PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Nuclear DNA Amounts in Angiosperms

M. D. Bennett and J. B. Smith

Phil. Trans. R. Soc. Lond. B 1991 **334**, 309-345
doi: 10.1098/rstb.1991.0120

Nuclear DNA amounts in angiosperms

M. D. BENNETT[1] AND J. B. SMITH[2]

[1] *Jodrell Laboratory, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3DS, U.K.*
[2] *The Cambridge Laboratory, Institute of Plant Science Research, Colney Lane, Norwich NR4 7UH, U.K.*

SUMMARY

Collected lists of nuclear DNA amounts estimated for a total of almost 1000 angiosperm species were published by Bennett & Smith (*Phil. Trans. R. Soc. Lond.* B **274**, 227–274 (1976)), and by Bennett *et al.* (*Proc. R. Soc. Lond.* B **216**, 179–199 (1982*a*)). Subsequently, work on nuclear genome size in flowering plant taxa, and interest in its consequences, has increased. Thus, estimates for 588 angiosperm species not previously listed were published, or communicated to us, between 1982 and mid-1986. As these additional estimates came from more than 50 sources which were either widely scattered in the scientific literature or unpublished personal communications, they are not readily accessible. This, and the many personal enquiries for the information received, shows that a further publication, compiling the new data is needed. This paper, therefore, contains a further supplementary list of absolute DNA amounts. This new compilation includes DNA *C* values for 629 angiosperm species not listed in either of the above-mentioned papers, with additional estimates for 119 species already listed by them. These data are assembled primarily for reference purposes. Analysis of citations of the two previously published lists and of personal requests for additional information both show that the major users of genome size information are cell and molecular biologists. Consequently, the species are listed as before in alphabetical order, rather than by any taxonomic scheme, as this was felt to be more helpful to these users

1. INTRODUCTION

The development of various routine chemical and cytochemical techniques for measuring the amount of DNA per cell, or per nucleus, has allowed the size of the unreplicated haploid nuclear genome (known as the *C*-value) to be estimated in several thousand plant or animal species since the 1950s. Comparison of the results has revealed considerable variation in DNA *C*-value between species in several, though not all, major taxonomic groups of such organisms (Callan 1972; Sparrow *et al.* 1972; Cavalier-Smith 1978, 1985*a*) including variation of at least 2500-fold among angiosperm species, with 1*C* values claimed to range from 0.05 pg in *Cardamine amara* to 127.4 pg in *Fritillaria assyriaca* (Bennett & Smith 1976; Bennett 1985).

It was soon recognized that variation in DNA amount both among eukaryotes as a whole, or among species within large taxonomic groups, such as insects, amphibia, algae, or the angiosperms, was not correlated with organismic complexity (Thomas 1971), and hence was not determined by a need for more types of genes. Various theories were advanced to account for the observed variation in DNA *C*-value, including changes in the number of DNA strands within chromosomes (Martin & Shanks 1966) and cryptopolyploidy (Sparrow & Nauman 1976), although these ideas were never widely accepted. However, with the discovery of repeated DNA sequences (Britten & Kohne 1968) and the finding that variation in DNA *C*-value in angiosperms mainly involves an increase in the amount and proportion of repeated DNA sequences in the nuclear genome (Flavell *et al.* 1974), many of which are presumably non-genic, and not transcribed (Lewin 1975; Orgel & Crick 1980), the search for an explanation for the question of the significance of the massive variation in DNA *C*-value, epitomized as the '*C*-value paradox' by Thomas (1971), became more focused. Thus, with increasing nuclear genome size the ratio of genic:non-genic DNA in the genome is reduced. Indeed, non-genic DNA probably accounts for 90%, and perhaps even 99% of the DNA in angiosperms with the largest genomes (Flavell 1980). Such information fostered new speculation concerning the origin and function (if any) of variation in DNA type and amount, and produced increased interest in genome size in the early 1980s. Non-genic sequences, whose amount and proportion can vary in the nuclear genome, were variously suggested to be 'junk' DNA (Ohno 1972), 'secondary' DNA (Hinegardner 1976), 'nonsense' DNA (Wang & Fundenberg 1974), and, more recently, as 'selfish' DNA (Orgel *et al.* 1980; Orgel & Crick 1980), 'parasitic' DNA (Orgel & Crick 1980), or 'ignorant' DNA (Dover 1980). Moreover, Dover (1982) has proposed a process of spread and fixation of 'selfish' repeated sequences as a result of non-reciprocal processes called 'molecular drive'.

Another major interest in the biological significance of genome size has stemmed from the finding that interspecific and intraspecific variation in DNA *C*-value is correlated, often very closely, with many diverse phenotypic characters at nuclear, cellular, tissue, and even organismic levels (Bennett 1973, 1985,

1987; Olmo 1983; Horner & MacGregor 1983; Cavalier-Smith 1985*b*).

For example, major interspecific variation in DNA amount in angiosperms has been shown to correlate with the total volume of centromeres per nucleus (Bennett *et al.* 1981), chromosome length or volume (Rees *et al.* 1966; Bennett *et al.* 1983; Anderson *et al.* 1985), nuclear volume and mass (Baetcke *et al.* 1967; Pegington & Rees 1970), cell volume and mass (Martin 1966; Jellings & Leech 1984; Lawrence 1985) and the volume of mature pollen grains (Bennett 1972; Lawrence 1985).

Other correlations have been shown between DNA amount and the number of chloroplasts per stomatal guard cell (Butterfass 1983) and the number of copies of the chloroplast genome per leaf mesophyll cell (Bowman 1986), seed mass (Bennett 1972; Jones & Brown 1976; Thompson 1990), the rate and duration of DNA synthesis (Van't Hof 1965, 1975), the minimum duration of the mitotic cell cycle (Van't Hof & Sparrow 1963; Evans *et al.* 1972; Van't Hof 1975), the duration of meiosis (Bennett 1971, 1977), minimum generation time (Bennett 1972; Smith & Bennett 1975), radiosensitivity (Sparrow & Miksche 1961; Underbrink & Pond 1976) and radiation-induced mutation rates (Abrahamson *et al.* 1973), ecological and phenological factors (Grime & Mowforth 1982) and the optimum environment and the geographical ranges of crop (Bennett 1976*a*, *b*; Rayburn *et al.* 1985; Laurie & Bennett 1985) and non-crop species (Bennett, *et al.* 1982*b*; Grime 1983). Clearly, nuclear DNA influences the phenotype in two distinct ways, first by expression of its genic content, and second by the physical effects of its mass and volume. The term 'nucleotype' was coined to define those conditions of the nuclear DNA which affect the phenotype independently of its encoded informational content (Bennett 1971, 1972, 1973). Thus studies of the consequences of large scale variation in DNA amount show that the DNA *C*-value is a character of fundamental biological significance.

Rees & Walters (1965) used DNA amount measurements to investigate the phylogeny of bread wheat. Since then comparisons of nuclear genome size in related angiosperm taxa have shown DNA *C*-value to be a useful character in several cytotaxonomical and evolutionary studies (Price 1976). Questions addressed in this context include: (i) whether the DNA *C*-value increases in proportion to ploidy level (Ohri & Khoshoo 1982; Marchi *et al.* 1983); (ii) whether the amount of DNA in particular constituent genomes of an allopolyploid, equals that of its putative donor species (Verma & Rees 1974; Nishikawa & Furuta 1978); (iii) whether evolutionarily advanced species within a group have more or less DNA than related diploids and hence whether advancement has involved the gain or loss of DNA (Nagato *et al.* 1981; Greilhuber 1982; Martin 1983); and (iv) whether or not the general pattern of DNA amounts within a group agrees with a previously established taxonomic scheme (for a group of diploids) based on other characters (Price & Bachmann 1975; Le Coq *et al.* 1977).

Interest in the amount of DNA in the genomes of organisms in general, and of angiosperms in particular, was noticeably increased in the early 1980s (see figure 1) for both practical and theoretical reasons of concern to a wide range of biologists. Publication of '*The evolution of genone size*' (Cavalier-Smith 1985*c*) exemplified this general interest, as did the significant work of Grime and colleagues in proposing ecological interpretations of variation in genome size (Grime & Mowforth 1982; Grime *et al.* 1985).

Part of this enhanced interest stemmed from the realization that detectable, and often quite considerable, intraspecific variation in DNA amount, despite a constant chromosome number and ploidy level, is much more common than was once thought (see Bennett 1985). Such intraspecific variation may also have adaptive significance (Bennett 1985) via its nucleotypic effects with plant phenotypic and phenological characters.

Another new interest came from the demonstration that interspecific variation in DNA amount is distributed in the karyotype in at least two highly non-random ways. Thus, in particular angiosperm genera, such variation involves either the addition or deletion of a constant absolute amount of DNA to each chromosome type (see Rees 1984) or the addition or deletion of a constant proportional amount of DNA which maintains the relative shapes of all the chromosome arms in the karyotype constant (see Rees *et al.* 1978; Brandham 1983). It has been suggested that such karyotype evolution is of functional significance, and may reflect selection for a particular architecture determined by constraints of position effects affecting interchromosomal interactions that depend on the spatially ordered genome (Bennett 1984*a*, *b*).

A knowledge of genome size is most useful to any worker estimating the number of clones needed to create a species gene library which should contain a given gene, or genes, with a defined probability. Further practical significance of a knowledge of the DNA *C*-value is seen from its relevance for choosing the most suitable species for particular kinds of molecular studies. For example, Meyerowitz was attracted to *Arabidopsis thaliana* as a potential plant equivalent of *Drosophila* because of its unusually small genome, and its extraordinarily short minimum generation time (a character itself related to very low DNA amount; Bennett 1972). The remarkable low amount of repeated DNA sequences, and the fact that specific genes are present in one copy per nuclear genome, two characters that reflect selection for a near minimal DNA amount for an angiosperm, make *Arabidopsis thaliana* highly suitable for 'chromosome walking' around the sites of restriction-fragment length polymorphisms linked to mutations to clone important genes, especially, it was hoped, those involved in the regulation of development (Leutwiler *et al.* 1984; North 1985). Indeed, very low genome size was one most important character influencing the recent selection of *A. thaliana* as the first angiosperm chosen to have its entire genome sequenced in an international collaboration (NSF 1990; Anderson 1991). Other angiosperm candidates for genome sequencing, such as *Oryza sativa*, are also chosen, or suggested, partly

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

because of their relatively low DNA *C*-values. On a different scale, knowledge of DNA *C*-values could have practical significance in view of recent suggestions that this character would play an important role in determining which plant and crop species would survive best the effects of a nuclear winter (Grime 1986), and how different plants would respond to ozone depletion (Bennett 1987) or to global warming (Grime 1986, 1990).

Given the wide interest in and considerable importance of DNA amount, it is obviously important that information regarding the amount of DNA that various organisms possess in their nuclear genomes is easily available to scientists. However, nuclear DNA amounts of angiosperms, often for only one or a few species, are published in numerous papers in diverse journals, while many estimates exist only as unpublished results in researchers' notebooks. Consequently, locating an estimate or checking whether an estimate has been made for a given taxon, can be both difficult and time consuming. There is, therefore, a continuing need to gather widely scattered DNA values into a single list assembled primarily for reference purposes. In view of this the present authors compiled a first list of DNA amounts for about 750 angiosperm species (Bennett & Smith 1976). Later a supplementary list of DNA amounts for a further 240 species not previously listed by Bennett & Smith (1976) was compiled (Bennett *et al.* 1982*a*). These lists have been widely used. For example, between 1976 and 1984 the Science Citation Index lists well over a hundred citations of the original list (Bennett & Smith 1976).

The number of estimates of DNA *C*-values for angiosperms published per year was reduced after 1976 compared with the early 1970s (Bennett *et al.* 1982*a*). However, that trend was strikingly reversed after 1981 (figure 1). Indeed, by mid-1986 the present authors became aware of estimates of DNA amount for 629 angiosperm species not included in either Bennett & Smith (1976) or Bennett *et al.* (1982*a*). Additional estimates for 119 species already included in a previous compilation were also located. Significantly, estimates for 588 of the previously unlisted species were published, or became known to us, after 1981. This large number of new estimates was obtained from more than fifty published or unpublished sources. Given the wide use made of previous lists, and the many requests for further information it was decided to compile these new or additional estimates of genome size into a single list in the present work as a further supplement to Bennett & Smith (1976).

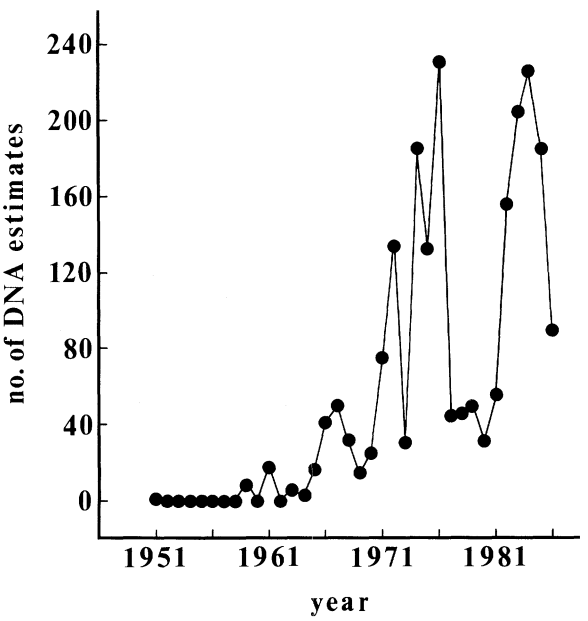

Figure 1. The number of DNA amounts for angiosperms published or communicated each year between 1951 and mid-1986 for 2073 estimates listed in Bennett & Smith (1976), Bennett *et al.* (1982*a*) and table 1 of the present work.

2. LIST OF DNA AMOUNTS IN ANGIOSPERMS

Information concerning estimates of DNA amounts in 748 angiosperm species is given in table 1, and some explanatory notes relating to this table are given in §5.

As in Bennett & Smith (1976) and Bennett *et al.* (1982*a*), species are presented, not in the order in which they would occur in a flora, but in alphabetical order. This arrangement is considered most helpful to non-taxonomists, who, it is anticipated, will continue to be the major users of the list.

The format of the present table 1 is identical with that of table 1 in Bennett *et al.* (1982*a*). To avoid confusion, original references for DNA amounts (given in column 13 of the present table 1) are numbered 108 *et seq.* to follow on consecutively from those numbered 1–54 in the corresponding column of table 8 and §7*c* of Bennett & Smith (1976), and 55–107 in the corresponding column of table 1 and §5*a* of Bennett *et al.* (1982*a*).

As noted previously, published DNA amounts are of widely different reliability; so some choice had to be exercised in deciding which estimates should be included in table 1, and which omitted. The procedure adopted was exactly as described in §7*c* of Bennett & Smith (1976).

3. USE OF MICROCOMPUTER

As noted previously (Bennett *et al.* 1982*a*), use of a microcomputer can greatly facilitate the storage and manipulation of DNA amount data. The complete data included in table 1 of the present work have been entered into an IBM microcomputer using Microsoft Word and are stored on a 5.25 inch floppy disk. Copies of this disk can be obtained for research purposes by arrangement with the first author.

The availability of these data in this form can greatly speed their examination and analysis. For example, using prime entries (see §5*d*) for species with known life-cycle type listed in table 1, it was relatively easy to ascertain that the mean 4*C* DNA amount for 139 annual species (11.96 pg) is significantly lower ($p < 0.01\,\%$) than that for 460 non-annuals (25.81 pg), thereby confirming the results of two previous comparisons (Bennett 1972; Bennett *et al.* 1982*a*) for two different but somewhat smaller samples of angiosperm species.

4. SUPPLEMENTARY LISTS OF DNA AMOUNTS FOR ANGIOSPERMS

The main author intends to publish further supplementary lists of DNA amounts for angiosperms at suitable intervals and would therefore continue to welcome receiving offprints, preprints and personal communications giving new DNA estimates for higher plants. Indeed, it is nearly ten years since the last supplementary list was published, and the present work only lists DNA *C*-values known to us by mid-1986. Since then new estimates of DNA amounts for more than 500 angiosperm species have been published (estimated) so that a further supplementary list is already needed and in preparation.

It would be most helpful, and increase the value and comparability of their data, if scientists publishing DNA estimates for species would wherever possible give all or as many details concerning their material(s) as in table 1, including: the authority, chromosome number, ploidy level, a *C*-value in absolute units, the standard species used for calibration and its assumed *C*-value, the method used to estimate DNA amount and the life-cycle type of the species.

Hitherto for simplicity, and because herbarium specimens are not available for most taxa whose DNA amounts were studied, species have been, and are in the present work, listed by using the names of materials given in the original paper or personal communication. To avoid ambiguity, and to allow checking of materials examined, authors publishing DNA amounts should, whenever possible, prepare a herbarium specimen of each taxon studied and state where it is deposited. Future supplementary lists will distinguish between estimates for materials where herbarium specimens are, or are not, available for taxonomic checking.

Fewer authors give DNA estimates only in arbitrary units in recent years. Nevertheless, it is worth noting again that relative DNA amounts for species in arbitrary units alone are of very limited use compared with those calibrated in absolute units. Thus, scientists are strongly recommended to publish results in absolute units. This need involve very little additional effort, and may be achieved by including in each experiment one or more species whose DNA amount is already known as a calibration standard.

Seed of most of the standard angiosperm species listed in §5*b* (with the exception of *Anemone virginiana* and *Senecio vulgaris*) may be obtained from the main author for this purpose.

5. NOTES TO TABLE 1

(*a*) The key to the original references for species DNA amounts in table 1 is as follows.

108. This paper; n.b. methods were as previously described in Bennett & Smith (1976).

109. Martin, N. J. 1983 Nuclear DNA variation in the Australasian Loranthaceae. In *Biology of mistletoes* (ed. M. Calder & P. Berhnhardt), pp. 277–293, Sydney: Academic Press.

110. Grime, J. P. & Mowforth, M. A. 1982 Variation in genome size – an ecological interpretation. *Nature, Lond.* **299**, 151–153.

111. Marchi, P., Illuminati, O., Macioce, A., Capineri, R. & D'Amato, G. 1983 Genome evolution and polyploidy in *Leucanthemum vulgare* Lam. Aggr. (Compositae). Karyotype analysis and DNA microdensitometry. *Caryologia* **36**, 1–18.

112. Raina, S. N. & Rees, H. 1983 DNA variation between and within chromosome complements of *Vicia* species. *Heredity, Lond.* **51**, 335–346.

113. Narayan, R. K. J. 1982 Discontinuous DNA variation in the evolution of plant species: The genus *Lathyrus*. *Evolution* **36**, 877–891.

114. Lawrence, M. E. 1985 *Senecio* L. (Asteraceae) in Australia: nuclear DNA amounts. *Aust. J. Bot.* **33**, 221–232.

115. Resslar, P. M., Stucky, J. M. & Miksche, J. P. 1981 Cytophotometric determination of the amount of DNA in *Arachis* L. sect. *Arachis* (Leguminosae). *Am. J. Bot.* **68**, 149–153.

116. Sims, L. E. & Price, H. J. 1985 Nuclear DNA content variation in *Helianthus* (Asteraceae). *Am. J. Bot.* **72**, 1213–1219.

117. Schifino, M. T. & Winge, H. 1983 Karyotypes and nuclear DNA content of species of the *Briza* complex and some other genera of *Poeae* (Gramineae). *Rev. Brazil. Genet.* **6**, 245–259.

118. Le Coq, C., Guervin, C., Hamel, J.-L. & Jolinon, D. 1978 La quantité d'ADN nucléaire et la garniture chromosomique chez quelques ombellifères: Application a l'étude de leur évolution. Actes du 2e Symposium International sur les Ombelliferes. 'Contributions pluridisciplinaires à la systématique'. Perpignan, pp. 281–291.

119. Jones, K. & Kenton, A. 1984 Mechanisms of chromosome change in the evolution of the tribe *Tradescantieae* (Commelinaceae). In *Chromosomes in evolution of eukaryotic groups* (ed. A. Sharma & A. K. Sharma), pp. 143–168. Boca Raton, Florida: CRC. Press.

120. Martinez, A. J. 1978 Chromosome relationships in the *Tradescantia crassifolia* alliance. Ph.D. thesis, University of Reading, U.K.

121. A. Kenton (personal communication, 1984).

122. Grif, V. G., Valovich, E. M. & Lebedeva, N. V. 1980 Parameters of the mitotic cycle in two species of *Trillium* L. *Tsitologia* **22**, 1331–1338.

123. Barlow, P. W. & Rathfelder, E. L. 1984 Correlations between the dimensions of different zones of grass root apices and their implications for morphogenesis and differentiation in roots. *Ann. Bot.* **53**, 249–260.

124. Anderson, L. K., Stack, S. M., Fox, M. H. & Zhang Chuansan. 1985 The relationship between genome size and synaptonemal complex length in higher plants. *Expl Cell Res.* **156**, 367–377.

125. Dhillon, S. S., Rake, A. V. & Miksche, J. P. 1980 Reassociation kinetics and cytophotometric characterisation of peanut (*Arachis hypogaea* L.) DNA. *Pl. Physiol.* **65**, 1121–1127.

126. N. Kuriyan (unpublished values communicated by R. K. Narayan, 1984).

127. Ramachandran, C. & Narayan, R. K. J. 1985 Chromosomal DNA variation in *Cucumis*. *Theor. appl. Genet.* **69**, 497–502.

128. E. M. Watson (personal communication, 1981).

129. S. W. Armstrong, A. D. Kidd, D. Francis, L. H. Jones & G. Smith (personal communication, 1984).

130. P. Barlow (personal communication, 1981).

131. Jones, L., Barfield, D., Barrett, J., Flook, A., Pollock, K. & Robinson, P. 1982 Cytology of oil palm cultures and regenerant plants. *Proc. 5th Int. Cong. Plant Tissue & Cell Culture*, 727–728.

132. Laurie, D. A. & Bennett, M. D. 1985 Nuclear DNA

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

content in the genera *Zea* and *Sorghum*. Intergeneric, interspecific and intraspecific variation. *Heredity, Lond.* **55**, 307–313.

133. Grime, J. P., Shacklock, J. M. L. & Band, S. R. 1985 Nuclear DNA contents, shoot phenology and species co-existence in a limestone grassland community. *New Phytol.* **100**, 435–445.

134. Ohri, D. & Khoshoo, T. N. 1982 Cytogenetics of cultivated *Bougainvilleas*. X. Nuclear DNA content. *Z. Pflanzenzuchtg.* **88**, 168–173.

135. Black, C. L. & Beckmann, R. L. 1983 The variability of nuclear DNA and its implications for polyploidy in white ash (*Fraxinus americana* L.: Oleaceae). *Am. J. Bot.* **70**, 1420–1423.

136. Hake, S. & Walbot, V. 1980 The genome of *Zea mays*, its organisation and homology to related grasses. *Chromosoma* **79**, 251–270.

137. Goldblatt, P., Walbot, V. & Zimmer, E. A. 1984 Estimation of genome size (C-value) in Iridaceae by cytophotometry. *Ann. Missouri Bot. Gard.* **71**, 176–180.

138. Nagato, Y., Yamamoto, K. & Yamashita, H. 1981 Variation of DNA content in Asian rice. *Jap. J. Genet.* **56**, 483–493.

139. S. W. Armstrong, A. D. Kidd & D. Francis (personal communication, 1984).

140. Guerra, M. dos S. 1984 Cytogenetics of *Rutaceae*. II. Nuclear DNA content. *Caryologia* **37**, 219–226.

141. Guerra, M. dos S. 1983 Variação no conteúdu de DNA nuclear de *Pisum sativum* L. *Ci. e Cult.* **35**, 1661–1663.

142. Pearson, G. G., Timmis, J. N. & Ingle, J. 1974 The differential replication of DNA during plant development. *Chromosoma* **45**, 281–294.

143. Murray, M. G., Cuellar, R. E. & Thompson, W. F. 1978 DNA sequence organisation in the pea genome. *Biochemistry* **17**, 5781–5790.

144. Kiper, M. & Herzfield, F. 1978 DNA sequence organisation in the genome of *Petroselinum sativum* (Umbelliferae). *Chromosoma* **65**, 335–351.

145. Greilhuber, J. 1982 Trends in der Chromosomenevolution von *Scilla* (Liliaceae). *Stapfia* **10**, 11–51.

146. Goldberg, R. B. 1978 DNA sequence organisation in the soybean plant. *Biochem. Genet.* **16**, 45–68.

147. Zimmermann, J. L. & Goldberg, R. B. 1977 DNA sequence organisation in the genome of *Nicotiana tabacum*. *Chromosoma* **59**, 227–252.

148. Greenlea, J. K., Rai, K. S. & Floyd, A. D. 1984 Intraspecific variation in nuclear DNA content in *Collinsia verna* Nutt. (Scrophulariaceae). *Heredity, Lond.* **52**, 235–242.

149. Yamamoto, K. & Nagato, Y. 1984 Variation of DNA content in the genus *Glycine*. *Japan. J. Breed.* **34**, 163–170.

150. Belford, H. S. & Thompson, W. F. 1981 Single copy DNA homologies in *Atriplex*. I. Cross reactivity estimates and the role of deletions in genome evolution. *Heredity, Lond.* **46**, 91–108.

151. Walbot, V. & Dure, L. S. 1976 Developmental biochemistry of cotton seed embryogenesis and germination. VII. Characterisation of the cotton genome. *J. molec. Biol.* **101**, 503–536.

152. Narayan, R. K. J. & Rees, H. 1976 Nuclear DNA variation in *Lathyrus*. *Chromosoma* **54**, 141–154.

153. Kenton, A. 1954 Chromosome evolution in the *Gibasis linearis* group (Commelinaceae). III. DNA variation, chromosome evolution, and speciation in *G. venestula* and *G. heterophylla*. *Chromosoma* **90**, 303–310.

154. S. R. Band (personal communication, 1984).

155. Olszewska, M. & Osiecka, R. 1982 The relationship between 2*C* DNA content, life cycle type, systematic position, and the level of DNA endoreduplication in nuclei of parenchyma cells during growth and differentiation of roots in some monocotyledonous species. *Biochem. Physiol. Pflanzen.* **177**, 319–336.

156. Olszewska, M. J. & Osiecka, R. 1983 The relationship between 2*C* DNA content, life cycle type, systematic position and the dynamics of DNA endoreduplication in parenchyma nuclei during growth and differentiation of roots in some dicotyledonous herbaceous species. *Biochem. Physiol. Pflanzen.* **178**, 581–599.

157. Olszewska, M. J. & Osiecka, R. 1984 The relationship between 2*C* DNA content, systematic position and the level of nuclear DNA endoreduplication during differentiation of root parenchyma in some dicotyledonous shrubs and trees. Comparison with herbaceous species. *Biochem. Physiol. Pflanzen.* **179**, 641–657.

158. Mowforth, M. A. G. 1986 Variation in nuclear DNA amounts in flowering plants: an ecological analysis. Ph.D. thesis, University of Sheffield.

159. Ogur, M., Erickson, R. O., Rosen, G. U., Sax, K. B. & Holden, C. 1951 Nucleic acids in relation to cell division in *Lilium longiflorum*. *Expl Cell Res.* **2**, 73–89.

160. Rayburn, A. L., Price, H. J., Smith, J. D. & Gold, J. R. 1985 C-band heterochromatin and DNA content in *Zea mays* L. *Am. J. Bot.* **72**, 1610–1617.

161. Chauhan, K. P. S. & Brandham, P. E. 1985 Chromosome and DNA variation in *Amorphophallus* (Araceae). *Kew Bull.* **40**, 745–758.

162. Leutwiler, L. S., Hough-Evans, B. R. & Meyerowitz, E. M. 1984 The DNA of *Arabidopsis thaliana*. *Molec. Gen. Genet.* **194**, 15–23.

163. Ainsworth, C. C., Parker, J. S. & Horton, D. M. 1984 Chromosome variation and evolution in *Scilla autumnalis*. In *Kew chromosome conference II* (ed. P. E. Brandham & M. D. Bennett), pp. 261–268. London: Allen & Unwin.

(*b*) Bennett & Smith (1976) gave absolute 4*C* DNA values for eight angiosperm species recommended for use as calibration standards to estimate DNA amounts in other species. Following her extensive work on *Senecio* Lawrence (1985) suggested that the value of 4*C* = 5.88 pg given by Bennett & Smith (1976) for *Senecio vulgaris* (PBI population) was too low. This seemed possible, as *S. vulgaris* had by far the lowest DNA amount of the eight standard species, and hence differed the most from *Allium cepa* cv. Ailsa Craig (4*C* = 67.0 pg), against which the other seven standard species were calibrated. It is desirable for technical reasons that the DNA amount of a calibration standard should not differ too greatly from that of an unknown. Consequently, the DNA amount of *S. vulgaris* (PBI population) was carefully recalibrated against a standard species with a lower DNA amount, namely, *Hordeum vulgare* cv. Sultan (4*C* = 22.24 pg). The slightly higher value obtained (4*C* = 6.33 pg) replaces the value for *S. vulgaris* given by Bennett & Smith (1976) in the following list of 4*C* DNA amounts for the eleven calibration standards available for use in the present work:

	amount/pg
A *Triticum aestivum* cv. Chinese Spring	69.27
B *Allium cepa* cv. Ailsa Craig	67.00
C *Vicia faba* (PBI, inbred line 6)	53.31
D *Anemone virginiana* line AV 200	35.67
E *Secale cereale* cv. Petkus Spring	33.14
F *Hordeum vulgare* cv. Sultan	22.24
G *Pisum sativum* cv. Minerva Maple	19.46
H *Zea mays* cv. W64A	10.93

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. *Chromosome number, ploidy level, life-cycle type, and nuclear DNA content in 748 angiosperm species*

(The superscript letters refer to notes in §5.)

entry no.[f]	species	family	monocot or dicot	$2n$‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
1	*Acer carpinifolium* Sieb.et Zucc.	Aceraceae	D	52	4	P	0.4	0.8	1.1	1.5	—	157	O	B	Fe
2c	*Acer pseudoplatanus* L.	Aceraceae	D	52	4	P	1.4	2.7	4.1	5.4	—	157	O	B	Fe
3	*Achillea millefolium* L.	Compositae	D	54	6	P	7.7	15.3	22.9	30.6	—	158[i]	O	I	Fe
4	*Agave colorata* Gentry	Agavaceae	M	60	2	P	4.5	9.1	13.6	18.1	—	108	O	G	Fe
5	*Agave desertii* Engelm.	Agavaceae	M	60	2	P	4.8	9.6	14.4	19.2	—	108	O	G	Fe
6	*Agave lechuguilla* Torr.	Agavaceae	M	120	4	P	8.6	17.2	25.8	34.4	—	108	O	J	Fe
7	*Agave palmeri* Engelm.	Agavaceae	M	60?	2	P	3.6	7.3	10.9	14.5	—	108	O	F	Fe
8	*Agrostemma githago* L.	Caryophyllaceae	D	—[u]	—[v]	A	2.1	4.2	6.3	8.4	—	156	O	B	Fe
9	*Agrostis canina* L.	Gramineae	M	—[u]	—[v]	P	3.4	7.0	10.5	14.0	—	154[i]	R	I	Fe
10	*Agrostis capillaris* L.	Gramineae	M	28	4	P	3.5	7.1	10.6	14.1	—	158[i]	O	I	Fe
11	*Agrostis stolonifera* L. *Agrostis tenuis* Sibth. (listed under *Agrostis capillaris* L.)	Gramineae	M	—[u]	—[v]	P	3.5	7.0	10.5	14.0	—	154[i]	R	I	Fe
12	*Agrostis vinealis* Schreber	Gramineae	M	—[u]	—[v]	P	3.5	6.9	10.4	13.8	—	133[i]	O	I	Fe
13	*Alepis flavida* (Hook. f.) Tieghem	Loranthaceae	D	24	2	P	7.3[f]	14.6[f]	21.9[f]	29.2[f]	—	109	O	C	Fe
14	*Alisma plantago-aquatica* L.	Alismataceae	M	14	2	P	10.3	20.6	30.9	41.2	—	154[i]	O	B	Fe
15b	*Allium porrum* L.	Liliaceae	M	32	4	P	31.6	63.2	94.8	126.4	—	124	O	B	FC
15c	*Allium porrum* L.	Liliaceae	M	32	4	P	32.7	65.3	98.0	130.6	—	155	O	B	Fe
16b	*Allium sativum* L.	Liliaceae	M	16	2	P	17.9	35.7	53.6	71.4	—	155	O	B	Fe
17b	*Allium schoenoprasum* L.	Liliaceae	M	16	2	P	8.3	16.6	24.9	33.2	—	124	O	B	FC
18	*Allium ursinum* L.	Liliaceae	M	14	2	P	31.5	63.0	94.5	126.0	—	110[i]	O	B	Fe
19	*Allium vineale* L.	Liliaceae	M	—[u]	—[v]	P	18.0	36.0	54.0	72.0	—	155	O	B	Fe
20	*Alnus glutinosa* (L.) Gaertner	Betulaceae	D	28	2	P	0.5	1.1	1.6	2.2	—	154[i]	R	I	Fe
21	*Alnus viridis* (Chaix) Lam et DC	Betulaceae	D	28	2	P	0.6	1.1	1.7	2.2	—	157	O	B	Fe
22	*Alopecurus geniculatus* L.	Gramineae	M	28	4	P	7.5	14.9	22.4	29.9	—	154[i]	R	I	Fe
23	*Alopecurus pratensis* L. cv.Brudzynski	Gramineae	M	—[u]	—[v]	P	6.8	13.6	20.4	27.2	—	155	O	B	Fe
24	*Amaranthus cruentus* L.	Amaranthaceae	D	32	2	A	0.5	1.1	1.6	2.1	—	108	O	J	Fe
25	*Amaranthus hypochondriacus* L.	Amaranthaceae	D	32	2	A	0.5	0.9	1.4	1.9	—	108	O	J	Fe
26	*Amaryllis belladonna* L.	Amaryllidaceae	M	22	2	P	15.1	30.1	45.2	60.2	—	155	O	B	Fe
27	*Amorphophallus abyssinicus* (A.Rich.) N.E.Brown	Araceae	M	26	2	P	10.7	21.5	32.2	42.9	—	161	O	B	Fe
28	*Amorphophallus bulbifer* (Roxb.) Blume	Araceae	M	39	3	P	9.3	18.6	27.9	37.1	—	161	O	B	Fe
29	*Amorphophallus commutatus* (Schott) Engl.	Araceae	M	26	2	P	11.7	23.5	35.2	47.0	—	161	O	B	Fe
30	*Amorphophallus dubius* Blume	Araceae	M	28	2	P	4.0	8.0	12.0	16.0	—	161	O	B	Fe
31	*Amorphophallus goetzei* (Engl.) N.E.Brown	Araceae	M	26	2	P	11.3	22.6	34.0	45.3	—	161	O	B	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

32	*Amorphophallus hildebrandtii* (Engl.) Engl.& Gehrm	Araceae	M	26	2	P	12.8	25.6	38.4	51.3	—	161	O	B	Fe
33	*Amorphophallus johnsonii* N.E.Brown	Araceae	M	26	2	P	15.8	31.7	47.5	63.3	—	161	O	B	Fe
34	*Amorphophallus lambii* Mayo & Widjaja	Araceae	M	26	2	P	7.6	15.3	22.9	30.5	—	161	O	B	Fe
35	*Amorphophallus laxiflorus* N.E.Brown	Araceae	M	26	2	P	11.8	23.5	35.3	47.0	—	161	O	B	Fe
36	*Amorphophallus oncophyllus* Prain ex.Hook.f.	Araceae	M	39	3	P	9.7	19.4	29.1	38.9	—	161	O	B	Fe
37	*Amorphophallus paeoniifolius* (Dennst.) Nicolson	Araceae	M	28	2	P	4.2	8.4	12.6	16.8	—	161	O	B	Fe
38	*Amorphophallus prainii* Hook.f.	Araceae	M	28	2	P	3.8	7.5	11.3	15.1	—	161	O	B	Fe
39	*Amorphophallus sutepensis* Gagnep.	Araceae	M	26	2	P	6.2	12.3	18.5	24.7	—	161	O	B	Fe
40	*Amyema artense* (Mont.) Danser	Loranthaceae	D	18	2	P	8.3	16.6	24.9	33.1	—	109	O	C	Fe
41	*Amyema bifurcatum* (Benth.) Tieghem	Loranthaceae	D	18	2	P	12.3[f]	24.7[f]	37.0[f]	49.3[f]	—	109	O	C	Fe
42	*Amyema cambagei* Danser	Loranthaceae	D	18	2	P	12.5	25.0	37.5	50.0	—	109	O	C	Fe
43	*Amyema congener*[e] (Sieber ex Schultes & J.H.Schultes) Tieghem	Loranthaceae	D	18	2	P	9.7[f]	19.3[f]	29.0[f]	38.7[f]	—	109	O	C	Fe
44	*Amyema conspicuum*[e] (F.M.Bail) Danser	Loranthaceae	D	18	2	P	9.4[f]	18.8[f]	28.2[f]	37.6[f]	—	109	O	C	Fe
45	*Amyema finisterrae* Danser	Loranthaceae	D	18	2	P	13.9	27.7	41.6	55.5	—	109	O	C	Fe
46	*Amyema friesianum*[e] (Schumann) Danser	Loranthaceae	D	18	2	P	13.8[f]	27.5[f]	41.3[f]	55.1[f]	—	109	O	C	Fe
47	*Amyema gaudichaudii* (DC.) Tieghem	Loranthaceae	D	18	2	P	10.9[f]	21.8[f]	32.8[f]	43.7[f]	—	109	O	C	Fe
48	*Amyema gibberulum*[e] (Tate) Danser	Loranthaceae	D	18	2	P	10.1[f]	20.2[f]	30.2[f]	40.3[f]	—	109	O	C	Fe
49	*Amyema herbertianum* Barlow	Loranthaceae	D	18	2	P	12.2	24.4	36.6	48.8	—	109	O	C	Fe
50	*Amyema hillianum* (Blakely) Danser	Loranthaceae	D	18	2	P	9.9[f]	19.8[f]	29.6[f]	39.5[f]	—	109	O	C	Fe
51	*Amyema linophyllum* (Fenzl) Tieghem	Loranthaceae	D	18	2	P	13.1[f]	26.1[f]	39.2[f]	52.3[f]	—	109	O	C	Fe
52	*Amyema lucasii*[e] (Blakely) Danser	Loranthaceae	D	18	2	P	9.2[f]	18.3[f]	27.5[f]	36.6[f]	—	109	O	C	Fe
53	*Amyema mackayense* (Blakely) Danser	Loranthaceae	D	18	2	P	10.3[f]	20.6[f]	30.9[f]	41.1[f]	—	109	O	C	Fe
54	*Amyema maidenii*[e] (Blakely) Barlow	Loranthaceae	D	18	2	P	9.6[f]	19.3[f]	28.9[f]	38.6[f]	—	109	O	C	Fe
55	*Amyema melaleucae* (Lehm. ex Miq.) Tieghem	Loranthaceae	D	18	2	P	11.5[f]	23.0[f]	34.4[f]	45.9[f]	—	109	O	C	Fe

‡ Chromosome number.
§ A, annual; B, biennial; P, perennial.
‖ O, original value; C, calibrated value; R, recalibrated value.
¶ The standard species used to calibrate the present amount.
†† Fe, Feulgen densitometry; Ch, chemical extraction; FC, flow cytometry; RK, reassociation kinetics.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	$2n$‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
56	*Amyema miquelii*[e] (Lehm. ex Miq.) Tieghem	Loranthaceae	D	18	2	P	17.0[f]	34.0[f]	50.9[f]	67.9[f]	—	109	O	C	Fe
57	*Amyema miraculosum*[e] (Miq.) Tieghem	Loranthaceae	D	18	2	P	10.0[f]	20.0[f]	30.0[f]	40.0[f]	—	109	O	C	Fe
58	*Amyema nestor* (S.Moore) Danser	Loranthaceae	D	18	2	P	12.8	25.6	38.4	51.3	—	109	O	C	Fe
59	*Amyema pendulum*[e] (Sieber ex Sprengel) Tieghem	Loranthaceae	D	18	2	P	17.4[f]	34.7[f]	52.1[f]	69.5[f]	—	109	O	C	Fe
60	*Amyema preissii*[e] (Miq.) Tieghem	Loranthaceae	D	18	2	P	15.3[f]	30.7[f]	46.0[f]	61.4[f]	—	109	O	C	Fe
61	*Amyema quandang*[e] (Lindley) Tieghem	Loranthaceae	D	18	2	P	9.6[f]	19.3[f]	28.9[f]	38.5[f]	—	109	O	C	Fe
62	*Amyema queenslandicum* (Blakely) Danser	Loranthaceae	D	18	2	P	9.8[f]	19.7[f]	29.5[f]	39.4[f]	—	109	O	C	Fe
63	*Amyema sanguineum*[e] (F.Muell.) Danser	Loranthaceae	D	18	2	P	10.5[f]	21.0[f]	31.5[f]	42.0[f]	—	109	O	C	Fe
64	*Amyema seemenianum*[e] (Schumann) Danser	Loranthaceae	D	18	2	P	13.3[f]	26.6[f]	40.0[f]	53.3[f]	—	109	O	C	Fe
65	*Amyema strongylophyllum* (Lauterb.) Danser	Loranthaceae	D	18	2	P	15.1[f]	30.1[f]	45.2[f]	60.2[f]	—	109	O	C	Fe
66	*Amyema villiflorum* (Domin) Barlow	Loranthaceae	D	18	2	P	8.7[f]	17.5[f]	26.2[f]	35.0[f]	—	109	O	C	Fe
67	*Amylotheca dictyophleba* (F.Muell.) Tieghem	Loranthaceae	D	24	2	P	13.7	27.5	41.2	55.0	—	109	O	C	Fe
68a	*Anemone nemorosa* L.	Ranunculaceae	D	—[u]	—[v]	P	19.1	38.1	57.2	76.2	—	133[i]	O	B	Fe
68b	*Anemone nemorosa* L.	Ranunculaceae	D	—[u]	—[v]	P	24.2	48.3	72.5	96.6	—	156	O	B	Fe
69	*Anethum graveolens* L.	Umbelliferae	D	22	2	A	1.2	2.4	3.6	4.8	—	156	O	B	Fe
70	*Anomatheca viridis* (Ait.) Goldbl.	Iridaceae	M	22	2	P	0.8	1.6	2.5	3.3	—	137	R	H[g]	Fe
71	*Anthoxanthum odoratum* L.	Gramineae	M	20	4	P	5.9	11.8	17.7	23.6	—	110[i]	O	E	Fe
72	*Anthriscus sylvestris* L. (Hoffm.)	Umbelliferae	D	16	2	P	2.3	4.5	6.8	9.0	—	154[i]	O	G	Fe
73	*Anthyllis vulneraria* L.	Leguminosae	D	12	2	P	0.5	1.0	1.4	1.9	—	110[i]	O	G	Fe
74	*Apium nodiflorum* (L.) Lag.	Umbelliferae	D	22	2	P	1.1	2.1	3.2	4.3	—	154[i]	R	H	Fe
75a	*Arabidopsis thaliana* L. (Heynh.) Line La–0	Cruciferae	D	10	2	A	0.2	0.4	0.5	0.7	—	108	O	J	Fe
75b	*Arabidopsis thaliana* L.(Heynh.) strain Columbia	Cruciferae	D	10	2	A	0.07	0.15	0.22	0.29	—	162	O	—	RK
76	*Arachis batizocoi* Krap.& Greg.	Leguminosae	D	20	2	A	2.5	5.0	7.4	9.9	—	115	O	Gallus	Fe
77	*Arachis cardenasii* Krap.& Greg.	Leguminosae	D	20	2	P	2.8	5.7	8.5	11.4	—	115	O	Gallus	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

78	*Arachis chacoense* Krap.& Greg.	Leguminosae	D	20	2	P	3.0	5.9	8.9	11.9	—	115	O	Gallus	Fe
79	*Arachis duranensis* Krap.& Greg.	Leguminosae	D	20	2	A	2.5	4.9	7.4	9.8	—	115	O	Gallus	Fe
80b	*Arachis hypogaea* L.	Leguminosae	D	40	4	A	2.2	4.3	6.5	8.6	—	125	O	Gallus	Fe
80c	*Arachis hypogaea* L.	Leguminosae	D	40	4	A	2.1	4.1	6.2	8.2	—	125	O	—	RK
80d	*Arachis hypogaea* L. var. *hypogaea*	Leguminosae	D	40	4	A	5.2	10.4	15.5	20.7	—	115	O	Gallus	Fe
81a	*Arachis hypogaea* L. var. *fastigiata* Waldron var. *fastigiata*	Leguminosae	D	40	4	A	5.6	11.1	16.7	22.2	—	115	O	Gallus	Fe
81b	*Arachis hypogaea* L. var. *fastigiata* var. *vulgaris* Harz.	Leguminosae	D	40	4	A	5.7	11.3	17.0	22.7	—	115	O	Gallus	Fe
82	*Arachis monticola* Krap.& Rig.	Leguminosae	D	40	4	—[w]	5.2	10.4	15.6	20.8	—	115	O	Gallus	Fe
83	*Arachis spegazzini* Greg.& Greg.	Leguminosae	D	20	2	A	2.5	5.0	7.5	10.0	—	115	O	Gallus	Fe
84	*Arachis stenosperma* Greg.& Greg.	Leguminosae	D	20	2	P	2.8	5.5	8.3	11.1	—	115	O	Gallus	Fe
85	*Arachis villosa* Benth. var. *corretina* Burk.	Leguminosae	D	20	2	P	2.9	5.8	8.7	11.7	—	115	O	Gallus	Fe
86	*Arachis villosa* Benth. var. *villosa*	Leguminosae	D	20	2	P	3.0	6.0	9.0	12.0	—	115	O	Gallus	Fe
87	*Arenaria serpyllifolia* L.	Caryophyllaceae	D	40	4	A–B	0.8	1.6	2.4	3.2	—	154[i]	R	H	Fe
88	*Armoracia lapatifolia* Gilib.	Cruciferae	D	32	4	P	1.3	2.5	3.8	5.0	—	156	O	B	Fe
89	*Arrhenatherum elatius* (L.) Beauv.ex J.& C.Presl	Gramineae	M	28	4	P	8.0	16.0	23.9	31.9	—	110[i]	O	E	Fe
90	*Arrhenechtites mixta* (A.Rich.) Belcher	Compositae	D	100	10	A	8.8	17.5	26.3	35.1	—	114	O	G	Fe.
91	*Artedia squamata* L.	Umbelliferae	D	16	2	A	1.2	2.5	3.7	5.0	—	118	R	B–247*[h]	Fe
92	*Artemisia vulgaris* L.	Compositae	D	18	2	P	3.0	6.0	9.0	12.0	—	154[i]	R	H	Fe
93	*Asparagus officinalis* L.	Liliaceae	M	20	2	P	2.1	4.2	6.3	8.4	—	155	O	B	Fe
94b	*Atriplex fruticulosa* Jepson	Chenopodiaceae	D	18	2	P	0.4	0.7	1.1	1.4	—	150[p]	O	—	RK
95b	*Atriplex hortensis* L.	Chenopodiaceae	D	18	2	A	0.8	1.5	2.3	3.0	—	150[p]	O	—	RK
96	*Atriplex patula* L.	Chenopodiaceae	D	36	4	A	2.1	4.3	6.4	8.6	—	154[i]	R	I	Fe
97	*Atriplex phyllostegia* (Torr.) S.Wats	Chenopodiaceae	D	18	2	A	0.5	1.0	1.4	1.9	—	150[p]	O	—	RK
98b	*Atriplex rosea* L.	Chenopodiaceae	D	18	2	A	0.4	0.8	1.2	1.6	—	150[p]	O	—	RK
99	*Atriplex sabulosa* Rouy	Chenopodiaceae	D	18	2	A	0.4	0.8	1.3	1.7	—	150[p]	O	—	RK
100	*Atriplex serenana* A.Nelson	Chenopodiaceae	D	18	2	A	0.4	0.8	1.3	1.7	—	150[p]	O	—	RK
101	*Atriplex triangularis* Willd.	Chenopodiaceae	D	18	2	—[w]	0.7	1.4	2.1	2.8	—	150[p]	O	—	RK
102	*Atriplex truncata* (Torr.) A.Gray	Chenopodiaceae	D	18	2	A	0.6	1.2	1.7	2.3	—	150[p]	O	—	RK
103	*Atropa belladonna* L.	Solanaceae	D	72	6	P	2.0	3.9	5.9	7.8	—	156	O	B	Fe
104c	*Avena fatua* L.	Gramineae	M	42	6	A	14.9	29.8	44.7	59.6	—	158[i]	O	D	Fe
105c	*Avena sativa* L. cv.Diadem	Gramineae	M	42	6	A	12.6	25.1	37.7	50.2	—	155	O	B	Fe
105d	*Avena sativa* L. cv.Pegaz	Gramineae	M	42	6	A	12.6	25.2	37.8	50.4	—	155	O	B	Fe
106	*Avenula pratensis* (L.) Dumort.	Gramineae	M	42	6	P	18.0	35.9	53.9	71.8	—	133[i]	O	B	Fe
107	*Avenula pubescens* (Hudson) Dumort.	Gramineae	M	14	2	P	5.1	10.1	15.2	20.2	—	133[i]	O	I	Fe
108	*Babiana virginea* Goldbl.	Iridaceae	M	14	2	P	1.5	3.0	4.6	6.1	—	137	R	H[g]	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	$2n$‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
109a	*Bellis perennis* L.	Compositae	D	18	2	P	1.9	3.9	5.8	7.7	—	154[i]	R	I	Fe
109b	*Bellis perennis* L.	Compositae	D	18	2	P	1.2	2.3	3.5	4.6	—	156	O	B	Fe
110	*Benthamina alyxifolia* (F.Muell.ex Benth.) Tieghem	Loranthaceae	D	18	2	P	10.1[f]	20.2[f]	30.4[f]	40.5[f]	—	109	O	C	Fe
111	*Berberis aggregata* Schn. var. *prattii* Schn.	Berberidaceae	D	—[u]	—[v]	P	0.9	1.8	2.6	3.5	—	157	O	B	Fe
112	*Berberis koreana* Palib.	Berberidaceae	D	—[u]	—[v]	P	0.5	1.0	1.5	2.0	—	157	O	B	Fe
113	*Berberis thunbergii* DC. var.*atropurpurea* Chenault.	Berberidaceae	D	—[u]	—[v]	P	1.3	2.5	3.8	5.0	—	157	O	B	Fe
114	*Berberis thunbergii* DC. var. *maximowiczii* Reg.	Berberidaceae	D	—[u]	—[v]	P	0.7	1.4	2.1	2.8	—	157	O	B	Fe
115	*Berberis vulgaris* L.	Berberidaceae	D	28	2	P	1.8	3.5	5.3	7.0	—	157	O	B	Fe
116	*Betula populifolia* Marsch.	Betulaceae	D	28	2	P	0.2	0.4	0.6	0.8	—	157	O	B	Fe
117	*Betula pubescens* Ehrh.	Betulaceae	D	28	2	P	0.8	1.5	2.3	3.0	—	158[i]	O	I	Fe
118	*Blackstonia perfoliata* (L.) Hudson	Gentianaceae	D	44	4	A	1.5	2.9	4.4	5.8	—	154[i]	R	I	Fe
119	*Boenninghausenia albiflora* (Hook.) Reichle	Rutaceae	D	20	2?	P	0.3	0.5	0.8	1.0	—	140	O	G–489f	Fe
120a	*Bougainvillea glabra* Choisy cv.Formosa	Nyctaginaceae	D	34	2	P	4.1	8.2	12.2	16.3	—	134	O	B	Fe
120b	*Bougainvillea glabra* Choisy cv.Jennifer	Nyctaginaceae	D	34	2	P	4.1	8.3	12.4	16.5	—	134	O	B	Fe
121a	*Bougainvillea X glabra-peruviana* cv. Blondie	Nyctaginaceae	D	34	2	P	3.8	7.6	11.3	15.1	—	134	O	B	Fe
121b	*Bougainvillea X glabra-peruviana* cv. Dream × cv Princess Margaret Rose	Nyctaginaceae	D	34	2	P	3.7	7.5	11.2	15.0	—	134	O	B	Fe
121c	*Bougainvillea X glabra-peruviana* cv. Lady Mary Baring	Nyctaginaceae	D	34	2	P	3.7	7.4	11.0	14.7	—	134	O	B	Fe
121d	*Bougainvillea X glabra-peruviana* cv. Mrs McCleans	Nyctaginaceae	D	34	2	P	3.7	7.4	11.1	14.8	—	134	O	B	Fe
121e	*Bougainvillea X glabra-peruviana* cv. Scarlet Queen Variegata	Nyctaginaceae	D	34	2	P	3.7	7.5	11.2	14.9	—	134	O	B	Fe
122	*Bougainvillea X glabra-peruviana* cv. Mrs McCleans	Nyctaginaceae	D	68	4	P	7.5	15.0	22.6	30.1	—	134	O	B	Fe
123	*Bougainvillea* cv.Mrs McCleans(4×) × cv.Shubhra(4×)	Nyctaginaceae	D	68	4	P	7.8	15.5	23.3	31.0	—	134	O	B	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

124	*Bougainvillea peruviana* Humb.& Bonp. cv. Princess Margaret Rose	Nyctaginaceae	D	34	2	P	3.5	7.0	10.5	14.0	—	134	O	B	Fe
125a	*Bougainvillea spectabilis* Willd. cv. Pradhan's Profusion	Nyctaginaceae	D	34	2	P	4.5	8.9	13.4	17.8	—	134	O	B	Fe
125b	*Bougainvillea spectabilis* Willd. cv. Splendens	Nyctaginaceae	D	34	2	P	4.4	8.8	13.2	17.6	—	134	O	B	Fe
126a	*Bougainvillea X specto-glabra* cv. Pradhan's Profusion × cv.Dream	Nyctaginaceae	D	34	2	P	4.2	8.4	12.6	16.9	—	134	O	B	Fe
126b	*Bougainvillea X specto-glabra* cv.Sanderiana	Nyctaginaceae	D	34	2	P	4.2	8.3	12.5	16.6	—	134	O	B	Fe
127a	*Bougainvillea X specto-peruviana* cv. H.C.Buck	Nyctaginaceae	D	34	2	P	3.9	7.8	11.7	15.7	—	134	O	B	Fe
127b	*Bougainvillea X specto-peruviana* Princess Margaret Rose × cv.Splendens	Nyctaginaceae	D	34	2	P	3.9	7.8	11.7	15.6	—	134	O	B	Fe
127c	*Bougainvillea X specto-peruviana* cv.Shubhra	Nyctaginaceae	D	34	2	P	4.0	8.0	12.0	16.0	—	134	O	B	Fe
127d	*Bougainvillea X specto-peruviana* cv. Thimma	Nyctaginaceae	D	34	2	P	7.7	15.4	23.0	30.7	—	134	O	B	Fe
128	*Bougainvillea X specto-peruviana* cv. Thimma	Nyctaginaceae	D	68	4	P	3.9	7.8	11.7	15.6	—	134	O	B	Fe
129a	*Bougainvillea* cv.Begum Sikandar	Nyctaginaceae	D	49	3	P	5.5	11.1	16.6	22.1	—	134	O	B	Fe
129b	*Bougainvillea* cv.Lady Mary Baring(4×) × cv.Sova(2×)	Nyctaginaceae	D	51	3	P	5.9	11.7	17.6	23.5	—	134	O	B	Fe
129c	*Bougainvillea* cv.Perfection	Nyctaginaceae	D	51	3	P	5.8	11.6	17.5	23.3	—	134	O	B	Fe
129d	*Bougainvillea* cv.Shubhra(4×) × cv. Boyce de Rose(2×)	Nyctaginaceae	D	51	3	P	5.7	11.4	17.2	22.9	—	134	O	B	Fe
129e	*Bougainvillea* cv.Wajid Ali Shah	Nyctaginaceae	D	51	3	P	5.9	11.9	17.8	23.8	—	134	O	B	Fe
130	*Brachypodium pinnatum* (L.) Beauv.	Gramineae	M	28	4	P	1.2	2.5	3.7	4.9	—	158[i]	O	I	Fe
131	*Brachypodium sylvaticum* (Hudson) Beauv.	Gramineae	M	28	4	P	0.5	1.0	1.5	1.9	—	154[i]	R	I	Fe
132a	*Brassica campestris* L. PHW–Aaa–1	Cruciferae	D	18	2	A–B	0.6	1.2	1.8	2.3	—	108	O	F	Fe
133b	*Brassica oleracea* L. cv.Amager	Cruciferae	D	—[u]	—[v]	B	0.8	1.6	2.3	3.1	—	156	O	B	Fe
134	*Briza bidentata* Rosengurtt	Gramineae	M	28	4	P?	4.3	8.7	13.0	17.3	—	117[o]	O	B	Fe
135	*Briza brachychaete* Ekman	Gramineae	M	28	4	P?	6.5	13.1	19.6	26.2	—	117[o]	O	B	Fe
136	*Briza brizoides* (Lam.) Kuntze	Gramineae	M	28	4	P?	5.1	10.2	15.2	20.3	—	117[o]	O	B	Fe
137	*Briza calotheca* Hack.	Gramineae	M	28	4	P?	5.8	11.7	17.5	23.4	—	117[o]	O	B	Fe
138	*Briza erecta* Lam.	Gramineae	M	28	4	P?	6.1	12.2	18.3	24.4	—	117[o]	O	B	Fe
139	*Briza itatiaiae* Ekman	Gramineae	M	28	4	P?	6.0	12.0	18.0	24.1	—	117[o]	O	B	Fe
140	*Briza jurgensii* Hackel	Gramineae	M	28	4	P?	6.3	12.7	19.0	25.4	—	117[o]	O	B	Fe
141	*Briza aff.jurgensii*	Gramineae	M	28	4	P?	6.0	12.0	18.0	24.0	—	117[o]	O	B	Fe
142	*Briza lamarckiana* Nees	Gramineae	M	28	4	P?	5.4	10.9	16.3	21.7	—	117[o]	O	B	Fe
143	*Briza macrostachya* Steud.	Gramineae	M	28	4	P?	5.3	10.5	15.8	21.1	—	117[o]	O	B	Fe
144b	*Briza maxima* L.	Gramineae	M	14	2	A	6.5	13.0	19.4	25.9	—	117[o]	O	B	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	$2n$‡‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
145b	*Briza media* L.	Gramineae	M	14	2	P	5.2	10.4	15.6	20.8	—	117[o]	O	B	Fe
146b	*Briza media* L.	Gramineae	M	28	4	P	7.5	15.1	22.6	30.2	—	117[o]	O	B	Fe
147b	*Briza minor* L.	Gramineae	M	10	2	A	2.9	5.8	8.7	11.6	—	117[o]	O	B	Fe
148b	*Briza poaemorpha* (Presl.) Henrard	Gramineae	M	28	4	P	4.5	9.0	13.5	18.1	—	117[o]	O	B	Fe
149	*Briza rufa* var.*rufa*	Gramineae	M	28	4	P?	5.1	10.2	15.3	20.4	—	117[o]	O	B	Fe
150	*Briza rufa* var.*sparsipilosa*	Gramineae	M	28	4	P?	4.9	9.8	14.7	19.6	—	117[o]	O	B	Fe
151	*Briza subaristata* Lam. var. *interrupta*	Gramineae	M	28	4	P	5.8	11.6	17.5	23.3	—	117[o]	O	B	Fe
152b	*Briza subaristata* Lam. var. *subaristata*	Gramineae	M	28	4	P	5.3	10.5	15.8	21.1	—	117[o]	O	B	Fe
153	*Briza uniolae* Nees	Gramineae	M	28	4	P?	5.4	10.8	16.2	21.6	—	117[o]	O	B	Fe
154	*Bromus bonariensis*[t]	Gramineae	M	42	6	—[w]	8.1	16.1	24.2	32.2	—	117[o]	O	B	Fe
155	*Bromus brachyanthera* Doell. var. *uruguayensis*	Gramineae	M	42	6	—[w]	11.6	23.2	34.7	46.3	—	117[o]	O	B	Fe
156b	*Bromus brevis* Nees ex Steud.	Gramineae	M	42	6	P	6.9	13.8	20.6	27.5	—	117[o]	O	B	Fe
157b	*Bromus commutatus* Schrad.	Gramineae	M	28	4	A	10.9	21.8	32.7	43.6	—	117[o]	O	B	Fe
158b	*Bromus erectus* Hudson	Gramineae	M	56	8	P	11.3	22.6	33.9	45.2	—	110[i]	O	E	Fe
159	*Bromus parodi*[t]	Gramineae	M	42	6	—[w]	9.7	19.5	29.2	38.9	—	117[o]	O	B	Fe
160b	*Bromus unioloides* H.B.K.	Gramineae	M	42	6	P	7.2	14.3	21.5	28.6	—	117[o]	O	B	Fe
161	*Bulbine alata* Baijnath	Liliaceae	M	28	2	A	8.6	17.3	25.9	34.5	—	128	O	B	Fe
162a	*Bulbine bulbosa* (R.Br.) Haw.	Liliaceae	M	24	2	P	16.9	33.8	50.7	67.6	—	128	O	B	Fe
162b	*Bulbine bulbosa* (R.Br.) Haw.	Liliaceae	M	24	2	P	14.6	29.1	43.7	58.2	—	128	O	B	Fe
163a	*Bulbine bulbosa* (R.Br.) Haw.	Liliaceae	M	46	4	P	13.7	27.4	41.1	54.8	—	128	O	B	Fe
163b	*Bulbine bulbosa* (R.Br.) Haw.	Liliaceae	M	46	4	P	19.5	39.0	58.4	77.9	—	128	O	B	Fe
163c	*Bulbine bulbosa* (R.Br.) Haw.	Liliaceae	M	48	4	P	29.6	59.2	88.8	118.4	—	128	O	B	Fe
163d	*Bulbine bulbosa* (R.Br.) Haw.	Liliaceae	M	48	4	P	25.4	50.7	76.1	101.4	—	128	O	B	Fe
164	*Bulbine bulbosa* (R.Br.) Haw.	Liliaceae	M	72	6	P	34.2	68.3	102.5	136.6	—	128	O	B	Fe
165b	*Bulbine semibarbata* (R.Br.) Haw	Liliaceae	M	26	2	A	7.2	14.4	21.5	28.7	—	128	O	B	Fe
165c	*Bulbine semibarbata* (R.Br.) Haw	Liliaceae	M	26	2	A	7.6	15.2	22.8	30.4	—	128	O	B	Fe
166a	*Bulbine semibarbata* (R.Br.) Haw	Liliaceae	M	54	4	A	17.0	34.0	51.0	68.0	—	128	O	B	Fe
166b	*Bulbine semibarbata* (R.Br.) Haw	Liliaceae	M	52	4	P?	14.7	29.5	44.2	58.9	—	128	O	B	Fe
167a	*Bulbine semibarbata* (R.Br.) Haw	Liliaceae	M	78	6	A	21.1	42.2	63.2	84.3	—	128	O	B	Fe
167b	*Bulbine semibarbata* (R.Br.) Haw	Liliaceae	M	78	6	A	19.9	39.8	59.7	79.6	—	128	O	B	Fe
168	*Callitriche stagnalis* Scop.	Callitrichaceae	D	10	2	P	1.2	2.5	3.7	4.9	—	154[i]	R	I	Fe
169b	*Caltha palustris* L.	Ranunculaceae	D	—[u]	—[v]	P	11.2	22.4	33.6	44.8	—	156	O	B	Fe
170	*Calystegia sepium* (L.) R.Br.	Convolvulaceae	D	22	2	P	0.8	1.6	2.4	3.2	—	154[i]	R	I	Fe
171	*Campanula rotundifolia* L.	Campanulaceae	D	68	4	P	2.7	5.3	8.0	10.6	—	158[i]	O	I	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

172	*Caragana arborescens* Lam.	Leguminosae	D	16	2	P	1.6	3.2	4.8	6.4	—	157	O	B	Fe
173	*Cardamine amara* L.	Cruciferae	D	16	2	P	0.05	0.11	0.16	0.22	—	154[i]	R	I	Fe
174	*Cardamine flexuosa* With.	Cruciferae	D	32	4	A–B	0.9	1.8	2.6	3.5	—	158[i]	O	I	Fe
175	*Cardamine pratensis* L.	Cruciferae	D	—[u]	—[v]	P	1.7	3.3	5.0	6.7	—	154[i]	R	I	Fe
176	*Carex caryophyllea* Latour	Cyperaceae	M	66	2	P	0.8	1.6	2.3	3.1	—	158[i]	O	I	Fe
177	*Carex flacca* Schreber	Cyperaceae	M	76	—[v]	P	0.3	0.6	0.9	1.2	—	133[i]	O	G	Fe
178	*Carex panicea* L.	Cyperaceae	M	32	—[v]	P	1.0	2.0	3.0	4.0	—	133[i]	O	I	Fe
179	*Carex pulicaris* L.	Cyperaceae	M	60	—[v]	P	0.4	0.8	1.2	1.6	—	133[i]	O	I	Fe
180	*Carica papaya* L.	Caricaceae	D	18	2	P	0.4	0.8	1.2	1.5	—	108	O	J	Fe
181	*Caucalis daucoides* L.	Umbelliferae	D	20	2	A	1.4	2.8	4.1	5.5	—	118	R	B–247*[h]	Fe
182	*Centaurea nigra* L.	Compositae	D	44?	4?	P	1.8	3.6	5.4	7.2	—	133[i]	O	G	Fe
183	*Centaurea scabiosa* L.	Compositae	D	20?	2?	P	1.8	3.5	5.3	7.1	—	154[i]	R	I	Fe
184	*Centaurium erythraea* Rafn.	Gentianaceae	D	—[u]	—[v]	A	1.2	2.5	3.7	4.9	—	154[i]	R	I	Fe
185	*Chamerion angustifolium* (L.) Scop.	Onagraceae	D	36	2	P	0.4	0.8	1.2	1.6	—	158[i]	O	I	Fe
186	*Chelidonium majus* L.	Papaveraceae	D	12	2	P	1.2	2.4	3.6	4.8	—	156	O	B	Fe
187	*Chenopodium pallidicaule* Aellen.	Chenopodiaceae	D	18	2	A	0.5	1.0	1.4	1.9	—	108	O	J	Fe
188	*Chenopodium quinoa* Willd.	Chenopodiaceae	D	36	4	A	1.3	2.6	4.0	5.3	—	108	O	J	Fe
189	*Chlorophytum elatum* Ait. var.*variagatum*	Liliaceae	M	28	4	P	9.8	19.5	29.3	39.0	—	155	O	B	Fe
190	*Cipura paludosa* Aubl.	Iridaceae	M	28	4	P	8.5	16.9	25.4	33.8	—	137	R	H[g]	Fe
191	*Cirsium arvense* (L.) Scop.	Compositae	D	34	2	P	1.6	3.1	4.7	6.2	—	154[i]	R	I	Fe
192	*Cirsium palustre* (L.) Scop.	Compositae	D	34	2	B	1.4	2.8	4.2	5.6	—	154[i]	R	I	Fe
193	*Cirsium vulgare* (Savi) Ten.	Compositae	D	68	4	P	2.6	5.2	7.7	10.3	—	154[i]	R	I	Fe
194a	*Citrus sinensis* (L.) Osbeck	Rutaceae	D	18	2	P	0.6	1.2	1.9	2.5	—	140	O	G–489f	Fe
195	*Clematis vitalba* L.	Ranunculaceae	D	16	2	P	9.1	18.1	27.2	36.2	—	157	O	B	Fe
196b	*Clivia miniata* L.	Amaryllidaceae	M	22	2	P	23.5	46.9	70.4	93.8	—	155	O	B	Fe
197	*Cocos nucifera* L. cv.Rennell	Palmae	M	32	2	P	1.6	3.2	4.8	6.4	—	129	O	C & G	Fe
198	*Coleonema album* Bartl.& Wendl.	Rutaceae	D	34	—[v]	P	1.0	1.9	2.9	3.8	—	140	O	G–489f	Fe
199	*Coleonema pulchrum* Hook.	Rutaceae	D	34	—[v]	P	1.0	2.0	3.1	4.1	—	140	O	G–489f	Fe
200	*Collinsia heterophylla* Buist ex R.Grah.	Scrophulariaceae	D	14	2	A	2.6	5.3	7.9	10.6	—	148	O	B	Fe
201a	*Collinsia tinctoria* Hartweg ex Benth.[e]	Scrophulariaceae	D	14	2	A	2.7	5.3	8.0	10.6	—	148	O	B	Fe
201b	*Collinsia tinctoria* Hartweg ex Benth.[e]	Scrophulariaceae	D	14	2	A	2.9	5.7	8.6	11.4	—	148	O	B	Fe
202a	*Collinsia verna* Nutt.[e]	Scrophulariaceae	D	14	2	A	1.8	3.7	5.5	7.4	—	148	O	B	Fe
202b	*Collinsia verna* Nutt.[e]	Scrophulariaceae	D	14	2	A	7.1	14.3	21.4	28.6	—	148	O	B	Fe
203	*Colutea arborescens* L.	Leguminosae	D	16	2	P	0.7	1.3	2.0	2.6	—	157	O	B	Fe
204b	*Convallaria majalis* L.	Liliaceae	M	38	2	P	15.1	30.1	45.2	60.2	—	155	O	B	Fe
205	*Coreopsis bicolor* Reichb.	Compositae	D	24	2	A	1.6	3.1	4.7	6.2	—	156	O	B	Fe
206	*Coreopsis grandiflora* Hogg.	Compositae	D	26	2	P	2.5	5.0	7.5	10.0	—	156	O	B	Fe
207	*Coriandrium sativum* L.	Umbelliferae	D	22	2	A	2.1	4.1	6.2	8.2	—	156	O	B	Fe
208	*Cornus sanguinea* L.	Cornaceae	D	22	2	P	0.9	1.8	2.7	3.7	—	154[i]	R	I	Fe
209	*Correa virens* Hook.	Rutaceae	D	32	4?	P	1.3	2.6	4.0	5.3	—	140	O	G–489f	Fe
210	*Corylus avellana* L.	Corylaceae	D	22	2	P	0.5	1.0	1.5	1.9	—	154[i]	R	I	Fe
211	*Crocus vernus* Wulf. cv.Grand Maitre	Iridaceae	M	8	2	P	11.6	23.1	34.7	46.2	—	155	O	B	Fe
212	*Cucumis africanus* L.	Cucurbitaceae	D	24	2	A	0.9	1.8	2.7	3.6	—	127	O	B	Fe
213	*Cucumis anguira* L. var. *longipes* (Hook.f.) A.Meeuse	Cucurbitaceae	D	24	2	A	0.8	1.6	2.4	3.2	—	127	O	B	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	2*n*‡	ploidy level *x*	life cycle type§	DNA amount/pg 1*C*	2*C*	3*C*	4*C*	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
214	*Cucumis dinteri* Ehr.	Cucurbitaceae	D	24	2	A	1.1	2.2	3.3	4.3	—	127	O	B	Fe
215	*Cucumis dipsaceus* Ehrb.	Cucurbitaceae	D	24	2	A	1.2	2.5	3.7	4.9	—	127	O	B	Fe
216	*Cucumis ficifolius*[t]	Cucurbitaceae	D	24	2	P	0.7	1.4	2.1	2.7	—	127	O	B	Fe
217	*Cucumis figarei* Delile,Cat ex Naud.	Cucurbitaceae	D	48	4	P	1.9	3.9	5.8	7.8	—	127	O	B	Fe
218	*Cucumis heptadactylus* Naud.	Cucurbitaceae	D	48	4	A	1.1	2.2	3.3	4.5	—	127	O	B	Fe
219	*Cucumis humifructus* Stent	Cucurbitaceae	D	24	2	A	1.2	2.5	3.7	4.9	—	127	O	B	Fe
220	*Cucumis meeusi* C.Jeffrey	Cucurbitaceae	D	48	4	P	1.6	3.2	4.8	6.4	—	127	O	B	Fe
221b	*Cucumis melo* L. cv.Spanish Winter	Cucurbitaceae	D	24	2	A	1.0	2.0	3.0	4.0	—	142	O	—	Fe
222	*Cucumis melo* L. var. *agrestis* (Naud.) Greb.	Cucurbitaceae	D	24	2	A	1.2	2.5	3.7	5.0	—	127	O	B	Fe
223	*Cucumis melo* L. var.*momordica*	Cucurbitaceae	D	24	2	A	1.1	2.3	3.4	4.6	—	127	O	B	Fe
224	*Cucumis melo* L. var. *utilissimus*	Cucurbitaceae	D	24	2	A	1.2	2.4	3.5	4.7	—	127	O	B	Fe
225	*Cucumis metuliferus* E.Mey.	Cucurbitaceae	D	24	2	A	1.2	2.4	3.6	4.8	—	127	O	B	Fe
226	*Cucumis prophetarum* L.	Cucurbitaceae	D	24	2	A	0.8	1.7	2.5	3.3	—	127	O	B	Fe
227	*Cucumis sagitattus* Wawra & Peyr	Cucurbitaceae	D	24	2	A	0.8	1.6	2.4	3.1	—	127	O	B	Fe
228b	*Cucumis sativus* L.	Cucurbitaceae	D	14	2	A	0.9	1.8	2.7	3.6	—	127	O	B	Fe
228c	*Cucumis sativus* L. cv.Kariha	Cucurbitaceae	D	14	2	A	1.0	2.0	3.0	4.0	—	142	O	—	Fe
229	*Cucumis sativus* L. var. *hardwickii*	Cucurbitaceae	D	14	2	A	0.9	1.8	2.7	3.6	—	127	O	B	Fe
230	*Cucumis trigonus*[t] (syn.*C.callosus*)	Cucurbitaceae	D	14	2	A	0.8	1.6	2.4	3.2	—	127	O	B	Fe
231	*Cucumis zeyheri* Sond.	Cucurbitaceae	D	24	2	P	0.8	1.7	2.5	3.4	—	127	O	B	Fe
232	*Cucumis zeyheri* Sond.	Cucurbitaceae	D	48	4	P	1.4	2.9	4.3	5.7	—	127	O	B	Fe
233	*Cynosurus cristatus* L.	Gramineae	M	14	2	A–P	2.8	5.6	8.4	11.2	—	154[i]	R	I	Fe
234	*Cyphomandra crassifolia*[t]	Solanaceae	D	24	2	P?	10.3	20.6	30.9	41.2	—	124	O	B	FC
235	*Cytisus nigricans* L.	Leguminosae	D	—[u]	—[v]	P	0.6	1.1	1.7	2.2	—	157	O	B	Fe
236	*Cytisus purpureus* Scop.	Leguminosae	D	48	4	P	0.9	1.7	2.6	3.4	—	157	O	B	Fe
237a	*Cytisus scoparius* (L.) Link	Leguminosae	D	48	4	P	0.9	1.7	2.6	3.4	—	158[i]	O	G	Fe
237b	*Cytisus scoparius* (L.) Link	Leguminosae	D	48	4	P	1.2	2.3	3.5	4.6	—	156	O	B	Fe
238b	*Dactylis glomerata* L.	Gramineae	M	14	2	P	4.3	8.7	13.0	17.3	—	154[i]	R	I	Fe
238c	*Dactylis glomerata* L. cv.Nakielska	Gramineae	M	—[u]	—[v]	P	4.5	8.9	13.4	17.8	—	155	O	B	Fe
239	*Dactylis glomerata* L.	Gramineae	M	28	4	P	6.2	12.4	18.6	24.8	—	117[o]	O	B	Fe
240	*Danthonia decumbens* (L.) DC.	Gramineae	M	36	4	P	3.0	5.9	8.9	11.8	—	158[i]	O	E	Fe
241	*Decaisnina brittenii* (Blakely) Barlow	Loranthaceae	D	24	2	P	8.0	16.1	24.1	32.1	—	109	O	C	Fe
242	*Decaisnina hollrungii*[e] (K.Schum.) Barlow	Loranthaceae	D	24	2	P	15.0[f]	30.1[f]	45.1[f]	60.2[f]	—	109	O	C	Fe
243	*Decaisnina signata* (F.Muell. ex Benth.) Tieghem	Loranthaceae	D	24	2	P	8.6[f]	17.3[f]	25.9[f]	34.6[f]	—	109	O	C	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

244b	*Delphinium ajacis* L.	Ranunculaceae	D	16	2	P	6.6	13.1	19.7	26.2	—	156	O	B	Fe
245	*Dendrophthoe falcata* (L.f.) Ettingsh.	Loranthaceae	D	18	2	P	6.2[f]	12.4[f]	18.6[f]	24.8[f]	—	109	O	C	Fe
246	*Dendrophthoe glabrescens* (Blakely) Barlow	Loranthaceae	D	18	2	P	2.7	5.5	8.2	11.0	—	109	O	C	Fe
247	*Dendrophthoe homoplastica* (Blakely) Danser	Loranthaceae	D	18	2	P	4.6	9.2	13.90	18.5	—	109	O	C	Fe
248	*Dendrophthoe odontocalyx* (F.Muell.ex Benth.) Tieghem	Loranthaceae	D	18	2	P	3.2	6.3	9.5	12.7	—	109	O	C	Fe
249	*Dendrophthoe vitellina* (F.Muell.) Tieghem	Loranthaceae	D	18	2	P	4.8[f]	9.6[f]	14.3[f]	19.1[f]	—	109	O	C	Fe
250	*Deschampsia flexuosa* (L.) Trin.	Gramineae	M	28	4	P	5.5	11.0	16.4	21.9	—	154[i]	R	I	Fe
251	*Dictamnus albus* L.	Rutaceae	D	36	—[v]	P	3.4	6.9	10.3	13.8	—	140	O	G–489f	Fe
252	*Dietes grandiflora* N.E.Br.	Iridaceae	M	20	2	P	5.9	11.7	17.6	23.4	—	137	R	H[g]	Fe
253	*Digitalis purpurea* L.	Scrophulariaceae	D	56	2	B	1.2	2.5	3.7	4.9	—	158[i]	O	I	Fe
254	*Diplatia furcata* Barlow	Loranthaceae	D	18	2	P	16.0[f]	32.0[f]	48.0[f]	64.0[f]	—	109	O	C	Fe
255	*Diplatia grandibracteata* (F.Muell.) Tieghem	Loranthaceae	D	18	2	P	15.7[f]	31.3[f]	47.0[f]	62.7[f]	—	109	O	C	Fe
256	*Echinochloa crus-galli* (L.) P.B	Gramineae	M	—[u]	—[v]	A	1.4	2.7	4.1	5.4	—	155	O	B	Fe
257a	*Elaeis guineensis* Jacq.	Palmae	M	32	2	P	1.2	2.4	3.6	4.8	—	131	O	Mus	Fe
257b	*Elaeis guineensis* Jacq.	Palmae	M	32	2	P	1.0	2.0	3.0	4.0	—	131	O	Gallus	Fe
258	*Eleocharis palustris* (L.) Roemer & Schultes	Cyperaceae	M	16	2	P	5.5	11.1	16.6	22.1	—	154[i]	R	I	Fe
259	*Elodea canadensis* Michsc.	Hydrocharitaceae	M	—[u]	—[v]	P	5.0	10.0	15.0	20.0	—	154[i]	R	I	Fe
260	*Elymus repens* (L.) Gould.	Gramineae	M	42	6	P	13.0	26.0	38.9	51.9	—	154[i]	O	B	Fe
261	*Epilobium hirsutum* L.	Onagraceae	D	36	2	P	0.3	0.6	0.9	1.2	—	158[i]	O	I	Fe
262	*Epilobium obscurum* Schreber	Onagraceae	D	36	2	P	0.2	0.5	0.7	1.0	—	154[i]	R	I	Fe
263	*Epilobium palustre* L.	Onagraceae	D	36	2	P	0.2	0.3	0.5	0.6	—	154[i]	R	I	Fe
264	*Erechtites valerianaefolia* (Wolf) DC.	Compositae	D	40	4	A	6.3	12.5	18.8	25.0	—	114	O	G	Fe
265	*Eriophorum angustifolium* Honckery	Cyperaceae	M	58	2	P	0.7	1.3	2.0	2.6	—	158[i]	O	I	Fe
266	*Eriophorum vaginatum* L.	Cyperaceae	M	58	2	P	0.5	1.1	1.6	2.1	—	158[i]	O	I	Fe
267	*Eryngium coeruleum* Bieb.	Umbelliferae	D	16	2	—[w]	0.7	1.4	2.1	2.8	—	118	R	B–247*[h]	Fe
268	*Eryngium giganteum* Bieb.	Umbelliferae	D	16	2	—[w]	2.8	5.6	8.4	11.2	—	118	R	B–247*[h]	Fe
269	*Eryngium variifolium* Coss.	Umbelliferae	D	16	2	—[w]	1.5	2.9	4.4	5.8	—	118	R	B–247*[h]	Fe
270	*Erytrochiton brasiliensis*[t]	Rutaceae	D	116	—[v]	P	5.0	9.9	14.9	19.9	—	140	O	G–489f	Fe
271	*Euchlaena mexicana* Schrad.	Gramineae	M	20	2	A	3.6	7.1	10.7	14.2	—	123	O	F	Fe
272	*Fagara zanthoxyloides*[t]	Rutaceae	D	72	—[v]	P	3.3	6.6	9.8	13.1	—	140	O	G–489f	Fe
273	*Festuca ovina* L.	Gramineae	M	14	2	P	4.8	9.5	14.3	19.0	—	110[i]	O	E	Fe
274b	*Festuca pratensis* Huds. cv.Mewa	Gramineae	M	—[u]	—[v]	P	2.2	4.4	6.6	8.8	—	155	O	B	Fe
274c	*Festuca pratensis* Huds.	Gramineae	M	14	2	P	4.4	8.9	13.3	17.8	—	117[o]	O	B	Fe
275	*Festuca rubra* L.	Gramineae	M	—[u]	—[v]	P	7.0	13.9	20.9	27.8	—	133[i]	O	I	Fe
276	*Festuca ulochaeta*[t]	Gramineae	M	42	6	—[w]	7.1	14.3	21.4	28.5	—	117[o]	O	B	Fe
277b	*Fraxinus americana* L.	Oleaceae	D	46	2	P	—	—	—	—	2.9[m]	135	O	Gallus	Fe
278b	*Fraxinus americana* L.	Oleaceae	D	92	4	P	—	—	—	—	5.6[m]	135	O	Gallus	Fe
279b	*Fraxinus americana* L.	Oleaceae	D	138	6	P	—	—	—	—	8.4[m]	135	O	Gallus	Fe
280a	*Fraxinus exelsior* L.[n]	Oleaceae	D	46	2	P	1.0	1.9	2.9	3.9	—	154[i]	R	I	Fe
280b	*Fraxinus exelsior* L.[n]	Oleaceae	D	46?	2?	P	1.9	3.8	5.7	7.6	—	157	O	B	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	$2n$‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
281	*Freesia alba* (G.L.Meyer) Gumbleton	Iridaceae	M	22	2	P	1.6	3.2	4.8	6.4	—	137	R	H[g]	Fe
282	*Galaxia fugacissima* (L.f.) Druce	Iridaceae	M	18	2	P	2.8	5.5	8.3	11.1	—	137	R	H[g]	Fe
283	*Galium aparine* L.	Rubiaceae	D	—[u]	—[v]	A	1.0	2.0	3.0	4.1	—	154[i]	R	I	Fe
284	*Galium palustre* L.	Rubiaceae	D	—[u]	—[v]	P	1.3	2.6	3.9	5.2	—	154[i]	R	I	Fe
285	*Galium saxatile* L.	Rubiaceae	D	44	4	P	1.5	2.9	4.4	5.8	—	154[i]	R	I	Fe
286	*Galium sterneri* Ehrend.	Rubiaceae	D	44	4	P	1.0	2.0	3.0	4.0	—	133[i]	O	I	Fe
287	*Galium verum* L.	Rubiaceae	D	—[u]	—[v]	P	2.0	4.0	5.9	7.9	—	154[i]	O	G	Fe
288	*Gibasis consobrina* D.R.Hunt	Commelinaceae	M	10	2	P	11.0	22.0	33.0	44.0	—	119	O	B	Fe
289	*Gibasis consobrina* D.R.Hunt	Commelinaceae	M	20	4	P	20.3	40.7	61.0	81.3	—	119	O	B	Fe
290	*Gibasis heterophylla* (Brandegee) Reveal & Hess	Commelinaceae	M	12	2	P	8.6	17.2	25.7	34.3	—	153	O	B	Fe
291a	*Gibasis karwinskyana* (Roem.& Schult.) Rohw.[e]	Commelinaceae	M	10	2	P	10.0[l]	20.0[l]	30.0[l]	40.0[l]	—	119	O	B	Fe
291b	*Gibasis karwinskyana* (Roem.& Schult.) Rohw.[e]	Commelinaceae	M	10	2	P	8.8[l]	17.7[l]	26.5[l]	35.4[l]	—	119	O	B	Fe
292	*Gibasis karwinskyana* (Roem.& Schult.) Rohw.	Commelinaceae	M	20	4	P	17.0	34.1	51.1	68.1	—	119	O	B	Fe
293	*Gibasis linearis* (Benth.) Rohw.	Commelinaceae	M	12	2	P	10.2	20.4	30.6	40.8	—	119	O	B	Fe
294	*Gibasis linearis* (Benth.) Rohw.	Commelinaceae	M	18	3	P	15.8	31.6	47.5	63.3	—	119	O	B	Fe
295	*Gibasis matudae* D.R.Hunt	Commelinaceae	M	10	2	P	17.8	35.6	53.3	71.1	—	119	O	B	Fe
296	*Gibasis pulchella* (Kunth) Rafin.	Commelinaceae	M	10	2	P	21.1	42.1	63.2	84.2	—	119	O	B	Fe
297	*Gibasis rhodantha* (Torrey) Reveal & Hess	Commelinaceae	M	12	2	P	11.4	22.8	34.2	45.6	—	119	O	B	Fe
298	*Gibasis rhodantha* (Torrey) Reveal & Hess	Commelinaceae	M	20	4	P	19.1	38.2	57.2	76.3	—	119	O	B	Fe
299	*Gibasis aff.rhodantha*	Commelinaceae	M	32	?5	P	27.4	54.8	82.1	109.5	—	119	O	B	Fe
300	*Gibasis schiedeana* (Kunth) D.R.Hunt	Commelinaceae	M	10	2	P	8.9	17.8	26.7	35.6	—	119	O	B	Fe
301	*Gibasis schiedeana* (Kunth) D.R.Hunt	Commelinaceae	M	16	4	P	16.1	32.2	48.3	64.5	—	119	O	B	Fe
302	*Gibasis speciosa* Reveal & Hess	Commelinaceae	M	10	2	P	10.5	21.0	31.4	41.9	—	119	O	B	Fe
303	*Gibasis speciosa* Reveal & Hess	Commelinaceae	M	22	4	P	20.5	40.9	61.4	81.9	—	119	O	B	Fe
304	*Gibasis venestula* (Kunth) D.R.Hunt ssp.*robusta* D.R.Hunt	Commelinaceae	M	12	2	P	8.7	17.3	26.0	34.6	—	153	O	B	Fe
305a	*Gibasis venustula* (Kunth) D.R.Hunt ssp.*venustula*[e]	Commelinaceae	M	12	2	P	8.7	17.3	26.0	34.6	—	153	O	B	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

305b	*Gibasis venestula* (Kunth) D.R.Hunt ssp.*venustula*[e]	Commelinaceae	M	12	2	P	5.4	10.9	16.3	21.7	—	153	O	B	Fe
306	*Gladiolus virescens* Thunb.	Iridaceae	M	30	2	P	1.4	2.8	4.2	5.5	—	137	R	H[g]	Fe
307	*Gleditschia sinensis* Lam.	Leguminosae	D	28	2	P	1.2	2.5	3.7	4.9	—	157	O	B	Fe
308	*Glyceria fluitans* (L.) R.Br.	Gramineae	M	40	4	P	1.7	3.4	5.2	6.9	—	154[i]	R	I	Fe
309	*Glyceria maxima* (Hartman) Holmberg	Gramineae	M	60	6	P	6.1	12.3	18.4	24.5	—	154[i]	R	I	Fe
310	*Glycine canescens* F.J.Hermann	Leguminosae	D	40	2	—[w]	—	—	—	—	3.2	149	O	—	Ch
311	*Glycine clandestina* Wendl.	Leguminosae	D	40	2	—[w]	—	—	—	—	4.7	149	O	—	Ch
312a	*Glycine max* (L.) Merr.	Leguminosae	D	40	2	A	2.0	3.9	5.9	7.9	—	146[q]	O	—	RK
312d	*Glycine max* (L.) Merr.	Leguminosae	D	40	2	A	—	—	—	—	4.3	149	O	—	Ch
313	*Glycine soja* (L.) Sieb. & Zucc.	Leguminosae	D	40	2	A	—	—	—	—	4.8	149	O	—	Ch
314	*Glycine tabacina* (Labill.) Benth.	Leguminosae	D	—[u]	—[v]	—[w]	—	—	—	—	5.7	149	O	—	Ch
315	*Glycine tomentella* Hayata	Leguminosae	D	—[u]	—[v]	—[w]	—	—	—	—	5.2	149	O	—	Ch
316d	*Gossypium hirsutum* L.	Malvaceae	D	52	4	A–P	1.6	3.2	4.8	6.4	—	151[r]	O	—	RK
317	*Gynandriris setifolia* (L.f.) Foster	Iridaceae	M	12	2	P	10.4	20.9	31.3	41.8	—	137	R	H[g]	Fe
318	*Gypsophila repens* L.	Caryophyllaceae	D	34	2	P	0.7	1.4	2.1	2.8	—	156	O	B	Fe
319	*Haemanthus katherinae* Bak.	Amaryllidaceae	M	18	2	P	58.9	117.7	176.6	235.4	—	155	O	B	Fe
320	*Helianthemum nummularium* (L.) Miller	Cistaceae	D	20	4	P	2.2	4.5	6.7	8.9	—	158[i]	O	G	Fe
321	*Helianthus agrestis* Pollard	Compositae	D	34	2	A	13.0	25.9	38.9	51.8	—	116	O	F	Fe
322	*Helianthus angustifolius* L.	Compositae	D	34	2	P	6.1	12.2	18.3	24.4	—	116	O	F	Fe
323g	*Helianthus annuus* L.	Compositae	D	34	2	A	3.3	6.6	9.9	13.2	—	124	O	B	FC
323h	*Helianthus annuus* L. cv.Jadalny	Compositae	D	34	2	A	2.5	5.0	7.5	10.0	—	156	O	B	Fe
323i	*Helianthus annuus* L. cv.macrocarpus	Compositae	D	34	2	A	3.6	7.2	10.8	14.4	—	116	O	F	Fe
323j	*Helianthus annuus* L. cv.Pionier	Compositae	D	34	2	A	2.3	4.6	6.9	9.2	—	156	O	B	Fe
324	*Helianthus anomalus* Blake	Compositae	D	34	2	A	5.6	11.2	16.8	22.4	—	116	O	F	Fe
325	*Helianthus argophyllus* Torrey & Gray	Compositae	D	34	2	A	4.4	8.9	13.3	17.7	—	116	O	F	Fe
326	*Helianthus bolanderi* Gray	Compositae	D	34	2	A	4.4	8.8	13.2	17.6	—	116	O	F	Fe
327	*Helianthus debilis* Nuttall ssp.*cucumerifolius* (T&G) Heiser	Compositae	D	34	2	A	3.3	6.6	9.9	13.2	—	116	O	F	Fe
328	*Helianthus debilis* Nuttall ssp. *debilis* Nuttall	Compositae	D	34	2	A	4.0	7.9	11.9	15.8	—	116	O	F	Fe
329	*Helianthus debilis* Nuttall ssp.*tardiflorus* Heiser	Compositae	D	34	2	A	3.7	7.5	11.2	14.9	—	116	O	F	Fe
330	*Helianthus deserticola* Heiser	Compositae	D	34	2	A	5.8	11.5	17.3	23.0	—	116	O	F	Fe
331	*Helianthus divaricatus* L.	Compositae	D	34	2	P	8.5	16.9	25.4	33.8	—	116	O	F	Fe
332	*Helianthus exilis* Gray	Compositae	D	34	2	A	4.8	9.6	14.4	19.2	—	116	O	F	Fe
333	*Helianthus giganteus* L.	Compositae	D	34	2	P	4.8	9.7	14.5	19.3	—	116	O	F	Fe
334	*Helianthus heterophyllus* Torrey & Gray	Compositae	D	34	2	P	4.9	9.8	14.7	19.6	—	116	O	F	Fe
335	*Helianthus microcephalus* Torrey & Gray	Compositae	D	34	2	P	5.1	10.2	15.3	20.4	—	116	O	F	Fe
336	*Helianthus neglectus* Heiser	Compositae	D	34	2	A	3.2	6.4	9.6	12.8	—	116	O	F	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	$2n$‡‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
337	*Helianthus niveus* (Benth.) Brandegee ssp.*canescens* Heiser	Compositae	D	34	2	A	3.7	7.3	11.0	14.6	—	116	O	F	Fe
338	*Helianthus paradoxus* Heiser	Compositae	D	34	2	A	5.4	10.7	16.1	21.4	—	116	O	F	Fe
339	*Helianthus petiolaris* Nuttall ssp.*fallax* Heiser	Compositae	D	34	2	A	3.4	6.8	10.2	13.6	—	116	O	F	Fe
340	*Helianthus petiolaris* Nuttall ssp.*petiolaris* Nuttall	Compositae	D	34	2	A	3.6	7.2	10.8	14.5	—	116	O	F	Fe
341	*Helianthus praecox* Engleman & Gray ssp.*praecox* Engleman & Gray	Compositae	D	34	2	A	3.5	7.1	10.6	14.1	—	116	O	F	Fe
342	*Helianthus radula* (Pursh) Torrey & Gray	Compositae	D	34	2	P	5.9	11.8	17.7	23.5	—	116	O	F	Fe
343	*Heracleum sphondylium* L.	Umbelliferae	D	22	2	A–P	1.9	3.8	5.7	7.6	—	133[i]	O	G	Fe
344	*Hesperantha bachmannii* Baker	Iridaceae	M	26	2	P	0.5	1.0	1.4	1.9	—	137	R	H[g]	Fe
345	*Heteranthelium piliferum* Hochst.ex Jaub.& Spach.	Gramineae	M	14	2	A	4.5	9.0	13.4	17.9	—	108	O	F	Fe
346	*Hexaglottis namaquana* Goldbl. ined	Iridaceae	M	12	2	P	8.9	17.9	26.8	35.7	—	137	R	H[g]	Fe
347	*Hieracium pilosella* L.	Compositae	D	—[u]	—[v]	P	4.2	8.5	12.7	17.0	—	154[i]	O	G	Fe
348	*Holcus lanatus* L.	Gramineae	M	14	2	P	1.7	3.4	5.1	6.8	—	110[i]	O	E	Fe
349	*Holcus mollis* L.	Gramineae	M	—[u]	—[v]	P	4.2	8.4	12.6	16.8	—	154[i]	R	I	Fe
350	*Homeria bifida* L.Bol.	Iridaceae	M	12	2	P	12.7	25.3	38.0	50.6	—	137	R	H[g]	Fe
351	*Homeria flaccida* Sweet	Iridaceae	M	24	4	P	17.9	35.7	53.6	71.4	—	137	R	H[g]	Fe
352	*Homeria pendula* Goldbl.	Iridaceae	M	12	2	P	9.8	19.5	29.3	39.0	—	137	R	H[g]	Fe
353f	*Hordeum vulgare* L. cv.Aramir	Gramineae	M	14	2	A	4.4	8.8	13.2	17.6	—	155	O	B	Fe
353g	*Hordeum vulgare* L. cv.Dura	Gramineae	M	14	2	A	4.9	9.8	14.7	19.6	—	155	O	B	Fe
353h	*Hordeum vulgare* L. cv.Goplanski	Gramineae	M	14	2	A	4.9	9.7	14.6	19.4	—	155	O	B	Fe
353i	*Hordeum vulgare* L. cv.Polon	Gramineae	M	14	2	A	4.4	8.7	13.1	17.4	—	155	O	B	Fe
354	*Hydrocotyle vulgaris* L.	Umbelliferae	D	96?	—[v]	P	1.0	1.9	2.9	3.9	—	154[i]	R	I	Fe
355	*Hyoscyamus niger* L.	Solanaceae	D	34	2	A	1.2	2.3	3.5	4.6	—	156	O	B	Fe
356	*Hypericum perforatum* L.	Hypericaceae	D	—[u]	—[v]	P	0.6	1.3	1.9	2.6	—	154[i]	R	H	Fe
357	*Hyssopus officinalis* L.	Labiatae	D	12	2	P	0.5	1.0	1.5	2.0	—	156	O	B	Fe
358	*Ileostylus micranthus* (Hook.f.) Tieghem	Loranthaceae	D	22	2	P	3.8[f]	7.7[f]	11.5[f]	15.4[f]	—	109	O	C	Fe
359	*Ilex aquifolium* L.	Aquifoliaceae	D	40	4	P	1.2	2.3	3.5	4.6	—	158[i]	O	I	Fe
360	*Impatiens glandulifera* Royle.	Balsaminaceae	D	18	2	A	1.2	2.3	3.5	4.6	—	158[i]	O	I	Fe
361	*Inula conyza* DC.	Compositae	D	32	4	B–P	3.4	6.8	10.2	13.5	—	154[i]	R	I	Fe
362	*Iris histrio* L.	Iridaceae	M	20	2	P	28.2	56.4	84.6	112.8	—	137	R	H[g]	Fe
363	*Iris siberica* L.	Iridaceae	M	28	4	P	2.1	4.2	6.3	8.4	—	155	O	B	Fe
364	*Juncus articulatus* L.	Juncaceae	M	80	8	P	1.8	3.7	5.5	7.3	—	154[i]	R	I	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

365	*Juncus bufonius* L.	Juncaceae	M	—[u]	—[v]	A	1.3	2.6	3.9	5.2	—	154[i]	R	I	Fe
366	*Juncus effusus* L.	Juncaceae	M	40	4	P	5.5	11.1	16.6	22.1	—	154[i]	R	I	Fe
367	*Juncus squarrosus* L.	Juncaceae	M	40	4	P	0.5	1.1	1.6	2.1	—	154[i]	R	I	Fe
368	*Koeleria macrantha* (Lebed) Schultes	Gramineae	M	14	2	P	4.6	9.2	13.8	18.4	—	133[i]	O	G	Fe
369	*Laburnum alpinum* Brecht et Persl.	Leguminosae	D	48	4	P	1.9	3.8	5.7	7.6	—	157	O	B	Fe
370	*Laburnum anagyroides* Med.	Leguminosae	D	48	4	P	0.8	1.6	2.4	3.2	—	157	O	B	Fe
371	*Lamiastrum galeobdolon* (L.) Ehrend & Polatschek	Labiatae	D	18	2	P	3.3	6.5	9.8	13.0	—	154[i]	R	I	Fe
372	*Lapeirousia verecunda* Goldbl.	Iridaceae	M	16?	2?	P	2.1	4.2	6.4	8.5	—	137	R	H[g]	Fe
373	*Lapsana communis* L.	Compositae	D	12	2	A	1.2	2.4	3.5	4.7	—	154[i]	R	I	Fe
374c	*Lathyrus angulatus* L.	Leguminosae	D	14	2	A	5.4	10.8	16.1	21.5	—	113	O	B	Fe
375b	*Lathyrus annuus* L.	Leguminosae	D	14	2	A	7.5	14.9	22.4	29.9	—	113	O	B	Fe
376c	*Lathyrus aphaca* L.	Leguminosae	D	14	2	A	7.0	14.0	21.1	28.1	—	113	O	B	Fe
376d	*Lathyrus aphaca* L.	Leguminosae	D	14	2	A	6.6	13.2	19.9	26.5	—	152[s]	O	—	RK
377c	*Lathyrus articulatus* L.	Leguminosae	D	14	2	A	6.1	12.2	18.2	24.3	—	113	O	B	Fe
377d	*Lathyrus articulatus* L.	Leguminosae	D	14	2	A	5.6	11.1	16.7	22.3	—	152[s]	O	—	RK
378c	*Lathyrus cicera* L.	Leguminosae	D	14	2	A	7.0	14.0	21.1	28.1	—	113	O	B	Fe
378d	*Lathyrus cicera* L.	Leguminosae	D	14	2	A	6.7	13.3	20.0	26.7	—	152[s]	O	—	RK
379c	*Lathyrus clymenum* L.	Leguminosae	D	14	2	A	6.7	13.4	20.1	26.9	—	113	O	B	Fe
379d	*Lathyrus clymenum* L.	Leguminosae	D	14	2	A	6.9	13.8	20.7	27.6	—	152[s]	O	—	RK
380c	*Lathyrus hirsutus* L.	Leguminosae	D	14	2	A	10.0	19.9	29.9	39.9	—	113	O	B	Fe
380d	*Lathyrus hirsutus* L.	Leguminosae	D	14	2	A	11.2	22.5	33.7	44.9	—	152[s]	O	—	RK
381b	*Lathyrus latifolius* L.	Leguminosae	D	14	2	P	12.4	24.8	37.2	49.6	—	113	O	B	Fe
382	*Lathyrus latifolius* L. var.*splendens*	Leguminosae	D	14	2	P	8.7	17.3	26.0	34.6	—	156	O	B	Fe
383	*Lathyrus maritimus* Bigelow	Leguminosae	D	14	2	P	6.6	13.2	19.7	26.3	—	113	O	B	Fe
384	*Lathyrus miniatus* Bieb. ex Stev.	Leguminosae	D	14	2	—[w]	3.4	6.9	10.3	13.7	—	113	O	B	Fe
385c	*Lathyrus nissolia* L.	Leguminosae	D	14	2	A	6.5	12.9	19.4	25.8	—	113	O	B	Fe
385d	*Lathyrus nissolia* L.	Leguminosae	D	14	2	A	6.2	12.5	18.7	24.9	—	152[s]	O	—	RK
386c	*Lathyrus ochrus* (L.) DC.	Leguminosae	D	14	2	A	6.8	13.6	20.4	27.3	—	113	O	B	Fe
386d	*Lathyrus ochrus* (L.) DC.	Leguminosae	D	14	2	A	7.0	14.0	21.0	28.0	—	152[s]	O	—	RK
387c	*Lathyrus odoratus* L.	Leguminosae	D	14	2	A	8.5	17.0	25.4	33.9	—	113	O	B	Fe
387d	*Lathyrus odoratus* L. cv.Cuthberson	Leguminosae	D	14	2	A	5.5	10.9	16.4	21.8	—	156	O	B	Fe
388	*Lathyrus pratensis* L.	Leguminosae	D	14	2	P	7.4	14.7	22.1	29.4	—	113	O	B	Fe
389c	*Lathyrus sativus* L.	Leguminosae	D	14	2	A	8.4	16.8	25.2	33.6	—	113	O	B	Fe
389d	*Lathyrus sativus* L.	Leguminosae	D	14	2	A	7.2	14.4	21.6	28.8	—	152[s]	O	—	RK
390b	*Lathyrus setifolius* L.	Leguminosae	D	14	2	A	7.0	14.0	21.0	28.0	—	113	O	B	Fe
391b	*Lathyrus sphaericus* Retz.	Leguminosae	D	14	2	A	7.1	14.2	21.3	28.4	—	113	O	B	Fe
392c	*Lathyrus sylvestris* L.	Leguminosae	D	14	2	P	12.3	24.7	37.0	49.3	—	113	O	B	Fe
393c	*Lathyrus tingitanus* L.	Leguminosae	D	14	2	A	11.0	22.1	33.1	44.2	—	113	O	B	Fe
393d	*Lathyrus tingitanus* L.	Leguminosae	D	14	2	A	7.4	14.7	22.1	29.4	—	152[s]	O	—	RK
394b	*Lathyrus tuberosus* L.	Leguminosae	D	14	2	P	9.8	19.5	29.3	39.0	—	113	O	B	Fe
395	*Lathyrus vestitis* Nutt. ex Torr.& Gray	Leguminosae	D	14	2	—[w]	14.6	29.2	43.8	58.4	—	113	O	B	Fe
396	*Lemna minor* L.	Lemnaceae	M	40	4	P	0.6	1.2	1.8	2.4	—	154[i]	R	I	Fe
397	*Leontodon hispidus* L.	Compositae	D	14	2	P	2.8	5.6	8.3	11.1	—	158[i]	O	I	Fe
398	*Lepidium sativum* L.	Cruciferae	D	—[u]	—[v]	A	0.5	1.0	1.5	1.9	—	156	O	B	Fe
399	*Leucanthemum gaudinii* DT.	Compositae	D	18	2	P	5.8	11.6	17.4	23.2	—	111	R	G–593a*[j]	Fe
400	*Leucanthemum heterophyllum* (W.) DC.	Compositae	D	72	8	P	21.2	42.5	63.7	84.9	—	111	R	G–593a*[j]	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	$2n$‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
401	*Leucanthemum laciniatum* Huter,Porta et Rigo	Compositae	D	18	2	P	6.5	13.0	19.5	26.0	—	111	R	G–593a*[j]	Fe
402	*Leucanthemum pachyphyllum* Marchi et Illuminati	Compositae	D	90	10	P	22.4	44.9	67.3	89.7	—	111	R	G–593a*[j]	Fe
403	*Leucanthemum pallens* (Gay) DC.	Compositae	D	36	4	P	11.7	23.5	35.2	46.9	—	111	R	G–593a*[j]	Fe
404	*Leucanthemum pallens* (Gay) DC.	Compositae	D	54	6	P	13.7	27.4	41.0	54.7	—	111	R	G–593a*[j]	Fe
405	*Leucanthemum pallens* (Gay) DC. × (*L.subglaucum* DeLarramb. × *L.pallens* (Gay) DC.)	Compositae	D	63	7	P	16.4	32.7	49.1	65.4	—	111	R	G–593a*[j]	Fe
406	*Leucanthemum praecox* Horvatic	Compositae	D	18	2	P	5.5	10.9	16.4	21.8	—	111	R	G–593a*[j]	Fe
407	*Leucanthemum subglaucum* DeLarramb.	Compositae	D	90	10	P	24.8	49.6	74.5	99.3	—	111	R	G–593a*[j]	Fe
408	*Leucanthemum tridactylites* (Fiori) Bazzichelli	Compositae	D	18	2	P	6.4	12.8	19.2	25.5	—	111	R	G–593a*[j]	Fe
409c	*Leucanthemum vulgare* Lam.	Compositae	D	36	4	P	12.7	25.4	38.1	50.7	—	111	R	G–593a*[j]	Fe
409d	*Leucanthemum vulgare* Lam.	Compositae	D	36	4	P	10.6	21.3	31.9	42.6	—	154[i]	R	I	Fe
410	*Levisticum officinale* Koch.	Umbelliferae	D	22	2	P	5.0	9.9	14.9	19.8	—	156	O	B	Fe
411	*Ligustrum vulgare* L.	Oleaceae	D	46	2	P	1.1	2.2	3.2	4.3	—	157	O	B	Fe
412a	*Lilium longiflorum* Thunb.	Liliaceae	M	24	2	P	35.2	70.4	105.6	140.8	—	124	O	B	FC
412b	*Lilium longiflorum* Thunb. cv.Croft	Liliaceae	M	24	2	P	53.0	106.0	159.0	212.0	—	159	O	—	Ch
413b	*Lolium multiflorum* Lam.	Gramineae	M	14	2	P	4.1	8.2	12.3	16.4	—	117[o]	O	B	Fe
414b	*Lolium perenne* L. cv.Nadmorski	Gramineae	M	—[u]	—[v]	P	3.4	6.7	10.1	13.4	—	155	O	B	Fe
415	*Lonicera coerulea* L.	Caprifoliaceae	D	—[u]	—[v]	P	1.0	2.0	3.0	4.0	—	157	O	B	Fe
416	*Lonicera nigra* L.	Caprifoliaceae	D	18	2	P	0.7	1.3	2.0	2.6	—	157	O	B	Fe
417	*Lonicera periclymenum* L.	Caprifoliaceae	D	—[u]	—[v]	P	2.7	5.5	8.2	11.0	—	154[i]	R	I	Fe
418	*Lonicera vesicaria* Kom.	Caprifoliaceae	D	18	2	P	3.9	7.8	11.6	15.5	—	157	O	B	Fe
419	*Lonicera xylosteum* L.	Caprifoliaceae	D	18	2	P	0.7	1.5	2.2	3.0	—	157	O	B	Fe
420b	*Lotus corniculatus* L.	Leguminosae	D	24	4	P	1.1	2.2	3.3	4.4	—	110[i]	O	G	Fe
421	*Lotus pedunculatus* Cav. cv.Grasslands Maku.	Leguminosae	D	12	2	P	1.1	2.1	3.2	4.3	—	154[i]	R	I	Fe
422	*Lotus uliginosus* Schkuhr.	Leguminosae	D	12	2	P	0.6	1.1	1.7	2.2	—	110[i]	O	G	Fe
423	*Luzula atrata* Edgar	Juncaceae	M	12	—[v]	—[w]	0.6	1.2	1.8	2.5	—	130	O	I	Fe
424	*Luzula australasica* Steud.	Juncaceae	M	12	—[v]	—[w]	0.5	1.1	1.6	2.1	—	130	O	I	Fe
425d	*Lycopersicon esculentum* Mill.	Solanaceae	D	24	2	A	1.1	2.2	3.3	4.4	—	124	O	B	FC
426	*Lysiana casuarinae* Tieghem	Loranthaceae	D	24	2	P	11.0	22.1	33.1	44.1	—	109	O	C	Fe
427	*Lysiana exocarpi*[e] (Behr) Tieghem	Loranthaceae	D	24	2	P	15.3[f]	30.6[f]	45.8[f]	61.1[f]	—	109	O	C	Fe
428	*Lysiana linearifolia*[e] (F.Muell.& Tate) Tieghem	Loranthaceae	D	24	2	P	12.9[f]	25.7[f]	38.6[f]	51.4[f]	—	109	O	C	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

429	*Lysiana murrayi*[e] Tieghem	Loranthaceae	D	24	2	P	12.9[f]	25.7[f]	38.6[f]	51.5[f]	—	109	O	C	Fe
430	*Lysiana spathulata* (Blakely) Barlow	Loranthaceae	D	24	2	P	11.2[f]	22.4[f]	33.7[f]	44.9[f]	—	109	O	C	Fe
431	*Lysiana subfalcata* (Hook.) Barlow	Loranthaceae	D	24	2	P	11.7[f]	23.3[f]	35.0[f]	46.6[f]	—	109	O	C	Fe
432	*Macrosolen cochinchinensis* (Lour.) Blume	Loranthaceae	D	24	2	P	17.5[f]	35.1[f]	52.6[f]	70.1[f]	—	109	O	C	Fe
433	*Magnolia kobus* DC. var.*borealis* Sarg.	Magnoliaceae	D	38	2	P	0.9	1.8	2.7	3.6	—	157	O	B	Fe
434b	*Magnolia soulangeana* Soul.	Magnoliaceae	D	76	4?	P	7.1	14.2	21.3	28.4	—	157	O	B	Fe
435	*Medicago lupulina* L.	Leguminosae	D	16	2	A–P	0.9	1.8	2.6	3.5	—	158[i]	O	I	Fe
436	*Melicope ternata* Forst.	Rutaceae	D	36	—[v]	P	0.9	1.9	2.8	3.7	—	140	O	G–489f	Fe
437	*Melilotus altissima* Thuill.	Leguminosae	D	16	2	A–P	1.2	2.5	3.7	4.9	—	110[i]	O	G	Fe
438	*Melissa officinalis* L.	Labiatae	D	32	4	P	0.8	1.6	2.4	3.2	—	156	O	B	Fe
439	*Mentha aquatica* L.	Labiatae	D	96	—[v]	P	1.5	3.0	4.5	6.0	—	154[i]	O	I	Fe
440	*Mentha piperita* L.	Labiatae	D	—[u]	—[v]	P	0.3	0.7	1.0	1.3	—	156	O	B	Fe
441	*Milium effusum* L.	Gramineae	M	28	4	P	5.0	10.0	15.0	20.0	—	154[i]	R	I	Fe
442	*Minuartia verna* (L.) Hiern.	Caryophyllaceae	D	24	2?	P	1.5	3.0	4.5	6.0	—	154[i]	O	G	Fe
443	*Molinia caerulea* (L.) Moench.	Gramineae	M	36	4	P	2.5	4.9	7.4	9.8	—	158[i]	O	I	Fe
444	*Monstera deliciosa* Liebm.	Araceae	M	—[u]	—[v]	P	4.6	9.1	13.7	18.2	—	155	O	B	Fe
445	*Moraea anomala* Lewis	Iridaceae	M	20	2	P	9.5	19.1	28.6	38.1	—	137	R	H[g]	Fe
446	*Moraea atropunctata* Goldbl.	Iridaceae	M	12	2	P	14.3	28.7	43.0	57.4	—	137	R	H[g]	Fe
447	*Moraea bipartita* L.Bol.	Iridaceae	M	12	2	P	10.1	20.3	30.4	40.6	—	137	R	H[g]	Fe
448	*Moraea calcicola* Goldbl.	Iridaceae	M	12	2	P	15.8	31.5	47.3	63.1	—	137	R	H[g]	Fe
449	*Moraea ciliata* (L.f.) Ker	Iridaceae	M	20	2	P	9.8	19.7	29.5	39.3	—	137	R	H[g]	Fe
450	*Moraea fugax* (de la Roche) Jacq.	Iridaceae	M	12?	2	P	8.6	17.2	25.9	34.5	—	137	R	H[g]	Fe
451	*Moraea inconspicua* Goldbl.	Iridaceae	M	20	2	P	10.0	19.9	29.9	39.9	—	137	R	H[g]	Fe
452	*Moraea tulbhagensis* L.Bol.	Iridaceae	M	24	4	P	31.4	62.7	94.1	125.5	—	137	R	H[g]	Fe
453a	*Moraea unguiculata* Ker	Iridaceae	M	12	2	P	11.4	22.7	34.1	45.4	—	137	R	H[g]	Fe
453b	*Moraea unguiculata* Ker	Iridaceae	M	12	2	P	10.6	21.2	31.9	42.5	—	137	R	H[g]	Fe
454	*Moraea villosa* (Ker) Ker	Iridaceae	M	24	4	P	31.4	62.7	94.1	125.5	—	137	R	H[g]	Fe
455	*Muellerina bidwilli* (Benth.) Barlow	Loranthaceae	D	22	2	P	5.0[f]	9.9[f]	14.9[f]	19.8[f]	—	109	O	C	Fe
456	*Muellerina eucalyptoides* (DC.) Barlow	Loranthaceae	D	22	2	P	6.5	12.9	19.4	25.8	—	109	O	C	Fe
457	*Murraya paniculata* (L.) Jack.	Rutaceae	D	18	2?	P	0.5	1.0	1.5	2.0	—	140	O	G–489f	Fe
458	*Muscari comosum* (L.) Miller	Liliaceae	M	18	2	P	6.4	12.7	19.1	25.4	—	155	O	B	Fe
459	*Myosotis scorpioides* L.	Boraginaceae	D	64	—[v]	P	1.4	2.8	4.2	5.6	—	154[i]	R	I	Fe
460	*Myrrhis odorata* (L.) Scop.	Umbelliferae	D	22	2	P	0.9	1.7	2.6	3.4	—	154[i]	R	I	Fe
461	*Narcissus poeticus* L.	Amaryllidaceae	M	—[u]	—[v]	P	13.8	27.5	41.3	55.0	—	155	O	B	Fe
462	*Nardus stricta* L.	Gramineae	M	26	2	P	2.1	4.2	6.3	8.4	—	154[i]	R	I	Fe
463d	*Nicotiana tabacum* L. var.Samsun	Solanaceae	D	48	4	A	3.3	6.6	9.9	13.2	—	147	O	—	RK
464b	*Nigella damascena* L.	Ranunculaceae	D	12	2	A	10.8	21.6	32.4	43.2	—	156	O	B	Fe
465	*Nuytsia floribunda* (Labill.) R.Br.	Loranthaceae	D	24	2	P	2.9	5.8	8.8	11.7	—	109	O	C	Fe
466	*Origanum vulgare* L.	Labiatae	D	30	3	P	0.7	1.4	2.0	2.7	—	158[i]	O	I	Fe
467	*Oryza perennis* Moench	Gramineae	M	24	2	P	—	—	—	—	3.7[k]	138	O	—	Ch
468a	*Oryza sativa* L. cv.IR36	Gramineae	M	24	2	A	0.5	1.0	1.5	2.0	—	108	O	J	Fe
468d	*Oryza sativa* L. cv.Nipponbare	Gramineae	M	24	2	A	0.4	0.8	1.1	1.5	—	108	O	J	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	$2n$‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
468e	*Oryza sativa* L. Jeypore strain (wild)	Gramineae	M	24	2	A	—	—	—	—	3.5[k]	138	O	—	Ch
468f	*Oryza sativa* L. Jeypore strain (cultiv.)	Gramineae	M	24	2	A	—	—	—	—	3.5[k]	138	O	—	Ch
469b	*Oryza sativa* L. ssp.*indica* Kato	Gramineae	M	24	2	A	—	—	—	—	3.4[k]	138	O	—	Ch
470b	*Oryza sativa* L. ssp.*japonica* Kato	Gramineae	M	24	2	A	—	—	—	—	3.3[k]	138	O	—	Ch
471	*Papaver nudicaule* L. cv.Gartenzwerg	Papaveraceae	D	—[u]	—[v]	P	1.8	3.5	5.3	7.0	—	156	O	B	Fe
472b	*Papaver orientale* L. cv.Grossmogul	Papaveraceae	D	—[u]	—[v]	P	6.8	13.5	20.3	27.0	—	156	O	B	Fe
473b	*Papaver somniferum* L. cv.Boston	Papaveraceae	D	22	2	A	3.3	6.6	9.9	13.2	—	156	O	B	Fe
473c	*Papaver somniferum* L. cv.Menuet	Papaveraceae	D	22	2	A	3.3	6.5	9.8	13.0	—	156	O	B	Fe
474	*Pastinaca sativa* L.	Umbelliferae	D	22	2	P	1.7	3.4	5.2	6.9	—	154[i]	R	I	Fe
475	*Peraxilla colensoi* (Hook.f.) Tieghem	Loranthaceae	D	24	2	P	6.3[f]	12.7[f]	19.0[f]	25.3[f]	—	109	O	C	Fe
476	*Peraxilla tetrasepala* (L.f.) Tieghem	Loranthaceae	D	24	2	P	5.3[f]	10.7[f]	16.0[f]	21.3[f]	—	109	O	C	Fe
477	*Petasites hybridus* (L.) P.Gaertner,B.Meyer & Scherb	Compositae	D	60	2	P	0.9	1.8	2.6	3.5	—	110[i]	O	G	Fe
478a	*Petroselinum sativum* Hoffm.	Umbelliferae	D	22	2	B	2.7	5.3	8.0	10.6	—	156	O	B	Fe
478b	*Petroselinum sativum* Hoffm.	Umbelliferae	D	22	2	B	2.0	4.0	6.0	8.0	—	144	O	Xenopus	Fe
479c	*Phaseolus vulgaris* L.	Leguminosae	D	22	2	A	0.5	1.0	1.5	2.0	—	156	O	B	Fe
480	*Philodendron andreanum* Devans	Araceae	M	—[u]	—[v]	P	1.2	2.4	3.6	4.8	—	155	O	B	Fe
481	*Phleum pratense* L.	Gramineae	M	42	6	P	4.1	8.3	12.4	16.6	—	154[i]	R	I	Fe
482	*Phoenix dactylifera* L.	Palmae	M	36	2	P	1.0	1.9	2.9	3.8	—	155	O	B	Fe
483	*Phragmites australis* (Cav.) Trin. ex Steudel	Gramineae	M	—[u]	—[v]	P	1.2	2.4	3.5	4.7	—	154[i]	R	I	Fe
484	*Phyodina navicularis* (Ortega) Rohw.	Commelinaceae	M	32	4	P	25.7	51.4	77.1	102.9	—	119	O	B	Fe
485	*Phyodina rosea* (Vent.) Rohw.	Commelinaceae	M	24	4	P	38.7	77.3	116.0	154.6	—	119	O	B	Fe
486	*Pillansia templemanii* L.Bol.	Iridaceae	M	40	4	P	2.3	4.7	7.0	9.4	—	137	R	H[g]	Fe
487	*Pimpinella major* (L.) Hudson	Umbelliferae	D	18	2	P	3.2	6.4	9.7	12.9	—	154[i]	O	G	Fe
488	*Pimpinella saxifraga* L.	Umbelliferae	D	36	4	P	5.1	10.3	15.4	20.5	—	158[i]	O	I	Fe
489f	*Pisum sativum* L. cv.Com MG	Leguminosae	D	14	2	A	5.9	11.9	17.8	23.7	—	141	O	G	Fe
489g	*Pisum sativum* L.	Leguminosae	D	14	2	A	4.6	9.2	13.8	18.4	—	143	O	—	RK
489h	*Pisum sativum* L.	Leguminosae	D	14	2	A	3.8	7.6	11.4	15.2	—	156	O	B	Fe
490	*Plantago lanceolata* L.	Plantaginaceae	D	12	2	P	1.2	2.4	3.6	4.8	—	158[i]	O	I	Fe
491	*Plantago major* L.	Plantaginaceae	D	12	2	P	0.9	1.7	2.6	3.4	—	154[i]	R	I	Fe
492	*Plantago media* L.	Plantaginaceae	D	24	4	P	0.9	1.8	2.7	3.7	—	154[i]	R	I	Fe
493b	*Poa annua* L.[e]	Gramineae	M	28	4	A	2.1	4.1	6.2	8.2	—	110[i]	O	I	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

493c	*Poa annua* L.[e]	Gramineae	M	28	4	A	1.4	2.9	4.3	5.7	—	158[i]	O	I	Fe
493d	*Poa annua* L.[e]	Gramineae	M	28	4	A	2.6	5.2	7.8	10.4	—	158[i]	O	I	Fe
494	*Polygonum lapathifolium* L.	Polygonaceae	D	22	2	A	0.7	1.4	2.1	2.8	—	154[i]	R	I	Fe
495	*Polygonum persicaria* L.	Polygonaceae	D	44	4	A	0.4	0.9	1.3	1.7	—	154[i]	R	I	Fe
496	*Primula vulgaris* L. cv. Saga	Primulaceae	D	22	2	P	0.5	1.0	1.5	2.0	—	139	O	C & G	Fe
497	*Prunella vulgaris* L.	Labiatae	D	32	4	P	0.6	1.3	1.9	2.6	—	154[i]	R	I	Fe
498	*Psidium guajava* L.	Myrtaceae	D	22	2	P	0.3	0.7	1.0	1.3	—	108	O	J	Fe
499	*Ptelea baldwinii*[t]	Rutaceae	D	42	—[v]	P	1.0	2.1	3.1	4.2	—	140	O	G–489f	Fe
500	*Pulsatilla grandis* Wend.	Ranunculaceae	D	16	2	P	13.3	26.6	39.9	53.2	—	156	O	B	Fe
501	*Quercus petraea* (Mattuschka) Liebl.	Fagaceae	D	24	2	P	0.8	1.6	2.4	3.2	—	154[i]	R	I	Fe
502	*Quercus sessilis* Ehr.	Fagaceae	D	24	2	P	0.5	1.0	1.5	2.0	—	157	O	B	Fe
503c	*Ranunculus acris* L. 'flore pleno'	Ranunculaceae	D	—[u]	—[v]	P	16.8	33.6	50.4	67.2	—	156	O	B	Fe
504	*Ranunculus pencillatus* (Dumort.) Bab.	Ranunculaceae	D	32	4	A–P	4.9	9.8	14.7	19.6	—	154[i]	R	I	Fe
505b	*Raphanus sativus* L. cv.Chodowianka	Cruciferae	D	18	2	A	0.6	1.3	1.9	2.5	—	156	O	B	Fe
506	*Raphanus sativus* L. cv.Tetra Ilowiecka	Cruciferae	D	36	4	A	1.5	2.9	4.4	5.8	—	156	O	B	Fe
507	*Rhamnus catharticus* L.	Rhamnaceae	D	24	2	P	1.3	2.6	3.9	5.3	—	154[i]	O	G	Fe
508	*Rhoeo spathacea* (Sw.) Stearn	Commelinaceae	M	12	2	P	6.9	13.7	20.6	27.5	—	121	O	B	Fe
509	*Robinia pseudoaccacia* L.	Leguminosae	D	20	2	P	0.7	1.3	2.0	2.6	—	157	O	B	Fe
510	*Roggeveldia fistulosa* Goldbl.	Iridaceae	M	12	2	P	7.2	14.3	21.5	28.6	—	137	R	I[g]	Fe
511	*Rorripa palustris* (L.) Besser	Cruciferae	D	32	4	A	0.7	1.4	2.1	2.8	—	154[i]	R	I	Fe
512	*Rosa acicularis* Lindley	Rosaceae	D	42	6	P	0.7	1.3	2.0	2.6	—	108	O	J	Fe
513	*Rosa blanda* Aiton	Rosaceae	D	21	3	P	0.3	0.6	0.8	1.1	—	108	O	J	Fe
514	*Rosa wichuraiana* Crepin	Rosaceae	D	14	2	P	0.1	0.2	0.4	0.5	—	108	O	J	Fe
515	*Rudbeckia hirta* L.	Compositae	D	38	2	P	6.5	13.0	19.5	26.0	—	156	O	B	Fe
516	*Rumex acetosa* L.	Polygonaceae	D	14	2	P	1.7	3.3	5.0	6.6	—	158[i]	O	I	Fe
517a	*Rumex obtusifolius* L.	Polygonaceae	D	40	4	P	1.5	3.1	4.6	6.1	—	158[i]	O	I	Fe
518	*Ruta chalepensis* L. var.*latifolia*	Rutaceae	D	40	—[v]	P	0.3	0.7	1.0	1.3	—	140	O	G–489f	Fe
519	*Ruta graveolens* L.	Rutaceae	D	78	—[v]	P	0.8	1.5	2.3	3.0	—	140	O	G–489f	Fe
520	*Ruta montana* (L.) L.	Rutaceae	D	40	—[v]	P	0.2	0.4	0.6	0.8	—	140	O	G–489f	Fe
521	*Salix caprea* L.	Salicaceae	D	38	2	P	0.4	0.9	1.3	1.7	—	158[i]	O	I	Fe
522	*Salix elegantissima* K.Koch	Salicaceae	D	—[u]	—[v]	P	0.4	0.7	1.1	1.4	—	157	O	B	Fe
523	*Salvia splendens* Ker-Gawl cv.Sello	Labiatae	D	32	4	A	0.9	1.7	2.6	3.4	—	156	O	B	Fe
524	*Sambucus nigra* L.	Caprifoliaceae	D	36	2	P	1.5	3.1	4.6	6.1	—	158[i]	O	I	Fe
525	*Sanguisorba minor* Scop.	Rosaceae	D	28	4	P	0.6	1.1	1.7	2.2	—	133[i]	O	I	Fe
	Sarothamnus scoparius (L.) Wimm (listed under *Cytisus scoparius* (L.) Link)														
526	*Scabiosa columbaria* L.	Dipsacaceae	D	16	2	P	1.2	2.4	3.6	4.8	—	154[i]	O	G	Fe
527a	*Scilla autumnalis* L.[e]	Liliaceae	M	14	2	P	7.7	15.3	23.0	30.6	—	163	O	?	Fe
527b	*Scilla autumnalis* L.[e]	Liliaceae	M	14	2	P	4.5	9.0	13.4	17.9	—	163	O	?	Fe
528	*Scilla autumnalis* L.[e]	Liliaceae	M	28	4	P	12.8	25.5	38.3	51.0	—	163	O	?	Fe
529	*Scilla bithynica* Boiss. ssp.*bithynica*	Liliaceae	M	12	2	P	29.2	58.3	87.5	116.6	—	145	O	B	Fe
530	*Scilla bithynica* Boiss. ssp.*radkae* (Davidoff) Speta	Liliaceae	M	12	2	P	22.9	45.8	68.7	91.6	—	145	O	B	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	$2n$‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
531	*Scilla koenigii* Fomin	Liliaceae	M	12	2	P	33.8	67.6	101.4	135.2	—	145	O	B	Fe
532	*Scilla rosenii* C.Koch	Liliaceae	M	12	2	P	23.8	47.6	71.4	95.2	—	145	O	B	Fe
533	*Scindapsus aureus* Engl.	Araceae	M	—[u]	—[v]	P	4.7	9.4	14.1	18.8	—	155	O	B	Fe
534	*Scirpus sylvaticus* L.	Cyperaceae	M	62	—[v]	P	0.5	0.9	1.4	1.8	—	158[i]	O	E	Fe
535	*Senecio amygdalifolius* F.v.Muell.	Compositae	D	38	4	P	6.7	13.4	20.2	26.9	—	114	O	G	Fe
536	*Senecio anethifolius* A.Cunn. ex DC.	Compositae	D	60	6	P	4.3	8.7	13.0	17.4	—	114	O	G	Fe
537	*Senecio aff.apargiaefolius* Walp.	Compositae	D	40	4	P	3.5	7.1	10.6	14.1	—	114	O	G	Fe
538	*Senecio bipinnatisectus* Belcher	Compositae	D	60	6	A	3.5	7.0	10.5	14.0	—	114	O	G	Fe
539	*Senecio biserratus* Belcher	Compositae	D	100	10	A	6.3	12.6	19.0	25.3	—	114	O	G	Fe
540	*Senecio cunninghamii* DC.	Compositae	D	60	6	P	4.7	9.5	14.2	18.9	—	114	O	G	Fe
541	*Senecio discifolius* Oliver	Compositae	D	10	2	A	3.6	7.1	10.7	14.3	—	114	O	G	Fe
542	*Senecio georgianus* DC. var.*latifolius* Black	Compositae	D	60	6	P	5.1	10.2	15.3	20.4	—	114	O	G	Fe
543	*Senecio glomeratus* Desf. ex Poir.	Compositae	D	60	6	A	4.8	9.6	14.4	19.2	—	114	O	G	Fe
544	*Senecio glomeratus* Desf. ex Poir. X *S.hispidulus* A.Rich.	Compositae	D	60	6	A	4.7	9.3	14.0	18.6	—	114	O	G	Fe
545	*Senecio glomeratus* Desf. ex Poir. X *S.minimus* Poir.	Compositae	D	60	6	A	4.8	9.5	14.3	19.1	—	114	O	G	Fe
546	*Senecio glossanthus* (Sond.) Belcher	Compositae	D	40	4	A	1.7	3.4	5.0	6.7	—	114	O	G	Fe
547	*Senecio glossanthus* (Sond.) Belcher	Compositae	D	80	8	A	3.7	7.5	11.2	15.0	—	114	O	G	Fe
548	*Senecio gregorii* F.v.Muell.	Compositae	D	40	4	A	3.1	6.3	9.4	12.6	—	114	O	G	Fe
549	*Senecio gunnii* (Hook.f.) Belcher	Compositae	D	40	4	P	3.5	7.0	10.5	14.0	—	114	O	G	Fe
550	*Senecio hispidulus* A.Rich. var.*dissectus* (Benth.) Belcher	Compositae	D	60	6	A	4.9	9.7	14.6	19.4	—	114	O	G	Fe
551	*Senecio hispidulus* A.Rich. var. *hispidulus*	Compositae	D	60	6	A	4.8	9.6	14.3	19.1	—	114	O	G	Fe
552	*Senecio hypoleucus* F.v.Muell. ex Benth.	Compositae	D	60	6	P	4.5	9.0	13.4	17.9	—	114	O	G	Fe
553	*Senecio jacobaea* L.	Compositae	D	40	4	B–P	2.3	4.5	6.8	9.0	—	154[i]	O	I	Fe
554	*Senecio lautus* G.Forst. ex Willd. ssp.*alpinus* Ali	Compositae	D	40	4	P	2.7	5.4	8.1	10.7	—	114	O	G	Fe
555	*Senecio lautus* G.Forst. ex Willd.ssp.*dissectifolius* Ali	Compositae	D	40	4	P	2.7	5.3	8.0	10.6	—	114	O	G	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

556	*Senecio lautus* G.Forst. ex Willd. ssp.*dissectifolius* Ali X *S.biserratus* Belcher	Compositae	D	70	7	P	4.4	8.9	13.3	17.8	—	114	O	G	Fe
557	*Senecio lautus* G.Forst. ex Willd. ssp.*lanceolatus* Ali	Compositae	D	40	4	P	2.4	4.9	7.3	9.8	—	114	O	G	Fe
558	*Senecio lautus* G.Forst. ex Willd. ssp.*lautus*	Compositae	D	40	4	A	2.7	5.4	8.1	10.8	—	114	O	G	Fe
559	*Senecio lautus* G.Forst. ex Willd. ssp.*maritimus* Ali	Compositae	D	40	4	P	2.5	5.1	7.6	10.2	—	114	O	G	Fe
560	*Senecio linearifolius* A.Rich.	Compositae	D	60	6	P	4.5	9.0	13.5	18.0	—	114	O	G	Fe
561	*Senecio linearifolius* A.Rich. X *S.bipinnasectus* Belcher	Compositae	D	60	6	P	4.1	8.2	12.2	16.3	—	114	O	G	Fe
562	*Senecio macranthus* A.Rich.	Compositae	D	40	4	P	9.4	18.7	28.1	37.5	—	114	O	G	Fe
563	*Senecio magnificus* F.v.Muell.	Compositae	D	40	4	P	7.9	15.9	23.8	31.7	—	114	O	G	Fe
564	*Senecio mikanioides* Otto ex Walp.	Compositae	D	20	2	P	2.9	5.9	8.8	11.8	—	114	O	G	Fe
565	*Senecio minimus* Poir. var. *minimus*	Compositae	D	60	6	A	5.0	9.9	14.9	19.8	—	114	O	G	Fe
566	*Senecio minimus* Poir. var. *picridioides* (Turcz.)Belcher	Compositae	D	60	6	A	4.9	9.8	14.8	19.7	—	114	O	G	Fe
567	*Senecio odoratus* Hornem. var. *obtusifolius* Black	Compositae	D	60	6	P	4.5	9.1	13.6	18.2	—	114	O	G	Fe
568	*Senecio odoratus* Hornem. var. *odoratus*	Compositae	D	60	6	P	4.5	9.1	13.6	18.1	—	114	O	G	Fe
569	*Senecio pectinatus* DC.	Compositae	D	80	8	P	7.8	15.5	23.3	31.1	—	114	O	G	Fe
570	*Senecio pterophorus* DC.	Compositae	D	20	2	P	1.1	2.1	3.2	4.2	—	114	O	G	Fe
571	*Senecio pterophorus* DC. X *S.glomeratus* Desf. ex Poir.	Compositae	D	40	4	P	2.9	5.9	8.8	11.7	—	114	O	G	Fe
572	*Senecio pterophorus* DC. X *S.hypoleucus* F.v.Muell. ex Benth.	Compositae	D	40	4	P	2.8	5.6	8.4	11.2	—	114	O	G	Fe
573	*Senecio quadridentatus* Labill	Compositae	D	40	4	P	3.2	6.4	9.6	12.8	—	114	O	G	Fe
574	*Senecio runcinifolius* Willis	Compositae	D	40	4	P	4.0	8.1	12.1	16.2	—	114	O	G	Fe
575	*Senecio spathulatus* A.Rich.	Compositae	D	40	4	P	3.1	6.1	9.2	12.3	—	114	O	G	Fe
576	*Senecio squarrosus* A.Rich.	Compositae	D	60	6	A	5.0	9.9	14.9	19.8	—	114	O	G	Fe
577	*Senecio vagus* F.v.Muell. ssp. *eglandulosus* Ali	Compositae	D	98	10	A	10.7	21.5	32.2	42.9	—	114	O	G	Fe
578	*Senecio velleioides* A.Cunn. ex DC.	Compositae	D	38	4	A	8.3	16.5	24.8	33.1	—	114	O	G	Fe
579a	*Senecio vulgaris* L.	Compositae	D	40	4	A	1.6	3.2	4.7	6.3	—	108	O	J	Fe
579b	*Senecio vulgaris* L.	Compositae	D	40	4	A	2.0	3.9	5.9	7.8	—	114	O	G	Fe
580	*Sessilistigma radians* Goldbl. ined. *Sieglingia decumbens* (L.) Benth.(listed under *Danthonia decumbens* (L.) DC.)	Iridaceae	M	12	2	P	13.7	27.4	41.1	54.8	—	137	R	H[g]	Fe
581	*Silene dioica* (L.) Clairv.	Caryophyllaceae	D	24	2	B–P	2.7	5.4	8.1	10.8	—	158[i]	O	I	Fe
582	*Silene nutans* L.	Caryophyllaceae	D	—[u]	—[v]	P	3.2	6.4	9.6	12.8	—	156	O	B	Fe
583	*Sisyrinchium convolutum* Nocca	Iridaceae	M	72	8	P	4.7	9.4	14.2	18.9	—	137	R	H[g]	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	$2n$‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
584	*Skimmia japonica* Thunb.	Rutaceae	D	30	—[v]	P	3.2	6.4	9.6	12.9	—	140	O	G–489f	Fe
585	*Sogerianthe sessiliflora*[t]	Loranthaceae	D	18	2	P	6.9	13.8	20.7	27.6	—	109	O	C	Fe
586	*Solanum abutiloides* (Griseb.) Bitter et Lillo	Solanaceae	D	24	2	—[w]	1.5	3.0	4.5	6.1	—	108	O	J	Fe
587	*Solanum aculeastrum* Dun.	Solanaceae	D	24	2	P	1.1	2.1	3.2	4.2	—	108	O	J	Fe
588	*Solanum alatum* Moench	Solanaceae	D	24	2	—[w]	1.4	2.7	4.1	5.4	—	108	O	J	Fe
589	*Solanum atropurpureum* Schrank	Solanaceae	D	24	2	P	1.1	2.2	3.4	4.5	—	108	O	J	Fe
590	*Solanum aviculare* Forst.	Solanaceae	D	46	2	P	0.9	1.8	2.7	3.6	—	108	O	J	Fe
591	*Solanum catombelense* Peyr	Solanaceae	D	24	2	P	1.2	2.5	3.7	4.9	—	108	O	J	Fe
592	*Solanum chacoense* Bitt.	Solanaceae	D	24	2	P	0.6	1.3	1.9	2.5	—	108	O	J	Fe
593	*Solanum demissum* Lindl.	Solanaceae	D	72	6	P	2.5	5.0	7.5	10.0	—	108	O	J	Fe
594a	*Solanum dulcamara* L.	Solanaceae	D	24	2	P	1.1	2.3	3.4	4.5	—	154[1]	R	I	Fe
594b	*Solanum dulcamara* L.	Solanaceae	D	24	2	P	0.8	1.6	2.4	3.2	—	156	O	B	Fe
595	*Solanum fendleri* A.Gray ssp.*fendleri*	Solanaceae	D	48	4	P	1.5	3.1	4.6	6.1	—	108	O	J	Fe
596	*Solanum giganteum* Jacq.	Solanaceae	D	24	2	P	1.9	3.8	5.7	7.6	—	108	O	J	Fe
597	*Solanum incanum* L.	Solanaceae	D	24	2	P	1.2	2.4	3.6	4.7	—	108	O	J	Fe
598	*Solanum laciniatum* Ait.	Solanaceae	D	92	4	P	1.8	3.6	5.3	7.1	—	108	O	J	Fe
599	*Solanum luteum* Miller	Solanaceae	D	48	4	A	2.0	4.0	6.0	8.0	—	108	O	J	Fe
600	*Solanum mammosum* L.	Solanaceae	D	22	2	P	2.7	5.3	8.0	10.7	—	108	O	J	Fe
601	*Solanum melongena* L.	Solanaceae	D	24	2	A–P	1.0	1.9	2.9	3.9	—	108	O	J	Fe
602	*Solanum nigrum* L. ssp.*schultesii* (Opiz.)Wess. var.*schultesii* f.*luridum* Wess.	Solanaceae	D	72	6	A	3.1	6.2	9.3	12.4	—	108	O	J	Fe
603	*Solanum nodiflorum* Jacq.	Solanaceae	D	24	2	A?	1.0	2.1	3.1	4.1	—	108	O	J	Fe
604	*Solanum oxycarpum* Schiede	Solanaceae	D	48	4	P	1.4	2.8	4.3	5.7	—	108	O	J	Fe
605	*Solanum phureja* Hawkes	Solanaceae	D	24	2	P	0.9	1.7	2.6	3.4	—	108	O	J	Fe
606	*Solanum pinnatisectum* Dun.	Solanaceae	D	24	2	P	0.8	1.5	2.3	3.1	—	108	O	J	Fe
607	*Solanum polyadenium* Greenm.	Solanaceae	D	24	2	P	1.1	2.3	3.4	4.6	—	108	O	J	Fe
608	*Solanum pseudocapsicum* L.	Solanaceae	D	24	2	A–P	1.3	2.7	4.0	5.4	—	108	O	J	Fe
609	*Solanum retroflexum* Dun.	Solanaceae	D	48	4	—[w]	2.3	4.5	6.8	9.0	—	108	O	J	Fe
610	*Solanum robustum* Wendl.	Solanaceae	D	24	2	—[w]	3.1	6.2	9.4	12.5	—	108	O	J	Fe
611	*Solanum seaforthianum* Andr.	Solanaceae	D	24	2	P	1.0	1.9	2.9	3.9	—	108	O	J	Fe
612	*Solanum sparsipilum* (Bitt.) Juz.& Buk.	Solanaceae	D	24	2	P	0.9	1.8	2.7	3.6	—	124	O	B	FC
613	*Solanum stenotomum* Juz.& Buk.	Solanaceae	D	24	2	P	1.2	2.4	3.6	4.8	—	124	O	B	FC
614	*Solanum torvum* Sw.	Solanaceae	D	24	2	P?	1.4	2.8	4.2	5.6	—	108	O	J	Fe
615	*Solanum tripartitum* Dun.	Solanaceae	D	24	2	—[w]	0.6	1.3	1.9	2.6	—	108	O	J	Fe
616b	*Solanum tuberosum* L. cv. Krokus	Solanaceae	D	48	4	P	1.9	3.7	5.6	7.4	—	156	O	B	Fe
616c	*Solanum tuberosum* L. cv. Lenino	Solanaceae	D	48	4	P	1.6	3.2	4.8	6.4	—	156	O	B	Fe
617	*Solanum tucumanense* Griseb.	Solanaceae	D	24	2	—[w]	0.9	1.8	2.6	3.5	—	108	O	J	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

618	*Solanum vernei* Bitt.& Wittm.	Solanaceae	D	24	2	P	0.8	1.6	2.4	3.2	—	108	O	J	Fe
619	*Sonchus oleraceus* agg.L.	Compositae	D	32	4	A	1.6	3.2	4.8	6.4	—	154[i]	R	I	Fe
620a	*Sorghum bicolor* (L.) Moench cv.275 TL80B	Gramineae	M	20	2	A	0.8	1.6	2.4	3.2	—	132	O	J	Fe
620b	*Sorghum bicolor* (L.) Moench cv.S9B BA81	Gramineae	M	20	2	A	0.8	1.6	2.4	3.2	—	132	O	J	Fe
620c	*Sorghum bicolor* (L.) Moench cv.G3E (cytoplasmic male sterile)	Gramineae	M	20	2	A	0.9	1.7	2.6	3.4	—	132	O	J	Fe
620d	*Sorghum bicolor* (L.) Moench cv.SII TL80B	Gramineae	M	20	2	A	0.8	1.6	2.3	3.1	—	132	O	J	Fe
621	*Sorghum bicolor* (L.) Moench ssp.*arundinaceum* race *verticilliflorum*	Gramineae	M	40	4	A	1.7	3.4	5.0	6.7	—	132	O	J	Fe
622a	*Sorghum bicolor* (L.) Moench ssp.*bicolor* race *caffrorum*	Gramineae	M	20	2	A	0.8	1.6	2.4	3.2	—	132	O	J	Fe
622b	*Sorghum bicolor* (L.) Moench ssp.*bicolor* race *caffrorum*	Gramineae	M	20	2	A	0.8	1.7	2.5	3.3	—	132	O	J	Fe
622c	*Sorghum bicolor* (L.) Moench ssp.*bicolor* race *durra*	Gramineae	M	20	2	A	0.7	1.5	2.2	3.0	—	132	O	J	Fe
622d	*Sorghum bicolor* (L.) Moench ssp.*bicolor* race *nervosum*	Gramineae	M	20	2	A	0.8	1.6	2.5	3.3	—	132	O	J	Fe
623	*Sorghum halepense* (L.) Pers. race *almum*	Gramineae	M	40	4	P	1.7	3.3	5.0	6.6	—	132	O	J	Fe
624	*Sorghum versicolor* Anderss.	Gramineae	M	10	2	A	2.1	4.2	6.4	8.5	—	132	O	J	Fe
625	*Sparganium erectum* L.	Sparganiaceae	M	30	2	P	0.6	1.2	1.8	2.4	—	154[i]	R	I	Fe
626b	*Spinacia oleracea* L.	Chenopodiaceae	D	12	2	A	0.8	1.6	2.5	3.3	—	150	O	—	RK
627	*Stachys officinalis* L.	Labiatae	D	16	2	P	4.5	9.0	13.5	18.1	—	154[i]	R	I	Fe
628	*Stellaria alsine* Grimm.	Caryophyllaceae	D	—[u]	—[v]	P	0.8	1.5	2.3	3.0	—	154[i]	R	I	Fe
629	*Stellaria holostea* L.	Caryophyllaceae	D	26	2	P	1.5	2.9	4.4	5.8	—	154[i]	R	I	Fe
630	*Stellaria media* Vill.	Caryophyllaceae	D	—[u]	—[v]	A	1.2	2.3	3.5	4.6	—	156	O	B	Fe
631	*Succisa pratensis* Moench.	Dipsacaceae	D	20	2	P	2.8	5.5	8.3	11.0	—	133[i]	O	I	Fe
632	*Syringa josikaea* Jacq.	Oleaceae	D	—[u]	—[v]	P	1.3	2.6	3.9	5.2	—	157	O	B	Fe
633	*Teucrium scorodonia* L.	Labiatae	D	34	2	P	1.2	2.4	3.5	4.7	—	154[i]	R	I	Fe
634	*Thlaspi alpestre* L.	Cruciferae	D	14	2	P	0.2	0.3	0.5	0.6	—	154[i]	O	G	Fe
635	*Thymus praecox* Opiz. ssp.*arcticus* (Durand) Jalas.	Labiatae	D	54	6?	P	1.4	2.8	4.2	5.6	—	158[i]	O	I	Fe
636	*Thyrsanthemum floribundum* (Mart.& Gal.) Pichon	Commelinaceae	M	32	4	P	7.2	14.5	21.7	28.9	—	119	O	B	Fe
637	*Torilis arvensis* (Hudson) Link	Umbelliferae	D	12	2	A	2.0	4.1	6.1	8.2	—	118	R	B–247*[h]	Fe
638	*Torilis japonica* (Houtt.) DC.	Umbelliferae	D	12	2	A	2.3	4.6	6.8	9.1	—	118	R	B–247*[h]	Fe
639	*Torilis leptophylla* (L.) Reichenb.f.	Umbelliferae	D	12	2	A	1.4	2.7	4.1	5.4	—	118	R	B–247*[h]	Fe
640	*Torilis nodosa* Gaertner	Umbelliferae	D	22	2	A	1.6	3.2	4.8	6.4	—	118	R	B–247*[h]	Fe
641	*Tradescantia canaliculata* Rafin.	Commelinaceae	M	24	4	P	39.1	78.1	117.2	156.3	—	121	O	B	Fe
642	*Tradescantia crassifolia* Cav.	Commelinaceae	M	12	2	P	10.8	21.5	32.3	43.0	—	120	O	B	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	$2n$‡	ploidy level x	life cycle type§	DNA amount/pg 1C	2C	3C	4C	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
643	*Tradescantia ernestiana* Anders.& Woodson	Commelinaceae	M	12	2	P	20.4	40.7	61.1	81.4	—	121	O	B	Fe
644	*Tradescantia fluminensis* Vell	Commelinaceae	M	67	10	P	6.0	12.0	18.0	24.0	—	119	O	B	Fe
645	*Tradescantia llamassii* Matuda	Commelinaceae	M	12	2	P	11.7	23.4	35.1	46.8	—	120	O	B	Fe
646	*Tradescantia pallida* (Rose) D.R.Hunt	Commelinaceae	M	12	2	P	8.3	16.5	24.8	33.0	—	120	O	B	Fe
647	*Tradescantia rozynskii* Matuda	Commelinaceae	M	12	2	P	6.1	12.2	18.3	24.4	—	120	O	B	Fe
648	*Tradescantia subaspera* Ker-Gawl.	Commelinaceae	M	24	4	P	39.9	79.9	119.8	159.7	—	119	O	B	Fe
649	*Tradescantia tepoxtlana* Matuda	Commelinaceae	M	12	2	P	5.9	11.8	17.7	23.6	—	120	O	B	Fe
650	*Trifolium alexandrium* L.	Leguminosae	D	16	2	A	1.0	2.1	3.1	4.2	—	126	O	B	Fe
651	*Trifolium ambiguum* Bieb.	Leguminosae	D	32	4	P	0.9	1.9	2.8	3.8	—	126	O	B	Fe
652a	*Trifolium arvense* L.	Leguminosae	D	14	2	A	0.7	1.5	2.2	2.9	—	158[i]	O	I	Fe
652b	*Trifolium arvense* L.	Leguminosae	D	14	2	A–B	0.8	1.6	2.4	3.2	—	126	O	B	Fe
653	*Trifolium campestre* Schreber.	Leguminosae	D	14	2	A	0.5	1.0	1.4	1.9	—	158[i]	O	I	Fe
654	*Trifolium dubium* Sibth.	Leguminosae	D	32	4	A	1.1	2.1	3.2	4.2	—	126	O	B	Fe
655	*Trifolium hybridum* L.	Leguminosae	D	16	2	P	0.8	1.6	2.4	3.2	—	126	O	B	Fe
656	*Trifolium hybridum* L.	Leguminosae	D	32?	4?	P	1.6	3.1	4.7	6.2	—	126	O	B	Fe
657	*Trifolium incarnatum* L.	Leguminosae	D	14	2	A	0.9	1.7	2.6	3.5	—	126	O	B	Fe
658	*Trifolium medium* L.	Leguminosae	D	c.80	10	P	3.6	7.1	10.7	14.2	—	158[i]	O	H	Fe
659a	*Trifolium pratense* L.	Leguminosae	D	14	2	P	0.7	1.3	2.0	2.6	—	110[i]	O	G	Fe
659b	*Trifolium pratense* L.	Leguminosae	D	14	2	P	0.8	1.5	2.3	3.1	—	126	O	B	Fe
660a	*Trifolium repens* L.	Leguminosae	D	32	4	P	1.5	3.1	4.6	6.1	—	110[i]	O	G	Fe
660b	*Trifolium repens* L.	Leguminosae	D	32	4	P	1.0	2.0	3.0	3.9	—	126	O	B	Fe
660c	*Trifolium repens* L. cv.Grasslands Huia	Leguminosae	D	32	4	P	1.1	2.2	3.3	4.4	—	154[i]	R	H	Fe
661	*Trifolium resupinatum* L.	Leguminosae	D	16	2	A	0.6	1.2	1.7	2.3	—	126	O	B	Fe
662	*Trillium camchatcense* Ker-Gawl.	Liliaceae	M	10	2	P	44.5	89.0	133.5	178.0	—	122	O	B	Fe
663	*Trillium rhombifolium* Kom.	Liliaceae	M	30	6	P	111.5	223.0	334.5	446.0	—	122	O	B	Fe
664	*Trisetum flavescens* (L.) Beauv.	Gramineae	M	—[u]	—[v]	P	2.6	5.1	7.7	10.2	—	154[i]	O	G	Fe
665	*Tritonia crocosmiifolia* Voss. var.*aurantiaca* Hort.	Iridaceae	M	22	2	P	1.1	2.2	3.3	4.4	—	155	O	B	Fe
666c	*Tulipa kaufmanniana* Regl. cv.Shakespeare	Liliaceae	M	24	2	P	35.4	70.8	106.2	141.6	—	155	O	B	Fe
667	*Tupeia antarctica* (Forst.f.) Cham.& Schlect.	Loranthaceae	D	24	2	P	4.1[f]	8.2[f]	12.3[f]	16.4[f]	—	109	O	C	Fe
668	*Turgenia latifolia* (L.) Hoffm.	Umbelliferae	D	24	2	A	3.0	5.9	8.9	11.9	—	118	R	B–247[h]	Fe
669	*Tussilago farfara* L.	Compositae	D	60	2	P	2.3	4.6	6.9	9.2	—	110[i]	O	G	Fe
670	*Typha latifolia* L.	Typhaceae	M	30	2	P	0.3	0.6	1.0	1.3	—	154[i]	R	H	Fe
671	*Ulex gallii* Planchon	Leguminosae	D	80	—[v]	P	2.9	5.8	8.7	11.6	—	154[i]	R	H	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

672	*Ulmus glabra* Hudson	Ulmaceae	D	28	2	P	1.1	2.1	3.2	4.3	—	154[i]	R	H	Fe
673	*Urtica dioica* L.	Urticaceae	D	52	4	P	1.6	3.2	4.7	6.3	—	158[i]	O	H	Fe
674	*Veronica beccabunga* L.	Scrophulariaceae	D	18	2	P	0.8	1.6	2.4	3.2	—	154[i]	R	H	Fe
675	*Veronica montana* L.	Scrophulariaceae	D	18	2	P	0.9	1.7	2.6	3.4	—	154[i]	R	H	Fe
676	*Viburnum bitchiuense* Mak.	Caprifoliaceae	D	16	2	P	3.8	7.6	11.4	15.2	—	157	O	H	Fe
677	*Viburnum opulus* L.	Caprifoliaceae	D	18	2	P	4.1	8.3	12.4	16.6	—	154[i]	R	H	Fe
678	*Vicia amurensis* Oett.	Leguminosae	D	12	2	—[w]	5.6	11.3	16.9	22.6	—	112	O	B	Fe
679c	*Vicia angustifolia* L. ssp. *angustifolia*	Leguminosae	D	12	2	A	2.5	5.0	7.5	10.0	—	112	O	B	Fe
680	*Vicia angustifolia* L. ssp. *segetalis* (Thuill.) Gaud.	Leguminosae	D	12	2	A	2.5	5.1	7.6	10.1	—	112	O	B	Fe
681b	*Vicia articulata* Hornem.	Leguminosae	D	14	2	A	7.1	14.2	21.4	28.5	—	112	O	B	Fe
682b	*Vicia atropurpurea* Desf.	Leguminosae	D	14	2	A–P	3.5	7.1	10.6	14.2	—	112	O	B	Fe
683c	*Vicia benghalensis* L.	Leguminosae	D	14	2	A–P	3.5	7.0	10.4	13.9	—	112	O	B	Fe
684b	*Vicia biennis* L.	Leguminosae	D	14	2	A	3.7	7.3	11.0	14.6	—	112	O	B	Fe
685b	*Vicia bithynica* L.	Leguminosae	D	14	2	A	5.0	10.0	15.0	20.0	—	112	O	B	Fe
686b	*Vicia cassubica* L.	Leguminosae	D	12	2	P	4.1	8.3	12.4	16.5	—	112	O	B	Fe
687	*Vicia cordata* Wulf.	Leguminosae	D	10	2	A	2.0	4.0	5.9	7.9	—	112	O	B	Fe
688b	*Vicia cracca* L.	Leguminosae	D	28	4	P	5.7	11.5	17.2	22.9	—	110[i]	O	C	Fe
688c	*Vicia cracca* L.	Leguminosae	D	28	4	P	7.2	14.4	21.6	28.8	—	156	O	B	Fe
688d	*Vicia cracca* L. var *cracca*	Leguminosae	D	28	4	P	6.5	13.0	19.5	26.0	—	112	O	B	Fe
689	*Vicia dalmatica* Kern.	Leguminosae	D	12	2	P	4.1	8.2	12.3	16.5	—	112	O	B	Fe
690	*Vicia dasycarpa* Ten.	Leguminosae	D	14	2	A	2.2	4.4	6.6	8.8	—	112	O	B	Fe
691b	*Vicia disperma* DC.	Leguminosae	D	14	2	A	2.6	5.2	7.8	10.4	—	112	O	B	Fe
692b	*Vicia dumetorum* L.	Leguminosae	D	14	2	P	9.3	18.6	27.8	37.1	—	112	O	B	Fe
693	*Vicia elegans* Guss.	Leguminosae	D	12	2	P	4.1	8.1	12.2	16.3	—	112	O	B	Fe
694	*Vicia eriocarpa* (Hausskn.) Hal	Leguminosae	D	14	2	A	2.3	4.5	6.8	9.0	—	112	O	B	Fe
695b	*Vicia ervilia* (L.) Willd.	Leguminosae	D	14	2	A	4.2	8.4	12.6	16.8	—	112	O	B	Fe
696	*Vicia faba* L. ssp. *major* cv. Hangdown	Leguminosae	D	12	2	A	13.4	26.7	40.1	53.4	—	156	O	B	Fe
697a	*Vicia faba* L. ssp. *minor* cv. Mazur	Leguminosae	D	12	2	A	13.1	26.1	39.2	52.2	—	156	O	B	Fe
697b	*Vicia faba* L. ssp. *minor* var. *minor* subvar. *minor*	Leguminosae	D	12	2	A	13.5	27.1	40.6	54.1	—	112	O	B	Fe
698b	*Vicia graminea* Sm.	Leguminosae	D	14	2	A	6.7	13.4	20.1	26.9	—	112	O	B	Fe
699b	*Vicia grandiflora* Scop. var. *grandiflora*	Leguminosae	D	14	2	A	4.5	9.1	13.6	18.1	—	112	O	B	Fe
700	*Vicia grandiflora* var. *kitaibeliana* Koch	Leguminosae	D	14	2	A	3.6	7.2	10.8	14.4	—	112	O	B	Fe
701b	*Vicia hajastana* Grossh.	Leguminosae	D	10	2	A	7.8	15.7	23.5	31.3	—	112	O	B	Fe
702c	*Vicia hirsuta* (L.) S.F.Gray	Leguminosae	D	14	2	A	3.6	7.3	10.9	14.5	—	110[i]	O	C	Fe
702d	*Vicia hirsuta* (L.) S.F.Gray	Leguminosae	D	14	2	A	4.5	9.0	13.4	17.9	—	112	O	B	Fe
703c	*Vicia hybrida* L.	Leguminosae	D	12	2	A	8.2	16.5	24.7	32.9	—	112	O	B	Fe
704b	*Vicia hyrcanica* Fisch.et Mey	Leguminosae	D	12	2	A	7.6	15.2	22.8	30.4	—	112	O	B	Fe
705	*Vicia incana* Gouan	Leguminosae	D	12	2	P	4.1	8.2	12.3	16.4	—	112	O	B	Fe
706b	*Vicia incisaeformis* Stef.	Leguminosae	D	14	2	A	4.3	8.7	13.0	17.3	—	112	O	B	Fe
707	*Vicia johannis* Tamasch. var. *johannis*	Leguminosae	D	14	2	—[w]	7.1	14.1	21.2	28.3	—	112	O	B	Fe
708b	*Vicia lathyroides* L.	Leguminosae	D	12	2	A	3.2	6.5	9.7	12.9	—	112	O	B	Fe
709	*Vicia ludoviciana* Nutt.	Leguminosae	D	14	2	—[w]	4.2	8.5	12.7	17.0	—	112	O	B	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	2*n*‡	ploidy level *x*	life cycle type§	DNA amount/pg 1*C*	2*C*	3*C*	4*C*	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
710d	*Vicia lutea* L.	Leguminosae	D	14	2	A	9.0	18.0	27.0	36.1	—	112	O	B	Fe
711	*Vicia macrocarpa* (Moris) Bertol.	Leguminosae	D	12	2	—[w]	2.7	5.4	8.1	10.8	—	112	O	B	Fe
712b	*Vicia melanops* Sibth.et Sm. var.*melanops*	Leguminosae	D	10	2	A	10.0	20.0	30.0	40.0	—	112	O	B	Fe
713b	*Vicia michauxii* Spreng.	Leguminosae	D	14	2	A	10.3	20.7	31.0	41.4	—	112	O	B	Fe
714	*Vicia monantha* Retz. var. *triflora* (Ten.) Burtt et Lewis	Leguminosae	D	14	2	A	1.9	3.9	5.8	7.7	—	112	O	B	Fe
715e	*Vicia narbonensis* L. var. *narbonensis*	Leguminosae	D	14	2	A	8.1	16.1	24.2	32.2	—	112	O	B	Fe
716b	*Vicia neglecta* Hanett et Mettin	Leguminosae	D	12	2	A	5.5	11.1	16.6	22.2	—	112	O	B	Fe
717b	*Vicia orobus* DC.	Leguminosae	D	12	2	P	5.3	10.6	15.9	21.2	—	112	O	B	Fe
718	*Vicia palaestina* Boiss.	Leguminosae	D	14	2	—[w]	2.6	5.1	7.7	10.2	—	112	O	B	Fe
719b	*Vicia pannonica* Crantz ssp. *pannonica*	Leguminosae	D	12	2	A	6.8	13.5	20.3	27.0	—	112	O	B	Fe
720b	*Vicia peregrina* L.	Leguminosae	D	14	2	A	9.6	19.2	28.7	38.3	—	112	O	B	Fe
721	*Vicia pilosa* M.B.	Leguminosae	D	14	2	A	2.4	4.8	7.2	9.6	—	112	O	B	Fe
722b	*Vicia pisiformis* L.	Leguminosae	D	12	2	P	7.1	14.2	21.2	28.3	—	112	O	B	Fe
723	*Vicia pseudorobus* Fisch.et Mey.	Leguminosae	D	14	2	—[w]	5.8	11.5	17.3	23.1	—	112	O	B	Fe
724b	*Vicia pubescens* Link	Leguminosae	D	14	2	A	3.7	7.4	11.0	14.7	—	112	O	B	Fe
725	*Vicia pyrenaica* Pourr.	Leguminosae	D	14	2	P	4.1	8.3	12.4	16.6	—	112	O	B	Fe
	Vicia sativa L. ssp. *angustifolia* (L.) Gaudin (listed under *V.sativa* ssp. *nigra*)														
726	*Vicia sativa* ssp. *nigra* L.	Leguminosae	D	14	2	A	1.7	3.3	5.0	6.6	—	158[i]	O	G	Fe
727b	*Vicia sativa* L.convar.*sativa* var.*sativa*	Leguminosae	D	12	2	A	2.3	4.5	6.8	9.0	—	112	O	B	Fe
728c	*Vicia sepium* L.var.*sepium*	Leguminosae	D	14	2	P	4.7	9.3	14.0	18.7	—	112	O	B	Fe
729	*Vicia serratifolia* Jacq.	Leguminosae	D	14	2	A	7.8	15.6	23.4	31.3	—	112	O	B	Fe
730b	*Vicia sylvatica* L.	Leguminosae	D	14	2	P	8.1	16.1	24.2	32.3	—	112	O	B	Fe
731b	*Vicia tenuifolia* Roth.	Leguminosae	D	24	4	P	8.0	16.0	24.0	32.0	—	112	O	B	Fe
732b	*Vicia tetrasperma* (L.) Schreb	Leguminosae	D	14	2	A	3.6	7.2	10.8	14.4	—	112	O	B	Fe
733	*Vicia vicioides* (Desf.) Cout.	Leguminosae	D	14	2	A	4.3	8.6	13.0	17.3	—	112	O	B	Fe
734b	*Vicia villosa* Roth.	Leguminosae	D	14	2	A	2.3	4.7	7.0	9.3	—	112	O	B	Fe
735	*Viola riviniana* Reichenb.	Violaceae	D	40	4	P	1.4	2.7	4.1	5.4	—	133[i]	O	I	Fe
736	*Watsonia brevifolia* Ker	Iridaceae	M	18	2	P	0.7	1.4	2.1	2.8	—	137	R	H[g]	Fe
737	*Yucca kaibabensis*[t]	Liliaceae	M	60	2	P	2.7	5.4	8.1	10.8	—	108	O	J	Fe
738	*Yucca kanabensis* McKelvey	Liliaceae	M	60?	2	P	2.6	5.1	7.7	10.2	—	108	O	F	Fe
739	*Zanthoxylum alatum* Roxb.	Rutaceae	D	106	—[v]	P	8.7	17.4	26.1	34.8	—	140	O	G–489f	Fe
740	*Zanthoxylum piperitum* DC.	Rutaceae	D	70	—[v]	P	3.6	7.2	10.8	14.4	—	140	O	G–489f	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

741	*Zea diploperennis* Iltis, Doebley & Manglesdorf	Gramineae	M	20	2	P	2.6	5.3	7.9	10.6	—	132	O	F	Fe
742a	*Zea luxurians* (Durieu & Ascherson) Bird Iltis G–5	Gramineae	M	20	2	A	4.6	9.1	13.7	18.3	—	132	O	F	Fe
742b	*Zea luxurians* (Durieu & Ascherson) Bird Iltis G–42	Gramineae	M	20	2	A	4.6	9.2	13.9	18.5	—	132	O	F	Fe
743g	*Zea mays* L. line Ar206[e]	Gramineae	M	20	2	A	2.5	5.0	7.6	10.1	—	160	O	F–743bh	Fe
743h	*Zea mays* L.ssp.*mays*[e] Race Chapalote	Gramineae	M	20	2	A	2.9	5.8	8.7	11.7	—	132	O	F	Fe
743i	*Zea mays* L.line F6[e]	Gramineae	M	20	2	A	2.6	5.1	7.7	10.3	—	160	O	F–743bh	Fe
743j	*Zea mays* L. line Gaspe Flint[e]	Gramineae	M	20	2	A	2.5	4.9	7.4	9.8	—	160	O	F–743bh	Fe
743k	*Zea mays* L. line Ge281[e]	Gramineae	M	20	2	A	2.8	5.5	8.3	11.0	—	160	O	F–743bh	Fe
743l	*Zea mays* L. line Ky21[e]	Gramineae	M	20	2	A	2.8	5.6	8.4	11.2	—	160	O	F–743bh	Fe
743m	*Zea mays* L. line Ky27[e]	Gramineae	M	20	2	A	2.9	5.7	8.6	11.5	—	160	O	F–743bh	Fe
743n	*Zea mays* L.ssp.*mays* KYS[e]	Gramineae	M	20	2	A	2.8	5.5	8.3	11.0	—	132	O	F	Fe
743o	*Zea mays* L. line KYS[e]	Gramineae	M	20	2	A	2.8	5.6	8.4	11.2	—	160	O	F–743bh	Fe
743p	*Zea mays* L. line Mo8w[e]	Gramineae	M	20	2	A	2.7	5.4	8.0	10.7	—	160	O	F–743bh	Fe
743q	*Zea mays* L. line Mo15w[e]	Gramineae	M	20	2	A	2.6	5.1	7.7	10.2	—	160	O	F–743bh	Fe
743r	*Zea mays* L. line Mp488[e]	Gramineae	M	20	2	A	2.6	5.2	7.8	10.4	—	160	O	F–743bh	Fe
743s	*Zea mays* L. line Ms116[e]	Gramineae	M	20	2	A	2.7	5.3	8.0	10.6	—	160	O	F–743bh	Fe
743t	*Zea mays* L.ssp.*mays*[e] Race Nal-Tel	Gramineae	M	20	2	A	3.0	6.0	8.9	11.9	—	132	O	F	Fe
743u	*Zea mays* L. line Nal-Tel[e]	Gramineae	M	20	2	A	2.8	5.6	8.4	11.2	—	160	O	F–743bh	Fe
743v	*Zea mays* L. line NY16[e]	Gramineae	M	20	2	A	2.7	5.4	8.2	10.9	—	160	O	F–743bh	Fe
743w	*Zea mays* L. line NY302[e]	Gramineae	M	20	2	A	2.5	5.1	7.6	10.2	—	160	O	F–743bh	Fe
743x	*Zea mays* L.ssp.*mays* Oh43[e]	Gramineae	M	20	2	A	2.6	5.3	7.9	10.6	—	132	O	F	Fe
743y	*Zea mays* L. line Pa88[e]	Gramineae	M	20	2	A	2.6	5.3	7.9	10.5	—	160	O	F–743bh	Fe
743z	*Zea mays* L.ssp.*mays*[e] Race Palomero Toluqueno	Gramineae	M	20	2	A	2.8	5.6	8.4	11.3	—	132	O	F	Fe
743ba	*Zea mays* L.ssp.*mays*[e] Red Tama Flint	Gramineae	M	20	2	A	2.6	5.1	7.7	10.3	—	132	O	F	Fe
743bb	*Zea mays* L.ssp.*mays*[e] Seneca 60	Gramineae	M	20	2	A	2.5	5.0	7.4	9.9	—	132	O	F	Fe
743bc	*Zea mays* L. line SD9[e]	Gramineae	M	20	2	A	2.5	5.1	7.6	10.1	—	160	O	F–743bh	Fe
743bd	*Zea mays* L. line T8[e]	Gramineae	M	20	2	A	2.6	5.2	7.7	10.3	—	160	O	F–743bh	Fe
743be	*Zea mays* L.[e] line Tama Knobless Flint	Gramineae	M	20	2	A	2.5	5.1	7.6	10.2	—	160	O	F–743bh	Fe
743bf	*Zea mays* L. line Tx601[e]	Gramineae	M	20	2	A	2.9	5.8	8.8	11.7	—	160	O	F–743bh	Fe
743bg	*Zea mays* L. line Tx5855[e]	Gramineae	M	20	2	A	2.7	5.4	8.0	10.7	—	160	O	F–743bh	Fe
743bh	*Zea mays* L.ssp.*mays* Va35[e]	Gramineae	M	20	2	A	2.6	5.2	7.7	10.3	—	132	O	F	Fe
743bi	*Zea mays* L.ssp.*mays* W64A[e]	Gramineae	M	20	2	A	2.7	5.5	8.2	10.9	—	108	O	F	Fe
743bj	*Zea mays* L. line W64A[e]	Gramineae	M	20	2	A	6.3	12.6	18.9	25.2	—	136	O	—	RK
743bk	*Zea mays* L.ssp.*mays*[e] Race Zapalote Chico	Gramineae	M	20	2	A	3.3	6.6	9.9	13.2	—	132	O	F	Fe
743bl	*Zea mays* L.ssp.*mays*[e] Race Zapalote Chico	Gramineae	M	20	2	A	3.5	7.0	10.5	13.9	—	132	O	F	Fe
743bm	*Zea mays* L.[e] line Zapalote Grande	Gramineae	M	20	2	A	3.0	6.1	9.1	12.1	—	160	O	F–743bh	Fe
743bn	*Zea mays* L.[e]	Gramineae	M	20	2	A	4.7	9.4	14.1	18.8	—	124	O	B	FC
743bo	*Zea mays* L.[e]	Gramineae	M	20	2	A	2.9	5.8	8.7	11.6	—	155	O	B	Fe

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Table 1. (*cont.*)

entry no.[f]	species	family	monocot or dicot	2*n*‡	ploidy level *x*	life cycle type§	DNA amount/pg 1*C*	2*C*	3*C*	4*C*	per cell	original reference[a]	present amount‖	standard species[b]¶	method of DNA estimation††
744a	*Zea mays* L.ssp.*mexicana*[e] Central Plateau teosinte	Gramineae	M	20	2	A	2.6	5.3	7.9	10.5	—	132	O	F	Fe
744b	*Zea mays* L.ssp.*mexicana*[e] Chalco teosinte	Gramineae	M	20	2	A	3.0	5.9	8.9	11.9	—	132	O	F	Fe
744c	*Zea mays* L.ssp.*mexicana*[e] Durango teosinte	Gramineae	M	20	2	A	2.6	5.2	7.8	10.5	—	132	O	F	Fe
744d	*Zea mays* L.ssp.*mexicana* K65–1[e]	Gramineae	M	20	2	A	3.1	6.3	9.4	12.5	—	132	O	F	Fe
744e	*Zea mays* L.ssp.*mexicana* K67–7[e]	Gramineae	M	20	2	A	3.1	6.2	9.3	12.4	—	132	O	F	Fe
744f	*Zea mays* L.ssp.*mexicana*[e] K67–17	Gramineae	M	20	2	A	3.0	5.9	8.9	11.9	—	132	O	F	Fe
744g	*Zea mays* L.ssp.*mexicana* K68–1[e]	Gramineae	M	20	2	A	3.1	6.3	9.4	12.5	—	132	O	F	Fe
744h	*Zea mays* L.ssp.*mexicana* K68–6[e]	Gramineae	M	20	2	A	3.1	6.1	9.2	12.2	—	132	O	F	Fe
744i	*Zea mays* L.ssp.*mexicana*[e] Nobogame teosinte	Gramineae	M	20	2	A	2.8	5.5	8.3	11.0	—	132	O	F	Fe
745	*Zea mays* L.ssp.*parviglumis* var.*huehuetenangensis* Iltis & Doebley[e]	Gramineae	M	20	2	A	3.0	6.1	9.1	12.2	—	132	O	F	Fe
746a	*Zea mays* L.ssp.*parviglumis* Iltis & Doebley var.*parviglumis*[e]	Gramineae	M	20	2	A	2.8	5.6	8.4	11.2	—	132	O	F	Fe
746b	*Zea mays* L.ssp.*parviglumis* Iltis & Doebley var.*parviglumis*[e]	Gramineae	M	20	2	A	2.9	5.8	8.7	11.6	—	132	O	F	Fe
746c	*Zea mays* L.ssp.*parviglumis* Iltis & Doebly var.*parviglumis*[e]	Gramineae	M	20	2	A	2.9	5.9	8.8	11.7	—	132	O	F	Fe
747	*Zea perennis* (Hitchc.) Reeves & Manglesdorf	Gramineae	M	40	4	P	5.3	10.6	15.8	21.1	—	132	O	F	Fe
748	*Zingeria biebersteiniana* (Claus) P.Smirnov	Gramineae	M	4	2	A	1.9	3.7	5.6	7.4	—	108	O	F	Fe

U *Senecio vulgaris* (PBI population)	6.33
J *Vigna radiata* cv. Berken	2.12
K *Oryza sativa* cv. IR36	2.02

If a species was calibrated in direct comparison with any one or more of the above eleven standard species, the standard species used is identified in column 15 by the appropriate capital letter as above, e.g. F is *Hordeum vulgare*, etc. If a species was calibrated by the present authors as described in §7*c* (iii) and (iv) of Bennett & Smith (1976), then the original standard species is identified as described above, and the intermediate standard species used is also denoted by its number in column 1 of either table 8 of Bennett & Smith (1976) or table 1 of the present work. An intermediate standard from the former is indicated by an asterisk, but this is omitted if the intermediate standard is from the present work. For instance, standard B was used to calibrate *Daucus carota* (species 247 in table 8 of Bennett & Smith (1976)) which was then used as an intermediate standard to calibrate *Artedia squamata*. The calibration standard of *A. squamata* in table 1 of the present work is, therefore, given as B-247*. See also note (*c*).

(*c*) Several species were calibrated by using animal cells as a standard, either mouse lymphocytes, or erythrocytes of chicken or clawed toad. In such cases the appropriate animal genus (*Mus*, *Gallus* or *Xenopus*) is given in column 14, and the original reference (from column 13) should be consulted for the assumed DNA amount of the particular animal standard used.

(*d*) When a new estimate (or estimates) is given for a species or subspecies already listed by Bennett & Smith (1976), or by Bennett *et al.* (1982*a*), the estimate is given a number and a lower case letter in column 1 of table 1. An 'a' implies that a value is preferred to any estimate for that species listed previously by us. Thus, for example, estimates for cells of known *C* value take precedence over 'per cell' estimates for populations of cells of unstated or unknown mean *C*-value. Where several estimates are available for the same species, the 'a' value is automatically chosen to represent the species in any arithmetical or statistical calculations. In this context, single estimates for species and 'a' values are referred to as 'prime entries'.

(*e*) Intraspecific variation in nuclear DNA amount is claimed to occur in this species. Consequently, the values given in table 1 should not be assumed to be correct for all accessions of the species. Often only the maximum and minimum values reported for accessions with the same ploidy level or chromosome number are given in table 1, e.g. *Bulbine bulbosa*, *B. semibarbata*, *Collinsia verna* and *Poa annua*. However, in some other examples, where intraspecific variation is reported between defined lines which are available for further study, estimates for many cultivars of a single species are listed in table 1 (e.g. see *Zea mays*).

(*f*) DNA amounts for Loranthaceae taken from table II of Martin (1983) are stated to be averages for the species, many of which showed significant variation in DNA amount between populations. n.b. The relative values in arbitrary units (a.u.) given in Martin (1983) were converted to absolute units for inclusion in table 1 of the present work using the conversion factor 100 a.u. = 53.31 pg, based on the 4*C* amount for *Vicia faba*, given as a footnote to table I in Barlow & Martin (1984). For example, *Amyema miquelli* showed '... a relatively continuous variation in which the highest value recorded was 46% greater than the lowest' (Barlow & Martin 1984). Such variation is illustrated in figure 3 of Barlow & Martin (1984) and figures 2–4 of Martin (1983). However, unlike for other species claimed to exhibit intraspecific variation in DNA amount (see footnote (e)), maximum and minimum DNA amounts are not given in table 1 of the present work for any Loranthaceae because it is not possible to assess these values accurately from the above mentioned figures, and the information is not stated elsewhere in the original papers.

(*g*) Goldblatt *et al.* (1984) state that the '*C*-value' for Iridaceae was originally 'calculated by comparison against a standard, *Zea mays*, of known genome size, 6.3 pg (Hake & Walbot 1980)'. P. Goldblatt (personal communication) confirmed that by '*C*-value' these authors do mean 1*C* value. However, Hake & Walbot used *Z. mays* cv. W64A as their calibration standard, whose 1*C* DNA content we determined as 2.73 pg (see §5*b*). As the value for *Z. mays* cv. W64A given by Hake & Walbot (1980) is well outside the range of values for lines of *Z. mays* ssp. *mays* estimated by Laurie & Bennett (1985) using standard F, estimates for Iridaceae given by Goldblatt *et al.* (1984) were recalibrated by multiplying by the conversion factor 0.433 (i.e. 2.73/6.30) before entry in table 1.

(*h*) 4*C* DNA amounts for Umbelliferous species given in arbitrary units by Le Coq *et al.* (1977) were converted to absolute units using the conversion factor 103 a.u. = 1 pg. This factor is obtained as the ratio of the estimates for *Daucus carota* ssp. *carota* given by Le Coq *et al.* (i.e. 412 a.u.) and by Owens (1974) (i.e. 4*C* = 4.0 pg; listed as species 247 in table 8 of Bennett & Smith (1976)).

(*i*) Grime & Mowforth (1982) listed DNA amounts for 162 British species including 110 cited from Bennett & Smith (1976) and their own original data for 52 species. (n.b. Their list should not have included *Ornithogalum longibracteatum* which is an African species not listed by Tutin *et al.* (1980). Moreover, *Campanula rotundifolia* should have had an asterisk in the legend to their figure 1 to show that its DNA amount was an original estimate.) Grime & Mowforth (1982) did not state which standard(s) were used to calibrate their original data. However, this information was kindly supplied by these authors (personal communication) and is included in the present table. Thus, these authors used standards C, E, G and I (see §5*b*). However, the last of these (I = *Senecio vulgaris* PBI population) (with an assumed 4*C* DNA amount of 5.88 pq) was used as calibration standard for 31 of their original species. As noted in footnote (b) the 4*C* DNA amount for *S. vulgaris* (PBI population) was recalibrated by us in 1985 and changed from 5.88 pq to 6.33 pg. This new value was communicated to Grime & Mowforth in 1985, and it was used by them in Grime *et al.* (1985), and Mowforth (1986). Consequently, with the exception of *Poa annua*, only values from

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Grime & Mowforth (1982) for species calibrated by them against standards C, E and G are included in table 1. Values for 30 species originally published by Grime & Mowforth (1982) using *S. vulgaris* as a calibration standard are taken from Mowforth (1986). However, the value for *Poa annua* (493b in table 1) was recalibrated by us by multiplying the original value given by Grime & Mowforth (1986) by 1.076 (i.e. 6.33/5.88) because this was not given in Mowforth (1986). Her later estimates of the DNA amounts of various genotypes of *P. annua* (Mowforth 1986) were independent of the earlier work (Grime & Mowforth 1982).

Seven species (*Agrostis tenuis*, *Chamaenerion angustifolium*, *Helianthemum chamaecistus*, *Sarothamnus scoparius*, *Sieglingia decumbens*, *Thymus drucei* and *Vicia sativa* ssp. *angustifolium*) listed by Grime & Mowforth (1982) do not appear in table 1 under those names because of nomenclatural change. Instead, they appear under their correct names given by Mowforth (1986), namely: *Agrostis capillaris*, *Chamerion angustifolium*, *Helianthemum nummularium*, *Cytisus scoparius*, *Danthonia decumbens*, *Thymus praecox* ssp. *arcticus* and *Vicia sativa* ssp. *nigra*.

S. R. Band (personal communication, 1984; see note (*a*), reference 154) listed DNA amounts not previously published for 105 species, of which 89 were obtained using *Senecio vulgaris* PBI population as a calibration standard, but assuming the old 4*C* amount of 5.88 pg (see note (*b*)). DNA amounts for nine of these 89 species, recalibrated using the correct DNA amount for *S. vulgaris* (6.33 pg) were subsequently published by Grime, Shacklock & Band (1985), and these are included in table 1. DNA amounts for the other 80 species were recalibrated by us, multiplying the value given by Band by 1.076 (i.e. 6.33/5.88) before inclusion in table 1.

(*j*) The absolute values for *Leucanthemum* species given by Marchi *et al.* (1983) were calibrated by them using the absolute value for *Ranunculus repens* of $2C = 23.08$ taken from Smith & Bennett (1975). However, the value was subsequently recalibrated and given as $2C = 22.40$ pg in Bennett & Smith (1976). Consequently, 2*C* values for *Leucanthemum* species from Marci *et al.* (1983) were recalibrated by multiplying by the conversion factor 0.97 (i.e. 22.40/23.08) for inclusion in table 1.

(*k*) Nagato *et al.* (1981) give relative DNA amount per cell for wild and cultivated *Oryza* taxa estimated by Feulgen microdensitometry using interphase nuclei in sections of root tips. They also estimated an absolute amount per cell in root tip cells using chemical means. Although the former results are given in tables in Nagato *et al.* (1981) the chemical results are not. However, their figure 1 shows the regression line for absolute chemical estimates on relative DNA amounts obtained by Feulgen microdensitometry. This allows the following equation to be derived: $y = 1.99 + 0.022x$, where y is the cellular DNA content in pg, and x is the relative DNA content per cell obtained by microdensitometry. Thus, the DNA amounts per cell for *Oryza* taxa from Nagato *et al.* (1981) given in table 1 were derived by substituting the relative DNA amounts obtained by microdensitometry given by Nagato *et al.* into this equation.

Subsequently, Y. Nagato (personal communication) stated (*sic*) that 'we measured chemically the genome size of "Nipponbare' as 2.18 (2*C*/cell). Mean 2*C* cellular DNA contents of *Oryza sativa* and *O. perennis* are 2.25 and 2.44 pg respectively (Nagato *et al.* 1981 in which values given by 3*C* cellular DNA content in pg)'. However, as shown in table 1, we estimated *O. sativa* cv. 'Nipponbare', kindly supplied by Nagato, as $2C = 0.77$ pg. It is reasonable to expect that the root tips of rice, as in many other grasses, would contain many cells with polyploid nuclei. If so, the mean DNA content per cell may not approximate to the 3*C* value, as assumed by Nagato *et al.* (1981), but to a higher *C*-value.

(*l*) Jones & Kenton (1984) give the range of 2*C* values for *Gibasis karwinskyana* ($2n = 10$) as 17.01–19.82 pg in their table 1, but as 17.68–20.01 pg in their table 2. As instructed by A. Kenton (personal communication, 1985) values for the latter were used in the present table 1.

(*m*) Black & Beckmann (1983) measured DNA amounts of leaf cell nuclei of *Fraxinus americana*, and three groups of values ranging from 2.29–3.14, 5.04–5.88 and 6.66–9.81 were identified as diploid, tetraploid and hexaploid accessions, respectively. As the mean DNA *C*-value of the sample nuclei in the three groups is unclear from Black & Beckman we calculated the mid value in the ranges given by them for each ploidy level and entered these as per cell values in table 1.

(*n*) Table 1 includes two entries for *Fraxinus excelsior*. The 4*C* value of 3.9 pg from S. R. Band (personal communication, 1984) is for material whose chromosome number is $2n = 46$. No chromosome number was given by Olszewska & Osiecka (1984) for material whose 4*C* DNA amount (7.6 pg) was almost twice that given by Band. Thus it seems probable that the material measured by Olszewska & Osiecka (1984) was tetraploid. Polyploidy is known for other species in the genus *Fraxinus* (e.g. see note (m)), but as far as the present authors are aware, it has not been reported in *F. excelsior*.

(*o*) Schifino & Winge (1983) expressed some reservations as to the reliability of their estimates of genome size as follows: '... it can be seen that wide within species variation in DNA content occurred. This was probably due to technical problems, since most of the variation was due to differences between slides of the same plant'. Estimates for DNA amount for grasses cited from Schifino & Winge may, therefore, be less reliable than those for most other sources cited in table 1.

(*p*) Belford & Thompson (1981) gave estimates of genome size for *Atriplex* species in their table 1 as 'haploid genome nucleotide pairs (NTP) $\times 10^{-8}$'. (n.b. We assume this should have read ' $\times 10^{8}$'). These data were expressed in picograms for the present table 1 on the assumption that 'haploid genome' equals 1*C* value, and using the conversion factor 1 pg = 0.965×10^{9} NTP.

(*q*) Goldberg (1978) stated in his abstract that: 'The

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

1N genome size of the soybean plant is 1.97 pg.' This value is given in the present table on the assumption that Goldberg's '1N' is equivalent to the 1*C* value for this species with $2n = 4x = 40$, as defined in §1.

(*r*) Walbot & Dure (1976) stated in their abstract that: 'The haploid genome size is found to be 0.795 pg DNA cell.' As this estimate seems to have been obtained by halving the 1*C* value (as defined in §1) to allow for the tetraploid nature of *Gossypium hirsutum* ($2n = 4x = 52$), the DNA amount given in table 1 was calculated by us on this assumption. However, it should be noted that the resulting 1*C* value (1.59 pg) is only about half of that previously reported by us for this species (1*C* = 3.1 pg; Bennett *et al.* 1982*a*) using *Hordeum vulgare* cv. Sultan, 4*C* = 22.24, as calibration standard.

(*s*) Narayan & Rees (1976) gave in their table 2 the percentage of the total DNA which is repetitive, and the kinetic estimate of the non-repetitive DNA amount in pg. Thus, the percentage of the total nuclear DNA which is non-repetitive ('% non-repetitive DNA') is obtained by difference. The data given in absolute units in their table 2 are 2*C* values, although this was not stated. The estimates for 2*C* DNA amount for *Lathyrus* species from Narayan & Rees (1976) based on reassociation kinetics given in table 1 were obtained by multiplying the kinetic estimate of the absolute amount of non-repetitive DNA by one hundred, and dividing by the percentage of non-repetitive DNA in the genome.

(*t*) The authority for this species is either unknown or unclear to the present authors.

(*u*) The chromosome number of this species is either unknown or unclear to the present authors.

(*v*) The ploidy level of this species is either unknown or unclear to the present authors.

(*w*) The life-cycle type of this species is either unknown or unclear to the present authors.

REFERENCES

Abrahamson, S., Bender, M. A., Conger, A. D. & Wolff, S. 1973 Uniformity of radiation-induced mutation rates among different species. *Nature, Lond.* **245**, 460–462.

Anderson, G. C. 1991 Green scheme avoids quarrels. *Nature, Lond.* **345**, 654.

Anderson, L. K., Stack, S. M., Fox, M. H. & Chuanshan, Z. 1985 The relationship between genome size and synaptonemal complex length. *Expl Cell Res.* **156**, 367–377.

Baetcke, K. P., Sparrow, A. H., Nauman, C. H. & Schwemmer, S. S. 1967 The relationship of DNA content to nuclear and chromosome volumes and radiosensitivity (LD_{50}). *Proc. natn. Acad. Sci. U.S.A.* **58**, 533–540.

Barlow, B. A. & Martin, N. J. 1984 Chromosome evolution and adaptation in mistletoes. In *Plant biosystematics* (ed. W. F. Grant), pp. 117–140. Toronto: Academic Press.

Bennett, M. D. 1971 The duration of meiosis. *Proc. R. Soc. Lond.* B **178**, 259–275.

Bennett, M. D. 1972 Nuclear DNA content and minimum generation time in herbaceous plants. *Proc. R. Soc. Lond.* B **181**, 109–135.

Bennett, M. D. 1973 Nuclear characters in plants. In *Basic mechanisms in plant morphogenesis* (Brookhaven Symp. Biol. **25**), pp. 344–366.

Bennett, M. D. 1976*a* DNA amount, latitude and crop plant distribution. *Envir. exp. Bot.* **16**, 93–108.

Bennett, M. D. 1976*b* DNA amount, latitude and crop plant distribution. In *Current chromosome research* (ed. K. Jones & P. E. Brandham), pp. 151–158. Amsterdam: North Holland Publishing Co.

Bennett, M. D. 1977 The time and duration of meiosis. *Phil. Trans. R. Soc. Lond.* B **277**, 201–226.

Bennett, M. D. 1984*a* The genome, the natural karyotype, and biosystematics. In *Plant biosystematics* (ed. W. F. Grant), pp. 41–66. Toronto: Academic Press.

Bennett, M. D. 1984*b* Nuclear architecture and its manipulation. pp. 469–502. In *Gene manipulation in plant improvement* (16th Stadler Genetics Symposium) (ed. J. P. Gustafson), pp. 469–502. New York: Plenum Publishing Corporation.

Bennett, M. D. 1985 Intraspecific variation in DNA amount and the nucleotypic dimension in plant genetics. In *Plant Genetics* (UCLA Symposia on Molecular and Cellular Biology. New Series vol. **35**) (ed. M. Freeling), pp. 283–302 New York: Alan Liss.

Bennett, M. D. 1987 Variation in genomic form in plants and its ecological implications. *New Phytol.* **106** (Suppl.), 177–200.

Bennett, M. D. & Smith, J. B. 1976 Nuclear DNA amounts in angiosperms. *Phil. Trans. R. Soc. Lond.* B **274**, 227–274.

Bennett, M. D., Smith, J. B., Ward, J. & Jenkins, G. 1981 The relationship between nuclear DNA content and centromere volume in higher plants. *J. Cell Sci.* **47**, 91–115.

Bennett, M. D., Smith, J. B. & Heslop-Harrison, J. S. 1982*a* Nuclear DNA amounts in angiosperms. *Proc. R. Soc. Lond.* B **216**, 179–199.

Bennett, M. D., Smith, J. B. & Lewis-Smith, R. I. 1982*b* DNA amounts of angiosperms from the antarctic and South Georgia. *Envir. Exp. Bot.* **22**, 307–318.

Bennett, M. D., Heslop-Harrison, J. S., Smith, J. B. & Ward, J. P. 1983 DNA density in mitotic and meiotic metaphase chromosomes of plants and animals. *J. Cell Sci.* **63**, 173–179.

Bowman, C. M. 1986 Copy numbers of chloroplast and nuclear genomes are proportional in mature mesophyll cells of *Triticum* and *Aegilops* species. *Planta* **167**, 264–274.

Brandham, P. E. 1983 Evolution in a stable chromosome system. In *Kew Chromosome Conference II* (ed. P. E. Brandham & M. D. Bennett), pp. 251–260. London: Allen & Unwin.

Britten, R. J. & Kohne, D. E. 1968 Repeated sequences in DNA. *Science, Wash.* **161**, 529–540.

Butterfass, Th. 1983 A nucleotypic control of chloroplast reproduction. *Protoplasma* **118**, 71–74.

Callan, H. G. 1972 Replication of DNA in the chromosomes of eukaryotes. *Proc. R. Soc. Lond.* B **181**, 19–41.

Cavalier-Smith, T. 1978 Nuclear volume control by nucleoskeletal DNA, selection for cell volume and cell growth rate, and the solution of the *C*-value paradox. *J. Cell Sci.* **34**, 247–278.

Cavalier-Smith, T. 1985*a* Eukaryote gene numbers, non-coding DNA and genome size. In *The evolution of genome size* (ed. T. Cavalier-Smith), pp. 69–103. Chichester: John Wiley.

Cavalier-Smith, T. (ed.) 1985*b* *The evolution of genome size.* Chichester: John Wiley.

Cavalier-Smith, T. 1985*c* Cell volume and the evolution of eukaryotic genome size. In *The evolution of genome size* (ed. T. Cavalier-Smith), pp. 105–184. Chichester: John Wiley.

Dover, G. A. 1980 Ignorant DNA? *Nature, Lond.* **285**, 618–619.

Dover, G. A. 1982 Molecular drive: a cohesive mode of species evolution. *Nature, Lond.* **299**, 111–117.

Evans, G. M., Rees, H., Snell, C. L. & Sun, S. 1972 The relationship between nuclear DNA amount and the

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

duration of the mitotic cycle. *Chromosomes Today* **3**, 24–31. London: Longmans.
Flavell, R. B. 1980 The molecular characteristics and organisation of plant chromosome DNA sequences. *A. Rev. Pl. Physiol.* **31**, 569–596.
Flavell, R. B., Bennett, M. D., Smith, J. B. & Smith, D. B. 1974 Genome size and the proportion of repeated nucleotide sequence DNA in plants. *Biochem. Genet.* **12**, 257–269.
Greilhuber, J. 1982 Trends in der Chromosomenevolution von *Scilla* (Liliaceae). *Stapfia* **10**, 11–51.
Grime, J. P. 1983 Prediction of weed and crop response to climate based on measurement of nuclear DNA content. *Asp. appl. Biol.* **4**, 87–98.
Grime, J. P. 1986 Predictions of terrestrial vegetation responses to nuclear winter conditions. *Int. J. Envir. Stud.* **28**, 11–19.
Grime, J. P. 1990 Ecological effects of climate change on plant populations and vegetative composition with particular reference to the British flora. In *Climatic change and plant genetic resources* (ed. M. Jackson, B. V. Ford & M. L. Parry), pp. 40–60. London: Belhaven Press.
Grime, J. P. & Mowforth, M. A. 1982 Variation in genome size, an ecological interpretation. *Nature, Lond.* **299**, 151–153.
Grime, J. P., Shacklock, J. M. L. & Band, S. R. 1985 Nuclear DNA contents, shoot phenology and species coexistence in a limestone grassland community. *New Phytol.* **100**, 435–445.
Hinegardner, R. 1976 Evolution of genome size. In *Molecular evolution* (ed. F. J. Ayala), pp. 179–199, Sunderland, Massachusetts: Sinauer.
Horner, H. A. & Macgregor, H. C. 1983 *C*-value and cell volume: their significance in the evolution and development of amphibians. *J. Cell Sci.* **63**, 135–146.
Jellings, A. & Leech, R. M. 1984 Anatomical variation in first leaves of nine *Triticum* genotypes, and its relationship to photosynthetic capacity. *New Phytol.* **96**, 371–382.
Jones, R. N. & Brown, L. M. 1976 Chromosome evolution and DNA variation in *Crepis*. *Heredity, Lond.* **36**, 91–104.
Laurie, D. A. & Bennett, M. D. 1985 Nuclear DNA content in the genera *Zea* and *Sorghum*. Intergeneric, interspecific and intraspecific variation. *Heredity, Lond.* **55**, 307–313.
Lawrence, M. E. 1985 *Senecio* L. (Asteraceae) in Australia. Nuclear DNA amounts. *Aust. J. Bot.* **33**, 221–232.
Le Coq, C., Guervin, C., Hamel, J.-L. & Jolinson, D. 1977 La quantité d'ADN nucleaire et la garniture chromosomique chez quelques ombelliferes: Application a l'étude de leur evolution. Actes de 2e Symposium International sur les Ombelliferes, Perpignan, pp. 281–291.
Leutwiler, L. S., Hough-Evans, B. R. & Meyerowitz, E. M. 1984 The DNA of *Arabidopsis thaliana*. *Molec. Gen. Genet.* **194**, 15–23.
Lewin, B. 1975 Units of transcription and translation: sequence components of heterogeneous nuclear DNA and messenger RNA. *Cell* **4**, 77–93.
Marchi, P., Illuminati, O., Macioce, A., Capineri, R. & D'Amato, G. 1983 Genome evolution and polyploidy in *Leucanthemum vulgare* Lam. Aggr. (Compositae). Karyotype analysis and DNA microdensitometry. *Caryologia* **36**, 1–18.
Martin, N. J. 1983 Nuclear DNA variation in the Australian Loranthaceae. In *Biology of mistletoes* (ed. M. Calder & P. Berhnhardt), pp. 277–293. Sydney: Academic Press.
Martin, P. G. 1966 Variation in the amounts of nucleic acids in the cells of different species of higher plants. *Expl Cell Res.* **44**, 84–98.
Martin, P. G. & Shanks, R. 1966 Does *Vicia faba* have multistranded chromosomes? *Nature, Lond.* **211**, 650–651.
Nagato, Y., Yamamoto, K. & Yamashita, H. 1981 Variation in DNA content in Asian rice. *Jap. J. Genet.* **56**, 483–493.
Nishikawa, K. & Furuta, Y. 1978 DNA content of nucleus and individual chromosomes, and its evolutionary significance. *Proc. 5th Int. Wheat Genet. Symp.*, pp. 133–138. New Delhi.
North, G. 1985 A plant joins the pantheon at last? *Nature, Lond.* **315**, 366–367.
NSF 1990 Document 90–80. A long-range plan for the multinational coordinated *Arabidopsis thaliana* genone research project. Washington D.C.: National Science Foundation.
Ohno, S. 1972 So much 'junk' DNA in our genome. In *Evolution of genetics systems* (ed. H. H. Smith) (Brookhaven Symp. Biol. **23**). pp. 366–370.
Ohri, D. & Khoshoo, T. N. 1982 Cytogenetics of cultivated *Bougainvilleas*. X. Nuclear DNA content. *Z. Pflanzenzuchtg.* **88**, 168–173.
Olmo, E. 1983 Nucleotype and cell size in vertebrates: a review. *Bas. Appl. Histochem.* **27**, 227–256.
Orgel, L. E. & Crick, F. H. C. 1980 Selfish DNA: the ultimate parasite. *Nature, Lond.* **284**, 604–607.
Orgel, L. E., Crick, F. H. C. & Sapienza, C. 1980 Selfish DNA. *Nature, Lond.* **288**, 645–646.
Owens, S. 1974 An examination of floral biology, breeding system and cytology in species of the genus *Daucus* and related genera in the tribe Caucealidea (Umbelliferae). Ph.D. thesis, University of Reading.
Pegington, C. & Rees, H. 1970 Chromosome weights and measures. *Heredity, Lond.* **25**, 195–205.
Price, H. J. 1976 Evolution of DNA content in higher plants. *Bot. Rev.* **42**, 27–52.
Price, H. J. & Bachmann, K. 1975 DNA content and evolution in the Microseridinae. *Am. J. Bot.* **62**, 262–267.
Rayburn, A. L., Price, H. J., Smith, J. D. & Gold, J. R. 1985 *C*-band heterochromatin and DNA content in *Zea mays*. *Am. J. Bot.* **72**, 1610–1617.
Rees, H. 1984 Nuclear DNA variation and the homology of chromosomes. In *Plant Biosystemaics* (ed. W. F. Grant), pp. 87–96. Toronto: Academic Press.
Rees, H., Cameron, F. M., Hazarika, M. H. & Jones, G. H. 1966 Nuclear variation between diploid angiosperms. *Nature, Lond.* **211**, 828–830.
Rees, H. & Jones, R. N. 1972 The origin of wide species variation in nuclear DNA content. *Int. Rev. Cytol.* **32**, 53–92.
Rees, H., Shaw, D. D. & Wilkinson, P. 1978 Nuclear DNA variation among acridid grasshoppers. *Proc. R. Soc. Lond.* B **202**, 517–525.
Rees, H. & Walters, M. R. 1965 Nuclear DNA and the evolution of wheat. *Heredity, Lond.* **20**, 73–82.
Smith, J. B. & Bennett, M. D. 1975 DNA variation in the genus *Ranunculus*. *Heredity, Lond.* **35**, 231–239.
Sparrow, A. H. & Miksche, J. P. 1961 Correlation of nuclear volume and DNA content with higher plant tolerance to chronic radiation. *Science, Wash.* **134**, 282–283.
Sparrow, A. H. & Nauman, A. F. 1976 Evolution of genome size by DNA doublings. *Science, Wash.* **192**, 524–529.
Sparrow, A. H., Price, H. J. & Underbrink, A. G. 1972 A survey of DNA content per cell and per chromosome of prokaryotic and eukaryotic organisms: some evolutionary considerations. *Brookhaven Symp. Biol.* **23**, 541–494.
Thomas, C. A. 1971 The genetic organisation of chromosomes. *A. Rev. Genet.* **5**, 237–256.
Thompson, K. 1990 Genome size, seed size and germination temperatures in herbaceous angiosperms. *Evolut. Trends Plants* **4**, 113–116.
Tutin, T. G., Heywood, V. H., Burgess, N. A., Moore,

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

D. M., Valentine, D. H., Walters, S. M. & Webb, D. A. (eds). 1980 *Flora Europaea*. Cambridge University Press.

Underbrink, A. G. & Pond, V. 1976 Cytological factors and their predictive role in comparative radiosensitivity: A general survey. *Curr. Top. Rad. Res. Quart.* **11**, 251–306.

Van't Hof, J. 1965 Relationships between mitotic cycle duration, S period duration and the average rate of DNA synthesis in the root meristem cells of several plants. *Expl Cell Res.* **39**, 48–65.

Van't Hof, J. 1975 The duration of chromosomal DNA synthesis, of the mitotic cycle, and of meiosis of higher plants. In *Handbook of genetics* 2 (ed. R. C. King), pp. 363–377. New York: Plenum Press.

Van't Hof, J. & Sparrow, A. H. 1963 A relationship between DNA content, nuclear volume, and minimum mitotic cycle time. *Proc. natn. Acad. Sci. U.S.A.* **49**, 897–902.

Verma, S. C. & Rees, H. 1974 Nuclear DNA and the evolution of allotetraploid *Brassicae*. *Heredity, Lond.* **33**, 61–68.

Wang, A. C. & Fudenberg, H. H. 1974 Gene expansion and antibody variability is nonsense DNA in 1 species, sense DNA in another species. *Am. J. Hum. Genet.* **26**, 90a.

Submitted by Sir Ralph Riley; received 16 April 1991; accepted 4 July 1991

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES