different nationalities with diverse backgrounds, as well as scientists from various generations to stimulate collaboration and promote new research avenues. □ Due to the limited space available at the La Gamba Biological Station (max. of 30 people), registrations will be processed on a first-come first-served basis. Confirmed participants include Robert Dressler (opening talk), David Roubik, Norris Williams, and Mark Whitten. □ For further information and to register, visit <http://homepage.ruhr-uni-bochum.de/thomas.eltz/Registration.html>.

### **21<sup>st</sup> World Orchid Conference**

The 21st World Orchid Conference (WOC21) will take place from 10-14 September 2014 in Johannesburg, South Africa, at the Sandton Convention Centre. At this writing in December 2013, 46 speakers are scheduled, including keynoters Johan Hermans (UK), Robert Fuchs (USA), Steven Johnson (South Africa), and Mike Fay (UK). The official conference hotels for WOC21 are the Maslow and Balaika hotels, and the official tour operator is now Hartley's Safaris, which will be conducting a variety of excursions to Cape Town, Botswana (Victoria Falls, Chobe National Park, Okavango Delta), Zambia (Victoria Falls, South Luangwa National Park, Lower Zambezi National Park), Quirimbas Archipelago, Namibia, Zambezi River, Mozambique (Niassa National Park), and other once-in-a-lifetime adventures. A pre-Conference tour will go the Namaqualand for the amazing wildflower display, and post-Conference tours will travel through the Cape Town area. Closer to Johannesburg, the world-famous Kruger National Park beckons. For further information, visit [www.woc21.org](http://www.woc21.org). You may also wish to hear a podcast of a radio broadcast featuring Show Chairman Anthony Grohovaz and Judd Kirkel, a specialist in the native orchids of South Africa, at this link: [http://melanie59669.podomatic.com/entry/2013-12-08T00\\_32\\_57-08\\_00](http://melanie59669.podomatic.com/entry/2013-12-08T00_32_57-08_00).

**The Second Shanghai Chenshan International Orchid Symposium and The Tenth International Symposium on Diversity and Conservation of Asian Orchids** is scheduled for 28-30 March 2014 at the Shanghai Chenshan Botanical Garden in Shanghai. Keynote speakers are Johan Hermans, Rodney Peakall, and Myong Gi Chung. Further information is available by writing to Meina Wang at

[csorchid2th@163.com](mailto:csorchid2th@163.com) and the Orchid Specialist Group, Asia website ([www.osgasia.org/eng/](http://www.osgasia.org/eng/)).

**The Fifth Scientific Conference on Andean Orchids** will be held in Cali, Colombia, in 2015. Information will be posted here as soon as it is available.

### **Recent Orchid Nomenclature**

New orchid names may now be accessed on the IPNI website:

([www.ipni.org/ipni/plantsearch?request\\_type=search&output\\_format=query&ret\\_defaults=on](http://www.ipni.org/ipni/plantsearch?request_type=search&output_format=query&ret_defaults=on))

Click on "Show additional search terms" on the right-hand side of the screen. After the search page appears, type in **Orchidaceae** under family name and (for example) **2010-11-30** under "Record date" and "Added since." This will pull up a list of all names added to the IPNI database since 30 November 2010.

### **20<sup>th</sup> WOC Proceedings**

The spectacular volume of the *Proceedings of the 20<sup>th</sup> World Orchid Conference, Singapore, 2011* with 584 pages and a supplementary CD has now been published. Those who wish to purchase a copy can obtain it from the National Parks Library Shop, Botany Centre, 1 Cluny Road, Singapore 259569 for SG\$246.45 plus postage. Overseas buyers will need to inquire about shipping charges ([nparks\\_library\\_shop@nparks.gov.sg](mailto:nparks_library_shop@nparks.gov.sg)).

### **Recent Literature**

We sincerely thank Paolo Grünanger for supplying new book titles and references from European orchid journals. If you are aware of any recent citations not listed here and henceforth, please send them – in the exact style below – to Alec Pridgeon ([a.pridgeon@kew.org](mailto:a.pridgeon@kew.org)) for publication in the following issue (January or July). Write "ORN references" in the subject line of the e-mail. Book citations should include author(s), date of publication, title, publisher, and place of publication (in that order). Journal titles should be spelled out in full.

#### **Anatomy and morphology**

Hobbhahn, N., Johnson, S. D., Bytebier, B., Yeung, E. C., and Harder, L. D. 2013. The evolution of floral nectaries in *Disa* (Orchidaceae: Disinae): recapitulation or diversifying innovation. *Annals of Botany* 112: 1303-1319.

#### **Books**

Abeli, T., Parolo, G., and Dell'Orto, V. 2012. *Orchidee Spontanee dell'Appennino Pavese*. Nuova Tipografia Popolare, Pavia, Italy.

Benigni, F. and Mandozzi, A. 2013. *Orchidee Spontanee. Guida Fotografica Alle Specie Più Diffuse dei Sibillini*. Ed. Tuber Communications.

Chowdery, H. J. and Agrawala, D. G. 2013. *A Century of West Himalayan Orchids*. BSMOS, Dehra Dun, India.

Colomo, S. 2012. La flora della Sardegna, vol. 16. Cefalantera - Elleborine - Ofride - Orchidea - Orchide - Platantera - Serapide. Ed. Archivio fotogr. Sardo, Nuoro, Italy.

Delforge, P. 2012. *Guide des Orchidées de France, de Suisse et du Benelux*. 2nd ed. Delachaux et Niestlé, Paris.

Elliott, J., Kurzweil, H. F., O'Byrne, P., Tan, K. W., van der Schans, A. S., Wong, S. M., and Yam, T. W. 2013. *Proceedings of the 20<sup>th</sup> World Orchid Conference, Singapore, 2011*. National Parks Board and Orchid Society of South East Asia, Singapore.

Griebel, N. 2013. *Die Orchideen Österreichs mit Orchideenwanderungen*. Freya Verlag, Austria.

Inguscio, S., Rossi, E., Scarpina, L. and Medagli, P. 2012. *Guida Alle Orchidee del Parco Naturale Regionale Porto Selvaggio e Palude del Capitano*. Ed. Salentina, Galatina, Italy.

Lavarack, B. 2013. *With Strange Device: a History of the Discovery of Tropical Australia's Orchids*. Australian Orchid Foundation, Buderim, Australia.

Sayers, B. and Sex, S. 2103. *Ireland's Wild Orchids: A Field Guide*. Collins Press, Wilton, Cork.

Schuiteman, A. 2013. *A Guide to Dendrobium of New Guinea*. Natural History Publications, Kota Kinabalu.

Szlachetko, D., Veyret, Y., Mytnik-Ejsmont, J., Sawicka, M., Rutkowski, P., and Baranow, P. 2012. *Orchids of French Guiana*. A.R.G. Gantner, Ruggell, Liechtenstein.

Vij, S. P., Verma, J., and Kumar, C. S. 2013. *Orchids of Himachal Pradesh*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India.

### **Conservation biology**

Almeida, P. R. M., Lopez-Roberts, M. C., Vigna, B. B. Z., Souza, A. P., Goes-Neto, A., and van den Berg, C. 2013. Microsatellite markers for the endangered orchids *Cattleya labiata* Lindl. and *C. warneri* T. Moore (Orchidaceae). *Conservation Genetics Resources* 5: 791-794.

Ercole, E., Rodda, M., Molinatti, M., Voyron, S., Perotto, S., and Girlanda, M. 2013. Cryopreservation of orchid mycorrhizal fungi: a tool for the conservation of endangered species. *Journal of Microbiological Methods* 93: 134-137.

Mohanty, P. and Das, J. 2013. Synthetic seed technology for short term conservation of medicinal orchid *Dendrobium densiflorum* Lindl. ex Wall. and assessment of genetic fidelity of regenerants. *Plant Growth Regulation* 70: 297-303.

Pandey, M. and Sharma, J. 2013. Characterization of microsatellite loci for *Cypripedium kentuckiense* (Orchidaceae). *Conservation Genetics Resources* 5: 1031-1033.

Sletvold, N., Dahlgren, J. P., Oien, D. I., Moen, A., and Ehrlen, J. 2013. Climate warming alters effects of management on population viability of threatened species: results from a 30-year experimental study on a rare orchid. *Global Change Biology* 19: 2729-2738.

### **Ecology**

Garcia-Gonzalez, A. and Damon, A. 2013. Abundance, distribution within phorophytes and fruit production of the first population of *Telipogon helleri* (Orchidaceae), discovered in Mexico. *Revista Mexicana de Biodiversidad* 84: 894-900.

Hundera, K., Aerts, R., De Beenhouwer, M., Van Overtveld, K., Helsen, K., Muys, B., and Honnay, O. 2013. Both forest fragmentation and coffee cultivation negatively affect epiphytic orchid diversity in Ethiopian moist evergreen Afromontane forests. *Biological Conservation* 159: 285-291.

Kartzinel, T. R., Trapnell, D. W., and Shefferson, R. P. 2013. Critical importance of large native trees for conservation of a rare Neotropical epiphyte. *Journal of Ecology* 101: 1429-1438.

Moreira, A. S. F. P., de Lemos, J. P., and Isaias, R. M. D. 2013. Structural adaptations of two sympatric epiphytic orchids (Orchidaceae) to a cloudy forest environment in rocky outcrops of southeast Brazil. *Revista de Biologia Tropical* 61: 1053-1065.

Newman, B. J., Ladd, P., Brundrett, M., and Dixon, K. W. 2013. Effects of habitat fragmentation on plant reproductive success and population viability at the landscape and habitat scale. *Biological Conservation* 159: 16-23.

Trapnell, D. W., Hamrick, J. L., Ishibashi, C. D., and Kartzinel, T. R. 2013. Genetic inference of epiphytic orchid colonization; it may only take one. *Molecular Ecology* 22: 3680-3692.

Wiegand, T., Raventos, J., Mujica, E., Gonzalez, E., and Bonet, A. 2013. Spatio-temporal analysis of the effects of Hurricane Ivan on two contrasting epiphytic orchid species in Guanahacabibes, Cuba. *Biotropica* 45: 441-449.

### **Ethnobotany/Ethnopharmacology**

Anuradha, K., Shyamala, B. N., and Naidu, M. M. 2013. *Vanilla* -- its science of cultivation, curing, chemistry, and nutraceutical properties. *Critical Reviews in Food*

*Science and Nutrition* 53: 1250-1276.

Moretti, M., Cossignani, L., Messina, F., Dominici, L., Villarini, M., Curini, M., and Marcotullio, M. C. 2013. Antigenotoxic effect, composition and antioxidant activity of *Dendrobium speciosum*. *Food Chemistry* 140: 660-665.

Park, E. J. and Lee, W. Y. 2013. Quantitative effects of various tree species on tuber growth and pharmacological compositions of *Gastrodia elata*. *Horticulture Environment and Biotechnology* 54: 357-363.

Subedi, A., Kunwar, B., Choi, Y., Dai, Y. T., van Andel, T., Chaudhary, R. P., de Boer, H. J., and Gravendeel, B. 2013. Collection and trade of wild-harvested orchids in Nepal. *Journal of Ethnobiology and Ethnomedicine* 9: 64.

### **History**

Koch, M. A., Schroder, C. N., Kiefer, M., and Sack, P. 2013. A treasure trove of plant biodiversity from the 20th century: the Werner Rauh Heritage Project at Heidelberg Botanical Garden and Herbarium. *Plant Systematics and Evolution* 299: 1793-1800.

Kumbaric, A., Savo, V., and Caneva, G. 2013. Orchids in the Roman culture and iconography: evidence for the first representations in antiquity. *Journal of Cultural Heritage* 14: 311-316.

### **Micropropagation/seed germination**

Aewsakul, N., Maneesorn, D., Serivichyaswat, P., Taluengjit, A., and Nontachaiyapoom, S. 2013. *Ex vitro* symbiotic seed germination of *Spathoglottis plicata* Blume on common orchid cultivation substrates. *Scientia Horticulturae* 160: 238-242.

Antony, J. J. J., Keng, C. L., Mahmood, M., and Subramaniam, S. 2013. Effects of ascorbic acid on PVS2 cryopreservation of *Dendrobium* Bobby Messina's PLBs supported with SEM analysis. *Applied Biochemistry and Biotechnology* 171: 315-329.

Bektas, E., Cuce, M., and Sokmen, A. 2013. *In vitro* germination, protocorm formation, and plantlet development of *Orchis coriophora* (Orchidaceae), a naturally growing orchid species in Turkey. *Turkish Journal of Botany* 37: 336-342.

da Silva, J. A. T. 2013. Impact of paper bridges, activated charcoal, and antioxidants on growth and development of protocorm-like bodies of hybrid *Cymbidium*. *In Vitro Cellular & Developmental Biology-Plant* 49: 414-420.

Decruse, S. W., Reny, N., Shylajakumari, S., and Krishnan, P. N. 2013. *In vitro* propagation and field establishment of *Eulophia cullenii* (Wight) Bl., a critically endangered orchid of Western Ghats, India through culture of seeds and axenic seedling-derived rhizomes. *In Vitro Cellular & Developmental Biology-Plant* 49: 520-528.

- Devi, H. S., Devi, S. I., and Singh, T. D. 2013. High frequency plant regeneration system of *Aerides odorata* Lour. through foliar and shoot tip culture. *Notulae Botanicae Hortobotanici Cluj-Napoca* 41: 169-176.
- Galdiano, R. F., Lemos, E. G. D., and Vendrame, W. A. 2013. Cryopreservation, early seedling development, and genetic stability of *Oncidium flexuosum* Sims. *Plant Cell Tissue and Organ Culture* 114: 139-148.
- Gantait, S. and Sinniah, U. R. 2013. Storability, post-storage conversion and genetic stability assessment of alginate-encapsulated shoot tips of monopodial orchid hybrid *Aranda Wan Chark Kuan 'Blue' × Vanda coerulea* Griff. ex Lindl. *Plant Biotechnology Reports* 7: 257-266.
- Gogoi, K., Kumaria, S., and Tandon, P. 2013. Cryopreservation of *Cymbidium eburneum* Lindl. and *C. hookerianum* Rchb.f., two threatened and vulnerable orchids via encapsulation-dehydration. *In Vitro Cellular and Developmental Biology-Plant* 49: 248-254.
- Hossain, M. M. and Dey, R. 2013. Multiple regeneration pathways in *Spathoglottis plicata* Blume - a study *in vitro*. *South African Journal of Botany* 85: 56-62.
- Hossain, M. M., Rahi, P., Gulati, A., and Sharma, M. 2013. Improved *ex vitro* survival of asymbiotically raised seedlings of *Cymbidium* using mycorrhizal fungi isolated from distant orchid taxa. *Scientia Horticulturae* 159: 109.
- Hu, W-H., Yang, Y-H., Liaw, S-I., and Chang, C. 2013. Cryopreservation of the seeds of a Taiwanese terrestrial orchid, *Bletilla formosana* (Hayata) Schltr. by vitrification. *Botanical Studies* 54: 33.
- Kabir, M. F., Rahman, M. S., Jamal, A., Rahman, M., and Khalekuzzaman, M. 2013. Multiple shoot regeneration in *Dendrobium fimbriatum* Hook., an ornamental orchid. *Journal of Animal and Plant Sciences* 23: 1140-1145.
- Mohanty, P., Paul, S., Das, M. C., Kumaria, S., and Tandon, P. 2012. A simple and efficient protocol for the mass propagation of *Cymbidium mastersii*: an ornamental orchid of northeast India. *AOB Plants*: pls023.
- Moreira, A. L., da Silva, A. B., Santos, A., dos Reis, C. O., and Landgraf, P. R. C. 2013. *Cattleya walkeriana* growth in different micropropagation systems. *Ciencia Rural* 43: 1804-1810.
- Paul, S. Kumaria, S., Tandon, P. 2012. An effective nutrient medium for asymbiotic seed germination and large-scale *in vitro* regeneration of *Dendrobium hookerianum*, a threatened orchid of northeast India. *AOB Plants*: plr032.
- Poobathy, R., Sinniah, U. R., Mahmood, M., and Subramaniam, S. 2013. Refinement of a vitrification protocol for protocorm-like bodies of *Dendrobium Sonia*-28. *Turkish Journal of Botany* 37: 940-949.



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Wu, R-Y., Chang, S-Y., Hsieh, T-F., and Chang, Y-S. 2013. Cryopreservation of *Bletilla formosana* seeds (Orchidaceae) by desiccation. *Scientia Horticulturae* 157: 108-112.

### **Molecular biology**

Bhattacharyya, P., Kumaria, S., Kumar, S., and Tandon, P. 2013. Start Codon Targeted (SCoT) marker reveals genetic diversity of *Dendrobium nobile* Lindl., an endangered medicinal orchid species. *Gene* 529: 21-26.

Chen, J-C., Lu, H-C., Chen, C-E., Hsu, H-F., Chen, H-H., and Yeh, H-H. 2013. The NPR1 ortholog *PhaNPR1* is required for the induction of *PhaPR1* in *Phalaenopsis aphrodite*. *Botanical Studies* 54: 31.

Chou, M-L., Shih, M-C., Chan, M-T., Liao, S-Y., Hsu, C-T., Haung, Y-T., Chen, J,J,W., Liao, D-C., Wu, F-H., and Lin, C-S. 2013. Global transcriptome analysis and identification of a CONSTANS-like gene family in the orchid *Erycina pusilla*. *Planta* 237: 1425-1441.

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Hsieh, M-H., Pan, Z-J., Lai, P-H., Lu, H-C., Yeh, H-H., Hsu, C-C., Wu, W-L., Chung, M-C., Wang, S-S., Chen, W-H., and Chen, H-H. 2013. Virus-induced gene silencing unravels multiple transcription factors involved in floral growth and development in *Phalaenopsis* orchids. *Journal of Experimental Botany* 64: 3869-3884.

Lin, C-S., Chen, J. J. W., Huang, Y-T., Hsu, C-T., Lu, H-C., Chou, M-L., Chen, L-C., Ou, C-I., Liao, D-C., Yeh, Y-Y., Chang, S-B., Shen, S-C., Wu, F-H., Shih, M-C., and Chan, M-T. 2013. Catalog of *Erycina pusilla* miRNA and categorization of reproductive phase-related miRNAs and their target gene families. *Plant Molecular Biology* 82: 193-204.

Salemme, M., Sica, M., Iazzetti, G., Gaudio, L., and Aceto, S. 2013. The AP2-like gene *OitaAP2* is alternatively spliced and differentially expressed in inflorescence

and vegetative tissues of the orchid *Orchis italica*. *PLOS ONE* 8(10): e77454.

### **Mycorrhiza**

Cowden, C. C. and Shefferson, R. P. 2013. Diversity of root-associated fungi of mature *Habenaria radiata* and *Epipactis thunbergii* colonizing manmade wetlands in Hiroshima Prefecture, Japan. *Mycoscience* 54: 327-334.

Kaushik, P. and Pal, P. 2013. Isolation of mycorrhizal fungi from roots of *Rhynchostylis retusa* Blume (Orchidaceae) from Dehradun. *Advances in Plant Sciences* 26: 137-139.

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Nurfadilah, S., Swarts, N. D., Dixon, K. W., Lambers, H., and Merritt, D. J. 2013. Variation in nutrient-acquisition patterns by mycorrhizal fungi of rare and common orchids explains diversification in a global biodiversity hotspot. *Annals of Botany* 111: 1233-1241.

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Umata, H., Ota, Y., Yamada, M., Watanabe, Y., and Gale, S. W. 2013. Germination of the fully myco-heterotrophic orchid *Cyrtosia septentrionalis* is characterized by low fungal specificity and does not require direct seed-mycobiont contact. *Mycoscience* 54: 343-352.

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