Biodivers Conserv (2014) 23:1215–1228
DOI 10.1007/s10531-014-0661-2

ORIGINAL PAPER

Eat your orchid and have it too: a potentially new conservation formula for Chinese epiphytic medicinal orchids

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Received: 27 November 2013 / Revised: 5 February 2014 / Accepted: 25 February 2014 /
Published online: 12 March 2014

Abstract About a quarter of Chinese wild orchid species are used in traditional medicine or as health food supplements. The market demand for some species, such as those in the epiphytic genus *Dendrobium*, has diminished many wild populations to local extinction or dangerously small numbers. Conservation of these heavily exploited orchids currently relies on a two-pronged approach: establishing nature reserves and encouraging massive commercial cultivation in artificial settings. We argue that these measures are not sufficient to restore or maintain healthy wild populations, and augmentation and reintroduction of these species in natural forests are needed. We argue for an unconventional reintroduction

Communicated by Danna J. Leaman.

Electronic supplementary material The online version of this article (doi: 10.1007/s10531-014-0661-2) contains supplementary material, which is available to authorized users.

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approach, in which populations planted in natural forests are allowed to be sustainably harvested (restoration-friendly cultivation). Because *Dendrobium* orchids are epiphytic, restoration-friendly cultivation of these species will not be at the expenses of other native plants. In addition, market premiums on wild-collected medicinal plants will generate incentives for farmers who participate in restoration-friendly cultivation to preserve natural forests. With proper policy and oversight, the restoration-friendly cultivation of medicinal *Dendrobium* orchids will facilitate the conservation of these threatened species, encourage protection of natural forests, and benefit marginalized rural communities. Adding this restoration-friendly cultivation into the current mix of conservation approaches has the potential to turn deeply-entrenched traditional uses of orchids from a conservation challenge to a conservation success.

Keywords Endangered species · Forest conservation · Karst region · Orchid conservation · Traditional Chinese Medicine · Economic incentive

Introduction

With an estimated 25,000 species, the Orchidaceae is among the most diverse flowering plant families known (Dixon et al. 2003). Chinese orchids, estimated to be at least 1,388 species, are important components of China's botanical diversity and of orchid diversity worldwide, with 491 spp. (35 %) known to be endemic (Chen et al. 2009). Habitat destruction and over collection for horticulture are threats common to wild orchids worldwide (Dixon et al. 2003). Threats from habitat destruction to biodiversity are especially acute in China because of the country's rapid economic growth and rural development in the past few decades (Liu et al. 2003).

A much less known threat to orchids of China is the 2000-year tradition in ethnobotanical use of orchid species in Traditional Chinese Medicine (TCM; Chinese Medicinal Material, INC. 1995). About 350 species (25 %) of Chinese orchids are used in TMC, 97 of which are Chinese endemics (Chen and Luo 2003; Liu et al. 2013). Many populations of these species have been exploited to local extirpation (Luo et al. 2003). For example, *Dendrobium catenatum*, known as 铁皮石斛 (pronounced as Tie Pi Shi Hu) in Chinese, is one of the most popular TCM herbs both in prescribed medicine and as a health food supplement (The State Pharmacopoeia Commission of P. R. China 2010). It is usually consumed directly as tea or mixed in soup. Its popularity started as tonic for traditional vocal artists to protect their voices and its use extended to cancer prevention and cure, as a boost to the immune system, and for other illnesses (The State Pharmacopoeia Commission of P. R. China 2010; Ng et al. 2012).

Wild populations of *D. catenatum* have declined rapidly due to overexploitation, as China's human population and purchasing power increased (Ding et al. 2009; Liu et al. 2011; Luo et al. 2013a). Known remaining populations of *D. catenatum* are small and sparsely distributed (Ding et al. 2008, 2009; Luo et al. 2013b). Several pockets of orchids that were under investigation suffer from extremely low pollinator visitation and fruit set, likely the result of too small a flowering display, with only a small number of open flowers in a given area in any given day during the flowering season (He et al. 2009).

In fact, more than 50 % of the 78 (14 endemic) Chinese species of *Dendrobium* (Zhu et al. 2009) are used in TCM for varying health purposes (Bao et al. 2001). Modern market demand for wild *Dendrobium* in China, many of which have showy flowers, is mostly for TCM. On the national scale, trade volume of medicinal *Dendrobium* spp. reached

600,000 kg fresh weight annually in the 1980s in China, all wild gathered (Bao et al. 2001), which has since declined due to exhaustion of natural populations. This phenomenon is also documented in the limestone regions of Guizhou and Guangxi that constitute the main traditional *Dendrobium* trading posts of China. In these regions, the trade volumes of several county level markets reached 10,000–40,000 kg each, annually in the 1980s and 1990s (Luo et al. 2013b; Editorial Board of Biodiversity in the Karst Area of Southwest Guangxi 2011). However, no large volume trade has been recorded in any of these markets in the late 2000s, and wild *Dendrobium* plants available in recent years have largely come from neighboring Vietnam and Laos (Editorial Board of Biodiversity in the Karst Area of Southwest Guangxi 2011). So this insatiable market demand has decimated accessible *Dendrobium* resources in China, and has started to impact wild populations in neighboring countries (Bao et al. 2001; Editorial Board of Biodiversity in the Karst Area of Southwest Guangxi 2011; Fig. 1a). This is also the case with many high profile medicinal plants and wildlife species (Zhang et al. 2008; Rosen and Smith 2010; Heinen and Shrestha-Acharya 2011; Dongol and Heinen 2012).

Globally, a few old and new measures have benefited orchid conservation. First of all, the establishment of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), in which all orchid species were listed, alleviates threats to wild

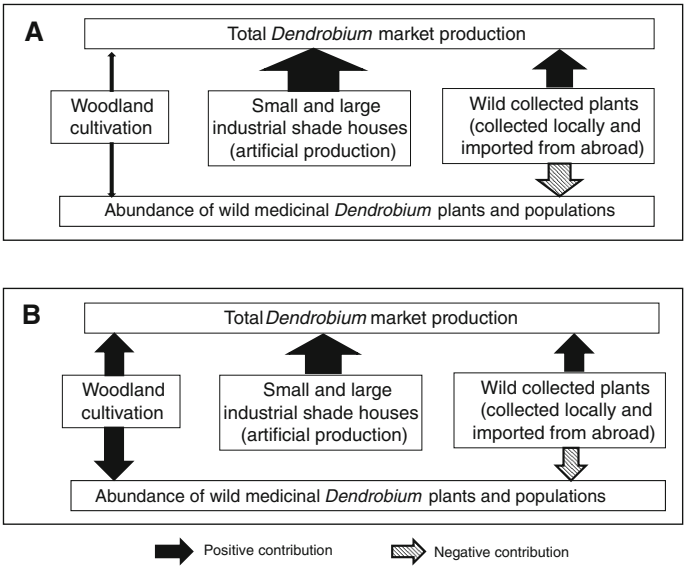

Fig. 1 Current (**A**) and desirable (**B**) conceptual states of *Dendrobium* cultivation and market status. Note: the thickness of the *arrows* indicate the magnitude of contribution. At the current state, Contribution to wild population abundance from woodland cultivation is small due to its small scale. In addition, harvest from wild plants and its negative impacts occur mostly outside of China as the Chinese domestic wild populations have been harvested exhaustively. At the desirable state, the scale of woodland cultivation is larger and so is its contribution to market and wild population restoration. As contribution from woodland cultivation to market increases, the market shares from shade house operations may shrink or stay the same, depending on whether the market is already saturated or not. In addition, woodland cultivation, subject to limitation on planting density as a measure to minimize negative impacts on the recipient forests (see text), large industrial shade house production should be maintained to meet the market demand. Finally, woodland cultivation would reduce the pressure on wild populations outside of China only partially since, at least at the moment, it is still cheaper to buy wild collected orchids in Laos, Myanmar, Vietnam etc. compared to artificially propagated plants from seeds

orchid populations due to horticultural trade between the orchid-rich developing countries to the orchid-hungry developed countries. In addition, development and perfection of artificial propagation of uniquely minute seeds of orchids has also reduced the demand on wild plants. Furthermore, establishment of protected areas have mitigated impacts of habitat deterioration and loss on ecosystem basis, within which orchids are part of. Finally, species reintroduction (sensu Menges 2008) has, on a few occasions thus far, helped restore orchid populations (Liu et al. 2012; Maschinski and Haskins 2012).

The purpose of this paper is to present the current conservation status of heavily exploited orchids in China, and to illustrate why the current conservation approach is inadequate for these species. Since our primary focus is the conservation of Chinese species that are consumed domestically, we will not discuss the function of CITES in this context. We make our case based on literature, formal and informal discussions with national and provincial officials and staff of nature reserves, and our field observations. We then describe a new cultivation mode, which takes advantage of the epiphytic trait of the medicinal *Dendrobium* orchids and reintroduces and/or augments them in natural forests (hereafter refer to as restoration-friendly cultivation). Restoration-friendly cultivation is unconventional endangered species reintroduction because it allows for sustainable harvest to address concerns of poaching and livelihood creation in and around nature reserves. We further demonstrate the ecological and conservation benefits of restoration-friendly cultivation of medicinal *Dendrobium* orchids. More importantly, we demonstrate that this cultivation mode not only enhances ecological value, but also provides much larger economic dividends than the cultivation of introduced *Eucalyptus* species, a popular cash crop that is incompatible with preservation of native biodiversity. We argue that incorporating restoration-friendly cultivation into the current conservation mix of approaches is probably better suited to the Chinese situation for biological sustainability, habitat conservation, poverty alleviation and meeting complex market demands. We also make specific management recommendations on how to make restoration-friendly cultivation work in practice.

Nature reserves and orchid protection—will establishing nature reserves save endangered orchids?

Establishing protected areas is the most important and proactive strategy for conservation purposes (Heinen 2012). The Chinese government has endorsed this strategy by setting up more than 335 national nature reserves, most within the last two decades (Xu et al. 2009; Zhang 2011). Many more nature reserves were established at the provincial and lower government levels.

Orchids in Chinese reserves

Judging by the species lists from nature reserves, the picture of orchid conservation in China looks quite optimistic. In a survey based on species lists, as 52 % of the Chinese orchid flora and 51 % of all Chinese endemic orchids were represented in at least one of the 543 (21 %) Chinese reserves included in the study (Qin et al. 2012). In the orchid-rich, tropical Hainan Island, all known native orchids of Hainan Island, including all known endemics, can be found in one or more of its protected areas (Song, X.-Q. Hainan University, personal communication; Francisco-Ortega et al. 2010). Similarly, at least 709 of the 760 species of

orchids of Yunnan, the most biologically diverse province of China, can be found in nature reserves of various kinds (Xu et al. 2010). Furthermore, China has one of the few national nature reserves in the world, i.e. the Yachang Orchid National Nature Reserve (hereafter refer to as the Yachang Reserve), that adopts orchid conservation as its main goal (Liu et al. 2009; Liu & Luo 2010). Nevertheless, with few exceptions, the population status of these orchids is poorly known (Francisco-Ortega et al. 2010; Xu et al. 2010).

We use the Yachang Reserve as an example throughout this article to illustrate our points as it has the explicit goal of orchid conservation. The Yachang Reserve is also a good representative of the key orchid conservation areas in China because it is located in the subtropical region of the country and is dominated by limestone. This region has the most orchid diversity in China (Cheng et al. 2009) and is considered to be a world orchid hotspot (Dixon et al. 2003).

A case in point, one of the most used orchids in TCM, *D. catenatum*, was one of the 140 species found in the Yachang Reserve. However, it has no known viable population within the reserve or in adjacent areas due most likely to over collection prior to the establishment of the reserve (Feng et al. 2012; unpublished data). Another case involves *Gastrodia eleta* (天麻,pronounced as Tian Ma in Chinese), another highly-priced TCM orchid, which is also on the species list of the Yachang Reserve but has no known viable population in the wild (Feng et al. 2012). In fact, it is so rare that when a colleague of ours needed to verify the existence of the species in the Yachang Reserve, he was led to a site with a few plants by a local farmer, only after he agreed to be blind folded so he would not be able to return (Feng, C.-L. Chinese Academy of Forestry, personal communication). These two cases illustrate the dire need for species restoration, via reintroduction and augmentation. Carrying out a conventional species reintroduction or augmentation (sensu Menges 2008) is not easy (Godefroid et al. 2011; Maschinski and Haskins 2012). Doing species restoration with taxa under very high market demand (and therefore high poaching risk) within the Chinese nature reserve system will have added challenges (below).

Managerial issues with chinese nature reserves that hinder conservation

A major obstacle facing Chinese reserves is insufficient funding by the central government (Han 2000; Liu et al. 2003; Zhou and Grumbine 2011), which distracts the nature reserves from its conservation missions (Heinen 2010, 2012). Nature reserves nationwide depend on managerial and local government entrepreneurial behavior for funding for staff support and other activities (Han 2000; Liu et al. 2003; Zhou and Grumbine 2011). This is the case with the Yachang Reserve. There is large-scale commercial orchid cultivation within the Yachang Reserve and *D. catenatum* is the main species cultivated (Fig. 2). The Yachang Reserve also sports an impressive tissue cultural facility, funded by the State Forestry Administration and the provincial Forestry Bureau, to propagate endangered orchids for restoration purposes (Tiangui Wu, The Yachang Reserve Administration, personal communication). However, the facility is being used primarily for the commercial *Dendrobium* operation. While large-scale shade house cultivation generates income for the Reserve, this mode of cultivation does not contribute to species restoration directly.

Another obstacle for Chinese reserve management is the complex relationship between nature reserves and local people. China adopted its protected areas system in the most strict sense, i.e. nature reserves allow minimal human interferences (Han 2000; Grumbine and Xu 2011). Yet, in practice, this concept has not worked well given the situation in rural China where large indigenous populations live in and around many Chinese reserves

Fig. 2 Large scale commercial artificial cultivation of the medicinal orchid *Dendrobium catenatum* in a shade house in the buffer zone of the Yachang Orchid National Nature Reserve. Photo credit: Hong Liu

(Harkness 1998; Han 2000; Jim and Xu 2003; Jiang 2005), and the complex physical mix of public, community and privately managed lands within many Chinese nature reserves (Han 2000; personal observations).

The Yachang Reserve is no exception. By Chinese standards, the Yachang Region is remote and sparsely populated (15 persons per km^2; Li et al. 2007). But this translates into more than 600 families and nearly 3,000 residents residing within the reserve, and double that amount in immediate adjacent areas. Community and private lands dotted within the reserve. These residents are mostly of the Zhuang and Yao ethnic minority groups. The income level of these residences is around ¥1,000 RMB (~$150) per year, about equal to the Chinese official poverty line (The Comprehensive Scientific Investigation Team of Guangxi Yachang Orchid Nature Reserve 2007). The county where the Yachang Reserve is located, as is the case of many counties in Karst dominated areas of China, is a national poverty county, a designation given by the Chinese central government for its extreme low average income (Zhangliang Chen, People's Government of Guangxi, personal communications). The limestone landscapes have fostered high levels of biological diversity, especially among orchids and a few other plant groups (Editorial Board of Biodiversity in the Karst Area of Southwest Guangxi 2011), but these landscape features also lead to limited arable land and low income for residents, thus promoting poverty. Ideally, any conservation strategy in this context must also include improving local income by allowing sustainable uses of important biotic resources.

Can massive commercial cultivation help to conserve threatened species?

Medicinal orchids are among the group of species whose wild existence is threatened by consumptive use in China. Encouraging artificial cultivation of plants or farming of animals to meet the market demand and thus reduce wild-collecting pressure, is a national conservation strategy adopted by the Chinese wildlife protection agencies (Staff of the China State Forestry Administration, personal communication). The efficacy of this

measure has been under intense debate (Kirkpatrick and Emerton 2009; Conrad and Conrad 2010). Regardless, motivated by market demands in the face of depleted natural resources, mass artificial cultivation of *Dendrobium* orchids, including that of *D. catenatum*, using modern in vitro seed germination and tissue culture techniques, was developed recently. This mass production, mostly done in industrial shade houses and currently estimated to be around 500 ha in area with a total market value of ¥250 billion RMB (US $39 billion), seems to have satisfied most of the market demand (Fig. 1A; Liu et al. 2011, 2013).

There are, however, two unsolved issues with this strategy. Firstly, the products of artificial cultivation, in contrast to ornamental orchids, are deemed inferior in quality as medicine and have a much lower market price than wild counterparts, as are the cases with many Asian medicinal plants (Heinen and Shrestha-Acharya 2011). *Gastrodia elata*, a threatened TCM orchid is a good example; mass artificial cultivation techniques were developed in the 1980s for *G. elata* (Liu et al. 2010), but collecting from the wild did not stop. Cultivation of medicinal plants under artificial conditions therefore cannot curb wild collecting pressures completely. Secondly, mass shade house operations are not designed for, and do not have a mechanism for, actively assisting wild population recovery (Fig. 1A). From the above discussion, we can clearly identify compelling reasons for alternative conservation strategies for these heavily exploited orchid species in China.

Restoration-friendly cultivation in natural settings: a new potential conservation tool

Because medicinal *Dendrobium* species are epiphytic and lithophytic (growing on bare rocks), they can be grown on tree trunks (Fig. 3A) or bare rocks (Fig. 3B) within natural forests. An emerging cultivation mode is doing exactly that. We term this restoration-friendly cultivation because the biological traits of *Dendrobium* spp. are such that individual plants can be harvested non-destructively, i.e. by taking only the older stems that have already flowered and fruited, thereby giving the planted individuals chances to recruit naturally in largely natural forests. Plants can be harvested annually in this manor for up to a decade (Liu et al. 2011).

The potential ecological benefits of restoration-friendly cultivation

The first and foremost benefit of restoration-friendly cultivation is restoration and sustainable harvest of depleted natural orchid resources. This will facilitate the recovery of wild populations by increasing population sizes directly and by allowing planted orchids to flower and recruit in the wild in due course. Restoration-friendly cultivation also encourages the conservation and restoration of native forests, because the medicinal *Dendrobium* orchids that are planted on tree trunks or on rocks within natural forests are valued more in the market than those grown in shade houses.

As such, cultivation of epiphytic *Dendrobium* in natural forests can help alleviate forest conversion pressure brought on by forest tenure reform in China that started in 2008 (Xu 2011).

Forest tenure reform has encouraged privatization of more than 100 million hectares of former collective forests (Xu 2011). While benefiting local economies, privatization also prompted concerns about biodiversity loss, as small landholders tend to cut down forests for immediate profit from timber and replace native forests with exotic trees of higher

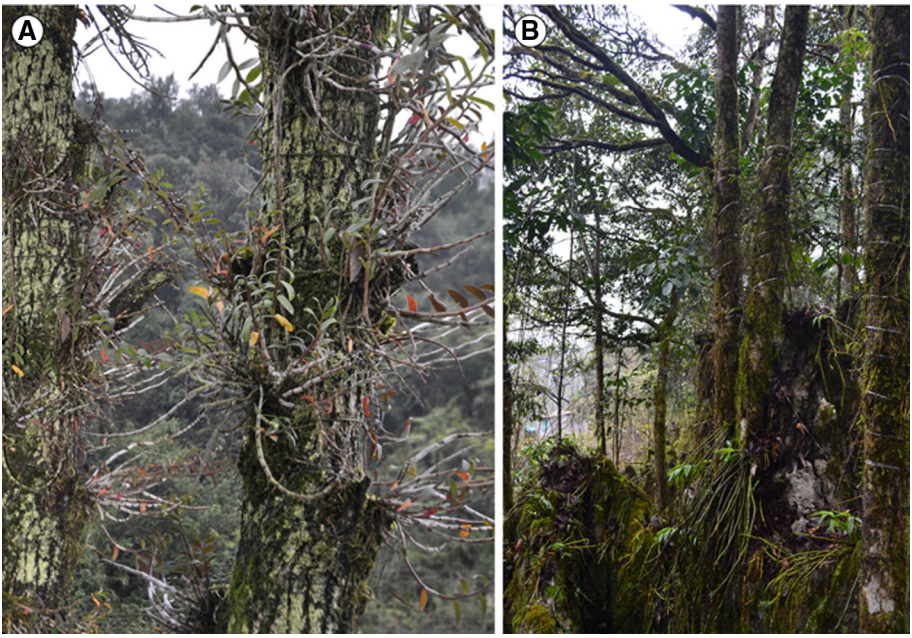

Fig. 3 Medicinal orchid *Dendrobium catenatum* were planted on native trees of *Castanopsis nigrescens* in a natural forest in the private forests within the Danxishan Geopark in Guangdong province (**A**), and *D. aduncum* on native trees of *C. fabri* and *Schima superma* and *D. nobile* on rocks of private land within the Malipo nature reserve in southeastern Yunnan province (**B**), in southern China. Photo credit: Zhong-Jian Liu

economic value that harbor little native diversity (Xu 2011). For example, Guangxi Province boasted 60 % forest coverage in 2011 (Guangxi Forestry Bureau Official Website: http://www.gxly.cn:8888/pub/cms/1/3537/3544/86963.html), but a third of this area was planted with non-native trees (Guangxi Forestry Bureau Official Website: http://www.gxly.cn:8888/pub/cms/1/3545/3559/3566/88981.html). In fact, Guangxi grows the majority of the Eucalyptus in China, partially the outcome of forest tenure reform (Guangxi Forestry Bureau Official Website: http://www.gxly.cn:8888/pub/cms/1/3537/3544/69239.html). Restoration-friendly orchid cultivation on privately held lands will provide owners with much greater economic incentives than other non-native forest products would, as indicated by the higher benefit-cost ratio of the restoration-friendly cultivation of *D. catenatum* (Table 1; Supplemental Table 1). Therefore, private orchid cultivation can be incorporated as part of a biodiversity-friendly management framework while forest tenure reform continues. This will promote conservation of the remaining natural habitats by offering a viable, profitable alternative to natural forest conversion (Table 1).

Incentives to preserve natural forests are especially needed in orchid-rich southwestern China, which is dominated by karst landscapes. Karst mountain ecosystems are inherently fragile because slopes are often steep, soils are scarce and of low fertility, and surface water can be scarce due to porous substrates (Jiang et al. 2008). Once damaged, such as by deforestation, karst ecosystems take a very long time to recover, resulting in rock desertification (Li and He 2002; Li et al. 2004; Su et al. 2006; Jiang et al. 2008; Zhou et al. 2010; Luo et al. 2013a). The limestone-dominated regions in Southwestern China are

Table 1 Comparison of initial investment, net present value, and benefit–cost ratio of restoration-friendly woodland cultivation, shade house cultivation of *Dendrobium catenatum* (tian-pi-shi-hu), and *Eucalyptus* plantation

Crop	Initial investment[a] (¥/mu)	Net present value[b] (at the end of 6 years) (¥/mu)	Benefit–cost ratio[c]
Woodland cultivation of *Dendrobium catenatum*	22,000	621,461	28.25
Shadehouse cultivation of *Dendrobium catenatum*	210,560	4,703,050	23.33
Eucalyptus sp. plantation	370	839	3.268

All monetary values are in Chinese Yuan RMB (¥) per mu. Calculations were based on crop rotation of 6-year and market prices of 2012 in Guangdong Province, China. ¥1 = US$0.1628; 1 mu = 0.0667 ha

[a] See supplemental Table 1 for more details on yearly economic costs and benefits

[b] Net present value is difference between the sum of discounted annual net benefits (for 6 years) and the initial investment

[c] Benefit–cost ratio is the ratio of the sum of discounted annual net benefits (for 6 years) to the initial investment

undergoing rapid changes due to the central government's, ''Great Western Development'' plan (Zhou and Grumbine 2011). Under population and development pressures, severe limestone desertification has occurred on more than half the total limestone areas in China (Jiang et al. 2008). Environmental degradation in these regions has made sustainable development and poverty alleviation more difficult. Many *Dendrobium* species, including *D. catenatum*, can also be grown, though may not be the optimal condition, on bare limestone rocks, so its cultivation can help to alleviate rock desertification.

Social benefits

Growing, tending and harvesting economic forests are labor intensive. This can be difficult for people in Yachang where a large proportion of young laborers have migrated to coastal regions to seek better incomes. Elders, women and children remain in the villages. Similarly, the industrial scale artificial cultivation operations described above, which demand very large initial investments (Table 1) and somewhat complex management, exclude the participation of villagers with limited education and financial means, other than perhaps being employed as cheap labor.

The proposed restoration-friendly orchid cultivation, with proper training and appropriate small loans, can be adopted by the marginalized populations of older and female rural residents in orchid hotspots because it requires non-intensive labor and smaller initial investments than shade house operations (Table 1). As mentioned above, these medicinal orchids command a high market value and can be harvested non-destructively for up to a decade or more in some species, allowing rural farmers to gain financial independence.

Potential pitfalls and possible ways to overcome them

There are three major potential pitfalls that may prevent the realization of the intended benefits of restoration-friendly cultivation. Firstly, seedlings of inappropriate genetic provenance are used such that species level genetic diversity is reduced or location adaption is lost or broken (Vallee et al. 2004; McKay et al. 2005). As a general guideline

we recommend that local sources should be used to preserve and restore possible local adaptations, as has been practiced at several locations where restoration-friendly cultivation has started (unpublished data). This is especially important for species with relatively wide natural distributions, such as *D. catenatum*, which are found in China and Japan, from the warm temperate region such as Zhejiang province to the subtropical Yunnan, Guizhou, Guangxi and Guangdong provinces. Population genetic studies revealed significant differences among populations across *D. catenatum*'s distribution range (Ding et al. 2008).

To address this issue, a product certification program can be created and administered by authorities to verify that seedlings and harvested products from restoration-friendly cultivation are of the correct species and genetic provenance (Fig. 4). On the other hand, considering that most existing pockets of populations are small and undergoing climate change, some mixing of populations of various distances should be experimented to increase the evolutionary potential of the restored populations (Frankham 1995; Maschinski et al. 2013).

Secondly, cultivation activities on existing natural forests may generate unintended impacts on recipient forests. For example, planting *Dendrobium* orchids may replace and limit natural recruitment of other epiphytic plants such as ferns, *Begonia* and *Gesneria*. In addition, periodic thinning of small trees and shrubs were observed in some locations to maintain a certain forest structure for *Dendrobium* cultivation. Furthermore, dense cultivation could require application of pesticides. To minimize such impacts, restoration-friendly cultivation should only be carried out on natural or semi-natural forests that are already prone to human activities, such as in many community and private forest patches within or close to nature reserves. These forests have been and will be impacted by forest tenure reform. The product certification program mentioned above could also be used to limit the impacts on restoration-friendly cultivation sites by managing planting density, maintaining a certain number of native trees, shrubs and herbs, and limiting pesticide use (Fig. 4). In contrast, in well-protected public forests, only conventional species reintroduction with no harvest agenda should be considered.

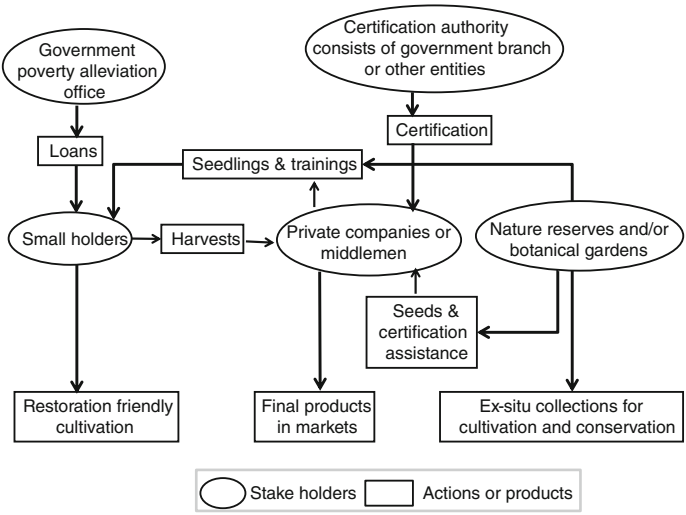

Fig. 4 Schematic mechanism in implementation of the restoration-friendly cultivation to realize the intended ecological and societal benefits. *Arrows* point to action recipients or outcomes

Thirdly, small holders, especially marginalized rural populations, may have difficulties purchasing relatively costly seedlings and finding appropriate markets. Chinese nature reserves in principle have obligations to assist local farmers to establish livelihoods that are consistent with natural resources conservation (Zhangliang Chen, Vice Governor of Guangxi, personal communication). Therefore, these nature reserves are in the right position to facilitate the implementation of biodiversity-friendly practices such as restoration-friendly cultivation. In the case of orchid cultivation it will be more practical for nature reserves, or certified private companies working with nature preserves, to acquire the facilities and investment needed to generate appropriate orchid seedlings (Fig. 4). They could also provide training in planting and harvesting techniques. Since botanical gardens have increasing roles and capacities in ex-situ plant conservation in general, they could partner with nature reserves to maintain ex-situ collections for restoration friendly cultivation, and to assist in the seed/plant source certification process (Fig. 4). In addition, the Chinese central government has a large budget for poverty alleviation programs, which can be tapped to provide loans to qualified farmers to participate in restoration-friendly cultivation (Fig. 4), as is the case in southwestern Guizhou province (Xiaoqing Luo, Guizhou Subtropical Crops Research Institute, personal communication). The product certification program can be designed to facilitate these processes.

Conclusion

It is well known that market demands for TCM have led to many high profile conservation problems, such as tiger, rhinoceroses, turtles, etc., poaching throughout Asia and other parts of the world (Lee et al. 1998; Zhang et al. 2008; Tilson and Nyhus 2010; Dongol and Heinen 2012). Many TCMs have no known medicinal properties to support their use, yet despite years of public education campaigns by international NGOs and the Chinese government, demands persist (Lee et al. 1998; Zhang et al. 2008; Tilson and Nyhus 2010; Dongol and Heinen 2012). For medicinal orchids such as *Dendrobium*, with research demonstrating mechanisms behind claimed medicinal functions (e.g. Ya et al. 2004), market demands will only grow.

Two key biological traits, i.e. being epiphytic (so that its cultivation will not be at the expenses of native trees) and having renewable stem growth (enabling non-destructive, multiple-year harvesting) render *Dendrobium* orchids ideal for restoration-friendly cultivation. Restoration-friendly cultivation should be implemented at relatively small scales, at selected locations as specified above, and should be managed with a product certification program. It can't and shouldn't replace shade house cultivation, which has been the major provider for the market in recent years, and this will continue (Fig. 1). Adding restoration-friendly cultivation to the current mix of conservation offers a scientific solution to the TCM conservation conflict that not only respects, but takes advantage of, deeply-entrenched traditions. Such a new solution to a persisting conservation issue also holds promise for other regions facing similar species conservation issues.

Acknowledgments We thank Hon. Zhang-Liang Chen, the Vice Governor of the People's Government of Guangxi for his unwavering support to biodiversity conservation. Mr. Changlin Feng of the Chinese Academy of Forestry is thanked for his assistance in information gathering during the preparation of this manuscript. We thank the Yachang Reserve Administration, including Directors Tiangui Wu, Shuwei Cai, and Vice Director Zuzhuang Zhao; also Zhenhai Deng, Shiyong Liu, Xinlian Wei, and other staff for their logistic support. This study was supported by grants from the National Key Project of Scientific and Technical Support Programs funded by the Ministry of Science & Technology of China

(No. 2012BAC01B05-3 to Yibo Luo), the Guangxi Chairman's Foundation (09203-04 to Hong Liu, Baoshan Chen and Yibo Luo), the Mohamed bin Zayed Species Conservation Fund (0905324 to Hong Liu and Yibo Luo), and Fairchild Tropical Botanic Garden (to Hong Liu).

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