POPULATION DYNAMICS OF *SCHISMATOGLOTTIS LANCIFOLIA*, AN UNDERSTORY AROID OF TROPICAL WET FORESTS, DURING FIVE YEARS

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Abstract

The population dynamics during five years, from 1982 to 1987, of *Schismatoglottis lancifolia* in Pinang Pinang plot of Ulu Gadut Valley, West Sumatra, is analyzed. The mortality of this perennial aroid was ca. 0.28 per year. The population at 1987 consisted conservatively of the similar component to that at 1982, irrespective of replacement of almost all clones through five year lapse.

Introduction

Schismatoglottis lancifolia is an understory aroid in Malesian tropical rain forests and displays polymorphic variations on leaf phenotypes and chromosome complements (Hotta *et al.*, 1985). Based on the analyses of her polymorphic characters between the spatial distributions, they conclude that the populations of this species are constructed hierarchical categories, populations diversify the genetical components from each other, but are not parallel to environmental factors. In other words, characters analyzed behave like neutral genes. Are these phenomena truly conservative through long time lapse?

The climate at Ulu Gadut area is situated under one of the most humid and highest temperature in Malesian tropics. Since this area seems to have no disadvantageous seasons for plant growth whole the year round, it is easily presumed that the categories at temperate zone of "perennial" and "annual" or "biennial" have little meanings. To understand how long do herbaceous plants live under the very stable environment of wet forest floors is very interesting and important steps for advancement of population biology at tropics.

This study was carried out aiming to analyze the population dynamics of the species and detect the change of composition of polymorphic characters at the same population during five years. The results may contribute to understand what demographic aspects undergo at the wet tropical forests.

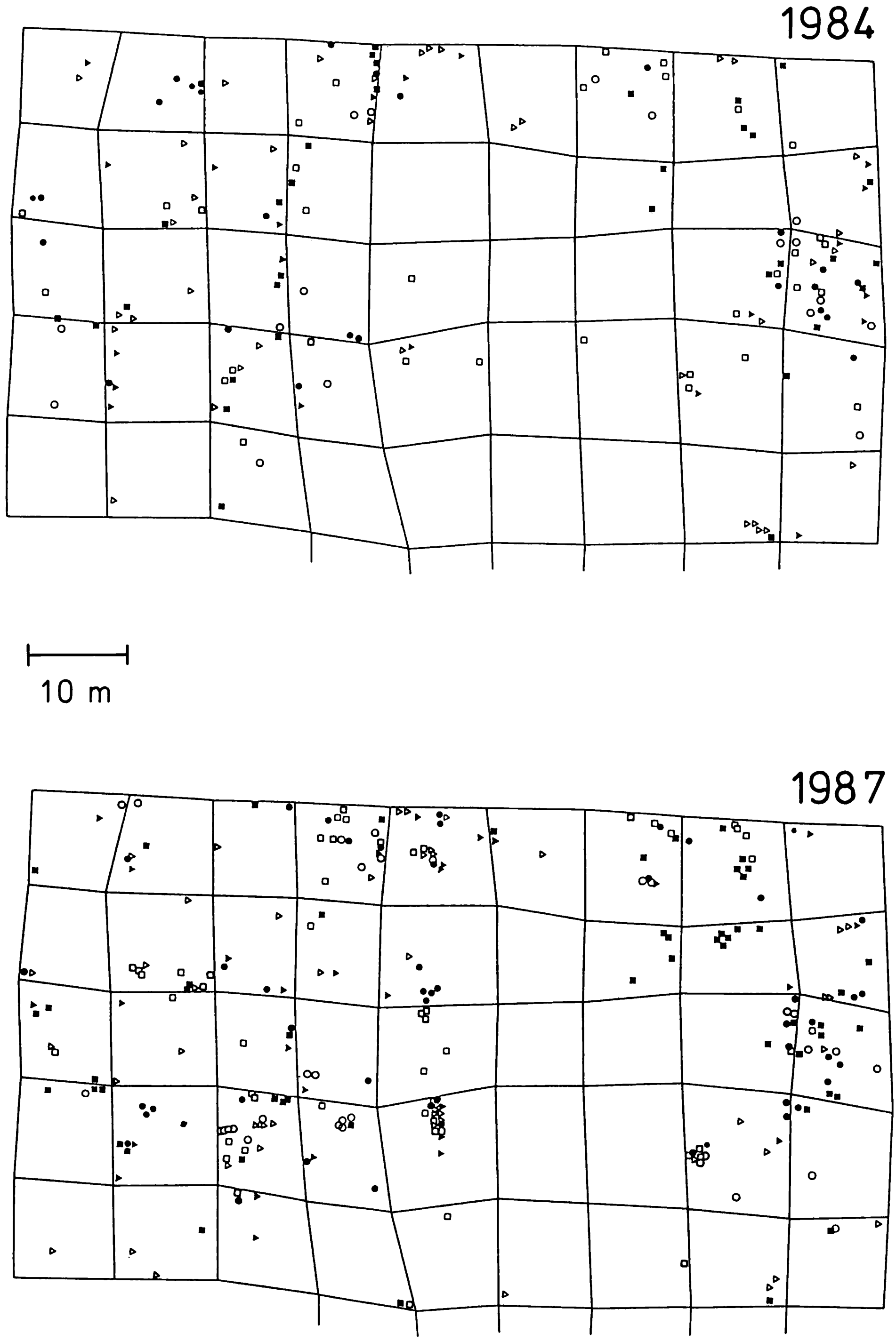

Fig. 1. Distribution patterns of clones at Pinang Pinang plot on Aug. '84 and Dec. '87. Symbols: solid circle; GGG, open circle; GGW, solid square; RGG, open square; RGW, solid triangle; RRG, open triangle; RRW, asterisk; GRG.

Materials and Methods

Schismatoglottis lancifolia Hall. F. ex Engl. displays some polymorphic variations in leaf colors, namely, green (G) vs. red (R) at petioles, green (G) vs. red (R) at leaf below and green (G) vs. white mottle (W) at leaf surface (Hotta *et al.*, 1985). On the basis of these variations, this study picked up six combinations, i. e., GGG, GGW, RGG, RGW, RRG and RRW (symbols were arranged petiole, leaf below and leaf surface from left to right) for the identifications of the individuality. The combination of GRG was not used for this analysis because of the minority in the population.

The study has been carried out at the Pinang Pinang plot, Ulu Gadut area, near Padang, West Sumatra. This plot is one of the representative places with abundant individuals. Further, we could use the map, which was prepared for forest ecology (Ogino *et al.*, 1984), to determine easily the spatial position of the plants.

The survived or renewed clones were identified from two criteria. If the spatial position of individuals at '87 corresponded to those at '84, and if the combination of the characters of the individual was the same as that of '84, it was identified as survived one, while if any one of criteria was not comparable, it was renewed one (Fig. 1).

Some of individuals from not only Pinang Pinang plot and around Ulu Gadut area have been cultivated at Osaka University, Japan, for five years to check whether these leaf characters were flexible or not. In the present, it is sure that all of the characters observed are stable, instead of the transplantation to the different environment from the field. These characters may be expressed by genetical regulations.

For the analysis of population dynamics, this study employed clone numbers. Because Pinang Pinang plot has been established for forest ecological studies, some investigators frequently entered into the plot, and then some of plants were accidentally downtrodden and divided into some small chips around rather narrow areas. These chips were viable and sprouted. If treated these individuals as the same value for statistic analyses as the seedlings, probably wrong conclusion should be induced. Therefore, these individuals were scored as the same clone.

For the statistic analyses, chi square test was employed.

Results and Discussion

Mortality during five years

At Pinang Pinang plot, the dead, survived and/or renewed clones at five year interval could be identified by the comparison of the spatial position and combination of leaf characters (Fig. 1, Table 1). The identification of clone induced the possibility to calculated the mortality of the clones of this species. The mortality can be calculated by following equation:

$$P_s = P_o\,(1 - m)^t; \qquad (1)$$

where, P_s, survived clone number; P_o, original clone number; m, mortality; and t, period (years). We can estimate the mortality by putting actual numbers into eqn (1) as follows.

The interval from '82 to '84;

$P_s = 60$, $P_o = 206$, $t = 1.67$, therefore
$m = 0.52$.

The interval from '84 to '87;

$P_s = 56$, $P_o = 164$, $t = 3.33$, therefore
$m = 0.28$.

The mortality estimated by the interval from '82 to '84 was about two times higher rate than that by '84 to '87. The reason of the difference may be arisen from the artificial impacts, but not from the natural role of population dynamics of the species. In this plot, all of the individuals were cut off at aboveground stems at '82 for cytological

Table 1. Components of each character in '82, '84 and '87 at Pinang Pinang plot.

	GGG	GGW	RGG	RGW	RRG	RRW	total
'82 Dec.	29	28	36	53	23	37	206
'84 Aug.	24	17	33	33	21	36	164
'87 Dec.	47	31	54	51	29	48	260
'82 → '84							
dead	21	20	24	39	16	26	146
survived	8	8	12	14	7	11	60
renewed	16	9	21	19	14	25	104
'84 → '87							
dead	16	15	20	22	12	23	108
survived	9	2	13	11	9	13	56
renewed	39	29	41	40	20	35	204
'82 → '87							
dead	28	27	32	49	20	30	186
survived	1	1	4	4	3	7	20
renewed	46	30	50	47	26	41	240

Table 2. Chi square test between expected and observed clones of survival during '84 and '87. Numerals in ( ) were calculated from the eqn (1) by m = 0.28 and t = 3.33.

	no. in '84 (P_0)	no. in '87 (P_s)
survived from '82	60	20 (20.1)
renewed during '82-'84	104	36 (34.8)

calculated chi square value is 0.0419
corresponding probability is more than 0.90.

analysis (Hotta *et al.*, 1985). The influences of cutting were not negligible. Probably the mortality estimated from the change during '84 and '87 is comparable with natural role. About one fourth of the populations per year were extinct in nature. If there are no impact of cutting at '82 the population size should maintain rather bigger, such as ca. 220 at '84.

The survived clones at '87 consisted of both survived clones since '82 and renewed ones at '84 (Table 2). The comparison of them indicated following ideas. 1) We could not detect any tendency that some clones were disposed to survive longer than the others. If survived 60 clones at '84 have any advangate of survival competition to the others, they are alive much more than the others. But the survival rates between both survived and renewed clones at '84 were the same. The survived 20 of 60 clones were alive through 5 years by the equivalent rate to 36 of 104 renewed clones at '84. There was no difference of mortality between both. 2) This "perennial" herb exhibited uncertain life span, but might die or survive by chance. Some clones within the population at '82 still survived at '87, while the other died already at '84. Hotta *et al.* (1985) estimated the individual numbers per one clone. According to them, about 70% clones were composed of single individual and the rare exceptional clone consisted of 14 individuals. These facts well correspond to the present presumption. Many clones have no chance to propagate vegetatively for short-term life. Long lived clones have a chance to reproduce individual stems and divide into multiple individuals.

Further, we can estimate the period of the half-life of this population, and that of extinction of more than 99% clones as follows.

$$(1 - 0.28)^t = 0.5 \qquad t = 2.1,$$
$$(1 - 0.28)^t < 0.01 \qquad t > 14.0.$$

About 2.1 years later, a half of populations should be replaced by newly germinated individuals, and about 14 years later, the temporal component of populations should almost change to new one. Therefore, it is presumed that the genetical components within populations should easily shift to the other one if there were any environmental changes and if the charac-

Table 3. Chi square test comparing dead, survived and renewed clones during 82 and 87 at Pinang Pinang plot. Numerals in ( ) are expected value.

	GGG	GGW	RGG	RGW	RRG	RRW	total
84 dead	21(23.3)	20(17.9)	24(28.2)	39(31.3)	16(16.8)	26(28.6)	146
84 surv.	8(9.6)	8(7.3)	12(11.6)	14(12.8)	7(6.9)	11(11.8)	60
84 renew.	16(16.6)	9(12.7)	21(20.1)	19(22.2)	14(12.0)	25(20.4)	104
87 dead	16(17.2)	15(13.2)	20(20.9)	22(23.1)	12(12.4)	23(21.2)	108
87 surv.	8(8.9)	2(6.9)	13(10.8)	11(12.0)	9(6.4)	13(11.0)	56
87 renew.	39(32.5)	29(25.0)	41(39.4)	40(43.6)	20(23.5)	34(40.0)	204
total	108	83	131	145	78	133	678

calculated chi square value is 16.289.
corresponding probability is 0.9061.
difference is not significant at $P > 0.05$.

ters responded to selection pressure, or if so-called random genetic drift proceeded.

Change of component of leaf characters during five years

The previous components of leaf characters at '82 population scarcely changed during five years judged from the results of chi square test (Table 3). Furthermore, this analysis pròved that any combination of characters died, survived or renewed randomly. The statistic analysis suggests that the component of the population did not change by time lapse. These may indicate no environmental changes at the population or no response to environmental changes. Based on the statistic analysis of this species, Hotta *et al.* (1985) concluded that any characters studied, even if chromosomes, did not respond to any environmental gradient. This study suggests no contradictions to their conclusion that the leaf characters of this species do not behave as an adaptive criterion against the any selection pressure. They may act genetically as neutral genes. It is very interesting to understand what has happened on the process of the diversification of components between populations described by Hotta *et al.* (1985).

References

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