

Supplementary tables

Table 1. Reports on successful identification of plant species using DNA barcoding techniques and the primers used.

Plant sample analysed	Markers studied	Most efficient marker	Reference
<i>Aquilaria</i> Lam.	ITS, matK, psbA-trnH, rbcL, trnL-F	ITS + matK, ITS + rbcL and ITS + trnL-F	(102)
<i>Boerhavia diffusa</i> L. <i>Tinospora cordifolia</i>	nrITS and matK	nrITS and matK	(103)
<i>Phyllanthus urinaria</i>	trnSGCU-trnG-UCC, trnT-UGU-trnL-UAA and petA-psbJ	trnSGCU-trnG-UCC, trnT-UGU-trnL-UAA and petA-psbJ	(104)
<i>Euphorbia tithymaloides</i>	rbcL, ITS, matK	matK	(105)
<i>Cissampelos pareira</i> L.		ITS, matK, psbA-trnH, rbcL	(106)
<i>Uncaria</i> sp.	ITS2, ITS, matK, psbA-trnH, rbcL, trnL-F	ITS/ITS2	(107)
<i>Tinospora sinensis</i> <i>Cocculus hirsutus</i>	ITS, matK, psbA-trnH, rbcL	ITS, matK, psbA-trnH, rbcL	(106)
<i>Eremogone</i> sps. <i>Minuartia</i> sps. <i>Pseudostellaria</i> sps. <i>Sagina</i> and <i>Stellaria</i> sps.	rbcL, psbA-trnH and ITS	rbcL + ITS	(108)
<i>Amaranthus hybridus</i>	rbcL, matK and ITS2	ITS2	(59)
<i>Aerva javanica</i>	rbcL, matK and ITS2	ITS2	(59)
<i>Coffea</i> sps.	matK and ITS2	matK	(109)
<i>Musa acuminata</i> Colla <i>M. balsiana</i> Colla	ITS2	ITS2	(110)
<i>Astragalus</i> L.	rbcL, matK, ITS2 and psbA-trnH	ITS2	(111)

<i>Catharanthus roseus</i>		psbA-trnH, ITS2	(112)
<i>Aenhenrya rotundifolia</i>	rbcl, matK	matK + rbcl	(113)
<i>Stephania</i> sp.	ITS, ITS2, psbA-trnH, matK, rbcl and trnL-F	ITS + psbA-trnH	(114)
<i>Clerodendrum</i> sp.	ITS2, matK, rbcl, ycf1 and different combinations	ITS2 + matK	(80)
<i>Senna obtusifolia</i> and <i>S. occidentalis</i>	ycf1, rpl23, petL and matK	Mini barcodes from matK, 647F-8476R primer	(115)
<i>Tectona grandis</i> <i>Artocarpus heterophyllus</i> <i>Swetenia macrophylla</i>	matK-trnT and atpB-rbcl	matK-trnT and atpB-rbcl	(116)
<i>Ocimum tenuiflorum</i> L.	trnH-psbA	trnH-psbA	(117)
<i>Calamus</i> sp.	rbcl, matK, ITS1, ITS2, psbA-trnH, rpoC, rpoB, psbK-psbI, atpF-atpH, psbZ-trnFM, PRK and RPB2	RPB2	(118)
<i>Santalum</i> L. sps.	matK, psbA-trnH, trnK and trnL and different combinations	psbA-trnH + trnK	(119)
<i>Pulsatilla</i> (Ranunculaceae)	rbcl, psbA-trnH, matK and ITS and 11 combinations	rbcl + matK + psbA-trnH, ITS	(120)
<i>Amomi fructus</i>	ITS, matK, rbcl rpoB and trnL-F	ITS	(121)
<i>Gymnostemma longipes</i> <i>G. burmanicum</i> , <i>G. pubescens</i>	Ycf3, accD, petD, psbB	petD + psbB	(122)
<i>Siraitia grosvenorii</i> and <i>S. siamensis</i>	ndhC-trnV-UAC, trnR-UCU-atpA, rpoB-trnC-GCA, ycf1	ndhC-trnV-UAC, trnR-UCU-atpA, rpoB-trnC-GCA, ycf1	(123)
<i>Achillea millefolium</i> L. <i>Melissa officinalis</i> L. <i>Echinacea pallida</i>	ITS, psbA-trnH rbcl1-B	rbcl1-B	(124)

<i>Zingiber officinale</i> Roscoe <i>Harpagophytum procumbens</i> <i>Echinacea purpurea</i> (L.) Moench, <i>Tilia platyphyllos</i> Scop	ITS, psbA-trnH rbcL1-B	ITS, psbA-trnH rbcL1-B	(124)
<i>Echinacea angustifolia</i> DC., <i>Epilobium angustifolium</i> L.	ITS, psbA-trnH rbcL1-B	ITS	(124)
<i>Ziziphora</i> sps.	ITS, trnL-F, matK	ITS	(125)
<i>Dendrobium</i> sps.	rbcL, matK and ITS2	ITS2	(126)
<i>Pterocarpus</i> sp.	ITS2, matK, ndhF-rpl32 and rbcL	matK + ndhF-rpl32 + ITS2	(127)
<i>Phyllanthus</i> sp.	rbcL, matK, ITS1, ITS2, psbA-trnH, trnL, trnL-F	matK, ITS, ITS2, psbA-trnH, trnL, trnL-F	(128)
<i>Pterocarpus santalinus</i>	ITS2, matK, ndhF-rpl32 and rbcL	ndhF-rpl32	(127)
<i>Panax</i> sp.		trnC-rps16, trnS-trnG and trnE-trnM	(129)
<i>Aegle marmelos</i> , <i>Andrographis paniculate</i> , <i>Asparagus racemosus</i> , <i>Bacopa monneri</i> , <i>Curcuma longa</i>	nr-ITS and psbA-trnH	nr-ITS and psbA-trnH	(130)
<i>Eurycoma longifolia</i>	rbcL, ITS2	ITS2	(131)
<i>Araliaceae</i> sps.	ITS2	ITS2	(132)
<i>Gekko gecko</i>		12S rRNA	(133)
<i>Annona muricata</i>	RbcL matK, trnL	rbcL	(134)
<i>Trachelospermum jasminoides</i>	ITS2	ITS2	(135)
<i>Swertia chirayita</i>	ITS, psbA-trnH, matK and rbcL	ITS	(136)
<i>Pulsatilla chinensis</i>	ITS2	ITS2	(137)
<i>Rhodiola crenulata</i> and <i>R. rosea</i>	ITS2	ITS2	(138)
<i>Dryopteridis crassirhizomatis</i> Rhizoma	psbA-trnH	psbA-trnH	(139)

<i>Hibiscus</i> sp.	matK, rbcLa, trnH-psbA and ITS2	matK, matK + ITS2 matK + ITS2 + trnH- psbA	(140)
<i>Curcuma longa</i>	ITS, matK and rbcL	ITS	(52)
<i>Calendula officinalis</i>	ITS, rbcL, 5' trnK-matK, trnL-F, psbA-trnH	trnK5' intron and trnL-F	(141)
<i>S. cordifolia</i>	rbcL, matK, psbA-trnH and ITS2	psbA-trnH + ITS2	(142)
<i>Bunium persiicum</i>	ITS2, rbcL-a, matK, psbA-trnH	psbA-trnH	(143)
<i>Radix et Rhizoma Clematidis</i>	trnH-psbA	trnH-psbA	(144)
<i>Cinnamomum verum</i>	rbcL, matK and psbA-trnH	psbA-trnH, rbcL	(145)
<i>Lilium</i> sp.	ITS, ITS2, rbcL, matK and psbA-trnH	ITS	(146)
<i>Atractylodis macrocephalae Rhizoma,</i> <i>Atractylodis Rhizoma</i>		ITS2	(147)
<i>Gossypium</i> sp.	rbcL, matK, ITS2	matK + ITS2	(148)
<i>Rouwolfia serpentina</i>	trnL-trnF, rpl16, rps16	rps16	(149)
<i>Gentiana</i> sps.	5SrRNA, trnH-psbA, TrnL-F, trnL-F and rpl36-rps8	5SrRNA, trnL-F	(150)
<i>Pinelliae tuber</i>	matK and rbcL	matK and rbcL	(36)
<i>Boerhavia diffusa</i>	ITS, ITS1, ITS2, psbA-trnH	ITS, ITS1	(151)
<i>Sabia parviflora</i>	trnH-psbA, rbcL-a, matK	trnH-psbA	(152)
<i>Taraxacum mongolium</i>		ITS1, nrDNA	(153)
<i>Taxillus chinensis</i>	rbcL, matK, psbA-trnH, ITS and ITS2	psbA-trnH	(154)
Pteridophyte sp.	rpoB, rpoC1 rbcL matK, psbA-trnH	psbA-trnH	(155)
<i>Dendrobium</i> sps.	psbA-trnH	psbA-trnH	(156)
<i>Roseceae</i> sp.	matK, rpoB, rpoC1, rbcL, nr DNA, ITS	ITS, nrDNA	(157)
<i>Euphorbia maculate</i> <i>E. humifus</i>		ITS1, ITS2	(158)
<i>Curcuma wenyujin,</i> <i>C. phaeoaulis</i> and <i>C. kwangsiensis</i>		5S rRNA spacer domain	(159)

Table 2. Application of DNA barcodes and DNA sequence-based markers in the authentication of herbal medicinal ingredients.

Sample analysed	DNA barcode analysed	Adulterants detected	Reference
<i>Piper nigrum</i>	rps16, trnK-UUU	<i>Carica papaya</i>	(160)
<i>Glehnia littoralis</i>	trnF-L, ITS	<i>S. costus</i> , <i>C. lanceolata</i> , <i>S. conoidea</i> , <i>C. tangshen</i> , <i>A. stricta</i>	(102)
<i>Phyllanthus urinaria</i>	trnSGCU-trnG-UCC, trnT-UCG-trnL-UAA and petA-psbJ	<i>P. acidus</i> , <i>P. reticulatus</i> , <i>P. niruri</i> , <i>P. niruri</i> sub sp. <i>lathyroides</i> , <i>P. pulcher</i> , <i>P.</i> <i>franchetianus</i>	(104)
<i>Scrophularia ningpoensis</i>	trnH-GUG-psbA, psbZ-trnG- GCC, trnT-UGU-trnL-UAA, trnP-GAA-ndhJ, ndhJ-ndhK, rbcL-accD, psbE-pet-L and psaC-ndhE, ndhF	<i>S. kakudensis</i> , <i>S. buergeriana</i> , <i>S. yoshimurae</i> .	(161)
<i>Artocarpus heterophyllus</i>	matK-trnT and atpB-rbcL	<i>Mangifera indica</i> , <i>P. americana</i>	(116)
<i>Tectona grandis</i>	matK-trnT and & atpB-rbcL	<i>Samanea saman</i> <i>Magnolia champaca</i>	(116)
<i>Achillea millefolium</i> L.	ITS	Different <i>Hypericum</i> species	(162)
<i>Matricaria chamomilla</i> L.	matK	<i>Matricaria recutita</i>	(163)
<i>A. millefolium</i> L.	matK	<i>Valeriana hirtella</i> , <i>Tilia cordata</i> <i>Blepharocalyx tweediei</i>	(163)
<i>Withania somnifera</i>	ITS2 and trnH-psbA	<i>Trigonella foenum-graceum</i> o r <i>Senna auriculata</i>	(96)
<i>Tilia platyphyllos</i>	matK	<i>T. cordata</i>	(163)
<i>Camellia sinensis</i> (L.) Kuntze	matK	<i>B. tweediei</i>	(163)

<i>Hypericum perforatum</i> L.	ITS	<i>H. maculatum</i> , <i>H. montanum</i> , <i>H. acmosepalum</i> , <i>H. barbatum</i> , <i>H. tetrapterum</i> <i>H. ascryon</i> , <i>H. crux andrea</i> , <i>H. hirsutum</i>	(162)
<i>Matricaria chamomilla</i>	matK	<i>Matricaria recutita</i>	(163)
<i>Valeriana officinalis</i> L.	matK	<i>Valeriana hirtella</i>	(163)
<i>Svetenia macrophylla</i>	matK-trnT and atpB-rbcL	<i>Magnolia champaca</i> , <i>P. americana</i> , <i>Toona ciliata</i>	(116)
<i>Cassia fistula</i>	atpF-atpH, trnH-psbA	<i>Cassia tora</i>	(164)
<i>Ocimum sanctum</i> , <i>Bacopa monneri</i>	atpF-atpH, trnH-psbA and trnL	<i>Vitex negundo</i> <i>Centella asiatica</i>	(164)
<i>Ziziphora</i> sp.	ITS	<i>Thymus</i> sps.	(125)
<i>Gloriosa superba</i>	nr-ITS and psbA-trnH	<i>Ipomea</i> sp.	(130)
<i>Ophiocordyceps sinensis</i>	ITS	<i>O. militaris</i>	(134)
<i>Dendroboium huoshanense</i>	ITS2	<i>D. moniliform</i> , <i>D. officinale</i>	(126)
Punarnava (<i>Boerhavia diffusa</i>)	nr-ITS and psbA-trnH	<i>Boerhavia erecta</i> L.	(130)
<i>Coscinium fenestratum</i>	nr-ITS and psbA-trnH	<i>Berberis</i> sp.	(130)
<i>Embelia ribes</i>	nr-ITS and psbA-trnH	<i>Embelia tsjeriam-cottam</i> and <i>Maesa indica</i>	(130)
<i>Tinospora cordifolia</i>	nr-ITS and psbA-trnH	<i>Tinospora sinensis</i>	(130)
Thyme powder	rbcl, matK	<i>Triticum</i> sp.	(165)

		<i>Aegilops speltoides</i>	
Ginger powder	rbcl, matK	<i>Oryza</i> sp. <i>Triticum</i> sp.	(165)
Nagakesar (<i>Mesua ferrea</i>)	nr-ITS, trnH-psbA	<i>Callophyllum inophyllum</i>	(130)
<i>Rhodiola crenulata</i> and <i>R. rosea</i>	ITS2	Other <i>Rhodiola</i> sps.	(138)
<i>S. cordifolia</i> (market sample)	psbA-trnH and ITS2	<i>Abutilon</i> sp <i>Ixonanthes</i> sp., <i>Terminalia</i> sp., <i>Fagonia</i> sp., <i>Tephrosia</i> sp. and various other <i>Sida</i> sps.	(142)
<i>Arisaematis rhizoma</i>	rbcl, matK	<i>Pinelliae tuber</i>	(166)
<i>Pinelliae tuber</i>	rbcl, matK	<i>Arisaematis rhizoma</i>	(166)
<i>Panax ginseng</i>	ITS2	<i>Panax quinquefolium</i>	(167)
<i>Dalbergia odorifera</i>	ITS2	<i>Caesalpinia sappan</i>	(167)
<i>Bupleurum chinense</i>	ITS2	<i>Bupleurum</i> sp.	(167)
<i>Glycine max</i>	ITS2	<i>Phaseolus vulgaris</i>	(167)
<i>Curcuma longa</i>	ITS	<i>C. zedoaria</i> , Cassava starch, wheat, barley and rye	(52)
<i>Crocus sativus</i>	trnH-psbA, rbcl-a and ITS2	<i>Carthamus tinctorius</i> or <i>Chrysanthemum x morifolium</i>	(168)
<i>Crocus sativus</i>	trnK5' intron and trnL-F	<i>Calendula officinalis</i>	(141)
<i>Bunium persicum</i>	ITS2, rbcl, matK, psbA-trnH	<i>Cuminum cymimum</i>	(143)
<i>Gentiana</i> sps.	5SrRNA and trnF-L	<i>Gentiana rhodantha</i> and <i>Podophyllum hexandrum</i>	(150)
<i>Pinelliae tuber</i>	matK and rbcl	<i>P. ternata</i> , <i>P. tripatrita</i> , <i>P. peditisecta</i>	(96)
<i>Boerhavia diffusa</i>	ITS, ITS1, ITS2 psbA-trnH	<i>Boerhavia erecta</i> , <i>B. repanda</i> , <i>B. coccinea</i> and	(151)

		<i>B. verticillata</i>	
<i>Sabia parviflora</i>	trnH-psbA	<i>S. yunnanensis</i> , <i>Pederia yunnanensis</i> , <i>P. scandens</i> var. <i>tomentosa</i> and <i>Sinomenium acutum</i>	(152)
<i>Radix astragali</i>	ITS + matK	<i>Astragalus membranaceus</i> <i>A. membranaceus</i> var. <i>mongholica</i>	(169)
<i>Taraxacum mongolium</i>	ITS1, nrDNA	<i>Taraxacum officinale</i> , <i>Ixeridium laevigatum</i> , <i>Youngia japonica</i> , <i>Ixeris chinensis</i> , <i>Emilia sonchifolia</i> var. <i>javanica</i>	(153)
<i>Crocus sativus</i>	ITS	<i>C. vernus-w</i> and <i>C. vernus-p</i> , <i>Chrysanthemum chanetii</i> , <i>Nelumbo nucifera</i> , <i>Zea mays</i> and <i>Garthamus tinctorius</i>	(168)