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A cytological study of the British Labiatae (excluding *Mentha*)

J. K. MORTON

Department of Biology, University of Waterloo, Ontario, Canada

ABSTRACT

Chromosome numbers based on indigenous material are reported for 41 of the 47 species of Labiatae native in Britain. The hybrid origin of *Stachys* × *ambigua* Sm. is confirmed, its chromosome complement at diakinesis consisting of 83 univalents. A spectrum of polyploidy is given, the incidence being 69·8%. This figure is likely to be reduced to 67% when the few remaining species are examined.

INTRODUCTION

In Britain the Labiatae consist of 47 native species, about 13 naturally occurring hybrids (or hybrid complexes) and some 16 well-established introduced species. Of these, 4 native and 3 introduced species, together with 9 hybrid complexes, belong to the genus *Mentha* and will not be considered in the present paper. An account of the chromosome numbers in the British Menthae has already been published (Morton 1956). The large proportion of introduced taxa (about one third) in the British Labiatae is largely due to many species being important herbs which have long been cultivated in cottage and monastery gardens for their fragrance, and their medicinal and culinary uses. Chromosome numbers are reported in this account for all but 6 of the native species, from material of known British origin. Details of the materials used, chromosome numbers, ploidy level, and the location of voucher specimens are given in Table 1. Genera and species are arranged alphabetically and the nomenclature is that of Warburg (1962).

MATERIALS AND METHODS

Living material was collected in the field and brought into cultivation either by transplanting or by growing from seed. In most cases chromosomes were studied in root-tip preparations using previously-described section and squash techniques (Morton 1956, 1962). Root-tips were taken from well-grown plants to prevent anomalies arising from seedling root-tips or from misidentification of immature material.

DISCUSSION

Most of the chromosome numbers confirm those already reported for the same species in other parts of their range. However, numbers for 26 of the species (and one hybrid) are here reported for the first time from material of British

TABLE 1. CHROMOSOME NUMBERS IN BRITISH LABIATAE

	J.K. Morton reference no. Vouchers** (or reference to publication)	Origin	2*n*	*n*	Base-no.	Ploidy	Illustration
Acinos arvensis (Lam.) Dandy	s.n. **DHM, JKM**	Worm's Head, Gower v.c. 41	18	—	9	2	—
,, ,,	4682 **JKM**	Raisby Quarries, Durham v.c. 66					Fig. 1a
Ajuga chamaepitys (L.) Schreb.	Rutland (1941)	British, unlocalised	28	—	7	4	—
A. pyramidalis L.	s.n. **JKM**	South Harris v.c. 110	32	—	8	4	Fig. 1b
A. reptans L.	Maude (1940)	British, unlocalised	32	—	8	4	—
,,	s.n. **JKM**	Hadley Woods, Sheffield v.c. 63	32	—	8	4	—
Ballota nigra L. subsp. *foetida* Hayek	Rutland (1941)	British, unlocalised	22	11	11	2	—
Betonica officinalis L.	4704 **DHM, JKM**	Westgate in Weardale v.c. 66	16	—	8	2	—
,,	s.n. **JKM**	Kynance Cove[1] v.c. 1	16	—	8	2	Fig. 1c
Calamintha ascendens Jord.	4817 **JKM**	Tytherington v.c. 34	48	—	12	4	Fig. 1d
,, ,,	4869 **JKM**	Mann's Sands, Brixham v.c. 3	48	—	12	4	—
,, ,,	5008 **DHM, JKM**	Saunton Sands, Barnstaple v.c. 4	48	—	12	4	—
Calamintha nepeta (L.) Savi	4787 **JKM**	Eynsham v.c. 23	48	—	12	4	—
,, ,,	4860 **JKM**	Corfe Castle v.c. 9	*c*72	—	12	6	—
C. sylvatica Bromf.	5087 **DHM, JKM**	Apes Down, Isle of Wight v.c. 10	24	—	12	2	Fig. 1e
Clinopodium vulgare L.	4715 **JKM**	Cirencester v.c. 33	20	—	10	2	Fig. 1f
,, ,,	s.n. **JKM**	Raisby Quarries, Durham v.c. 66	20	—	10	2	—
Galeobdolon luteum Huds. (= *Lamiastrum galeobdolon* (L.) Ehr. & Polat.)	4723 **JKM**	Wooten Under Edge v.c. 34	36	—	9	4	—
,, ,, ,,	s.n. **JKM**	Hadley Woods, Sheffield v.c. 63	36	—	9	4	Fig. 2a
,, ,, ,,	Wegmüller (1971)	many localities	36	—	9	4	—
,, ,, ,,	,, ,,	Lincolnshire	18	—	9	2	—
Galeopsis speciosa Mill.	5025 **DHM, JKM**	Gretna v.c. 72	16	—	8	2	Fig. 2c
G. tetrahit L. (inc. *G. bifida* Boenn.)	4774 **JKM**	Inverness v.c. 96	32	—	8	4	—
,, ,, ,,	5153 **JKM**	Kirkwall, Orkney v.c. 111	—	16	8	4	—
Glechoma hederacea L.	4950 **JKM**	Avebury v.c. 7	36	—	9	4	—
,, ,,	Rutland (1941)	British, unlocalised	36	—	9	4	—
Lamium album L.	4727 **JKM**	Bishop Auckland v.c. 66	18	—	9	2	Fig. 1g
L. amplexicaule L.	4865 **DHM, JKM**	Berry Head, Brixham v.c. 3	18	—	9	2	—
L. hybridum Vill.	5023 **JKM**	Edmondsley v.c. 66	36	—	9	4	—

L. moluccellifolium Fr.	5143	**JKM, WAT**	Dunnet Dunes v.c. 109	36	—	9	4	Fig. 2e
L. purpureum L.	4799	—	Ireshope Burn, Weardale v.c. 66	18	—	9	2	—
**Leonurus cardiaca* L.	Rutland (1941)		British, unlocalised	18	—	9	2	—
Lycopus europaeus L.	4709	**JKM**	Kew v.c. 17	22	—	11	2	—
Marrubium vulgare L.	4966	**JKM**	Saunton Sands, Barnstaple v.c. 4	34	—	17	2	—
,, ,, ,,	Rutland (1941)		British, unlocalised	34	—	17	2	—
Melittis melissophyllum L.	s.n.	—	King Harry Ferry, Truro v.c. 2	30	—	15	2	Fig. 1h
Nepeta cataria L.	5001	**JKM**	Ewelm v.c. 23	34	—	17	2	—
,, ,, ,,	4786, 5109	**JKM**	Green Lane, Woodstock v.c. 23	34	—	17	2	Fig. 2d
Origanum vulgare L.	Rutland (1941)		British, unlocalised	30	—	15	2	—
**Prunella laciniata* (L.) L.	4816	**JKM**	Tytherington v.c. 34	28	—	7	4	Fig. 1i
P. vulgaris L.	4707	**JKM**	Westgate in Weardale v.c. 66	28	—	7	4	—
Salvia horminoides Pourr.	4806	**JKM**	Thetford v.c. 28	54	—	9	6	Fig. 1j
,, ,, ,,	4816	**JKM**	Corfe Castle v.c. 9	54	—	9	6	—
,, ,, ,,	4887	**DHM, JKM**	Wilton v.c. 8	54	—	9	6	—
,, ,, ,,	5079	**JKM**	Plymouth Ho v.c. 3	54	—	9	6	—
Scutellaria galericulata L.	4708	**JKM**	Kew v.c. 17	32	—	8	4	Fig. 1k
S. minor Huds.	4825	**JKM**	Bollihope, Frosterly v.c. 66	*c*32	—	8	4	—
Stachys alpina L.	4724	**DHM, JKM**	Wooten under Edge v.c. 34	30	—	15	2	Fig. 1l
S. × *ambigua* Sm.	5090	**JKM**	King Harry Ferry, Truro v.c. 2	83	—	—	—	—
,, ,,	5139	**JKM, WAT**	Wick v.c. 109	83	—	—	—	—
,, ,,	5227	**JKM**	Melmerby, Penrith v.c. 70	83	—	—	—	Fig. 2b
S. arvensis (L.) L.	4974	**DHM, JKM**	Croyde v.c. 4	10	—	5	2	—
S. palustris L.	p1147	**JKM**	Wixall[2] v.c. 40	102	—	17	6	—
S. sylvatica L.	4302	**JKM**	Ross Carbery,[3] Cork v.c. H3	64	—	8	8	—
Teucrium scordium L.	s.n.	—	Braunton Burrows v.c. 4	32	—	8	4	—
T. scorodonia L.	4268	**JKM**	Black Head, Clare v.c. H15	*c*32	—	?	?	—
,, ,,	Rutland (1941)		British, unlocalised	34	—	17	2	—
Thymus drucei Ronn.	Pigott (1954)		Many localities	50–56	—	7	8	—
T. pulegioides L.	Pigott (1954)		Norfolk and Surrey	28	—	7	4	—
T. serpyllum L.	Pigott (1954)		Norfolk and Suffolk	24	—	6	4	—

[1] dwarf maritime ecotype—see p. 244.
[2] a white-flowered form
[3] flowers of an unusual greenish colour
* not native in Britain
** **DHM** .... Herbarium of the Department of Botany, University of Durham, U.K.
WAT .... Herbarium of the Department of Biology, University of Waterloo, Canada
JKM .... Author's herbarium

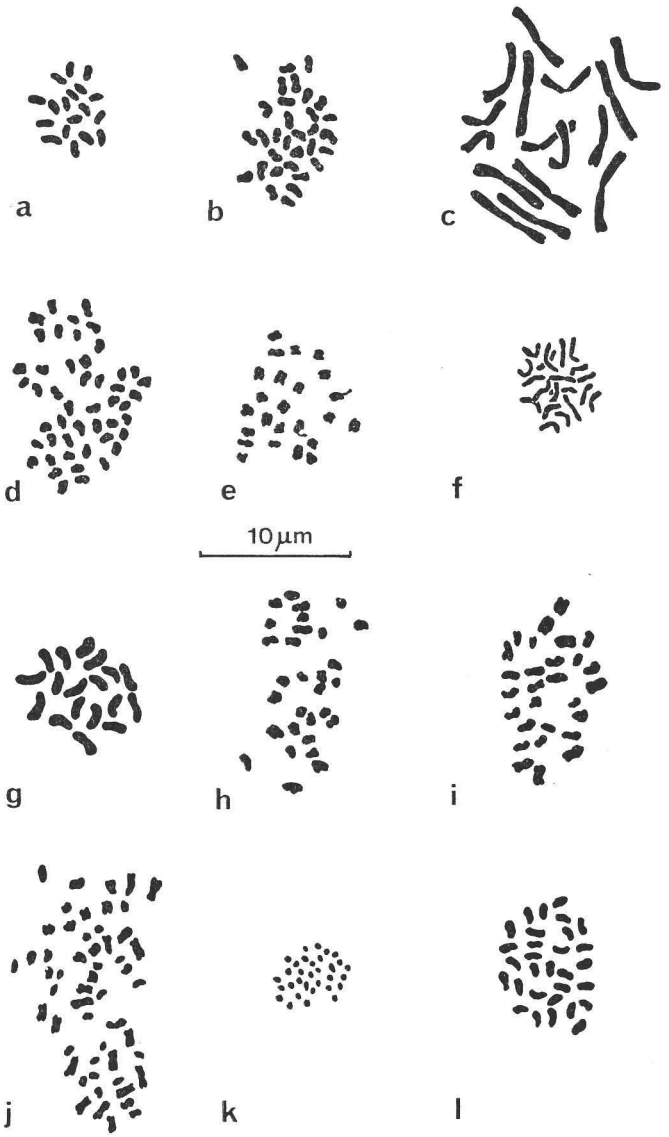

FIGURE 1. Chromosomes in British Labiatae:

a. *Acinos arvensis*
b. *Ajuga pyramidalis*
c. *Betonica officinalis*
d. *Calamintha ascendens*
e. *C. sylvatica*
f. *Clinopodium vulgare*
g. *Lamium album*
h. *Melittis melissophyllum*
i. *Prunella laciniata*
j. *Salvia horminoides*
k. *Scutellaria galericulata*
l. *Stachys alpina*

Metaphase plates of root-tip mitosis in squash preparations, except for a, f, g, k and l, which are from sections. In all except c and f the material was prefixed in a saturated aqueous paradichlorobenzene solution

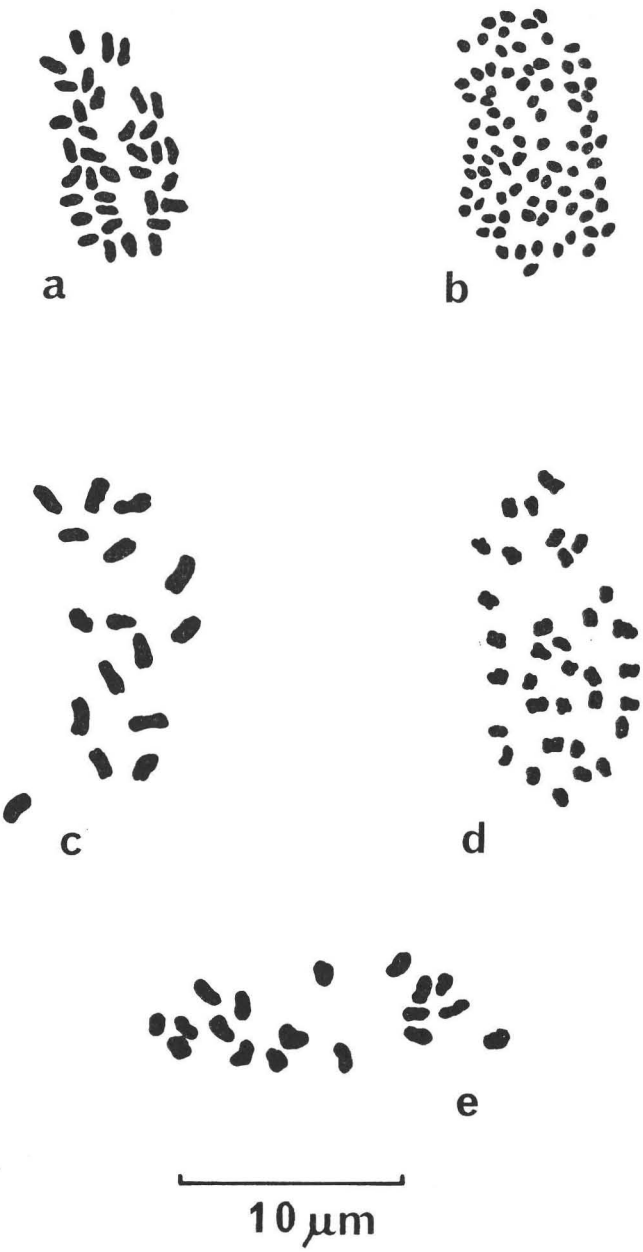

FIGURE 2. Chromosomes in British Labiatae:

a. *Galeobdolon luteum*
b. *Stachys* × *ambigua*
c. *Galeopsis speciosa*
d. *Nepeta cataria*
e. *Lamium moluccellifolium*

a–d. Metaphase plates of root-tip mitosis in squash preparations. Material prefixed with paradichlorobenzene.
e. Anaphase II of pollen-mother-cell meiosis in squash preparation.

origin, including 3 species and one hybrid* not previously examined cytologically. Few of these observations call for any comment but the following are worthy of note.

Betonica officinalis L. The material from Kynance Cove was a dwarf maritime ecotype which in nature grows only 3 or 4 inches high. Under cultivation in the north of England it retained its dwarf habit over the 6 years that it was grown, and made a very attractive rock-garden plant. Similar plants grow on the sea-cliffs at Marsden, Co. Durham.

Calamintha. The species of this genus form a polyploid series of apparently closely related species. Experimental work is desirable to determine their relationships. In particular the hexaploid material of *C. nepeta* from Corfe Castle requires further study to see whether it may be of hybrid origin with accompanying amphidiploidy.

Glechoma hederacea L. It is desirable that more material of this species be examined from elsewhere in Britain. In continental Europe diploid and tetraploid races occur, together with triploids in some areas. Similarly both races occur in North America as a result of introduction (Gill & Morton 1973). A fuller study of British populations may reveal a situation similar to that in *Galeobdolon luteum* (Wegmüller 1971) in which both diploid and tetraploid races occur in this country.

Prunella. The population of *P. laciniata* at Tytherington has undergone extensive introgression with *P. vulgaris* and it is doubtful whether pure *P. laciniata* remains in that locality.

Previous workers (fide Federov 1969) have frequently reported a diploid number of 32 in this genus, both for *P. laciniata* and *P. vulgaris*. My own observations indicate that both these species have $2n = 28$ in Britain.

Salvia horminoides Pourr. The number reported here ($2n = 54$) for British material may be a new number for this species, but there is considerable confusion in the literature with *S. verbenaca* L. for which this and other numbers ($2n = 42$ and 64) have also been reported.

Stachys × *ambigua* Sm. This has for a long time been presumed to be a hybrid between *S. palustris* and *S. sylvatica*. The diploid number ($2n = 83$) reported here for the first time confirms this, for the parents have $2n = 102$ and 64 respectively. Furthermore, the count for the Wick material was obtained from a pollen-mother-cell squash which showed 83 univalents at diakinesis. *S.* × *ambigua* is a rather variable plant and it is possible that it consists of a hybrid complex rather than a simple F_1 hybrid, which these chromosome counts suggest. Further material is being examined to resolve this problem (see also Wilcock 1972). *S. palustris* itself is a very variable and widely distributed plant. In North America some of its forms have been erroneously referred to as *S.* × *ambigua* (Epling 1934). Recent work on North American plants of *S. palustris* shows that most have $2n = 64$, though a plant with $2n = 96$ has been found (Gill & Morton 1973).

**Calamintha nepeta* (L.) Savi, *Scutellaria minor* L., *Stachys* × *ambigua* Sm. and *Teucrium scordium* L.

POLYPLOIDY

The spectrum of polyploidy for the native British Labiatae can be readily established from the above data, coupled with those already published for the genus *Mentha* (Morton 1956). There are only 4 native species of *Mentha* in Britain—*M. aquatica* ($2n = 96$), *M. arvensis* ($2n = 72$), *M. rotundifolia* ($2n = 24$) and *M. pulegium* ($2n = 20$) *. I am now of the opinion that the base-number in the section Mentha is probably 12 rather than 6. The forms of *M. spicata* and *M. longifolia* with $2n = 36$ are sterile triploids with incomplete chromosome pairing —not fertile hexaploids. Several genera have high base-numbers which are almost certainly of secondary origin due to allopolyploidy—viz. *Marrubium* (17), *Melittis* (15), *Nepeta* (17), *Origanum* (15), *Stachys* (15 and 17) and *Teucrium* (17). The spectrum of polyploidy thus becomes:—

	Primary diploids		13
Polyploids	$4x$	17	30
	$6x$	3	
	$8x$	3	
	Secondary base-numbers	7	
	% polyploidy		69·8

This is slightly lower than the figure (71·4%) calculated several years ago from less complete information (Morton 1961) in which the base-number in the genus *Mentha* section Mentha was presumed to be 6.

On the basis of their known chromosome numbers in material from other countries, the 6 Labiatae which have not yet been examined cytologically using British material (*Salvia pratensis*, *S. verbenaca*, *Stachys germanica*, *Galeopsis angustifolium*, *G. segetum* and *Teucrium botrys*) will not greatly alter this picture, but will probably reduce the percentage of polyploidy to about 67%. This high percentage of polyploidy in the British Labiatae contrasts with that found in our native Caryophyllaceae where the percentage is 41·2 (Blackburn & Morton 1957).

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* The count for *M. pulegium* is from material collected at Slapton Sands in Devon.

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