

การติดตามการเติบโตและอายุไขของไลเคน ณ อุทยานแห่งชาติเขาใหญ่ ประเทศไทย

MONITORING GROWTH AND LIFE LONGEVITY OF LICHENS AT KHAO YAI NATIONAL PARK, THAILAND

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บทคัดย่อ: การศึกษาในครั้งนี้มีวัตถุประสงค์เพื่อเปรียบเทียบการเติบโตและอายุไขของไลเคนในเขตร้อนจาก 6 สภาพป่า เนื่องจากไม่มีรายงานการศึกษาไลเคนกลุ่มนี้ในที่ไหนมาก่อน ทั้งนี้เพื่อใช้เป็นข้อมูลพื้นฐานในการอนุรักษ์และใช้ประโยชน์อย่างยั่งยืน การติดตามการเติบโตของไลเคนเริ่มต้นตั้งแต่ พ.ศ. 2542-2548 จากไลเคนทั้งสิ้น 306 แทลลัส โดยการลากขอบเขตแทลลัสบนแผ่นพลาสติกใส ในช่วงเวลาต่าง ๆ และคำนวณอัตราการเติบโตจากการเพิ่มขึ้นของเส้นผ่าศูนย์กลางแทลลัสต่อหน่วยเวลา จากการติดตามเป็นเวลา 7 ปี พบว่าไลเคนร้อยละ 57 เสื่อมสลายไปซึ่งส่วนมากเกิดจากปัจจัยสภาพแวดล้อมตามธรรมชาติ มีแทลลัสไลเคนเพียง 132 แทลลัส ที่ยังติดตามการเติบโตได้ ซึ่งประกอบด้วยครัสโตสร้อยละ 60 และโฟลิโอสร้อยละ 27 โดยไลเคนครัสโตสมีอัตราการรอดสูงสุดบนพรรณไม้ปลูก รองลงมาในป่าดิบแล้ง ป่าเต็งรัง ป่าดิบชื้น และป่ารุ่มสอง คิดเป็นร้อยละ 82, 71, 67, 49 และ 44 ตามลำดับ ส่วนไลเคนโฟลิโอสมีอัตราการเหลือรอดมากที่สุดป่าเต็งรัง และรองลงมาในพรรณไม้ปลูก ป่าดิบเขา ป่ารุ่มสอง และป่าดิบแล้ง คิดเป็นร้อยละ 55, 33, 21, 18 และ 13 ตามลำดับ โดยป่าดิบชื้นไม่มีไลเคนโฟลิโอสเหลือรอดเลย ขณะที่การเติบโตของแทลลัสครัสโตสมีค่าเฉลี่ย 2.2 มม./ปี ($n = 88$) ส่วนโฟลิโอสมีค่าเฉลี่ย 5.2 มม./ปี ($n = 44$) อัตราการเติบโตสูงสุดของครัสโตส 8 มม./ปี พบในป่ารุ่มสอง และโฟลิโอส 12.3 มม./ปี พบในป่าดิบเขา ผลจากการติดตามการเติบโตตลอด 7 ปี พบว่าไลเคนโฟลิโอสที่เติบโตเร็วในป่าที่มีความชื้นสูง เช่น ป่าดิบชื้น ดิบแล้ง และป่ารุ่มสอง มีอายุสั้นกว่าพวกที่อาศัยอยู่ในป่าที่มีความชื้นต่ำ เช่น ป่าเต็งรัง ซึ่งมีอัตราการเติบโตต่ำกว่าในกลุ่มแรก

Abstract: This study aimed at comparing growth and longevity of tropical lichens in six forests. Growth of tropical lichens is largely unknown. The information can be used as baseline data for conservation and sustainable utilization of lichen resources. Measuring expansions of 306 lichen thalli were performed during 1999-2005. Thallus growths were obtained by tracing their edges over transparent sheets at different time intervals. Growth rates were expressed as increasing thallus diameters per unit time. After 7 years, 57 % of the thalli disintegrated, mostly due to natural factors, only 132 thalli remained intact. Regardless of the lower montane forest, the highest rate of survival among the crustose thalli was found in the tree plantation (TP), and subsequently lower in the dry evergreen forest (DEF), the dry dipterocarp forest (DDF), the tropical rain forest (TRF) and the secondary forest (SF) accounted for 82, 71, 67, 49 and 44 % respectively. The foliose lichen had the highest survival rate in the DDF and lower in the TP, LMF, SF and DEF recorded 55, 33, 21, 18 and 13 % respectively. All of them in the TRF disintegrated. The remaining crustose thalli had average growth rate of 2.2 mm/year ($n = 88$), whilst 44 of the survival foliose thalli grew 5.2 mm/year. The highest growth rate of 8 mm/year was measured from the SF for the crustose lichens, and the 12.3 mm/year for the foliose lichens from the LMF. This investigation reveals that life longevity of the foliose lichens in the wet conditions of the TRF, DEF and SF seems to be shorter than those inhabited the dry site of the DDF, although growth rate of the former group was higher.

Introduction: Lichens produce novel products that can be utilized in varieties of purposes for example for food, medicine and agriculture, as well as environmental monitoring (1, 2). Sustainable utilization of lichens require knowledge on production rate, growth and life longevity. Reports from the temperate regions, from long-term monitoring of several years, indicate that lichens have very slow growth rates, but the thalli can persist up to several hundred years (1, 3, 4). Pioneer study on growth rates of lichens in the tropic, on short-term basis of 20 months, indicates that tropical lichens at Khao Yai National Park have faster growth rates than those reported else where (5). However, life span of lichen in the tropic is not known, because it needs long-term monitoring. This report presents a seven-year monitoring of growth and thalli longevity of lichens naturally inhabited six tropical ecosystems at Khao Yai National Park.

Methodology: This observation is the on-going project of long-term observation on lichen growth started and reported by Osathanon during 1999-2002 (5). In 1999 he began measuring thallus areas of a total of three hundred and six lichen thalli consisting of 149 crustose and 144 foliose thalli grew in six forest types at Khao Yai National Park. These forests were the lower montane rain forest (LMF), tropical rain forest (TRF), dry evergreen forest (DEF), dry dipterocarp forest (DDF), secondary forest (SF) and tree plantation (TP). The lichens were mostly corticolous of various tree hosts. During 2002-2005 we frequently revisited the sites and recorded thallus areas by drawing thallus edges over transparent sheets. Thallus areas were measured by using LI-3000A (Li-COR, Inc., USA), and diameters were then calculated. Growth rates were determined by changing thallus diameters over time according to Hale (3).

Result, Discussion and Conclusion: After seven years almost half of the thalli disintegrated or disappeared (Table 1). They were mostly caused by termite and insect infestation of the host trees, covering by adjacent fast growing thalli of other lichens and vascular epiphytes, falling of barks and host trees, as well as fire. Only 132 thalli, accounted for 43% of the original number, survived and remained traceable for their growths. The foliose thalli seems to survive much less than the crustose (Table 1). Most of the foliose thalli had incomplete shape, especially the central part, which detached and lost from the substrates. This is probably inherited characteristic of the fast-growing lichens (6). However, the remaining thalli could resume growing, and this were the remnant of thalli that the areas were measured and reported in this study. This phenomena was observed in every forest type except the dry dipterocarp forest, where 55 % of the original foliose thalli remain intact. The same type of thalli in the other four forests, TRF, DEF, SF and LMF lost more than 80 % of the original number (remained only 0-21 %) (Table 1). These forests had wetter conditions than the DDF, which may favor growth of the other organisms that were natural enemy of the lichens or it may enhance activity of the saprophytic microbe that invaded the host trees. Moreover, sheering force of wind and storm tore the branches where observations were undergone. The detrimental factors which cause shorter life span of the foliose thalli in the wet habitats worth further long term investigation. Apparently the crustose thalli were in better condition than the foliose with higher proportion of survivors (Table 1). Regardless of the crustose thalli in the LMF, where sample size was insufficient, and was not taking in to account. Larger survivor of the crustose lichens in the other forests was due in part to their morphology. Crustose thalli were generally thin and attached firmly to substrates, and that happen to devoid of physical forces from the surrounding environment, as well as natural enemy.

Table 1 Survival of tropical lichen thalli after seven-year monitoring in six forest types at Khao Yai National Park. (Crustose thalli in LMF was excluded)

| Forest types | Crustose | | | Foliose | | |
|----------------------------------|----------|-----|-----------|---------|-----|-----------|
| | Start | End | % Survive | Start | End | % Survive |
| LMF | (2) | (2) | (100) | 14 | 3 | 21 |
| TRF | 43 | 21 | 49 | 19 | - | 0 |
| DEF | 28 | 20 | 71 | 8 | 1 | 13 |
| DDF | 12 | 8 | 67 | 33 | 18 | 55 |
| SF | 32 | 14 | 44 | 45 | 8 | 18 |
| Plantation | 28 | 23 | 82 | 42 | 14 | 33 |
| Total | 143 | 86 | 60 | 161 | 44 | 27 |
| Grand total (Crustose + Foliose) | | | Start | 306 | | |
| | | | End | 130 | | |
| % Survive | | | 42 | | | |

After seven year the survived crustose and foliose thalli had average growth rates of 2.2 and 5.2 mm/year respectively (Table 2), comparing with 1.3 and 6.4 mm/year reported after two years of observation by Osatanond (5). The magnitude of the maximum, minimum and average growth rates of both groups of lichen seems to be smaller than the previous report. The foliose lichens measured in this report consisted of 13 species (8 genera), of which *Heterodermia hypoleuca* and *Parmotrema tinctorum* had the highest growth rates of 12.3 and 9.3 mm/yr respectively. The survived crustose lichen consisting of 29 species (20 genera), of which *Porina mamillana* and *Letrouitia vulpina* were the fastest growing species (8 and 5.6 mm/yr respectively). Lichen growth rate and thalli longevity at Khao Yai National Park is the first of its kind reported for the tropic. The information is important for conservation and sustainable utilization of lichen resources in the tropic.

Table 2 Growth rates of lichens during 2 and 7 years (1999-2002 and 1999-2005) in six type of tropical forests at Khao Yai National Park

| Lichen | Change of thallus diameter (mm/yr) | | | | | |
|----------|------------------------------------|------|---------------|---------|------|--------------|
| | 2 years | | | 7 years | | |
| | Min | Max | Ave. | Min | Max | Ave. |
| Foliose | 2.4 | 20.4 | 6.4 (n = 160) | 0.1 | 12.3 | 5.2 (n = 44) |
| Crustose | 0 | 12 | 1.3 (n = 146) | 0 | 8 | 2.2 (n = 88) |

References:

- (1) Brodo, I. M., Sharnoff, S. D. and Sharnoff, S. (2001). *Lichens of North America*. Yale University Press, London.
- (2) Richardson, D.H.S. (1991). *Pollution monitoring with lichens*. Richmond publishing Co. Ltd. England.
- (3) Hale, M. E. (1959). *Bull. Torrey Bot. Club.* **86**, 126-129.
- (4) Lang, O. L. (1990). *Israel J. Bot.* **39**, 383-394.
- (5) Nimitr Osathanon. (2002). *Microclimate and growth of some lichens at Khao Yai National Park*. Ramkhamhaeng University, Bangkok.
- (6) Armstrong, R. A. (1974) *New Phytol.* **73**, 913.

Keywords: lichens, growth, life span, tropical region