Notes

CREEPING INFLATION IN THE LENGTH OF ENGLISH COUNTY FLORAS, 1730–1960

County Floras are so varied that any general trends which have taken place in their long history can easily be masked by individual variation. This note addresses two questions which it is difficult to answer simply by visual inspection:

Did the average length of Floras increase from 1730 to 1960?

Did the proportion of introductory material to species accounts increase during that period?

Webb (1978) used the phrase "creeping inflation" to describe the tendency of species accounts in multi-volume descriptive Floras such as *Flora Europaea* to increase in length as the project progresses. We have adopted it to cover the tendency of successive books or articles in a formal or informal series to increase in length. An example is provided by the *Biological Flora of the British Isles* series in the *Journal of Ecology*. The accounts of the first 20 species (1941–46) averaged 9·8 pages per species, whereas those of the last 21 species published before a major change in the format of the journal (1985–91) averaged 16·6 pages.

ASSESSING THE LENGTH OF FLORAS

We examined 66 of the 68 Floras listed by Preston (2003, Table 1). Ray (1660) is excluded for statistical reasons as an outlying data point and Jacob (1836) is excluded as an incomplete Flora. Floras published after 1960 were not included as there were major changes in the presentation of data after that date, with the increasing tendency to include distribution maps. The total length of a Flora is taken as the numbers of pages devoted to vascular plants. Pages devoted to non-vascular plants have been disregarded, as have any gazetteers and indexes. This total has been apportioned into two subtotals, for introductory matter and for species accounts (including their addenda and errata). The former includes background material on geology, climate and vegetation, historical and biographical notes, tables of occurrence of species within the county and in neighbouring counties, etc. Although we have used the term introductory matter, substantial sections appear in some Floras after the species accounts.

ANALYSING THE DATA

The data on page length for the 66 Floras are plotted in Figure 1 against the year of publication. These plots suggest an increase in the length of both the introductory material and the species accounts in Floras, particularly in the period 1850–1960. Regression analysis demonstrates that the increases in the total length of Floras is statistically significant ($R^2 = 14{\cdot}7\%$; slope = 1·7 pages per year, $p < 0{\cdot}001$), as are the component increases in the introductory material ($R^2 = 18{\cdot}5\%$; slope = 0·6 pages per year, $p < 0{\cdot}001$) and the species accounts ($R^2 = 8{\cdot}5\%$; slope = 1·1 pages per year, $p < 0{\cdot}5$). The proportion of introductory matter in Floras has increased, but at a very slow rate ($R^2 = 7{\cdot}6\%$; slope = 0·0009 pages per year, $p < 0{\cdot}5$).

The plots highlight the outlying points as well as the general trends. The longest Flora (assessed by our methods) is Horwood & Noel's (1933) *The flora of Leicestershire and Rutland*, 144 pages longer than its nearest rival, Druce's (1897) *The flora of Berkshire*. Horwood & Noel (1933) also have the most introductory matter, their 300 pages well ahead of Lees' (1867) *The botany of Worcestershire*, Druce's Berkshire and Baker's (1863) *North Yorkshire*. Keble Martin & Fraser's (1939) *Flora of Devon* contains the longest section of species accounts, ahead of Horwood & Noel (1933) and Bromfield's (1856) *Flora Vectensis*. Four Floras have over 50% of their pages devoted to introductory matter, and (not surprisingly) all depart from the standard pattern of county floras. They are Lees' (1867) *The botany of Worcestershire* (82%), discussed by Preston (2003), Baker's (1863) *North Yorkshire* (64%), which as its subtitle indicates, includes 'studies of its botany, geology, climate and physical geography', Good's (1948) *A geographical handbook of the Dorset flora* (54%) and De Crespigny's (1877) *A new London flora* (54%).

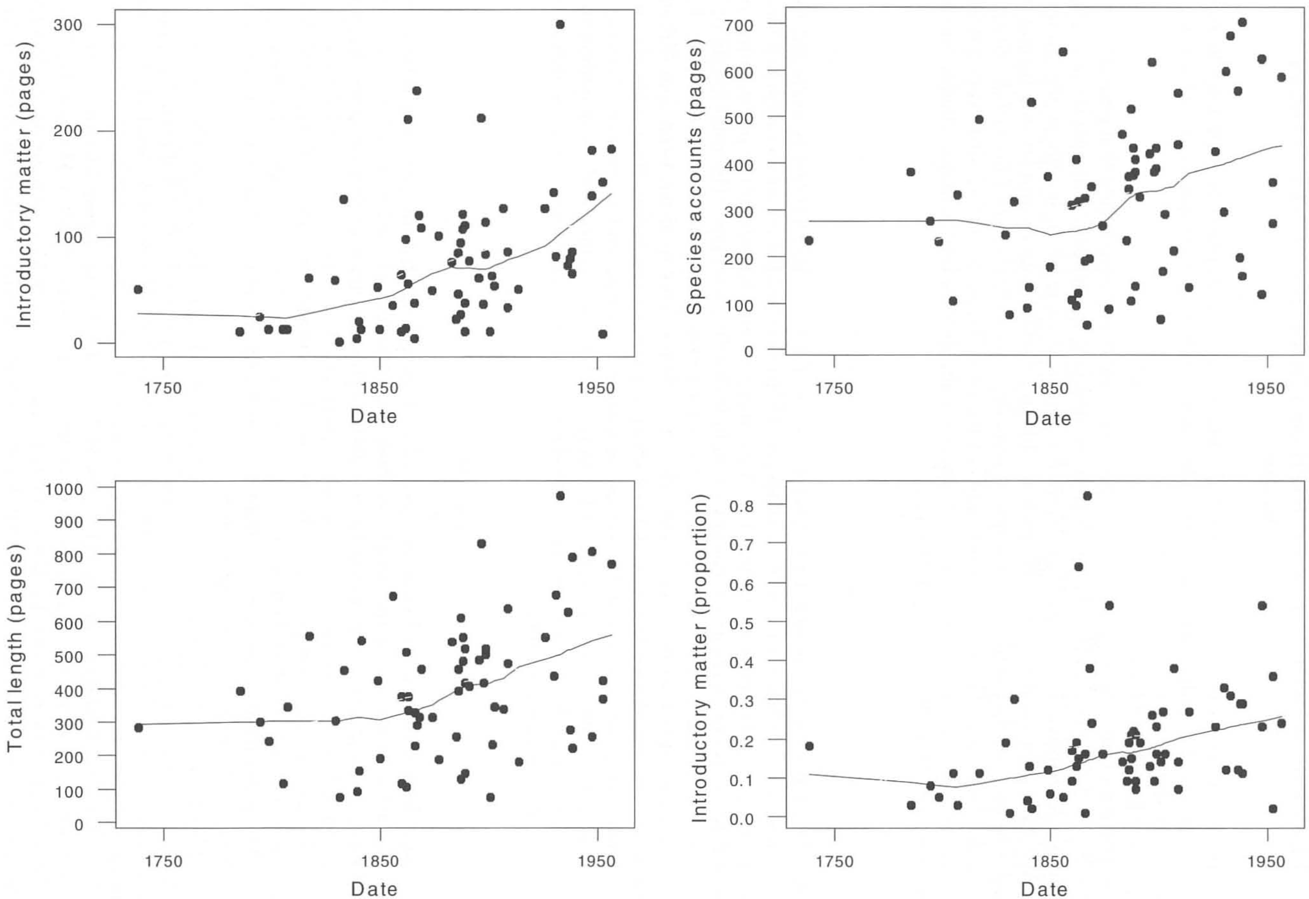

FIGURE 1. The length of the introductory matter and of the species accounts in county Floras published between 1730 and 1960, their total length and the proportion of introductory matter, plotted against date. The linear regression line (dashed) and the LOWESS (locally-weighted scatter plot smoother) line indicate trends over the study period.

The shortest Floras were Bagnall's (1901) *The flora of Staffordshire*, published as a supplement to the *Journal of Botany*, and Winch's (1831) *Flora of Northumberland and Durham*, the latter (ironically) covering an area now divided into three vice-counties. Winch (1831) included fewer than 10 pages of introductory matter, as did Howitt (1839) in *The Nottinghamshire flora*, Keys (1866–72) in his *Flora of Devon and Cornwall* and Kent & Lousley (1951–57) in *A hand list of the plants of the London area*. The shortest section devoted to species accounts is in Lees (1867), followed by Bagnall (1901) and Winch (1831). There are, of course, many shorter county check-lists which we have not included in the works analysed.

CONCLUSION

The number of pages is only an approximate measure of the length of a Flora, as pages vary in size and the amount of written material on the page differs according to design and font size. However, the variation in page size between 1730 and 1960 is less than it subsequently became, as Floras did not appear with the large page sizes subsequently adopted by modern atlas Floras. There therefore seems little reason to doubt that 'creeping inflation' did affect the length of county floras between 1730 and 1960, although there was very great variation in the length of individual Floras throughout that period. The length of the introductory material increased in response to the growing tendency of authors to provide a detailed treatment of the history of botany in the county and (in the 20th Century) the ecological aspects of the flora. Species accounts lengthened as the cumulative number of records increased over the years, and as counties were covered with increasing thoroughness, often by an increased number of recorders. The increase in length in the middle of the 19th Century may also in part reflect cheaper printing costs (Allen 2003). The phrase 'creeping inflation', although in some ways apt, perhaps suggests that the increasing length of Floras is an undesirable trend. In fact, later botanists have reason to be grateful for the wealth of records contained in the late 19th and early 20th Century Floras, even if the introductory accounts in some Floras seem unnecessarily prolix. After 1960, the adoption of grid maps allowed many more records to be summarised in a succinct manner, although sometimes this was at the expense of the historical context provided by the earlier works.

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PLOIDY OF *PRIMULA FARINOSA* L. REVISITED

Since 1932 the existence of polyploidy in *Primula farinosa* L. of European provenance has been accepted without re-examination of the sources of information. Chromosome numbers were given as 2n = 18, 2n = 36 and 2n = 72 in *The Chromosome Atlas of Flowering Plants* (Darlington & Wylie 1955). The sources of these records have been traced, and the validity of characteristic numbers other than 2n = 18, at least for European material, is questioned. Chromosome counts for *P. farinosa* distant from Europe are based on material from the mountainous Sayan region of Russia: Krogulevich (1978) records 2n = 18 and 2n =36 "according to our data" and 18, 36, and 72 "from other sources"; discussion of these records is beyond the scope of this note.

Darlington (1956) suggested that some *Primula* species including *P. farinosa* have produced tetraploids – "(probably auto-tetraploids) which have appeared within their own limits of distribution and variation (e.g. in Gothland *[sic]*)". Darlington was evidently referring to intraspecific variation and quoted no source for his reference to *P. farinosa,* but this might be presumed to relate to a letter to *Nature* (Davies 1953) in which evidence for such tetraploidy was illustrated by a photograph of a meiotic configuration in a squash preparation from a plant taken from the Swedish island of Götland. No clear indication of the numbers of cells or plants examined was provided although the comment that *the plant* appeared morphologically distinct from the British *Primula* may be a clue. Davies' (1953) count of n = 9 for *P farinosa* is evidently based upon material from a number of English localities.

Bruun (1932) had previously established 2n = 18 as characteristic of P. *farinosa* material, but also illustrated a count of 2n = 72 in a root tip cell, "with chromosomes clearly shorter than the main species", for one plant of unspecified provenance designated P. *farinosa* L. f. *Warei* Stein.; and, in a single plant with poor roots from Scotland, he found two anaphases of "probably, 36 to 50 chromosomes". Chromosome numbers other than 2n = 18 are thus based on very few cells from very few plants. Bruun expressed the need for re-examination of British material, and Davies (1953) mentioned the desirability of a more comprehensive cytological survey.

Bruun's illustrations, clearly establishing a chromosome number of 2n = 18 for *P. farinosa* from the island of Öland, Sweden, include an indubitable mitotic metaphase in polar view, and an illustration (see Fig. 1) of *"P. farinosa* ... Metaphase I n = 9". The latter comprises two cells, each with nine stained bodies, but the bodies are not obviously bivalent and the configurations seem more likely therefore to be meiotic telophase II cells in incipient pollen grains derived from a broken-down pollen mother cell tetrad: with either interpretation the number of chromosomes is not in doubt.

Discussion here must now centre on the suggestion by Davies (1953), and taken up by Darlington (1956) that a "form" of *P. farinosa* with 2n = 36 existed or exists. Three photographs, each measuring approximately 25 × 20 mm, and captioned "Meiotic metaphases ... of forms of *Primula farinosa"* provided the cytological evidence presented by Davies. It is necessary to consider only one of these – captioned "Tetraploid from Gotland". The photograph is evidently of a pollen-mother cell, although this is not stated. It is not reproduced here; instead, interpretative drawings are presented in Fig. 1. The stained units have shapes suggesting that they are each duplex, this being particularly evident in the body on the extreme left. However, the meiotic figure is not a meiotic metaphase, either first or second. It is, in fact, a telophase following anaphase I of meiosis. This contention is supported by the addition of explanatory lines to the illustration: the dashed line E – E in the enlarged drawing in Fig. 1 shows the notional position of the equator of metaphase 1, and highlights the existence of two sets of chromosomes – the end product of a division. Furthermore, had the cell been at metaphase 1 the usual technique of aceto-carmine staining and squashing would have presented an equatorial view with stained bodies clearly bivalent, and more-or-less in a row prior to the separation of their components: spindles are usually tipped onto their sides during squashing. The dotted lines in the figure enclose notional groups of chromosomes (each comprising two chromatids) reflected on each side of the dashed line showing how the final resting places of the anaphase I chromosomes corresponded in the living cell.

There are nine chromosomes in each telophase I configuration; each chromosome would be due to 'appear' on the spindle of metaphase II, and to reveal more clearly its component chromatids as

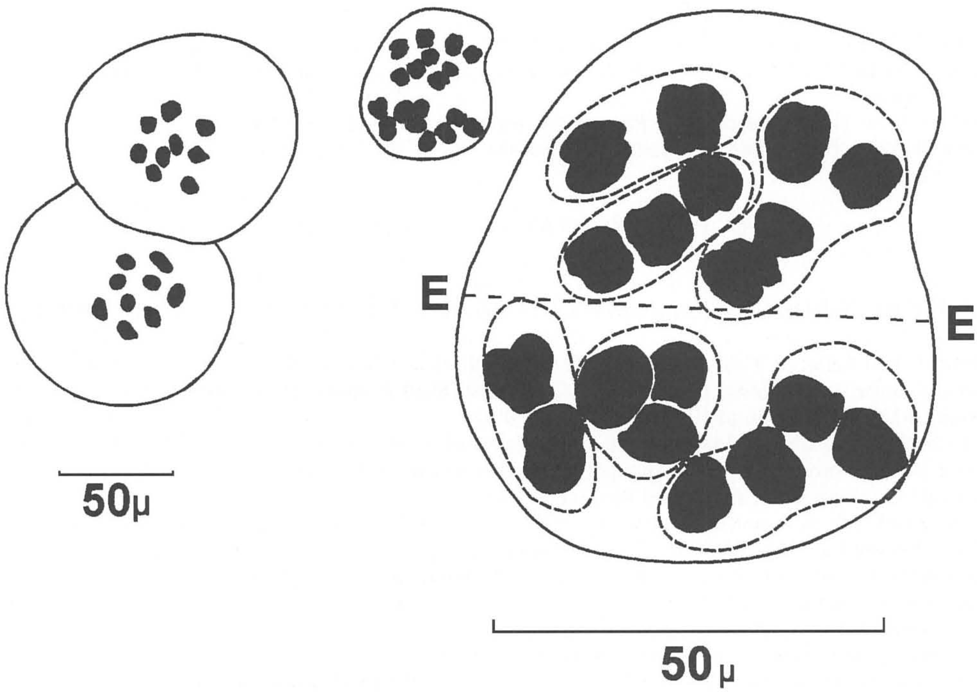

FIGURE 1. Chromosome complements of P. *farinosa* illustrated. Left: Bruun's (1932) "mejotic metaphase I n =9 *[x3500]*" from Öland, and inset an interpretative drawing based on a photograph described as a meiotic metaphase in acetocarmine of a form of *Primula farinosa* × 1200 "Tetraploid from Götland" by Davies (1953) - both at original size. Right enlargement of the inset with further interpretation: E ---- E hypothetical position of spindle equator; dotted lines enclose notionally corresponding groups of chromosomes on each side of the equator. Scales for the larger drawings are approximations calculated from the figures given by these authors.

these separated at anaphase II. The photograph thus provided good evidence that the pollen mother cell would have given rise to a tetrad with each potential pollen grain carrying nine chromosomes. Thus n = 9, and 2n = 18, in this Götland material.

As Davies (1953) wrote – "it is now clear that a more detailed cytological survey of this group *[Farinosae]*, from all over its geographical range, is desirable." To this might be added the provision that counts based on very few cells or single plants should be viewed with caution as being representative of a population. The presence of an endemic autotetraploid population anywhere (especially on a small island alongside diploids) is *a priori* unlikely. Autopolyploid individuals, with reduced sexual fertility, may occur sporadically in a plant species, as may single polyploid cells through failure of cytokinesis; whether chromosome counts greater than 2n = 18 in Bruun's paper were representative of individual plants or of atypical cells cannot be known This re-examination of *Primula farinosa* cytology illustrates how disputable information can originate, and generate theory persisting in the botanical literature for decades.

ACKNOWLEDGMENTS

Sources of illustrations reviewed here are given in the text and in the references.

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NEW RECORDS FOR *FALLOPIA* × *CONOLLYANA*: IS IT TRULY SUCH A RARITY?

Hybrid seed between *F. japonica* and *F. baldschuanica* was first discovered as long ago as 1983 from a range of locations, many of them in Wales (Bailey 2001), during the examination of seed produced by open-pollinated *Fallopia japonica* var. *japonica* plants. It took another four years for it to be found established in the wild at Railway Fields, Haringey by David Bevan (Bailey 1988). Since then no more established plants have been recorded from the British Isles. The discovery of isolated occurrences of this taxon throughout Europe prompted the publication of the new hybrid combination *F.* × *conollyana* (Bailey 2001). It is a most remarkable feature of this story that although most seed produced by *F. japonica* var. *japonica* in Europe is of this combination, only a vanishingly small proportion of it ever seems to become established in nature. Such seed when collected in the wild is frequently viable, and high germination rates are achieved when sown under greenhouse conditions.

There the situation remained until September 2002 when one of the authors (M.S.), discovered four putative *F.* × *conollyana* plants in the London Borough of Haringey whilst undertaking survey work for the Greater London Authority. The plants were found growing in a south-facing gutter on the asphalted roof of an old brick building at the North Middlesex Sports Club ground on Park Road GR TQ2988 (v.c. 21). The substrate was mostly humic run-off from the roof and approximately 5 cm deep. The *F.* × *conollyana* plants were growing in association with *Senecio squalidus*, *Poa annua* and *Solanum dulcamara*, and were suffering from water-stress in the unusually dry autumn. The largest of the plants was approximately 30 cm tall, much branched with a woody base; the second plant although smaller also had a woody base and the two remaining plants were single unbranched stems less than 10 cm tall. From this, it is evident that we are not dealing with a single cohort and that these plants represent successful germination and establishment over a period of two or more years. The largest plant appears to be two or three years old. The other woody plant could be younger or the same age, but certainly more than a year old as evidenced by the woody base. The two smallest are 2002 seedlings. What at first might appear to be a somewhat eccentric place for seed germination and establishment, is on reflection not so odd when considering the natural habitat of Japanese Knotweed in Japan. Bailey (in press) discusses the question of seed germination in Japan, where there is a marked distinction between the habitat of tall lowland *F. japonica* and the dwarf montane varieties. At high altitudes *F. japonica* is often the only higher plant present, and when other taxa do occur, there are still considerable areas of bare rock or volcanic ash to be found. In such habitats *F. japonica* is regularly recruited from seed and there is much genetic variation, with plants of all ages including seedlings. In contrast, at lower altitudes the taller lowland plants eke out their existence at the margins of dense forest and often appear to be clonal. Considering the very slow growth and lack of competitive ability of *F. japonica* seedlings, it is probable that seed germination in lowland habitats can only occur in the aftermath of major earth movements or volcanic activity. In this context, a hot bare roof does not seem such an odd place for a seedling with initial slow growth and little competitive ability. This does however beg the question of what happens to all the seed produced in Britain, which falls on bare soil. A reasonable theory is that seed does not survive our winters. Not, we hasten to add, due to the cold, as *F. japonica* grows at 3,500m on Mt Fuji! Although the hybrid seed is perfectly viable, it is still hybrid seed and, as such, the endosperm is not fully developed compared to seed produced by intraspecific fertilization or between taxa with comparable ploidy levels and base numbers (see Bailey 2001). The seed which gives rise to *F.* × *conollyana*, often contains enough endosperm for germination, but there is frequently a gap between the pericarp and the endosperm. In the damp conditions of a typical British winter it is quite possible that such malformed seed could be vulnerable to attack and destruction by zoosporic soil fungi such as *Pythium* and *Phytophthora*. The occurrence of plants of *F.* × *conollyana* where fungi dependant largely upon ground water for dispersal are unlikely to occur is of interest and may partially explain the apparent great rarity of this hybrid as mature plants in north-west Europe.

Finally, one must consider the implications of the first two confirmed British records for *F.* × *conollyana* occurring in the same region of London – is there something special about Haringey and if so, what? Or are urban botanists uniquely positioned to become adept at alien and novel plant identification? Whilst this note was in preparation another established plant of *F.* × *conollyana* was discovered growing in a garden in Eydon Northamptonshire (v.c. 32 SP5450), raising, the possibility of *F. conollyana* occurring in further sites across the British Isles; additionally, the potential for a new allopolyploid speciation event should now be considered more seriously.

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