Chromosome Numbers of Some Alpine Species of
Saussurea (Asteraceae) in Nepal Himalaya

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Chromosome numbers of nine species of Saussurea collected in the alpine region in Khumbu Himal, Nepal, are reported. Two different chromosome numbers are counted in Saussurea gossypiphora and its allied species in section Eriocoryne (subgenus Eriocoryne), i.e., 2n = 36 from S. gossypiphora, S. nishiokae and S. tridactyla, and 2n = 32 from S. simpsoniana and S. topkegolensis. The number of S. gossypiphora is different from the previous study (n = 13). Saussurea graminifolia in section Pycnocephala (subgenus Saussurea) is 2n = 32. In section Amphiraena (subgenus Amphiraena) chromosome numbers of two species, S. obvallata and S. uniflora, are 2n = 32, while that of S. hookeri is 2n = 36. The chromosome numbers of S. nishiokae, S. tridactyla, S. topkegolensis, S. graminifolia S. uniflora and S. hookeri are recorded for the first time.

Key words: chromosome number, Himalaya, alpine plant, Saussurea

Saussurea is one of the large genera of Asteraceae consisting of about 400 species classified into six subgenera (Lipschitz 1979). The species belonging to subgenus Eriocoryne, distributed in Central Asia and the Sino-Himalayan region, are characterized by the peculiar synflorescence (syncephalum). Some species have a peculiar form named snowball plant (Ohba 1988) in which synflorescence is concealed by leaves with dense long white soft hairs, and Saussurea gossypiphora D.Don is a representative. Saussurea graminifolia Wall. ex Benth. belonging to section Pycnocephala (subgenus Saussurea) also takes snowball form. Saussurea obvallata (DC.) Edgew. and S. uniflora Wall. ex Seh.Bip. (subgenus Amphiraena, sect. Amphiraena) are also peculiar in having synflorescence covered with large translucent cauline leaves, and representatives of green-house plant (Ohba 1988, Ohba and Akiyama 1998). The present paper aims to provide the chromosome number of these six species of snowball and two species of green-house Saussurea as well as S. hookeri C.B.Clarke (subgenus Amphiraena, section Amphiraena) providing data for cytological diversity of the alpine plant in the Himalaya.

Materials and Methods

The first author, Amano collected ten samples belonging to nine species of Saussurea from several localities in Khumbu Himal, East Nepal, in 1995 (Table 1). In each sample apices of vegetative shoots were fixed with Newcomer fluid after pretreatment by 0.1% colchicine solution about 3 hrs. The materials macerated by 1% cellulase solution for 20 min. at 37°C after

---178---
soaking 1 hr. in water, and then stained by 1 % lacto-propionic orcein. Voucher specimens are deposited in TI.

Results and Discussion

Chromosome numbers were counted for nine species. Figures 1 and 2 show chromosomes of the snowball Saussurea; five species in section Eriocoryne and S. graminifolia in section Pycnocephala. In section Eriocoryne Saussurea gossypiphora (Figs. 1a, b), S. nishiokae Kitam. (Figs. 1c, d), and S. tridactyla Sch.Bip. ex Hook.f. (Figs. 1e, f) had 2n=36, while S. simpsoniana (Field. & Gardner) Lipsch. (Figs. 2a, b) and S. topkegolensis H.Ohba & S.Akiyama (Figs. 2c, d) had 2n=32. Except for S. gossypiphora and S. simpsoniana, their chromosome numbers are reported for the first time. The chromosome number of S. graminifolia was 2n=32 (Figs. 2e, f).

The chromosome number of S. gossypiphora was reported as n=13 by Malla et al. (1979). This number is different from our observation (2n=36). The chromosome number n= c.16 was reported by Shetty (1967) under the name of S. sacra Edgew. The species was considered to be conspecific with S. simpsoniana by Lipschitz (1979). This number is consistent with our observation (2n=32) of S. simpsoniana.

Two different chromosome numbers 2n=32 and 36 are found in section Eriocoryne in the present study. It become clear that the snowball formed Saussurea in section Eriocoryne are diversified cytologically and also suggests that Saussurea topkegolensis, which was considered to be close to S. gossypiphora, is also needed to compare with S. simpsoniana for phylogenetic consideration. The chromosome number 2n=32 of S. graminifolia is the first record from section Pycnocephala in which 2n=26, 36 and 52 were recorded previously.
The chromosome numbers of three species of section Amphiraena were counted (Fig. 3). Two green-house formed species, *Saussurea obvallata* (Figs. 3a, b) and *S. uniflora* (Figs. 3c, d) had 2n = 32, while *S. hookeri* with exposed synflorescence had 2n = 36 (Figs. 3e, f).

Two different chromosome numbers
Fig. 2. Chromosomes of Saussurea subgenera Eriocoryne and Saussurea. a, b: *S. simpsoniana* (2n = 32), c, d: *S. topkegolensis* (2n = 32), e, f: *S. graminifolia* (2n = 32). Bar indicates 10 μm.
Fig. 3. Chromosomes of Saussurea subgenus Amphiraena. a, b: S. obvallata (2n=32), c, d: S. uniflora (2n=32), e, f: S. hookeri (2n=36). Bar indicates 10 μm.

2n=32 and 36 are also found in the species of section Amphiraena. In S. obvallata n=c.16 was reported by Shetty (1967), n=16 by Gupta and Gill (1988, 1989) and Gupta et al. (1989). The chromosome numbers S. uniflora and S. hookeri are reported for the
first time. Section Amphiraena extends from Himalaya to Central Asia and Siberia. The chromosome numbers were reported from some other greenhouse formed species in section Amphiraena. *Saussurea involcrata* (Kar. & Kir.) Sch.Bip. was reported to be 2n = 32 by Ma et al. (1984). Chromosome number of *Saussurea orgaadayi* V.Khan. & Krasnob. distributed in the Altai Mountains was reported to have 2n = 32 and/or 32 + 1B under the name of *S. involcrata* by Krasnobilov et al. (1983), Rostovtzeva (1983) and Krasnikeva et al. (1984). The chromosome number, 2n = 36, was reported from *S. dorogostaiskyi* Krasnob. distributed in West Sayan Mountains by Krasnobilov et al. (1983), Rostovtzeva (1983) and Krogulevich and Rostovtzeva (1984). *Saussurea bracteata* Decne. from west Himalaya was reported to be n = 16 by Jee et al. (1989), and the number is the same as *S. uniflora* (the present study). It is noted that two different chromosome numbers, 2n = 32 and 36, are found in greenhouse formed species in section Amphiraena.

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References
来の報告（n=13）と異なる。Pycnocephala 節の Saussurea graminifolia の染色体数は 2n=32 であった。Amphilaena 節の染色体数は、S. obvallata、S. uniflora ともに 2n=32 であり、Saussurea obvallata の染色体数は従来の報告と一致した。同じ節の S. hookeri の染色体数はこれと異なり、2n=36 であった。

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