

Chromosome numbers in *Rubus* (Rosaceae) of Taiwan

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Abstract. Taiwan is rich in species of *Rubus* (Rosaceae), with 37 species known from an island of only 36,000 km². *Rubus* is classified into 12 subgenera worldwide, of which subgenera *Chamaebatus* (1 species), *Malachobatus* (16 species) and *Idaeobatus* (20 species) occur in Taiwan. In this paper, we document the chromosome numbers of all 37 species of *Rubus* in Taiwan and cite vouchers for all of them. First counts are here reported for 19 of the 37 species. Based on $x = 7$, *Chamaebatus* is hexaploid; *Malachobatus* consists of tetraploids, hexaploids and octoploids; and *Idaeobatus* is uniformly diploid in Taiwan. Our results indicate that all 20 species of subgenus *Idaeobatus* in Taiwan have speciated at the diploid level, while the five species of section *Sozostili* in subgenus *Malachobatus* have speciated at the tetraploid level.

Keywords: Chromosome number; Polyploidy; Rosaceae; *Rubus*; Taiwan.

Introduction

The genus *Rubus* consists of about 250 sexual species and innumerable apomictic taxa (Mabberley, 1997). Focke (1910, 1911, 1914) classified the world's *Rubus* into 12 subgenera: *Chamaemorus* (Focke) Focke, *Cylactis* (Focke) Focke, *Dalibarda* (Focke) Focke, *Chamaebatus* Focke, *Comaropsis* Focke, *Orobatus* Focke, *Dalibardastrum* Focke, *Malachobatus* (Focke) Focke, *Anoplobatus* Focke, *Idaeobatus* (Focke) Focke, *Lampobatus* Focke and *Rubus* (*Eubatus* Focke). *Rubus* is richly represented in Taiwan, an island of ca. 36,000 km², with 37 species in 3 subgenera: subgen. *Chamaebatus*, 1 sp. (*R. pectinellus* Maxim.); subgen. *Malachobatus*, 16 spp. (*R. buergeri* Miq., *R. formosensis* Kuntze, *R. hayata-koidzumii* Naruh., *R. hui* Diels, *R. kawakamii* Hayata, *R. laciniatostipulatus* Hayata ex Koidz., *R. lambertianus* Ser., *R. liui* Yuen P. Yang et S. Y. Lu, *R. morii* Hayata, *R. nagasawanus* Koidz., *R. pyriformis* Sm., *R. pseudobuergeri* Sasaki, *R. rolfei* S. Vidal., *R. rufus* Focke, *R. swinhoei* Hance, *R. tephrodes* Hance); and subgen. *Idaeobatus*, 20 spp. (*R. cardotii* Koidz., *R. corchorifolius* L. f., *R. croceacanthus* H. Lév., *R. fraxinifolius* Poir., *R. glandulosopunctatus* Hayata, *R. incanus* Sasaki, *R. inopertus* Focke, *R. linearifoliolatus* Hayata, *R. mesogaeus* Focke, *R. parviaraliifolius* Hayata, *R. parvifolius* L., *R. pinfaensis* H. Lév., et Vaniot, *R. ptiopetalus* Hayata ex Koidz., *R. pungens* Cambess., *R. rubroangustifolius* Sasaki, *R. subcrataegifolius* (H. Lév. et Vaniot) H. Lév. et Vaniot, *R. sumatranus* Miq., *R. tagallus* Cham. et Schltdl., *R. taiitoensis* Hayata, *R. taiwanicolus* Koidz.).

Taiwan undoubtedly has one of the richest assemblages of *Rubus* in the world. The species richness of *Rubus* in Taiwan is readily seen in the fact that Japan harbors only 36 species of *Rubus*, yet is about ten times larger than Taiwan. Fourteen of the 37 species of *Rubus* in Taiwan are endemic (38%). Of the rest, 10 (27%) also occur in Japan, 19 (51%) are also found on mainland China, and 8 (22%) are also found in the Philippines.

Floristic studies of *Rubus* in Taiwan have been undertaken by Liu and Yang (1969), Ying (1985), Hsieh and Ohashi (1993), and Lu and Ou (1994), yet many taxonomic problems remain for this difficult genus. Cytological information often leads to a better understanding of difficult plant groups. We therefore carried out a cytological survey of all 37 species of *Rubus* in Taiwan, excluding only the doubtful and ambiguous taxa.

Materials and Methods

Plants of the 37 species of *Rubus* used in this study were grown from seeds collected from 47 localities in Taiwan. All the living specimens grown from seeds are conserved in the experimental garden of Toyama University. Voucher specimens (Table 1) made from original populations are deposited at HAST. To observe the chromosomes, root tips collected from potted plants were pretreated in a 2 mM 8-hydroxyquinoline solution for one hr at room temperature and subsequently held at 5°C for 15 hr. The root tips were then fixed in a mixture of glacial acetic acid and absolute ethyl alcohol (1 : 3) for one hr, soaked in 1N HCl for a few hours, macerated in 1N HCl at 60°C for 11.5 min, and then immersed in tap water. Meristematic cells were stained in 1.5% lacto-propionic orcein, and the usual squashing method was applied for the examination of somatic chromosomes in the root tip cells.

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Table 1. Vouchers of Taiwanese *Rubus* species subjected to cytological studies.

Species	Collection locality	Collection number
<i>R. buergeri</i>	Taipei Hsien: Sanhsia, on the way from Manyuehyuan Forest Resort to Peichatienshan, 1,300 m	Ching-I Peng 17160
<i>R. cardotii</i> *	Taipei City: Yangmingshan National Park, Chihshingshan hiking trail, ca. 550 m	Jr-Jen Chen 450
<i>R. corchorifolius</i>	Hsinchu Hsien: Wufeng Hsiang, on the way to Kuanwu, ca. 1,450 m	Lu-Jane Juan 9
<i>R. croceacanthus</i>	Nantou Hsien: Jenai Hsiang, Pilu Forest Road, ca. 2,500 m	Jr-Jen Chen 411
<i>R. formosensis</i>	Kaohsiung Hsien: Taoyuan Hsiang, Tienchi, ca. 2,300 m	Chia-Hua Lin 429
	Nantou Hsien: Jenai Hsiang, Meifeng, ca. 2,100 m	Ching-I Peng 16967
	Kaohsiung Hsien: Taoyuan Hsiang, between Lanya Bridge and Likuan, ca. 1,500 m	Chia-Hua Lin 401
<i>R. fraxinifolius</i>	Hualien Hsien: Hsiulin Hsiang, Hoping Forest Road, ca. 820 m	Shu-Mei Liu 370
	Taipei Hsien: Wulai Hsiang, Hsiaoyi, 280 m	Kuo-Fang Chung 1466
<i>R. glandulosopunctatus</i> *	Hsinchu Hsien: Wufeng Hsiang, Kuanwu, along Talu Forest Road, ca. 2,000 m	Lu-Jane Juan 13
<i>R. hayata-koidzumii</i>	Hualien Hsien: along trail from Tienchi to Nanhutashan, 2,840 m	Susan Kelley 225-98
	Nantou Hsien: Jenai Hsiang, Tsueifeng, 2,700 m	Bruce Wang 602
<i>R. hui</i>	Taipei Hsien: Hsichih City, Hsiwan Road, ca. 550 m	Jr-Jen Chen 446
	Taipei Hsien: Wulai Hsiang, Tatungshan, ca. 850 m	Ching-I Peng 17998
<i>R. incanus</i> *	Taichung Hsien: Hoping Hsiang, Forest Road 730, 2,425 m	Susan Kelley 116-98
	Nantou Hsien: Jenai Hsiang, just past Tayuling, Rt. 14A, 2,700 m	Susan Kelley 136-98
	Nantou Hsien: Jenai Hsiang, along trail from Yunhai to Tienchi, 2,500 m	Susan Kelley 197-98
<i>R. inopertus</i>	Nantou Hsien: Jenai Hsiang, Juiyenhsi Forest Reserve, ca. 2,150 m	Jr-Jen Chen 420
<i>R. kawakamii</i> *	Taichung Hsien: Hoping Hsiang, 2,300 m alt.	Susan Kelley 110-98
	Kaohsiung Hsien: Taoyuan Hsiang, between Likuan and Tienchi, ca. 1,750 m	Chia-Hua Lin 409
<i>R. laciniatostipulatus</i> *	Nantou Hsien: Puli, Liyutan, ca. 550 m	Jr-Jen Chen 438
<i>R. lambertianus</i>	Nantou Hsien: Hsini Hsiang, Luona village, 1,600 m	Ching-I Peng 16995
<i>R. linearifoliolatus</i> *	Ilan Hsien: Chiaohsi Hsiang, Szuchi, ca. 820 m	Ya-Yi Huang 380
<i>R. liui</i> *	Ilan Hsien: Tatung Hsiang, Yuanyang Lake Nature Reserve, ca. 1,670 m	Ching-I Peng 17423
<i>R. mesogaesus</i>	Nantou Hsien: Jenai Hsiang, Juiyenhsi Forest Reserve, ca. 2,150 m	Jr-Jen Chen 426
<i>R. morii</i> *	Nantou Hsien: Jenai Hsiang, Tayuling, ca. 2,350 m	Jr-Jen Chen 417
<i>R. nagasawanus</i> *	Ilan Hsien: Yuanshan Hsiang, Hsiatsukung, ca. 40 m	Jr-Jen Chen 451
<i>R. parvialiiifolius</i> *	Hsinchu Hsien: Wufeng Hsiang, along Hsien Road 122, ca. 600 m	Lu-Jane Juan 2
<i>R. parvifolius</i>	Taichung City: Campus of Tunghai University, ca. 150 m	Ya-Yi Huang 156
<i>R. pectinellus</i>	Nantou Hsien: Luku Hsiang, Hsitou Forest Recreation Area, Fenghuangshan, ca. 1,760 m	Yui-Ching Kao 27
<i>R. pinfaensis</i>	Hualien Hsien: Hsiulin Hsiang, Chingshuishan, 1,150 m	Jr-Jen Chen 596
<i>R. piptopetalus</i>	Nantou Hsien: Luku Hsiang, Hsitou Forest Recreation Area, ca. 1,100 m	Ching-I Peng 16788
	Taichung Hsien: Hoping Hsiang, on Tahsuehshan ("Hsuehshan") Forest Road, 1,850 m	Shu-Hui Wu 1274
<i>R. pseudobuergeri</i> *	Hsinchu Hsien: Chienshih Hsiang, Yuanyang Lake Nature Reserve, Chilan, ca. 1,600 m	Jr-Jen Chen 391
<i>R. pungens</i>	Hualien Hsien: Hsiulin Hsiang, Hohuanshan, ca. 2,900 m	Jr-Jen Chen 418
<i>R. pyrifolius</i>	Nantou Hsien: Yuchih Hsiang, Lienhuachih Station, Taiwan Forestry Research Institute, ca. 660 m	Jr-Jen Chen 442
<i>R. rolfei</i>	Chiayi Hsien: Alishan Hsiang, Yushan National Park, Tatachia Saddle to Paiyuan Lodge, ca. 2,850 m	Jr-Jen Chen 671
<i>R. rubroangustifolius</i> *	Nantou Hsien: Jenai Hsiang, Juiyenhsi Forest Reserve, ca. 2,150 m	Jr-Jen Chen 422
<i>R. rufus</i>	Taipei Hsien: Hsichih City, Hsiwan Road, ca. 500 m	Jr-Jen Chen 445
<i>R. subcrataegifolius</i>	Hsinchu Hsien: Wufeng Hsiang, Kuanwu, along Talu Forest Road, ca. 2,000 m	Lu-Jane Juan 12
<i>R. sumatranus</i>	Nantou Hsien: Yuchih Hsiang, Lienhuachih, ca. 650 m	Jr-Jen Chen 440
<i>R. swinhoei</i>	Taipei City, Yangmingshan, 800 m alt.	Ching-I Peng 16904
<i>R. tagallus</i>	Ilan Hsien: Tsaoling Ancient Trail, ca. 150 m	Ching-I Peng 16945
<i>R. taitoensis</i> *	Kaohsiung Hsien: Taoyuan Hsiang, Tienchi, ca. 2,300 m	Chia-Hua Lin 430
<i>R. taiwanicolus</i> *	Taichung Hsien: Jenai Hsiang, just past Tayuling, Rt. 14A, 2,600 m	Susan Kelley 133-98
	Taitung Hsien: Haituan Hsiang, Hsiangyang, ca. 2,300 m	Chia-Hua Lin 456
<i>R. tephrodes</i>	Ilan Hsien: Chiaohsi Hsiang, Szuyuanyakou, at entrance of Forest Road 720, ca. 1,900 m	Ya-Yi Huang 383

*Endemic species in Taiwan.

Results and Discussion

Chromosome counts of *Rubus* in Taiwan examined in this study are as follows: $2n = 14$ in *R. cardotii*, *R. corchorifolius*, *R. croceacanthus*, *R. fraxinifolius*, *R. glandulosopunctatus*, *R. incanus*, *R. inopertus*, *R. linearifoliolatus*, *R. mesogaeus*, *R. parviaraliifolius*, *R. parvifolius*, *R. pinfaensis*, *R. piptopetalus*, *R. pungens*, *R. rubroangustifolius*, *R. subcrataegifolius*, *R. sumatranus*, *R. tagallus*, *R. taitoensis* and *R. taiwanicolus*; $2n = 28$ in *R. formosensis*, *R. hayata-koidzumii*, *R. kawakamii*, *R. lambertianus*, *R. liui*, *R. morii*, *R. nagasawanus*, *R. rufus*, *R. swinhoei* and *R. tephrodes*; $2n = 42$ in *R. hui*, *R. laciniatostipulatus*, *R. pectinellus*, *R. pyrifolius* and *R. rolfei*; $2n = 56$ in *R. buergeri* and *R. pseudobuergeri* (Table 2; Figures 1–37). *Rubus* is believed to have a base number of $x = 7$ (Darlington and Wylie, 1955; Fedorov, 1969). Our data are consistent with that hypothesis. On this basis, the species of Taiwan include diploids, tetraploids, hexaploids and octoploids.

As shown in Table 2, chromosome counts are reported here for the first time for 19 species: *R. cardotii*, *R. glandulosopunctatus*, *R. hui*, *R. incanus*, *R. kawakamii*, *R. laciniatostipulatus*, *R. linearifoliolatus*, *R. liui*, *R. nagasawanus*, *R. parviaraliifolius*, *R. piptopetalus*, *R. pseudobuergeri*, *R. pyrifolius*, *R. rolfei*, *R. rubroangustifolius*, *R. rufus*, *R. tagallus*, *R. taitoensis* and *R. taiwanicolus*. Our chromosome counts for the rest of the Taiwanese species substantiate previous reports. The count of $2n = 28$ in *R. formosensis* agrees with a previous report by Thompson and Zhao (1993), who studied the plant deposited at the National Clonal Germplasm Repository, USA. The count of $2n = 28$ in *R. morii*, corresponds to the meiotic chromosome report of Hsu (1968). A count of $2n = 28$ in *R. tephrodes* agrees with the count for a plant from Hortus Academia Sinica, Peking (Vaarama, 1954); $2n = 14$ in *R. inopertus* coincides with counts by Vaarama (1954), Britten and Hull (1957) and Thompson and Zhao (1993); $2n = 14$ in *R. fraxinifolius* and *R. pinfaensis* and $2n = 28$ in *R. swinhoei* are consistent with the reports of Thompson (1995) for the same species, collected in Guizhou; $2n = 28$ in *R. hayata-koidzumii* agrees with the count reported by Iwatsubo and Naruhashi (1993) for a plant growing in the Botanic Garden at the University of British Columbia, Canada. Our counts of other species – *R. buergeri* ($2n = 56$), *R. corchorifolius* ($2n = 14$), *R. croceacanthus* ($2n = 14$), *R. lambertianus* ($2n = 28$), *R. mesogaeus* ($2n = 14$), *R. pectinellus* ($2n = 42$), *R. pungens* ($2n = 14$), *R. subcrataegifolius* ($2n = 14$) and *R. sumatranus* ($2n = 14$) – all are in accordance with counts reported for plants of the same species collected in Japan (Jinno, 1951a, b, 1958a,b; Iwatsubo and Naruhashi, 1992, 1993).

Many of the first chromosome counts are the same as those observed in close relatives. The chromosome count of $2n = 28$ reported here for *R. kawakamii* (endemic to Taiwan) is the same as that reported for *R. swinhoei* of mainland China, Taiwan and the Ryukyus, as these two species are morphologically very similar. Similarly, *Rubus nagasawanus*, also endemic to Taiwan, has the same chro-

mosome number ($2n = 28$) as *R. tephroides*; the two were treated as synonymous by Liu and Yang (1969) and Ying (1985). Again, *R. hui* and *R. reflexus* have the same chromosome number ($2n = 42$). *Rubus hui* was thought to be a variety of *R. reflexus* (Metcalf, 1932; Yu and Lu, 1985; Zhang, 1985) from mainland China. However, we agree with Liu and Yang (1969), Yang (1982), Ying (1985), Hsieh and Ohashi (1993), and Lu and Ou (1994), who treated them as distinct. *Rubus pseudobuergeri*, with $2n = 56$, is morphologically very similar to both *R. buergeri* ($2n = 56$) in Taiwan and to *R. hakonensis* ($2n = 56$) in Japan. *Rubus taitoensis*, a diploid with $2n = 14$, is morphologically similar to *R. palmatus* ($2n = 14$), *R. grayanus* ($2n = 14$) and *R. ribisoideus* ($2n = 14$) from Japan. In morphology, the Taiwanese *R. incanus* and *R. parviaraliifolius* (subgen. *Idaeobatus*, sect. *Thyrsidae*), both diploid with $2n = 14$, resemble the mainland Chinese diploids *R. innominatus* and *R. adenophorus* respectively.

Rubus in Taiwan is represented by three of the 12 recognized subgenera: *Chamaebatus*, *Malachobatus* and *Idaeobatus*. Species of *Chamaebatus* are known to be diploid (1 sp. in North America) and hexaploid (2 spp. in Asia). Our count of $2n = 42$ for the Taiwanese *R. pectinellus* agrees with the hexaploid reports for the mainland Chinese and Japanese species.

As summarized by Thompson (1997), all species of subgenus *Malachobatus* are polyploid ($4x$, $6x$, $8x$, and $14x$), except for certain previous ambiguous counts. Taiwanese plants of the subgenus were also $4x$, $6x$, and $8x$. Section *Sozostili* of subgen. *Malachobatus* is vine-like in habit. All five Taiwanese members of this section have $2n = 28$ chromosomes, which suggests that they speciated at the tetraploid level.

Our study shows that all ten species of *Rubus* subgen. *Idaeobatus* sect. *Rosifolii* ('*Rosifolius* group' in Taiwan, characterized by raspberry type fruits, pinnate leaves, a stalked receptacle and inflorescences with one to a few large flowers), including *R. cardotii*, *R. croceacanthus*, *R. fraxinifolius*, *R. glandulosopunctatus*, *R. linearifoliolatus*, *R. piptopetalus*, *R. rubroangustifolius*, *R. sumatranus*, *R. tagallus* and *R. taiwanicolus*, are consistently diploid. Members of the Japanese *Rosifolius* group for which chromosome numbers are known (*R. commersonii*, *R. croceacanthus*, *R. hirsutus*, *R. illecebrosus*, *R. minusculus*, *R. okinawaensis*, *R. sumatranus*) are also all diploid (Longley, 1924; Longley and Darrow, 1924; Iwatsubo and Naruhashi, 1992, 1993, 1996; Naruhashi and Iwatsubo, 1993), indicating that polyploidization may not have occurred in the *Rosifolius* group in eastern Asia.

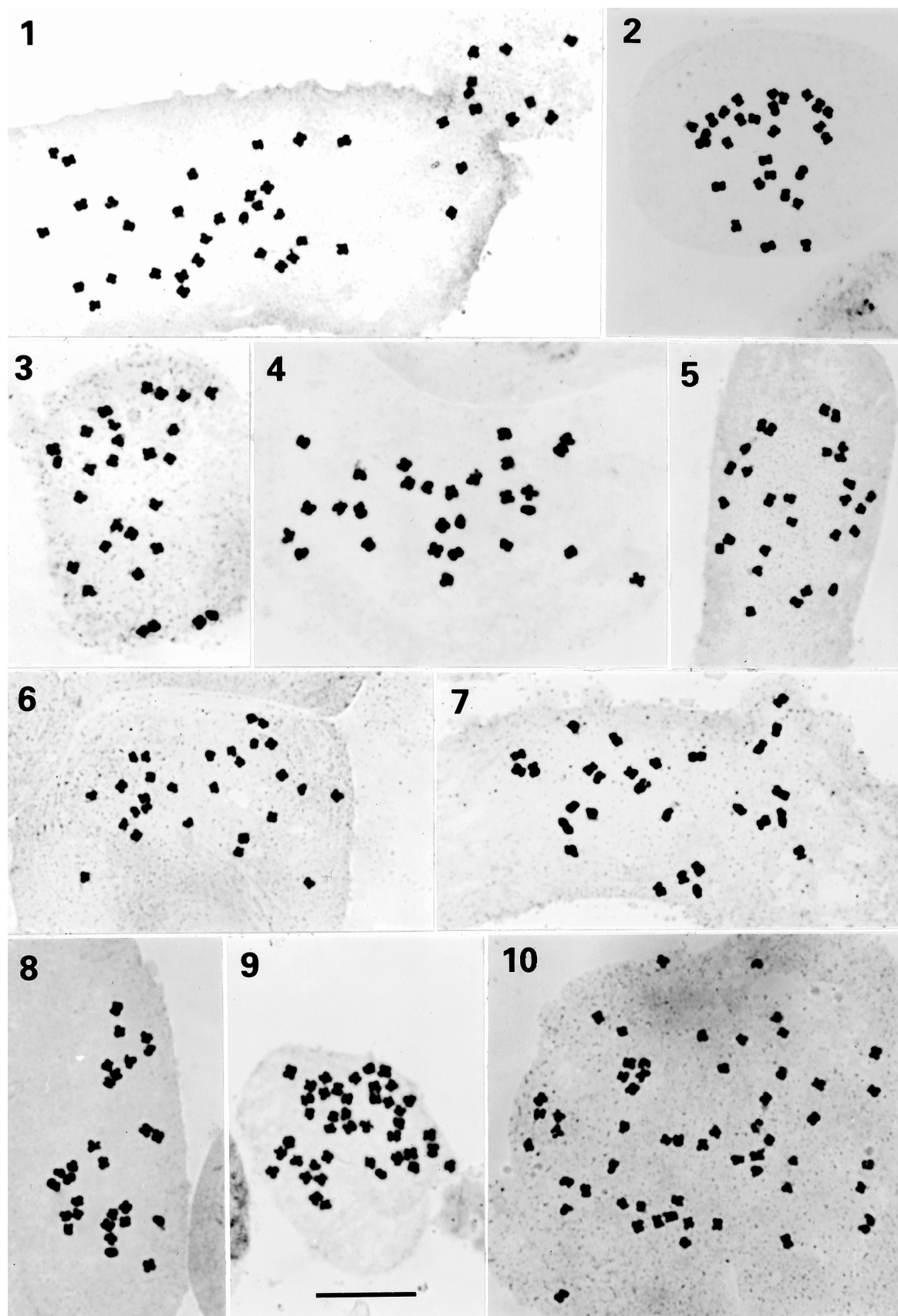
Despite the fact that plants in subgenus *Idaeobatus* are the most variable among the twelve subgenera of *Rubus*, speciation has been mainly at the diploid level (triploids and tetraploids being exceptional). Our studies of all 20 species of subgenus *Idaeobatus* in Taiwan revealed $2n = 14$, which substantiated other cytological reports.

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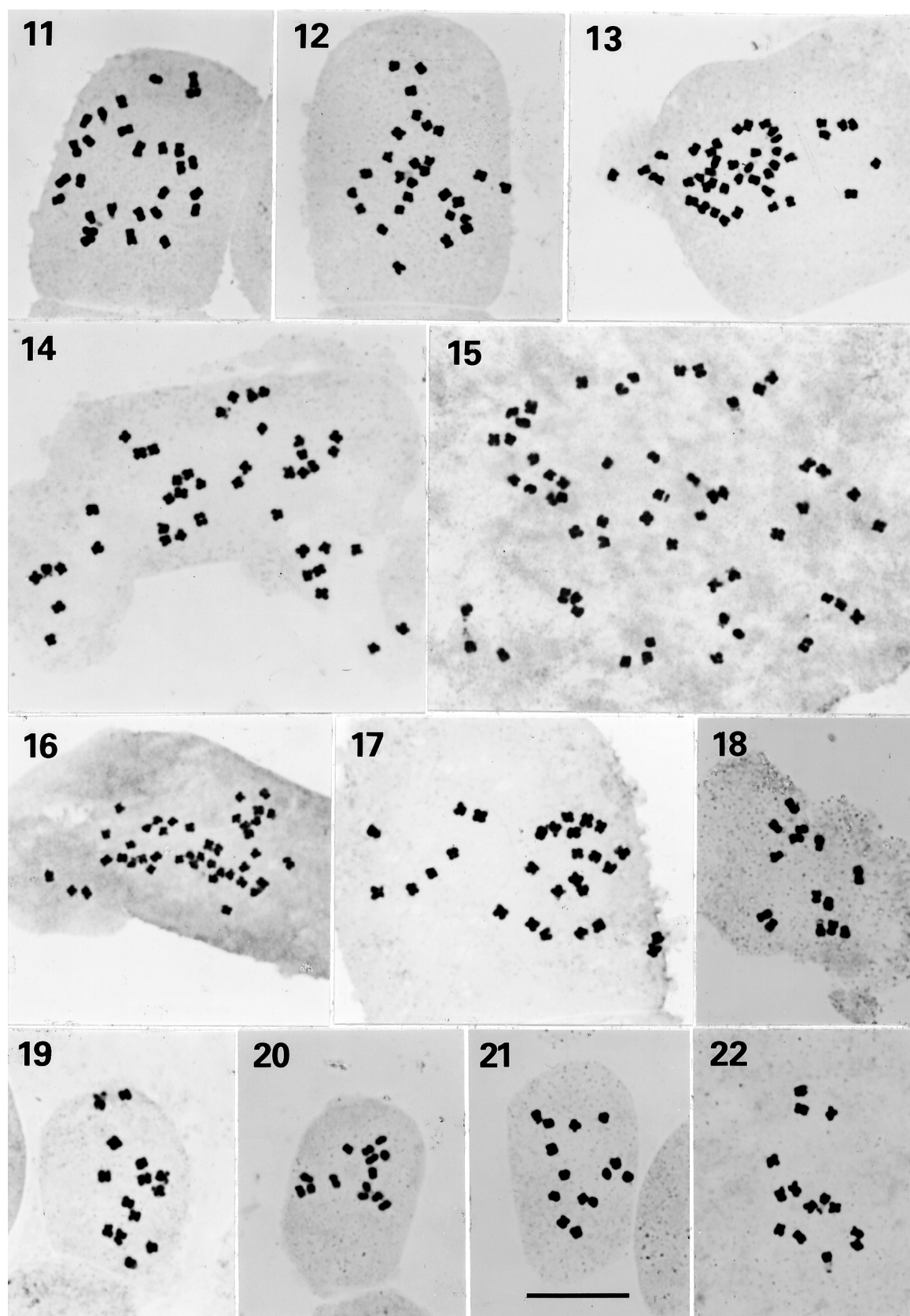
Table 2. Chromosome numbers in *Rubus* of Taiwan.

Species	Present count (2n)	Previous count		References	Figure
		(n)	(2n)		
Subgen. CHAMAEBATUS					
<i>R. pectinellus</i>	42		42	Jinno (1951a, 1958a,b); Iwatsubo and Naruhashi (1993)	1
Subgen. MALACHOBATUS					
Sect. Sozostyli					
<i>R. kawakamii</i>	28*				2
<i>R. lambertianus</i>	28		28	Iwatsubo and Naruhashi (1992)	3
<i>R. liui</i>	28*				4
<i>R. morii</i>	28	14		Hsu (1968)	5
<i>R. swinhoei</i>	28		28	Thompson (1995)	6
Sect. Elongati					
<i>R. nagasawanus</i>	28*				7
<i>R. tephrodes</i>	28		28	Vaarama (1954)	8
Sect. Pyrifolii					
<i>R. pyrifolius</i>	42*				9
Sect. Moluccani					
<i>R. buergeri</i>	56		42	Naruhashi et al. (1998)	10
			56	Jinno (1951a,b, 1958a); Naruhashi et al. (1998)	
<i>R. formosensis</i>	28		28	Thompson and Zhao (1993)	11
<i>R. hayata-koidzumii</i>	28		28	Iwatsubo and Naruhashi (1993); Thompson and Zhao (1993)	12
<i>R. hui</i>	42*				13
<i>R. laciniatostipulatus</i>	42*				14
<i>R. pseudobuergeri</i>	56*				15
<i>R. rolfei</i>	42*				16
<i>R. rufus</i>	28*				17
Subgen. IDAEOBATUS					
Sect. Corchorifolii					
<i>R. corchorifolius</i>	14		14	Iwatsubo and Naruhashi (1993)	18
		7		Naruhashi et al. (1994)	
<i>R. subcrataegifolius</i>	14		14	Jinno (1958a, as <i>R. koehnneanus</i>); Naruhashi and Iwatsubo (1993); Thompson and Zhao (1993, as <i>R. trianthus</i>); Thompson (1995, as <i>R. microphyllus</i> var. <i>subcrataegifolius</i>)	19
<i>R. taitoensis</i>	14*				20
Sect. Rosifolii					
<i>R. cardotii</i>	14*				21
<i>R. croceacanthus</i>	14		14	Iwatsubo and Naruhashi (1992, 1996)	22
<i>R. fraxinifolius</i>	14		14	Thompson and Zhao (1993, as <i>R. fraxinifolius</i> "Hayata")	23
<i>R. glandulosopunctatus</i>	14*				24
<i>R. linearifoliolatus</i>	14*				25
<i>R. ptiopetalus</i>	14*				26
<i>R. rubroangustifolius</i>	14*				27
<i>R. sumatranus</i>	14		14	Jinno (1958a, as <i>R. asper</i>); Iwatsubo and Naruhashi (1992)	28
<i>R. tagallus</i>	14*				29
<i>R. taiwanicolus</i>	14*				30
Sect. Pungentes					
<i>R. inopertus</i>	14		14	Vaarama (1954); Britten and Hull (1957); Thompson and Zhao (1993)	31
<i>R. pinfaensis</i>	14		14	Thompson (1995)	32
<i>R. pungens</i>	14		14	Iwatsubo and Naruhashi (1992)	33
Sect. Thyrsidaei					
<i>R. incanus</i>	14*				34
<i>R. parviaraliifolius</i>	14*				35
Sect. Parvifolii					
<i>R. mesogaeus</i>	14		14	Jinno (1958a)	36
<i>R. parvifolius</i>	14		14	Darrow and Longley (1933); Vaarama (1954); Probatova et al. (1989); Nishikawa (1990); Iwatsubo and Naruhashi (1991, 1996)	37
			21	Iwatsubo and Naruhashi (1999)	
			28	Chen (1993)	

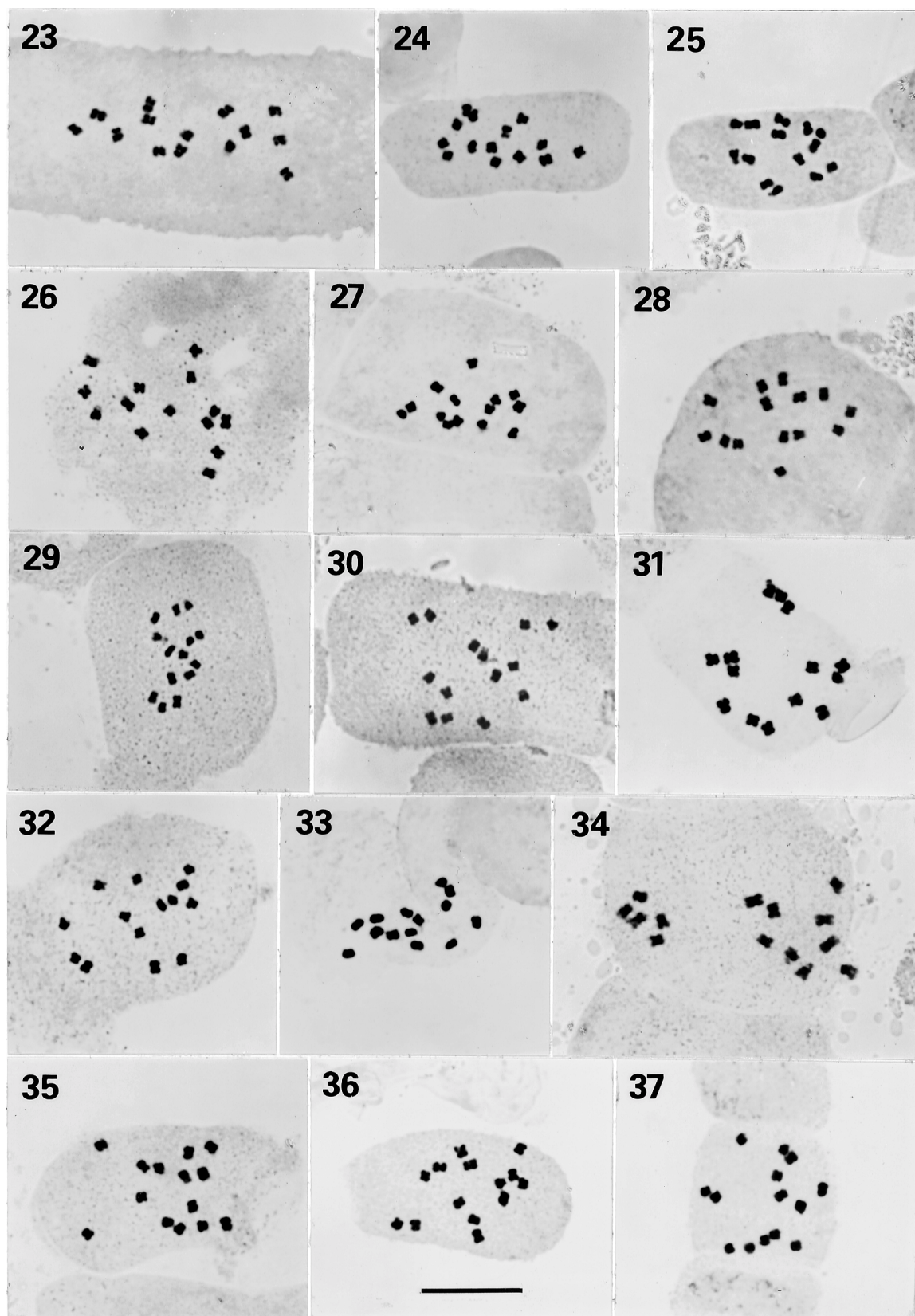
*First chromosome count.



Figures 1-10. Microphotographs of somatic metaphase chromosomes of Taiwanese *Rubus*. 1: *R. pectinellus* ($2n = 42$); 2: *R. kawakamii* ($2n = 28$); 3: *R. lambertianus* ($2n = 28$); 4: *R. liui* ($2n = 28$); 5: *R. morii* ($2n = 28$); 6: *R. swinhoei* ($2n = 28$); 7: *R. nagasawanus* ($2n = 56$); 8: *R. tephrodes* ($2n = 28$); 9: *R. pyrifolius* ($2n = 42$); 10: *R. buergeri* ($2n = 56$). Scale bar equals 10 μm .



Figures 11-22. Microphotographs of somatic metaphase chromosomes of Taiwanese *Rubus* (Cont.). 11: *R. formosensis* ($2n = 28$); 12: *R. hayata-koidzumii* ($2n = 28$); 13: *R. hui* ($2n = 42$); 14: *R. laciniatostipulatus* ($2n = 42$); 15: *R. pseudobuergeri* ($2n = 56$); 16: *R. rolfei* ($2n = 42$); 17: *R. rufus* ($2n = 28$); 18: *R. corchorifolius* ($2n = 14$); 19: *R. subcrataegifolius* ($2n = 14$); 20: *R. taitoensis* ($2n = 14$); 21: *R. cardotii* ($2n = 14$); 22: *R. croceacanthus* ($2n = 14$). Scale bar equals 10 μm .



Figures 23-37. Microphotographs of somatic metaphase chromosomes of Taiwanese *Rubus* (Cont.). 23: *R. fraxinifolius* ($2n = 14$); 24: *R. glandulosopunctatus* ($2n = 14$); 25: *R. linearifoliolus* ($2n = 14$); 26: *R. ptiopetalus* ($2n = 14$); 27: *R. rubroangustifolius* ($2n = 14$); 28: *R. sumatranus* ($2n = 14$); 29: *R. tagallus* ($2n = 14$); 30: *R. taiwanicolus* ($2n = 14$); 31: *R. inopertus* ($2n = 14$); 32: *R. pinfaensis* ($2n = 14$); 33: *R. pungens* ($2n = 14$); 34: *R. incanus* ($2n = 14$); 35: *R. parviaraliifolius* ($2n = 14$); 36: *R. mesogaeus* ($2n = 14$); 37: *R. parvifolius* ($2n = 14$). Scale bar equals 10 μm .

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台灣產薔薇科懸鉤子屬植物染色體數之研究

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台灣面積僅 36,000 平方公里，原生的懸鉤子屬植物（薔薇科）種類極為豐富，共有 37 種。世界的懸鉤子屬植物可分類為 12 個亞屬，台灣產 *Chamaebatus*（1 種），*Malachobatus*（16 種）及 *Idaeobatus*（20 種）等 3 亞屬。本研究報導台灣產所有原生之懸鉤子屬植物的染色體數，其中 19 種植物之染色體數為首次之報導。懸鉤子屬植物之染色體基本數為 $x=7$ ，台灣產 *Chamaebatus* 亞屬植物為六倍體；*Idaeobatus* 亞屬植物皆為二倍體；*Malachobatus* 亞屬則包含四倍體、六倍體及八倍體的種類。本研究顯示台灣產 *Idaeobatus* 亞屬的全部 20 種懸鉤子屬植物皆在二倍體的層次進行種化；*Malachobatus* 亞屬 *Sozostili* 組全部 5 種皆在四倍體的層次進行種化。

關鍵詞：染色體數；多倍體；薔薇科；懸鉤子屬；台灣。