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云南九种樟科植物种子的萌发及脱水耐性

杨娅娟, 郭永杰, 秦少发, 胡枭剑*
(中国科学院昆明植物研究所中国西南野生生物种质资源库, 昆明 650201)

摘要: 种子库是对野生植物进行长期迁地保存的重要手段, 但不适用于种子脱水敏感的植物。樟科植物中有不少为我国南方常见的重要经济林木, 许多种类具有较高的生态及经济价值, 但关于其种子萌发及脱水耐性等生物学方面的研究资料十分缺乏。本研究选取来源于5个属的9种樟科植物, 对其种子休眠及萌发特性进行了初步的研究并利用100粒种子法原理确定其脱水耐性。结果表明樟树(*Cinnamomum camphora*)种子可能具有中度生理休眠; 毛尖树(*Actinodaphne forrestii*)、倒卵叶黄肉楠(*Actinodaphneo bovata*)、米槁(*Cinnamomum migao*)、网叶山胡椒(*Lindera metcalfiana* var. *dictyophylla*)、香叶树(*Lindera communis*)及多果新木姜子(*Neolitsea polycarpa*)的种子具有浅生理休眠; 阴香(*Cinnamomum burmannii*)及粉叶楠(*Phoebe glaucophylla*)的种子可能不具有休眠。全部9种樟科植物种子在脱水到2.86%~7.16%含水量后均失去全部活力; 而保湿保存的种子含水量保持在17.32%~44.87%之间, 仍保持全部或大部分活力; 因此该研究涉及的9种樟科植物都是脱水敏感性种子, 不适合传统的种子库保存方法。

关键词: 樟科; 种子; 休眠; 萌发; 脱水耐性
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Seed Storage Behavior and Seed Germination of Nine Species of Lauraceae from Yunnan, China

YANG Ya-juan, GUO Yong-jie, QIN Shao-fa, HU Xiao-jian*
(*Germplasm Bank of Wild Species in Southwest of China*, *Kunming Institute of Botany*, *Chinese Academy of Sciences*, Kunming 650201, China)

Abstract: Seed banking following internationally agreed standards is an important way for preserving collections of wild plant species *ex situ*; but this method is not suitable for desiccation sensitive species. Lauraceae comprehends some of the dominant species in the evergreen broadleaved forest in the south of China and contains many species both of ecological and economical importance. However, study on seed biology such as germination and desiccation tolerance of this family is scarce. Seeds of 9 species from 5 genera of this family were collected and their dormancy status and germination requirement were studied; also their desiccation tolerance were determined using a modified 100-seed test. The results showed that seeds of *Cinnamomum camphora* probably have intermediate physiological dormancy; seeds of *Actinodaphne forrestii*, *Actinodaphne obovata*, *Cinnamomum migao*, *Lindera metcalfiana* var. *dictyophylla*, *Lindera communis* and *Neolitsea polycarpa* are non-deep physiological dormant; Seeds of *Cinnamomum burmannii* and *Phoebe glaucophylla* may have no or negligible dormancy. All 9 species lost seed viability after desiccated to 2.86% - 7.16% moisture content while still retained considerable viability with moisture content ranged from 17.32% to 44.87% after moist storage; thus seeds of the 9 species are all desiccation sensitive and can not be stored at the conventional seed bank conditions.

Key words: Lauraceae; Seed; Dormancy status; Germination; Desiccation tolerance

* Author for correspondence; E-mail: huxiaojian@mail.kib.ac.cn
Received date: 2015-06-11, Accepted date: 2015-10-19
作者简介: 杨娅娟(1986-)女, 助理工程师, 主要从事种子脱水耐性, 储藏习性等相关研究及工作。
E-mail: yangyajuan@mail.kib.ac.cn

Plant species in China as well as world wide are facing greater threat nowadays than during the recent geological past (Li and Pritchard, 2009). To counter this threat, both *in situ* and *ex situ* conservation measurements should be taken into account. In practice, seed banking following internationally agreed standards is mostly used to preserve collections *ex situ* (Li and Pritchard, 2009). Seed bank of the Germplasm Bank of Wild Species (GBOWS) in Kunming China aiming on the conservation of wild plant species of China, has preserved over 8 000 species with more than 30 000 collections by the end of 2014. The conventional way for seed banking is storage dry seeds (moisture content around 5%) at a cold temperature (around −20 ℃). However, this method is only effective for orthodox seeds which can be dried without damage, to low levels of moisture content, and their longevity increases with decrease in seed storage moisture content and temperature over a wide range (Roberts, 1973); for recalcitrant and some intermediate seeds which are desiccation sensitive to different extent, other ways of long term conservation such as cryopreservation have to be considered. Thus, determination of the seed desiccation tolerance of target species is essential for successful seed banking and *ex situ* conservation.

For determination of desiccation tolerance and storage behavior, Hong and Ellis (1996) had developed a very precise method, but it costs thousands of seeds. For tree species especially endangered tree species, it is difficult to collect enough seeds to conduct this experiment and often needs to compromise the wild population, also the large-screening of desiccation tolerance requires considerable human resource and consumables (Pritchard *et al.*, 2004). Prichard *et al.* (2004) devised a less complicated method to check the desiccation tolerance of several palm species using only 100 seeds. The basic idea is to compare the viability of both the freshly matured seeds and the moist stored seeds with seeds after desiccation. If the seeds after desiccation fail to germinate while the fresh and moist stored seeds have similar germination levels, the seeds are considered to be desiccation sensitive. This method can not determine species classed as intermediate, but for the seed bank (e. g. GBOWS) following the conventional seed storage protocol, it is a very useful and economical way for initial identification of desiccation sensitive seeds.

Lauraceae comprehends some of the dominant species in the evergreen broadleaved forest in the southwest of China (Li and Pritchard, 2009); this family is economically important as sources of medicine, timber, nutritious fruits and perfumes (Li *et al.*, 2008). However its seed biology is under-researched (Li and Pritchard, 2009), seed desiccation tolerance of many species are still unknown. Thus we collected 9 species from 5 genuses of this family. For 8 of the 9 species, seed germination requirement and desiccation tolerance had not been reported before.

To determine the seed desiccation tolerance, we adopted the basic principal of '100-seeds test' proposed by Prichard *et al.* (2004), but as we had some more seeds available, 3 replicates instead of 2 for the germination test were used, this allowed us to perform an one-way ANOVA test for the germination percentage data.

Before performing the '100-seeds test', it is desirable to find an effective way for obtaining a relatively high germination percentage as the indication of the seed viability first. Thus we also conducted an experiment to determine the temperature as well as hormone requirement for seed germination of the 9 species.

1 Materials and methods

1.1 Seed collection

Nine species from 5 genera of Lauraceae were collected during November, 2011, from different locations of Yunnan Province, China (Table 1).

All collections were transported to the GBOWS within 1 week. After cleaning, all collections were put in a room with a relative humidity (RH) of (75 ± 10) % and a temperature of (15 ± 3) ℃ until the

Table 1　Collection information of the 9 Lauraceae species

Species	Date of collection	Locality	Altitude/m
Actinodaphne forrestii	2011-11-6	Malipo, Wenshan, Yunnan, China	1450
A. bovata	2011-11-7	Malipo, Wenshan, Yunnan, China	1139
Cinnamomum burmannii	2011-11-7	Simao, Puer, Yunnan, China	1400
C. camphora	2011-11-7	Simao, Puer, Yunnan, China	1966
C. migao	2011-11-7	Malipo, Wenshan, Yunnan, China	1320
Lindera communis	2011-11-6	Xishan, Kunming, Yunnan, China	1450
L. metcalfiana var. *dictyophylla*	2011-11-3	Malipo, Wenshan, Yunnan, China	1400
Neolitsea polycarpa	2011-11-7	Malipo, Wenshan, Yunnan, China	1320
Phoebe glaucophylla	2011-11-6	Malipo, Wenshan, Yunnan, China	1200

start of the experiment, both of the desiccation treatment and germination test started within 1 week.

Initial moisture content (MC) was determined using 10 replicates with 1 seed for each replicate. Fresh seeds were weighed by an electronic balance (0.00001 g) and the dry weight was obtained using the same balance after seeds were dried at 103 ℃ for 17 hours (ISTA, 1999).

1.2　Germination of the freshly matured seeds

The germination test of the freshly matured seeds was conducted under 20, 25, 30 and 25/10 ℃ (night/day), the photoperiod was 12 h light with 22.2 μmol·$m^{-2}s^{-1}$ illumination by cool white fluorescent light and 12 h dark. A gibberellic acid (GA_3) treatment of 200 mg·L^{-1} was also used for each temperature excluding 25/10 ℃. In each treatment, 3 replicates of 25 seeds were used. The germination medium was 1% agar/water or 1% agar/water with 200 mg·L^{-1} GA_3. The germination was checked every 7 days and a seed with a radical more than 2 mm was considered to be germinated, and the germination test was terminated if no germination was recorded for consecutive 4 weeks. At the point of termination, ungerminated seeds were cut through; empty seeds were excluded for the calculation of germination percentage.

1.3　Desiccation and moist storage protocol

The desiccation of seeds were conducted by mixing seeds with an equal weight of silica gel in a plastic box sealed with an air-tight lid at 15 ℃. The equilibrium relative humidity (eRH) of the seeds were measured every 2 days using a Rotronic HC2-AW probe attached to a HygroLab C1 unit (Rotronic Ltd., Crawley, UK), the silica gel was changed after the measurement of eRH, once it equaled to or below 15%, the desiccation process was terminated and the moisture content was determined using the same method as the determination of initial moisture content. Also 3 replicates of 25 seeds were used for the germination test with the best temperature and hormone combination obtained from the germination test of freshly matured seeds mentioned above.

Once the desiccation process finished, seeds of the same species moist stored were also taken out for MC determination and germination test which follow the same protocol of the desiccated seeds.

1.4　Statistical analysis

Moisture content (MC) was calculated as:

$$MC = (FW-DW)/FW$$

Where FW is the fresh weight and DW is the dry weight.

Germination percentage (GP) and mean germination time (MGT) was calculated as:

$$GP = \sum n_i / N$$

$$MGT(\text{days}) = \sum (t_i * n_i) / \sum n_i$$

Where t_i is the number of days from experiment starting, n_i is the number of seeds germinated at each checking day and N is the total number of seeds tested.

For freshly matured seeds, we analyzed the germination percentages and mean germination time using a univariate General Linear Model to test the effect of temperature; a Student-Newman-Keuls (S-N-K) post-hoc test was applied for multiple comparisons between different temperatures; while a T test

was applied for the effect of GA_3 at each temperature excluding 25/10 ℃.

For seeds that desiccated and moist stored, we compared the germination percentage with the initial germination percentage of the freshly matured seeds by applying an one way ANOVA with a Student-Newman-Keuls (S-N-K) post-hoc test.

The percentage data were arcsine transformed before analysis. Differences obtained at a level of $P<0.05$ were considered to be significant. All statistical analysis was carried out by SPSS 16.0 (Chicago, IL, USA).

2 Results

2.1 Moisture content

Ranges of the moisture contents of the freshly matured seeds, seeds after desiccation and seeds after moist storage are 14% to 45%, 2.86% to 7.16% and 17.32% to 44.87% respectively (Table 2).

2.2 Germination of freshly matured seeds

Five of total 9 species achieved a relatively high germination percentage (over 80%) of freshly matured seeds; while 2 species germinated to 60% – 70% and the other 2 species germinated around 45%. Though most of them germinated readily at 20 or 25/10 ℃, the optimal germination temperature varied among different species (Table 3).

The effect of GA_3 also varied among different species, for it promoted GP and reduced MGT both significantly for seeds of *C. migao* and *L. metcalfiana* var. *dictyophylla*, while no significant effect was shown on GP or MGT on *C. camphora* and *P. glaucophylla*. For *A. obovata* and *L. communis* GA_3 only promoted germination percentage at some temperatures while for *N. polycarpa* only MGT was reduced significantly by GA_3 at 20 ℃. There was also a significantly negative effect of GA_3 on *C. burmannii* at 25 ℃, and MGT was slightly reduced by GA_3 at 20 ℃ (Table 3 and 4).

2.3 Response to desiccation and moist storage

Moist stored seeds of the 2 *Actinodaphne* species and *L. metcalfiana* var. *dictyophylla* germinated equally to freshly matured seeds while no seed germinated after desiccation. The rest 6 species showed significant reduction after moist storage, but still retained the ability to germinate while no germination occurred after desiccation (Table 2).

3 Discussion

Though there was a significant reduction of MGT by GA_3 at 20 ℃ for seeds of *C. burmannii*, but the germination was checked every 7 days, the difference between the two MGT data was within 7 days, so this difference could be due to systematic error and had no significant biological meaning; thus we speculated that seeds of *C. burmannii* and *P. glaucophylla* may have no or negligible dormancy, for they germinated readily at some temperatures and GA_3 had no effect on either GP or MGT. Seeds of *C. camphora*

Table 2 Effects of desiccation and moist storage on seed germination of the 9 Lauraceae species

Seed lot	Fresh		Desiccation		Moist storage	
	Moisture content/%	Germination /%	Moisture content/%	Germination /%	Moisture content/%	Germination /%
Actinodaphne forrestii	43.54 ± 5.89	93.33 ± 11.55a	5.73 ± 1.20	0c	35.00 ± 2.09	86.67 ± 8.32a
A. obovata	45.85 ± 4.73	84.33 ± 15.01a	3.49 ± 0.35	0c	44.87 ± 7.01	77.67 ± 4.04a
Cinnamomum burmannii	25.85 ± 1.14	96.00 ± 4.00a	3.69 ± 1.03	0c	17.32 ± 1.68	64.00 ± 4.00b
C. camphora	26.32 ± 1.08	70.67 ± 4.62a	3.56 ± 1.08	0c	21.30 ± 1.35	45.33 ± 2.31b
C. migao	35.02 ± 4.41	60.00 ± 8.00a	2.86 ± 0.27	0c	19.52 ± 7.04	49.33 ± 8.33b
Lindera communis	23.24 ± 11.45	44.00 ± 4.00a	3.69 ± 0.85	0c	23.61 ± 8.86	29.33 ± 2.31b
L. metcalfiana var. *dictyophylla*	24.79 ± 5.73	48.00 ± 22.27a	6.31 ± 3.81	0c	26.56 ± 11.87	30.66 ± 12.22a
Neolitsea polycarpa	24.04 ± 6.86	80.00 ± 10.58a	2.87 ± 0.32	0c	19.52 ± 7.04	52.00 ± 10.58b
Phoebe glaucophylla	37.99 ± 3.56	92.00 ± 10.58a	7.16 ± 0.45	0c	43.57 ± 7.53	68.00 ± 6.93b

Data are means ± standard deviation. Different letters represent significant different treatment means (within the same species) by S-N-K test at 5% level of significance

Table 3　Effects of different treatments on germination percentage (%) of freshly matured seeds of 9 Lauraceae species at different temperatures

Species	Temprature/℃	GA_3 solution concentration/mg·L^{-1}		Total by temprature
		0	200	
Actinodaphne forrestii	20	33.33 ± 6.11	49.33 ± 10.06	41.33 ± 11.50a
	25	77.33 ± 8.33	90.67 ± 10.07	84.00 ± 11.03b
	30	28.00 ± 2.00	58.76 ± 10.06	43.33 ± 21.97a
	25/10	93.33 ± 11.55	—	93.33 ± 11.55b
	Total by treatment	58.00 ± 31.15	66.22 ± 20.70	—
A. obovata	20	51.00 ± 10.15	73.33 ± 6.51*	62.17 ± 14.41ab
	25	66.67 ± 23.71	84.33 ± 15.01	75.50 ± 20.22b
	30	17.67 ± 30.60	46.67 ± 43.84	32.17 ± 37.36ac
	25/10	0	—	0c
	Total by treatment	33.83 ± 32.39	68.11 ± 28.79	—
Cinnamomum burmannii	20	96.00 ± 4.00	96.00 ± 4.00	96.00 ± 3.58a
	25	90.67 ± 2.31	70.67 ± 4.62*	80.67 ± 11.43b
	30	0	0	0c
	25/10	0	—	0c
	Total by treatment	46.67 ± 48.82	55.56 ± 43.19	—
C. camphora	20	0	2.67 ± 2.31	1.33 ± 2.07a
	25	1.33 ± 2.31	2.67 ± 2.31	2.00 ± 2.19a
	30	17.33 ± 2.31	21.33 ± 12.86	19.33 ± 8.55b
	25/10	70.67 ± 4.62	—	70.67 ± 4.62c
	Total by treatment	16.57 ± 24.44	8.89 ± 11.45	—
C. migao	20	24.00 ± 16.00	29.33 ± 2.31	26.67 ± 10.63a
	25	12.00 ± 6.93	32.00 ± 10.58	22.00 ± 13.56a
	30	5.33 ± 2.31	60.00 ± 8.00*	32.67 ± 30.40a
	25/10	28.00 ± 8.00	—	28.00 ± 8.00a
	Total by treatment	17.33 ± 12.57	40.44 ± 16.18	—
Lindera communis	20	0.08 ± 0.00	44.00 ± 4.00*	26.00 ± 19.88a
	25	12.00 ± 6.93	22.67 ± 15.14	17.33 ± 12.04a
	30	0	0	0b
	25/10	0	—	0b
	Total by treatment	5.00 ± 6.18	22.22 ± 20.60	—
L. metcalfiana var. *dictyophylla*	20	33.33 ± 16.65	48.00 ± 22.27	40.67 ± 19.34a
	25	5.33 ± 4.62	14.67 ± 4.62	10.00 ± 6.57b
	30	0	10.67 ± 2.31*	5.33 ± 6.02b
	25/10	12.00 ± 6.93	—	12.00 ± 6.93b
	Total by treatment	12.67 ± 15.43	24.44 ± 21.11	—
Neolitsea polycarpa	20	80.00 ± 10.58	77.33 ± 14.05	78.67 ± 11.22a
	25	40.00 ± 14.42	36.00 ± 0.00	38.00 ± 9.38b
	30	0	4.00 ± 6.93	2.00 ± 4.90c
	25/10	45.33 ± 22.03	—	45.33 ± 22.03b
	Total by treatment	41.33 ± 32.01	39.11 ± 32.79	—
Phoebe glaucophylla	20	72.00 ± 6.93	74.67 ± 12.22	73.33 ± 9.04a
	25	54.67 ± 4.62	50.7 ± 6.11	52.67 ± 5.31b
	30	12.00 ± 12.00	26.67 ± 12.86	19.33 ± 13.72c
	25/10	92.00 ± 10.58	—	92.00 ± 10.58d
	Total by treatment	57.67 ± 31.75	50.67 ± 22.80	—

Data are means ± standard deviation. Asterisk (*) represents the significant effect of GA_3 treatment. Different letters represent significant different temperature means (within the same species) by S-N-K test at 5% level of significance. Dash (—) represents data unavailable

Table 4 Effects of different treatments on mean germination time (days) of freshly matured seeds of the 9 Lauraceae species at different temperatures

Species	Temprature/℃	GA_3 solution concentration/mg·L^{-1}		Total by temprature
		0	200	
Actinodaphne forrestii	20	155.33 ± 22.68	65.14 ± 8.66*	110.23 ± 51.73a
	25	95.01 ± 10.89	41.44 ± 0.74*	68.22 ± 30.14b
	30	58.50 ± 9.96	44.38 ± 3.76	51.44 ± 10.25c
	25/10	85.49 ± 0.70	—	85.49 ± 0.70d
	Total by treatment	98.58 ± 38.73	50.32 ± 12.15	—
A. obovata	20	108.76 ± 16.74	104.58 ± 27.90	106.67 ± 20.70a
	25	100.36 ± 60.18	54.17 ± 5.25	77.27 ± 45.83ab
	30	28.00 ± 48.50	33.79 ± 29.26	30.89 ± 35.96bc
	25/10	—	—	—
	Total by treatment	59.28 ± 59.08	64.18 ± 37.57	—
Cinnamomum burmannii	20	38.12 ± 0.81	32.19 ± 0.68*	35.15 ± 3.32a
	25	27.68 ± 1.10	29.26 ± 2.54	28.47 ± 1.95b
	30	—	—	—
	25/10	—	—	—
	Total by treatment	16.45 ± 17.62	20.48 ± 15.47	—
C. camphora	20	—	14.00 ± 12.12	7.00 ± 10.84a
	25	9.33 ± 16.16	18.67 ± 16.16	14.00 ± 15.34a
	30	35.93 ± 1.61	43.68 ± 7.64	39.81 ± 6.51b
	25/10	136.97 ± 14.64	—	136.97 ± 14.64c
	Total by treatment	45.56 ± 57.58	25.45 ± 17.54	—
C. migao	20	122.42 ± 41.00	50.12 ± 12.60*	57.71 ± 57.23a
	25	33.73 ± 5.47	28.19 ± 1.47	30.96 ± 4.69b
	30	71.17 ± 10.10	84.25 ± 30.64	77.71 ± 21.63a
	25/10	137.33 ± 10.60	—	137.33 ± 10.60c
	Total by treatment	89.78 ± 48.80	56.03 ± 27.93	—
Lindera communis	20	63.00 ± 14.00	102.83 ± 8.23*	82.92 ± 24.11a
	25	36.40 ± 13.50	53.28 ± 5.51	44.84 ± 13.06b
	30	—	—	—
	25/10	—	—	—
	Total by treatment	24.85 ± 28.96	52.04 ± 44.81	—
L. metcalfiana var. *dictyophylla*	20	85.63 ± 9.86	54.08 ± 13.82*	69.86 ± 20.34a
	25	33.83 ± 31.76	35.00 ± 7.00	34.42 ± 20.58b
	30	—	28.00 ± 0.00*	14.00 ± 15.34c
	25/10	44.10 ± 5.28	—	44.10 ± 5.28b
	Total by treatment	40.89 ± 34.99	39.03 ± 14.02	—
Neolitsea polycarpa	20	150.57 ± 3.24	118.58 ± 4.19*	134.58 ± 17.84a
	25	88.35 ± 7.23	75.70 ± 8.57	82.03 ± 9.91b
	30	—	18.67 ± 32.33	9.33 ± 22.86c
	25/10	135.15 ± 13.97	—	135.15 ± 13.97a
	Total by treatment	93.52 ± 61.64	70.98 ± 46.57	—
Phoebe glaucophylla	20	57.15 ± 5.86	52.41 ± 3.09	54.78 ± 4.93a
	25	42.23 ± 3.13	39.02 ± 7.75	40.62 ± 5.57b
	30	19.05 ± 16.51	30.11 ± 5.05	24.58 ± 12.49c
	25/10	81.93 ± 3.64	—	81.93 ± 3.64d
	Total by treatment	50.09 ± 25.09	40.51 ± 10.88	—

Data are means ± standard deviation. Asterisk (*) represents the significant effect of GA_3 treatment. Different letters represent significant different temperature means (within the same species) by S-N-K test at 5% level of significance. Dash (—) represents data unavailable

was reported to be physiological dormant, and need cold stratification for 4 months as well as a H_2O_2 treatment (Chien and Lin, 1999); in this study, seeds have no response to GA_3, so we speculated that they were intermediate dormant according to the classification system of Baskin and Baskin (2004). For the rest 6 species, due to their positive response to GA_3, we infer that they have non-deep physiological dormancy (Baskin and Baskin, 2004). However, determination of dormancy type was not the main purpose of this study, the primary aim for conducting germination experiment was to obtain an acceptable germination as a parameter for the testing of seed viability; more detailed work still need to be done for the 2 *Lindera* species and *C. migao* to optimize the germination.

To date, only one *Cassytha* species from Australia is confirmed to be desiccation tolerant in the family of Lauraceae (Royal Botanic Gardens Kew, 2015); and different genera are unevenly studied. For genera of *Actinodaphne* and *Phoebe*, no data is available for any species. Our data on the 2 species from *Actinodaphne* and 1 species of *Phoebe* showed all of them are desiccation sensitive. *Cinnamomum* is the most intensively studied genus of this family and 3 species were confirmed to be recalcitrant (Royal Botanic Gardens Kew, 2015). Probably due to its relatively wide distribution and economical importance, *C. camphora* is one of the most studied species of the family. Different researches implied different desiccation tolerance. Study on collection from Nepal showed seeds still retained some germinibility after dry stored at ambient temperatures for 6 or 12 months, but exact moisture content was not stated (Campbell, 1980). Chien and Lin (1999) desiccated seeds collected from Taiwan province to 6.7%, a large portion of the desiccated seeds survived after 12 months of storage at 5 ℃ or 15 ℃ but lost viability after 1 month at −20 ℃, thus they classified the seeds of *C. camphora* as intermediate. In this study, moisture content was reduced to 3.56% and all seeds lost viability. The different response could be due to different levels of desiccation, however, origin of collection could also be a factor (Hong and Ellis, 1996). Similar result was shown for *Camellia sinensis*, desiccation tolerance differed between collections from different sites, but non of them survived −20 ℃ (Chen *et al.*, 2012). Though the exact storage behavior of this specie is still unclear, based on the current data, we consider seeds of *C. camphora* can not be stored under the conventional seed bank condition (i.e. 5% MC at −20 ℃).

For the rest of the two *Cinamomum* species studied here, significant reduction were shown on GP after moist storage, we speculated the loss of viability could be due to the reduction of the moisture content, and loss of viability with time during moist storage could also be a reason; however, more than 45% of seeds still retained their viability whilst no germination occurred after desiccated to a MC below 5%; these two species can be classified as desiccation sensitive.

The two species from genus *Lindera* in this study are also desiccation sensitive, another species *L. megaphylla* is classified as intermediate (Royal Botanic Gardens Kew, 2015). For the two species of *Neolitsea* with known storage behavior, one is classified as recalcitrant and another intermediate (Royal Botanic Gardens Kew, 2015). In this study, seeds of *N. polycarpa* showed a significant reduction after moist storage, but still retained more than 50% germinibility while no germination occurred after desiccation to 2.87% MC; thus we consider this species to be desiccation sensitive.

Though the result of this research did not fit perfectly into the 3 categories showed in the article of Prichard *et al.* (2004), the effect of moisture content on seed viability can be distinguished, for all the 9 species of Lauraceae, no germination occurred after desiccation while still considerable germinability retained after moist storage of the same period. According to the principle of '100-seeds test', all these 9 species of Lauraceae can be classified as desiccation sensitive.

Based on the current data on seed desiccation tolerance of Lauraceae, only one species from the genus *Cassytha* L. was confirmed to be desiccation tolerant, and species of this genus are different in being parasitic vines with other tree of shrub species of this family. Only one *Cassytha* species distributed in China, and its desiccation tolerance is unknown. As this family is both ecologically and economically important, more detailed work should be done on its seed biology in the future.

In conclusion, seeds of *C. burmannii* and *P. glaucophylla* may have no or negligible dormancy, seeds of *C. camphora* may be intermediate physiological dormant, while seeds of *A. forrestii*, *A. obovata*, *C. migo*, *L. communis*, *L. metcalfiana* var. *dictyophylla* and *P. glaucophylla* are probably non-deep physiological dormant. Seeds of the 9 Lauraceae species are all discussion sensitive, thus can not be preserved by the conventional seed bank, other methods for long term conservation *ex situ* such as cryo-preservation should be considered.

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