

Review Article

Links between Biomass of (*Cremastra Appendiculata*) Roots Cuticle and Daily Solar Radiation by Big Data of Long-Time Wild Investigation in Mei County

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Abstract: (*Cremastra appendiculata*) not only is a vital medicinal material plant by treating lumbago and arthritis, but also it is a widely distributed wide plant species from 500m to 3100m in *Mei County* of China. However, understanding links between total biomass of roots cuticle and daily solar radiation is difficult. This study explained that there is the increasing of total biomass of roots cuticle with increasing of daily solar radiation as well as links between total biomass of roots cuticle and daily solar radiation is the significant positive correlation from 20.578mol/m²•d to 24.158mol/m²•d along elevation from 500m to 1500m ($P<0.01$); there are decreasing of this total biomass of roots cuticle with increasing of daily solar radiation as well as the linkages between this total biomass of roots cuticle and daily solar radiation is the significant negative correlation from 24.15mol/m²•d to 27.246mol/m²•d along elevation from 1500m to 3100m ($P<0.01$). This research provides a series of areas ecological adaptation of daily solar radiation and six landscapes of this species. Therefore, this has vital theoretical and practical significance by medicinal plant species protection for better future of human health, ecosystem services and ecosystem functions along daily solar radiation.

Keywords: Biomass of roots cuticle; daily solar radiation; links; medicinal; areas ecological adaptation.

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INTRODUCTION

More and more researches have assessed the links between total biomass of roots cuticle of medical plants and environments along elevation from total biomass of plant roots cuticle (plant functional groups, biodiversity, height, total biomass of roots cuticle) of medicinal plant species perspective by biodiversity researches (Table 1) [1-11], which based on better future of human health by the finding medicinal plants. However, traditional medicinal plant species with typical history spanning over 1500 years, as well as areas ecological adaptation of a lot of total biomass of roots cuticle of plant are unknown and values of medicinal species also cannot be utilized [12-16].

(*Cremastra appendiculata*) not only is a vital medicinal material plant of treating lumbago and arthritis, but also it is widely distributed wide specie along elevation from 500 to 3100m by “big data” of our long-time investigation in *Mei County*. This species is

belonging to *Cremastra* genus of Orchidaceae families of Monocotyledoneae in Angiospermae. However, understanding the links between total biomass of roots cuticle of medical plants and dynamics of daily solar radiation along elevation is unknown, as well as the links between total biomass of roots cuticle of plants and daily solar radiation is difficult finding along elevation and environmental factors [1-17].

Meanwhile, elevation and environmental (daily solar radiation, disturbances) gradient also influence on total biomass of roots cuticle (biomass, biodiversity, structure, *et al.*) of plant species in “big data” investigation of our long years researches. Understanding these medical values of medicinal species and the links between total biomass of roots cuticle of medicinal plant and the daily solar radiation and different areas ecological adaptation of medicinal plants is a vital rule.

Table-1: Evaluation of links between dynamics of medicinal plants and environmental factors

Assessments of links between multilevel medicinal plant and elevation	Authors
Links between biodiversity of plant functional groups and elevation at STEDS.	Liao, <i>et al.</i> , 2010[1].
Links between biomass of medicinal herbs and elevation in wetland landscape.	Liao, <i>et al.</i> , 2011a [2].
Links between plant functional groups diversity and elevation in forest.	Liao, <i>et al.</i> , 2011b [3].
Links between plant functional groups and elevation in near-natural forests.	Liao, <i>et al.</i> , 2014a [4].
Links between biodiversity and disturbance of different elevation in wetland.	Chen, <i>et al.</i> , 2019[5].
Links between number of medicinal tree species and elevation in forestation.	Liao, <i>et al.</i> , 2019a [6].
Links between medicinal tree trunk volume and elevation in forest landscape.	Liao, <i>et al.</i> , 2019b [7].
Links between average height of medicinal tree and elevation in landscapes.	Liao, <i>et al.</i> , 2019c [8].
Links between number of tree community crown volume and elevation.	Liao, <i>et al.</i> , 2019d [9].
Links between number of tree individual specie’s crown volumes and elevation.	Liao, <i>et al.</i> , 2019e[10].
Links between diversity of herbs and different disturbance of different elevation.	Liao, 2014 b[11].

Therefore, there is not only the vital links between total biomass of roots cuticle of species and daily solar radiation, but also there is a series of (good, better, best) this species areas ecological adaptation of daily solar radiation in six near-natural ecosystem for the better future of ecosystem composition (services, functions, structures) and human health along the different elevation and environments at the spatial-temporal-environmental-disturbance scales (STEDS).

Environmental condition, situation of special vegetation and methods of research

Research typical area is local in three vegetation zones in China: firstly, evergreen vegetation

in north subtropical zone; secondly, evergreen and deciduous coniferous and broad-leaved mixed forest in north subtropical and warm temperate transition; thirdly, deciduous vegetation in warm temperate zone by large total biomass of roots cuticle investigation of medicinal plant. Thus, our research area is local in evergreen and deciduous coniferous and broad-leaved mixed forest in north subtropical and warm temperate transition (landscape types included: urban, rural settlement, wetland, forest, grassland, farmland, river landscape as well as mixed zone landscape interaction each other) along elevation and environmental gradient in *Mei County* of China (Figure 1).

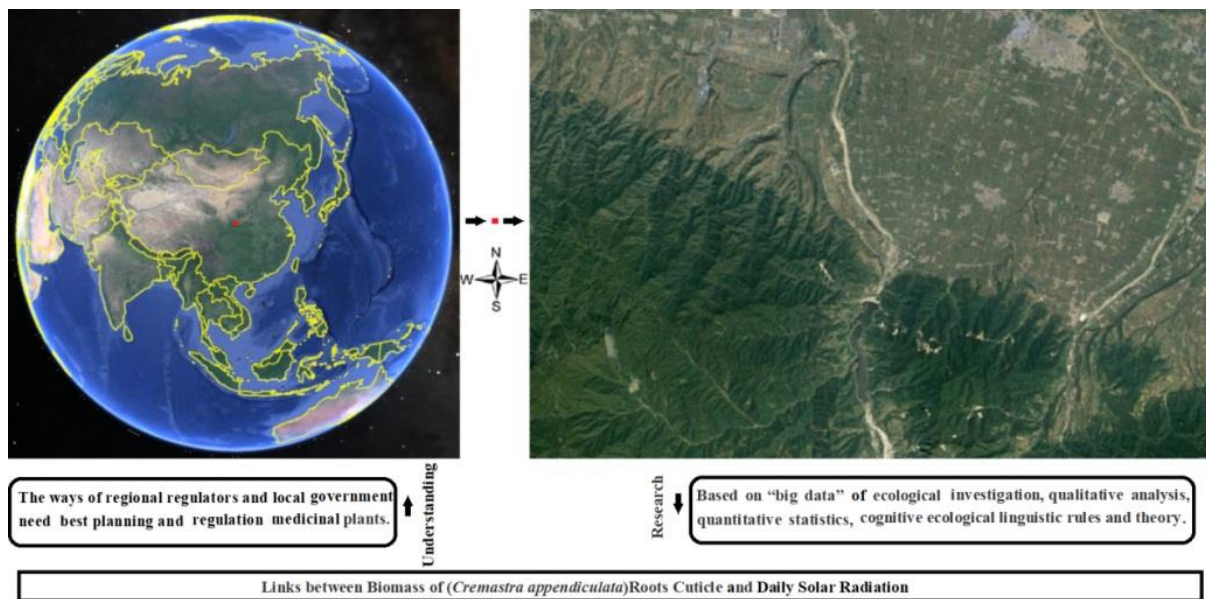


Fig-1: A Digital Cadaster Map and Research Methods of Typical Location in Mei County of China of Earth

There is a long time investigation by the links between medicinal plant species diversity and environments from 2005 to 2019. Investigation “big data” included that dynamics of total biomass of roots cuticle of medicinal plants or other index along environments (*Fu-niu Mountain, Yellow River, Ye County, Yi-luo River, Bai-gui Lake, et al.*) based on ecological cognitive ability [2-15].

Thus, there is the links between total biomass of (*Cremastra appendiculata*) roots cuticle and daily solar radiation as well as there is a series of (good, better, best) natural landscapes areas ecological adaptation of daily solar radiation of this medical plant species by the “big data” of the ecological investigation, qualitative analysis, quantitative statistics, human cognitive ecological linguistic rules, theories, methods

and ways along elevation and environmental gradient [3-19].

Results based on quantitative statistics and qualitative analysis

(Cremastra appendiculata) not only is a vital medicinal material plant of treating lumbago and arthritis, but also it is widely distributed wide plant species along elevation from 500 to 3100m in natural

ecosyleaves along elevation from 500m to 3100m in *Mei County*. However, understanding daily solar radiation effect on the links between this total biomass of roots cuticle and daily solar radiation is very difficult. Using “big data” investigation, this research suggested there are three rules along increasing of daily solar radiation and elevation gradient in *Mei County* of China:

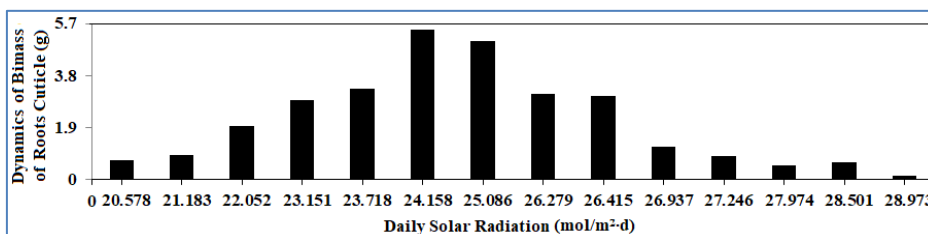


Fig-2: Dynamics of Biomass of Roots Cuticle along Daily Solar Radiation Gradient

Firstly, this research proposed that not only there is the increasing of total biomass of roots cuticle of this plant species with the increasing daily solar radiation, and there is the significant positive correlation between total biomass of roots cuticle of this species and daily solar radiation from 20.578mol/m²·d to 24.158mol/m²·d ($P<0.01$) along elevation from 500m to 1500m, but also there is the decreasing of total biomass of roots cuticle of this plant species with the

increasing of daily solar radiation, as well as there is the significant negative correlation between total biomass of roots cuticle of this plant species and daily solar radiation from 24.158mol/m²·d to 28.973mol/m²·d ($P<0.01$) along elevation from 1500m to 3100m. Because there is the increasing of daily solar radiation with increasing daily solar radiation and elevation is the significant positive correlation along elevation from 500m to 3100m ($P<0.01$) (Figure 2, 3; Table 2, 3).

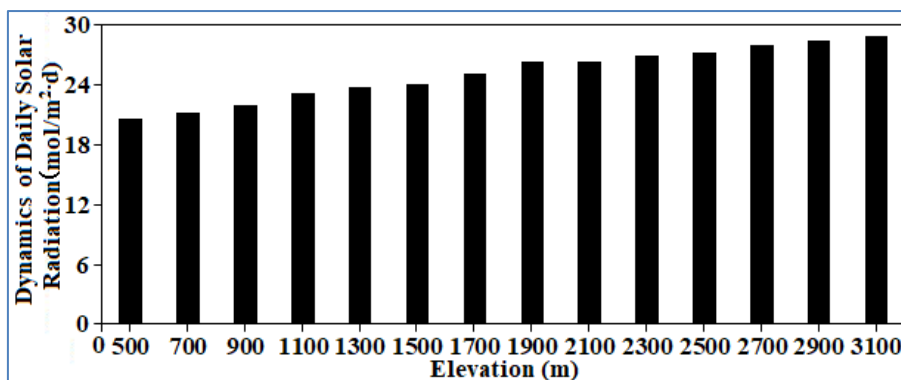


Fig-3: Dynamics of Daily Solar Radiation along Elevation Gradient

Secondly, this research provided good areas ecological adaptation of daily solar radiation of this medical plant species is local in the areas ecological adaptation of daily solar radiation from 20.578mol/m²·d to 28.973mol/m²·d along elevation from 500m to 3100m, and not only there are better areas ecological adaptation of daily solar radiation of this species from

23.151mol/m²·d to 27.974mol/m²·d along elevation gradient from 1100m to 2700m, but also there are the best areas ecological adaptation of daily solar radiation of this medical plant species from 23.718mol/m²·d to 25.086mol/m²·d along elevation from 1300m to 1700m at STEDS in *Mei County* (Figure 2,3).

Table-2: Correlation between Total Biomass of Roots cuticle and Daily Solar Radiation

Daily Solar Radiation along Elevation Gradient	Plant Biomass of Roots cuticle
Daily Solar Radiation From 500m to 1500m	0.944**
Daily Solar Radiation From 150m to 3100m	-0.958**

Note: *, $P<0.05$; **, $P<0.01$.

Thirdly, this research suggested that medicinal plant (*Cremastra appendiculata*) of treating lumbago and arthritis is local in six natural landscape types (forest, mixed between grassland and forest, mixed between forest and wetland, mixed between forest and

river, mixed between forest and urban, mixed between forest and rural settlement), because of there is result of dynamics of air and soil environments along elevation and environmental gradient at “big data” STEDS (Figure1).

Table-3: Correlation between Total Biomass of Roots cuticles Daily Solar Radiation Gradient

Elevation (m)	Elevation Gradient from 500m to 3100m
Daily Solar Radiation	0.992**

Note: **, $P < 0.01$.

This work finds a series of typical (good, better, best) areas ecological adaptation of (*Cremastra appendiculata*) of treating lumbago and arthritis along elevation (daily solar radiation), and there is links between total biomass of roots cuticle and daily solar radiation along elevation.

In short, regional planners need regulation a lot of landscape sustainability based on researches on total biomass of roots cuticle of medical plant species (biodiversity, composition, structure, *et al.*) by the “big data” investigation, qualitative analysis, quantitative statistics, human cognitive ecological linguistic rules and theory of the links between biodiversity and environments in the global, local, regional landscapes for the better future of human health and ecosystem stability (functions, structures, services) and human health along elevation, daily solar radiation [1-15, 26-44].

CONCLUSION AND DISCUSSION

Understanding the dynamics of total biomass of roots cuticle of medicinal species is very difficult [2-25]. This research suggested three rules with biomass of roots cuticle of this species:

Firstly, there is the significant positive correlation between total biomass of roots cuticle of this species and daily solar radiation along elevation from 500m to 1500m ($P < 0.01$), because of there is increasing of total biomass of roots cuticle with increasing of daily solar radiation from $20.578 \text{ mol/m}^2 \cdot \text{d}$ to $24.158 \text{ mol/m}^2 \cdot \text{d}$. Meanwhile, there is significant negative correlation between Total biomass of roots cuticle and daily solar radiation along elevation from along elevation from 1500m to 3100m ($P < 0.01$), because of there is decreasing of total biomass of roots cuticle with increasing of daily solar radiation from $24.158 \text{ mol/m}^2 \cdot \text{d}$ to $27.246 \text{ mol/m}^2 \cdot \text{d}$ ($P < 0.01$).

Secondly, this research provided good areas ecological adaptation along elevation from 500 to 3100m, the better areas ecological adaptation along elevation from 1100 to 2500m, and the best areas ecological adaptation of daily solar radiation of this medical plant along elevation from 1300 to 1700m is

local in *Mei County* of China along environmental gradient at STEDS (Figure 2, 3).

Thirdly, this research suggested that total biomass of roots cuticle of this species of treating lumbago and arthritis is local in six near-landscape types (forests, mixed landscapes between forestation and wetland, mixed landscapes between grassland and forestation, mixed landscapes between forest and urban, mixed landscapes between forest and river, mixed landscapes between forest and rural settlement) by “big data” and researches along air and soil environments (Figure1).

Therefore, this research has a vital theoretical and practical significance for the reasonable protection of total biomass of roots cuticle of this species along the daily solar radiation and elevation gradient in six natural landscapes. Because of this plant species not only is a vital widely distributed wide medicinal plant species of treating lumbago and arthritis, but also there are three rules by the links between total biomass of roots cuticle of this species and daily solar radiation.

Abbreviation: STEDS, the spatial-temporal-environmental-disturbance scales.

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