論　文

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Natural distribution of *Pterostyrax hispida* under the tree canopies of artificial *Larix leptolepis* stand

カラマツ人工林冠下におけるオオバアサガラの分布状況

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Abstract: *Pterostyrax hispida* sometimes grows in colonies under the artificial *Larix leotolepis* stands in the Kanto districts or Central part of Japan. This study researched the natural distribution of *Pterostyrax hispida* at artificial *Larix leptolepis* stands in the 800 to 900 meters altitude in the Okutama Training Forest of Tokyo University of Agriculture. The *Pterostyrax hispida* colonies were often luxuriant under the *Larix leptolepis* tree canopies, but they were decreased under the *Criptomeria japonica* and *Chamaecyparis obtusa* canopies. The growth of *Pterostyrax* colonies also showed proportion with the tree height difference between *Pterostyrax* and *Larix,* or growth of the tree canopies of *Larix.* Those conditions must be suitable for *Pterostyrax* growth, because the light condition were profitable for them. However, growing in colonies of *Pterostyrax* restrained the other woody plants under the tree canopies of *Larix*. At the clay soil stands, the average height of *Pterostyrax* was low and their colonies decreased, too. It also showed the *Pterostyrax* has possibility as an indicator of soil condition.
Keywords: *Pterostyrax hispida*, *Larix leptolepis*, colony, tree canopies, indicator

要旨：関東や中部などの内陸のカラマツ人工林において，その林冠下には，落葉広葉樹のオオバアサガラ（*Pterostyrax hispida* Sieb. et Zucc．：エゴノキ科）の群生が見受けられる。本研究では，東京農業大学・奥多摩演習林内の標高 700～1000m前後の複数のカラマツ林分において，その林冠下におけるオオバアサガラの分布状況を調べた。調査の結果，カラマツ林冠下でオオバアサガラは繁茂，群生をするものの，スギ・ヒノキ林冠下では減少することが確認された。また，上木であるカラマツとの樹高差が大きく，カラマツの林冠形成が大きいほど，オオバアサガラの群落形成および個々の受光および生長に有利であること，オオバアサガラの繁茂状況が他の下層植生樹木の生育にも影響を与えることがうかがえた。さらに，埴土質の土壌ではオオバアサガラは樹高が低く，群落形成も困難であったことから，森林土壌の土質を示す指標植物としても使用可であることが推察された。
キーワード：オオバアサガラ・カラマツ・群生・林冠・指標植物

Ⅰ．Introduction

Pterostyrax hispida sometimes grow in colonies under the artificial *Larix leotolepis* stands in the Kanto districts or Central part of Japan（Fig.1）. It has been known as one of the deer dislike woody plants (*3, 4*）. Therefore, the colonies are found in the high deer density under the artificial tree stands, too（*1, 2*）.

However, it has not been cleared how they are distributed naturally under the artificial tree stands conditions exactly.

Therefore, this study researched the natural distribution of them under the artificial *Larix leptolepis* canopies.

Fig.1 *Pterostyrax hispida* under the *Larix leotolepis* stand in the Kita-aiki village in Nagano Prefecture

（受理日 2017 年 8 月 1 日）

Ⅱ. Method

This survey focused on three artificial *Larix leptolepis* stands in the Okutama Training Forest of Tokyo University of Agriculture, located in Okutama region of Tokyo. It is situated at lat. 35 ° 49 ′ 2” N. and long. 139 ° 4’ 45” E. The surveyed stands were located in 800 to 900 meters high above sea level.

Stand A was poor results stand of *Larix leptolepis*, located in 850 meters high above sea level. The stand slope was 5 degree and face north direction. Soil texture was mainly clay.

Stand B was another *Larix leptolepis* stand located in 900 meters high from sea level. The stand slope was 15 degree and face north direction. Soil texture was loam and clay loam. It was also stony.

Stand A and B are approximately same age.

Stand C was mixed forest of *Criptomeria japonica,* and *Chamecyparis obtusa* just nearby *Larix* stand. It was located in approximately 840 meters high above sea level, the stand slope was 15 degree and faced north direction. Soil texture was stony.

The area of each survey plot was 100 ㎡. I drew the tree canopy projections of each stand and measured the tree height, diameter at breast height, and density per a hectare of *Larix leptolepis* and *Pterostyrax hispida.* The relatively light intensity was measured under the *Larix* crowns but not under the crowns of *Pterostyrax hispida.* I also checked SPAD (Amount of chlorophyll) of leaves of *Pterostyrax hispida.* I checked 5 times a leave and repeat 6 leaves per a stock.

Fig.2 Measuring SPAD from leaves of *Pterostyrax hispida.*

Ⅲ. Results and discussion

Tree canopies projections of stand A to C are shown on Figure 3 to 5.

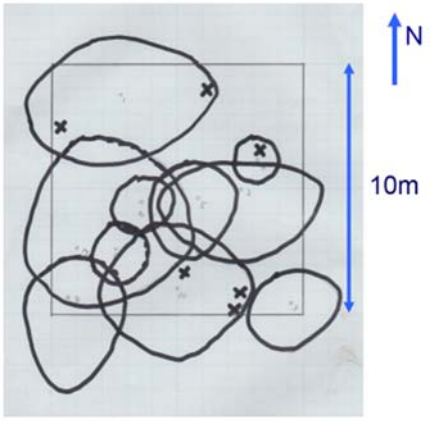

Fig.3. Tree canopies projections of Stand A
（× *Pterostyrax* stock)

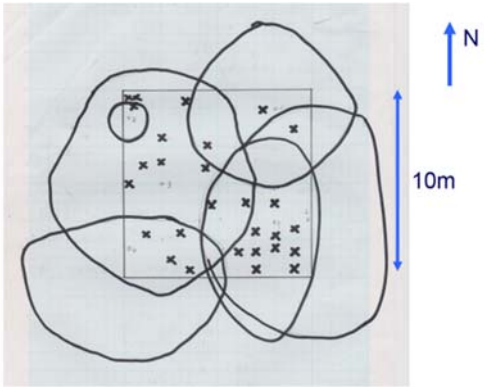

Fig.4. Tree canopies projections of Stand B
（× *Pterostyrax* stock)

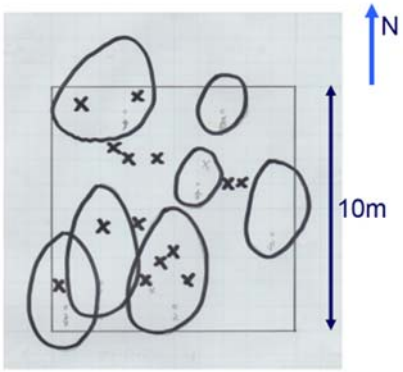

Fig.5.Tree canopies projections of Stand C
（× *Pterostyrax* stock)

Table 1 shows the condition of each stand. The growth of high story of Stand B was the biggest and the density of *Pterostyrax* was also the highest. Average relative light in density of Stand A was high, but the growth and density of *Pterostyrax* was low. It suggests *Pterostyrax* colony was influenced by other factors beside the light condition, although it is shade intolerant tree.

Table 1. Conditions of Stand A to C

	Stand A	Stand B	Stand C
High story average tree height (m)	13.1 (±4.0)	20.3 (±4.0)	15.0 (±0.4)
High story average crown height (m)	5.0 (±0.8)	8.2 (±1.7)	4.6 (±1.2)
High story average DBH (cm)	18.0 (±3.7)	36.7 (±5.6)	18.1 (±4.9)
High story average canopies area (㎡)	8.2 (±3.3)	15.9 (±5.6)	7.0 (±1.7)
High story density per a hectare	700	600	800
Pterostyrax average tree height (m)	2.5 (±1.6)	3.3 (±3.1)	1.4 (±0.7)
Pterostyrax average DBH (cm)	2.3 (±2.0)	5.9 (±1.8)	1.1 (±0.8)
Pterostyrax average canopies area (㎡)	4.6 (±3.3)	8.0 (±1.0)	4.5 (±2.9)
Pterostyrax density per a hectare	700	2800	1100
Average relative light intensity (%)	25.0 (±8.2)	7.2 (±1.6)	5.0 (±1.4)

Next, the soil profiles of each stand are shown on Fig.6 to Fig.8.

Stand A was that A layer was 15 to 20cm and B layer was 60 to 80cm。The soil texture was mainly clay. Stand B's A layer was twice deeper than Stand A, and the soil texture was mainly loam and stony. Stand C's B layer was thick, but it had many stones. At the clay soil stands, the average height of *Pterostyrax* was low and their colonies decreased, too. These results showed the *Pterostyrax* has possibility as an indicator of soil condition.

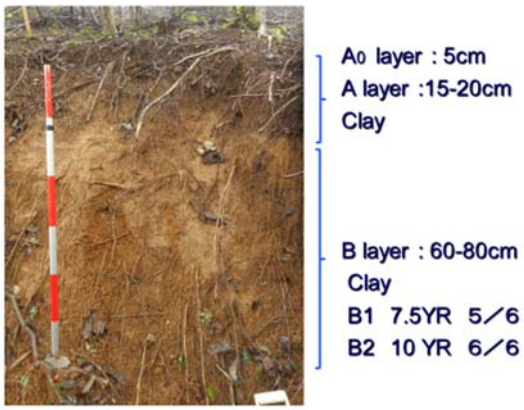

Fig.6. Soil profile of Stand A

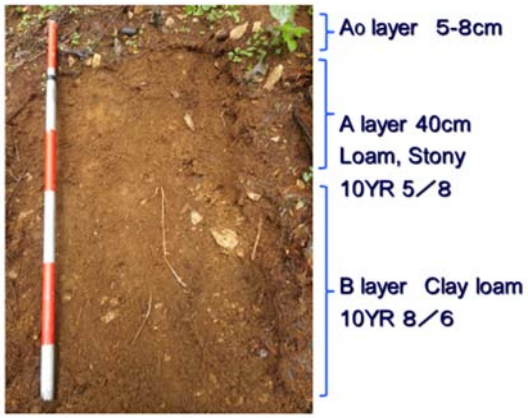

Fig.7. Soil profile of Stand B

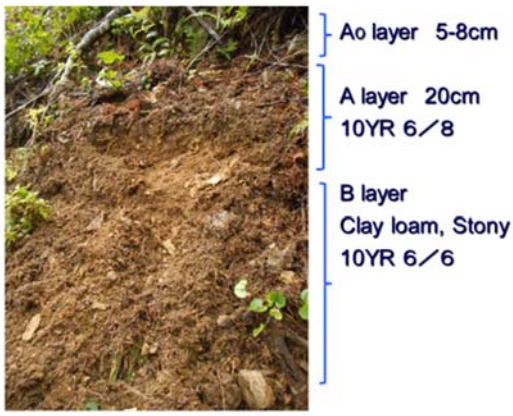

Fig.8. Soil profile of Stand C

The *Pterostyrax hispida* colonies were often luxuriant under the *Larix leptolepis* tree canopies, but they were decreased under the *Criptomeria japonica* and *Chamaecyparis obtusa* canopies. The growth of *Pterostyrax* colonies showed proportion with the tree height difference between *Pterostyrax* and *Larix,* or growth of the tree canopies of *Larix*. Those conditions must be suitable for *Pterostyrax* growth, because the light condition were profitable for them.

Advanced *Pterostyrax* colonies were seen in the Stand B. Not only the high tree density, but also multi-layered colonies of it were seen (Fig. 9). On the contrast, *Pterostylax* stocks were decreased under the *Criptomeria japonica* and *Chamaecyparis obtusa* canopies (Fig.10).

Fig.9. Multi-layered colonies of *Pterostyrax* of Stand B

Fig. 10. Floor vegetation condition of Stand C

Average amounts of SPAD of *Pterostyrax* are shown on the Fig.11. SPAD data of Stand A with the highest light intensity was the highest.

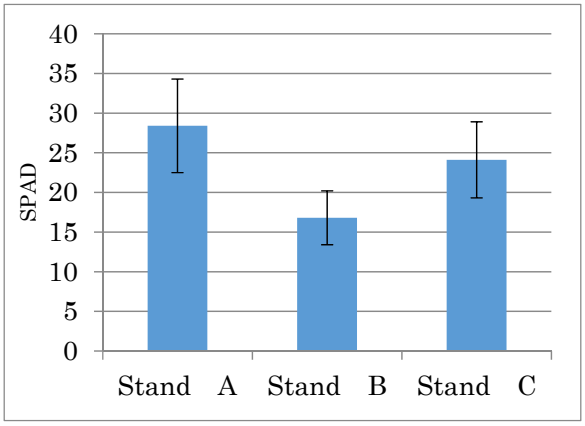

Fig.11. Agerage amount of SPAD of *Pterostyrax* of each stands

Canopies area of high story and *Pterostyrax* and its numbers are shown on Fig.12 and relation between high story canopies area and number of *Pterostyrax hispida* is shown on Fig. 13.

Relation between canopies area of high story and under *Pterostyrax*, and high story canopies area and numbers of *Pterostyrax* was correlative (r=0.8466).

However, growing in colonies of *Pterostylax* restrained the other woody plants under the tree canopies of *Larix*. Therefore, at artificial *Larix* stands, controlling *Pterostyrax* is important for keeping diversity of vegetation.

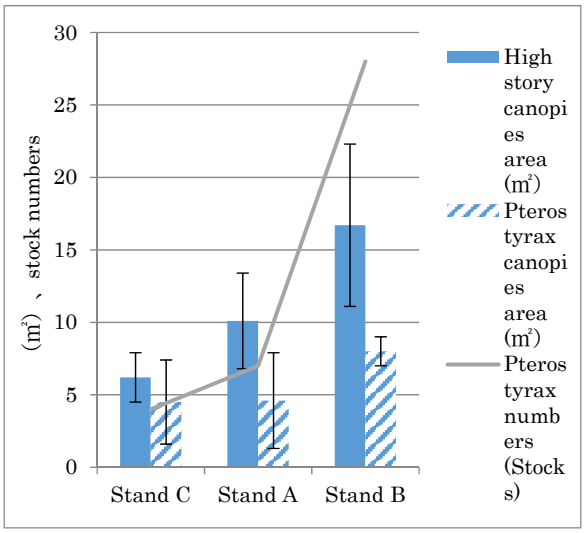

Fig.12 Canopies area of high story and *Pterostyrax hispida* and its stock numbers

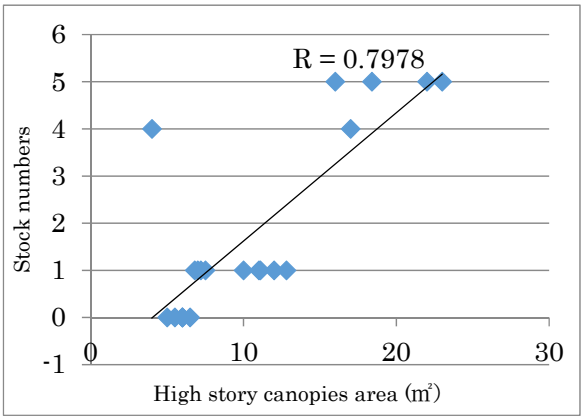

Fig.13. Relation between high story canopies area and number of *Pterostyrax hispida*

Ⅳ. Conclusion

Pterostyrax hispida is a kind of shade intolerant tree (*1,2,3,4*). They make colonies under the artificial *Larix leptolepis* stands with good soil condition. Especially, broad *Larix* canopies condition is suitable for their growth and making colonies. But they cannot make colonies under the *Larix* canopies at the clay soil stand, even with the suitable light condition. Therefore, *Pterostyrax* can be possibly an indicator of soil condition. However, controlling them on the floor of artificial *Larix* stands is another assignment.

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