A KARYOLOGICAL SURVEY OF LONICERA, II

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IN THE FIRST PAPER presenting the results of this survey, all the chromosome numbers recorded for the genus *Lonicera*, to that date, were assembled, together with many new counts. Since that time the study of *Lonicera* has continued, but to bring the investigation to a conclusion all the additional counts that have been made using the Arnold Arboretum collections are presented below (together with three further records that have appeared in the literature).

Cytological methods, documentation and nomenclature used here follow those of the first paper, to which reference should be made.[1]

An attempt was made to note differences in karyotype morphology and, certainly, differences in the overall size of chromosome complements were observed between different species. Also, variation in individual chromosomes, their size, centromere position, and the presence and size of satellites were noted, but considering the relatively large number of species in the genus and the few individuals investigated, it has not proved possible to compare and correlate these differences, and their groupings, with the infrageneric classification proposed by Rehder (1903).

At metaphase the chromosomes, in many cases, were so contracted that two satellites were not always visible. Thus, it was not possible to determine whether or not *Lonicera modesta* had a satellited chromosome pair. More details of morphology could be observed at late prophase. In some cells, pretreatment with oxyquinoline (Tjio & Levan, 1950) caused a structural differentiation of the chromosomes by revealing positively and negatively heteropycnotic segments. Homologues of similar size could then be identified by the location of the centromere and by the individual distribution of these segments. A comparable pattern has been observed in several homologues of different species of *Lonicera*. FIGURES 1 to 10 present examples which were encountered of nuclei in mitosis (most examples taken from species in different subsections of Rehder's classification).

A few comments may be made. In four cases both diploid and tetraploid plants have been recorded within the same species. In *Lonicera ferdinandii* Franch., the earlier undocumented counts and all the plants at the Arnold Arboretum appear to be diploid, except for one (AA 21595) which is tetraploid. This particular bush is an old one, raised from seed of *Rock 13519* collected in S.W. Kansu, China, in 1925, yet phenotypical-

* In this survey, the cytological investigations have been carried out by one of us (L.R.), and the complementary taxonomy by the other (P.S.G.).

[1] Part I was published in Jour. Arnold Arb. **47**: 222–247. 1966.

ly it does not appear to differ significantly from the diploid. In *L. alpigena* L., Poucques (1949, pp. 129 & 186) has recorded $n = 9$ and $2n = 18$, both of which numbers were confirmed by counts on a plant in the Arnold Arboretum (AA 91–60) which, unfortunately, died before an authenticating herbarium specimen was collected. However, in this species, the tetraploid number, $2n = 36$, has been found in two plants of f. *nana* (Carr.) Zabel (see below). In *L. maximowiczii* (Rupr.) Maxim. var. *sachalinensis* Fr. Schmidt we can now document a tetraploid ($n = 18$ and $2n = 36$), in contrast to the diploid number of $2n = 18$ recorded for the species by Janaki Ammal & Saunders (1952, p. 540). The plant on which their count was based does not appear to have been documented and it is now impossible to know which variety may have been involved, or to confirm its identity. Lastly, in our first paper we recorded a plant of *L. modesta* Rehd. var. *modesta* as diploid ($n = 9$ and $2n = 18$) and of var. *lushanensis* Rehd. as tetraploid ($n = 18$ and $2n = 36$), both plants having been raised from seed sent from the Lushan Botanic Gardens in China. Here, however, there is need for taxonomic reassessment, as we have pointed out (Rüdenberg & Green, 1966, p. 225). Available herbarium material has proved inadequate to enable one to come to a sound conclusion, but it may well prove that two species are involved where diagnostic distinctions need careful delineation.

It is, perhaps, worth drawing attention to the fact that in the whole of both subsections TATARICAE and OCHRANTHAE, including many cultivars and hybrids, but with one exception, no polyploid plants have been observed. The exception is *Lonicera floribunda* Boiss. & Buhse (AA 341–44) which is tetraploid. Within and between these subsections hybridization takes place readily, yet meiosis in most of these diploid hybrids is, with the exception of some plants with bridges, perfectly normal. A few of the plants studied at the Arnold Arboretum form bridges at anaphase I, especially *L.* × *bella*; meiosis was, therefore, checked the next year to determine its constancy and whether or not the frequency of these bridges could be correlated with the seasonal variation in climate. It was found that the number of cells showing bridges was not the same for the two years. It was smaller after the more normal spring, in contrast to one with especially cold nights and periods of drought.

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TABLE. Additional chromosome numbers in Lonicera

SPECIES	*n*	*2n*	DOCUMENTATION AND COLLECTOR	GENERAL DISTRIBUTION
		Subgenus LONICERA (Subgen. *Chamaecerasus* (L.) Rehd.) SECT. ISOXYLOSTEUM Rehd.		
Subsect. MICROSTYLAE Rehd.				
L. angustifolia Wall. ex DC.	9		See Mehra & Gill in Löve (1968, p. 576). Based on *Mehra & Gill 1291* (PUNJAB), Simla, W. Himalayas	Himalayas
**L. syringantha* Maxim.	18		AA 405–35, *Palmer*, 1 June & 26 Aug. 1936	North & West China
*var. *wolfii* Rehd.	18	36	AA 4992–2, *Allen*, 1 June 1927, also *Dudley & Dodd*, 28 May 1965	West China
*cv. Grandiflora		36	AA 1089–61, *Rüdenberg*, 18 May 1966	
		Sect. ISIKA (Adans.) Rehd.		
Subsect. CAERULEAE Rehd.				
L. villosa (Mich.) Roem. & Schult.		18	See Löve & Löve (1966, p. 51). Based on *Löve & Löve 7496* & *7591*, Mt. Washington, New Hampshire	Northeastern North America

Subsect. PILEATAE Rehd.			
**L. pileata* Oliv.	18	AA 151031–B, *Dudley & Dodd*, 28 May 1965	Central and western China
	9	AA 225–28–E, *Green*, 4 Nov. 1965 and (as 225–28) *Kobuski & Roush*, 14 Sept. 1931	
**L. nitida* Wils.	18	AA 923–49, *Green*, 4 Nov. 1965	Western China
Subsect. VESICARIAE (Komar.) Rehd.			
L. ferdinandii Franch.	18	AA 21595 (*Rock 13519*, Kansu, 1925), *Kreps*, 25 May 1964	Northern China
Subsect. BRACTEATAE (Hook. f. & Thoms.) Rehd.			
L. altmannii Reg. & Schmalh.			
*var. *pilosiuscula* Rehd.	18	AA 14999, *Rehder*, 5 May 1927	Turkestan
Subsect. DISTEGIAE (Raf.) Rehd.			
L. involucrata (Richards.) Banks ex Spreng.			
	9 18	See Taylor & Mulligan (1968, p. 109). Based on *CTS 35077* & *CT 35434*, Graham Is., British Colombia	Northern America and south into Rocky Mts.
Subsect. ALPIGENAE Rehd.			
L. alpigena L.			
f. *nana* (Carr.) Zabel	36†	AA 14994–1, *Allen*, 13 August 1927	Central and southern European Mts.
	36	AA 803–35, *Green*, 26 May 1965	

* This is the first publication of a documented count for this taxon.

† Due to an error $2n = 18$ was incorrectly recorded for this plant in part I, p. 234.

TABLE. Additional chromosome numbers in Lonicera (*Continued*)

SPECIES	*n*	*2n*	DOCUMENTATION AND COLLECTOR	GENERAL DISTRIBUTION
Subsect. RHODANTHAE (Maxim.) Rehd.				
**L. tatarinowii* Maxim.		18	AA 17–44–B (*Meyer 1938a*, China, 1913), *Palmer*, 27 May 1936	Northern China & Korea
L. maximowiczii (Rupr.) Maxim.				
*var. *sachalinensis* Fr. Schmidt		36	AA 10102–C (*Wilson 8875*, Korea, 1917), *Dudley*, 4 June 1965, and *Rüdenberg*, 25 May 1966	Saghalin and Korea
	18		AA 598–38–B, *Dudley*, 4 June 1965, and *Rüdenberg*, 25 May 1966	
L. orientalis Lam.		18	AA 201–38–A, *Dudley*, 4 June 1965	Asia Minor to western China
	9		AA 956–34 (*Balls 1656*, Turkey, 1934), *Green*, 2 June 1964	
*var. *longifolia* (Dipp.) Rehd.		18	AA 15102, *Palmer*, 13 June 1940	
Sect. LONICERA (Sect. *Coeloxylosteum* Rehd.)				
Subsect. TATARICAE Rehd.				
L. tatarica L.		18	AA 288–41–A, *Green*, 31 May 1965	Eastern Europe to Turkestan
	9		AA 69–64, *Rüdenberg*, 10 May 1968	

f. *sibirica* (Pers.) Rehd.	9		AA 716–45–B, *Kreps*, 26 May 1964	
*cv. Albo-Rosea	9	18	AA 1199–62, *Gibson*, 17 May 1968	
*cv. Cardinal 101	9	18	AA 96–61, *Rüdenberg*, 27 May 1966	
*cv. Plumfield Red	9		AA 97–61, *Rüdenberg*, 27 May 1966	
*cv. Red Giant	9	18	AA 1240–64, *Rüdenberg*, 10 May 1968	
L. × *xylosteoides* Tausch	9		AA 15141, *Kobuski & Metcalfe*, 16 May 1930	Cultivation
Subsect. OCHRANTHAE (Zabel) Rehd.				
L. × *notha* Zabel	9		AA 762–64, *Rüdenberg*, 10 May 1968	Cultivation
		18	AA 572–1–A, *Palmer*, 15 May & 7 July 1936 (as AA 572)	
L. morrowii A. Gray	9		AA 1232–53, *Green*, 26 May 1965	Japan
L. × *bella* Zabel	9		AA 1023–60, *Gibson*, 17 May 1968	Cultivation

* This is the first publication of a documented count for this taxon.

TABLE. Additional chromosome numbers in Lonicera (*Continued*)

SPECIES	*n*	*2n*	DOCUMENTATION AND COLLECTOR	DISTRIBUTION GENERAL
L. × *muendeniensis* Rehd.	9		AA 1314–62, *Rüdenberg*, 10 May 1968	Cultivation
	9		AA 793–64, *Rüdenberg*, 10 May 1968	
		18	AA 1193–65, *Rüdenberg*, 10 May 1968	
f. *xanthocarpa* Hort.		18	AA 188–36–A, *Kreps*, 25 May 1964	
L. xylosteum L.	9		AA 765–34, *Rüdenberg*, 26 May 1966	Europe to Altai Mts.
	9		AA 358–62, *Gibson*, 17 May 1968	
*f. *mollis* (Regel) Rehd.	9		AA 66–37, *Kreps*, 26 May 1964	
*cv. Nana	9		AA 626–62, *Rüdenberg*, 16 May 1968	
L. chrysantha Turcz.	9		AA 1044–37–A, *Green*, 31 May 1965	Northeast Asia and Japan
f. *regeliana* (Kirchn.) Rehd.	9		AA 587–54, *Green*, 20 May 1965	
**L.* × *pseudo-chrysantha* Braun ex Rehd.	9		AA 686–54, *Rüdenberg*, 18 May 1966	Cultivation
L. koehneana Rehd.	9		AA 632–64, *Rüdenberg*, 10 May 1968	Western China

L. maackii (Rupr.) Maxim.	9	18	AA 15109–2, *Palmer*, 13 June & 7 Oct. 1940, and *Flint*, 19 Sept. 1966	Manchuria and China
f. *podocarpa* Franch. ex Rehd.		18	AA 7190–B (*Wilson 194*, W. Hupeh, 1907), *Dodd*, 28 June 1965, and *Flint*, 19 Sept. 1966	China
		18	AA 12319 (*Hers 1358*, China, 1919), *Palmer*, 27 May & 9 Sept. 1936, and *Flint*, 19 Sept. 1966	
		18	AA 15050–B (*Wilson 194bis*, W. Hupeh, 1907), *Palmer*, 24 Sept. 1936, and *Dudley & Dodd*, 28 June 1965, and *Flint*, 19 Sept. 1966	
		18	AA 23153–A, *Dudley & Dodd* 28 June 1965, and *Flint* 19 Sept. 1966	
L. quinquelocularis Hardw.				
f. *translucens* (Carr.) Zabel		18	AA 213–59–A, *Green*, 21 June 1965	Afghanistan to the Himalaya
		18	AA 213–59–B, *Appenzeller*, 9 June 1966	
Sect. NINTOOA (Sweet) Maxim.				
Subsect. LONGIFLORAE Rehd.				
L. japonica Thunb.				
*var. *halliana* (Dippel) Nicholson		18	AA 953–1, *Sargent*, 12 July 1884	Eastern Asia

* This is the first publication of a documented count for this taxon.

TABLE. **Additional chromosome numbers in Lonicera** (*Continued*)

SPECIES	*n*	*2n*	DOCUMENTATION AND COLLECTOR	GENERAL DISTRIBUTION
*var. *repens* (Sieb.) Rehd.	9	18	AA 897–49, *Appenzeller*, 20 June 1966	
*cv. Aureo-Reticulata		18	AA 1445–63, *Fordham*, July 1965	
Subgenus CAPRIFOLIUM (Adans.) Dippel (Subgen. *Periclymenum* (Mill.) Rehd.)				
Subsect. CYPHEOLAE (Raf.) Rehd.				
**L. glaucescens* Rydberg	9	18	AA 1031–52–A, *Appenzeller*, 9 June 1966	Northeastern North America
Subsect. EUCAPRIFOLIA (Spach) Rehd.				
**L. caprifolium* L.	9		AA 699–62, *Dudley*, 10 July 1965	Europe and western Asia
**L.* × *heckrottii* Hort. ex Rehd.		ca. 45	AA 113–49–A, *Rüdenberg*, 8 June 1966, and *Gibson*, 14 June 1968	Cultivation

* This is the first publication of a documented count for this taxon.

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EXPLANATION OF PLATES

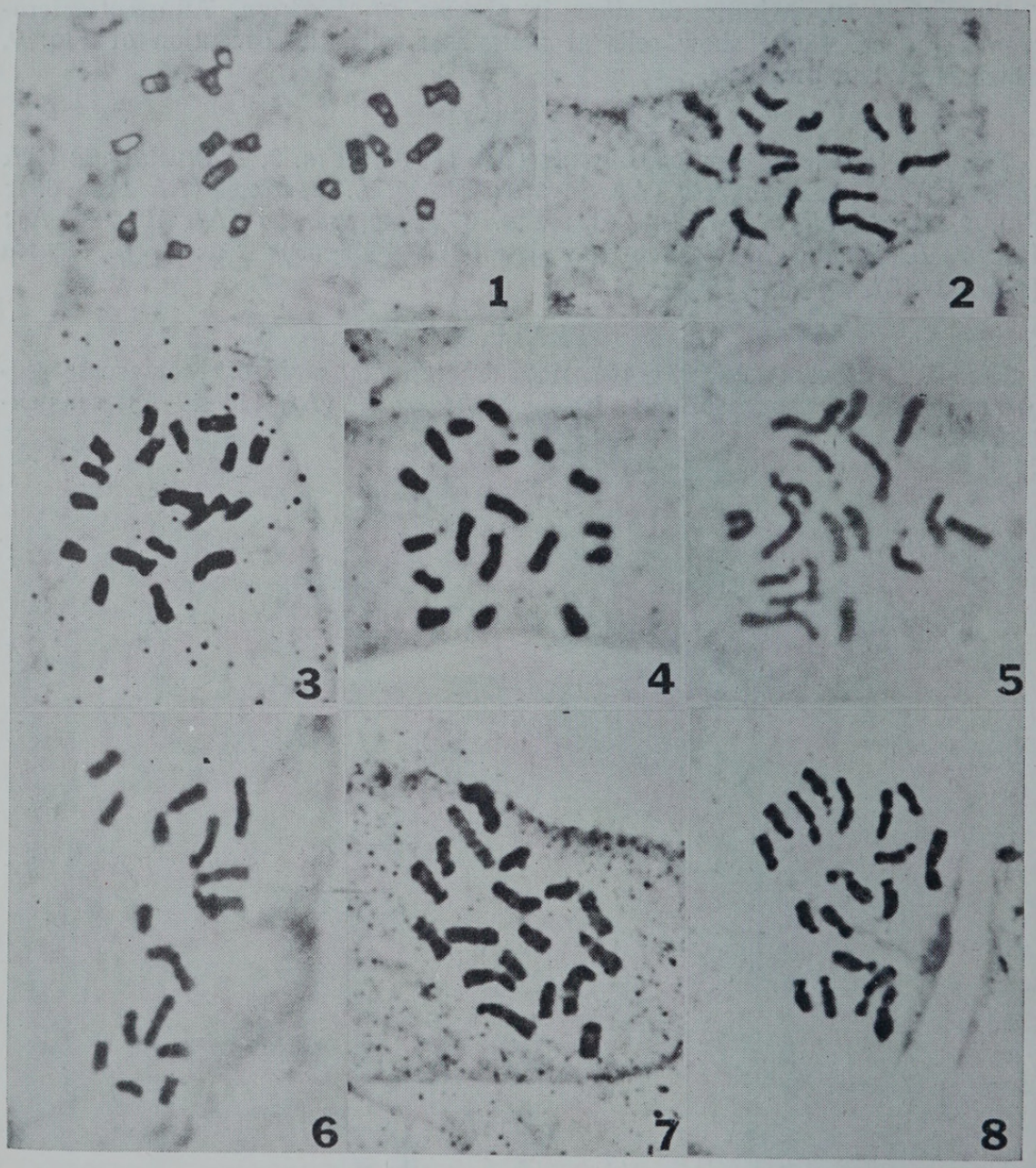
FIGURES 1–10. Mitotic divisions in species of *Lonicera*. All photomicrographs (× ca. 1800) show cells at metaphase with the exception of FIG. 9, which is at late prophase.

PLATE I

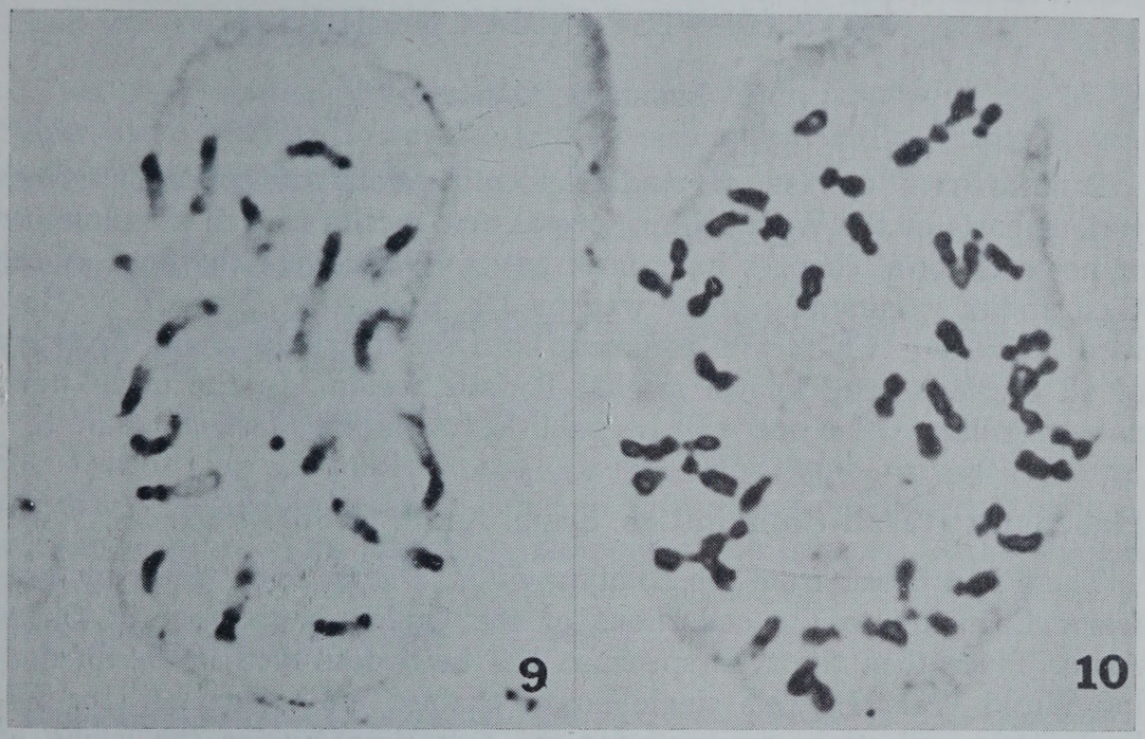
FIG. 1, *L. altmannii* var. *pilosiuscula* (AA 14999); FIG. 2, *L. involucrata* (AA 16–44); FIG. 3, *L. modesta* (AA 24–36); FIG. 4, *L. morrowii* (AA 1283–65); FIG. 5, *L.* × *bella* (AA 48–42–B); FIG. 6, *L. chrysantha* (AA 1044–37–A); FIG. 7, *L. japonica* cv. Aureo-Reticulata (AA 1445–63); FIG. 8, *L. etrusca* (AA 231–46).

PLATE II

FIG. 9, *L. etrusca* (AA 231–46), note differentially stained chromosome segments at end of prophase. FIG. 10, *L.* × *heckrottii* (AA 113–49–A), ca. pentaploid.



RÜDENBERG & GREEN, LONICERA, II



RÜDENBERG & GREEN, LONICERA, II