Mikio ONO*: **Chromosome number of *Scalesia* (Compositae), an endemic genus of the Galapagos Islands (2)****

小野幹雄*: ガラパゴス群島特産属 *Scalesia* (キク科) の染色体数**

The genus *Scalesia* is one of the endemic genera of the Galapagos Islands, and is well differentiated throughout the archipelago. According to Howell (1941), eighteen species of the genus are taxonomically grouped into four series; that is Dentatae, Pedunculatae, Foliaceae and Lobatae. All three species and their varieties of the series Pedunculatae are arboreous, being 2–10 m tall, whereas the species of the other series are all shrubby.

As for chromosome numbers, I have reported 2n=68 for two species of the genus (1967); *Scalesia affinis* and *S. pedunculata*. The former species belongs to the series Dentatae, and the latter to Pedunculatae. Recently the same chromosome number was confirmed by Eliason (1970) for several species of the genus. The species examined by him are *S. affinis*, *S. Crockeri* (Ser. Dentatae), *S. microcephala* (Ser. Pedunculatae) and *S. Hopkinsii* (Ser. Lobatae).

In the present paper I report the chromosome number of some additional species including *S. Stewartii*, of which the chromosome count is the first report of the series Foliaceae.

Material and Method All the material here dealt with germinated in Tokyo from the 'seeds' included in the mature fruiting heads, that were collected by Dr. Shuzo Itow during his stay in the Galapagos from February to June of 1970. He sent them to me as study samples. His collections are as follows: *Scalesia villosa*, Pta. Cormorant, Floreana, Mar. 26, 1970; *S. pedunculata* var. *Svensonii*, Santa Cruz, Apr. 4, 1970; *S. microcephala*, Volcan Alcedo, Isabela, Apr. 8, 1970; *S. Stewartii*, Bartholome, Mar. 30, 1970; *S. Baurii*, Pinzon (Duncan), 440 m alt., May. 14, 1970; *S. Hellerii*, Tortuga Bay, Santa Cruz, May. 3, 1970; Santa Fe (Barrington), Apr. 3, 1970; *S. incisa*, San Cristobal, Jun 3, 1970.

* Makino Herbarium, Tokyo Metropolitan University, Tokyo 158. 東京都立大学理学部牧野標本館
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All the seeds were sown in a greenhouse in Tokyo, and of these, *S. pedunculata* var. *Svensonii*, *S. microcephala*, *S. Stewartii*, *S. Baurii* and *S. incisa* germinated and were carefully cultivated.

Root-tips of the seedlings were pretreated with 0.002 M solution of 8-oxyquinoline for three hours, and fixed with 45% acetic acid for thirty minutes or more. After hydrolyzed in mixed solution of 1N-HCl and 45% acetic acid (1 : 1) of 60°C for three minutes, the material was squashed and stained with acetic orcein.

Results and Discussion

1) **Scalesia pedunculata** Hook. fil. var. **Svensonii** Howell The fruiting heads were collected in Isla Santa Cruz (Indefatigable Island), where this entity makes a climax vegetation on the higher part of the southern slope of the island. The chromosome count is 2n=68, being the same number as I previously reported.

2) **Scalesia microcephala** Robinson As naturally imagined from being belonged to the series Pedunculatae, this is a low tree of 2-4 m high with a single trunk and the rounded crown. It is an endemic species of Isla Isabela (Albemarle Island). The heads were collected on Volcan Alcedo.

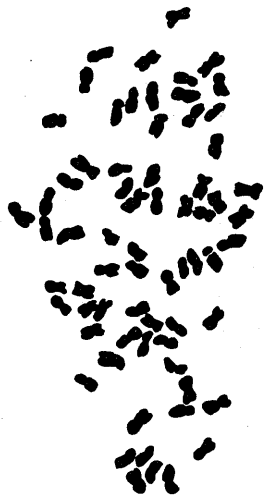

Fig. 1. Somatic chromosomes of *S. microcephala*. × ca. 1500.

Fig. 2. Somatic chromosomes of *S. Stewartii*. × ca. 1500.

The somatic chromosome number is 2n=68 and the karyotype is quite similar as that of the preceding species. Of 34 pairs of the total chromosomes, 26 pairs have a median or submedian constriction, and the other 8 pairs have a subterminal one. The karyotype formula is expressed as $K_{(n)}=34=26V+8J$. All the chromosomes are so small, the longest one being less than three μ long, and the total length of the 68 chromosomes is approximately 140–150 μ.

3) **Scalesia Stewartii** Riley Having remarkable foliaceous phyllaries, this species is referred to the series Foliaceae by Howell. It is distinct from the other species of the series by having glandular hairs on its leaves. This species, as well as the remaining two species of the series, has been reported only from Isla Santiago (James Island). Recently, however, Harling (1963) described a new variety of this species, *S. Stewartii* var. *euryphylla*, based on specimens collected from Isla Bartholome (Bartholomew Island), a small islet situated very near to Isla Santiago. The fruiting heads, from which the examined material were taken, were collected from Isla Bartholome. In my mind the heads can be identified with those of the new variety of Harling, because the outer phyllaries of the fruiting heads are actually rather broader than those of the mother species (5–7 mm wide), matching well with Harling's key-character of the new variety.

The somatic chromosome number of this entity is 2n=68, the same count as the other species of the genus. As for its karyotype, there are several features worthy to note; the chromosomes are generally as long as those of *S. affinis*, but the shortest pair of the chromosomes is only about 1 μ long, being nearly one-half of the length of the shortest chromosome of either *S. affinis* or any other species of the genus examined (Fig. 5). Total length of the 68 chromosomes are approximately 205–230 μ. Out of the 34 pairs, 26 have a median or submedian constriction, and 7 subterminal. The shortest pair is almost dot-shaped. The karyotype formula of this entity can be concluded as $K_{(n)}=34=26V+7J+1v$.

4) **Scalesia Baurii** Rob. et Greenm. The examined material is germinated from the achenes collected in Isla Pinzon (Duncan Island), a small islet located between Isla Santa Cruz and Isla Isabela. According to Howell (1941), it is interesting that the series Lobatae, to which this species and the following *S. incisa* are belonged, are characteristically restricted to

Fig. 3. Somatic chromosomes of *S. Baurii*. × ca. 1500.

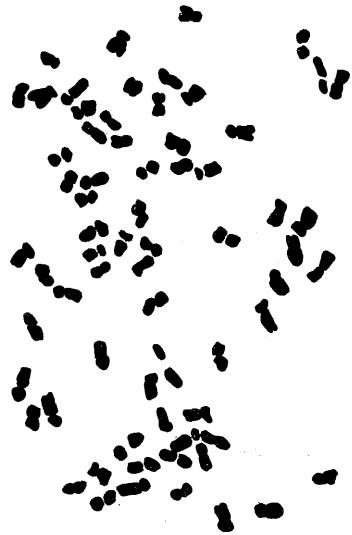

Fig. 4. Somatic chromosomes of *S. incisa*. × ca. 1500.

several small islets, showing a conspicuous endemism and diversity among themselves. *S. Baurii* has been reported only from Isla Pinzon, though there have been only a few collections. These specimens vary so much each other and Howell (1941) and Harling (1963) have casted a doubt on the demarcation of the species. The relationship between this species and the other two related species of the same island, *S. Hopkinsii* and *S. Snodgrassii*, is still uncertain, thus Harling pointed out a probability of these three entities to represent intraspecific variations. Anyhow, according to Harling, *S. Baurii* is rather common in Isla Pinzon, especially on the eastern and north-eastern sides of the island, where the material examined by me were collected. The somatic chromosome count is $2n=68$, the same number as the other species of the genus. But the chromosomes are very short and the karyotype could not be analyzed.

5) **Scalesia incisa** Hook. fil. The achenes were collected in Isla San Cristobal (Chatham Island). Belonging to the same series Lobatae as the preceding, this species was known only from the single collection of C. Darwin (1835) from the same island. According to Howell (1941), it seems to be

closely related to *S. divisa* and *S. Baurii*, whereas Hemsley (1901) suggested an affinity between this species and *S. retroflexa*. The chromosome number examined is 2n=68, and the karyotype is analyzed as $K_{(n)}=34=26V+8J$, namely, 26 pairs of the chromosomes have median or submedian constrictions and the remaining 8 have subterminal ones. The total length of the 68 chromosomes is approximately 150 μ long.

Based on the results obtained, all the species examined cytologically (Ono 1967, Eliason 1970 and Ono present paper) have the same chromosome number as 2n=68, and the karyotypes are quite similar, being $K_{(n)}=34=26V+8J$, except in case of *S. Stewartii*, of which the karyotype is shown as $K_{(n)}=34=26V+7J+1v$ (Table 1). The latter karyotype can be explained to have been introduced from the karyotype of the majority of the genus

Table 1. Somatic chromosome numbers and karyotypes of the genus *Scalesia*

species	locality	chromosome number	karyotype	author
I Dentatae				
S. affinis	Santa Cruz	2n=68	26V+8J	Ono 1967
S. affinis	Santa Cruz	2n=68	——	Eliason 1970
S. Crockeri	Santa Cruz	2n=68	——	Eliason 1970
II Pedunculatae				
S. pedunculata var. *Svensonii*	Santa Cruz	2n=68	26V+8J	Ono 1967
S. pedunculata var. *parviflora*	Floreana	2n=68	26V+8J	Ono 1967
S. microcephala	Isabela	2n=68	——	Eliason 1970
S. microcephala	Isabela	2n=68	26V+8J	Ono (present paper)
III Foliaceae				
S. Stewartii	Bartholome	2n=68	26V+7J+1v	Ono (present paper)
IV Lobatae				
S. Hopkinsii	Pinta	2n=68	——	Eliason 1970
S. Baurii	Pinzon	2n=68	——	Ono (present paper)
S. incisa	San Cristobal	2n=68	26V+8J	Ono (present paper)

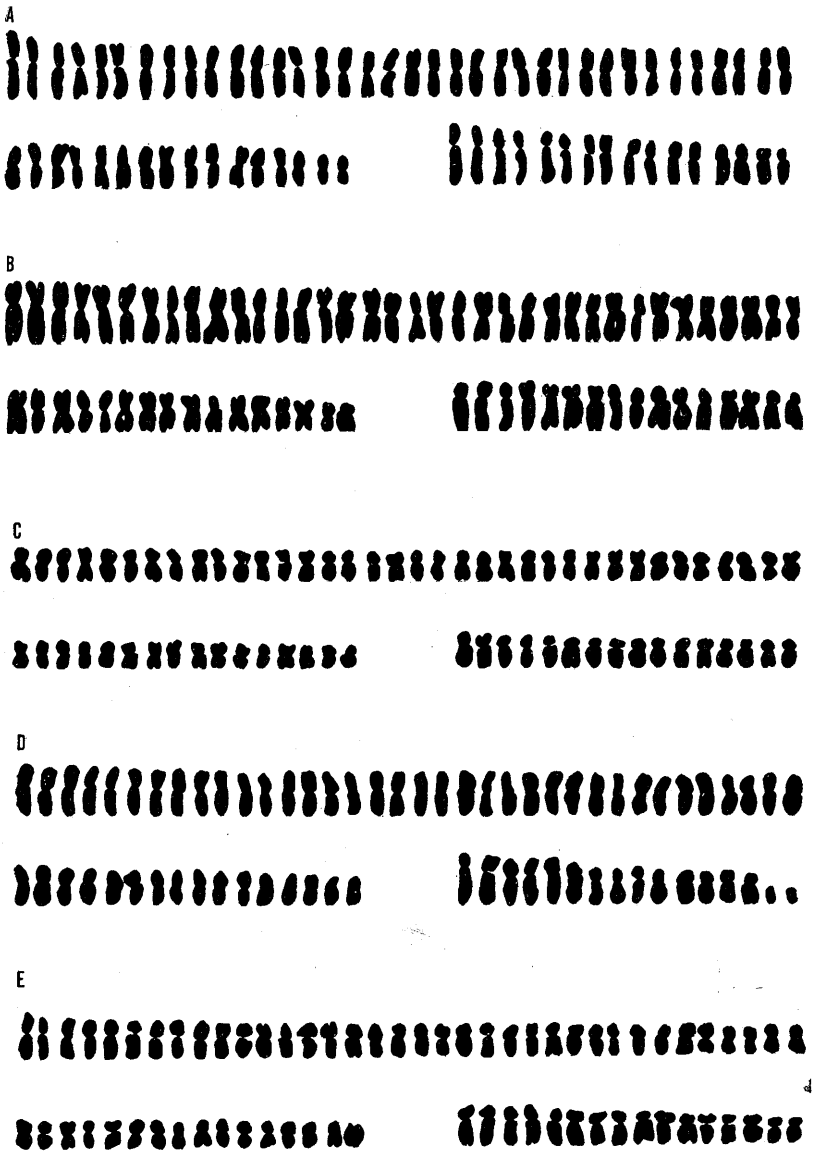

Fig. 5. Karyotypes of the species of *Scalesia*, A; *S. affinis* B; *S. pedunculata* C; *S. microcephala* D; *S. Stewartii* E; *S. incisa*.

($K_{(n)}=34=26V+8J$) by losing a part of the longer arms of one pair of the J-type chromosomes. It is noteworthy that this karyotype is found in *S. Stewartii* of the series Foliaceae, which is morphologically conspicuous by having leaf-like phyllaries on flower heads, and occupy a geographically restricted area.

Concerning the phylogenetic relationship of the genus, I have discussed in the previous papers (1967 a, 1967 b) that the genus may have a close relationship with the Central American genera, *Tithonia* and *Viguiera*, based on the basic number of chromosomes ($x=17$) along with their half-shrubby habit. As the chromosome number of the genus has been confirmed as $2n=68$ throughout the all four series of the genus (Ono 1967 and present paper, Eliason 1970), the probability of certain species of these genera to be the ancestor of the genus *Scalesia* is increased. I also expected the presence of several diploid species ($2n=34$) among the low shrubby groups of *Scalesia* such as the series Dentatae or Lobatae, as the first migrator to the islands. From these hypothetical settlers, the taller arborescent species of the series Pedunculatae might have been derived secondarily, as a result of an adaptation to the moist and thickly-wooded condition of the higher montane parts of the larger central islands of the archipelago. However, there has not been found any such diploid species. Based on this fact it is also assumed that the first ancestor of *Scalesia*, which migrated into the islands from their original habitat of the continental side, might have been tetraploid individuals ($2n=68$).

As for the length of the chromosomes, in some species (i. e. *S. affinis*, *S. pedunculata* and *S. Stewartii*) the total length of the 68 chromosomes is comparatively long, whereas in other species (i. e. *S. microcephala* and *S. incisa*) it is short (Fig. 5). But the materials examined are so few that I am hesitating to discuss on this problem. Additional data based on ample material are awaited.

Acknowledgement I wish to express my cordial thanks to Dr. Shuzo Itow of Nagasaki University who kindly made an extensive collection of fruiting heads of the genus nearly all over the islands and sent them to me for this study. My acknowledgement is also due to Dr. Fumio Maekawa, Professor Emeritus of the University of Tokyo for his valuable advices.

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1) Howell, J.T., Proc. Calif. Acad. Sci. Ser. 4, **22**: 222 (1941). 2) Ono, M., Journ. Jap. Bot. **42**: 353 (1967 a). 3) Eliason, U., Botaniska Notiser. **123**: 149 (1970). 4) Harling, G., Acta Horti Berg. **20**: 63 (1963). 5) Hemsley, W.B., in Hooker's Icones Plantarum, (4), vol. **8**: pl. 2715 (1901). 6) Ono, M., Noticias Galapagos **9-10**: 16 (1967 b). 7) Ono, M., Biol. Sci. (Iwanami Publ. Co. Tokyo) **22**: 1 (1970) (in Japanese).

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ガラパゴス群島特産のキク科木本であるスカレシア属 *Scalesia* 5 種について染色体数を確認した。この属の染色体数に関しては，既に小野 (1967), Eliason (1970) により 2n=68 が報告されているが，今回の結果を加えて同属の 4 つの系 (series) 全部にわたってこの数が確認された。染色体は比較的小さく，形態的に明らかな特徴は認め難いが，核型をほぼ確認したものについては，$K_{(n)}=34=26V+8J$ で，中央部付近に狭搾をもつもの 26 対と，次端部にもつもの 8 対が認められた。ただし 1 種 *S. Stewartii* では最小の 1 対が中央部に狭搾のある小さな染色体でその核型は $K_{(n)}=34=26V+7J+1v$ と表示できる。この種が特徴ある葉状の総苞片をもつ Ser. Foliaceae に属し，サンチャゴ島とその付属小島にだけ生育する，ごく限られた分布の種である点は興味深い。この核型は，他の系の種に共通に見られる核型の，J 染色体（次端部狭搾）の 1 対が，その長腕の一部を失うことによって派生したとの推測も可能である。スカレシア属の系統に関しては，染色体基本数 (x=17) の比較から，中米産の半低木性キク科である *Tithonia* や *Viguiera* 属との関係を前に指摘したが，今回の観察結果はこれを補強した。また群島内で分化したこの属の全部の系について，同じ染色体数 (2n=68, 4 倍体) が認められたことは，この属のガラパゴス群島への移住と定着が，この倍数性の成立に負うところ大きく，恐らくはそれ以前に大陸において，4 倍体の成立が先行していたことを推測させる。

○初島氏のグミバナスについて (久内清孝) Kiyotaka Hisauchi: On the new Japanese name given by Dr. Hatsushima for *Solanum elaeagnifolium* Cav.

初島住彦博士の新著琉球植物誌 (1971) で同氏は *Solanum elaeagnifolium* Cav. にグミバナスなる新和名を提唱されたが，これは，佐野純雄氏が本誌 26 巻 (1951) p. 139 で用いられたラシャナスなる先行名称と重復する。初島氏の標本は見ていないが，佐野氏の当時の標本は東大資料館に蔵されている。 (東邦大学薬学部)