

江西苦苣苔科一新种——龙南报春苣苔

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摘要: 描述了产于江西九连山地区的苦苣苔科 (Gesneriaceae) 一新种——龙南报春苣苔 (*Primulina longnanensis* G. L. Xu)。该种与同属植物温氏报春苣苔 (*P. wenii* Jian Li et L. J. Yan)、九连山报春苣苔 (*P. jiulianshanensis* F. Wen et G. L. Xu) 形态接近, 且分子证据也表明该新种与温氏报春苣苔和九连山报春苣苔近缘, 但前者花冠筒细筒形或弯曲细筒形, 中间的苞片和中间的小苞片极小或退化, 苞片和花萼裂片先端每侧具 1~3 个紫红色小齿, 叶柄和叶片两面被腺毛, 花丝疏被短腺毛, 退化雄蕊无毛, 花萼裂片、花冠筒、檐部裂片上唇和下唇以及退化雄蕊等部位均远小于后二者, 故易与后二者相区别。

关键词: 龙南报春苣苔; 苦苣苔科; 新种; 江西; 九连山

中图分类号: Q949.778.4 文献标志码: A 文章编号: 1674-7895(2024)01-0098-10

DOI: 10.3969/j.issn.1674-7895.2024.01.10

***Primulina longnanensis* (Gesneriaceae), a new species from Jiangxi** DENG Xinxin^{1,2}, ZENG Nuoguo³, XU Guoliang^{4,①}, ZHANG Zufu⁴, ZUO Zhengyu⁵ (1. College of Tourism and Landscape Architecture, Guilin University of Technology, Guilin 541004, China; 2. Guangxi Institute of Botany, Guangxi Zhuang Autonomous Region and Chinese Academy of Sciences, Guilin 541006, China; 3. Ganzhou Forest Science Research Institute, Ganzhou 341008, China; 4. Jiangxi Jiulianshan National Nature Reserve Administrative Bureau, Ganzhou 341799, China; 5. Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650201, China), *J. Plant Resour. & Environ.*, 2024, 33(1): 98-107

Abstract: *Primulina longnanensis* G. L. Xu, a new Gesneriaceae species from Jiulianshan area in Jiangxi, China was described. Morphologically similar to *Primulina wenii* Jian Li et L. J. Yan and *Primulina jiulianshanensis* F. Wen et G. L. Xu, *P. longnanensis* stands out as a distinct taxon based on both morphological and molecular evidence. Key distinguishing characters include the tubular or curved-tubular corolla tube, central bracts and central bracteoles very small or absent, 1-3 small purplish-red teeth at apex of each side of bracts and calyx lobes, glandular-pubescent on both surfaces of petioles and leaf blades, sparsely glandular-puberulent filaments, glabrous staminodes, and smaller obviously in calyx lobes, corolla tube, upper lip and lower lip of limb, and staminodes than *P. wenii* and *P. jiulianshanensis*.

Key words: *Primulina longnanensis* G. L. Xu; Gesneriaceae; new species; Jiangxi; Jiulianshan

1883 年建立的报春苣苔属 (*Primulina* Hance) 最初为单种属, 其模式种为产于广东北部连江流域的报

春苣苔 (*P. tabacum* Hance)^[1]。2011 年, Liu 等^[2]基于形态学特征发表了该属的第 2 个种——广西报春

收稿日期: 2023-05-16

基金项目: 广西科学院基础研究基金 (CQZ-C-1901); 江西省林业局林业科技创新项目 (创新专项 2022-2)

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引用格式: 邓欣欣, 曾惟国, 徐国良, 等. 江西苦苣苔科一新种——龙南报春苣苔[J]. 植物资源与环境学报, 2024, 33(1): 98-107.

苣苔(*P. guangxiensis* Yan Liu et W. B. Xu)。基于形态学和分子生物学的证据,报春苣苔属于 2011 年被重新定义^[3-5]。近年来,随着分类学家对报春苣苔属的不断深入研究,该属大量的新分类群被发表和报道,根据 Plants of the World Online 网站(<http://www.plants of the world online.org/>)截至 2022 年 12 月 31 日的数据库,全世界共有该属植物 240 种(含变种,下同),仅 2020 年报道的该属新种就有 10 个^[6]。目前,报春苣苔属为中国分布的苦苣苔科(Gesneriaceae)中物种数量最多的属^[7]。

江西省地处中亚热带,共有苦苣苔科植物 14 属 41 种,主要分布于赣南和赣中等地区,其中报春苣苔属植物 15 种^[8]。2011 年后发表的报春苣苔属新种有 4 个,分别为乐平小花苣苔(*P. lepingensis* Z. L. Ning et M. Kang)^[9]、遂川报春苣苔(*P. suichuanensis* X. L. Yu et J. J. Zhou)^[10]、粗筒小花苣苔(*P. inflata* Li. H. Yang et M. Z. Xu)^[11]和九连山报春苣苔(*P. jiulianshanensis* F. Wen et G. L. Xu)^[7]。2022 年 3 月,作者所在研究团队对江西省南部的苦苣苔科植物进行科考时发现 1 个特殊种群,形态与九连山报春苣苔^[7]和温氏报春苣苔(*P. wenii* Jian Li et L. J. Yan)^[12]相近,然而经过连续 2 年对该野外种群的仔细观察,发现该种的苞片、小苞片、花萼和花冠等部位形态以及叶柄、叶片、花丝和退化雄蕊等部位的毛被形态与前二者有明显区别,且该种群的花冠、花丝、萼片和退化雄蕊等部位远小于九连山报春苣苔和温氏报春苣苔,结合形态学和分子生物学的证据并查阅相关文献^[13-15],确认其为一新种,根据模式产地,命名为龙南报春苣苔(*Primulina longnanensis* G. L. Xu),模式标本保存于广西植物研究所标本馆(IBK)。

1 研究方法

1.1 形态学观察

经过多次在野外观察龙南报春苣苔种群的形态特征,于盛花期和果实成熟期采集活体植株并测量叶片、花序和果序等部位,使用 MZ41 两档变倍体视显微镜(广州市明美光电技术有限公司)和 Olympus-CX33 光学显微镜(日本奥林巴斯株式会社)观察各部位的微观形态,使用 Nikon D750 单反相机(日本尼康株式会社)拍摄记录。同时,与保存于安徽大学生命科学学院植物标本室(ANU)、中国科学院西双版纳

热带植物园标本馆(HITBC)、广西植物研究所标本馆、中国科学院华南植物园标本馆(IBSC)、中国科学院昆明植物研究所标本馆(KUN)和中国科学院植物研究所标本馆(PE)等标本馆的报春苣苔属植物标本进行对比。用于形态对比的温氏报春苣苔和九连山报春苣苔的数据来源于原始文献^[12,7]。

1.2 取样和 DNA 测序

从龙南报春苣苔野外种群中随机选择 1 株,采集新鲜叶片放入硅胶中干燥保存,取 0.3 g 的干燥叶片,使用 CTAB 植物基因组 DNA 快速提取试剂盒(北京普鲁顿生物科技有限公司)提取 DNA^[16]。分别按照 Möller 等^[17]和 Smissen 等^[18]的方法对 ITS 和 *trnL-F* 序列进行扩增和测序。从 GenBank 网站(<https://www.ncbi.nlm.nih.gov/nucleotide>)下载 178 种报春苣苔属植物和 2 种石山苣苔属(*Petrocodon* Hance)植物的 ITS 和 *trnL-F* 序列,凭证标本号和 GenBank 登录号见表 1。

1.3 系统发育树构建

利用 MAFFT v.7.017 软件将获得的龙南报春苣苔序列以及 178 种报春苣苔属植物和 2 种石山苣苔属植物的 ITS 和 *trnL-F* 序列进行组装和比对^[19],随后利用 Geneious 9.1.4 软件对 ITS 和 *trnL-F* 序列进行校正和组合^[20]。分别利用最大似然法和贝叶斯推理法对上述植物进行基于 ITS 序列、*trnL-F* 序列和 ITS+*trnL-F* 组合序列的系统发育分析。最大似然法分析利用 IQ-TREE 1.6.12 软件^[21],使用 GTR+R6 模型,重复 1 000 次超快自展分析。贝叶斯推理法分析利用 MrBayes v.3.2.6 软件^[22],基于 Markov Chain Monte Carlo (MCMC)算法,使用 GTR+I+G 模型,设置 4 条运行链,运行 1×10^6 代,每 1 000 代取 1 棵树,前 25% 的树作为老化样本丢弃,使用剩余的树构建一致树。之后,对基于 ITS 序列、*trnL-F* 序列和 ITS+*trnL-F* 组合序列 3 个矩阵构建的系统发育树结果进行拓扑结构对比,当冲突分支的超快自展支持率(UFBoot)大于或等于 80%、贝叶斯后验概率(BIPP)大于或等于 0.95 时,认为结果存在明显冲突^[23]。

2 结果和分析

2.1 形态学分析

龙南报春苣苔的生境和形态特征及温氏报春苣苔、九连山报春苣苔的形态特征见图版 I。

表1 供试报春苔属和石山苔属植物的凭证标本号及 ITS 和 *trnL*-F 序列的 GenBank 登录号
Table 1 Voucher numbers and GenBank accession numbers of ITS and *trnL*-F sequences of test *Primulina* Hance and *Petrocodon* Hance plants

种(变种) Species (variety)	凭证标本号 Voucher number	GenBank 登录号 GenBank accession number		种(变种) Species (variety)	凭证标本号 Voucher number	GenBank 登录号 GenBank accession number	
		ITS	<i>trnL</i> -F			ITS	<i>trnL</i> -F
<i>Primulina alutacea</i>	YD07	KY394847	KY393441	<i>Primulina heterochroa</i>	GXMES01	KY394898	KY393492
<i>Primulina argentea</i>	YMBC	KY394848	KY393442	<i>Primulina heterotricha</i>	HNBT01	KY394899	KY393493
<i>Primulina baishouensis</i>	GXLG05	KY394849	KY393443	<i>Primulina hezhouensis</i>	HZXH	MK747143	MK746258
<i>Primulina balansae</i>	BALAN	MK747141	MK746274	<i>Primulina hiepii</i>	WF2	MK747144	MK746223
<i>Primulina beiliuensis</i>	GXBLBC	KY394850	KY393444	<i>Primulina hochiensis</i>	GXIB	JX506903	JX506795
<i>Primulina beiliuensis</i> var. <i>fimbribracteata</i>	SGQJ04	KY394851	KY393445	<i>Primulina huaijiensis</i>	GDHJ02	KF498127	KY393495
<i>Primulina bicolor</i>	SLHLCB	KY394852	KY393446	<i>Primulina huangü</i>	WF12	MK747138	MK746231
<i>Primulina bipinnatifida</i>	GXLG04	KY394853	KY393447	<i>Primulina huananensis</i>	Xu11697	KU220602	KU220608
<i>Primulina bobaiensis</i>	BBGL01	KY394854	KY393448	<i>Primulina jiangyongensis</i>	HNJY01	KY394902	KY393496
<i>Primulina bogneriana</i>	WF7	MK747166	MK746225	<i>Primulina jingxiensis</i>	LZXHGL01	KY394903	KY393497
<i>Primulina brachytricha</i>	DWDMCZ	KF498048	KY393450	<i>Primulina jülianshanensis</i>	WF217	OP243287	OP243283
<i>Primulina brachytricha</i> var. <i>magnibracteata</i>	KFC4193	MK369979	MK369994	<i>Primulina jüwanshanica</i>	JWS	MK747116	MK746260
<i>Primulina brunnea</i>	BRUN	MK747142	MK746275	<i>Primulina juliae</i>	LJM1210011	MG727889	MG727873
<i>Primulina bullata</i>	GXJX06	KF498071	KY393451	<i>Primulina langshanica</i>	LSCZ	KY394907	KY393501
<i>Primulina cangwuensis</i>	GXLG04	KY394855	KY393447	<i>Primulina latinervis</i>	XIN1	KY394908	KY393502
<i>Primulina cardaminifolia</i>	GXLB	MK747131	MK746255	<i>Primulina laxiflora</i>	P22927	JX506910	JX506802
<i>Primulina carinata</i>	NTBC	KY394858	KY393452	<i>Primulina lechangensis</i>	GDLC12	KY394910	KY393504
<i>Primulina cataractarum</i>	N1	MW900263	MW960358	<i>Primulina leei</i>	LSGL01	KY394911	KY393505
<i>Primulina chizhouensis</i>	JXFY01	KY394860	KY393454	<i>Primulina leiophylla</i>	GXJX07	KY394912	KY393506
<i>Primulina colaniae</i>	WF8	MK747167	MK746224	<i>Primulina lepingensis</i>	JXLP01	KY394913	KY394913
<i>Primulina confertiflora</i>	GDYS05	MK747101	MK746253	<i>Primulina leprosa</i>	GXMS055	KY394914	KY393508
<i>Primulina cordata</i>	HYH010	KC190200	KC190207	<i>Primulina lianpingensis</i>	CHLT016	MH343910	MH344542
<i>Primulina cordifolia</i>	GXRA02	KY394863	KY393457	<i>Primulina liboensis</i>	GXJX08	KY394917	KY393511
<i>Primulina cordistigma</i>	GDYCXZ	MK747118	MK746251	<i>Primulina liguliformis</i>	GXIB	JX506912	JX506804
<i>Primulina crassirhizoma</i>	CJGL01	KY394864	KY393458	<i>Primulina lijiangensis</i>	GLS01	KY394919	KY393513
<i>Primulina crassituba</i>	HNSP	MK747147	MK746230	<i>Primulina linearicalyx</i>	KFC4141	MH032854	MH032841
<i>Primulina curvituba</i>	GXHJ01	MK747137	MK746242	<i>Primulina linearifolia</i>	GXNN01	KY394921	KY393515
<i>Primulina danxiaensis</i>	P22865	JX506886	JX506778	<i>Primulina lingchuanensis</i>	LXCHGL01	KY394922	KY393516
<i>Primulina debaoensis</i>	DBGL01	KY394868	KY393462	<i>Primulina linglingensis</i>	LLBC	KY394923	KY393517
<i>Primulina depressa</i>	DXS02	KY394869	KY393463	<i>Primulina linglingensis</i> var. <i>fragrans</i>	XHLLBC2	MK746285	MK746285
<i>Primulina diffusa</i>	PJGL01	KY394871	KY393465	<i>Primulina liujianensis</i>	LJGL01	KY394924	KY393518
<i>Primulina dongguanica</i>	DGBC	KY394872	KY393466	<i>Primulina lobulata</i>	GDQX04	KF498054	KY393519
<i>Primulina drakei</i>	YNCP01	KY394873	KY393467	<i>Primulina longganensis</i>	P22948	JX506916	JX506808
<i>Primulina dryas</i>	HKDMS	KY394875	KY393469	<i>Primulina longicalyx</i>	GXGL01	KY394927	KY393521
<i>Primulina duanensis</i>	DABC	KY394877	KY393471	<i>Primulina longii</i>	XWB	JX506917	JX506809
<i>Primulina eburnea</i>	P22908	JX506891	JX506783	<i>Primulina longnanensis</i>	WF216	OP243286	OP243282
<i>Primulina effusa</i>	KFC4167	MK369976	MK369991	<i>Primulina longzhouensis</i>	P22963	JX506918	JX506810
<i>Primulina fengkaiensis</i>	KFC4130	MK369975	MK369990	<i>Primulina lunglinensis</i>	GZXY04	KY394930	KY393524
<i>Primulina fengshanensis</i>	KFC4195	MK369970	MK369985	<i>Primulina lunglinensis</i> var. <i>amblyosepala</i>	LCDE	MK747105	MK746281
<i>Primulina fimbrisepala</i>	P22863	JX506894	JX506786	<i>Primulina lungzhouensis</i>	GXJX10	KY394931	KY393525
<i>Primulina fimbrisepala</i> var. <i>mollis</i>	GXIB	JX506895	JX506787	<i>Primulina luochengensis</i>	LCWCCGL01	KY394932	KY393526
<i>Primulina flavimaculata</i>	KFC3988	MK369974	MK369989	<i>Primulina lutea</i>	1844	JX506921	JX506813
<i>Primulina floribunda</i>	DHGL01	KY394886	KY393480	<i>Primulina lutescens</i>	PBLS01	MK747135	MK746263
<i>Primulina fordii</i>	LJM1207202	MG727881	MG727878	<i>Primulina lutvittata</i>	KFC4149	MK369978	MK369993
<i>Primulina fordii</i> var. <i>dolichotricha</i>	DHS01	MK747125	MK746247	<i>Primulina luzhaiensis</i>	HYH019	KC190197	KC190204
<i>Primulina gemella</i>	GEME	MK747146	MK746254	<i>Primulina mabaensis</i>	SZY02	KY394937	KY393531
<i>Primulina glabrescens</i>	GZLBSM	MK747132	MK746278	<i>Primulina macrodonta</i>	GXIB	JX506923	JX506815
<i>Primulina glandacestriata</i>	GXLCHW	MK747114	MK746256	<i>Primulina maculata</i>	Xu11916	KU220604	KU220609
<i>Primulina glandulosa</i>	GXPCLG	KY394887	KY393481	<i>Primulina maguanensis</i>	YNMG	MK747127	MK746267
<i>Primulina gongchengensis</i>	GCGLO1	KY394889	KY393483	<i>Primulina malipoensis</i>	YNMLP01	MK747123	MK746240
<i>Primulina grandibracteata</i>	YNHK	MK747121	MK746266	<i>Primulina medica</i>	GXPCLM	KY394940	KY393534
<i>Primulina guigangensis</i>	GXGGBC	KY394892	KY393486	<i>Primulina melanofilamenta</i>	GXXA	MK747158	MK746277
<i>Primulina guihaiensis</i>	GXLG036	KY394893	KY393487	<i>Primulina minor</i>	WXXH1	MK747160	MK746290
<i>Primulina guizhongensis</i>	GXGZBC	KY394894	KY393488	<i>Primulina minutimaculata</i>	GXLZ10	KY394941	KY393535
<i>Primulina halongensis</i>	HLW01	KY394895	KY393489	<i>Primulina moi</i>	SCWY03	KF498115	KY393536
<i>Primulina hedytidea</i>	XWB	JX506905	JX506797	<i>Primulina mollifolia</i>	GXESWC	KY394943	KY393537

续表1 Table 1 (Continued)

种 (变种) Species (variety)	凭证标本号 Voucher number	GenBank 登录号 GenBank accession number		种 (变种) Species (variety)	凭证标本号 Voucher number	GenBank 登录号 GenBank accession number	
		ITS	trnL-F			ITS	trnL-F
<i>Primulina multifida</i>	DLXHGL01	KY394946	KY393540	<i>Primulina sinensis</i>	GDSZ01	KF498055	KF498164
<i>Primulina nandanensis</i>	GXJX02	KY393541	KY393541	<i>Primulina sinovietnamica</i>	Peng21956	MK369973	MK369988
<i>Primulina napoensis</i>	GXIB	JX506930	JX506821	<i>Primulina spinulosa</i>	GXFS02	KF498063	KY393576
<i>Primulina ningmingensis</i>	NMGL01	KY394949	KY393543	<i>Primulina subrhomboidea</i>	GXYX02	KY395018	KY393577
<i>Primulina obtusidentata</i>	GZJK01	KF498096	KY393544	<i>Primulina subulata</i>	GDYA01	KY395020	KY393579
<i>Primulina ophiopogoides</i>	GXFS01	KF498062	KY393545	<i>Primulina subulata</i> var. <i>guilinensis</i>	GXHYXH	KY394967	KY393561
<i>Primulina orthandra</i>	ZRBC2	MK747128	MK746286	<i>Primulina subulatisepala</i>	CQAYH01	MK747122	MK746246
<i>Primulina parvifolia</i>	GGSL01	KY394952	KY393546	<i>Primulina sichuanensis</i>	GDLC07	KY395021	KY393580
<i>Primulina pengii</i>	W0397	KU220603	KU220610	<i>Primulina swinglei</i>	GXRX01	KY395022	KY393581
<i>Primulina petrocosomeoides</i>	SHDBC	KY394953	KY393547	<i>Primulina tabacum</i>	LZ01	KY395023	KY393582
<i>Primulina pinnatifida</i>	MS02	KY394954	KY393548	<i>Primulina tenuifolia</i>	GXBM01	KY395024	KY393583
<i>Primulina polycephala</i>	GDLZ06	KY394955	KY393549	<i>Primulina tenuituba</i>	GZGY01	KY395025	KY393584
<i>Primulina porphyrea</i>	DNGL01	KU173793	KU173799	<i>Primulina tiandengensis</i>	GXTD03	KY395027	KY393586
<i>Primulina pseudoeburnea</i>	KY394958	KY394958	KY393552	<i>Primulina tribracteata</i>	GXFS04	KY395028	KY393587
<i>Primulina pseudoglandulosa</i>	GXYX06	KF498138	KY393482	<i>Primulina tribracteata</i> var. <i>zhuan</i>	1877	JX506952	JX506843
<i>Primulina pseudoheterotricha</i>	XWB	JX506933	JX506824	<i>Primulina tsoongii</i>	ZSGL01	KY395029	KY393588
<i>Primulina pseudolinearifolia</i>	JXY	MK747140	MK746280	<i>Primulina varicolor</i>	GXNP01	KF498086	KY393589
<i>Primulina pseudomollifolia</i>	JMMXH1	MK747134	MK746244	<i>Primulina verecunda</i>	LBJX01	KY395031	KY393590
<i>Primulina pseudoroseoalba</i>	JFHGL01	KY394959	KY393553	<i>Primulina versicolor</i>	GDYD01	MK747155	MK746252
<i>Primulina pteropoda</i>	HNCJ01	KY394960	KY393554	<i>Primulina vestita</i>	QZXT	MK747156	MK746282
<i>Primulina pungentisepala</i>	JEGL01	KY394962	KY393556	<i>Primulina villosissima</i>	QXY01	KY395032	KY393591
<i>Primulina purpurea</i>	ZHGL01	KY394964	KY393558	<i>Primulina wenii</i>	WENI	MK747148	MK746284
<i>Primulina qingyuanensis</i>	GDQX01	KY394965	KY394965	<i>Primulina wentsaii</i>	GXLZ047	KY395033	KY393592
<i>Primulina renifolia</i>	GXDA02	KY394966	KY393560	<i>Primulina wuae</i>	WSBC	MK747159	MK746265
<i>Primulina repanda</i>	GXBM03	KY394968	KY393562	<i>Primulina xinpingensis</i>	GGGL01	KY394891	KY393485
<i>Primulina ronganensis</i>	GXRA01	KF498135	KY393564	<i>Primulina xiziae</i>	ZJHZ01	KY395038	KY393597
<i>Primulina rongshuiensis</i>	GXRS01	KF498088	KY393565	<i>Primulina yangchunensis</i>	GDYC01	KY395039	KY393598
<i>Primulina roseoalba</i>	LDGL01	KY394972	KY393566	<i>Primulina yangshanensis</i>	GDNX01	KY395040	KY393599
<i>Primulina rosulata</i>	GXPL05	KU528874	KU528884	<i>Primulina yangshuoensis</i>	GXYS07	KY395042	KY393601
<i>Primulina rotundifolia</i>	003	KY394975	KY393569	<i>Primulina yingdeensis</i>	YD03	KU528876	KU528886
<i>Primulina rubribracteata</i>	JH01R	KU173791	KU173797	<i>Primulina yungfuensis</i>	GXIB	JX506957	JX506848
<i>Primulina sclerophylla</i>	GXDA01	KY394979	KY393573	<i>Primulina zhoui</i>	WF18	MK747104	MK746222
<i>Primulina secundiflora</i>	GZQZ	MK747119	MK746279	<i>Petrocodon ainsliifolius</i>	CWH88	KF202291	KF202298
<i>Primulina shouchengensis</i>	GXYF02	KY394980	KY393574	<i>Petrocodon hancei</i>	CIPeng22903	KY796057	KY796059
<i>Primulina sichuanensis</i>	SCBC	MK747162	MK746264				

龙南报春苣苔与温氏报春苣苔的区别主要表现为前者叶柄和叶片两面均密被长柔毛、短柔毛和腺毛;而后者叶柄密被长柔毛,叶片两面密被长柔毛和短柔毛。前者苞片先端每侧具 1~3 个紫红色小齿,中间苞片长 1.0~3.0 mm,宽 1.0~1.5 mm,且部分中间的苞片和中间的小苞片退化;而后者苞片全缘,中间的苞片长 10.0~12.0 mm,宽 1.3~1.6 mm,且苞片和小苞片无退化。前者花萼裂片长 4.0~6.0 mm,宽 1.0~1.5 mm,先端每侧具 1~3 个紫红色小齿;而后者花萼裂片长 14.0~15.0 mm,宽约 2.5 mm,全缘。前者花冠筒细筒形或弯曲细筒形,长 1.8~2.0 cm,口部直径 8.0~10.0 mm,檐部裂片上唇长 3.0~5.0 mm,下唇长 6.0~8.0 mm,花冠筒内侧疏被短腺毛;而后者花冠筒喇叭形,长约 2.8 cm,口部直径约 1.7 cm,檐部裂片

上唇长 10.0~12.0 mm,下唇长 10.0~13.0 mm,花冠筒内侧疏被短柔毛。前者花丝疏被短腺毛,两侧的退化雄蕊长 1.5~2.5 mm,中间的退化雄蕊贴生于花冠筒基部以上约 2.0 mm 处;而后者花丝无毛,两侧的退化雄蕊长约 7.5 mm,中间的退化雄蕊贴生于花冠筒基部以上约 5.0 mm 处。前者蒴果长 2.0~3.0 cm,而后者蒴果长约 5.0 cm。

龙南报春苣苔与九连山报春苣苔的区别主要表现为前者叶草质或纸质,侧脉每侧 3 或 4 条,苞片和小苞片为 2 或 3,苞片先端每侧具 1~3 个紫红色小齿,且部分中间的苞片和中间的小苞片退化,两侧的退化雄蕊无毛;而后者叶厚纸质,侧脉每侧 4~6 条,苞片和小苞片均为 3,苞片全缘,且苞片和小苞片无退化,两侧的退化雄蕊疏被短腺毛。前者花冠筒细筒

形或弯曲细筒形,花冠筒上侧喉部的肿块紫红色,花冠筒下侧的2条脊蓝紫色;而后者花冠筒喇叭形,花冠筒上侧喉部的肿块深红褐色,花冠筒下侧的2条脊上半部蓝紫色,下半部黄褐色。后者各部位尺寸明显比前者大,比如后者的花萼裂片长8.0~11.0 mm,宽约2.0 mm,花冠筒长2.6~3.0 cm,口部直径1.3~1.6 cm,檐部裂片上唇长6.0~8.0 mm,下唇长8.0~12.0 mm,两侧的退化雄蕊长约6.0 mm。

龙南报春苣苔 新种

Primulina longnanensis G. L. Xu, sp. nov.

This new species differs from *Primulina wenii* Jian Li et L. J. Yan by petiole, both surfaces of leaf blades densely villous, pubescent, and glandular-pubescent (vs. petiole densely villous, both surfaces of leaf blades densely villous and pubescent in *P. wenii*); each side of bracts with 1–3 small purplish-red teeth at apex, partial central bracts and central bracteoles absent (vs. bracts entire, bracts and bracteoles persistent); calyx lobes 4.0–6.0 mm long, 1.0–1.5 mm wide, each side with 1–3 small teeth at apex (vs. 14.0–15.0 mm long, ca. 2.5 mm wide, entire); corolla tube tubular or curved-tubular (vs. corolla tube funnellform).

This new species differs from *Primulina juliashansis* F. Wen et G. L. Xu by each side of bracts with 1–3 small purplish-red teeth at apex, partial central bracts and central bracteoles absent (vs. entire, bracts and bracteoles persistent in *P. juliashanensis*); lateral staminodes glabrous (vs. sparsely glandular-puberulent); corolla tube tubular or curved-tubular (vs. corolla tube funnellform).

Holotype: China. Jiangxi (江西), Ganzhou (赣州), Longnan (龙南), Shixiashan Water Conservation Area (石峡山水源保护区), E114° 51' 05.89", N24°55'36.60", in damp place of cliff by the river under evergreen broad-leaved forest, alt. ca. 268 m, 4 Apr. 2022, G. L. Xu (徐国良), JLSXGL-20220404 (IBK!).

Perennial herbs. Rhizome terete, 1.0–2.0 cm long, 0.7–1.1 cm in diam. Leaves all basal, 4–9; petiole 1.0–3.0 cm long, 4.0–6.0 mm wide, both surfaces densely white villous, pubescent, and glandular-pubescent. Leaf blade oblong-elliptic or broadly elliptic,

4.0–9.0 cm long, 3.0–7.0 cm wide, herbaceous or chartaceous, adaxially dark green, abaxially pale green, both surfaces densely white villous, pubescent, and glandular-pubescent; leaf base apparently asymmetric, cuneate, margin irregularly obtuse-serrate, apex slightly obtuse; lateral veins 3 or 4 on each side, adaxially inconspicuously sunken, abaxially prominently raised. Inflorescence dichotomous cymes, axillary, 1–3-branched, 3–7-flowered; peduncle and pedicle green, both densely erect white villous and pubescent; peduncle 4.0–9.0 cm long, 1.5–2.0 mm in diam.; pedicle 3.0–8.0 mm long, 1.0–1.5 mm in diam. Bracts 2 or 3, lanceolate, apex acute, abaxially densely white villous and pubescent, adaxially subglabrous, ciliate, margin entire but each side with 1–3 small purplish-red teeth at apex; lateral bracts on either side in the same size, opposite, 7.0–12.0 mm long, 2.0–2.5 mm wide; central bracts 1.0–3.0 mm long, 1.0–1.5 mm wide, or absent. Bracteoles 2 or 3, lanceolate, indumentum as same as bracts; the lateral ones 2.0–5.0 mm long, 0.5–1.5 mm wide; the central ones 0.5–1.0 mm long, ca. 1.0 mm wide, or absent. Calyx 5-parted, lobes lanceolate, 4.0–6.0 mm long, 1.0–1.5 mm wide, nearly equal, abaxially densely white villous and pubescent, ciliate, adaxially sparsely puberulent, margin entire but each side of calyx lobes with 1–3 small purplish-red teeth at apex. Corolla bluish-purple to purplish-red, 2.3–2.7 cm long; corolla tube tubular or curved-tubular, 1.8–2.0 cm long, mouth 8.0–10.0 mm in diam., base 4.0–5.0 mm in diam., outside glandular-puberulent. Corolla tube inside sparsely glandular-puberulent, abdomen with two obviously bluish-purple longitudinal ridges, one purplish-red ovate lump on the upper throat of the corolla tube, glandular-puberulent. Limb distinctly 2-lipped, upper lip 2-lobed, lobes broadly ovate or semicircular, 3.0–5.0 mm long, 4.0–6.0 mm wide at the bottom; lower lip 3-lobed, lobes ovate or oblong, 6.0–8.0 mm long, 4.0–7.0 mm wide at the bottom. Stamens 2, adnate to ca. 1.0 cm above the base of corolla tube; filaments 6.0–8.0 mm long, geniculate near the base, yellowish or white, sparsely glandular-puberulent; anthers reniform, ca. 2.0 mm

long, slightly constricted at middle, densely pubescent and glandular-puberulent. Staminodes 3, glabrous, white or light purple, lateral ones 1.5–2.5 mm long, adnate to ca. 8.0 mm above the base of corolla tube, apex capitate; the central ones ca. 0.5 mm long, adnate to ca. 2.0 mm above the base of corolla tube. Disc annular, ca. 1.0 mm high, margin undulate, glabrous, pale green. Pistil pale green, 1.7–2.0 cm long; style 1.3–1.7 cm long, ca. 0.5 mm in diam., sparsely glandular-puberulent and pubescent. Ovary oblong, light red, 4.0–7.0 mm long, ca. 1.0 mm in diam., parietal placenta, densely villous and glandular-pubescent. Stigma oblong or triangle, 2-lobed, ca. 2.0 mm long. Capsule linear, 2.0–3.0 cm long, densely villous and glandular-pubescent. Fl. Mar. to Apr., fr. Apr. to Sep.

多年生草本。根状茎圆柱状,长1.0~2.0 cm,直径0.7~1.1 cm。叶基生,具4~9枚叶;叶柄长1.0~3.0 cm,宽4.0~6.0 mm,两面密被白色长柔毛、短柔毛和腺毛。叶片长椭圆形或宽椭圆形,长4.0~9.0 cm,宽3.0~7.0 cm,纸质或草质,正面深绿色,反面淡绿色,两面密被白色长柔毛、短柔毛和腺毛;叶基部明显不对称,楔形,边缘有不规则钝齿,先端微钝;侧脉每侧3或4条,上面不明显,下面显著凸起。二歧聚伞花序腋生,1~3回分支,花3~7朵;花序梗和花梗绿色,均密被直立的白色长柔毛和短柔毛;花序梗长4.0~9.0 cm,直径1.5~2.0 mm;花梗长3.0~8.0 mm,直径1.0~1.5 mm。苞片2或3,披针形,急尖,外侧密被白色长柔毛和短柔毛,内侧近光滑,具缘毛,先端每侧具1~3个紫红色小齿,其余部位全缘;两侧苞片对生,同形,长7.0~12.0 mm,宽2.0~2.5 mm;中间苞片长1.0~3.0 mm,宽1.0~1.5 mm,或退化。小苞片2或3,披针形,毛被和苞片一样;两侧小苞片长2.0~5.0 mm,宽0.5~1.5 mm;中间小苞片长0.5~1.0 mm,宽约1.0 mm,或退化。花萼5深裂,裂片披针形,长4.0~6.0 mm,宽1.0~1.5 mm,近相等,外侧密被白色长柔毛和短柔毛,具缘毛,内侧疏被短柔毛,先端每侧具1~3个紫红色小齿,其余部位全缘。花冠蓝紫色至紫红色,长2.3~2.7 cm;花冠筒细筒形或弯曲细筒形,长1.8~2.0 cm,口部直径8.0~10.0 mm,基部直径4.0~5.0 mm,外侧被短腺毛。花冠筒内侧疏被短腺毛,腹部有2个明显的蓝紫色纵向脊,上侧喉部有1紫红色卵形肿块,肿块被短腺毛。檐部2唇形,上唇2浅裂,

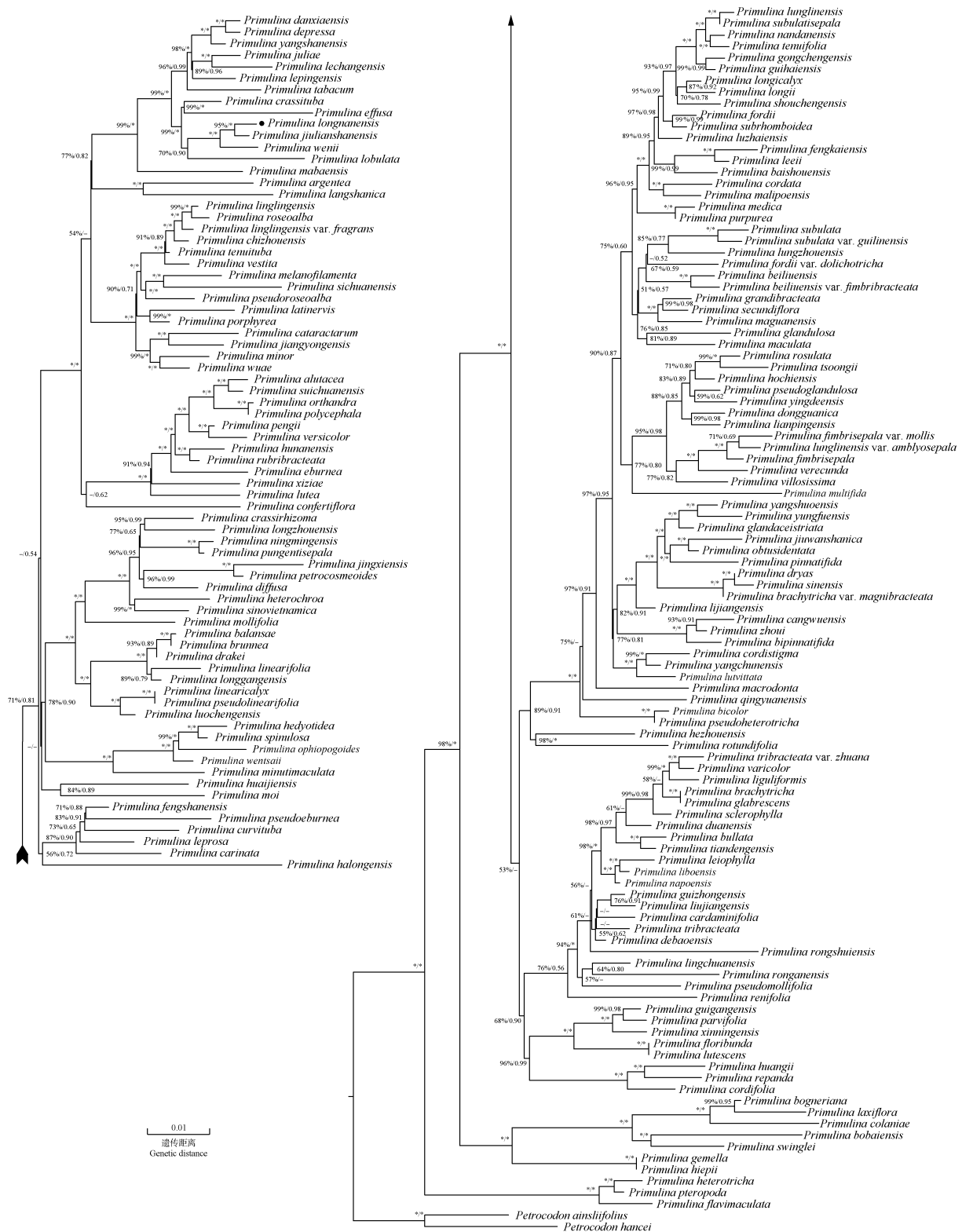
裂片宽卵形或半圆形,长3.0~5.0 mm,底部宽4.0~6.0 mm;下唇3浅裂,裂片卵形或长圆形,长6.0~8.0 mm,底部宽4.0~7.0 mm。雄蕊2,贴生于花冠筒基部以上约1.0 cm处;花丝长6.0~8.0 mm,近基部膝状弯曲,淡黄色或白色,疏被短腺毛;花药肾形,长约2.0 mm,中部略窄,密被短柔毛和短腺毛。退化雄蕊3,无毛,白色或淡紫色,两侧的退化雄蕊长1.5~2.5 mm,贴生于花冠筒基部以上约8.0 mm处,先端头状;中间的退化雄蕊长约0.5 mm,贴生于花冠筒基部以上约2.0 mm处。花盘环形,高约1.0 mm,边缘波状,无毛,浅绿色。雌蕊浅绿色,长1.7~2.0 cm;花柱长1.3~1.7 cm,直径约0.5 mm,疏被短腺毛和短柔毛。子房长圆形,淡红色,长4.0~7.0 mm,直径约1.0 mm,侧膜胎座,密被长柔毛和腺毛。柱头长圆形或三角形,2裂,长约2.0 mm。蒴果线形,长2.0~3.0 cm,密被长柔毛和腺毛。花期3月至4月,果期4月至9月。

Paratype: China. Jiangxi (江西), Ganzhou (赣州), Longnan (龙南), Shixiashan Water Conservation Area (石峡山水源保护区), E114° 51' 05.89", N24°55'36.60", in damp place of cliff by the river under evergreen broad-leaved forest, alt. ca. 268 m, 10 Aug. 2023, G. L. Xu (徐国良), JLSXGL-20230810 (NAS).

2.2 系统发育分析

龙南报春苣苔 ITS 序列的比对长度为 772 bp,其中,变异位点 445 个,简约信息位点 332 个,分别占 ITS 序列比对长度的 57.6% 和 43.0%; *trnL-F* 序列的比对长度为 836 bp,其中,变异位点 199 个,简约信息位点 94 个,分别占 *trnL-F* 序列比对长度的 23.8% 和 11.2%; 基于 ITS 和 *trnL-F* 序列构建的系统发育树拓扑结构基本一致,二者均表明该新种与温氏报春苣苔亲缘关系密切。由于 ITS+*trnL-F* 组合序列构建的系统发育树的支持度和分辨率均更高^[9],因此使用 ITS+*trnL-F* 组合序列进行进一步的分子研究。ITS+*trnL-F* 组合序列比对长度为 1 608 bp,其中,变异位点 644 个,简约信息位点 426 个,分别占 ITS+*trnL-F* 组合序列比对长度的 40.0% 和 26.5%。

基于 ITS+*trnL-F* 组合序列报春苣苔属植物的系统发育树见图 1。龙南报春苣苔与九连山报春苣苔为姐妹类群(超快自展支持率为 95%,贝叶斯后验概率为 1.00),二者所构成的姐妹分支再与温氏报春苣



分支上“/”左、右两侧的数值分别表示超快自展支持率(UFBoot)和贝叶斯后验概率(BIPP),“*”表示UFBoot值为100%或BIPP值为1.00,“-”表示UFBoot值小于50%或BIPP值小于0.50。The values on the left and right of “/” above the branches represent the ultrafast bootstrap value (UFBoot) and Bayesian posterior probability (BIPP), respectively, “*” represents that the UFBoot value is 100% or the BIPP value is 1.00, and “-” represents that the UFBoot value is less than 50% or the BIPP value is less than 0.50.

图 1 基于 ITS+trnL-F 组合序列的报春苣苔属植物和石山苣苔属植物的系统发育树
Fig. 1 Phylogenetic tree of *Primulina* Hance and *Petrocodon* Hance plants based on ITS+trnL-F combined sequence

苣苔成姐妹群(超快自展支持率为 100%, 贝叶斯后验概率为 1.00)。三者共同与粗筒报春苣苔 [*Primulina crassituba* (W. T. Wang) Mich. Möller et A. Weber]、散序小花苣苔 (*P. effusa* F. Wen et B. Pan)、浅裂小花苣苔 [*P. lobulata* (W. T. Wang) Mich. Möller et A. Weber] 构成支持率较高的分支。

龙南报春苣苔的 ITS 序列 (615 bp) 与温氏报春苣苔有 9 个碱基存在差异, 与九连山报春苣苔有 5 个碱基存在差异; 该新种的 *trnL-F* 序列 (710 bp) 与温氏报春苣苔有 2 个碱基存在差异, 与九连山报春苣苔有 3 个碱基存在差异 (表 2)。

表 2 龙南报春苣苔与温氏报春苣苔、九连山报春苣苔 ITS 和 *trnL-F* 序列的差异碱基¹⁾

Table 2 Differential bases of ITS and *trnL-F* sequences of *Primulina longnanensis* G. L. Xu with *P. wenii* Jian Li et L. J. Yan and *P. jiulianshanensis* F. Wen et G. L. Xu¹⁾

种类 Species	ITS 序列不同位点的差异碱基 Differential base at different sites of ITS sequence												<i>trnL-F</i> 序列不同位点的差异碱基 Differential base at different sites of <i>trnL-F</i> sequence		
	18	77	156	158	161	162	399	412	422	428	468	558	369	510	512
Pl	A	G	C	T	T	G	T	A	G	C	G	A	A	T	T
Pw	G	A	A	C	T	G	C	C	G	A	A	T	G	T	C
Pj	A	A	C	T	C	T	T	A	—	C	A	A	G	G	C

¹⁾ Pl: 龙南报春苣苔 *Primulina longnanensis* G. L. Xu; Pw: 温氏报春苣苔 *P. wenii* Jian Li et L. J. Yan; Pj: 九连山报春苣苔 *P. jiulianshanensis* F. Wen et G. L. Xu. —: 表示该位点无碱基 Indicating that there is no base at this site.

3 讨 论

报春苣苔属除了少数物种, 如蚂蟥七 [*Primulina fimbriseipala* (Hand.-Mazz.) Yin Z. Wang]、神农架报春苣苔 [*P. tenuituba* (W. T. Wang) Yin Z. Wang] 和大齿报春苣苔 [*P. juliae* (Hance) Mich. Möller et A. Weber] 等, 大部分种分布狭窄且特有, 在世界已知的报春苣苔属植物中, 有超过 170 个物种都是狭域分布的喀斯特特有物种, 往往仅见于中国华南和西南以及越南北部特化的石灰岩小生境中^[24]。江西省苦苣苔科植物资源远比邻近的广东和广西等省份少^[25], 造成这种现象的原因可能与江西的气候较后 2 个省份寒冷以及喀斯特地貌相对较少等有关。

目前仅发现 1 个龙南报春苣苔的居群, 分布在龙南市郊区石峡山水源保护区常绿阔叶林, 该种植物生长在土壤贫瘠的砂页岩石壁上, 根系伸入节理的岩缝中, 伴生种有紫背天葵 (*Begonia fimbriatipula* Hance)、倒挂铁角蕨 (*Asplenium normale* Don)、耳基卷柏 (*Selaginella limbata* Alston) 和九连山铁角蕨 (*Asplenium jiulianshanense* K. W. Xu et G. L. Xu) 等, 该居群形态特征稳定, 数量较稀少, 成熟个体 100 株左右, 建议加强对该种群的科学监测, 以保护该种群。九连山报春苣苔和龙南报春苣苔二者分布点相距不超过 50 km, 不同的是九连山报春苣苔分布于丹霞地

貌, 而龙南报春苣苔附生于阴湿的砂页岩上, 这些植物的发现进一步丰富了中国苦苣苔科植物。

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图版说明 Explanation of Plate

图版 I 1–21. 龙南报春苣苔: 1. 生境; 2. 居群; 3. 野生植株; 4. 花; 5. 叶柄和叶片正面和反面; 6. 苞片外侧; 7. 苞片内侧; 8. 花序; 9. 花萼裂片外侧; 10. 花萼裂片内侧; 11. 花冠解剖; 12. 苞片先端放大(箭头示小齿); 13. 花萼裂片先端放大(箭头示小齿); 14. 两侧的退化雄蕊; 15. 雄蕊; 16. 果序; 17. 蒴果横切面; 18. 花序梗上的苞片(箭头示退化的中间苞片); 19. 叶柄和叶片两面的腺毛放大(箭头示腺毛); 20. 花梗上的小苞片(箭头示退化的中间小苞片); 21. 雌蕊. 22–24. 温氏报春苣苔: 22. 栽培植株; 23. 花序正面观; 24. 花序侧面观. 25–27. 九连山报春苣苔: 25. 野生植株; 26. 花序; 27. 苞片和花萼裂片.

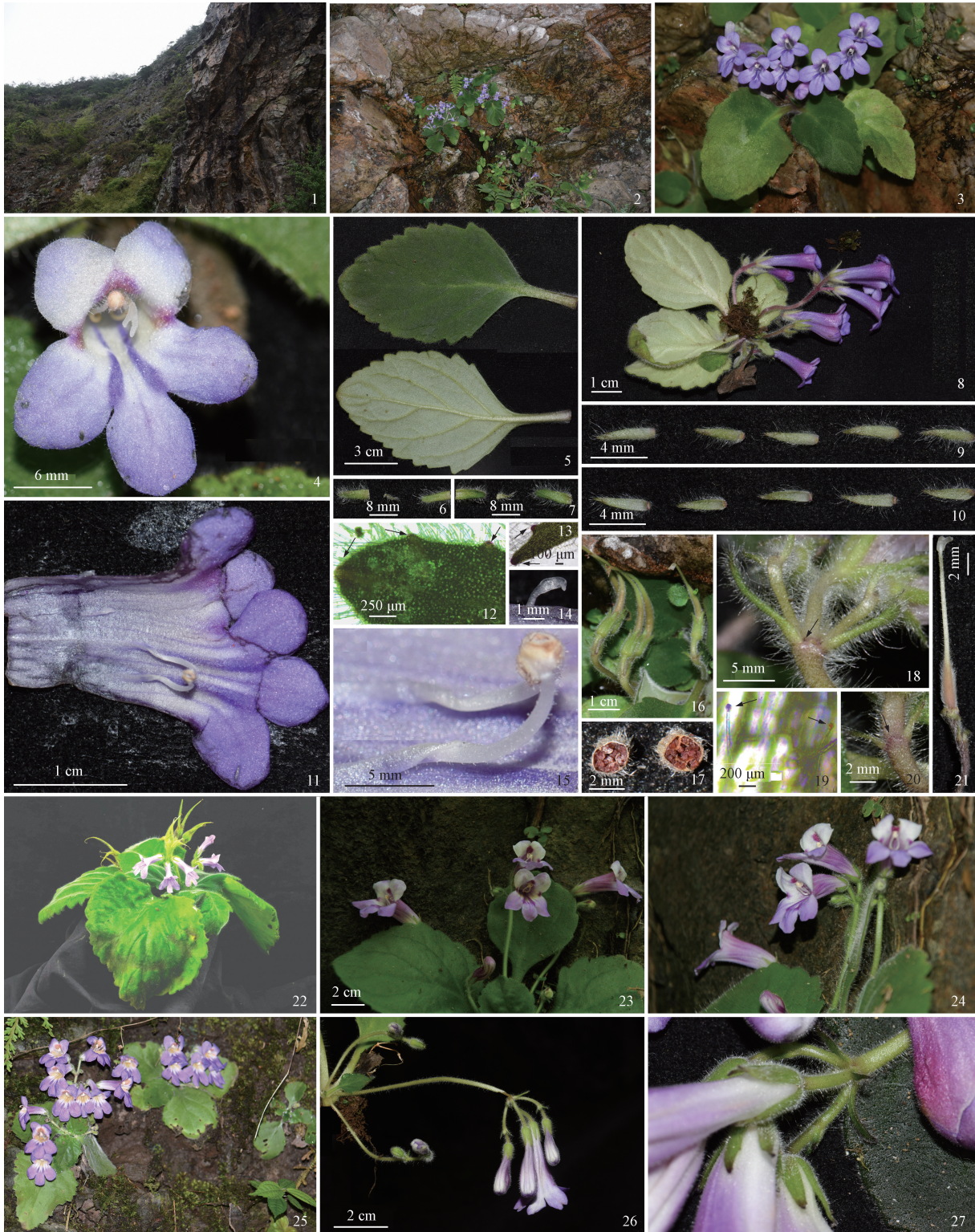
Plate I 1–21. *Primulina longnanensis* G. L. Xu: 1. Habitat; 2. Population; 3. Wild plants; 4. Flowers; 5. Adaxial and abaxial surfaces of petiole and leaf blades; 6. Abaxial surface of bracts; 7. Adaxial surface of bracts; 8. Inflorescence; 9. Abaxial surface of calyx lobes; 10. Adaxial surface of calyx lobes; 11. Opened corolla; 12. Amplification of apex of bract (arrows indicate small teeth); 13. Amplification of apex of calyx lobe (arrows indicate small teeth); 14. Lateral staminodes; 15. Stamens; 16. Infructescence; 17. Transverse section of capsules; 18. Bracts on peduncle (the arrow indicates central bracts absent); 19. Amplification of glandular-pubescent of petiole and leaf blade (arrows indicate glandular-pubescent); 20. Bracteoles on pedicle (the arrow indicates central bracteoles absent); 21. Pistil. 22–24. *Primulina wenii* Jian Li et L. J. Yan: 22. Cultivated plants; 23. Frontal view of inflorescence; 24. Lateral view of inflorescence. 25–27. *Primulina jilianshansis* F. Wen et G. L. Xu: 25. Wild plants; 26. Inflorescence; 27. Bracts and calyx lobes.

邓欣欣, 等: 江西苦苣苔科一新种——龙南报春苣苔

图版 I

DENG Xinxin, et al.: *Primulina longnanensis* (Gesneriaceae), a new species from Jiangxi

Plate I



图版说明见文末 See the plate explanation at the end of the text