采自甘肃白龙江流域中国茶渍属地衣的三个新记录种

吕 蕾[1]，任 强[1]，孙立彦[1,2]，杨 芳[1]，赵遵田[1]*

(1.山东师范大学 生命科学学院，济南 250014；2.泰山医学院，山东 泰安 271000)

摘 要：在对甘肃白龙江流域的茶渍属(*Lecanora*)地衣进行调查采集和鉴定的基础上，报道三个中国新记录种：暗灰茶渍(*L. cinereofusca* H. Magn)，暗黄茶渍(*L. flavidofusca* Müll. Arg.)和颗粒茶渍(*L. perplexa* Brodo)。对每种给出了详尽的形态、解剖和化学特征描述，并提供了每种的外部形态照片。

关键词：地衣；茶渍属；暗灰茶渍；暗黄茶渍；颗粒茶渍；中国新记录

中图分类号：Q939.5 **文献标识码**：A **文章编号**：1000-3142(2009)03-0311-03

Three species of the lichen genus *Lecanora* new to China from Bailong River Valley, Gansu Province

Lü Lei[1], REN Qiang[1], SUN Li-Yan[1,2], YANG Fang[1], ZHAO Zun-Tian[1]*

(1. *College of Life Science, Shandong Normal University*, Jinan 250014, China;
2. *Taishan Medical College*, Taian 271000, China)

Abstract: Three species of the lichen genus *Lecanora* from Bailong River Valley, Gansu Province are reported new to China. They are *L. cinereofusca* H. Magn., *L. flavidofusca* Müll. Arg. and *L. perplexa* Brodo. The detailed morphological, anatomical and chemical descriptions of the species are given. A short comment for each species is made under the description. Photos of the thalli are also presented.

Key words: Lichen; *Lecanora*; *L. cinereofusca*; *L. flavidofusca*; *L. perplexa*; new record to China

The lichen genus *Lecanora* Ach. belongs to Lecanoraceae, Lecanorales, Lecanoromycetidae, Ascomycetes, Ascomycota, Fungi (Kirk *et al.*, 2001). It is one of the most striking and widespread crustose lichen genera which is characterized by having Lecanorine-apothecia and Lecanora-type asci containing 8-32 hyaline, simple spores (mostly 8 spores). 77 species, 11 varieties and 5 forms have been reported from China, three of them are multispored (Wei, 1991; Aptroot & Seaward, 1999; Mamut *et al.*, 2004; Wang *et al.*, 2007).

Based on field work and identification of collections from Bailong River Valley, Gansu Province, three species of the lichen genus *Lecanora* new to China were found and reported here.

1 Material and methods

All the specimens were collected from Bailong River Valley. Bailong River is located in longitudes 101°40′－105°20′E and latitudes 32°21′－35°50′ N in the southern part of Gansu Province. Being a tributary of Jialing River of Yangtse River system and rising in the Min Shan Mountains, the river is about 600 km long. It flows

收稿日期：2007-11-07 **修回日期**：2008-09-06

基金项目：国家自然科学基金(30470003)[Supported by the National Natural Science Foundation of China(30470003)]

作者简介：吕蕾(1983-)，女，山东济南人，硕士研究生，从事地衣分类及系统学研究。

* 通讯作者(Author for correspondence, E-mail: ztzhao@sohu.com author)

through Deibu, Zhouqu, Wudu and Wenxian in an average gradient of about 30°, with drainage area of about 27 400 km^2. The climate of the upper reaches is temperate-humid, and that of the middle warm-humid, while that of the lower reaches subtropical-humid. (Kang *et al.*, 1999).

All the specimens examined are preserved in the Lichen Section of Botanical Herbarium, Shandong Normal University (SDNU).

Thalli were examined and measured under dissecting microscope (Motic K-400L) and apothecial sections were cut and then mounted in water for observation under light microscope (JNOECXS-213). Photos of the thalli were taken under OLYMPUS SZX12 with DP70. The chemical constituents were identified using thin layer chromatography (TLC) (Culberson, 1972). The terms of morphology and anatomy were used after Brodo (1984), Lumbsch *et al.* (1997), and Guderley & Lumbsch (1999).

2 Results and discussions

2.1 *Lecanora cinereofusca* H. Magn, Meddel. Göteborgs Bot. Trädg. 7:86(1932)(Fig. 1:A)

Thallus yellowish white to dark yelloweish grey, continuous, smooth to verruculose, margin definite. Prothallus absent. Apothecia immersed in thallus, finally becoming sessile, (0.4)0.6—1.0(1.5) mm in diam., discs reddish orange to dark reddish brown, epruinose, margin verrucose to ridged and rough, becoming discontinuous in many specimens. Amphithecium: cortex inspersed, 12—15 μm laterally, 15—20 μm at base, containing numerous large KOH-insoluble crystals (*Pulicaris*-type according to Brodo 1984). Epihymenium granular with coarse crystals which dissolve in concentrated HNO_3 (*Chlarotera*-type according to Brodo 1984), pigmented red-brown, 7.5—12.5 μm tall. Hymenium hyaline, 47.5—67.5 μm tall. Asci clavate, 8-spored, ascospores hyaline, simple, broadly ellipsoid, (6.0)7.5—12.5(15)×4.5—7.0 μm.

Chemistry: atranorin, pannarin, placodialic acid.

Habitat: on bark.

Specimen examined: Gansu: Diebu, Yiwagou, alt. 3 680 m, 2006/Ⅶ/25, Shi Xiu-Li & Han Guo-Ying, 060064; Zhouqu, Huacaopoxigou, alt. 3 400 m, 2006/Ⅶ/29, Yang Fang & Shi Xiu-Li, 061074; Wenxian, Qiujiaba, alt. 2 350 m, 2006/Ⅷ/3, Wang Chen-Lei & Lü Lei, 061822.

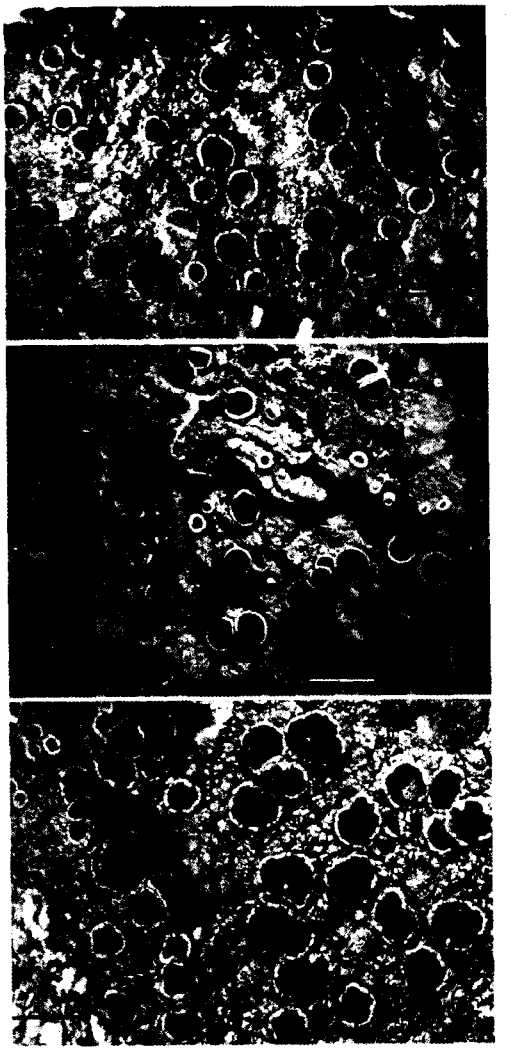

Fig. 1 **A.** Morphology of *Lecanora cinereofusca* H. Magn, Scale = 2 mm, Yang Fang & Shi Xiu-Li, 061669; **B.** Morphology of *Lecanora flavidofusca* Müll. Arg., Scale=2 mm, Wang Chen-Lei & Lü Lei, 061181; **C.** Morphology of *Lecanora perplexa* Brodo, Scale=2 mm, Shi Xiu-Li & Yang Fang, 061794.

Discussion: *Lecanora cinereofusca* is readily distinguished by its verrucose to discontinuous apothecial margins and containing pannarin, placodialic acid. It is similar to *L. cinereocarnea* in morphology but differs in having different chemistry constitute, the former contains pannarin and placodialic acid but the latter con-

tains gangaleoidin.

World distribution: a circumpolar element species occurring in North America, Central Europe and Eastern Asia(Brodo, 1984).

2.2 *Lecanora flavidofusca* Müll. Arg., Bull. Herb. Boissier 3:633(1895)(Fig. 1:B)

Thallus yellowish white to yellowish grey, smooth, continuous or verrucose-areolate, margin indefinite. Prothallus absent. Apothecia sessile, (0.3)0.5 −1.0(1.3) mm in diam., discs red-brown to dark brown, eprinose, margin concolorous with thallus, even or prominent, smoth. Amphithecium: cortex indistinct, 10−20 μm laterally, 10−20 μm at base, containing numerous small KOH-insoluble crystals (*Allophana*-type according to Brodo 1984). Epihymenium inspersed with fine granules (*Pulicaris*-type according to Brodo 1984), pigmented orange-brown, 7.5−15 μm tall. Hymenium hyaline, 47.5-75 μm tall. Asci clavate, 8-spored, ascospores hyaline, simple, ellipsoid, 7.5 −13×4.5−8 μm.

Chemistry: atranorin, usnic acid, zeorin, arthothelin.

Habitat: on bark.

Specimen examined: Gansu: Diebu, Dalagou, alt. 2 700 m, 2006/Ⅷ/26, Shi Xiu-Li & Yang Fang, 060409; Zhouqu, Huacaopoxigou, alt. 3 300 m, 2006/Ⅷ/29, Yang Fang & Shi Xiu-Li, 060961; Zhouqu, Yangbuliang, alt. 3 300 m, 2006/Ⅷ/29, Wang Chen-Lei & Lü Lei, 061181.

Discussion: *Lecanora flavidofusca* is readily distinguished by its relatively dark brown apothecial discs, granulose epihymenium, and the presence of usnic acid. It is closely related to *L. alba*, which, however, can be distinguished by the egranulose epihymenium, and smaller ascospores.

World distribution: pantropical element, recorded from Australasia, North America, and the Pacific Area. (Ryan *et al.*, 2004)

2.3 *Lecanora perplexa* Brodo, Beih. Nova Hedwigia 79:148 (1984)(Fig. 1:C)

Thallus white to yellowish grey, verruculose to granulose, usually thick, margin definite. Prothallus absent. Apothecia sessile, 0.4−1.0(1.5) mm in diam., discs reddish-brown, epruinose, margin thick, flexuose or verrucose. Amphithecium: cortex indistinct, 12−18 μm thick, or absent, containing numerous large KOH-insoluble crystals (*Pulicaris*-type according to Brodo 1984). Epihymenium orange-brown, pigmentation not altered by KOH, without crystals (*Glabrata*-type according to Brodo 1984), 5−12.5 μm high. Hymenium hyaline, 50−62.5 μm tall. Asci clavate, 8-spored, ascospores hyaline, simple, ellipsoid, 6.5−9.5 (13)×4.5−5.5(7.5) μm.

Chemistry: atranorin, zeorin.

Habitat: on bark or rock.

Specimen examined: Gansu: Wenxian, Qiujiaba, alt. 2 350 m, 2006/Ⅷ/3, Wang Chen-Lei & Lü Lei, 061633; alt. 2 500 m, 2006/Ⅷ/4, Yang Fang & Shi Xiu-Li, 061982; alt. 2 600 m, 2006/Ⅷ/4, Yang Fang & Shi Xiu-Li, 062049.

Discussion: *Lecanora perplexa* is very easy to be distinguished from other species of *Lecanora* for its very obvious granulose thallus, large amphithecial crystals and containing zeorin.

World distribution: an East Asian-North American disjunctive element species occurring in North America(Brodo, 1984) and China.

References:

魏江春. 1991. 中国地衣综览[M]. 北京: 万国学术出版社, 1−278

Aptroot A, Seaward MRD. 1999. Annotated checklist of Hongkong lichens[J]. Tropical Bryol, **17**: 57−101

Brodo IM. 1984. North American species of the *Lecanora* subfusca group[C]//Hertel H, Oberwinkler F(eds). Beitrage zur Lichenologie. Festscrift J. Poelt. Beiheft zur Nova Hedwigia 79. J. Cramer, Vaduz, 63−185

Culberson CF. 1972. Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method[J]. *J Chromatogr*, **72**: 113−125

Guderley R, Lumbsch HT. 1999. Notes on multispored species of *Lecanora* sensu stricto[J]. *Lichenologist*, **31**(2): 197−210

Kang YX(康永祥), Chen YP(陈亚萍), Li JX(李景侠), *et al.* 1999. The characteristics of the woody plant flora in Bailongjiang Watershed(白龙江流域木本植物区系特征)[J]. *Acta Bot Boreal-Occident Sin*(西北植物学报), **19**(2): 337−343

Kirk PM, Cannon PF, David JC, *et al.* 2001. Ainsworth & Bisby's Dictionary of the Fungi(ninth edition)[M]. CABI Bioscience. CABI International, 1−655

Lumbsch HT, Plümper M, Guderley R, *et al.* 1997. The corticolous species of *Lecanora* sensu stricto with pruinose apothecial discs

(下转第 365 页 Continue on page 365)

李振国. 1999. 植物细胞质膜透性的测定[A]. 中国科学院上海植物生理研究所，上海市植物生理学会. 现代植物生理学实验指南[M]. 北京：科学出版社，302－303

Hsu YT, Kao KH. 2004. Cadmium toxicity is reduced by nitric oxide in rice leaves[J]. *Plant Growth Regul*, **42**: 227－238

Hunt J. 1982. Dilute hydrochloric acid extraction of plant material for routine cation analysis[J]. *Commun Soil Sci Plant Anal*, **13**(1): 49－55

Kopyra M, Gwóz′dz′ EA. 2003. Nitric oxide stimulates seed germination and counteracts the inhibitory effect of heavy metals and salinity on root growth of *Lupinus luteus*[J]. *Plant Physiol Biochem*, **41**: 1 011－1 017

Laspina NV, Groppa MD, Tomaro ML, *et al*. 2005. Nitric oxide protects sunflower leaves against Cd-induced oxidative stress[J]. *Plant Sci*, **169**(2): 323－330

Salt DE, Smith RD, Raskin I. 1998. Phytoremediation[J]. *Annu Rev Plant Physiol Plant Mol Bio*, **49**: 643－668

Stohs SJ, Bagchi D. 1995. Oxidative mechanism in the toxicity of metal ions[J]. *Free Radic Biol Med*, **18**(2): 321－326

Wallance A, Frolich E, Lunt OR. 1996. Calcium requirements of higher plants[J]. *Nature*, **29**: 634－638

Wang HZ(王慧忠), He CP(何翠屏), Yang H(杨华). 2003. Investigation report about effecting of the heavy metals pollution on lawn growth(土壤重金属污染对草坪性状影响的调查研究)[J]. *Prat Sci*(草业科学), (1): 53－55

Wang YB(王友保), Huang YJ(黄永杰), Yan M(严密), *et al*. 2006. Effects of Cu on growth and activate oxygen metabolism of *Festuca arundinace*(铜污染对高羊茅生长及活性氧代谢影响的研究)[J]. *J Soil Water Conservation*(水土保持学报), **20**(6): 167－170, 191

Wendehenne D, Pugin A, Klessig DF. 2001. Nitric oxide: comparative synthesis and signaling in animal and plant cells[J]. *Trends Plant Sci*, **6**(4): 177－183

Xu S (徐胜), Li JL (李建龙), Zhao DH (赵德华). 2004. Research advances in physiological ecological and biochemical characteristics of *Festuca arundinacea*(高羊茅的生理生态及其生化特性研究进展)[J]. *Acta Pratacul Sin*(草业学报), **13**(1): 58－64

Yao J(姚婧), Chen XM(陈雪梅), Wang YB(王友保). 2008. Effects of soils contaminated by lead on germination and seedling growth of *Festuca arundinacea*(Pb 污染土壤对高羊茅种子萌发及幼苗生长的影响)[J]. *J Shanghai Jiaotong Univ*(*Agric Sci*)(上海交通大学学报·农业科学版), **26**(1): 61－65

Yang JR(杨居荣), Bao ZP(鲍子平), Zhang SQ(张素芹). 1993. The distribution of Cd, Pb in plant cell and their soluable-combinative forms(镉，铅在植物细胞内的分布及其可溶性结合形态)[J]. *China Environ Sci*(中国环境科学), **13**(4): 263－268

Yamasaki H, Shaniohi SY, Takahashi S. 1999. An alternative pathway for nitric oxide production in plant: new feature of an old enzyme[J]. *Trends Plant Sci*, **4**(4): 128－129

Zhang YB(张远兵), Liu AR(刘爱荣), Fang R(方蓉). 2008. Effect of exogenous nitric oxide on the growth and the antioxidant enzymes activities of *Lolium perenne* under Cd^{2+} stress(外源一氧化氮对镉胁迫下黑麦草生长和抗氧化酶活性的影响)[J]. *Acta Pratacul Sin*(草业学报), **17**(4): 57－64

Zhang X(张雄). 1982. Determination of viality of root and pollens of wheat with TTC and its applications (用 TTC 法测定小麦根和花粉的活力及其应用)[J]. *Plant Physiol Commun*(植物生理学通讯), **91**(3): 48－50, 56

Zhao SL(赵树兰), Duo LA(多立安). 2008. Growth response and threshold concentration of *Agrostis stoloniferato* Cu^{2+}, Zn^{2+}, Cd^{2+} or Pb^{2+} stress(匍茎剪股颖对 Cu^{2+}、Zn^{2+}、Cd^{2+} 与 Pb^{2+} 胁迫的生长响应与阈限浓度)[J]. *Guihaia*(广西植物), **28**(1): 100－106

(上接第 313 页 Continue from page 313)

[M]//Tibell L, Hedberg I(eds). Lichen Studies Dedicated to Rolf Santesson. Symbolae Botanicae Upsalienses, Acta Universitatis Upsaliensis, Uppsala, 131－161

Mamut R(热衣木·马木提), Keyimu A(阿孜古丽·克依木), Abbas A(阿不都拉·阿巴斯). 2004. New Chinese records of the lichen genus *Lecanora* Ach. collected from Khanas Nature Reserve of Xinjiang (采自新疆喀纳斯自然保护区茶渍属的中国新记录地衣种)[J]. *Mycosystema*(菌物学报), **23**(1): 167－168

Ryan BD, Lumbsch HT, Messuti MI, *et al*. 2004. *Lecanora*[M]// Nash TH III, Ryan BD, Diederich P(eds). Lichen Flora of the Greater Sonoran Desert Region. Vol. 2. Lichens Unlimited, Arizona State University, Tempe, Arizona, 176－286

Wang CL(王辰磊), Sun LY(孙立彦), Ren Q(任强), *et al*. 2007. A preliminary study of multispored *Lecanora* from Mt. Taibai(太白山茶渍属地衣多孢种类的初步研究) [J]. *Mycosystema*(菌物学报), **26**(1): 46－50