ネパール産オランダイチゴ属2種のランナー

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Naohiro NARUHASHI*, Mamoru SUGIMOTO** and Takashi SATO***: **Runners of Two Nepalese Species of *Fragaria***

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オランダイチゴ属2種のランナー

Abstract

Runners of two Nepalese *Fragaria* were morphologically divided into two types. Change in the internode length of *F. nubicola* was explained by the law of expanding relative growth. On the other hand, the changing pattern of the internode length of the runner in *F. daltoniana* fitted the model showing oscillation.

Key Words: *Fragaria nubicola—Fragaria daltoniana—*Nepal—Runner

After flowering, plants of the genus *Fragaria* put out runners from leaf axiles for the purpose of vegetative reproduction. The runner, which consists of nodes and internodes, gets longer and longer.

The runner of *Fragaria* was recognized morphologically as a so-called *Fragaria* type in the *Potentillae*; it is divided into two subtypes (SUGIMOTO *et al.*, 1987). One is the type in which a scaly leaf is produced on only the first node (the nearest node to the mother stock) of the runner; the second node and after have normal leaf and adventitious roots. This type is observed in *F. nipponica*. The other is the type in which a scaly leaf is produced on the odd-numbered nodes and adventitious roots grow from the even-numbered nodes after the second. This type is observed in *F. ananassa*, *F. iinumae* and *F. vesca.*

Moreover, an examination of the length of internode of the runner in four species of *Fragaria* has suggested that there may be some relationship to the above two runner types (SATO *et al.*, 1988).

One of the authors, NARUHASHI, observed the runners on two *Fragaria* species, *F. daltoniana* J. GRAY and *F. nubicola* LINDL. ex LACAITA, at several places in Nepal and measured the length of the internodes of the runner. The results are reported here.

Materials and Methods

Sampling sites, altitude above sea level, sampling dates and voucher specimen numbers for 11 populations (A-K) of two species are shown in Table 1.

The runner internodes were collected with the plants and measured, and the runners usually were pressed on the same day. The number of plants collected in each population ranged from 7 to 35 individuals.

Results and Discussion

Fragaria nubicola

This species, distributed from the Himalayas (1600-4000 m) to West China, was mainly found in kharkas, the margins of forests and open places along passes in the mountains, 1800-2600 m above sea level. In the species a scaly leaf was found on only the first node, and adventitious roots sprouted from all nodes except the first.

Fragaria daltoniana

The plants were distributed from the Himalayas to Northern Burma, and were found at altitudes ranging from 1600 to 4000 m in mountain meadows, on rocks and in kharkas in the Himalayan mountains. Scaly leaves of this species were found on all nodes of an odd number. Nodes with adventitious roots and those without adventitious roots alternated with one another,

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Table 1. List of samples and populations examined.

Code	Species	Sampling site	Altitude	Sampling date	Specimen nr.
A	*F. nubicola*	C. Nepal : Gandaki Zone, Kaski Distr., Tadapani	2550m	Aug. 23, 1988	8810948
B	*F. nubicola*	E. Nepal : Koshi Zone, Sankhuwa Sabha Distr., Tashi Gaun	1960m	Jul. 12, 1988	8810325
C	*F. nubicala*	E. Nepal : Koshi Zone, Sankhuwa Sabha Distr., Jaljale	1850m	Jul. 12, 1988	8810324
D	*F. nubicola*	E. Nepal : Koshi Zone, Sankhuwa Sabha Distr., Unshisa Kharka	2850m	Jul. 15, 1988	8810430
E	*F. nubicola*	C. Nepal : Dhaulagiri.Zone, Myagdi Distr., Paudwar	1900m	Sep. 5, 1988	8811292
F	*F. nubicola*	E. Nepal : Koshi Zone, Sankhuwa Sabha Distr., Chichila	1850m	Jul. 8, 1988	8810229
G	*F. nubicola*	C. Nepal : Dhaulagiri Zone, Mustang Distr., Kokethanti	2480m	Aug. 29, 1988	8811186
H	*F. daltoniana*	E. Nepal : Koshi Zone, Sankhuwa Sabha Distr., Cha Ding Kharka	3900m	Jul. 30, 1988	8810648
I	*F. daltoniana*	E. Nepal : Koshi Zone, Sankhuwa Sabha Distr., Unshisa Kharka	3270m	Jul. 31, 1988	8810693
J	*F. daltoniana*	E. Nepal : Koshi Zone, Sankhuwa Sabha Distr., Unshisa Kharka	2840m	Jul. 15, 1988	8810431
K	*F. daltoniana*	C. Nepal : Gandaki Zone, Kaski Distr., Tolka	1690m	Aug. 20, 1988	8810852

Table 2. Length of runner and of each internode.

Code	Length of runner (mm)	Length of internode (mm)															
		1*	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	1636± 83**	137± 7	169± 7	206± 8	213± 7	201± 6	189± 6	179± 6	178± 7	171± 8							
B	1094± 54	56± 3	112± 5	155± 7	173± 6	177± 4	165± 5	171± 7									
C	1566± 69	55± 6	122± 9	154±12	184±13	183±10	176± 9	174± 9	176± 9	179±12							
D	1269± 66	92± 7	179± 8	206± 7	210± 6	208± 5	198± 8	187± 9									
E	1910±189	86± 7	146±11	203±13	214± 9	203± 8	194±11	180±17	183±18	183±16	180±12						
F	1087± 55	77± 6	138± 7	170± 7	177± 6	173± 6	170± 6	181± 8									
G	1706± 76	167±10	178± 9	212±13	228±13	217±11	215± 9	208± 7	182±10								
H	839± 23	113± 4	151± 4	137± 4	140± 3	131± 4	135± 4										
I	955± 45	142± 7	154± 5	156± 7	136± 6	137± 8	127± 5										
J	917± 44	119± 6	134± 6	132± 4	121± 4	123± 5	115± 4	109± 4									
K	1405±120	70± 4	94± 3	78± 4	103± 5	80± 4	107± 5	86± 4	107± 4	92± 5	109± 6	91± 5	112± 5	89± 5	108± 3	83± 2	104± 4

* ordering internode from base to apex of runner

* * mean ± standard error

and adventitious roots sprouted from all nodes of an even number.

Population K was situated in a valley between Beri Kharka and Tolka ; the plants were growing at the foot of a bridge built of small stones. The light and water conditions seemed to be good. The long runners of the plants were hanging down from the top of the bridge foot ; there was almost no anchoring by the adventitious roots that sprouted from the nodes.

From the description above, it becomes clear that there are morphologically two types of runners in Nepalese *Fragaria,* as noted in our previous report (SATO et al., 1988) ; the runner of *F. nubicola* was shown to be the same type as Japanese *F. nipponica,* and that of *F. daltoniana* was similar to *F. iinumae.*

The lengths of the internodes of runners at each sampling site are shown and illustrated in Table 2 and Fig. 1.

As shown by graphs A to G for seven populations of *F. nubicola* in Fig. 1, the change of internode length can be regarded as explained by the law of expanded relative growth (OGAWA et al., 1965), as follows :

$$\frac{1}{ln} = \frac{A}{or} + B$$

where ln = internode length of n-th number,
or = ordering of internode, and
A and B the coefficients.
In this case the nodes up to the sixth were used, because they were well developed.

The correlation coefficient derived from this regression was compared not among populations but among individuals within species, whether it has significance in statistical analysis or not.

The change of internode length of many runners explained by this regression was found in populations A to G of *F. nubicola.* On the other hand, the change was not found in the populations H to K of *F. daltoniana.* As a result of x^2-test, there was a significant difference ($x^2 = 64.8$ p < 0. 001).

This indicates that the relation between the length of the internode and ordering in *F. nubicola* may be explained by the law of expanded relative growth. *Fragaria daltoniana,* however, has little fitness to the present formula and may be difficult to explain by using the expanded relative growth.

In graph K of Fig. 1, the changing pattern of the length of the internode appears to be oscillographic. This phenomenon is found in other populations belong to *F. daltoniana* as well as population K and also found in *F. nubicola.* That is to say, it is understood that the unit continuity of the length of an odd number and an even number does exist.

To investigate this problem, we made a model from the relation seen in population K and examined the mean deviation of each population using the model. The longest runner of each individual was chosen for analysis.

The model formula adopted here is as follows :

$$SA = \sum_{n=1}^{\frac{no}{2}} (l_{2n} - l_{2n-1})$$

where ln = the internode length of n-th number
N = number of runners,
no = number of internodes, and
SA = mean difference between the length of the internode of an even number and that of an odd number.

If m is length of internode, it becomes

$$m = \frac{1}{no} \sum_{n=1}^{no} l_n$$

When it fluctuates with amplitude of $\frac{1}{2} SA$ to the axis of mean length of internode, it becomes the expectation $= (-1)^n \times \frac{1}{2} SA + m$
If H means difference from expectation, then

$$H = \frac{1}{no} \sum_{n=1}^{no} [l_n - \{(-1)^n \times \frac{1}{2} SA + m\}]$$

We calculated this H on each runner of the population and the mean PH per population, and derived

$$PH = \frac{1}{N} \sum_{i=1}^{N} H_i$$

The value of mean PH in each population is shown in Table 3.

There was a clear difference between the two species, because the mean value of the whole population of *F. nubicola* was 34.3 ± 5.0, and that of *F. daltoniana* was 17.5 ± 3.7.

On the basis of this result, it becomes evident that the regularity or oscillation in the change of internode length is more clearly shown in *F. daltoniana* than in *F. nubicola.* This means that in *F. daltoniana,* there is a tendency toward regularity in the change of the internode length of
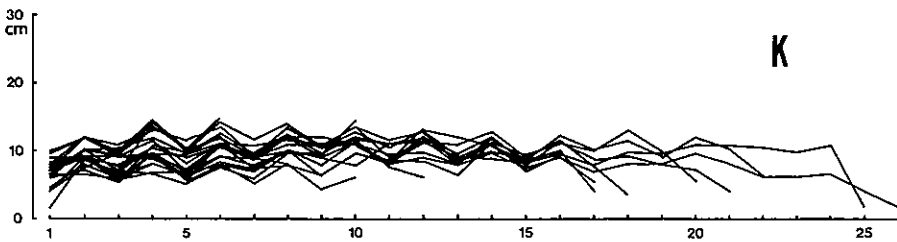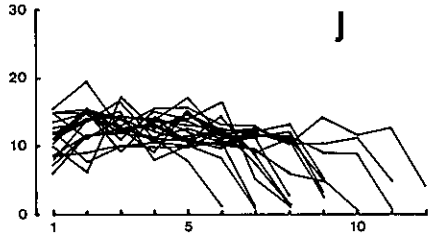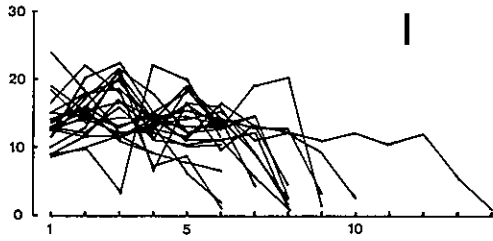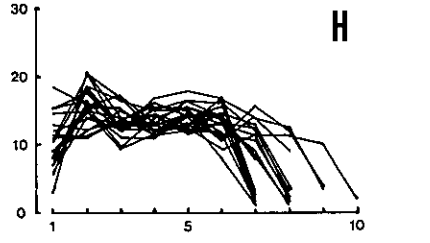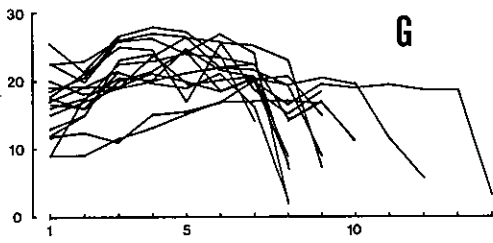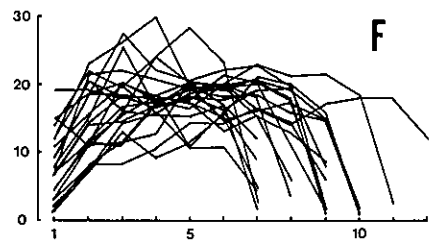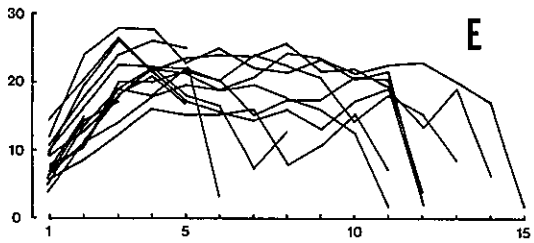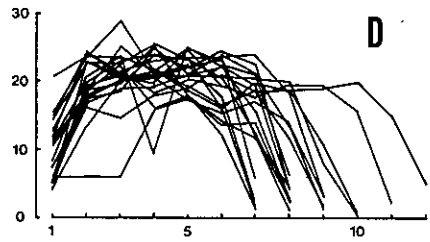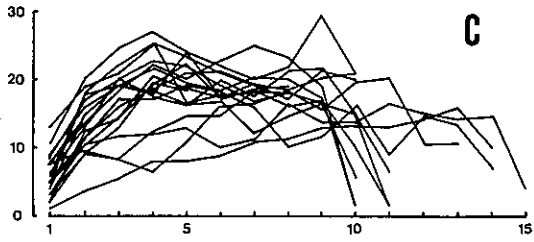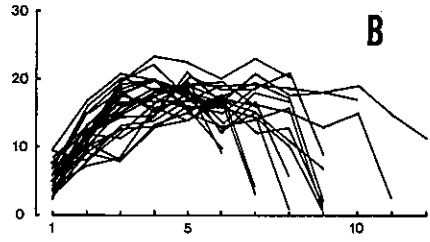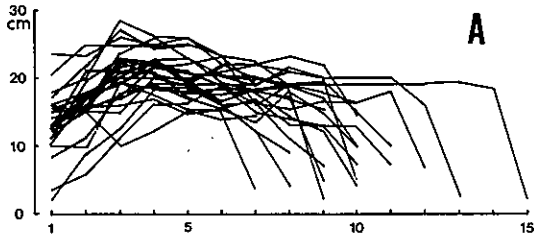
Table 3.   Mean of *PH* values in sampling sites

	F. nubicola							*F. daltoniana*			
	A	B	C	D	E	F	G	H	I	J	K
N	20	22	16	16	10	35	11	13	17	15	7
PH	29.3	38.5	38.2	38.1	35.8	36.1	24.3	21.3	20.6	16.0	12.2
	m=34.3 *SD*=5.0							*m*=17.5 *SD*=3.7			

the runner as a unit consisting of an odd-numbered internode and an even-numbered internode. That is, an odd-numbered internode and the following even-numbered internode make a set, and it may be understood that an odd-numbered internode is shorter than that of the following even-numbered internode and is shorter than the preceding even-numbered internode.

The phenomenon of the set of odd and even internodes may be related to the position of the scaly leaf and the following normal leaf on the runner of the present *F. daltoniana* and Japanese *F. iinumae* and to the alternate sprouting of adventitious roots on the runners of both species.

The *PH* value of K (12.2) is the smallest, which means K is the closest to the model. This is speculated to be the homogeneous and ideal environmental condition for the development of the runner in the population.

Conclusions

1. Two Nepalese *Fragaria* species were morphologically divided into two types, as shown in a previous report (SUGIMOTO et al., 1987). *Fragaria daltoniana* was of the same type as *F. iinumae*, and *F. nubicola* was of the *F. nipponica* type.
2. Although the runner type of *F. nubicola* and *F. nipponica* was the same, the changing pattern of length in the first internode and the second internode in two species was not in agreement. This phenomenon needs further investigation.
3. The change by ordering in the internode length of *F. nubicola* was explained by the law of expanding relative growth: at first the internode length increased and afterwards remained constant. On the other hand, the

changing pattern of the internode length of the runner in *F. daltoniana* fit the model showing oscillation. Probably this means that an odd-numbered internode and an even-numbered internode make a unit characterized by regular change.

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摘　要

ネパールで調査したオランダイチゴ属2種, 計11カ所のランナーについて分析した。その結果：

1. ネパール産オランダイチゴ属の2種は, 形態上から2つの型に分けられた。それらは既報の2つ

Fig. 1(left). Length of internode on a runner. Horizontal axis shows order of developing internode, numbering from the mother plant ; vertical axis shows length of internode. Each figure indicates the result from one sampling site (see Table 1 for sample codes).

の型（SUGIMOTO *et al.*, 1987）であり，*F. daltoniana* は *F. iinumae* と同じであり，*F. nubicola* は *F. nipponica* と同じであった。

2．*F. nipponica* と *F. nubicola* は同じランナー型に入るが，第一節間と第二節間の長さの変化では，一致しなかった。このことは今後の調査を必要とする。

3．節間長のオーダーによる変化は *F. nubicola* は

拡大相対成長則のモデルによくフィットしていた。つまり，最初は節間が長くなり，その後一定の値をとるような傾向がある。それに対して，*F. daltoniana* のランナーは振動していると考えたモデルに合う。このことは,奇数節と偶数節がセットになっており，規則的に変化するためと考えられる。

(Received May 1, 1989)

○　**真砂久哉氏の御逝去を悼む**（木下慶二）Keiji KINOSHITA : Obituary of the Late Mr. Hisaya MANAGO
　真砂久哉氏が平成元年5月26日に闘病の甲斐なく，享年60歳の若さで亡くなられたことは，痛惜のきわみであります。氏は林業家の長男として林業経営にたずさわるかたわら，植物ことにシダの研究に執念を燃やされました。

　温和で人をそらさないお人柄は植物を通じて広く各方面に知己を得られ,昭和50年には紀州シダの会を結成され，広く同好の士の提携・交流をはかられました。氏は全県下をくまなく踏査し，和歌山県のシダ相の解明に大きな業績を残されましたが，氏が考えておられた紀州シダ植物相の集大成を見るに至らずして他界されたことは，心残りであったことと推察いたします。また氏は大塔山の自然林の保護運動や環境庁の第一回の植生調査などにも中心的活動をされ，一方文化財保護にも関心を持たれて，田辺市の文化財審議会委員として活躍するかたわら，熊野物産初志などの復刻を成しとげられ，田辺市誌のシダ植物篇の執筆が絶筆となったということです。植物の研究に殉ぜられたような気魄を感じます。心から御冥福をお祈り申し上げます。

○　筒井貞雄　福岡県植物目録　第1号（シダ植物）　福岡植物研究会（〒833　筑後市大字山ノ井76　益村聖　方）。昭和63年4月1日発行。B5判，516頁。頒価10,000円。
　福岡植物研究会では全5巻構成の「福岡県植物目録」の完成をめざしており，第1巻(シダ植物)が昨年発行された。本書は3部からなり，第1部は標本目録で，金井方式のメッシュごとに産地名，標本番号が記載されている。このメッシュは，第3部の分布図に対応しており，優れた整理の仕方だと思う。第2部は，目録中全種の標本のシルエットである。私が特に感心したのは，各種の標本産地の列記の次にある〈ノート〉欄である。著者の豊富なフィールドワークを背景として,生育環境の簡潔な描写,近縁な分類群との関係についての考察が断然光っている。じっくり検証してみたくなる作業仮説がいっぱいで,本当に困ってしまう。　　　（綿野泰行）
　○　沼田俊三　写真と記録　青森県のラン　花と山のガイド　平成元年4月20日発行。B5判，208頁，自己出版，定価3,000円。
　自然史の研究は長い年月を要する。青森市の開業医である著者が，本業のかたわら，一種のランを撮影するのにうまくいって2～3年,たいていは5～6年も足を運び続け,昭和56年の着手以来まる8年の歳月をかけて，遂に青森県のラン73種すべての撮影に成功した。その成果を1冊に結集したのがこの本であり，前半は131枚のカラー写真による73種のランとその生育地の記録，後半は「ランの花の基礎知識」「花と山のガイド」「植物写真をはじめたい人のために」「出会いということ」などの文章構成となっている。植物写真のガイドを書かれるだけに，写真は実にすばらしく，中でも東北地方初発見のミスズラン，稀有のクシロチドリなど垂涎の的である。どこに出しても恥しくないでき映えだけに，植物名に学名のないのが惜しまれる。申し込みは〒030 青森市花園1-5-9著者あて。　　　　　（清水建美）
　○　小林禧樹　西神戸（神戸市西区及びその周辺地域）の植物　平成元年1月19日発行。B5判，141頁，自己出版。頒価1,500円＋〒260円。
　これは神戸市西区を中心とした丘陵地帯（最高標高330m），田園地帯および都市部の植物誌である。ほとんど人為環境化されたほぼ250km²の調査域の中にシダ植物78種，種子植物1,028種が記録され，アオイゴケやヒメミコシガヤやノジギクなどのほぼ東限を占める植物，アリマグミやフサタヌキモなどのほぼ西限を占める植物，ヒガンマムシグサやセンダイスゲなどの稀有の植物も確かめられた。さすがに帰化植物は多く帰化率は12.9%に上るが，都会の自然の中にも精査をすればなおいくつもの発見があることは教訓的である。申し込みは，〒673 明石市大蔵谷清水583-36著者あて。　　　（清水建美）