การเติบโตของไลเคนที่ย้ายปลูกบนวัสดุเทียมในทิศต่างๆ

GROWTH OF LICHENS TRANSPLANTED ON ARTIFICIAL SUBSTRATE ON DIFFERENT ORIENTATION OF HABITATS.

สุปราณี แสนธนู และ กัณฑรีย์ บุญประกอบ

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บทคัดย่อ: ไลเคนเป็นสิ่งมีชีวิตที่โตช้า กระบวนการสังเคราะห์ด้วยแสงและการเติบโตของไลเคน ใช้แสงและน้ำจ าก หมอก น้ำค้าง และความชื้นในบรรยากาศซึ่งได้รับ แตกต่างกันขึ้นอยู่กับแหล่ง ที่ไลเคนอาศัยอยู่ วัตุประสงค์ของการศึกษาในครั้งนี้เพื่อ ศึกษาถึงอิธิพลของทิศทางที่ มีผลการเติบโตของไลเคน ที่ย้ายปลูกบนวัสดุเทียม โดยการย้ายปลูกไลเคน *Parmotrema tinctorum* จำนวน 286 แทลลัสบนตาข่ายไนลอนที่หันไปทางทิศตะวันออก ทิศตะวันตก ทิศเหนือ ทิศใต้ และในแนวราบ ณ อุทยานแห่งชาติเขาใหญ่ พร้อมทั้งบันทึกสภาพภูมิอากาศเฉพาะแห่ง และวัดอัตราการเติบโต หลังการย้ายปลูก 8 เดือน พบว่าไลเคนที่ย้ายปลูกด้านทิศตะวันออก มีอัตราการเติบโตสูงสุดเฉลี่ยวัดได้ 0.62 มิลิเมตร/เดือน รองลงมาคือในแนวราบ ทิศใต้ ทิศตะวันตก และทิศเหนือ มีอัตราการเติบโตใกล้เคียงกันวัดได้ 0.4 มิลิเมตร/เดือน และทิศเหนือพบอัตราการเติบโตน้อยที่สุด 0.3 มิลิเมตร/เดือน ในช่วงเช้าไลเคนทิศตะวันออกได้รับแสงสูงถึง 1,500 $\mu molm^{-2}s^{-1}$ เป็นผลให้พบอัตราการ เติบโตสูง ในขณะที่ทิศเหนือได้รับแสงในช่วงเช้าเพียง 180 $\mu molm^{-2}s^{-1}$ แสงจึงเป็นปัจจัย สำคัญที่มีอิทธิพลต่อการเติบโต การเพิ่มผลผลิตไลเคนแบบแผ่นใบจึงทำได้ด้วยการ ย้ายปลูกไลเคนให้หันแทลัสไปทางทิศตะวันออกจึงให้ผลผลิตจากมวลชีวภาพสูงที่สุด

Abstract: Lichens have slow growth rates. Their photosynthesis and growth depend on resources from the atmosphere i.e. fog, dew, relative humidity, illumination. These factors vary among growth habitats. The objective of this study was to observe the influence of different aspects of habitats on growth of lichens transplanted on artificial substrate. Two hundred and eighty-six thalli of *Parmotrema tinctorum* were attached on nylon meshes that stand over the ground at different orientation to the sun. These were the east, the south, the west, the north and the horizontal. Growth of the thalli and microclimate of the habitats were measured. After eight months of transplantation it was found that growth rates of the transplanted lichens on the east-facing side, accounting

for 0.62 mm/month, was significantly higher than those form the other aspects ($P \leq 0.001$). Lichens transplanted on horizontal, southern, western and northern sides had similar growth rates of 0.4 mm/month. The lowest growth rates (0.3 mm/month) were found at the north-facing aspect. Habitats of the east-facing aspect received light intensity up to 1500 $\mu molm^{-2}s^{-1}$ during early morning, whereas the lichens in the northern side received merely 180 $\mu molm^{-2}s^{-1}$ of light in the morning. Light was therefore an overriding factor that determined growth and biomass production of the transplanted lichens. In conclusion, maximum biomass production of the foliose lichens can be achieved by transplant them on the east-facing aspect.

Introduction: Khao Yai National Park has frequent fog, dew and high humidity, which support a luxurious growth of lichen flora. *Parmotrema tinctorum* is a common lichen grow in every types of forest at KYNP. It metabolism is active through moistening by dew and/or fog during the night and, in the very early morning it exhibited the typical brief peak of net photosynthesis before thallus dried out. The thallus remains almost completely dry for the remainder of the day [1]. The *P. tinctorum* has high potential to be utilized for dyes and other uses. It is necessary to make the most of this lichen in a sustainable manner by increasing biomass production. Therefore, this study attempted to develop technique for transplantation of this lichens, which may be applied to other lichens in the tropic in the future.

Methodology

Transplantation: The transplantation started in October 2008 and last to June 2009. Two hundred and eighty-six thalli of *P. tinctorum* (Despr. ex Nayl.) Hale collected from the bark of different trees in KYNP were attached on nylon meshes. These artificial substrates stand over the ground at about 45^{o} inclination facing the East, the South, the West, the North and horizontal sides. The transplantation area was located near the training center at KYNP.

Microclimate: Microclimate (illumination, temperature and moisture) was measured every 5 minute for 24 hours by using Licor-1400. The measurements were performed in 1 April 2009 and 6 August 2009 as the representative of microclimate in summer and rainy season.

Growth measurement: Photographs of the thalli were taken, and growth was measured by digital images and AxioVision LE. Rel. 4.1 software.

Result, discussion and conclusion: After eight months of transplantation it was found that different orientation to the sun influenced growth of the transplanted thalli of lichens at Khao Yai National Park. Table.1 shows that growth rate on the East-facing side was the highest accounting for 0.62 mm/month. This growth rate was significant

different from those transplanted on others aspects ($P \leq 0.001$). Lichens transplanted on horizontal, southern, western and northern sides had similar growth rates of 0.4 mm/month. The lowest growth rate of 0.3 mm/month was observed from thalli that transplanted on the north-facing aspect. Some thalli grew continuously, whereas others had no thallus expansion during months of observation. It is important to note that thalli with low growth rates developed numerous isidia. These thalli might allocate their photosynthetic resources to make up this structure, for reproduction [2], rather than for growth. By contrast, thalli with higher growth rates develop less isidia. This strategy is one of the factor that cause variation in growth rates of the lichen thalli other than external factor of climate. Fig. 1 showed microclimate on five orientation of substrates, which lichen were transplanted. It revealed that the north-facing aspect had the highest illumination during early morning while the thalli were moisten by absorbing atmospheric moisture during the night. High illumination on the west-facing aspect occurred in the afternoon when thalli were dried, therefore photosynthesis for biomass production could not be performed. In addition, light intensity on the north-facing aspect was low almost throughout the day. This condition limited photosynthesis and growth of the thalli. The results indicated that habitat orientation had strong influence on growth and biomass production of lichens. This was because of the different amount of moisture that thalli held during the morning when they were photosynthetic active. The most important results that can be drawn from this experiment were 1) Technique developed, for the first time, for transplantation of thallus fragment of lichens on artificial substrate was successful. 2) Biomass production of lichen can be maximized by transplantation of thalli on east-facing aspect. These findings lead to sustainable utilization of lichens in the future.

Table 1 Average**,** maximum and minimum growth rates of the lichen *P. tinctorum* transplanted on artificial substrate during October 2008 and June 2009 on different aspects at Khao Yai National Park.

Growth rate (mm/month)				
Aspects	No. of growth	Maximum	Minimum	Average
East	59	1.72	0.111	0.62±0.34a
South	56	1.40	0.008	0.41±0.27b
West	58	0.95	0.029	0.39±0.24b
Horizontal	58	1.15	0.014	0.42±0.23b
North	55	0.86	0.027	0.30±0.17b

*Average values in vertical column followed by the same letter do not differ significantly at $P < 0.05$ by Turkey's pairwise comparisons.

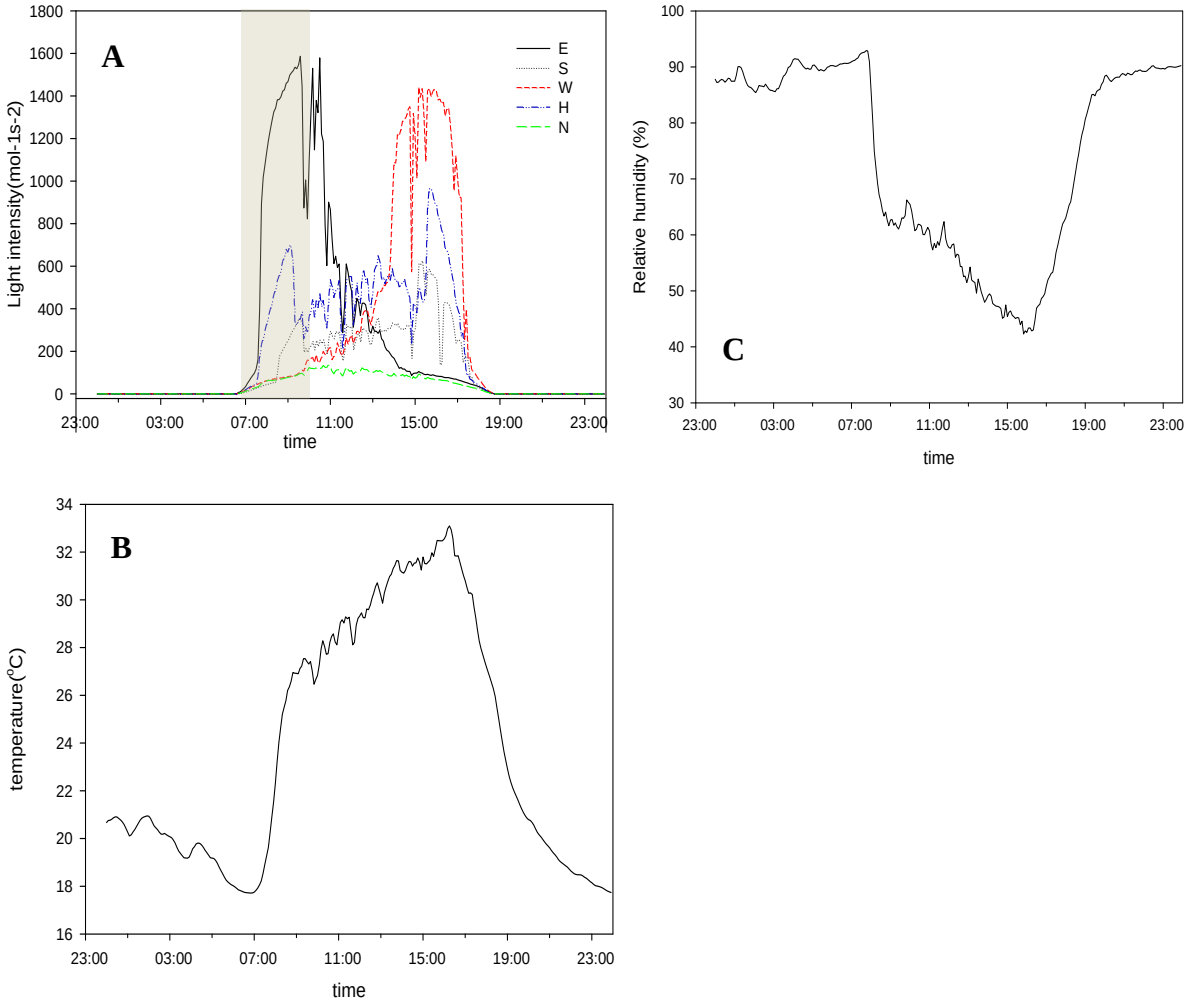

Fig 1 Microclimates at transplantation site, measured on 1 April 2009, (A) light intensity, (B) temperature and (C) relative humidity. The grey region was the period that lichen had photosynthesis (6-10 am.)

Reference

1. O. L. Lange, T.G.A. Green, A. Meyer, and H. Zellner., *Flora*.**202**,2006, 479-487.
2. S.B. Barbosa, S.R. Machado, and M.P. Marcelli, *Micro*.2009, (in press).

Keywords: lichen transplantation, aspects, growth rate

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