

Links between important values of (*Cremastra appendiculata*) and elevations by long-time investigation and qualitative analysis and quantitative statistics of "Big data"

Bing-Hua Liao ^{1, 2, *}

¹ The Key Laboratory of Ecological Restoration in Hilly Areas, Forestry Department of Henan Province, Institute of chemistry and environmental engineering, Ping-ding-shan University, Ping-ding-shan City, 467000, China.

² Institute of life and science, Henan University, Kai-feng City, He-nan Province, 475004, China.

Abstract

(*Cremastra appendiculata*) of treating lumbago and arthritis not only is a vital medicinal material plant, but also it is a widely distributed wide plant species. This plant species is widely distributed elevation from 500m to 3100m in Mei County of China. However, understanding dynamics of Important Value of this species is very difficult along elevation. This research explained that links between Important Value of this species and elevation is the significant positive correlation from 500m to 1500m ($P < 0.01$) as well as the links between Important Value of this species and elevation are the significant negative correlation from 1500m to 3100m ($P < 0.01$). This study provides six natural landscape types and a series of areas ecological adaptation for finding new medical species along different elevation. Thus, this research has vital theoretical and practical significance for medicinal plant protection at spatial-temporal-environmental-disturbance scales (STEDS).

Keywords: Important Vales; Elevation; Links; Areas ecological adaptation; Medicinal species.

1. Introduction

More and more research has assessed the correlation among Important Values (biomass, average height, numbers, biodiversity) of species and elevation from Important Vales (biomass, average height, numbers, biodiversity, at al.) of medicinal plant perspective (Table 1) [1-11], for better future of human health (ecosystems) [6-11]. However, medicinal species with typical history spanning over 1500 years, and areas ecological adaptation of a lot of Important Values of species pairs are unknown, as well as cognitive ecological theory of the links between Important Values of medicinal species and elevation can be unknown along environmental gradient [3-15].

Thus, understanding these medical values of medicinal spices, as well as the links between co-dominance abundance dominancy of species pairs of different areas ecological adaptation and elevation is a vital ecological rule along elevation and environmental gradient in the landscapes.

(*Cremastra appendiculata*) not only is vital medicinal material of treating lumbago and arthritis, but also is widely distributed wide specie in Mei County of China. This specie is belonging to *Cremastra* genus of Orchidaceae families of Monocotyledoneae in Angiospermae. Understanding Important Values of this species is unknown, however. Indeed, our research not only explained that there are links between Important Values of this species and elevation, but also explained that this species is a typical medical plant by the treating lumbago and arthritis for human better health.

* Corresponding author: Bing-Hua Liao

The Key Laboratory of Ecological Restoration in Hilly Areas, Forestry Department of Henan Province, Institute of chemistry and environmental engineering, Ping-ding-shan University, Ping-ding-shan City, 467000, China.

Therefore, there are some vital rules that the correlations between Important Values of this species and elevation in the different natural landscape types of Mei County of China at the STEDS by the long-time investigation and qualitative analysis and quantitative statistics of "Big Data".

Table 1 Links between medicinal plant structure number (biomass, height) and elevation.

Links between medicinal plant structure number (biomass, height) and elevation	Reference
Links between elevation environments and numbers of plant species at STEDS.	[1]
Links between biomass of medicinal herb and elevation in wetland landscape.	[2]
Links between plant functional number and elevation in forest landscape.	[3]
Links between plant functional number and elevation in near-natural forests.	[4]
Links between herbs number and disturbance of different elevation in wetland.	[5]
Links between number of medicinal tree species and elevation in forestation.	[6]
Links between number of medicinal tree trunk volume and elevation at STEDS.	[7]
Links between height of medicinal tree and elevation in the natural landscape.	[8]
Links between number of tree community crown volume and elevation in forest.	[9]
Links between number of tree individual specie’s crown volume and elevation.	[10]
Links between herbs number and different disturbance of different elevation.	[11]

2. Materials and methods

Typical area is local in three zones: firstly, evergreen vegetation of north subtropical zone; secondly, evergreen and deciduous coniferous and broad-leaved mixed forest of north subtropical and warm temperate transition; thirdly, deciduous vegetation of warm temperate zone in Earth. However, area of our study is local in evergreen, deciduous coniferous and broad-leaved mixed forest in north subtropical and warm temperate transition in Mei County of China (Figure 1).

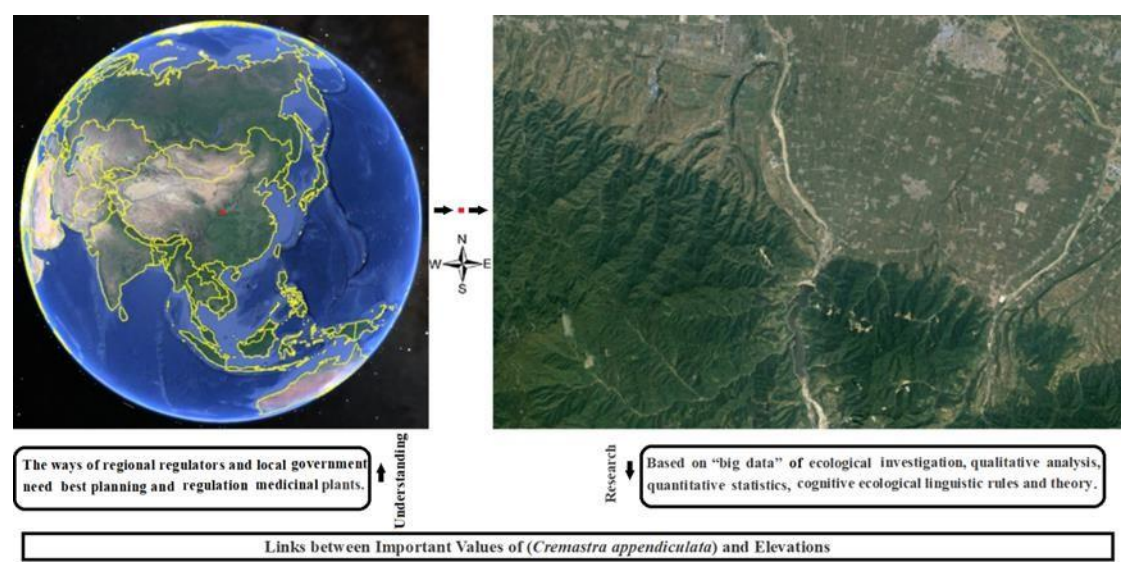


Figure 1 A Digital Cadaster Map and Research Methods of Typical Location in Mei County of China of Earth.

There are long-time investigation of links between Important Values of medicinal species and elevation from 2005 to 2019 in Mei County. Investigation of “big data” included that Important Values or other index of medicinal species along environment by our previous researches [2-15].

Thus, there is the links between Important Values of medical plant species and elevation, as well as there is a series of (good, better, best) natural landscapes areas ecological adaptation of elevation of medicinal plant species biomass by the “big data” of the ecological investigation, qualitative analysis, quantitative statistics, cognitive ecological linguistic rules, theories, methods and ways along different elevation and environmental gradient at the STEDS by the long-time investigation and qualitative analysis and quantitative statistics of “Big Data” [3-18].

3. Results

Based on “big data” of plant investigation, this species is a widely distributed wide species along elevation from 500m to 3100m. (*Cremastra appendiculata*) is a widely distributed along the different elevation from 500m to 3100m in Mei County of China. However, understanding the elevation effect on the links between Important Values of plant species and elevation is very difficult, because elevation effect on Important Values of plant species (biodiversity, et al) [2-15, 16-24].

Using the dynamics of “big data” investigation, this research suggested there are four rules:

Firstly, this research suggested that there is not only increasing of Important Values of (*Cremastra appendiculata*) with increasing of elevation from 500m to 1500m, as well as there are but also decreasing of Important Values of (*Cremastra appendiculata*) with increasing of elevation from 1500m to 3100m along elevation gradient at STEDS in Mei County of China (Figure 2).

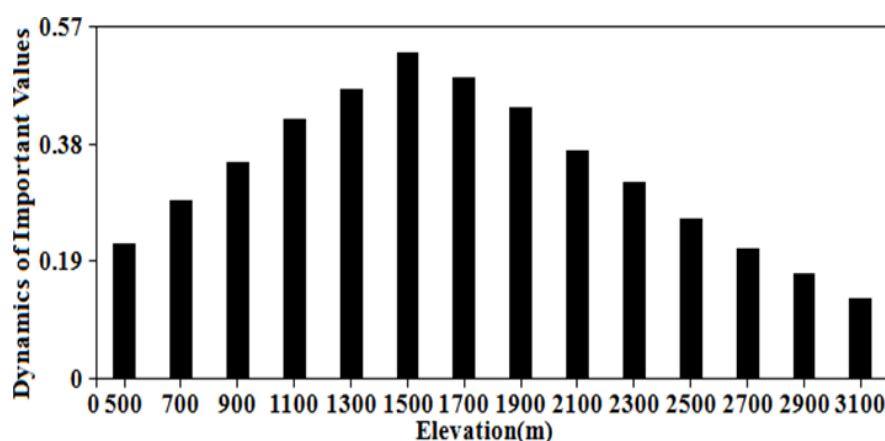


Figure 2 Dynamics of Important Values of this Plant Species along Elevation Gradient

Table 2 Correlation between Important Values of Species and Elevation

Elevation (m)	Elevation From 500m to 1500m	Elevation From 150m to 3100m
Important Values of Species	0.999**	-0.998**

Note: **, $P < 0.01$.

Secondly, this research explained that there is the significant positive correlations between Important Values of (*Cremastra appendiculata*) and elevation from 500m to 1500m ($P < 0.01$), as well as there is significant negative correlations between Important Values of this species and elevation from 1500m to 3100m ($P < 0.01$) along elevation and environmental gradient (Table 2).

Thirdly, this research provides a good areas ecological adaptation of (*Cremastra appendiculata*) from 500m to 3100 in Mei County in China. Meanwhile, this research proposed that there is not only the better area ecological adaptation of (*Cremastra appendiculata*) from 1000m to 2000m, there is but also the best areas ecological adaptation of (*Cremastra*

appendiculata) from 1300m to 1700m; because there are results that there are not only dynamics of different air environmental factors, there are but also dynamics of different soil environmental factors from 500m to 3100m by the dynamics of Important Values of (*Cremastra appendiculata*) in Mei County (Figure 2).

Fourthly, this research proposed that medicinal plant species (*Cremastra appendiculata*) is local in six natural landscape (forest, natural forestation landscape, mixed natural landscape between forestation and grassland, mixed natural landscape between forestation and wetland, mixed natural landscape between river and forestation, mixed natural landscape between forestation and urban, mixed natural landscape between forestation and rural settlement) by the "big data" of Important Values of (*Cremastra appendiculata*) investigation along elevation, because there may be results that there are not only dynamics of air environments, there are but also dynamics of soil environmental factors from 500m to 3100m by the dynamics of Important Values of (*Cremastra appendiculata*) biomass along elevation gradient at STEDS in Mei County of China.

Thus, this research found a series of typical (good, better, best) areas ecological adaptation of (*Cremastra appendiculata*) of treating lumbago and arthritis along elevation gradient, as well as there is the links between Important Values of this plant species and elevation gradient.

4. Discussion

Understanding medicinal species is very difficult at STEDS [1-14, 25- 29]. This research suggested three rules between Important Values of (*Cremastra appendiculata*) and elevation gradient at the STEDS by long-time investigation, qualitative analysis and quantitative statistics of "Big Data".

1. This research suggested that there is increasing of Important Values of (*Cremastra appendiculata*) with increasing of elevation from 500m to 1500m, as well as there is decreasing of Important Values of (*Cremastra appendiculata*) with increasing of elevation from 1500m to 3100m (Figure 2). There is the significant positive correlation between Important Values of (*Cremastra appendiculata*) and elevation from 500m to 1500m ($P < 0.01$) as well as there is the significant negative correlation between Important Values of (*Cremastra appendiculata*) and elevation from 1500m to 3100m along elevation gradient in Mei County ($P < 0.01$) (Table 2).

2. This research provides six natural landscape types (forestation types, mixed types between forestation and grassland, mixed types between forestation and wetland, mixed types between forestation and river, mixed types between forest and urban, mixed types between forestation and rural settlement), as well as there is a series of areas ecological adaptation (a good areas ecological adaptation from 500m to 3100, the better area ecological adaptation from 1000m to 2000m, the best areas ecological adaptation from 1300m to 1700m) for finding (*Cremastra appendiculata*) by dynamics of Important Values of (*Cremastra appendiculata*) at STEDS in Mei County of China.

3. (*Cremastra appendiculata*) not only is a vital medicinal material of treating lumbago and arthritis, but also it is belonging to *Cremastra* genus of Orchidaceae families of Monocotyledoneae in Angiospermae, as well as it is widely distributed wide specie by the "big data" long-time investigation of Important Values of (*Cremastra appendiculata*) in Mei County at STEDS.

Therefore, this research has a vital theoretical and practical significance for the reasonable protection of (*Cremastra appendiculata*) along different elevation gradient in the different ecosystems, because this plant species not only is an important widely distributed wide medicinal material plant by treating lumbago and arthritis, but also there are three rules by the links between Important Values of (*Cremastra appendiculata*) and elevation in Mei County of China. Indeed, the better regional regulators and government need the best planning and regulation a lot of medicinal plant management sustainability of communities by the researches on Important Values of (*Cremastra appendiculata*) (biodiversity, height, biomass, number, et al.) based on dynamics of the linkages among biodiversity, elevation, environmental factors in local, regional, global natural ecosystems for the better future of ecosystem functions and human health at the STEDS [1-14, 30-39].

5. Conclusion

Treating lumbago and arthritis often influence human health in the global urban and countryside. This article suggests that (*Cremastra appendiculata*) of treating lumbago and arthritis not only is a vital medicinal plant, but also it is a widely distributed species in Mei County. So, (*Cremastra appendiculata*) is key medicinal material plant to human wellbeing in local and global landscapes. However, this article suggests this medicinal material plant species is only widely

distributed elevation from 500m to 3100m, but also understanding dynamics of the links between Important Value of this species and elevation. And the links between Important Value of this species and elevation are the significant positive correlation from 500m to 1500m ($P < 0.01$), and the links between Important Value of this species and elevation are the significant negative correlation from 1500m to 3100m ($P < 0.01$) in Mei County of Shan-xi Province of China. Therefore, this study has theoretical and practical significance for this medicinal plant protection at STEDS..

Compliance with ethical standards

Acknowledgments

This work was supported by A Grade of Key Disciplines of Environmental Science Foundation, B Grade of Key Disciplines of Mistrisals Science of *Ping-Ding-shan University* in China; Science and Technology Department of He'nan Province Foundation (KJT-17202310242; 092102110165); Subprojects by Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES); and better ideas of researchers of "1st Biotechnology World Congress" in 2011, "2nd Biotechnology World Congress" in 2012, "3rd Biotechnology World Congress" in 2013 is appreciated.

References

- [1] Liao BH, Wang XH. Plant functional group classifications and a generalized hierarchical framework of plant functional traits, *African Journal of Biotechnology*. 2010; 9: 9208-9213.
- [2] Liao BH, Ding SY, Liang GF, et al. Dynamics of plant functional groups composition along environmental gradients in the typical area of Yi-Luo River watershed. *African Journal of Biotechnology*. 2011a; 10: 14485- 14492.
- [3] Liao BH, Ding SY, Hu N, et al. Dynamics of environmental gradients on plant functional groups composition on the northern slope of the Fu-Niu Mountain Nature Reserve. *African Journal of Biotechnology*. 2011b; 10: 18939-18947.
- [4] Liao BH, Liu QF, Lu D, et al. Dynamics of environmental gradients on plant functional groups composition species in near-natural community ecological restoration on the southern slope of the Fu-Niu Mountain Nature Reserve. *Journal of Science*. 2014a, 4: 306-312.
- [5] Chen HS, Liao BH, Hang CZ, et al. Research on risk assessment and early warning mechanism of agricultural non-point source pollution in Bai-gui Lake watershed by GIS. *International Journal of Pharmacognosy and Pharmaceutical Sciences*. 2019; 1: 25-29.
- [6] Liao BH, Liu M, Huang CZ, et al. Dynamics of (Sophora japonica)Community's Tree Individual Number along Elevation Gradient in Ye County. *International Journal of Pharmacognosy and Pharmaceutical Sciences*. 2019a; 1: 1-4.
- [7] Liao BH, Liu YP, Zuo H, et al. Dynamics of 18 (Sophora japonica) Tree Community's Total Trunk Volume along Elevation Gradient in Ye County. *International Journal of Current Advanced Research*. 2019c; 8: 19063-19066.
- [8] Liao BH, Liu YP, Zuo H, et al. Elevation Dynamics of (Sophora japonica) Community's Height in Ye County. *International Journal of Research Pharmaceutical and Nano Sciences*. 2019b; 8: 48 -54.
- [9] Liao BH, Liu YP, et al. Dynamics Crown Volume of 18 (Sophora japonica) Tree Communities along Elevation Gradient in Ye County. *Open Journal of Ecology*. 2019d; 9: 209 -215.
- [10] Liao BH, Liu YP, Zuo H, et al. Dynamics of 18 (Sophora japonica) Tree Individual Specie's Crown Volume along Elevation Gradient in Ye County. *International Journal of Research Pharmaceutical and Nano Sciences*. 2019e; 8: 62-68.
- [11] Liao BH. A new model of dynamic of plant diversity in changing farmlands, implications for the management of plant biodiversity along differential environmental gradient in the spring. *African Journal of Environmental Science and Technology*. 2014b; 8: 171- 177.
- [12] Zhu DM, Liao BH. A dynamical system of human cognitive linguistic theory in learning and teaching of the typical university in Henan Province. *International Journal of Pharmacy & Therapeutics*. 2015; 6: 4-6.
- [13] Yang Y, Sun M, et al. Germplasm resources and genetic breeding of Paeonia: a systematic review. *Horticulture Research*. 2020; 7: 1-19.
- [14] Jin D, Dai KP, et al. Secondary Metabolites Profiled in Cannabis Inflorescences, Leaves, Stem Barks, and Roots for Medicinal Purposes. *Scientific Reports*. 2020; 10: 1-14.

- [15] Kozuharova E, Matkowski A, et al. *Amorpha fruticosa* - A Noxious Invasive Alien Plant in Europe or a Medicinal Plant against Metabolic Disease? *Front Pharmacol*. 2017; 8: 333.
- [16] Giovannini P, Howes MJ, Edwards SE. Medicinal plants used in the traditional management of diabetes and its sequelae in Central America: A review. *J Ethnopharmacol*, 2016, 184: 58-71.
- [17] Szopa A, Klimek-Szczykutowicz M, Kokotkiewicz A, et al. Phenolic acid and flavonoid production in agar, agitated and bioreactor-grown microshoot cultures of *Schisandra chinensis* cv. Sadova No.1 - a valuable medicinal plant. *J Biotechnol*. 2019; 305: 61- 70.
- [18] Mesfin F, Demissew S, Teklehaymanot T. An ethnobotanical study of medicinal plants in Wonago Woreda, SNNPR, Ethiopia. *J Ethnobiol Ethnomed*. 2009; 5: 28.
- [19] Elkins AC, Deseo MA, Rochfort S, et al. Development of a validated method for the qualitative and quantitative analysis of cannabinoids in plant biomass and medicinal cannabis resin extracts obtained by super-critical fluid extraction. *J Chromatogr B Analyt Technol Biomed Life Sci*. 2019; 109: 76-83.
- [20] Baque MA, Moh SH, Lee EJ, et al. Production of biomass and useful compounds from adventitious roots of high-value added medicinal plants using bioreactor. *Biotechnol Adv*. 2012; 30: 1255-67.
- [21] Saeed S, Ali H, Khan T, et al. Impacts of methyl jasmonate and phenyl acetic acid on biomass accumulation and antioxidant potential in adventitious roots of *Ajuga bracteosa* Wall ex Benth., a high valued endangered medicinal plant. *Physiol Mol Biol Plants*. 2017; 23: 229- 237.
- [22] Prasad R, Kamal S, Sharma PK, et al. Root endophyte *Piriformospora indica* DSM 11827 alters plant morphology, enhances biomass and antioxidant activity of medicinal plant *Bacopa monniera*. *J Basic Microbiol*, 2013; 53: 1016-1024.
- [23] Fuentes P, Zhou F, Erban A, et al. A new synthetic biology approach allows transfer of an entire metabolic pathway from a medicinal plant to a biomass crop. *Elife*. 2016; 5: e1360-1364.
- [24] Rukh G, Ahmad N, et al. Photodependent somatic embryogenesis from non-embryogenic calli and its polyphenolics content in high-valued medicinal plant of *Ajuga bracteosa*. *J Photochem Photobiol B*. 2019; 190: 59-65.
- [25] Das A, Kamal S, Shakil NA, et al. The root endophyte fungus *Piriformospora indica* leads to early flowering, higher biomass and altered secondary metabolites of the medicinal plant, *Coleus forskohlii*. *Plant Signal Behav*. 2012; 7: 103-112.
- [26] Schafhauser T, Jahn L, Kirchner N, et al. Antitumor astins originate from the fungal endophyte *Cyanoderma asteris* living within the medicinal plant *Aster tataricus*. *Proc Natl Acad Sci USA*. 2019; 116: 26909-26917.
- [27] Singh SP, Gaur R. Evaluation of antagonistic and plant growth promoting activities of chitinolytic endophytic actinomycetes associated with medicinal plants against *Sclerotium rolfsii* in chickpea. *J Appl Microbiol*. 2016; 121: 506-518.
- [28] Das K, Dang R, Shivananda TN, Sur P. Interaction between phosphorus and zinc on the biomass yield and yield attributes of the medicinal plant *stevia* (*Stevia rebaudiana*). *Scientific World Journal*. 2005; 5: 390-395.
- [29] Zubek S, Mielcarek S, Turnau K. Hypericin and pseudohypericin concentrations of a valuable medicinal plant *Hypericum perforatum* L. are enhanced by arbuscular mycorrhizal fungi. *Mycorrhiza*. 2012; 22: 149-156.
- [30] Takshak S, Agrawal SB. Defence strategies adopted by the medicinal plant *Coleus forskohlii* against supplemental ultraviolet-B radiation: Augmentation of secondary metabolites and antioxidants. *Plant Physiol Biochem*. 2015; 97: 124-138.
- [31] Larsen HO. Commercial medicinal plant extraction in the hills of Nepal: local management system and ecological sustainability, *Environ Manage*. 2002; 29: 88-101.
- [32] Bojić M, Maleš Ž, Antolić A, et al. Antithrombotic activity of flavonoids and polyphenols rich plant species. *Acta Pharm*. 2019; 69: 483-495.
- [33] Maleš Ž, Drvar DL, et al. Application of medicinal plants in several dermatovenerological entities. *Acta Pharm*. 2019; 69: 525-531.
- [34] Wyk BEV. A review of commercially important African medicinal plants. *J Ethnopharmacol*. 2015; 176: 118-134.
- [35] Ali H, Khan MA, Kayani WK, et al. Production of biomass and medicinal metabolites through adventitious roots in *Ajuga bracteosa* under different spectral lights. *J Photochem Photobiol B*. 2019; 193: 109-117.

- [36] Putterman D. Biodiversity treaty nations to study biosafety protocol. *Nature*. 1994; 372: 585.
- [37] Song H, Payne S, et al. Spatiotemporal modulation of biodiversity in a synthetic chemical- mediated ecosystem. *Nature Chemical Biology*. 2009; 5:929-935.
- [38] Opgenoorth L, Hotes S, Mooney H. IPEPS: Biodiversity panel should play by rules. *Nature*. 2014; 506: 159.
- [39] Liao, Mace GM, Ekins P. Limits to agricultural land for retaining acceptable levels of local biodiversity. *Nature Sustainability*. 2019; 2: 491-498.