

•研究报告•

比较不同DNA条形码对中国海岸带耐盐植物的识别率

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摘要: 海岸带耐盐植物是一个生态和经济价值独特的庞杂类群, 人们对其DNA条形码特性的了解甚少。本文对我国从辽宁到海南10个沿海省(市)大陆及岛屿海岸带耐盐植物广泛采样, 从采集获得的样品中筛选出53科97属116个物种共562个样品进行DNA条形码研究。对3个叶绿体片段(*matK*、*rbcL*、*trnH-psbA*)和1个核基因片段(ITS)进行了扩增和测序, 统计各个片段的引物通用性和序列获得率, 并检验了物种识别率。从序列获得率来看, *matK*和*trnH-psbA*片段表现最好, ITS较差, ITS和*matK*的引物通用性比其他2个片段差。序列相似性分析表明, 单个片段ITS物种识别率最高(73.36%), 其次为*matK* (64.03%) and *trnH-psbA* (61.21%), *rbcL*的物种识别率最低, 仅为46.41%。系统发育树分析显示*matK*的物种识别率最高(82.3%), 依据*trnH-psbA*片段难以获得可靠的系统发育树。多维度非度量分析(non-metric multidimensional scaling, NMDS)表明在进行海岸带区域性植物的DNA条形码研究时, 叶绿体片段和核基因片段均应该考虑。综合上述研究结果, 推荐联合片段ITS + *matK*作为中国海岸带耐盐植物DNA条形码。本文为海岸带耐盐植物研究提供了总计1,939条DNA条形码基础数据, 为构建耐盐植物DNA条形码数据库奠定了基础。

关键词: DNA条形码; 海岸带; 耐盐植物; 物种识别率; ITS; *matK*

Comparison of species resolution rates of DNA barcoding for Chinese coastal halo-tolerant plants

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Abstract: Halo-tolerant plants compose a huge group of plants with unique ecological and economical value. Little is known about their DNA barcoding speciality. In this study, 562 samples of coastal halo-tolerant plants (including 53 families, 97 genera and 116 species) were collected from 10 coastal provinces, ranging from Liaoning to Hainan. Three chloroplast DNA markers (*matK*, *rbcL* and *trnH-psbA*) and one nuclear DNA marker (ITS) were amplified and sequenced. Primer universality and sequence availability of each locus were examined and species resolution rates were tested. When considering sequence availability, *matK* and *trnH-psbA* were among the best. But the primer universality of ITS was marginally worse than expected. The all-to-all BLASTn searches indicated that the species resolution rate of ITS was the highest (73.36%), followed by those of *matK* (64.03%), *trnH-psbA* (61.21%) and *rbcL* (46.41%). Phylogenetic trees (NJ trees) indicated that the species resolution rate of *matK* was the highest (82.3%), but no reliable NJ tree based on *trnH-psbA* could be acquired because of unequal sequence length. NMDS and PCoA results demonstrated that both chloroplast DNA markers and nuclear DNA markers should be considered when conducting coastal plant DNA barcoding studies. Based on the above results, we suggest that the combination of ITS + *matK*

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should be regarded as the barcode for halo-tolerant plants in Chinese coastal regions. In total, the 1939 newly acquired sequences in this study lay the foundation for a DNA barcode database of coastal halo-tolerant plants.

Key words: DNA barcoding; coastal region; halo-tolerant plants; species resolution rate; ITS; *matK*

耐盐植物包括盐生植物(赵可夫和李法曾, 1999; 林鹏, 2006)和一些能在盐渍生境正常生长的非盐生植物, 如在海岸高潮带附近盐渍化生境中的白茅(*Imperata cylindrica*)、芦苇(*Phragmites australis*)及海杧果(*Cerbera manghas*)等(王文卿, 2013)。据统计, 我国海岸带耐盐植物约有517种(陈兴龙等, 1999)。以耐盐植物为主体形成的海岸带近海湿地生态系统, 是全球单位面积生态服务功能最高的生态系统之一。它们极高的初级生产力和营养循环能力对海岸水体的物理、化学和生物环境带来了深远的影响(Short et al, 2007; Gedan et al, 2011; Sandilyan & Kathiresan, 2012)。然而沿海地区众多环境问题的出现, 造成海岸湿地面积衰减迅速(Waycott et al, 2009), 植物物种多样性也受到显著影响(Molnar et al, 2008; Seebens et al, 2013), 因此对耐盐植物的生物多样性保护工作十分迫切。

DNA条形码技术已经有十多年的发展历史(Hebert et al, 2003; CBOL Plant Working Group, 2009; China Plant BOL Group, 2011), 但比较、推荐合适的DNA条形码片段依然有大量的工作有待完成(Kress et al, 2010; Hollingsworth, 2011; Li et al, 2012; Braukmann et al, 2017)。早期的研究工作多关注特定分类单元的最适DNA条形码筛选, 在特定分类单元或不同谱系中, 物种识别率的差异主要归因于不同类群的进化历史(Ebihara et al, 2010; Hollingsworth et al, 2011)。将DNA条形码技术引入群落生态学和区系地理学中, 是系统发育生物学、生态学与条形码技术的交叉融合, 已成为近年来新的研究热点(Kress et al, 2015; 李德铎和曾春霞, 2015; Pei et al, 2017)。对于区域性植物的DNA条形码研究, 目前较多地集中在热带森林及亚热带森林(Gonzalez et al, 2009; Kress et al, 2009; Parmentier et al, 2013; Liu et al, 2015), 与此同时, 一些重要区域的植物DNA条形码库逐渐形成和充实(Burgess et al, 2011; Costion et al, 2011; De Vere et al, 2012; Parmentier et al, 2013)。由此, DNA条形码不仅可作为一种快速识别物种的方法, 也为快速评价和保护特

定区域的生物多样性提供了工具。

海岸带耐盐植物中有许多类群形态学鉴定难度较大, 如米草属(*Spartina*) (Baumel et al, 2001)、藜属(*Chenopodium*) (Bera et al, 1993; Rana et al, 2012)、碱蓬属(*Suaeda*) (Chu et al, 2003)、川蔓藻属(*Ruppia*) (Ito et al, 2010; Triest & Sierens, 2010)等。但仅有少数滨海耐盐植物类群有DNA条形码的研究报道(Schwarzbach & Ricklefs, 2000; Bafeel et al, 2012; Lucas et al, 2012; Munir et al, 2015)。同时由于其生境位于海陆交界处, 交通不便, 进行海洋生物(如海草、红树植物等)条形码研究时, 陆生耐盐植物经常被忽略(Trivedi et al, 2016); 而进行陆生植物相关研究时, 滨海耐盐植物同样难以得到重视(Bafeel et al, 2012; Lucas et al, 2012; Munir et al, 2015)。因此, 本文重点关注我国滨海海洋湿地生态系统中耐盐植物DNA条形码的获取及其物种识别率分析比较, 为建立海岸带生态系统中耐盐植物的DNA条形码数据库奠定基础。

1 方法

1.1 样品收集

本研究样品采集地涵盖辽宁到海南的11个沿海省市24个县市, 对海岸带耐盐植物进行了广泛的样品采集, 每个样品对应采集凭证标本2份及分子材料1份。广布物种每个样品的采样点间距大于100 km, 狭域分布种样品的采样点间距不小于20 km, 共获得2,300余号标本。选取含5个样品以上、分布点代表性好的物种共计116种562个样品进行实验。凭证标本存放于华东师范大学生命科学学院植物标本馆(HSNU); 采集记录详见附录1。

1.2 DNA提取、扩增及测序

根据生命条形码联盟(Consortium for the Barcode of Life, CBOL)推荐及前人进行大范围区域性植物DNA条形码的研究数据(CBOL Plant Working Group, 2009), 本研究选取4个候选片段, 包括1个核基因片段(ITS)及3个叶绿体基因片段(*matK*、*rbcL*及*trnH-psbA*)。采用CTAB法提取总DNA并进行扩增, 4

个片段的扩增体系见附录2。DNA片段扩增后的测序工作委托上海华津(Huagene)公司完成, 测序引物与PCR引物相同。由于*matK*引物通用性低, 对禾本科所有物种、马鞭草科的单叶蔓荆(*Vitex rotundifolia*)、大戟科的海滨大戟(*Euphorbia atoto*)进行PCR和测序时使用引物*matK*-390F/*matK*-1326R, 其他物种则使用*matK* 3F-KIM/*matK* IR-KI (Cuénoud et al, 2002)。引物与PCR条件详情见附录3。

1.3 数据处理

1.3.1 物种识别率的获得

使用 Seqman (DNASTAR package, Burland, 2000)软件对测序公司返回的序列的波峰进行检查, 拼接结果以.seq格式输出保存。使用Mega 5.0 (Tamura et al, 2011)的MUSCLE功能对所得序列进行比对, 最终输出.fas格式。使用软件 BLASTN v2 (Tatusova & Madden, 1999) 进行all-to-all BLASTn searches (Altschul et al, 1990)。这种分析方法需要建立本地数据库, 即已有的全部序列信息的本地数据库, blast结果是返回查询序列与数据库序列比对的得分。由于海岸带耐盐植物物种分布区跨度大、种内变异较大, 且单种属及寡种属占绝大多数, 种间差异大且种内样品间的序列一致性较低, 因此, 当查询序列与数据库中同种不同样品序列比对时的一致性比例达98%以上(且为最高值), 该查询序列所属的物种的全部样品序列都能达到此标准, 排除不同物种间样品比对也获得同样高的序列一致性比例的情形, 可认为该物种鉴定成功。手动统计所有样品比对结果, 得出物种识别率(Liu et al, 2015)。联合片段的比对是在单个片段基础上累加。系统发育方法neighbour-joining (NJ)分析时使用MEGA上 neighbour-joining 选项, 选择 paramete-distance, 进行1,000次迭代的聚类分析, 所有样品聚为一支单系(自展值>50%), 认为该物种鉴定成功。统计单个片段和联合片段的物种识别率。

1.3.2 NMDS分析

使用多维度非度量(non-metric multidimensional scaling, NMDS) (Kruskal, 1964)方法对物种识别结果[0,1]矩阵进行排序分析, 该分析在R语言软件包中的VEGAN软件(R Core Team, 2012)中完成。NMDS分析结果优劣依赖应力系数值(stress)的大小 (Khalaf & Kochzius, 2002)。选用Bray-Curtis距离, 因

为其在大范围和小范围的坐标轴上都具有稳健性 (Newmaster et al, 2008; Liu et al, 2015)。NMDS运算的步骤如下: (1)将物种识别率处理为[0,1]矩阵, 鉴定成功为1, 鉴定失败为0, 最后储存.CVS格式的[0,1]矩阵; (2)打开R语言软件包, 调出VEGAN软件, 将[0,1]矩阵转换为Bray-Curtis距离; (3)使用mono-MDS函数进行运算、排序; (4)使用plot绘制图表。

2 结果

2.1 引物通用性及序列获得率

本实验共获得53科97属116个物种562个样品的1,939条序列数据。使用引物18sdir/ITS4 (White et al, 1990)对ITS进行扩增, 序列获得率略低(85.59%) (表1)。*matK* 3F-KIM/*matK* IR-KIM这对引物对*matK*进行扩增时, 在藜科等效果很好, 但在禾本科扩增结果极差; 引物更换为*matK*-390F/*matK*-1326R, 禾本科测序结果较为理想, 所有物种均获得可靠序列。*rbcL*的序列获得率为83.04%, 使用引物*rbcL* a-f/*rbcL* a-r进行扩增和测序时, 有5属5种每个样品均未获得序列信息, 相较于Kress等(2009)推荐的引物稍差。总体上, 从序列获得率来看, *matK*和*trnH-psbA*片段表现最好, ITS和*rbcL*相对较差, 但ITS和*matK*均存在引物通用性的问题。

表1 序列获得率及片段长度
Table 1 Summary of the sequencing success rate and length of candidate barcoding fragments

片段名称 Locus	获得序列数 Species resolution rate	序列获得率 Sequence availability	测序成功物种数 Species successfully sequenced	片段长度 Fragment length (bp)
ITS	481	85.59%	106	304–632
<i>matK</i>	502	89.32%	116	611–721
<i>rbcL</i>	465	83.04%	109	371–650
<i>trnH-psbA</i>	491	87.36%	116	142–907

2.2 候选片段的物种识别率

2.2.1 序列相似性分析

使用序列相似性方法获得每个样品的BLASTn结果, 562个样品全部纳入分析, 其中由于测序原因, 一些物种仅有1个样品测序成功(ITS有4个物种, *matK*有1个物种, *rbcL*有6个物种, *trnH-psbA*有2个物种)。如序列矩阵中1个物种只包含1个样品(均由扩增或测序失败造成), 表明相应片段的个体间

差异大, 为避免高估物种识别率, 该物种处理为鉴定失败。将各个片段及联合片段的物种识别率绘制成柱状图, 结果显示: 单个片段ITS表现最好为73.36%, *matK*物种识别率为64.03%; *rbcL*、*trnH-psbA*在单个片段中表现一般, 分别为46.49%、61.21%。联合片段中ITS + *matK* + *trnH-psbA*结果高达84.76%, ITS + *matK*两者联合结果也能达到83.02% (图1)。

本研究中属内物种数目多于1的属共15个, 其中马唐属(*Digitaria*)、藜属各包含4个物种, 其他均

为2–3个物种。统计这15个属的物种识别率(图2), 结果显示: ITS为51.52%, 是所有4个片段中最好的; 片段联合分析, 物种识别率最高的是ITS + *matK* + *trnH-psbA* (65.71%), 其次是ITS + *matK* + *rbcL* (62.56%)和ITS + *matK* (62.50%) (图2)。显然, 与图1数据相比, 当属内物种数目增多时, 片段的鉴定能力明显下降。

2.2.2 系统发育分析

基于ITS、*matK*和*rbcL*三个片段的全部样品构建系统发育树(NJ树略), 统计物种识别率(图3), 种

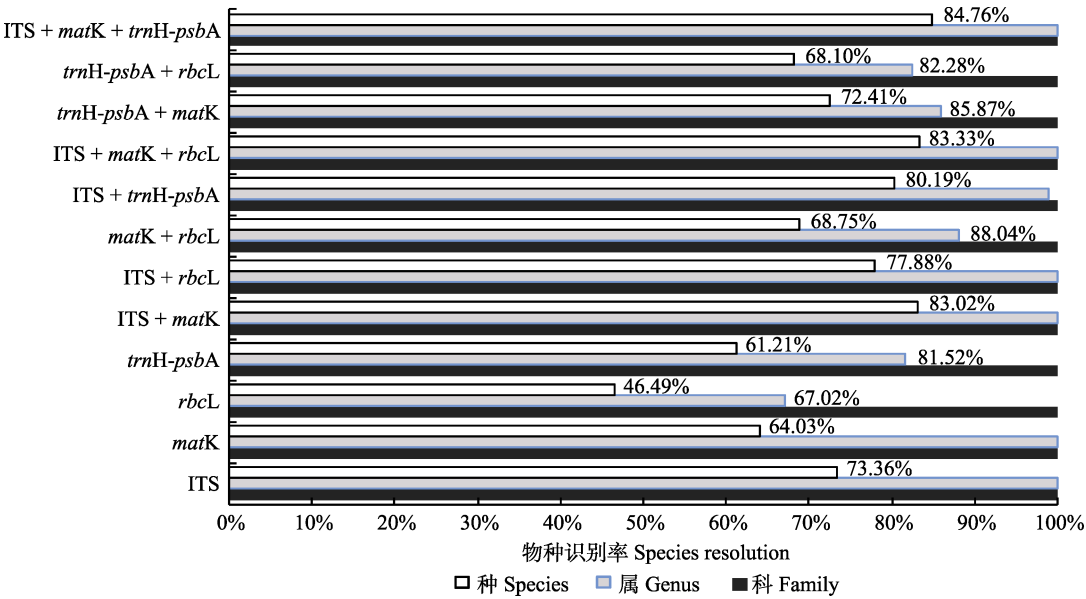


图1 序列相似性方法的物种识别率统计
Fig. 1 Species resolution rate from all to all BLASTn searches

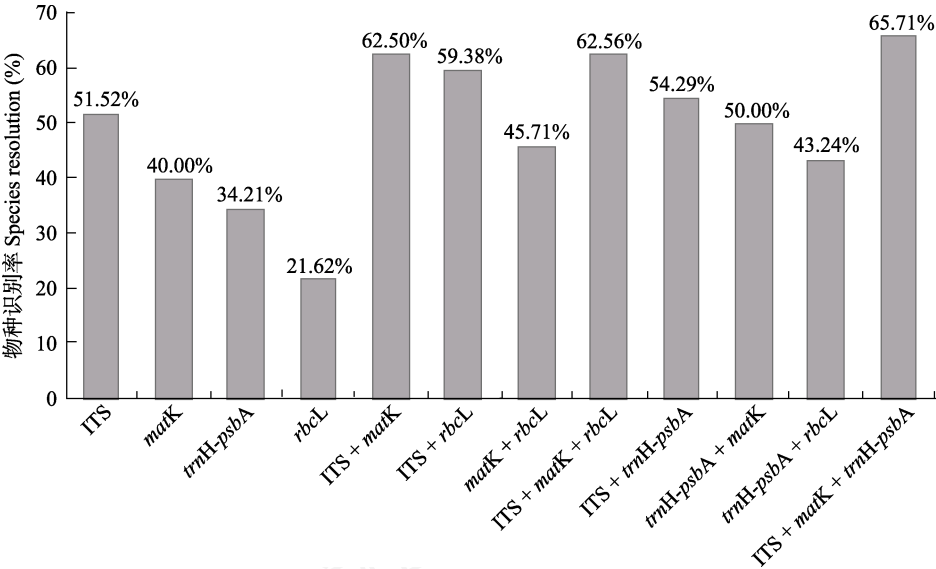


图2 属内物种数目多于1的15个属的物种识别率统计
Fig. 2 Species resolution rate of 15 genera which contain more than one species

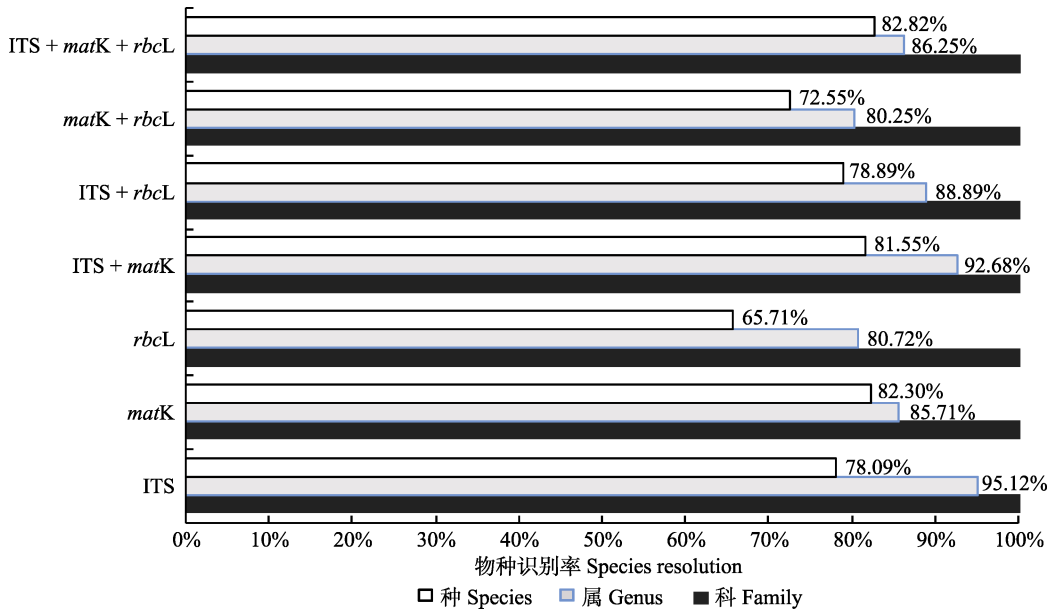


图3 系统发育方法的物种识别率统计
Fig. 3 Species resolution rate based on the phylogenetic method

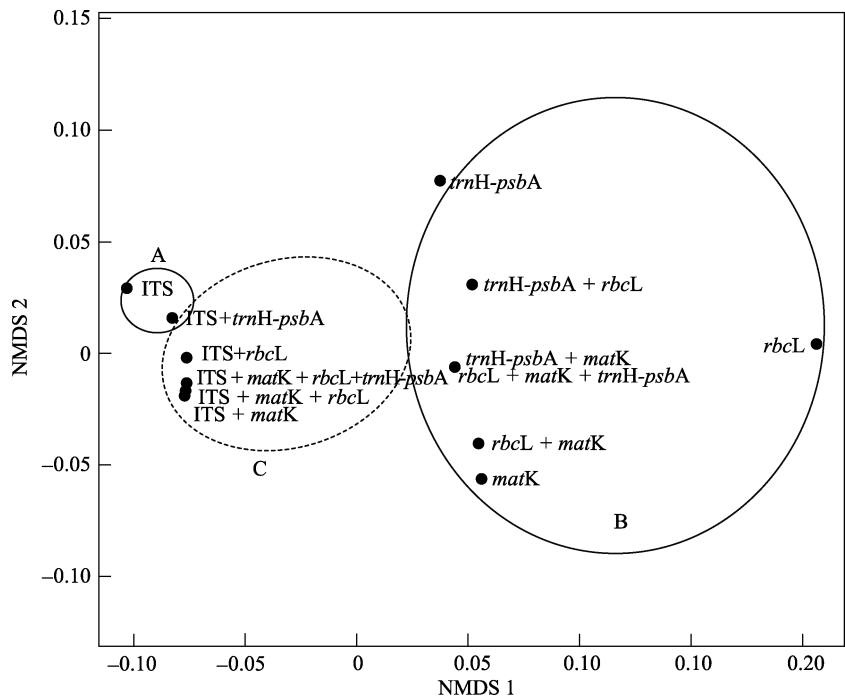


图4 候选DNA条形码片段的NMDS分析(Stress值: 0.011)
Fig. 4 Multivariate analysis of non-metric multidimensional scaling for the four barcode markers NMDS. Stress value: 0.011.

内所有样品聚为一支, 即认为物种鉴定成功。NJ树的结果显示 $matK$ 表现最好(82.30%), 其次是ITS(78.09%)。在科/属水平的物种识别率趋势与物种水平基本一致, 在属水平显示单个片段ITS效果最好(为95.12%)(图3)。不管是BLASTn结果还是NJ树结果, $rbcL$ 的属、种识别率表现都是最差(图1, 图3)。

两片段ITS + $matK$ 联合及三片段ITS + $matK$ + $rbcL$ 联合的物种水平识别率大体一致, 约为82–83% (图3)。由于 $trnH-psbA$ 片段长度不一致, 比对相当困难, 即使分科比对之后, 将所有科的样品放在同一.fas文件中, 依然联合失败, 因此未对其进行系统发育分析。

对比两种分析方法发现: 单个片段表现最好的片段是ITS (73.36%) (图1)或*matK* (82.30%) (图3), 而最差的均是*rbcL* (46.49%、65.71%)。联合片段的分析结果中, BLASTn方法最好的是ITS + *matK* + *trnH-psbA* (为84.76%), NJ树的结果是ITS + *matK* + *rbcL* (为82.82%)。虽然ITS + *matK*两者联合的结果稍低, 但也能分别达到83.02% (图1)和81.55% (图3)。由于*trnH-psbA*片段长度不一致, 该片段未能包括在系统发育分析方法中。

2.3 核基因与叶绿体基因片段物种识别差异性分析

将基于BLASTn的物种识别率转换成Bray-Curtis矩阵, 并用R语言软件包中的vegan软件进行NMDS运算。迭代20次, stress值就能趋于稳定达到0.011, 说明排序结果十分可靠。图4中点的相互靠近代表相关片段间的物种识别差异性较小(相距越远代表差异性越大)。结果显示: 叶绿体基因与核基因的物种识别在NMDS排序图中存在明显的A、B两个区域, 表明这两类片段的物种识别差异性较大; 而当核基因片段ITS与叶绿体片段联合时, 排序位置(C区)处于A和B之间, 表明这两类片段在物种识别中均发挥了作用(图4)。C区偏向靠近A区, 则表明核基因片段ITS具有更强的物种识别能力, 与前文进行物种识别率的运算时显示单个ITS的结果最好(图1)、叶绿体与ITS联合片段的物种识别率显著提高(图1)的结果一致。

3 讨论

3.1 ITS、*matK*、*rbcL*和*trnH-psbA* 4个片段扩增及序列获得率比较

本文探讨了核基因片段ITS和叶绿体片段*matK*、*rbcL*及*trnH-psbA*作为条形码的潜在价值。使用1对引物可以扩增出所有耐盐植物的ITS, 但在测序时碰到一定的困难, 芦竹属(*Arundo*)、大拂子茅(*Calamagrostis macrolepis*)、海刀豆(*Canavalia rosea*)、披碱草属(*Elymus*)等仍有80个样品测序未成功, 使用引物ITS3/ITS4 (White et al, 1990)对ITS2扩增及测序, 依然没有得到这些属的正确序列, 序列获得率只有85.59%。导致测序失败的原因可能是由于ITS具有poly结构、异源多倍体的影响等, 在很多研究中都有与本文相似的情况(Chase et al, 2005; Kress et al, 2005; Newmaster et al, 2006; Liu et al,

2016), 这是它作为优秀的条形码存在的最大问题。*matK*基因片段全长为1,500 bp左右, 引物通用性不高和单核苷酸重复序列一直是其在DNA条形码应用中的重大障碍(Costion et al, 2011; Yu et al, 2011; Parmentier et al, 2013), 通常利用全长的前半段进行系统发育和条形码分析(Sugita et al, 1985; Steane 2005; Barthet & Hilu, 2007; Yu et al, 2011)。本研究使用了2对通用引物才完成所有类群的扩增, 并得到最好的序列获得率89.32% (表1)。*rbcL*的序列获得率仅为83.04%, 仍有共计97个样品未获得*rbcL*序列信息, 这应该是引物选择上的问题, 已有研究表明这对引物不是扩增*rbcL*序列的最佳引物(Kress et al, 2009)。如果换用最佳引物, 预计序列获得率将得到一定的提升。尽管叶绿体*trnH-psbA*片段使用1对引物扩增及测序在4个片段中表现比较优秀(表1), 但已有报道表明该片段存在长度不一致的严重问题(Chase et al, 2007)。本研究亦发现其长度变化极大: 在碱蓬(*Suaeda glauca*)的长度仅有250 bp, 在盐地碱蓬(*S. salsa*)的长度为400 bp, 而在禾本科中长度则达750 bp。片段长度差别过大及插入/缺失过多导致比对联合无法进行, 因此不适宜用于系统发育分析(Hamilton et al, 2003; Yamashiro et al, 2004; Newmaster et al, 2006)。

由此可见, 从各片段的引物通用性及序列获得率综合分析, 我们认为针对滨海耐盐植物而言, 没有哪一个片段完美无缺, 在条形码的实际应用中更重要的是参考物种识别率进行择优。

3.2 相关DNA片段的物种识别率及最优条形码推荐

前人研究发现ITS进化速率比叶绿体片段快3-4倍, 因此在很多系统分类学研究中将ITS作为目标片段之一(Chase et al, 2007)。本研究的序列相似性分析发现在种水平, 单个片段ITS物种识别率表现最好(73.36%) (图1), 而NJ树分析结果也达到78.09% (图3)。ITS不仅在一些大属如梅花草属(*Parnassia*)、无花果属(*Ficus*)、庭菖蒲属(*Sisyrinchium*)、报春花属(*Primula*)等的研究中相比于其他单个片段表现较好(Li et al, 2012; Yang et al, 2012; Alves et al, 2014; Yan et al, 2015), 在给定的地理区域进行样品收集和植物DNA条形码评价时, 也发现ITS(ITS2)的物种识别率表现最好(Liu et al, 2015)。同时有报道根据物种识别率推荐ITS作为种子植物

的DNA条形码(China Plant BOL Group, 2011)。

*matK*是叶绿体片段中表现最出色的片段之一,在核酸水平和氨基酸水平的替换率与*rbcL*相比分别高3倍和6倍,变异位点也多于*rbcL* (Olmstead & Palmer, 1994; Barthet & Hilu, 2007)。本研究中NJ方法中*matK*物种识别率表现最好,为82.3% (图3),在BLASTn方法中仅次于ITS (图1),在属水平的识别率和属中物种数目多于1时物种水平的识别率都较其他叶绿体片段优秀(图1、2)。本研究经综合比较,认为*matK*是值得推荐为海岸带生态系统的耐盐植物DNA条形码之一。

前人研究曾提出以*matK* + *rbcL*作为陆生植物核心条形码片段(CBOL Plant Working Group, 2009),而越来越多研究发现尽管*rbcL*的扩增和测序都比较容易,但其缺乏足够多的变异位点(China Plant BOL Group, 2011)。我们也发现滨海耐盐植物尽管在科水平*rbcL*的识别率能达到100%,但在属及物种水平上的识别率最低(图1、2、3),没有足够的变异位点将大量类群区分开。因此推测在进行广泛的区域性高等植物DNA条形码研究时,*rbcL*并不适合。

*trnH-psbA*作为进化速率最快的片段之一,在某些属如龙胆属(*Gentiana*)、碱蓬属等属内的变异幅度比较大(Chase et al, 2007; Dong et al, 2012; Liu et al, 2016);在禾本科、天门冬科、唇形科等科的一些物种的*trnH-psbA*片段中有*rps19*插入(Pang et al, 2012)。插入和缺失导致片段长度差异较大,在植物类群繁多的区域DNA条形码研究中无法运用系统发育方法进行分析(Hamilton et al, 2003; Yamashiro et al, 2004; Newmaster et al, 2006)。即使进行序列相似性分析,*trnH-psbA*的物种识别率也较低(61.21%) (图2)。

在进行区域性DNA条形码的研究中,前人主要研究*matK*、*rbcL*及*trnH-psbA*三个叶绿体片段。Kress等(2009)对Panama区域内296个木本物种进行研究,发现叶绿体片段*matK* + *rbcL*的物种识别率高达98%,但这一高识别率是源于大量科、属只包含1个物种;Gonzalez等(2009)的研究中*matK* + *rbcL*在木本植物只有61%的分辨率(Gonzalez et al, 2009);在Liu等(2015)对鼎湖山国家级自然保护区的531种木本植物研究中,*matK* + *rbcL*也仅有66.83%的物种识别率。本研究中对海岸带耐盐植物进行广泛取样,研究结果表明*matK*的序列相似性分析得到的物种

识别率为64.03%,与前人进行区域植物DNA条形码的研究结果大体一致(Gonzalez et al, 2009; Liu et al, 2015)。而相对于叶绿体基因,我们发现核基因ITS与叶绿体基因对物种的识别存在差异性,ITS与叶绿体片段联合后能将物种识别率提高到83.02% (图1、4),所以在进行海岸耐盐植物DNA条形码研究时,核基因与叶绿体基因都应该考虑。综合研究结果,本文推荐以ITS + *matK*作为中国海岸带耐盐植物的DNA条形码。

但这2个片段在亲缘关系十分靠近的类群中作为DNA条形码表现并不完美(Chase et al, 2005; De Vere et al, 2015)。在已有报道中表明二型马唐(*Digitaria heterantha*)、马唐(*D. sanguinalis*)和升马唐(*D. ciliaris*)之间亲缘关系非常近(Vega et al, 2009; Adoukonou-Sagbadja et al, 2010),分享共同祖先。本研究表明ITS + *matK*无法提供足够的变异位点将马唐属的4个物种分开。所以对于大属来说,如果该属存在亲缘关系比较近的物种,DNA条形码的分辨率会下降(Ebihara et al, 2010; Liu et al, 2016),需要发现新思路加以解决。

3.3 关于中国海岸带耐盐植物DNA条形码数据库

本研究针对中国海岸带生态系统中盐沼植物和非盐生耐盐植物获得了1,939个条形码序列信息,源自116个物种562个样品,占中国海岸带耐盐植物的22.43%。由于中国海岸带面积宽广、耐盐植物数量众多、测序分析的工作量巨大,后续研究还需要补充更多耐盐植物物种,并且补充整合海草及红树植物数据,构建一个完整、高覆盖度的DNA条形码数据库。

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附录 Supplementary Material

附录1 本研究的样品采集信息及条形码序列信息

Appendix 1 Collecting information and GenBank accession numbers of samples

<http://www.biodiversity-science.net/fileup/PDF/2017164-1.pdf>

附录2 候选条形码片段的PCR反应体系

Appendix 2 PCR amplification system of the candidate barcoding fragments

<http://www.biodiversity-science.net/fileup/PDF/2017164-2.pdf>

附录3 扩增使用引物及条件

Appendix 3 Amplification protocol and primers information

<http://www.biodiversity-science.net/fileup/PDF/2017164-3.pdf>

附录1 本研究的样品采集信息及条形码序列信息

Appendix 1 Collecting information and GenBank accession numbers of samples

物种名 Specise name	采集者/采集号 Collector/Voucher Numbers	采集地 Locality	登陆号 GenBank accession			
			ITS	matK	rbcL	trnH-psbA
京芒草 <i>Achnatherum pekinense</i> (Hance) Ohwi	Yao, Li, Wei 20151057	辽宁大连	MF063501	MF064038	—	MF062300
京芒草 <i>Achnatherum pekinense</i> (Hance) Ohwi	Yao, Li, Wei 20151139	辽宁大连	MF063502	MF064039	—	MF064601
链荚豆 <i>Alysicarpus vaginalis</i> (L.) DC.	Yao, Li, Wei 20141435	海南陵水	—	MF064254	—	—
链荚豆 <i>Alysicarpus vaginalis</i> (L.) DC.	Yao, Zhang(1) 20141023	广西北海	MF063691	MF064255	MF065346	MF064813
链荚豆 <i>Alysicarpus vaginalis</i> (L.) DC.	Wei, Li, Zhang(2) 2014769	福建漳州	MF063692	MF064256	MF065347	MF064814
链荚豆 <i>Alysicarpus vaginalis</i> (L.) DC.	Yao, Wei 20150127	广东湛江	MF063693	—	—	—
皱果苋 <i>Amaranthus viridis</i> L.	Yao, Zhang(1) 20141081	广西北海	MF063694	MF064257	MF065348	MF064815
皱果苋 <i>Amaranthus viridis</i> L.	Yao, Li, Wei 20141346	海南万宁	MF063695	MF064258	MF065349	MF064816
皱果苋 <i>Amaranthus viridis</i> L.	Wei, Li, Zhang(2) 2014645	福建宁德	MF063696	MF064259	MF065350	MF064817
皱果苋 <i>Amaranthus viridis</i> L.	Yao, Wei 20150518	浙江温州	MF063697	—	MF065351	MF064818
皱果苋 <i>Amaranthus viridis</i> L.	Yao, Wei, Yang 20151332	江苏连云港	MF063698	MF064260	MF065352	MF064819
毛秆野古草 <i>Arundinella hirta</i> (Thunb.) Tanaka	Yao, Li, Wei 20151034	辽宁大连	MF063503	MF064040	MF065147	MF064602
毛秆野古草 <i>Arundinella hirta</i> (Thunb.) Tanaka	Yao, Li, Wei 20151102	辽宁大连	MF063504	MF064041	MF065148	MF064603
毛秆野古草 <i>Arundinella hirta</i> (Thunb.) Tanaka	Yao, Li, Wei 20151182	辽宁葫芦岛	MF063506	MF064043	MF065150	MF064605
芦竹 <i>Arundo donax</i> L.	Yao, Wei 20150537	浙江温州	—	MF064044	MF065151	MF064606
芦竹 <i>Arundo donax</i> L.	Yao, Wei 20150703	浙江温岭	—	MF064045	MF065152	MF064607
芦竹 <i>Arundo donax</i> L.	Yao, Wei 20150840	浙江舟山	—	MF064046	—	MF064608
兴安天门冬 <i>Asparagus dauricus</i> Fisch. ex Link	Wei, Li, Zhang(1) 2014360	山东荣成	MF063699	MF064261	MF065353	MF064820
兴安天门冬 <i>Asparagus dauricus</i> Fisch. ex Link	Wei, Li, Zhang(1) 2014401	山东蓬莱	MF063700	MF064262	MF065354	MF064821
兴安天门冬 <i>Asparagus dauricus</i> Fisch. ex Link	Yao, Li, Wei 20151075	辽宁大连	MF063701	MF064263	MF065355	MF064822
兴安天门冬 <i>Asparagus dauricus</i> Fisch. ex Link	Yao, Li, Wei 20151219	辽宁葫芦岛	MF063702	MF064264	—	MF064823
兴安天门冬 <i>Asparagus dauricus</i> Fisch. ex Link	Yao, Wei, Yang 20151286	河北秦皇岛	MF063703	MF064265	MF065356	MF064824
酒饼簕 <i>Atalantia buxifolia</i> (Poir.) Oliv.	Yao, Li, Wei 20141376	海南万宁	MF063704	MF064266	MF065357	MF064825
酒饼簕 <i>Atalantia buxifolia</i> (Poir.) Oliv.	Yao, Li, Wei 20141473	海南陵水	MF063705	MF064267	MF065358	MF064826
酒饼簕 <i>Atalantia buxifolia</i> (Poir.) Oliv.	Yao, Li, Wei 20141646	海南昌江	MF063706	MF064268	MF065359	MF064827
酒饼簕 <i>Atalantia buxifolia</i> (Poir.) Oliv.	Yao, Wei 20150136	广东湛江	MF063707	MF064269	MF065360	MF064828
海滨藜 <i>Atriplex maximowicziana</i> Makino	Wei, Li, Zhang(2) 2014802	福建漳州	MF063349	MF063884	MF064997	MF064446
海滨藜 <i>Atriplex maximowicziana</i> Makino	Wei, Li, Zhang(2) 2014842	福建漳州	MF063350	MF063885	MF064998	MF064447
海滨藜 <i>Atriplex maximowicziana</i> Makino	Yao, Li, Wei 20141534	海南东方	MF063351	—	MF064999	MF064448
海滨藜 <i>Atriplex maximowicziana</i> Makino	Yao, Wei 20150453	广东南澳	MF063352	MF063886	MF065000	MF064449
海滨藜 <i>Atriplex maximowicziana</i> Makino	Yao, Li, Wei 20141630	海南昌江	MF063353	—	MF065001	MF064450
海滨藜 <i>Atriplex maximowicziana</i> Makino	Yao, Wei 20150013	广东湛江	MF063354	MF063887	MF065002	MF064451
滨藜 <i>Atriplex patens</i> (Litv.) Iljin	Wei, Li, Zhang 2014323	山东荣成	MF063355	MF063888	MF065003	—
滨藜 <i>Atriplex patens</i> (Litv.) Iljin	Yao, Wei 20151061	广东湛江	MF063356	MF063889	MF065004	MF064452
滨藜 <i>Atriplex patens</i> (Litv.) Iljin	Yao, Li, Wei 20151087	辽宁大连	MF063357	MF063890	MF065005	MF064453
滨藜 <i>Atriplex patens</i> (Litv.) Iljin	Yao, Li, Wei 20151217	辽宁葫芦岛	MF063358	MF063891	MF065006	MF064454
滨藜 <i>Atriplex patens</i> (Litv.) Iljin	Yao, Wei, Yang 20151291	河北秦皇岛	MF063359	MF063892	MF065007	MF064455
滨藜 <i>Atriplex patens</i> (Litv.) Iljin	Yao, Wei, Yang 20151339	江苏连云港	MF063360	MF063893	MF065008	MF064456
海榄雌 <i>Avicennia marina</i> (Forsk.) Vierh.	Yao, Zhang(1) 20141086	广西北海	MF063708	MF064270	MF065361	MF064829
海榄雌 <i>Avicennia marina</i> (Forsk.) Vierh.	Yao, Li, Wei 20141522	海南陵水	MF063709	MF064271	—	MF064830
海榄雌 <i>Avicennia marina</i> (Forsk.) Vierh.	Yao, Li, Wei 20141539	海南东方	MF063710	MF064272	MF065362	MF064831
海榄雌 <i>Avicennia marina</i> (Forsk.) Vierh.	Yao, Li, Wei 20141641	海南昌江	MF063711	MF064273	MF065363	MF064832
海榄雌 <i>Avicennia marina</i> (Forsk.) Vierh.	Yao, Wei 20150159	广东湛江	MF063712	MF064274	MF065364	MF064833

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蔺草 <i>Beckmannia syzigachne</i> (Steud.) Fern.	Yao, Wei 20150501	浙江温州	MF063713	MF064047	MF065153	MF064609
蔺草 <i>Beckmannia syzigachne</i> (Steud.) Fern.	Yao, Wei 20150713	浙江玉环	MF063714	MF064048	MF065154	MF064610
阔叶丰花草 <i>Borreria latifolia</i> (Aubl.) K. Schum.	Yao, Zhang(1) 20141053	广西北海	MF063715	MF064275	MF065365	MF064834
阔叶丰花草 <i>Borreria latifolia</i> (Aubl.) K. Schum.	Yao, Li, Wei 20141276	海南文昌	MF063716	MF064276	MF065366	MF064835
阔叶丰花草 <i>Borreria latifolia</i> (Aubl.) K. Schum.	Yao, Li, Wei 20141596	海南东方	MF063717	MF064277	MF065367	MF064836
阔叶丰花草 <i>Borreria latifolia</i> (Aubl.) K. Schum.	Yao, Wei 20150053	广东湛江	MF063718	—	—	MF064837
阔叶丰花草 <i>Borreria latifolia</i> (Aubl.) K. Schum.	Yao, Wei 20150237	广东惠州	MF063719	MF064278	MF065368	MF064838
扁穗雀麦 <i>Bromus catharticus</i> Vahl.	Yao, Wei 20150531	浙江温州	MF063509	MF064049	MF065155	MF064611
扁穗雀麦 <i>Bromus catharticus</i> Vahl.	Yao, Wei 20150642	浙江温岭	MF063510	MF064050	MF065156	MF064612
扁穗雀麦 <i>Bromus catharticus</i> Vahl.	Yao, Wei, Yang 20151408	江苏盐城	MF063511	MF064051	MF065157	—
雀麦 <i>Bromus japonicus</i> Thunb. ex Murr.	Yao, Wei 20150504	浙江温州	MF063512	—	MF065158	MF064613
刺果苏木 <i>Caesalpinia bonduc</i> (L.) Roxb.	Yao, Zhang(1) 20141077	广西北海	MF063720	—	—	—
刺果苏木 <i>Caesalpinia bonduc</i> (L.) Roxb.	Yao, Li, Wei 20141469	海南陵水	MF063721	—	—	MF064839
刺果苏木 <i>Caesalpinia bonduc</i> (L.) Roxb.	Yao, Li, Wei 20141586	海南东方	MF063722	MF064279	—	MF064840
刺果苏木 <i>Caesalpinia bonduc</i> (L.) Roxb.	Yao, Wei 20150091	广东湛江	MF063723	MF064280	—	MF064841
刺果苏木 <i>Caesalpinia bonduc</i> (L.) Roxb.	Yao, Wei 20150234	广东惠州	MF063724	—	—	MF064614
蔓草虫豆 <i>Cajanus scarabaeoides</i> (L.) Thouars	Yao, Li, Wei 20141443	海南陵水	MF063725	—	—	MF064615
蔓草虫豆 <i>Cajanus scarabaeoides</i> (L.) Thouars	Wei, Li, Zhang(1) 2014854	福建漳州	MF063726	MF064281	MF065369	MF064616
蔓草虫豆 <i>Cajanus scarabaeoides</i> (L.) Thouars	Yao, Wei 20150123	广东湛江	MF063727	—	—	MF064617
大拂子茅 <i>Calamagrostis macrolepis</i> Litv.	Wei, Li, Zhang(1) 2014342	山东荣成	—	MF064052	MF065159	MF064614
大拂子茅 <i>Calamagrostis macrolepis</i> Litv.	Wei, Li, Zhang(1) 2014502	山东东营	—	MF064053	MF065160	MF064615
大拂子茅 <i>Calamagrostis macrolepis</i> Litv.	Yao, Li, Wei 20151074	辽宁大连	—	—	MF065161	MF064616
大拂子茅 <i>Calamagrostis macrolepis</i> Litv.	Yao, Wei, Yang 20151395	江苏盐城	—	—	MF065162	MF064617
肾叶打碗花 <i>Calystegia soldanella</i> (L.) R. Br.	Wei, Li, Zhang(1) 2014295	山东荣成	MF063728	MF064282	MF065370	MF064842
肾叶打碗花 <i>Calystegia soldanella</i> (L.) R. Br.	Wei, Li, Zhang(2) 2014651	福建宁德	MF063729	MF064283	MF065371	MF064843
肾叶打碗花 <i>Calystegia soldanella</i> (L.) R. Br.	Yao, Wei 20150816	浙江舟山	MF063730	MF064284	MF065372	MF064844
肾叶打碗花 <i>Calystegia soldanella</i> (L.) R. Br.	Yao, Li, Wei 20151084	辽宁大连	MF063731	MF064285	MF065373	MF064845
肾叶打碗花 <i>Calystegia soldanella</i> (L.) R. Br.	Yao, Wei, Yang 20151368	江苏连云港	MF063732	MF064286	MF065374	MF064846
海刀豆 <i>Canavalia maritima</i> (Aubl.) Thou.	Yao, Zhang(1) 20141047	广西北海	—	MF064287	MF065375	—
海刀豆 <i>Canavalia maritima</i> (Aubl.) Thou.	Yao, Li, Wei 20141325	海南万宁	—	MF064288	—	—
海刀豆 <i>Canavalia maritima</i> (Aubl.) Thou.	Yao, Li, Wei 20141447	海南陵水	—	MF064289	MF065376	—
海刀豆 <i>Canavalia maritima</i> (Aubl.) Thou.	Wei, Li, Zhang(2) 2014591	福建宁德	—	MF064290	MF065377	—
海刀豆 <i>Canavalia maritima</i> (Aubl.) Thou.	Yao, Wei 20150030	广东湛江	—	MF064291	MF065378	—
无根藤 <i>Cassytha filiformis</i> L.	Yao, Li, Wei 20141280	海南文昌	MF063733	MF064292	—	MF064847
无根藤 <i>Cassytha filiformis</i> L.	Yao, Li, Wei 20141334	海南万宁	MF063734	MF064293	MF065379	MF064848
无根藤 <i>Cassytha filiformis</i> L.	Yao, Li, Wei 20141591	海南东方	—	MF064294	MF065380	MF064849
无根藤 <i>Cassytha filiformis</i> L.	Wei, Li, Zhang(2) 2014848	福建漳州	MF063735	MF064295	MF065381	MF064850
无根藤 <i>Cassytha filiformis</i> L.	Yao, Wei 20150203	广东惠州	MF063736	MF064296	MF065382	MF064851
蒺藜草 <i>Cenchrus echinatus</i> L.	Yao, Wei 20150254	广东惠州	MF063513	MF064054	MF065163	MF064618
蒺藜草 <i>Cenchrus echinatus</i> L.	Yao, Li, Wei 20141246	海南文昌	MF063514	MF064055	MF065164	—
蒺藜草 <i>Cenchrus echinatus</i> L.	Yao, Li, Wei 20141329	海南万宁	—	MF064056	MF065165	MF064619
蒺藜草 <i>Cenchrus echinatus</i> L.	Yao, Li, Wei 20141464	海南陵水	MF063515	MF064057	MF065166	—
尖头叶藜 <i>Chenopodium acuminatum</i> Willd.	Yao, Wei 20150383	广东南澳	MF063361	MF063894	MF065009	MF064457
尖头叶藜 <i>Chenopodium acuminatum</i> Willd.	Yao, Wei 20150132	广东湛江	MF063362	MF063895	MF065010	MF064458

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尖头叶藜 <i>Chenopodium acuminatum</i> Willd.	Yao, Wei 20150189	广东惠东	MF063363	MF063896	MF065011	MF064459
尖头叶藜 <i>Chenopodium acuminatum</i> Willd.	Yao, Wei, Yang 20151304	河北秦皇岛	MF063364	MF063897	MF065012	MF064460
尖头叶藜 <i>Chenopodium acuminatum</i> Willd.	Wei, Li, Zhan(2) 2014685	福建平潭	MF063365	MF063898	MF065013	MF064461
尖头叶藜 <i>Chenopodium acuminatum</i> Willd.	Wei, Li, Zhang(2) 2014699	福建平潭	MF063366	MF063899	MF065014	MF064462
藜 <i>Chenopodium album</i> L.	Li, Zhang(1) 2014184	上海崇明	MF063368	MF063900	MF065016	MF064464
藜 <i>Chenopodium album</i> L.	Yao, Li, Wei 2014245	浙江慈溪	MF063369	MF063901	MF065017	MF064465
藜 <i>Chenopodium album</i> L.	Wei, Li, Zhang(1) 2014314	山东荣成	MF063370	MF063902	MF065018	MF064466
藜 <i>Chenopodium album</i> L.	Wei, Li, Zhang(2) 2014779	福建漳州	MF063377	MF063909	MF065023	MF064473
藜 <i>Chenopodium album</i> L.	Yao, Wei 20150168	广东湛江	MF063378	MF063910	MF065024	MF064474
藜 <i>Chenopodium album</i> L.	Yao, Wei 20150500	浙江温州	MF063379	MF063911	MF065025	MF064475
藜 <i>Chenopodium album</i> L.	Yao, Li, Wei 20151064	辽宁大连	MF063388	MF063920	MF065033	MF064484
藜 <i>Chenopodium album</i> L.	Yao, Li, Wei 20151163	辽宁葫芦岛	MF063390	MF063921	MF065034	MF064485
藜 <i>Chenopodium album</i> L.	Yao, Wei, Yang 20151267	河北秦皇岛	MF063393	MF063924	MF065037	MF064488
藜 <i>Chenopodium album</i> L.	Yao, Wei, Yang 20151310	江苏连云港	MF063394	MF063925	MF065038	MF064489
灰绿藜 <i>Chenopodium glaucum</i> L.	Yao, Li, Wei 2014244	浙江慈溪	MF063402	MF063934	MF065048	MF064498
灰绿藜 <i>Chenopodium glaucum</i> L.	Wei, Zhang(1) 2014263	上海奉贤	MF063403	MF063935	MF065049	MF064499
灰绿藜 <i>Chenopodium glaucum</i> L.	Wei, Li, Zhang(1) 2014455	山东蓬莱	MF063404	MF063936	MF065050	MF064500
灰绿藜 <i>Chenopodium glaucum</i> L.	Wei, Li, Zhang(1) 2014499	山东东营	MF063405	MF063937	MF065051	MF064501
灰绿藜 <i>Chenopodium glaucum</i> L.	Wei, Li, Zhang(2) 2014729	福建平潭	MF063406	MF063938	MF065052	MF064502
灰绿藜 <i>Chenopodium glaucum</i> L.	Yao, Wei 20150614	浙江温岭	MF063407	MF063939	MF065053	MF064503
灰绿藜 <i>Chenopodium glaucum</i> L.	Yao, Wei 20150839	浙江舟山	—	MF063940	MF065054	MF064504
灰绿藜 <i>Chenopodium glaucum</i> L.	Yao, Li, Wei 20151132	辽宁大连	MF063408	MF063941	MF065055	MF064505
灰绿藜 <i>Chenopodium glaucum</i> L.	Yao, Wei, Yang 20151294	河北秦皇岛	MF063409	MF063942	MF065056	MF064506
灰绿藜 <i>Chenopodium glaucum</i> L.	Yao, Wei, Yang 20151343	江苏连云港	MF063410	MF063943	MF065057	MF064507
灰绿藜 <i>Chenopodium glaucum</i> L.	Yao, Wei, Yang 20151420	江苏盐城	MF063411	MF063944	MF065058	MF064508
小藜 <i>Chenopodium serotinum</i> L.	Yao, Wei 20150015	广东湛江	MF063413	MF063948	MF065061	MF064512
小藜 <i>Chenopodium serotinum</i> L.	Yao, Wei 20150181	广东惠州	MF063414	MF063949	MF065062	MF064513
小藜 <i>Chenopodium serotinum</i> L.	Yao, Wei 20150618	江苏盐城	MF063415	MF063950	MF065063	MF064514
小藜 <i>Chenopodium serotinum</i> L.	Yao, Wei, Yang 20151421	江苏盐城	MF063416	MF063951	MF065064	MF064515
小藜 <i>Chenopodium serotinum</i> L.	Wei, Zhang(1) 2015268	上海奉贤	MF063417	—	MF065065	—
台湾虎尾草 <i>Chloris formosana</i> (Honda) Keng	Yao, Li, Wei 20141357	海南万宁	MF063516	MF064058	MF065167	MF064620
台湾虎尾草 <i>Chloris formosana</i> (Honda) Keng	Yao, Li, Wei 20141423	海南陵水	MF063517	MF064059	MF065168	MF064621
台湾虎尾草 <i>Chloris formosana</i> (Honda) Keng	Yao, Wei 20150035	广东湛江	MF063518	MF064060	MF065169	MF064622
台湾虎尾草 <i>Chloris formosana</i> (Honda) Keng	Yao, Wei 20150312	广东惠州	MF063519	MF064061	MF065170	MF064623
台湾虎尾草 <i>Chloris formosana</i> (Honda) Keng	Yao, Wei 20150416	广东南澳	MF063520	MF064062	MF065171	MF064624
台湾虎尾草 <i>Chloris formosana</i> (Honda) Keng	Yao, Wei, Yang 20151284	河北秦皇岛	MF063521	MF064063	MF065172	MF064625
虎尾草 <i>Chloris virgata</i> Sw.	Wei, Li, Zhang 2014425	山东蓬莱	MF063522	MF064065	MF065173	MF064626
虎尾草 <i>Chloris virgata</i> Sw.	Yao, Li, Wei 20151066	辽宁大连	MF063523	MF064066	—	MF064627
虎尾草 <i>Chloris virgata</i> Sw.	Yao, Li, Wei 20151158	辽宁葫芦岛	MF063524	MF064067	MF065174	MF064628
虎尾草 <i>Chloris virgata</i> Sw.	Yao, Wei, Yang 20151248	河北秦皇岛	MF063525	MF064068	—	MF064629
虎尾草 <i>Chloris virgata</i> Sw.	Yao, Wei, Yang 20151354	江苏连云港	MF063526	MF064069	MF065175	MF064630
苦郎树 <i>Clerodendrum inerme</i> (L.) Gaertn.	Yao, Zhang(1) 20141005	广西北海	MF063737	MF064297	MF065383	MF064852
苦郎树 <i>Clerodendrum inerme</i> (L.) Gaertn.	Yao, Li, Wei 20141279	海南文昌	MF063738	MF064298	MF065384	MF064853
苦郎树 <i>Clerodendrum inerme</i> (L.) Gaertn.	Yao, Li, Wei 20141541	海南东方	MF063739	MF064299	MF065385	MF064854

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			ITS	matK	rbcL	trnH-psbA
苦郎树 <i>Clerodendrum inerme</i> (L.) Gaertn.	Wei, Li, Zhang(2) 2014599	福建宁德	MF063740	MF064300	MF065386	MF064855
苦郎树 <i>Clerodendrum inerme</i> (L.) Gaertn.	Yao, Wei 20150001	广东湛江	MF063741	MF064301	MF065387	MF064856
软毛虫实 <i>Corispermum puberulum</i> Iljin	Wei, Li, Zhang(1) 2014371	山东蓬莱	MF063418	MF063952	MF065066	MF064516
软毛虫实 <i>Corispermum puberulum</i> Iljin	Yao, Li, Wei 20151071	辽宁大连	MF063419	MF063953	MF065067	MF064517
软毛虫实 <i>Corispermum puberulum</i> Iljin	Yao, Li, Wei 20151211	辽宁葫芦岛	MF063420	MF063954	MF065068	MF064518
软毛虫实 <i>Corispermum puberulum</i> Iljin	Yao, Li, Wei 20151227	辽宁葫芦岛	MF063421	MF063955	MF065069	MF064519
软毛虫实 <i>Corispermum puberulum</i> Iljin	Yao, Wei, Yang 20151242	河北秦皇岛	MF063422	MF063956	MF065070	MF064520
软毛虫实 <i>Corispermum puberulum</i> Iljin	Yao, Wei, Yang 20151302	河北秦皇岛	MF063423	MF063957	MF065071	MF064521
鱼木 <i>Crateva formosensis</i> (Jacobs) B. S. Sun	Yao, Li, Wei 20141383	海南万宁	MF063742	MF064302	MF065388	MF064857
鱼木 <i>Crateva formosensis</i> (Jacobs) B. S. Sun	Yao, Li, Wei 20141622	海南昌江	MF063743	MF064303	MF065389	MF064858
鱼木 <i>Crateva formosensis</i> (Jacobs) B. S. Sun	Wei, Li, Zhang(2) 2014667	福建宁德	MF063744	MF064304	MF065390	MF064859
鱼木 <i>Crateva formosensis</i> (Jacobs) B. S. Sun	Yao, Wei 20150140	广东湛江	MF063745	MF064305	MF065391	MF064860
假还阳参 <i>Crepidiastrum lanceolatum</i> (Houtt.) Nakai	Li, Zhang(1) 20141663	上海小金 山岛	MF063746	MF064306	MF065392	MF064861
假还阳参 <i>Crepidiastrum lanceolatum</i> (Houtt.) Nakai	Li, Zhang(1) 2014170	上海佘山	MF063747	MF064307	—	MF064862
假还阳参 <i>Crepidiastrum lanceolatum</i> (Houtt.) Nakai	Yao, Wei 20150555	浙江温州	MF063748	MF064308	—	MF064863
假还阳参 <i>Crepidiastrum lanceolatum</i> (Houtt.) Nakai	Yao, Wei 20150660	浙江温岭	MF063749	MF064309	—	MF064864
假还阳参 <i>Crepidiastrum lanceolatum</i> (Houtt.) Nakai	Yao, Wei 20150801	浙江舟山	MF063750	MF064310	MF065393	MF064865
芙蓉菊 <i>Crossostephium chinense</i> (L.) Makino	Li, Zhang(1) 2014218	上海佘山	MF063751	MF064311	MF065394	MF064866
芙蓉菊 <i>Crossostephium chinense</i> (L.) Makino	Wei, Li, Zhang(2) 2014707	福建平潭	MF063752	MF064312	MF065395	MF064867
芙蓉菊 <i>Crossostephium chinense</i> (L.) Makino	Wei, Li, Zhang(2) 2014787	福建漳州	MF063753	MF064313	MF065396	MF064868
芙蓉菊 <i>Crossostephium chinense</i> (L.) Makino	Yao, Wei 20150684	浙江温岭	MF063754	MF064314	MF065397	—
芙蓉菊 <i>Crossostephium chinense</i> (L.) Makino	Yao, Wei 20150805	浙江舟山	MF063755	MF064315	—	MF064869
吊裙草 <i>Crotalaria retusa</i> L.	Yao, Zhang(1) 20141049	广西北海	MF063756	MF064316	MF065398	MF064870
吊裙草 <i>Crotalaria retusa</i> L.	Yao, Li, Wei 20141398	海南万宁	MF063757	MF064317	MF065399	MF064871
吊裙草 <i>Crotalaria retusa</i> L.	Yao, Li, Wei 20141428	海南陵水	MF063758	MF064318	MF065400	MF064872
吊裙草 <i>Crotalaria retusa</i> L.	Yao, Wei 20150094	广东湛江	MF063759	MF064319	MF065401	MF064873
吊裙草 <i>Crotalaria retusa</i> L.	Yao, Wei 20150201	广东惠州	MF063760	MF064320	MF065402	MF064874
菟丝子 <i>Cuscuta chinensis</i> Lam.	Wei, Li, Zhang(1) 2014410	山东蓬莱	MF063761	—	MF065403	MF064875
菟丝子 <i>Cuscuta chinensis</i> Lam.	Yao, Wei 20150741	浙江温岭	MF063762	—	MF065404	MF064876
菟丝子 <i>Cuscuta chinensis</i> Lam.	Yao, Li, Wei 20151080	辽宁大连	MF063763	—	MF065405	MF064877
菟丝子 <i>Cuscuta chinensis</i> Lam.	Yao, Li, Wei 20151169	辽宁葫芦岛	MF063764	—	MF065406	MF064878
菟丝子 <i>Cuscuta chinensis</i> Lam.	Yao, Wei, Yang 20151263	河北秦皇岛	MF063765	—	MF065407	MF064879
橘草 <i>Cymbopogon goeringii</i> (Steud.) A. Camus	Yao, Li, Wei 20141638	海南昌江	MF063527	MF064070	MF065176	MF064631
橘草 <i>Cymbopogon goeringii</i> (Steud.) A. Camus	Yao, Wei 20150724	浙江玉环	MF063528	—	—	MF064632
橘草 <i>Cymbopogon goeringii</i> (Steud.) A. Camus	Yao, Wei 20150859	浙江舟山	MF063529	—	MF065177	MF064633
地梢瓜 <i>Cynanchum thesioides</i> (Freyn) K. Schum.	Wei, Li, Zhang(1) 2014412	山东蓬莱	—	MF064321	MF065408	MF064880
地梢瓜 <i>Cynanchum thesioides</i> (Freyn) K. Schum.	Yao, Li, Wei 20151086	辽宁大连	—	MF064322	MF065409	MF064881
地梢瓜 <i>Cynanchum thesioides</i> (Freyn) K. Schum.	Yao, Li, Wei 20151183	辽宁葫芦岛	—	MF064323	MF065410	MF064882
地梢瓜 <i>Cynanchum thesioides</i> (Freyn) K. Schum.	Yao, Wei, Yang 20151265	河北秦皇岛	—	MF064324	MF065411	MF064883
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Yao, Li, Wei 20141243	海南文昌	MF063530	MF064071	MF065178	MF064634

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			ITS	matK	rbcL	trnH-psbA
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Yao, Li, Wei 20141543	海南东方	MF063531	MF064072	MF065179	MF064635
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Yao, Li, Wei 2014247	浙江慈溪	MF063532	MF064073	MF065180	MF064636
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Wei, Li, Zhang(1) 2014336	山东荣成	MF063533	MF064074	MF065181	MF064637
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Wei, Li, Zhang(2) 2014738	福建平潭	MF063534	MF064075	MF065182	MF064638
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Wei, Li, Zhang(2) 2014839	福建漳州	MF063535	MF064076	MF065183	MF064639
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Yao, Wei 20150190	广东惠州	MF063536	MF064077	—	MF064640
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Yao, Wei 20150535	浙江温州	MF063537	MF064078	MF065184	MF064641
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Yao, Wei 20150762	浙江舟山	MF063538	MF064079	MF065185	MF064642
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Yao, Wei, Yang 20151305	河北秦皇岛	MF063539	MF064080	MF065186	MF064643
狗牙根 <i>Cynodon dactylon</i> (L.) Pers.	Yao, Wei, Yang 20151382	江苏连云港	MF063540	MF064081	MF065187	MF064644
龙爪茅 <i>Dactyloctenium aegyptium</i> (L.) Beauv.	Yao, Li, Wei 20141271	海南文昌	MF063541	MF064083	MF065189	MF064645
龙爪茅 <i>Dactyloctenium aegyptium</i> (L.) Beauv.	Yao, Li, Wei 20141317	海南万宁	MF063542	MF064084	MF065190	MF064646
龙爪茅 <i>Dactyloctenium aegyptium</i> (L.) Beauv.	Yao, Li, Wei 20141421	海南陵水	MF063543	MF064085	MF065191	MF064647
龙爪茅 <i>Dactyloctenium aegyptium</i> (L.) Beauv.	Yao, Li, Wei 20141562	海南东方	MF063544	MF064086	MF065192	MF064648
龙爪茅 <i>Dactyloctenium aegyptium</i> (L.) Beauv.	Wei, Li, Zhang(2) 2014647	福建宁德	MF063545	MF064087	MF065193	MF064649
龙爪茅 <i>Dactyloctenium aegyptium</i> (L.) Beauv.	Wei, Li, Zhang(2) 2014704	福建平潭	MF063546	MF064088	MF065194	MF064650
龙爪茅 <i>Dactyloctenium aegyptium</i> (L.) Beauv.	Wei, Li, Zhang(2) 2014770	福建漳州	MF063547	MF064089	MF065195	MF064651
龙爪茅 <i>Dactyloctenium aegyptium</i> (L.) Beauv.	Yao, Wei 20150371	广东南澳	MF063548	—	—	—
升马唐 <i>Digitaria ciliaris</i> (Retz.) Koel.	Yao, Zhang(1) 20141027	广西北海	MF063549	MF064090	MF065196	MF064652
升马唐 <i>Digitaria ciliaris</i> (Retz.) Koel.	Yao, Li, Wei 20141326	海南万宁	—	—	MF065197	MF064653
升马唐 <i>Digitaria ciliaris</i> (Retz.) Koel.	Yao, Li, Wei 20141560	海南东方	MF063550	MF064091	MF065198	MF064654
升马唐 <i>Digitaria ciliaris</i> (Retz.) Koel.	Li, Zhang(1) 2014176	上海佘山	—	MF064092	—	—
升马唐 <i>Digitaria ciliaris</i> (Retz.) Koel.	Yao, Wei 20150065	广东湛江	—	MF064093	MF065199	MF064655
升马唐 <i>Digitaria ciliaris</i> (Retz.) Koel.	Yao, Li, Wei 20151002	辽宁大连	—	MF064094	MF065200	MF064656
升马唐 <i>Digitaria ciliaris</i> (Retz.) Koel.	Yao, Li, Wei 20151130	辽宁大连	—	MF064095	—	MF064657
升马唐 <i>Digitaria ciliaris</i> (Retz.) Koel.	Yao, Wei, Yang 20151270	河北秦皇岛	MF063551	MF064096	—	MF064658
升马唐 <i>Digitaria ciliaris</i> (Retz.) Koel.	Yao, Wei, Yang 20151319	江苏连云港	MF063552	MF064097	—	MF064659
升马唐 <i>Digitaria ciliaris</i> (Retz.) Koel.	Yao, Wei, Yang 20151446	江苏盐城	—	MF064098	—	MF064660
亨利马唐 <i>Digitaria henryi</i> Rendle	Yao, Li, Wei 20141272	海南文昌	MF063553	MF064099	MF065203	MF064661
亨利马唐 <i>Digitaria henryi</i> Rendle	Yao, Li, Wei 20141314	海南万宁	MF063554	MF064100	—	MF064662
二型马唐 <i>Digitaria heterantha</i> (Hook. f.) Merr.	Yao, Zhang(1) 20141011	广西北海	MF063555	MF064101	MF065204	MF064663
二型马唐 <i>Digitaria heterantha</i> (Hook. f.) Merr.	Yao, Wei 20150089	广东湛江	MF063556	MF064102	MF065205	MF064664
二型马唐 <i>Digitaria heterantha</i> (Hook. f.) Merr.	Yao, Wei 20150207	广东惠州	MF063557	MF064103	MF065206	MF064665
马唐 <i>Digitaria sanguinalis</i> (L.) Scop.	Wei, Li, Zhang(1) 2014468	山东蓬莱	MF063558	MF064104	MF065207	MF064666
马唐 <i>Digitaria sanguinalis</i> (L.) Scop.	Yao, Wei 20150188	广东惠州	MF063559	MF064105	MF065208	MF064667
千金子 <i>Leptochloa chinensis</i> (Linnaeus) Nees	Wei, Li, Zhang(1) 2014454	山东蓬莱	MF063560	MF064106	MF065209	MF064668
千金子 <i>Leptochloa chinensis</i> (Linnaeus) Nees	Yao, Wei, Yang 20151351	江苏连云港	MF063561	MF064107	MF065210	MF064669
千金子 <i>Leptochloa chinensis</i> (Linnaeus) Nees	Yao, Wei, Yang 20151423	江苏盐城	MF063562	—	MF065211	MF064670
土荆芥 <i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants	Wei, Li, Zhang(2) 2014576	福建宁德	MF063425	MF063959	MF065073	MF064522
土荆芥 <i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants	Wei, Li, Zhang(2) 2014661	福建宁德	MF063426	MF063960	MF065074	MF064523
土荆芥 <i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants	Wei, Li, Zhang(2) 2014713	福建平潭	MF063427	MF063961	MF065075	MF064524
土荆芥 <i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants	Wei, Li, Zhang(2) 2014808	福建漳州	MF063428	MF063962	MF065076	MF064525

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			ITS	matK	rbcL	trnH-psbA
土荆芥 <i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants	Yao, Wei 20150003	广东湛江	MF063429	MF063963	MF065077	MF064527
土荆芥 <i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants	Yao, Zhang(1) 20141070	广西北海	MF063424	MF063958	—	MF064526
土荆芥 <i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants	Yao, Wei 20150270	广东惠州	MF063430	MF063964	MF065078	MF064528
土荆芥 <i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants	Yao, Wei 20150502	浙江温州	—	MF063965	MF065079	MF064529
土荆芥 <i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants	Yao, Wei 20150655	浙江温岭	—	MF063966	MF065080	—
土荆芥 <i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants	Yao, Wei 20150751	浙江舟山	—	MF063967	MF065081	MF064530
稗 <i>Echinochloa crusgalli</i> (L.) Beauv.	Wei, Zhang(1) 2014266	上海奉贤	MF063563	MF064108	MF065212	MF064671
稗 <i>Echinochloa crusgalli</i> (L.) Beauv.	Wei, Li, Zhang(1) 2014337	山东荣成	MF063564	MF064109	—	MF064672
稗 <i>Echinochloa crusgalli</i> (L.) Beauv.	Wei, Li, Zhang(1) 2014404	山东蓬莱	MF063565	MF064110	MF065213	MF064673
稗 <i>Echinochloa crusgalli</i> (L.) Beauv.	Wei, Li, Zhang(1) 2014500	山东东营	MF063566	MF064111	MF065214	MF064674
稗 <i>Echinochloa crusgalli</i> (L.) Beauv.	Wei, Li, Zhang(2) 2014835	福建漳州	MF063567	MF064112	MF065215	MF064675
稗 <i>Echinochloa crusgalli</i> (L.) Beauv.	Yao, Wei 20150081	广东湛江	—	MF064113	—	—
稗 <i>Echinochloa crusgalli</i> (L.) Beauv.	Yao, Wei 20150191	广东惠州	MF063568	MF064114	MF065216	MF064676
稗 <i>Echinochloa crusgalli</i> (L.) Beauv.	Yao, Wei, Yang 20151289	河北秦皇岛	MF063569	MF064115	MF065217	MF064677
稗 <i>Echinochloa crusgalli</i> (L.) Beauv.	Yao, Wei, Yang 20151313	江苏连云港	MF063570	MF064116	MF065218	MF064678
稗 <i>Echinochloa crusgalli</i> (L.) Beauv.	Yao, Wei, Yang 20151400	江苏盐城	MF063572	MF064118	MF065220	MF064679
牛筋草 <i>Eleusine indica</i> (L.) Gaertn.	Yao, Zhang(1) 20141028	广西北海	MF063574	MF064120	MF065222	MF064680
牛筋草 <i>Eleusine indica</i> (L.) Gaertn.	Wei, Li, Zhang(1) 2014421	山东蓬莱	MF063575	MF064121	—	MF064681
牛筋草 <i>Eleusine indica</i> (L.) Gaertn.	Wei, Li, Zhang(2) 2014581	福建宁德	MF063576	MF064122	MF065223	MF064682
牛筋草 <i>Eleusine indica</i> (L.) Gaertn.	Wei, Li, Zhang(2) 2014773	福建漳州	MF063577	MF064123	MF065224	MF064683
牛筋草 <i>Eleusine indica</i> (L.) Gaertn.	Yao, Wei 20150259	广东惠州	MF063578	MF064124	MF065225	MF064684
牛筋草 <i>Eleusine indica</i> (L.) Gaertn.	Yao, Wei 20150336	广东南澳	MF063579	MF064125	MF065226	MF064685
牛筋草 <i>Eleusine indica</i> (L.) Gaertn.	Yao, Li, Wei 20151003	辽宁大连	MF063580	MF064126	MF065227	MF064686
牛筋草 <i>Eleusine indica</i> (L.) Gaertn.	Yao, Wei, Yang 20151255	河北秦皇岛	MF063581	MF064127	MF065228	MF064687
牛筋草 <i>Eleusine indica</i> (L.) Gaertn.	Yao, Wei, Yang 20151412	江苏盐城	MF063582	MF064128	MF065229	MF064688
肥披碱草 <i>Elymus excelsus</i> Turcz.	Yao, Li, Wei 20151193	辽宁葫芦岛	—	—	MF065230	MF064689
肥披碱草 <i>Elymus excelsus</i> Turcz.	Yao, Wei, Yang 20151300	河北秦皇岛	—	MF064129	MF065231	MF064690
柯孟披碱草 <i>Elymus kamoji</i> (Ohwi) S. L. Chen	Yao, Li, Wei 2014254	浙江慈溪	—	MF064132	MF065234	MF064692
柯孟披碱草 <i>Elymus kamoji</i> (Ohwi) S. L. Chen	Yao, Wei 20150505	浙江温州	—	MF064133	MF065235	MF064693
柯孟披碱草 <i>Elymus kamoji</i> (Ohwi) S. L. Chen	Yao, Wei 20150626	浙江温岭	—	MF064134	MF065236	MF064694
知风草 <i>Eragrostis ferruginea</i> (Thunb.) Beauv.	Yao, Wei 20150593	浙江温州	MF063583	MF064135	MF065241	MF064698
知风草 <i>Eragrostis ferruginea</i> (Thunb.) Beauv.	Yao, Li, Wei 20151063	辽宁大连	—	MF064136	MF065242	MF064699
知风草 <i>Eragrostis ferruginea</i> (Thunb.) Beauv.	Yao, Wei, Yang 20151260	河北秦皇岛	MF063584	—	MF065243	MF064700
小画眉草 <i>Eragrostis minor</i> Host	Wei, Li, Zhang(1) 2014430	山东蓬莱	MF063585	MF064139	MF065245	MF064704
小画眉草 <i>Eragrostis minor</i> Host	Yao, Wei, Yang 20151353	江苏连云港	MF063586	MF064140	MF065246	MF064705
鲫鱼草 <i>Eragrostis tenella</i> (L.) Beauv. ex Roem. et Schult.	Yao, Li, Wei 20141551	海南东方	MF063634	MF064142	MF065248	MF064706
鲫鱼草 <i>Eragrostis tenella</i> (L.) Beauv. ex Roem. et Schult.	Yao, Wei 20150098	广东湛江	—	MF064143	MF065249	MF064707
野黍 <i>Eriochloa villosa</i> (Thunb.) Kunth	Wei, Li, Zhang(1) 2014345	山东荣成	MF063590	MF064144	MF065250	MF064708
野黍 <i>Eriochloa villosa</i> (Thunb.) Kunth	Wei, Li, Zhang(1) 2014462	山东蓬莱	MF063591	MF064145	MF065251	MF064709

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			ITS	matK	rbcL	trnH-psbA
野黍 <i>Eriochloa villosa</i> (Thunb.) Kunth	Yao, Li, Wei 20151033	辽宁大连	MF063592	MF064146	MF065252	MF064710
野黍 <i>Eriochloa villosa</i> (Thunb.) Kunth	Yao, Li, Wei 20151157	辽宁葫芦岛	MF063593	MF064147	MF065253	MF064711
野黍 <i>Eriochloa villosa</i> (Thunb.) Kunth	Yao, Wei, Yang 20151341	江苏连云港	MF063594	MF064148	MF065254	MF064712
海滨大戟 <i>Euphorbia atoto</i> Forst. f.	Yao, Zhang(1) 20141057	广西北海	MF063766	MF064325	MF065412	MF064884
海滨大戟 <i>Euphorbia atoto</i> Forst. f.	Yao, Li, Wei 20141310	海南万宁	MF063767	MF064326	—	MF064885
海滨大戟 <i>Euphorbia atoto</i> Forst. f.	Yao, Wei 20150072	广东湛江	MF063768	MF064327	MF065413	MF064886
海滨大戟 <i>Euphorbia atoto</i> Forst. f.	Yao, Wei 20150225	广东惠州	MF063769	—	MF065414	MF064887
滨柃 <i>Eurya emarginata</i> (Thunb.) Makino	Yao, Wei 20150398	广东南澳	—	MF064328	MF065415	MF064888
滨柃 <i>Eurya emarginata</i> (Thunb.) Makino	Yao, Wei 20150561	浙江温州	MF063770	MF064329	MF065416	MF064889
滨柃 <i>Eurya emarginata</i> (Thunb.) Makino	Yao, Wei 20150673	浙江温岭	MF063771	MF064330	MF065417	MF064890
滨柃 <i>Eurya emarginata</i> (Thunb.) Makino	Yao, Wei 20150792	浙江舟山	MF063772	MF064331	MF065418	MF064891
银花苋 <i>Gomphrena celosioides</i> Mart.	Yao, Zhang(1) 20141067	广西北海	MF063773	MF064332	—	MF064892
银花苋 <i>Gomphrena celosioides</i> Mart.	Yao, Li, Wei 20141328	海南万宁	MF063774	MF064333	MF065419	MF064893
银花苋 <i>Gomphrena celosioides</i> Mart.	Yao, Li, Wei 20141412	海南陵水	MF063775	MF064334	MF065420	MF064894
银花苋 <i>Gomphrena celosioides</i> Mart.	Yao, Li, Wei 20141561	海南东方	MF063776	MF064335	MF065421	MF064895
匙羹藤 <i>Gymnema sylvestre</i> (Retz.) Schult.	Yao, Li, Wei 20141384	海南万宁	MF063777	MF064336	—	MF064896
匙羹藤 <i>Gymnema sylvestre</i> (Retz.) Schult.	Yao, Li, Wei 20141510	海南陵水	MF063778	MF064337	MF065423	MF064897
匙羹藤 <i>Gymnema sylvestre</i> (Retz.) Schult.	Yao, Wei 20150580	浙江温州	MF063780	MF064339	MF065424	MF064898
镰稈草 <i>Harpachne harpachnoides</i> (Hack.) Keng	Yao, Wei 20150171	广东湛江	MF063595	—	—	MF064713
镰稈草 <i>Harpachne harpachnoides</i> (Hack.) Keng	Yao, Wei 20150247	广东惠州	MF063596	MF064149	MF065255	MF064714
长花牛鞭草 <i>Hemarthria longiflora</i> (Hook. f.) A. Camus	Yao, Li, Wei 20151229	辽宁葫芦岛	MF063597	MF064150	MF065256	MF064715
长花牛鞭草 <i>Hemarthria longiflora</i> (Hook. f.) A. Camus	Yao, Wei, Yang 20151278	河北秦皇岛	MF063598	MF064151	—	MF064716
黄槿 <i>Hibiscus tiliaceus</i> L.	Yao, Zhang(1) 20141118	广西防城港	MF063781	MF064340	—	MF064899
黄槿 <i>Hibiscus tiliaceus</i> L.	Yao, Li, Wei 20141525	海南陵水	MF063782	—	—	—
黄槿 <i>Hibiscus tiliaceus</i> L.	Yao, Wei 20150031	广东湛江	MF063783	MF064341	—	MF064900
黄槿 <i>Hibiscus tiliaceus</i> L.	Yao, Wei 20150527	浙江温州	MF063784	—	—	—
白茅 <i>Imperata cylindrica</i> (L.) Beauv.	Yao, Li, Wei 20141273	海南文昌	MF063599	MF064152	MF065257	MF064717
白茅 <i>Imperata cylindrica</i> (L.) Beauv.	Yao, Li, Wei 20141306	海南万宁	MF063600	MF064153	MF065258	MF064718
白茅 <i>Imperata cylindrica</i> (L.) Beauv.	Yao, Li, Wei 20141624	海南昌江	MF063601	—	—	MF064719
白茅 <i>Imperata cylindrica</i> (L.) Beauv.	Yao, Li, Wei 2014233	浙江慈溪	MF063602	—	MF065259	—
白茅 <i>Imperata cylindrica</i> (L.) Beauv.	Yao, Li, Wei 2014461	海南万宁	MF063603	MF064154	MF065260	—
白茅 <i>Imperata cylindrica</i> (L.) Beauv.	Wei, Li, Zhang(2) 2014622	福建宁德	MF063604	MF064155	—	—
白茅 <i>Imperata cylindrica</i> (L.) Beauv.	Wei, Li, Zhang(2) 2014829	福建漳州	MF063605	MF064156	MF065261	—
白茅 <i>Imperata cylindrica</i> (L.) Beauv.	Yao, Wei 20150077	广东湛江	MF063606	MF064157	MF065262	MF064720
白茅 <i>Imperata cylindrica</i> (L.) Beauv.	Yao, Wei 20150205	广东惠州	MF063607	MF064158	MF065263	MF064721
白茅 <i>Imperata cylindrica</i> (L.) Beauv.	Yao, Wei 20150615	浙江温岭	MF063608	MF064159	MF065264	MF064722
硬毛木蓝 <i>Indigofera hirsuta</i> L.	Yao, Zhang(1) 20141042	广西北海	MF063785	MF064342	MF065425	—
硬毛木蓝 <i>Indigofera hirsuta</i> L.	Yao, Li, Wei 20141434	海南陵水	MF063786	MF064343	MF065426	—
硬毛木蓝 <i>Indigofera hirsuta</i> L.	Wei, Li, Zhang(2) 2014771	福建漳州	MF063787	MF064344	MF065427	—
硬毛木蓝 <i>Indigofera hirsuta</i> L.	Yao, Wei 20150142	广东湛江	MF063788	MF064345	MF065428	—
硬毛木蓝 <i>Indigofera hirsuta</i> L.	Yao, Wei 20150240	广东惠州	MF063789	MF064346	MF065429	—
厚藤 <i>Ipomoea pes-caprae</i> (L.) Sweet	Yao, Zhang(1) 20141000	广西北海	MF063790	MF064352	MF065430	MF064906
厚藤 <i>Ipomoea pes-caprae</i> (L.) Sweet	Yao, Li, Wei 20141240	海南文昌	MF063791	MF064353	MF065431	MF064907

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			ITS	matK	rbcL	trnH-psbA
厚藤 <i>Ipomoea pes-caprae</i> (L.) Sweet	Yao, Li, Wei 20141498	海南陵水	MF063792	MF064354	MF065432	MF064908
厚藤 <i>Ipomoea pes-caprae</i> (L.) Sweet	Wei, Li, Zhang(2) 2014731	福建平潭	MF063793	MF064355	MF065433	MF064909
厚藤 <i>Ipomoea pes-caprae</i> (L.) Sweet	Yao, Wei 20150411	广东南澳	MF063794	MF064356	MF065434	MF064910
假厚藤 <i>Ipomoea imperati</i> (Vahl) Griseb.	Yao, Li, Wei 20141261	海南文昌	MF063795	MF064347	MF065435	MF064901
假厚藤 <i>Ipomoea imperati</i> (Vahl) Griseb.	Yao, Li, Wei 20141300	海南万宁	MF063796	MF064348	MF065436	MF064902
假厚藤 <i>Ipomoea imperati</i> (Vahl) Griseb.	Yao, Li, Wei 20141601	海南昌江	MF063797	MF064349	MF065437	MF064903
假厚藤 <i>Ipomoea imperati</i> (Vahl) Griseb.	Wei, Li, Zhang(2) 2014658	福建宁德	MF063798	MF064350	MF065438	MF064904
假厚藤 <i>Ipomoea imperati</i> (Vahl) Griseb.	Wei, Li, Zhang(2) 2014863	福建漳州	MF063799	MF064351	MF065439	MF064905
毛鸭嘴草 <i>Ischaemum antheophoroides</i> (Steud.) Miq.	Liu 20140915_10	上海崇明	MF063610	MF064160	MF065266	MF064724
毛鸭嘴草 <i>Ischaemum antheophoroides</i> (Steud.) Miq.	Yao, Zhang(1) 20141141	广西防城港	MF063611	MF064161	MF065267	—
毛鸭嘴草 <i>Ischaemum antheophoroides</i> (Steud.) Miq.	Wei, Li, Zhang(1) 2014363	山东荣成	MF063612	MF064162	MF065268	MF064725
有芒鸭嘴草 <i>Ischaemum aristatum</i> L.	Yao, Li, Wei 20141628	海南昌江	—	MF064163	MF065269	MF064726
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Wei, Li, Zhang(1) 2014297	山东荣成	MF063433	MF063969	MF065082	MF064532
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Wei, Li, Zhang(2) 2014646	福建宁德	MF063434	MF063972	MF065085	MF064535
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Yao, Wei 20150515	浙江温州	MF063435	MF063973	MF065086	MF064536
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Yao, Wei 20150701	浙江温岭	MF063436	MF063974	MF065087	MF064537
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Yao, Wei 20150794	浙江舟山	MF063437	MF063975	MF065088	MF064538
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Yao, Li, Wei 20151001	辽宁大连	MF063438	MF063976	MF065089	—
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Yao, Li, Wei 20151117	辽宁大连	MF063439	MF063979	MF065092	MF064541
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Yao, Li, Wei 20151144	辽宁葫芦岛	MF063440	MF063980	MF065093	MF064542
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Yao, Li, Wei 20151233	河北秦皇岛	MF063441	MF063981	MF065094	MF064543
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Yao, Li, Wei 20151318	江苏连云港	MF063442	MF063982	MF065095	MF064544
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Yao, Li, Wei 20151424	江苏盐城	MF063443	MF063983	MF065096	MF064545
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Wei, Li, Zhang(1) 2014426	山东蓬莱	MF063444	MF063970	MF065083	MF064534
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Wei, Li, Zhang(1) 2014510	山东东营	MF063445	MF063971	MF065084	—
地肤 <i>Kochia scoparia</i> (L.) Schrad.	Li, Zhang(1) 2014150	上海崇明	MF063446	MF063968	—	—
海滨山黧豆 <i>Lathyrus maritimus</i> (L.) Bigelow	Wei, Li, Zhang(1) 2014357	山东荣成	MF063800	MF064357	MF065440	MF064911
海滨山黧豆 <i>Lathyrus maritimus</i> (L.) Bigelow	Wei, Li, Zhang(1) 2014397	山东蓬莱	MF063801	MF064358	MF065441	MF064912
海滨山黧豆 <i>Lathyrus maritimus</i> (L.) Bigelow	Yao, Wei 20150804	浙江舟山	MF063802	MF064359	MF065442	MF064913
海滨山黧豆 <i>Lathyrus maritimus</i> (L.) Bigelow	Yao, Li, Wei 20151065	辽宁大连	MF063803	MF064360	MF065443	MF064914
海滨山黧豆 <i>Lathyrus maritimus</i> (L.) Bigelow	Yao, Li, Wei 20151149	辽宁葫芦岛	MF063804	MF064361	MF065444	MF064915
匍枝栓果菊 <i>Launaea sarmentosa</i> (Willd.) Merr. et Chun	Yao, Li, Wei 20141247	海南文昌	MF063805	MF064362	MF065445	—
匍枝栓果菊 <i>Launaea sarmentosa</i> (Willd.) Merr. et Chun	Yao, Li, Wei 20141298	海南万宁	MF063806	MF064363	MF065446	—
匍枝栓果菊 <i>Launaea sarmentosa</i> (Willd.) Merr. et Chun	Wei, Li, Zhang(2) 2014871	福建漳州	MF063807	MF064364	MF065447	—
匍枝栓果菊 <i>Launaea sarmentosa</i> (Willd.) Merr. et Chun	Yao, Wei 20150068	广东湛江	MF063808	MF064365	MF065448	—
匍枝栓果菊 <i>Launaea sarmentosa</i> (Willd.) Merr. et Chun	Yao, Wei 20150196	广东惠州	MF063809	MF064366	MF065449	—
滨麦 <i>Leymus mollis</i> (Trin.) Hara	Wei, Li, Zhang(1) 2014300	山东荣成	—	MF064164	MF065270	MF064727
滨麦 <i>Leymus mollis</i> (Trin.) Hara	Yao, Li, Wei 20151199	辽宁葫芦岛	—	MF064165	MF065271	MF064728
补血草 <i>Limonium sinense</i> (Girard) Kuntze	Yao, Li, Wei 20141577	海南东方	MF063810	MF064367	MF065450	MF064916

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			ITS	matK	rbcL	trnH-psbA
补血草 <i>Limonium sinense</i> (Girard) Kuntze	Yao, Wei 20150263	广东惠州	MF063811	MF064368	—	MF064917
补血草 <i>Limonium sinense</i> (Girard) Kuntze	Yao, Wei 20150829	浙江舟山	MF063812	—	MF065451	MF064918
补血草 <i>Limonium sinense</i> (Girard) Kuntze	Yao, Li, Wei 20151101	辽宁大连	MF063813	MF064369	—	MF064919
补血草 <i>Limonium sinense</i> (Girard) Kuntze	Yao, Li, Wei 20151380	江苏连云港	MF063814	MF064370	—	MF064920
滨海珍珠菜 <i>Lysimachia mauritiana</i> Lam.	Yao, Li, Wei 20141231	上海金山	MF063815	MF064371	—	MF064921
滨海珍珠菜 <i>Lysimachia mauritiana</i> Lam.	Wei, Li, Zhang(2) 2014586	福建宁德	MF063816	MF064372	—	MF064922
滨海珍珠菜 <i>Lysimachia mauritiana</i> Lam.	Wei, Li, Zhang(2) 2014853	福建漳州	MF063817	MF064373	—	—
滨海珍珠菜 <i>Lysimachia mauritiana</i> Lam.	Yao, Wei 20150420	广东南澳	MF063818	—	—	—
滨海珍珠菜 <i>Lysimachia mauritiana</i> Lam.	Yao, Wei 20150556	浙江温州	MF063819	—	—	MF064923
刺裸实 <i>Maytenus diversifolia</i> (Maxim.) Ding Hou	Yao, Li, Wei 20141365	海南万宁	MF063820	—	MF065452	—
刺裸实 <i>Maytenus diversifolia</i> (Maxim.) Ding Hou	Yao, Li, Wei 20141482	海南陵水	MF063821	MF064374	—	—
刺裸实 <i>Maytenus diversifolia</i> (Maxim.) Ding Hou	Yao, Li, Wei 20141620	海南昌江	MF063822	—	MF065453	—
刺裸实 <i>Maytenus diversifolia</i> (Maxim.) Ding Hou	Yao, Wei 20150131	广东湛江	—	MF064375	—	—
五节芒 <i>Miscanthus floridulus</i> (Lab.) Warb. ex Schum. et Laut.	Wei, Li, Zhang(2) 2014724	福建平潭	MF063613	MF064166	—	MF064729
五节芒 <i>Miscanthus floridulus</i> (Lab.) Warb. ex Schum. et Laut.	Yao, Wei 20150533	浙江温州	MF063614	MF064167	—	MF064730
芒 <i>Miscanthus sinensis</i> Anderss.	Yao, Zhang(1) 20141124	广西防城港	MF063615	MF064168	—	—
芒 <i>Miscanthus sinensis</i> Anderss.	Yao, Li, Wei 20141354	海南万宁	—	MF064169	MF065272	MF064731
芒 <i>Miscanthus sinensis</i> Anderss.	Wei, Li, Zhang(1) 2014327	山东荣成	MF063616	MF064170	—	MF064732
芒 <i>Miscanthus sinensis</i> Anderss.	Yao, Wei, Yang 20151245	河北秦皇岛	—	—	MF065273	—
芒 <i>Miscanthus sinensis</i> Anderss.	Yao, Wei, Yang 20151376	江苏连云港	MF063617	MF064171	—	—
类芦 <i>Neyraudia reynaudiana</i> (Kunth) Keng ex Hitchcock	Yao, Wei 20150344	广东南澳	MF063618	MF064172	MF065274	MF064733
露兜树 <i>Pandanus tectorius</i> Sol.	Yao, Zhang(1) 20141075	广西北海	—	MF064376	MF065454	MF064924
露兜树 <i>Pandanus tectorius</i> Sol.	Yao, Li, Wei 20141278	海南文昌	—	MF064377	MF065455	MF064925
露兜树 <i>Pandanus tectorius</i> Sol.	Yao, Li, Wei 20141468	海南陵水	—	MF064378	MF065456	MF064926
露兜树 <i>Pandanus tectorius</i> Sol.	Yao, Wei 20150084	广东湛江	—	MF064379	MF065457	MF064927
露兜树 <i>Pandanus tectorius</i> Sol.	Yao, Wei 20150378	广东南澳	—	MF064380	MF065458	MF064928
铺地黍 <i>Panicum repens</i> L.	Yao, Zhang(1) 20141014	广西北海	MF063619	MF064173	MF065275	MF064734
铺地黍 <i>Panicum repens</i> L.	Yao, Zhang(1) 20141114	广西防城港	MF063620	MF064174	MF065276	MF064735
铺地黍 <i>Panicum repens</i> L.	Yao, Li, Wei 20141244	海南文昌	MF063621	MF064175	MF065277	MF064736
铺地黍 <i>Panicum repens</i> L.	Yao, Li, Wei 20141549	海南东方	MF063622	MF064176	MF065278	MF064737
铺地黍 <i>Panicum repens</i> L.	Wei, Li, Zhang(2) 2014606	福建宁德	MF063623	MF064177	MF065279	MF064738
铺地黍 <i>Panicum repens</i> L.	Wei, Li, Zhang(2) 2014819	福建漳州	MF063624	MF064178	MF065280	MF064739
铺地黍 <i>Panicum repens</i> L.	Yao, Wei 20150093	广东湛江	MF063625	MF064179	MF065281	MF064740
铺地黍 <i>Panicum repens</i> L.	Yao, Wei 20150251	广东惠州	MF063626	MF064180	MF065282	MF064741
龙珠果 <i>Passiflora foetida</i> L.	Yao, Zhang(1) 20141050	广西北海	MF063823	MF064381	MF065459	MF064929
龙珠果 <i>Passiflora foetida</i> L.	Yao, Li, Wei 20141282	海南文昌	MF063824	—	MF065460	MF064930
龙珠果 <i>Passiflora foetida</i> L.	Yao, Li, Wei 20141448	海南陵水	MF063825	—	MF065461	MF064931
龙珠果 <i>Passiflora foetida</i> L.	Yao, Li, Wei 20141557	海南东方	MF063826	MF064382	—	MF064932
龙珠果 <i>Passiflora foetida</i> L.	Yao, Wei 20150070	广东湛江	MF063827	—	MF065462	MF064933
滨海前胡 <i>Peucedanum japonicum</i> Thunb.	Wei, Li, Zhang(2) 2014697	福建平潭	MF063828	MF064383	MF065463	—
滨海前胡 <i>Peucedanum japonicum</i> Thunb.	Wei, Li, Zhang(2) 2014751	福建平潭	MF063829	MF064384	MF065464	—
滨海前胡 <i>Peucedanum japonicum</i> Thunb.	Yao, Wei 20150547	浙江温州	MF063830	MF064385	MF065465	—

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			ITS	matK	rbcL	trnH-psbA
滨海前胡 <i>Peucedanum japonicum</i> Thunb.	Yao, Wei 20150709	浙江温岭	MF063831	MF064386	MF065466	—
滨海前胡 <i>Peucedanum japonicum</i> Thunb.	Yao, Wei 20150803	浙江舟山	MF063832	MF064387	MF065467	—
束尾草 <i>Phacelurus latifolius</i> (Steud.) Ohwi	Yao, Li, Wei 20141656	海南昌江	MF063627	MF064181	MF065283	MF064742
束尾草 <i>Phacelurus latifolius</i> (Steud.) Ohwi	Yao, Li, Wei 2014238	浙江慈溪	MF063628	MF064182	MF065284	MF064743
芦苇 <i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Yao, Li, Wei 2014227	浙江慈溪	—	MF064183	MF065283	MF064744
芦苇 <i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Wei, Li, Zhang(1) 2014377	山东蓬莱	—	MF064184	MF065284	MF064745
芦苇 <i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Wei, Li, Zhang(1) 2014485	山东东营	—	MF064185	MF065285	MF064746
芦苇 <i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Wei, Li, Zhang(2) 2014602	福建宁德	—	MF064186	MF065286	MF064747
过江藤 <i>Phyla nodiflora</i> (L.) Greene	Yao, Zhang(1) 20141090	广西北海	MF063833	MF064388	MF065468	MF064934
过江藤 <i>Phyla nodiflora</i> (L.) Greene	Yao, Li, Wei 20141249	海南文昌	MF063834	MF064389	MF065469	MF064935
过江藤 <i>Phyla nodiflora</i> (L.) Greene	Yao, Li, Wei 20141598	海南东方	MF063835	MF064390	MF065470	MF064936
过江藤 <i>Phyla nodiflora</i> (L.) Greene	Wei, Li, Zhang(2) 2014593	福建宁德	MF063836	MF064391	MF065471	MF064937
过江藤 <i>Phyla nodiflora</i> (L.) Greene	Yao, Wei 20150037	广东湛江	MF063837	MF064392	MF065472	MF064938
阔苞菊 <i>Pluchea indica</i> (L.) Less.	Yao, Zhang(1) 20141089	广西北海	MF063838	MF064393	MF065473	MF064939
阔苞菊 <i>Pluchea indica</i> (L.) Less.	Yao, Li, Wei 20141397	海南万宁	MF063839	MF064394	MF065474	MF064940
阔苞菊 <i>Pluchea indica</i> (L.) Less.	Yao, Li, Wei 20141567	海南东方	—	MF064395	MF065475	MF064941
阔苞菊 <i>Pluchea indica</i> (L.) Less.	Yao, Wei 20150002	广东湛江	MF063840	MF064396	—	MF064942
阔苞菊 <i>Pluchea indica</i> (L.) Less.	Yao, Wei 20150393	广东南澳	MF063841	MF064397	MF065476	MF064943
白顶早熟禾 <i>Poa acroleuca</i> Steud.	Yao, Wei 20150511	浙江温州	MF063630	MF064189	MF065287	MF064752
白顶早熟禾 <i>Poa acroleuca</i> Steud.	Yao, Wei 20150697	浙江温岭	—	MF064190	—	—
白顶早熟禾 <i>Poa acroleuca</i> Steud.	Yao, Wei 20150755	浙江舟山	MF063631	MF064191	MF065288	MF064753
细长早熟禾 <i>Poa proluxior</i> Rendle	Yao, Wei 20150652	浙江温岭	MF063636	MF064192	MF065290	MF064756
细长早熟禾 <i>Poa proluxior</i> Rendle	Yao, Wei 20150730	浙江玉环	MF063637	MF064193	MF065291	MF064757
棒头草 <i>Polypogon fugax</i> Nees ex Steud.	Yao, Li, Wei 2014248	浙江慈溪	MF063639	MF064196	MF065294	MF064758
棒头草 <i>Polypogon fugax</i> Nees ex Steud.	Yao, Wei 20150606	浙江温州	MF063640	MF064197	MF065295	MF064759
棒头草 <i>Polypogon fugax</i> Nees ex Steud.	Yao, Wei 20150610	浙江温岭	MF063641	MF064198	MF065296	MF064760
棒头草 <i>Polypogon fugax</i> Nees ex Steud.	Yao, Wei 20150764	浙江舟山	MF063642	MF064199	MF065297	MF064761
棒头草 <i>Polypogon fugax</i> Nees ex Steud.	Yao, Wei 20150853	浙江舟山	MF063643	MF064200	MF065299	MF064762
棒头草 <i>Polypogon fugax</i> Nees ex Steud.	Yao, Wei, Yang 20151440	江苏盐城	MF063644	MF064201	MF065300	MF064763
多枝扁莎 <i>Pycnus polystachyus</i> (Rottb.) P. Beauv.	Yao, Zhang(1) 20141037	广西北海	—	—	MF065477	MF064944
多枝扁莎 <i>Pycnus polystachyus</i> (Rottb.) P. Beauv.	Wei, Li, Zhang(2) 2014608	福建宁德	—	—	MF065478	—
多枝扁莎 <i>Pycnus polystachyus</i> (Rottb.) P. Beauv.	Wei, Li, Zhang(2) 2014733	福建平潭	—	MF064398	MF065479	MF064945
多枝扁莎 <i>Pycnus polystachyus</i> (Rottb.) P. Beauv.	Yao, Wei 20150129	广东湛江	—	—	MF065480	MF064946
多枝扁莎 <i>Pycnus polystachyus</i> (Rottb.) P. Beauv.	Yao, Wei 20150321	广东惠州	—	MF064399	MF065481	MF064947
海滨莎 <i>Remirea maritima</i> Aubl.	Yao, Li, Wei 20141296	海南万宁	MF063842	—	—	MF064948
海滨莎 <i>Remirea maritima</i> Aubl.	Yao, Li, Wei 20151124	辽宁大连	MF063843	MF064400	MF065482	MF064949
海滨莎 <i>Remirea maritima</i> Aubl.	Yao, Li, Wei 20151226	辽宁葫芦岛	MF063844	MF064401	MF065483	MF064950
红毛草 <i>Melinis repens</i> (Willd.) Zizka	Yao, Zhang(1) 20141038	广西北海	MF063645	MF064202	MF065301	MF064764
红毛草 <i>Melinis repens</i> (Willd.) Zizka	Yao, Li, Wei 20141287	海南文昌	MF063646	MF064203	MF065302	MF064765
红毛草 <i>Melinis repens</i> (Willd.) Zizka	Wei, Li, Zhang(1) 2014342	山东荣成	MF063647	MF064204	MF065303	MF064766
红毛草 <i>Melinis repens</i> (Willd.) Zizka	Yao, Wei 20150141	广东湛江	MF063648	MF064205	MF065304	MF064767
红毛草 <i>Melinis repens</i> (Willd.) Zizka	Yao, Wei 20150192	广东惠州	MF063649	MF064206	MF065305	MF064768
红毛草 <i>Melinis repens</i> (Willd.) Zizka	Yao, Wei 20150365	广东南澳	MF063650	MF064207	MF065306	MF064769
筒轴茅 <i>Rottboellia cochinchinensis</i> (Loureiro) Clayton	Yao, Zhang(1) 20141105	广西防城港	MF063651	MF064208	MF065307	MF064770

物种名 Specise name	采集者/采集号 Collector/Voucher Numbers	采集地 Locality	登陆号 GenBank accession			
			ITS	matK	rbcL	trnH-psbA
筒轴茅 <i>Rotthoellia cochinchinensis</i> (Loureiro) Clayton	Wei, Li, Zhang(2) 2014821	福建漳州	MF063652	MF064209	—	—
斑茅 <i>Saccharum arundinaceum</i> Retz.	Yao, Li, Wei 20141359	海南万宁	MF063653	MF064208	MF065308	MF064771
斑茅 <i>Saccharum arundinaceum</i> Retz.	Yao, Li, Wei 20141450	海南陵水	MF063654	MF064209	—	—
斑茅 <i>Saccharum arundinaceum</i> Retz.	Yao, Wei 20150092	广东湛江	MF063655	MF064210	—	MF064772
盐角草 <i>Salicornia europaea</i> L.	Yao, Wei 20150435	广东南澳	MF063453	MF064211	MF065309	MF064773
盐角草 <i>Salicornia europaea</i> L.	Yao, Wei 20150841	浙江舟山	MF063454	MF064212	MF065310	MF064774
盐角草 <i>Salicornia europaea</i> L.	Liu lef20150507-6	广西北海	MF063455	MF063989	MF065099	MF064551
无翅猪毛菜 <i>Salsola komarovii</i> Iljin	Yao, Li, Wei 20151159	辽宁葫芦岛	MF063457	MF063997	MF065100	MF064552
无翅猪毛菜 <i>Salsola komarovii</i> Iljin	Yao, Wei, Yang 20151369	江苏连云港	MF063458	MF063999	MF065102	MF064553
无翅猪毛菜 <i>Salsola komarovii</i> Iljin	Wei, Li, Zhang(1) 2014296	山东荣成	MF063459	MF063993	MF065107	MF064554
无翅猪毛菜 <i>Salsola komarovii</i> Iljin	Wei, Li, Zhang(1) 2014373	山东蓬莱	MF063460	MF063994	—	MF064555
无翅猪毛菜 <i>Salsola komarovii</i> Iljin	Yao, Li, Wei 20151062	辽宁大连	MF063461	MF063995	MF065103	MF064556
无翅猪毛菜 <i>Salsola komarovii</i> Iljin	Yao, Li, Wei 20151070	辽宁大连	MF063462	MF063996	MF065104	MF064557
无翅猪毛菜 <i>Salsola komarovii</i> Iljin	Yao, Li, Wei 20151264	河北秦皇岛	MF063463	MF063998	MF065105	MF064558
刺沙蓬 <i>Salsola tragus</i> L.	Yao, Li, Wei 20151225	辽宁葫芦岛	MF063464	MF064000	MF065106	MF064559
刺沙蓬 <i>Salsola tragus</i> L.	Yao, Wei, Yang 20151307	河北秦皇岛	MF063465	MF064001	MF065108	MF064560
刺沙蓬 <i>Salsola tragus</i> L.	Yao, Li, Wei 20151209	辽宁葫芦岛	MF063466	—	MF065109	MF064561
艾蒿 <i>Sauropus bacciformis</i> (L.) Airy Shaw	Yao, Zhang(1) 20141066	广西北海	MF063845	MF064402	MF065110	MF064562
艾蒿 <i>Sauropus bacciformis</i> (L.) Airy Shaw	Yao, Li, Wei 20141248	海南文昌	MF063846	MF064403	MF065111	MF064563
艾蒿 <i>Sauropus bacciformis</i> (L.) Airy Shaw	Yao, Li, Wei 20141572	海南东方	MF063847	MF064404	MF065484	MF064951
艾蒿 <i>Sauropus bacciformis</i> (L.) Airy Shaw	Yao, Wei 20150011	广东湛江	MF063848	MF064405	MF065485	MF064952
艾蒿 <i>Sauropus bacciformis</i> (L.) Airy Shaw	Yao, Wei 20150425	广东南澳	MF063849	MF064406	MF065486	MF064953
草海桐 <i>Scaevola sericea</i> Vahl	Yao, Li, Wei 20141255	海南文昌	MF063850	MF064407	MF065487	MF064954
草海桐 <i>Scaevola sericea</i> Vahl	Yao, Li, Wei 20141305	海南万宁	MF063851	—	MF065488	MF064955
草海桐 <i>Scaevola sericea</i> Vahl	Yao, Li, Wei 20141491	海南陵水	MF063852	MF064408	MF065489	MF064956
草海桐 <i>Scaevola sericea</i> Vahl	Yao, Li, Wei 20141629	海南昌江	MF063853	MF064409	MF065490	MF064957
草海桐 <i>Scaevola sericea</i> Vahl	Yao, Wei 20150386	广东南澳	MF063854	—	MF065491	MF064958
沙滩黄芩 <i>Scutellaria strigillosa</i> Hemsl.	Wei, Li, Zhang(1) 2014362	山东荣成	—	MF064410	MF065492	MF064959
沙滩黄芩 <i>Scutellaria strigillosa</i> Hemsl.	Wei, Li, Zhang(1) 2014407	山东蓬莱	—	MF064411	MF065493	MF064960
沙滩黄芩 <i>Scutellaria strigillosa</i> Hemsl.	Yao, Li, Wei 20151205	辽宁葫芦岛	—	MF064412	MF065494	MF064961
海马齿 <i>Sesuvium portulacastrum</i> (L.) L.	Yao, Zhang(1) 20141024	广西北海	MF063855	MF064413	MF065495	MF064962
海马齿 <i>Sesuvium portulacastrum</i> (L.) L.	Yao, Li, Wei 20141457	海南陵水	MF063856	MF064414	MF065496	MF064963
海马齿 <i>Sesuvium portulacastrum</i> (L.) L.	Yao, Li, Wei 20141615	海南昌江	MF063857	MF064415	—	MF064964
海马齿 <i>Sesuvium portulacastrum</i> (L.) L.	Yao, Wei 20150020	广东湛江	MF063858	MF064416	—	MF064965
海马齿 <i>Sesuvium portulacastrum</i> (L.) L.	Yao, Wei 20150158	广东湛江	MF063859	MF064417	—	MF064966
大狗尾草 <i>Setaria faberii</i> Herrm.	Wei, Li, Zhang(1) 2014597	福建宁德	MF063632	MF064213	—	MF064967
大狗尾草 <i>Setaria faberii</i> Herrm.	Wei, Li, Zhang(1) 2014628	福建宁德	MF063633	MF064214	—	MF064968
狗尾草 <i>Setaria viridis</i> (L.) Beauv.	Yao, Wei, Yang 20141539	河北秦皇岛	MF063656	—	MF065311	—
狗尾草 <i>Setaria viridis</i> (L.) Beauv.	Yao, Li, Wei 2014231	浙江慈溪	MF063657	MF064216	MF065312	MF064775
狗尾草 <i>Setaria viridis</i> (L.) Beauv.	Wei, Li, Zhang(1) 2014315	山东荣成	MF063658	MF064217	—	—
狗尾草 <i>Setaria viridis</i> (L.) Beauv.	Wei, Li, Zhang(1) 2014399	山东蓬莱	MF063659	MF064218	MF065314	MF064777
狗尾草 <i>Setaria viridis</i> (L.) Beauv.	Wei, Li, Zhang(2) 2014716	福建平潭	MF063660	MF064219	MF065315	MF064778
互花米草 <i>Spartina alterniflora</i> Lois.	Yao, Li, Wei 2014240	浙江慈溪	MF063664	MF064223	MF065316	MF064779
互花米草 <i>Spartina alterniflora</i> Lois.	Wei, Li, Zhang(1) 2014514	山东东营	MF063665	MF064224	MF065317	MF064780

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			ITS	matK	rbcL	trnH-psbA
互花米草 <i>Spartina alterniflora</i> Lois.	Wei, Li, Zhang(2) 2014580	福建宁德	MF063666	MF064225	—	—
互花米草 <i>Spartina alterniflora</i> Lois.	Wei, Li, Zhang(2) 2014601	福建宁德	MF063667	MF064226	MF065320	MF064784
互花米草 <i>Spartina alterniflora</i> Lois.	Wei, Li, Zhang(2) 2014749	福建平潭	MF063668	MF064227	—	MF064785
互花米草 <i>Spartina alterniflora</i> Lois.	Wei, Li, Zhang(2) 2014805	福建漳州	—	MF064228	—	—
互花米草 <i>Spartina alterniflora</i> Lois.	Yao, Wei 20150025	广东湛江	—	MF064229	—	MF064786
互花米草 <i>Spartina alterniflora</i> Lois.	Liu 20150507_7		MF063669	MF064230	MF065321	—
互花米草 <i>Spartina alterniflora</i> Lois.	Yao, Wei 20150622	浙江温岭	MF063670	MF064231	MF065322	MF064787
互花米草 <i>Spartina alterniflora</i> Lois.	Yao, Wei 20150835	浙江舟山	—	MF064232	MF065323	MF064788
老鼠芳 <i>Spinifex littoreus</i> (Burm. f.) Merr.	Yao, Zhang(1) 20141010	广西北海	MF063671	MF064233	MF065324	MF064789
老鼠芳 <i>Spinifex littoreus</i> (Burm. f.) Merr.	Yao, Li, Wei 20141301	海南万宁	MF063672	MF064234	MF065325	MF064790
老鼠芳 <i>Spinifex littoreus</i> (Burm. f.) Merr.	Yao, Li, Wei 20141462	海南陵水	MF063673	MF064235	MF065326	MF064791
老鼠芳 <i>Spinifex littoreus</i> (Burm. f.) Merr.	Wei, Li, Zhang(2) 2014860	福建漳州	MF063674	MF064236	MF065327	MF064792
双蕊鼠尾粟 <i>Sporobolus diander</i> (Retz.) Beauv.	Yao, Li, Wei 20141408	海南万宁	MF063675	—	MF065328	—
双蕊鼠尾粟 <i>Sporobolus diander</i> (Retz.) Beauv.	Wei, Li, Zhang(1) 2014702	福建平潭	MF063676	MF064237	—	MF064793
双蕊鼠尾粟 <i>Sporobolus diander</i> (Retz.) Beauv.	Yao, Wei 20150047	广东湛江	MF063677	MF064238	MF065329	MF064794
双蕊鼠尾粟 <i>Sporobolus diander</i> (Retz.) Beauv.	Yao, Wei 20150281	广东惠州	MF063678	MF064239	MF065330	MF064795
双蕊鼠尾粟 <i>Sporobolus diander</i> (Retz.) Beauv.	Yao, Wei 20150363	广东南澳	MF063679	—	MF065331	MF064796
鼠尾粟 <i>Sporobolus fertilis</i> (Steud.) W. D. Clayt.	Wei, Li, Zhang(2) 2014592	福建宁德	MF063680	MF064240	MF065332	MF064797
鼠尾粟 <i>Sporobolus fertilis</i> (Steud.) W. D. Clayt.	Yao, Wei 20150411	广东南澳	MF063681	MF064241	MF065333	MF064798
盐地鼠尾粟 <i>Sporobolus virginicus</i> (L.) Kunth	Yao, Li, Wei 20141451	海南陵水	MF063683	MF064242	MF065334	MF064799
盐地鼠尾粟 <i>Sporobolus virginicus</i> (L.) Kunth	Yao, Li, Wei 20141568	海南东方	MF063684	MF064243	MF065335	MF064800
盐地鼠尾粟 <i>Sporobolus virginicus</i> (L.) Kunth	Wei, Li, Zhang(2) 2014639	福建宁德	—	MF064244	MF065336	MF064802
盐地鼠尾粟 <i>Sporobolus virginicus</i> (L.) Kunth	Wei, Li, Zhang(2) 2014807	福建漳州	—	MF064245	MF065337	MF064803
盐地鼠尾粟 <i>Sporobolus virginicus</i> (L.) Kunth	Yao, Wei 20150074	广东湛江	—	MF064246	—	MF064804
假马鞭 <i>Stachytarpheta jamaicensis</i> (L.) Vahl.	Yao, Zhang(1) 20141019	广西北海	—	MF064418	MF065338	MF064805
假马鞭 <i>Stachytarpheta jamaicensis</i> (L.) Vahl.	Yao, Li, Wei 20141260	海南文昌	MF063860	MF064225	—	MF064806
假马鞭 <i>Stachytarpheta jamaicensis</i> (L.) Vahl.	Yao, Li, Wei 20141570	海南东方	MF063861	MF064226	MF065497	MF064969
假马鞭 <i>Stachytarpheta jamaicensis</i> (L.) Vahl.	Yao, Wei 20150042	广东湛江	—	MF064227	MF065498	MF064970
假马鞭 <i>Stachytarpheta jamaicensis</i> (L.) Vahl.	Yao, Wei 20150377	广东南澳	MF063862	MF064420	MF065499	MF064971
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Wei, Li, Zhang(1) 2014612	福建宁德	MF063470	MF064421	MF065500	MF064972
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Wei, Li, Zhang(1) 2014614	福建宁德	MF063471	MF064422	MF065501	MF064973
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Wei, Li, Zhang(1) 2014636	福建宁德	MF063472	MF064005	MF065115	MF064567
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Wei, Li, Zhang(1) 2014815	福建漳州	MF063473	MF064006	MF065116	MF064568
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Yao, Wei 20150261	广东惠州	MF063476	MF064007	MF065117	MF064569
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Yao, Wei 20150010	广东雷州	MF063474	MF064008	MF065118	MF064570
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Yao, Wei 20150157	广东湛江	MF063475	MF064009	MF065121	MF064573
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Yao, Wei 20150434	广东南澳	MF063477	MF064010	MF065119	MF064571
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Wei, Li, Zhang(1) 2014513	山东东营	MF063469	MF064011	MF065120	MF064572
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Yao, Zhang(1) 20141025	广西北海	MF063467	MF064012	MF065122	MF064574
南方碱蓬 <i>Suaeda australis</i> (R. Br.) Moq.	Yao, Wei(1) 20150831	浙江舟山	MF063480	MF064013	—	MF064566
碱蓬 <i>Suaeda glauca</i> (Bunge) Bunge	Yao, Li, Wei(1) 2014235	浙江慈溪	MF063481	MF064014	—	MF064564
碱蓬 <i>Suaeda glauca</i> (Bunge) Bunge	Wei, Li, Zhang(1) 2014291	山东荣成	MF063482	MF064015	—	MF064577
碱蓬 <i>Suaeda glauca</i> (Bunge) Bunge	Yao, Wei 20150609	浙江温岭	MF063484	MF064016	MF065127	MF064578
碱蓬 <i>Suaeda glauca</i> (Bunge) Bunge	Wei, Li, Zhang(1) 2014374	山东蓬莱	MF063483	MF064017	MF065128	MF064579

物种名 Specise name	采集者/采集号 Collector/Voucher Numbers	采集地 Locality	登陆号 GenBank accession			
			ITS	matK	rbcL	trnH-psbA
碱蓬 <i>Suaeda glauca</i> (Bunge) Bunge	Yao, Wei 20150824	浙江舟山	MF063485	MF064019	—	MF064581
碱蓬 <i>Suaeda glauca</i> (Bunge) Bunge	Yao, Li, Wei i20151009	辽宁大连	MF063486	MF064018	MF065129	—
碱蓬 <i>Suaeda glauca</i> (Bunge) Bunge	Yao, Li, Wei 20151089	辽宁大连	MF063487	MF064020	—	MF064582
碱蓬 <i>Suaeda glauca</i> (Bunge) Bunge	Yao, Li, Wei 20151147	辽宁葫芦岛	MF063488	MF064021	MF065130	MF064583
碱蓬 <i>Suaeda glauca</i> (Bunge) Bunge	Yao, Wei, Yang 20151256	河北秦皇岛	MF063489	MF064022	MF065131	MF064584
碱蓬 <i>Suaeda glauca</i> (Bunge) Bunge	Yao, Wei, Yang 20151317	江苏连云港	MF063490	MF064023	MF065132	MF064585
盐地碱蓬 <i>Suaeda salsa</i> (L.) Pall.	Yao, Li, Wei 2014236	浙江慈溪	MF063492	MF064024	MF065133	MF064586
盐地碱蓬 <i>Suaeda salsa</i> (L.) Pall.	Wei, Zhang(1) 2014273	上海奉贤	MF063493	MF064025	MF065134	MF064587
盐地碱蓬 <i>Suaeda salsa</i> (L.) Pall.	Wei, Li, Zhang(1) 2014348	山东荣成	MF063494	MF064027	MF065136	MF064589
盐地碱蓬 <i>Suaeda salsa</i> (L.) Pall.	Wei, Li, Zhang(1) 2014488	山东东营	MF063495	MF064028	MF065137	MF064590
盐地碱蓬 <i>Suaeda salsa</i> (L.) Pall.	Yao, Li, Wei 20151120	辽宁大连	MF063496	MF064029	MF065135	MF064591
盐地碱蓬 <i>Suaeda salsa</i> (L.) Pall.	Yao, Li, Wei 20151216	辽宁葫芦岛	—	MF064030	MF065138	MF064592
盐地碱蓬 <i>Suaeda salsa</i> (L.) Pall.	Yao, Wei, Yang 20151301	河北秦皇岛	MF063497	MF064031	MF065140	MF064593
盐地碱蓬 <i>Suaeda salsa</i> (L.) Pall.	Yao, Wei, Yang 20151338	江苏连云港	—	MF064032	MF065141	MF064594
盐地碱蓬 <i>Suaeda salsa</i> (L.) Pall.	Yao, Wei, Yang 20151401	江苏盐城	MF063498	MF064033	MF065142	MF064595
番杏 <i>Tetragonia tetragonioides</i> (Pall.) Kuntze	Wei, Li, Zhang(1) 2014579	福建宁德	—	MF064034	MF065143	MF064596
番杏 <i>Tetragonia tetragonioides</i> (Pall.) Kuntze	Wei, Li, Zhang(1) 2014720	福建平潭	MF063863	MF064035	MF065144	MF064597
番杏 <i>Tetragonia tetragonioides</i> (Pall.) Kuntze	Wei, Li, Zhang(1) 2014781	福建漳州	MF063864	MF064423	MF065502	MF064974
番杏 <i>Tetragonia tetragonioides</i> (Pall.) Kuntze	Yao, Wei 20150027	广东湛江	MF063865	MF064424	MF065503	—
番杏 <i>Tetragonia tetragonioides</i> (Pall.) Kuntze	Yao, Wei 20150599	浙江温州	MF063866	MF064425	MF065504	MF064975
砂引草 <i>Tournefortia sibirica</i> L.	Wei, Li, Zhang(1) 2014294	山东荣成	MF063867	MF064426	MF065505	MF064976
砂引草 <i>Tournefortia sibirica</i> L.	Wei, Li, Zhang(1) 2014370	山东蓬莱	—	MF064427	MF065506	MF064977
砂引草 <i>Tournefortia sibirica</i> L.	Yao, Li, Wei 20151077	辽宁大连	—	MF064428	—	MF064978
砂引草 <i>Tournefortia sibirica</i> L.	Yao, Wei, Yang 20151366	江苏连云港	MF063868	MF064429	—	MF064979
碱菀 <i>Tripolium vulgare</i> Nees	Yao, Li, Wei 2014241	浙江慈溪	MF063869	MF064430	MF065507	MF064980
碱菀 <i>Tripolium vulgare</i> Nees	Wei, Zhang(1) 2014261	上海奉贤	MF063870	MF064431	MF065508	MF064981
碱菀 <i>Tripolium vulgare</i> Nees	Yao, Li, Wei 20151222	辽宁葫芦岛	MF063871	MF064432	MF065509	MF064982
碱菀 <i>Tripolium vulgare</i> Nees	Yao, Wei, Yang 20151287	河北秦皇岛	MF063872	MF064433	MF065510	MF064983
碱菀 <i>Tripolium vulgare</i> Nees	Yao, Wei, Yang 20151315	江苏连云港	MF063873	MF064434	MF065511	MF064984
单叶蔓荆 <i>Vitex rotundifolia</i> L.	Yao, Zhang 20141009	广西北海	MF063874	MF064435	MF065512	MF064985
单叶蔓荆 <i>Vitex rotundifolia</i> L.	Yao, Li, Wei 20141259	海南文昌	MF063875	MF064436	MF065513	MF064986
单叶蔓荆 <i>Vitex rotundifolia</i> L.	Wei, Li, Zhang(1) 2014301	山东荣成	MF063876	MF064437	MF065514	MF064987
单叶蔓荆 <i>Vitex rotundifolia</i> L.	Yao, Wei 20150597	浙江温州	MF063877	MF064438	MF065515	MF064988
单叶蔓荆 <i>Vitex rotundifolia</i> L.	Yao, Li, Wei 20151191	辽宁葫芦岛	MF063878	MF064439	MF065516	MF064989
了哥王 <i>Wikstroemia indica</i> (L.) C. A. Mey	Yao, Zhang(1) 20141031	广西北海	MF063879	—	MF065517	MF064990
了哥王 <i>Wikstroemia indica</i> (L.) C. A. Mey	Yao, Li, Wei 20141644	海南昌江	MF063880	MF064440	MF065518	MF064991
了哥王 <i>Wikstroemia indica</i> (L.) C. A. Mey	Wei, Li, Zhang(1) 2014765	福建平潭	MF063881	MF064441	MF065519	MF064992
了哥王 <i>Wikstroemia indica</i> (L.) C. A. Mey	Yao, Wei 20150725	浙江温岭	MF063882	MF064442	MF065520	MF064993
了哥王 <i>Wikstroemia indica</i> (L.) C. A. Mey	Yao, Li, Wei 20151021	辽宁大连	MF063883	MF064443	MF065521	MF064994
沟叶结缕草 <i>Zoysia matrella</i> (L.) Merr.	Yao, Wei 20150054	广东湛江	MF063685	MF064444	MF065522	MF064995
沟叶结缕草 <i>Zoysia matrella</i> (L.) Merr.	Yao, Wei 20150680	浙江温岭	MF063686	MF064445	MF065523	MF064996
中华结缕草 <i>Zoysia sinica</i> Hance	Yao, Li, Wei 20141283	海南文昌	—	MF064247	MF065339	MF064807
中华结缕草 <i>Zoysia sinica</i> Hance	Yao, Wei 20150215	广东惠州	MF063687	MF064248	MF065340	MF064808
中华结缕草 <i>Zoysia sinica</i> Hance	Yao, Wei 20150451	广东南澳	MF063688	MF064249	MF065341	—

物种名 Specise name	采集者/采集号 Collector/Voucher Numbers	采集地 Locality	登陆号 GenBank accession			
			ITS	matK	rbcL	trnH-psbA
中华结缕草 <i>Zoysia sinica</i> Hance	Yao, Wei 20150542	浙江温州	MF063689	MF064250	MF065342	MF064809
中华结缕草 <i>Zoysia sinica</i> Hance	Yao, Wei 20150710	浙江温岭	MF063690	MF064251	MF065343	MF064810

Li: 李宏庆, Wei: 魏亚男, Yao: 姚鹏程, Zhang(1): 张振, Zhang(2): 张丽芳, Yang: 杨主爱, Liu: 刘文亮; —: data not obtained.

附录2 候选条形码片段的PCR反应体系

Appendix 2 PCR amplification system of the candidate barcoding fragments

	ITS	<i>matK</i>	<i>rbcL</i>	<i>trnH-psbA</i>
10×Buffer (Mgcl ₂ free)	2.5 μL	2 μL	2.5 μL	2 μL
Mgcl ₂ (25 mM)	1.5 μL	0.6 μL	2.5 μL	2 μL
dNTP (2.5 μM)	0.5 μL	3.2 μL	4 μL	3.2 μL
Taq polymerase (2.5 U/μL)	0.5 μL	0.4 μL	0.5 μL	0.4 μL
Primers (10 pmol/μL)	0.5 μL	1 μL	1 μL	1 μL
DNA template	1 μL	1 μL	1 μL	1 μL
ddH ₂ O	To 25 μL	To 25 μL	To 25 μL	To 25 μL

附录3 扩增使用引物及条件
Appendix 3 Amplification Protocol and Primers Information

片段 Fragment	引物 Primers	扩增程序 Amplification Protocol
ITS	18sdir: CGTAACAAGGTTTCCGTA ITS4: TCCTCCGCTTATTGATATGC (White et al, 1990)	94℃ 4 min; 94℃ 1 min; 50℃ 45 s; 72℃ 1 min 30 cycles; 72℃ 5 min
matK	matK 3F-KIM: CGTACAGTACTTTTGTTTACGAG matK IR-KIM: ACCCAGTCCATCTGGAAATCTTGGTTC (http://barcoding.si.edu) matK 390F: CGATCTATTCATTCAATATTTC matK 1326R: TCTAGCACACGAAAGTCGAAGT*	94℃ 1 min; 94℃ 30 s; 52℃ 20 s; 72℃ 50 s 35 cycles; 72℃ 5 min
rbcL	rbcL a-f: ATGTCACCACAAACAGAGACTAAAGC rbcL a-r: CTTCTGCTACAAATAAGAATCGATCTC (Kress & Erickson 2007)	95℃ 4 min; 94℃ 30 s; 55℃ 1 min; 70℃ 1 min 35 cycles; 54℃ 1 min
trnH-psbA	trnH: CGCGCATGGTGGATTACAATCC (Tate & Simpson 2003) psbA: GTTATGCATGAACGTAATGCTC (Sang et al, 1997)	95℃ 4 min; 94℃ 30 s; 55℃ 1 min; 72℃ 1 min 35 cycles; 72℃ 10 min

*禾本科所有物种、单叶蔓荆、海滨大戟使用的引物, 参见Cuénoud 等 (2002)
* Primers for Poaceae, *Vitex rotundifolia* and *Euphorbia atoto*. see Cuénoud et al, (2002)