



(RESEARCH ARTICLE)



## Relations between biomass of (*Smilax scobinicaulis*) Fresh Roots and Daily Solar Radiation

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### Abstract

(*Smilax scobinicaulis*) not only is a medicinal material plant by treating joint pain, but also it is a widely distributed wide species from 500m to 3100m in *Mei County* of China. However, explaining links between total biomass of fresh roots and daily solar radiation is difficult. Herein explains that it is an increasing of total biomass of fresh roots with increasing of daily solar radiation, a link between total biomass of fresh roots and daily solar radiation is a significant positive correlation from 20.578mol/m<sup>2</sup>•d to 24.158mol/m<sup>2</sup>•d along elevation from 500m to 1500m ( $P<0.01$ ); it is a decreasing of this total biomass of fresh roots with increasing of daily solar radiation, it is a link between this total biomass of fresh roots and daily solar radiation is the significant negative correlation from 24.15mol/m<sup>2</sup>•d to 27.246mol/m<sup>2</sup>•d along elevation from 1500m to 3100m ( $P<0.01$ ). Herein provides key areas ecological adaptation of daily solar radiation and six landscapes. So, this has key theoretical and practical significance by medicinal species protection for future of human well-being at daily solar radiation at spatial-temporal-environmental-disturbance scales (STEDS).

**Keywords:** Total biomass of fresh roots; Daily solar radiation; Links; Medicinal; Areas ecological adaptation

### 1. Introduction

More and more scientists have assessed the links between total biomass of fresh roots of medical plants and environments along elevation from total biomass of fresh roots (plant functional groups, biodiversity, height, total biomass of fresh roots) of medicinal species perspective by biodiversity researches (Table 1)<sup>1-21</sup>, 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 fresh roots of plant are unknown and values of medicinal species also cannot be utilized along eco-landscape environmental gradient<sup>12-21</sup>.

(*Smilax scobinicaulis*) not only is a vital medicinal material plant of treating joint pain, 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*. The species is belonging to *Smilax L.* genus of Liliaceae families of Monocotyledoneae in Angiospermae. However, understanding the links between total biomass of fresh roots of medical plants and dynamics of daily solar radiation along elevation is unknown, as well as the linkages between total biomass of fresh roots of plants and daily solar radiation is difficult finding along elevation and environmental factors<sup>11-27</sup>. And, elevation and environmental (daily solar radiation, disturbances) gradient also influence on total biomass of fresh roots (biomass, biodiversity, structure, et al.) of plant species in “big data” investigation of our long years researches Understanding these medical values of medicinal spices

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and links between total biomass of fresh roots of medicinal plant species and the daily solar radiation and different areas ecological adaptation of medical plants is a vital rule along different environments.

As such, there is not only the vital links between total biomass of fresh roots 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 ecosystems for better future of ecosystems.

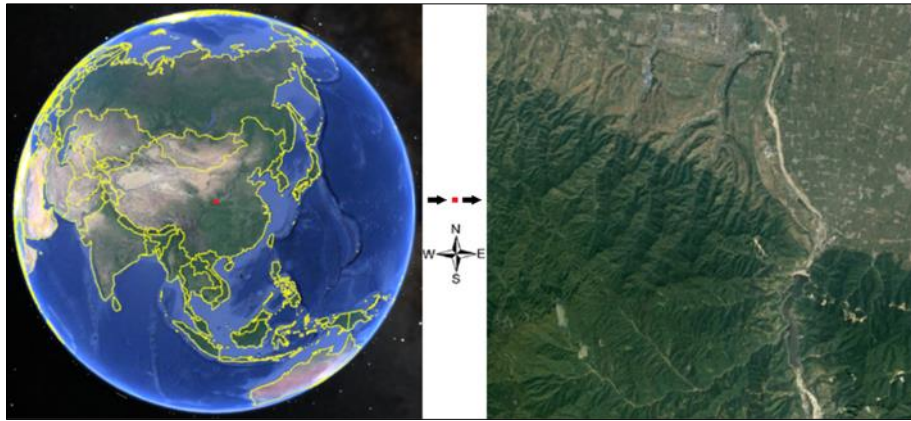
**Table 1** Evaluation of links between dynamics of medicinal plants and environmental factors

Assessments of links between multilevel medicinal plant and elevation	Authors
Links between biodiversity of plant functional groups and elevation at STEDS.	Liao, et al., 2010 <sup>1</sup> .
Links between biomass of medicinal herbs and elevation in wetland landscape.	Liao, et al., 2011 a <sup>2</sup> .
Links between plant functional groups diversity and elevation in forest.	Liao, et al., 2011 b <sup>3</sup> .
Links between plant functional groups and elevation in near-natural forests.	Liao, et al., 2014 a <sup>4</sup> .
Links between number of medicinal tree species and elevation in forestation.	Liao, et al., 2019 a <sup>5</sup> .
Links between average height of medicinal tree and elevation in landscapes.	Liao, et al., 2019 b <sup>6</sup> .
Links between medicinal tree trunk volume and elevation in forests.	Liao, et al., 2019 c <sup>7</sup> .
Links between number of tree community crown volume and elevation.	Liao, et al., 2019 d <sup>8</sup> .
Links between number of individual specie's crown volumes and elevation.	Liao, et al., 2019 e <sup>9</sup> .
Links between plant diversity and different disturbance of different elevation.	Liao, 2014 b <sup>10</sup> .
Links between dry weight biomass of biomedical plant and elevations.	Liao, 2020 a <sup>11</sup> .
Links between total biomass of fresh weight of medical plant and elevations.	Liao, 2020 b <sup>12</sup> .
Links between vegetation coverage of biomedical plant and elevation.	Liao, 2020 c <sup>13</sup> .
Links between pair's co-dominance abundance dominancy and elevation.	Liao, 2020 d <sup>14</sup> .
Relation between plant average height of biomedical plant and elevation.	Liao, 2020 e <sup>15</sup> .
Links between biomass of biomedical plant roots cuticle and elevation.	Liao, 2020 f <sup>16</sup> .
Links between biomass of medical plant roots cuticle and daily solar radiation.	Liao, 2020 g <sup>17</sup> .
Links between leafstalk biomass of biomedical plant and elevation.	Liao, 2020 h <sup>18</sup> .
Links between biomass of biomedical plant stems cuticle and elevation.	Liao, 2020 i <sup>19</sup> .
Links between Important Values of biomedical plant species and elevations	Liao, 2020 j <sup>20</sup> .
Links between moisture content of biomass of biomedical plant and elevation.	Liao, 2020 k <sup>21</sup> .

## 2. Material and methods

The 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 fresh roots 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 Shan'xi Province* of China (Figure 1).

There is a long time investigation by the links between medicinal plant species diversity and environments from 2005 to 2019. Investigation of "big data" included that the dynamics of total biomass of fresh roots of key medicinal plants or other index along environmental gradients (*Fu-niu Mountain, Yellow River, Ye County, Yi-luo River, Mei-county, Bai-gui Lake, et al.*)<sup>2-25</sup>.

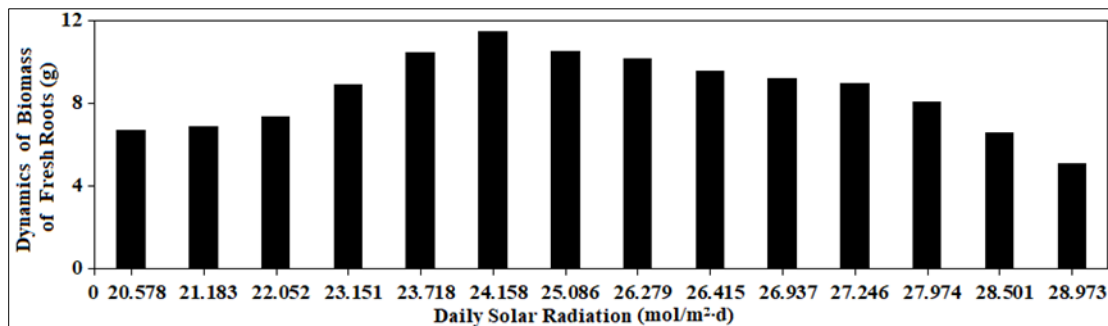


**Figure 1** A Digital Cadaster Map and Typical Location in *Mei County* of China of Earth

Thus, there is the links between total biomass of (*Smilax scobinicaulis*) fresh roots and daily solar radiation, and 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 for predicting on ecological rules<sup>3-31</sup>.

### 3. Results

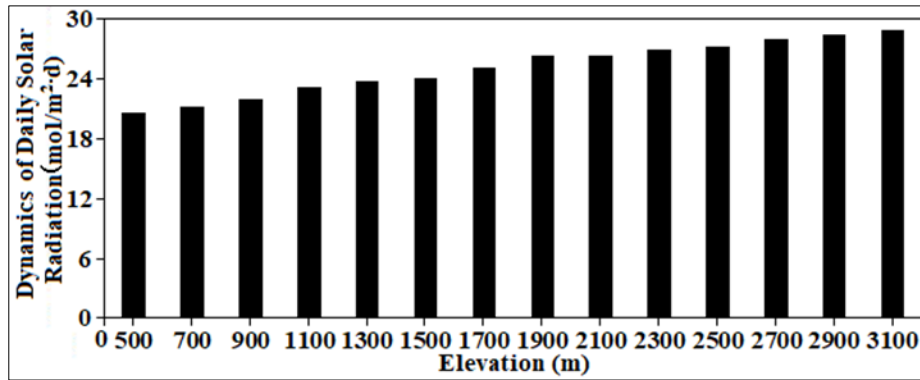
(*Smilax scobinicaulis*) not only is a vital medicinal material plant of treating joint pain, but also it is widely distributed wide plant species along elevation from 500 to 3100m in natural ecosystems along elevation from 500m to 3100m in *Mei County*. However, understanding daily solar radiation effect on the links between this total biomass of fresh roots and daily solar radiation is difficult. Using “big data” investigation, this research showed there are three rules at increasing of daily solar radiation and elevation gradient in *Mei County* of *Shan'xi Province* of China:



**Figure 2** Dynamics of Total Biomass of Fresh Roots along Daily Solar Radiation Gradient

Firstly, this research proposed that not only there is the increasing of total biomass of fresh roots of this plant species with the increasing daily solar radiation, and there is the significant positive correlation between total biomass of fresh roots of this species and daily solar radiation from 20.578mol/m<sup>2</sup>•d to 24.158mol/m<sup>2</sup>•d ( $P<0.01$ ) along elevation from 500m to 1500m, but also there is the decreasing of total biomass of fresh roots of this plant species with the increasing of daily solar radiation, and there is the significant negative correlation between total biomass of fresh roots of this plant species and daily solar radiation from 24.158mol/m<sup>2</sup>•d to 28.973mol/m<sup>2</sup>•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 gradient from 500m to 3100m ( $P<0.01$ ) at STEDS (Figure 2, 3; Table 2, 3).

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/m<sup>2</sup>•d to 28.973mol/m<sup>2</sup>•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/m<sup>2</sup>•d to 27.974mol/m<sup>2</sup>•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/m<sup>2</sup>•d to 25.086mol/m<sup>2</sup>•d along elevation from 1300m to 1700m at STEDS in *Mei County* (Figure 2,3).



**Figure 3** Dynamics of Daily Solar Radiation along Elevation Gradient

**Table 2** Correlations between Total Biomass of Fresh Roots and Daily Solar Radiation

Daily Solar Radiation along Elevation Gradient	Plant Biomass of Fresh Roots
Daily Solar Radiation From 500m to 1500m	0.958**
Daily Solar Radiation From 150m to 3100m	-0.946**

Note: \*\*,  $P < 0.01$ .

Thirdly, this research suggested that medicinal plant (*Smilax scobinicaulis*) of treating joint pain 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 (Figure 1).

**Table 3** Correlations between Total Biomass of Fresh Roots Daily Solar Radiation Gradient

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

Note: \*\*,  $P < 0.01$ .

Thus, this research finds a series of typical (good, better, best) areas ecological adaptation of (*Cremastra appendiculata*) of treating joint pain along elevation (daily solar radiation), and there is a linkage between total biomass of fresh roots and daily solar radiation along elevation gradient.

#### 4. Discussion

Predicting dynamics of total biomass of fresh roots of medicinal species is very difficult<sup>2-35</sup>. This research suggested three rules with biomass of fresh roots of this species:

Firstly, it is a significant positive correlation between the total biomass of fresh roots of this species and daily solar radiation along elevation from 500m to 1500m ( $P < 0.01$ ), because of it is an increasing of total biomass of fresh roots with increasing of daily solar radiation from 20.578mol/m<sup>2</sup>·d to 24.158mol/m<sup>2</sup>·d. Ant, it is a significant negative correlation between Total biomass of fresh roots and daily solar radiation along elevation from along elevation from 1500m to 3100m ( $P < 0.01$ ), because of it is a decreasing of total biomass of fresh roots with increasing of daily solar radiation from 24.158mol/m<sup>2</sup>·d to 27.246mol/m<sup>2</sup>·d ( $P < 0.01$ ) at STEDS in landscapes.

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 fresh roots of this species of treating joint pain 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 other environmental gradients (Figure 1).

As such, this study has a vital theoretical and practical significance for the reasonable protection of total biomass of fresh roots 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 joint pain, but also there are three rules by the links between total biomass of fresh roots of this species and daily solar radiation. In short, regional planners need regulation a lot of landscape sustainability based on researches on total biomass of fresh roots of medicinal plant (biodiversity, composition, structure, et al.) by “big data” investigation, qualitative analysis, quantitative statistics, 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, or other environmental factors in multilevel scale<sup>1-15, 26-44</sup>.

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## 5. Future work

Indeed, a better regional regulator and local government need a better planning and regulation a lot of medicinal plant management eco-sustainability of ecosystems by the researches on biomass of leafstalk along elevation and environments with dynamics of biodiversity in the global, local, regional natural ecosystem types with the ways “big data” investigation, quantitative statistics, scientific analysis for better future of vital vegetation ecosystems and human well-being<sup>32-43</sup>.

Next work this finding is a basal knowledge for the better understanding the interrelations between environmental factors and multilevel diversity (e.g., landscapes, population, communities, and species level)<sup>44-48</sup>. Future human ecological cognitive linguistic theory<sup>49</sup> must understand the different environmental factors influencing the multilevel species ecological traits (such as leaves, stem barks, roots<sup>50</sup>, resources and genetic breeding<sup>51</sup>, synthetic metabolism<sup>52</sup>, biodiversity<sup>53</sup>, adventitious roots<sup>54</sup>, microbiome shift<sup>55</sup>, anti-infective plants<sup>56</sup>) for decrease ecosystem collapse and biodiversity loss<sup>57</sup> by green chemical approach<sup>58</sup>, phytochemistry, therapeutics methods<sup>59</sup>.

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## 6. Conclusion

Here, herein shows that (*Smilax scobinicaulis*) not only is a medicinal material plant by treating joint pain, but also it is a widely distributed wide species from 500m to 3100m in *Mei County* of China. Herein explains that it is an increasing of total biomass of fresh roots with increasing of daily solar radiation, total biomass of fresh roots and daily solar radiation is a significant positive correlation from 20.578mol/m<sup>2</sup>•d to 24.158mol/m<sup>2</sup>•d from 500m to 1500m ( $P < 0.01$ ) elevation; it is a decreasing of this total biomass of fresh roots with increasing of daily solar radiation, a link between total biomass of fresh roots and daily solar radiation is a significant negative correlation from 24.15mol/m<sup>2</sup>•d to 27.246mol/m<sup>2</sup>•d from 1500m to 3100m elevation ( $P < 0.01$ ). Herein shows key eco-adaptation of daily solar radiation and six landscapes. So, this has key theoretical and practical significance by medicinal species for future of human well-being at daily solar radiation.

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## Compliance with ethical standards

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