Scholar Publishing Group
Academic Journal of Environmental Biology
https://doi.org/10.38007/AJEB.2021.020303
ISSN 2789-8407 Vol. 2, Issue 3: 19-27

Relationship between Snow and Ice Disasters in Phyllostachys Pubescens Forest and Environmental and Biological Characteristics in the Context of Big Data

Temu Tecla*

KEMRI Wellcome Trust Res Programme, Kilifi, Kenya

**corresponding author*

Keywords: Big Data Background, Snow and Ice Disaster in Phyllostachys Pubescens Forest, Environment, Biological Characteristics

Abstract: With the development of science and technology, big data(BD) technology is gradually applied to all aspects of life. At the same time, under the trend of global warming, the frequency of Snow and Ice Disaster(SAID) in PPF is also gradually increasing. Therefore, based on BD, this paper studies and analyzes the relationship between SAIDs in PPF and environmental and biological characteristics(BC). Taking the SAID of PP Forest(PPF) in a province as an example, the characteristics of SAID of PPF, altitude gradient and ice pressure disaster of different bamboo ages were studied and analyzed, and then the relationship between SAID of PPF and environment and the relationship between SAID of PPF and BC were discussed; It provides a scientific basis for promoting the rejuvenation of PPF, the improvement of production capacity and the restoration of ecological functions, and also provides a reference for the sustainable development of bamboo ecosystem.

1. Introduction

With the advent of the general trend of global warming, the occurrence frequency of SAIDs in Moso bamboo forests in recent years is relatively high, which generally occurs in winter, even in the alternation of seasons. It is an extreme climate phenomenon that causes disasters due to strong cooling or low temperature after snowfall or rainfall. The ice and snow disaster will seriously endanger the stability and health of forest ecosystem. Snow and low temperature weather can not only cause direct damage to vegetation, but also indirectly cause potential danger to the whole ecosystem. The damage or even death of a large number of trees will reduce the ability of the ecosystem to resist disasters, make the whole forest ecosystem fragile and sensitive, and be more vulnerable to the interference of forest pests. Serious forest pest disasters will break out, leading to

the reduction of the stability of the forest ecosystem and endangering the health of the ecosystem. Therefore, based on the background of BD, this paper studies and analyzes the relationship between SAIDs in PPF and environmental and BC.

Many scholars at home and abroad have studied and analyzed the relationship between SAIDs in PPF and environmental and BC under the background of BD. A large number of studies have shown that the biological characteristic parameters of PP, such as branch height, DBH, plant height, density and leaf area index, are correlated, and there should be a critical point between density and taper. In high-density large-diameter bamboo forests, the competition is stronger with the increase of bamboo age, which makes the taper of PP significantly lower, and the taper decreases with the increase of standing bamboo degree. At this time, the impact of SAIDs on PP will increase [1]. In order to promote the stability of taper and reduce ice and snow disasters, hook tips, selective cutting and precise fertilization should be carried out in time. Reasonable bamboo density and taper are the main factors affecting the resistance of Moso bamboo to ice and snow disasters. According to statistics, an ice and snow disaster may cause disasters to thousands of square kilometers of forests. A large number of scholars have shown that due to the impact of global warming, this kind of cold winter and warm summer may often occur, and this conclusion has also been recognized by the meteorology community [2].

The main factors that affect the occurrence of ice and snow disasters are precipitation and precipitation type. Disasters generally occur in sleet weather or precipitation before snowfall. If the temperature drops below 0 ℃, long-term low temperature will make the freezing accumulation on the tree crown. When their weight is greater than the bearing capacity of the branches, the branches will bend or even break, thus causing disasters to the forest. At the same time of freezing disaster, if we encounter gale weather again, some trees may be uprooted, which will cause more in-depth ecological problems. Combined with the development needs of PP production, this paper selects the SAID of PPF in a province as the research object to study and explore the relationship between the SAID of PPF and environmental and BC, so as to provide a scientific basis for promoting the rejuvenation of PPF, the improvement of production capacity and the restoration of ecological functions in this province, and also provide a reference for the sustainable development of bamboo ecosystem in the South [3-4].

2. Test and Analysis of the Relationship Between SAIDs in Moso Bamboo Forest and Environmental and BC

2.1. Analysis of SAID Characteristics of Moso Bamboo Forest

In this paper, a province is selected to test and analyze the relationship between SAIDs of PPF and environmental and BC. The number and DBH of PP are used as the investigation indicators of productivity, the sum of the cross-sectional area of PP is used as the measurement indicators of the biomass production capacity of the sample plot, and the background standing bamboo degree and DBH of the experimental forest are used as the comparison basis to evaluate the production capacity of PPF after the SAIDs [5-6].

Characteristics of disasters in horizontal zones: it can be found from table 1 (unit: cm.m, plant / mu,%, year) that there are great differences in Moso bamboo and ice jade disasters in different horizontal zones, which generally shows the change law of light disaster in the East and West, and heavy disaster in the middle. In longitude, the disaster is the most serious in the 116 °-117 °east longitude zone, with the average disaster rate and disaster index of PPFs as high as 75.3% and 0.51

respectively. Similar changes are also shown in the latitude zone. The disaster is light in the north and south, heavy in the middle, and the most serious in the north latitude region, with the average disaster rate of 71.5%, the average disaster index of 0.46, followed by the disaster in the South PP production area [7-8].

Table 1. The disasters situation of different level zone

Horizontal zone		Average DBH	Standing bamboo degree	Disaster rate	thickness	length	height	Disaster index	stand	Disaster bamboo
Longitude	115 °West	8.8	118	61.5	0.8	2.5	1.8	0.35	2.7	2.7
	115 °-116 °	11.4	129	64.0	1.0	3.7	2.0	0.48	2.9	3.0
	116 °-117 °	9.9	103	75.3	1.1	3.8	2.4	0.51	2.5	2.4
	117 °East	10.3	107	40.2	1.0	2.9	2.0	0.27	2.2	2.3
Latitude	South of 26 °	9.7	128	53.4	0.9	2.9	2.1	0.34	2.6	2.8
	28 °-29 °	10.6	119	66.6	1.0	3.2	1.8	0.46	2.5	2.6
	North of 29 °	10.0	112	40.4	1.1	3.4	2.9	0.27	2.3	2.4

2.2. Characteristics of Moso Bamboo Disaster in Altitude Gradient

There are significant differences in bamboo ice pressure disasters at different altitudes in a province. The disaster situation in areas below 300m is significantly lower than that in high altitudes. The average disaster rate of forest stands is 24.3 percentage points lower than that in areas between 500m and 800m, and the disaster index is 0.22 lower. There is little difference in the disaster situation of Moso Bamboo in the zone of 300m-800m, and the disaster situation in the area above 800m decreases slightly [9]. The fracture height of bamboo decreases with the increase of altitude above 300m, and the fracture length of bamboo increases with the increase of altitude, as shown in Table 2.

Table 2. Ice pressure disasters of PP at different altitudes in Jiangxi Province

	<300	300-500	500-800	>800
Number of sample plots	8	19	22	16
Standing bamboo degree	112.4	103.8	116.9	119.3
Disaster rate	42.8%	65.3%	66.9%	60.3%
Disaster index	0.27	0.42	0.47	0.39

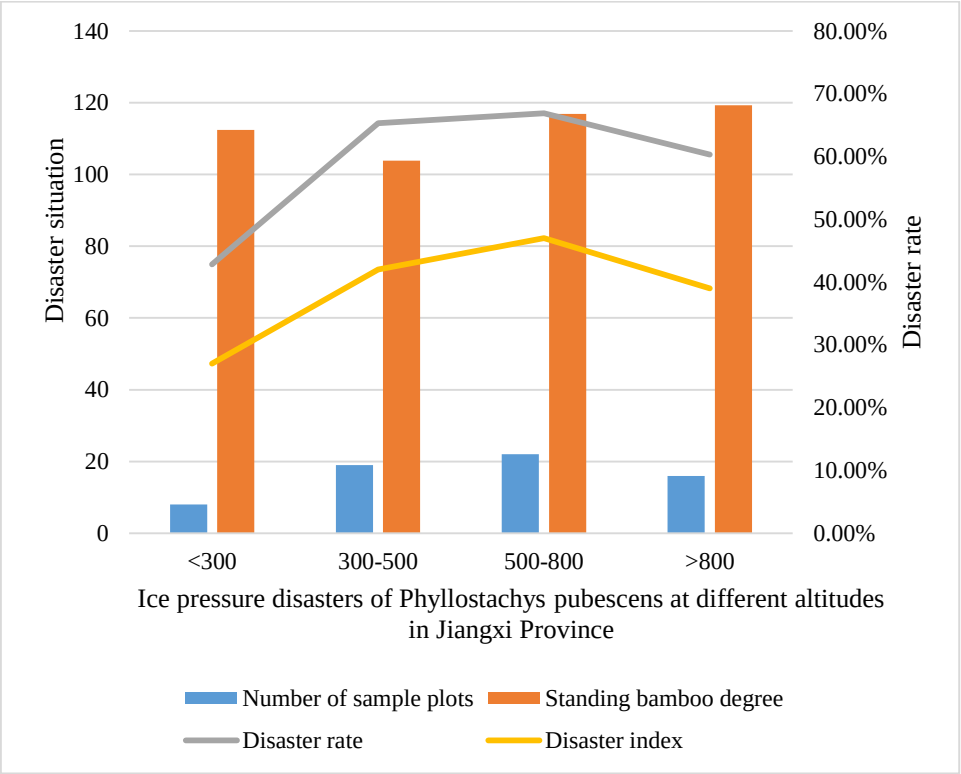

Figure 1. Ice pressure disasters of PP at different altitudes in Jiangxi Province

2.3. Characteristics of Ice Pressure Disasters at Different Bamboo Ages

According to the analysis of the table, the disaster degree of bamboo plants with different bamboo ages varies, and the overall disaster situation shows a trend of decreasing with the increase of bamboo age. One year old Hsinchu is the most affected, with an average disaster rate of 69.5% and a disaster index of 0.48. The disaster situation of 4-year-old and 6-year-old bamboos is low, especially the latter. The average disaster rate and disaster index are shown in Table 3 and Figure 2 [10-11].

Table 3. Table of average disaster rate and disaster situation index

	1	2	3	4	5	More than 6 years
Level 0	30.5	42.4	41.3	49.3	38.6	53.2
Level 1	16.7	19.8	18.3	50.3	18.9	22.7
Level 2	8.7	18.4	7.3	18.5	5.9	1.4
Level 3	2.1	7.0	1.5	7.1	2.1	2.6
Level 4	3.5	1.6	1.6	1.7	2.2	2.6
Level 5	37.8	28.5	30.3	1.4	31.8	16.3

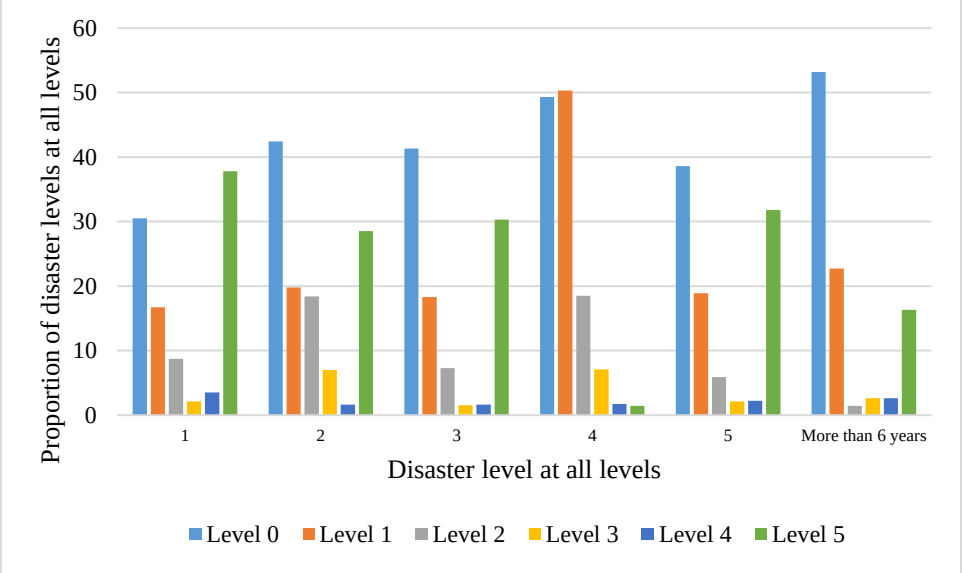

Figure 2. Disaster level at all levels

It can be seen from the above data that the ice pressure disaster of PP with different bamboo diameters has a relatively obvious change law. There is little difference between the average disaster rate of bamboo plants and the average height of bamboo fracture at each diameter class. The disaster index, the average wall thickness of the middle section of the broken bamboo, the average length of bamboo fracture, etc. all increase with the increase of the diameter class. The proportion of disaster level of bamboo plants at each diameter class is consistent with the overall performance of the province, which is concentrated at level 1 and level 5 [12-13].

The characteristics of bamboo ice pressure disaster in different slope directions are: the bamboo forest on the north slope is the most affected, followed by the South and West slopes, and the bamboo forest on the east slope is less affected. The average disaster rate and disaster index of the forest on the north slope are higher than those on the east slope by percentage points and respectively [14]. The average disaster rate, disaster index and the average length of bamboo rupture increase with the East, South, West and north slopes. The bamboo rupture height of affected bamboo plants is higher on the West and south slopes, and lower on the East and north slopes [15].

The average disaster rate of the stand, the disaster index and the average wall thickness of the broken bamboo increased with the increase of the slope, among which the disaster of the bamboo forest above the slope degree was the most serious, and the average disaster rate and disaster index were as high as and respectively. Characteristics of Moso Bamboo ice pressure disaster with different stand densities changes of Moso Bamboo ice pressure disaster with different stand densities are inconsistent in different stand types [16]. In pure forests, the average disaster rate and disaster index generally decrease with the increase of standing bamboo degree. It can be seen that the management of pure PPFs should moderately increase the stand bamboo degree, which can play a better role in resisting ice pressure and wind collapse. The average disaster rate and disaster index of mixed forest stand are opposite to those of pure forest, and generally increase with the increase of standing bamboo degree. The reason needs further research and analysis [17]. The average fracture length of the affected bamboo and the average age of the affected bamboo, whether pure forest or mixed forest, increase with the increase of the standing bamboo degree. The former may be due to the sparse standing bamboo degree, lack of mutual support, and the thin wall thickness of the

standing bamboo, which is easy to cause fracture. The latter may be the reason why the larger the discrete bamboo degree of the forest, the more the standing bamboo age class [18].

3. Evaluation Model of the Relationship between SAIDs in PPF and Environmental and BC under the Background of BD

The relationship between SAIDs in Moso bamboo forest and environmental and BC is complex and changeable. Based on the background of BD, this paper normalizes the positive indicators and negative indicators with formulas (1) and (2) respectively.

$$K_{ij} = \frac{K_{ij} - K_{\min}}{K_{\max} - K_{\min}} \tag{1}$$

$$K_{ij} = \frac{K_{\min} - K_{ij}}{K_{\max} - K_{\min}} \tag{2}$$

In the formula, Kij is the first evaluation index, the value of the jth grid, kmax is the maximum value of the ith evaluation index, and Kmin is the minimum value of the ith evaluation index.

In this paper, a comprehensive quantitative evaluation of the relationship between SAIDs in PPF and environmental and BC is carried out:

$$H_i = \sum_{j=1}^{n} E_j K_j \tag{3}$$

the spatial weighted sum is carried out after the normalization of the influencing factors, and the calculation formula is: where hi is the evaluation index of forest ecological self-organization ability of the ith grid. The size of this value reflects the self-organization ability of forest ecosystem, and its range is [0,1]. EJ is the weight value of the jth resilience index, which reflects the impact of different ecosystem resilience indexes on self-organization ability, and the value range is [0,1]; KJ is the normalized standard value of the jth index, and N is the number of evaluation indexes. Through the comprehensive index evaluation model of forest ecosystem resilience, the relationship between SAIDs in PPF and environmental and BC was analyzed.

Compared with the areas with less disaster, the areas with more severe disaster have a higher degree of recovery. Therefore, there is a certain corresponding relationship between recovery ability and resistance, which is consistent with the law learned in ecology in the past: the stronger the stability of resistance, the weaker the adaptability and reconstruction ability. Therefore, in order to measure the resilience more reasonably, The relationship between resistance and adaptability and reconstruction needs to be considered.

4. Relationship between SAIDs in PPF and Environmental and BC in the Context of BD

4.1. Relationship between SAIDs in PPF and Environment

4.1.1. Impact of SAID on Vegetation

SAID is one of the important factors that interfere with the growth of vegetation. The economic, ecological, structural and social service values of forest ecosystems will be disturbed by this extreme climate disaster. The damage caused by SAIDs to vegetation can be mainly divided into

physical damage and physiological damage, in which physical damage mainly refers to branch breaking, tree overturning, tree lodging, etc. Generally speaking, the twigs and fractures of vegetation to a lesser extent will continue to grow normally after the disaster; However, when lodging and overturning damage occur, the vegetation cannot recover by itself, and it needs to be cleared manually and replanted. Physiological injury mainly includes frostbite, freeze death and frozen buds. In addition to low temperature, the accumulation of ice and snow will also cause compression to the vegetation, causing it to bend and fold, etc. this damage mainly occurs in the seedling stage, because its branches are not strong enough, it is easy to be affected by the backlog of ice and snow; When ice is covered on the extended branches of inclined seedlings, it will form hard and obvious damage on their young branches. In addition, excessive ice load will also cause damage to the roots of trees, and sometimes trees will even be uprooted. After the melting of ice and snow, the impact of ice and snow accumulation on trees can still be seen. Within a week after the lifting of the rain and snow freeze, some trees quickly recovered their upright posture, but some were still bent after two years due to serious damage.

4.1.2. Impact of SAID on Forest Ecosystem

Snowfall in the normal intensity range will basically not cause damage to the forest ecosystem. However, if heavy snowfall with high intensity, long time and large range is encountered, and the snowfall process is accompanied by low temperature weather, it is difficult to melt the snow. This disaster has a great impact on the growth environment of vegetation and poses a great threat to the forest.

4.2. Relationship between SAIDs and BC of Moso Bamboo Forest

The SAID will cause direct damage to the forest vegetation itself and the growth environment. The water in vegetation cells is easy to condense and expand at low temperature, which separates the cell wall from the protoplast and causes direct damage to the cell structure, thus affecting the activity and function of cells. Long term heavy snow and low temperature weather will freeze plant cells and tissues, especially the plants in southern China, which have poor cold resistance and are more vulnerable to impact. For example, the mortality of Camellia oleifera and Camellia sinensis is very high. In addition, plants have been oppressed by snow for a long time, which makes the branches of trees bend or even break. Tree species that are easily broken by snow cover mainly include pine, fir, poplar, birch, bamboo, etc.

The occurrence of ice and snow disasters is easy to change the structure of the forest ecosystem in the affected areas. Severe snowstorms can cause trees to collapse, bend or break, forming many canopy gaps. Ice and snow disasters will lead to a sharp decline in the service functions and benefits of forest ecosystems. In the normal forest ecosystem that has not been disturbed by ice and snow, there are abundant plant species, strong water and soil conservation ability, stable and slow climate change, good air quality, and balanced carbon and oxygen content; However, after being disturbed by severe snowstorms, the forest structure is destroyed, the trunk is bent or broken, and it is very easy to turn over and collapse, resulting in slow growth and even death of vegetation. Therefore, the service function and benefit of the forest ecosystem are greatly reduced compared with the original. Forest ecosystem is an open and self-adjusting system, which maintains dynamic balance through input and output energy; Due to the interference of snow and ice for a long time, the original stable state is broken, the renewal direction of the ecosystem changes, and its process is also changed accordingly. Especially in the broad-leaved forest, a large number of vegetation canopy gaps have

been formed, which has rapidly developed for sunny plants, and changed the stand composition structure and service function of the forest ecosystem.

5. Conclusion

Under the background of BD, based on a large number of forest land and climate survey and observation data, this paper studies the relationship between SAIDs in PPF and environmental and BC, breaks through the previous quantitative evaluation of disasters, environmental and BC in a certain state, and puts forward an evaluation model based on BD technology in combination with frequent extreme climate disasters in recent years; However, the field verification has not been carried out yet, and the verification of field observation data is the direction of future research; There may be some deviations in the comprehensive indicators of environmental and BC, and the way of empowerment needs to be improved. However, the results of this paper are relatively comprehensive and objective, and can provide theoretical support and important scientific basis for the management of forest ecosystem.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1] Shokoohi R, Moradi S, Ghavami Z, et al. Investigation of Some Qualitative Characteristics of Sludge Produced in Hamadan Wastewater Treatment Plant and Its Application in Agricultural Lands. Avicenna Journal of Environmental Health Engineering, 2019, 6(1):1-7. https://doi.org/10.34172/ajehe.2019.01

[2] Sb A, Vpp B, Rk B, et al. Influence of iron doping towards the physicochemical and BC of hydroxyapatite - ScienceDirect. Ceramics International, 2021, 47(4):5061-5070.

[3] Be?Dowska M, J?Druch A, ??czyński, Leszek, et al. Coastal erosion as a source of mercury into the marine environment along the Polish Baltic shore. Environmental Science and Pollution Research, 2020, 23(16):16372-16382. https://doi.org/10.1007/s11356-016-6753-7

[4] Roddy J W, Blanco R E, Hill G S, et al. Correlation of radioactive waste treatment costs and the environmental impact of waste effluents in the nuclear fuel cycle for use in establishing "as low as practicable" guides: milling of uranium ores. Neurosciences, 2019, 12(3):226-31.

[5] Warren L, Mills J. Re: Leadership by example: saying no to health industry board membership. BMJ, 2021, 14(1):70-71.

[6] Mamatha S, Haware D. Document on fluoride accumulation in ground and surface water of Mysore, Karnataka, India. Current World Environment, 2021, 8(2):259-265.

https://doi.org/10.12944/CWE.8.2.11

[7] Burnett M C A, Silverman D T, Lalich N R. Bladder Cancer. Environment international, 2019, 25(5):677-688.

[8] Damien, Mathis, Pierre, et al. Thermal characterization of bio-based phase changing materials in decorative wood-based panels for thermal energy storage. Green Energy & Environment, 2019, v.4(01):60-69. https://doi.org/10.1016/j.gee.2018.05.004

[9] Towsey M, Zhang L. report false-colour spectrograms of long duration acoustic recordings. Ecological Informatics, 2019, 21(3):110-119.

[10] Rosenthal S, Veloso M, Dey A K, et al. is someone in this office available to help me? proactively seeking help from spatially-situated humans. Journal of Intelligent & Robotic Systems, 2019, 66(1-2):205-221.

[11] Tsoumachidou S, Lambropoulou D, Poulios I. Homogeneous photocatalytic oxidation of UV filter para-aminobenzoic acid in aqueous solutions. Environmental Science and Pollution Research, 2020, 24(2):1-9. https://doi.org/10.1007/s11356-016-7434-2

[12] Aiello G, Hopps F, Santisi D, et al. The Employment of Unmanned Aerial Vehicles for Analyzing and Mitigating Disaster Risks in Industrial Sites. IEEE Transactions on Engineering Management, 2020, PP(99):1-12.

[13] Norton J, Gibson T D. Introduction to disaster prevention: doing it differently by rethinking the nature of knowledge and learning. Disaster Prevention & Management, 2019, 28(1):2-5. https://doi.org/10.1108/DPM-02-2019-323

[14] YAN, Yan, YANG, et al. Disaster reduction stick equipment: A method for monitoring and early warning of pipeline-landslide hazards. Journal of Mountain Science, 2019, v.16(12):4-17.

[15] Orimoloye I R, Kalumba A M, Mazinyo S P, et al. Geospatial analysis of wetland dynamics: Wetland depletion and biodiversity conservation of Isimangaliso Wetland, South Africa. Journal of King Saud University - Science, 2020, 32(1):90-96. https://doi.org/10.1016/j.jksus.2018.03.004

[16] Jorge, David, Gonzalez, et al. On fine-grained geolocalisation of tweets and real-time traffic incident detection - ScienceDirect. Information Processing & Management, 2019, 56(3):1119-1132. https://doi.org/10.1016/j.ipm.2018.03.011

[17] Kang J. The Media Spectacle of a Techno-City: COVID-19 and the South Korean Experience of the State of Emergency. The Journal of Asian Studies, 2020, 79(3):589-598.

[18] Sasaki H, Maruya H, Abe Y, et al. Scoping Review of Hospital Business Continuity Plans to Validate the Improvement after the 2011 Great East Japan Earthquake and Tsunami. The Tohoku Journal of Experimental Medicine, 2020, 251(3):147-159. https://doi.org/10.1620/tjem.251.147