

Studies of Polysety in *Dicranum polysetum* (Dicranaceae, Musci)

by

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樋口正信* : ナミシッポゴケ (シッポゴケ科, 蘚類) のポリセティの研究

In *Pseudobryum speciosum* it was suggested that there is no geographical difference in the frequency of polysety (Higuchi 1997b). This study adds further quantitative data on polysety, especially its variation among the populations in a small area.

Dicranum polysetum Sw. (Dicranaceae) is boreal species, and is characterized by robust plant, undulate leaves and recurved leaf margins. Polysety in this species is well-known and has been reported by several authors, in which they have described the number of setae (e.g., Crum and Anderson (1981) noted "Setae usually clustered, 1-5(7) per perichaetium"). However, there is no quantitative study on polysety of this species. The purpose of this study is to better understand the nature of polysety in *Dicranum polysetum*.

Materials and Methods

Plant material with sporophytes was obtained from the following locality situated in central Honshu, Japan: Nagano-ken, Kami-ina-gun, Hase-mura, Todai, 1000 m alt. (35° 47' N, 138° 8' E), 27 June 1997.

All fertile shoots were taken from seven populations (P1~P7) which were different in size and discontinuously dispersed over a small area (ca. 5 × 5 m). The methods used for this study follow those of Higuchi (1997b), but some different points are annotated. In *Dicranum polysetum* showing successive growth, the parts of plant formed year by year can be recognized. The old setae of the previous year were ignored. When a shoot is branched (cf. Fig. 3: 2), they were counted individually. For the measurement of shoot length the part developed in the last year was measured. The voucher specimens are deposited in the herbarium of the National Science Museum, Tokyo (TNS).

Results

Table 1 shows the frequency of polysety in *Dicranum polysetum*. The frequency of polysety was significantly different among seven populations. In each population over 50% of the fertile shoots were polysetous, and totally over 80% of the fertile shoots were polysetous. The number of setae in a gametocium varied from one to six, which is nearly in accord with the description by Crum and Anderson (1981). The most frequent number of setae per gametocium was one in P2 and P3, two in

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Table 1. Number of shoots with 1~6 setae in *Dicranum polysetum*

| Number of setae | 1 | 2 | 3 | 4 | 5 | 6 | Total of shoots |
|-----------------|------|------|------|------|-----|-----|-----------------|
| P1 | 14 | 17 | 13 | 3 | — | — | 47 |
| % | 29.8 | 36.2 | 27.6 | 6.4 | | | |
| P2 | 20 | 16 | 13 | 1 | — | — | 50 |
| % | 40 | 32 | 26 | 2 | | | |
| P3 | 19 | 11 | 15 | 5 | 1 | — | 51 |
| % | 37.2 | 21.6 | 29.4 | 9.8 | 2.0 | | |
| P4 | 9 | 22 | 16 | 6 | 3 | — | 56 |
| % | 16.1 | 39.3 | 28.6 | 10.7 | 5.3 | | |
| P5 | 18 | 22 | 30 | 12 | 3 | 2 | 87 |
| % | 20.7 | 25.3 | 34.5 | 13.8 | 3.4 | 2.3 | |
| P6 | 35 | 53 | 50 | 23 | 8 | — | 169 |
| % | 20.7 | 31.4 | 29.6 | 13.6 | 4.7 | | |
| P7 | 48 | 64 | 131 | 109 | 33 | 3 | 388 |
| % | 12.4 | 16.5 | 33.7 | 28.1 | 8.5 | 0.8 | |
| Total | 163 | 205 | 268 | 159 | 48 | 5 | 848 |
| % | 19.2 | 24.2 | 31.6 | 18.7 | 5.7 | 0.6 | |

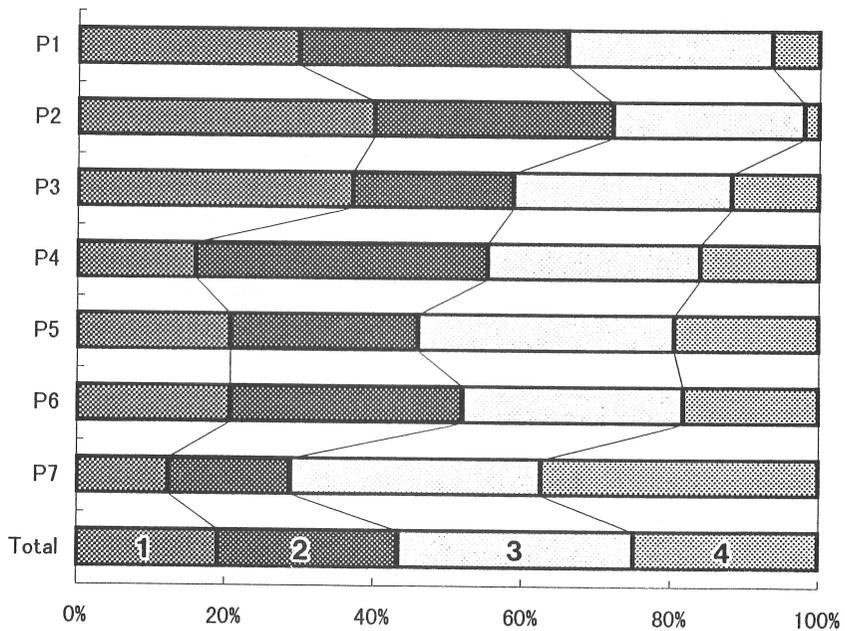


Fig. 1. Histograms of the proportion of the number of shoots in *Dicranum polysetum* based on Table 1. 1: shoots with one seta, 2: shoots with two setae, 3: shoots with three setae, and 4: shoots with four or more setae.

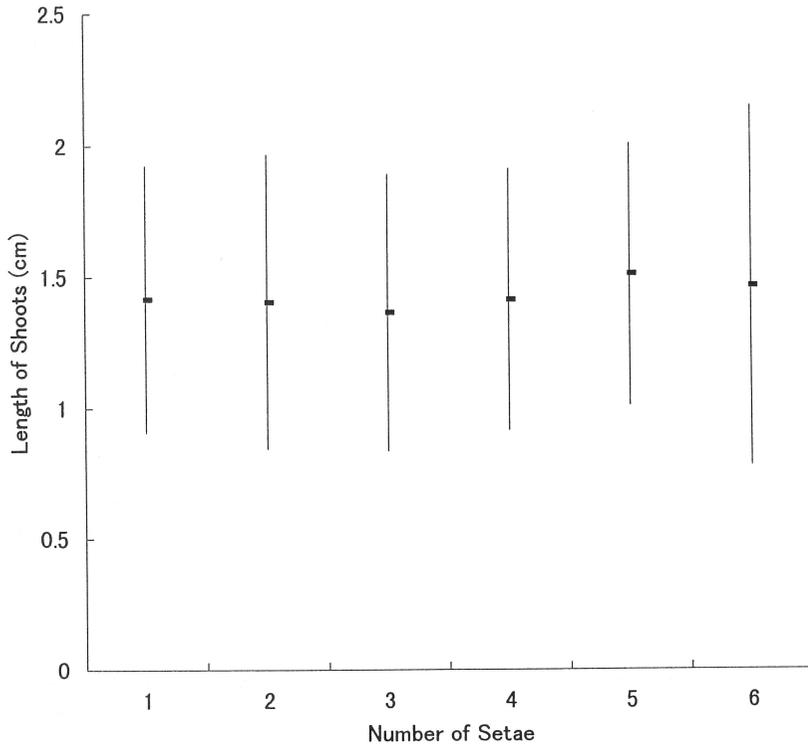


Fig. 2. Shoot length on each shoots with 1~6 setae in *Dicranum polysetum* ; bars represent \pm one standard deviation about the mean.



Fig. 3. *Dicranum polysetum* Sw. 1. Plants with sporophytes showing the LCI stage. 2. Shoots with two and three mature sporophytes showing the LCI stage. Leaves removed to show the gametocidia. Old sporophytes formed in the last year persist. (Scale bars, 1, 2: 1 cm)

P1, P4 and P6 and three in P5 and P7. Totally three was the most common. A χ^2 -test shows that the differences among the proportion of the number of setae in each population were significant ($P=0.05$) (Fig. 1). The number of setae per shoot seemed to rise proportionately with increase in the number of fertile shoots examined.

Measurement of shoot length is given in Fig. 2. There is no significant difference between the length of monosetous shoots and polysetous ones. It suggests that the size of gametophytes, at least shoot length, has no influence on the number of sporophytes in this species.

Most sporophytes were in the Early Calyptra Intact (ECI) stage and the Late Calyptra Intact (LCI) stage as defined by Greene (1960). In the ECI stage the capsule is not expanding and has the same diameter as the seta. In the LCI stage the capsule is expanding or has attained full size. The development of sporophytes in a gametoeceium was almost synchronous (Fig. 3).

Discussion

Polysety in *Dicranum majus* was studied by Sowter (1951) and Hughes (1980). Sowter (1951) reported by examining 297 shoots that (1) about 67% of the fertile shoots were polysetous, (2) the number of setae in a gametoeceium varied from one to six and (3) two is the most common. While Hughes (1980) recorded by examining 287 shoots that (1) about 55% of the fertile shoots were polysetous, (2) the number of setae in a gametoeceium varied from one to five and (3) one is the most common. *Dicranum polysetum* showed higher degree of polysety than that of *D. majus*. The frequency of polysety in *Dicranum majus* is similar to that previously reported for *Plagiomnium insigne* (Koponen 1968), *Mnium spinosum* (Higuchi 1997a) and *Pseudobryum speciosum* (Higuchi 1997b).

Higuchi (1997b) suggested that there is no geographical difference in the frequency of polysety in *Pseudobryum speciosum*. While the frequency of polysety in *Dicranum polysetum* was different among seven populations in a small area. Higuchi (1997b) examined more than one hundred shoots per each locality. It is considered that the frequency of polysety is more or less unstable in low sample size. There was no significant difference between the length of monosetous shoots and polysetous ones not only in *Pseudobryum speciosum* but also *Dicranum polysetum*. This supports an idea that the size of gametophytes has no influence on the number of sporophytes in polysetous mosses.

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Summary

Polysety in *Dicranum polysetum* was investigated based on material from central Japan. The frequency of polysety is discussed. Totally over 80% of the fertile shoots were polysetous. The number of setae in a gametoeceium varied from one to six, and three was the most common. The frequency of polysety was different among populations in a small area. A comparison of the number of sporophytes per gametoeceium and its correlation to shoot length is described, but no definite correlation was found.

摘 要

ポリセティとは一つのガメテシウムに複数の孢子体が形成される現象で、長野県戸台での調査により得たサンプルを用いて、ナミシッポゴケのポリセティをより明らかにすることを目的に研究を行った。本種は北半球に広く分布し、本種にポリセティが見られることはこれまでよく知られていたが、従来の報告ではさく柄の数が記載されるだけ、より詳しい研究はなされていなかった。調べた848株中80%以上がポリセティを示した。ガメテシウムあたりのさく柄の数は1~6本であり、全体では3本のものが一番多かった。ポリセティの頻度は狭い地域(約5×5m)に分散する7つの個体群間で差が見られた。シュートあたりのさく柄の数とシュートの長さの間には相関が見られなかった。

References

- Crum, H. A. and L. E. Anderson, 1981. Mosses of Eastern North America. Vol.1, pp.1-663. Columbia University Press, New York.
- Greene, S. W., 1960. The maturation cycle, or the stages of development of gametangia and capsules in mosses. Trans. Brit. Bryol. Soc. 3: 736-745.
- Higuchi, M., 1997a. On the polysety of four species of mosses from China. Bryol. Res. 7: 53-55 (in Japanese with English summary).
- , 1997b. Studies of polysety in *Pseudobryum speciosum* (Mniaceae, Musci). Bull. Natn. Sci. Mus., Tokyo, Ser. B, 23 (in press).
- Hughes, J. H., 1980. The relation between the occurrence of polysety and the number of archegonia in the female inflorescences of *Dicranum majus* and *D. scoparium*. J. Bryol. 11: 337-342.
- Koponen, T., 1968. On polysety in *Plagiomnium* Kop. Sect. *Rosulata* (Kindb.) Kop. (Bryophyta). Memo. Soc. Fauna Flora Fenn. 44: 24-32.
- Sowter, F. A., 1951. The polysetous inflorescence of *Dicranum majus* L. Trans. Brit. Bryol. Soc. 1: 73-74.