Telopea 11(3) 308–313

Chromosome numbers in some species of *Dicranoloma* from Australia, New Zealand and Papua New Guinea

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Abstract

Chromosome numbers have been added or confirmed for a number of Australasian species of *Dicranoloma* based on studies of New Zealand (and several Australian) collections. These are n = 7 for *D. dicarpum, D. platycaulon, D. robustum*; n = 8 for *D. plurisetum*; New Zealand populations of *D. menziesii* had n = 7 and lacked the *m*-chromosome found in Australian populations where n = 8 (7 + m). *D. billarderii* has n = 12 chromosomes. The chromosome number of n = 7 is confirmed for *D. dicarpum* in Papua New Guinea. The chromosome number of n = 9 (7 + 2 m) recorded for *D. serratum* in Ramsay (1985) is now referred to *D. leichhardtii* with which *D. serratum* has been synonymised (Klazenga 2003).

Introduction

The family Dicranaceae is well represented in Australia and New Zealand where the genus *Dicranoloma* is prominent in wet forests. The species are erect, with almost unbranched stems and form tall turfs or small cushions on soil, fallen tree trunks or are sometimes epiphytic. The genus has been revised by Klazenga (2003) who recognises 15 species from Australasia with 10 species and 2 endemics in New Zealand (Beever et al 1992, Fife 1995, Klazenga 2003) and 13 species with 3 endemics in Australia (Klazenga 2003).

Chromosome numbers have been published previously for five Australian species – *D. billarderii*[1] n = 12, *D. dicarpum* n = 7, *D. menziesii* n = 8 (7 + m), *D. robustum* n = 7 and *D. leichhardtii* n = 9 (7 + 2m; as *D. serratum*) (Ramsay 1974, 1985; Fritsch 1982, 1991). A mitotic count of n = 12 from New Zealand material of *D. billarderii* (as *Dicranum billarderi*) has also been made (Przywara et al. 1992).

[1] The spelling of this epithet has been the subject of much debate. The original spelling was *billarderii*, indicating that Bridel's intended latinisation of La Billardière's name was Billarderius, a form also reflected in his germanicised version of the name (W. Greuter and J. McNeill, pers. comm.). The name should, therefore, remain as published (ICBN Art. 60.7) and not be modified either to *billardierei*, following Art.60.7(b), Ex.15, or to *billarderi*, following Art. 60.11.

 ISSN0312–9764

Materials and Methods

The chromosome numbers obtained are based on meiotic studies of fresh material collected in the field, transported to the laboratory and maintained under cool conditions until capsules reached the correct stage of development. The methods used follow those outlined by Ramsay (1982) using aceto-carmine stain and slides made permanent using dry ice and mounting in euparal (Ramsay 1974). Permanent slides using this technique are still clear and are able to be examined 20 years later. A total of 30 populations from Australia and/or New Zealand and two from Papua New Guinea were examined. Voucher specimens have been lodged at NSW and detailed locality information can be obtained upon request, citing the number codes in Table 1.

Chromosome numbers

Meiotic studies of six New Zealand species have been made while numbers for additional populations of various species in Australia are confirmed. Two populations of *Dicranoloma dicarpum* in Papua New Guinea were also examined for the first time (Table 1).

1. *Dicranoloma billarderii* (Brid. ex Anon.) Paris, n = 12, Fig. 1

Two cytotypes n = 12 and n = 13 (12 + m) from meiotic studies were reported on Australian material by Ramsay (1974, 1985). Przywara et al (1992) recorded the chromosome number n = 12 on the basis of mitotic material for a population from New Zealand. In the present studies, the meiotic chromosome number was determined as n = 12 (Fig. 1) for one population from New Zealand (21/87) and from an additional Australian population (12/80; Table 1).

2. *Dicranoloma dicarpum* (Nees) Paris, n = 7, Figs 2–8.

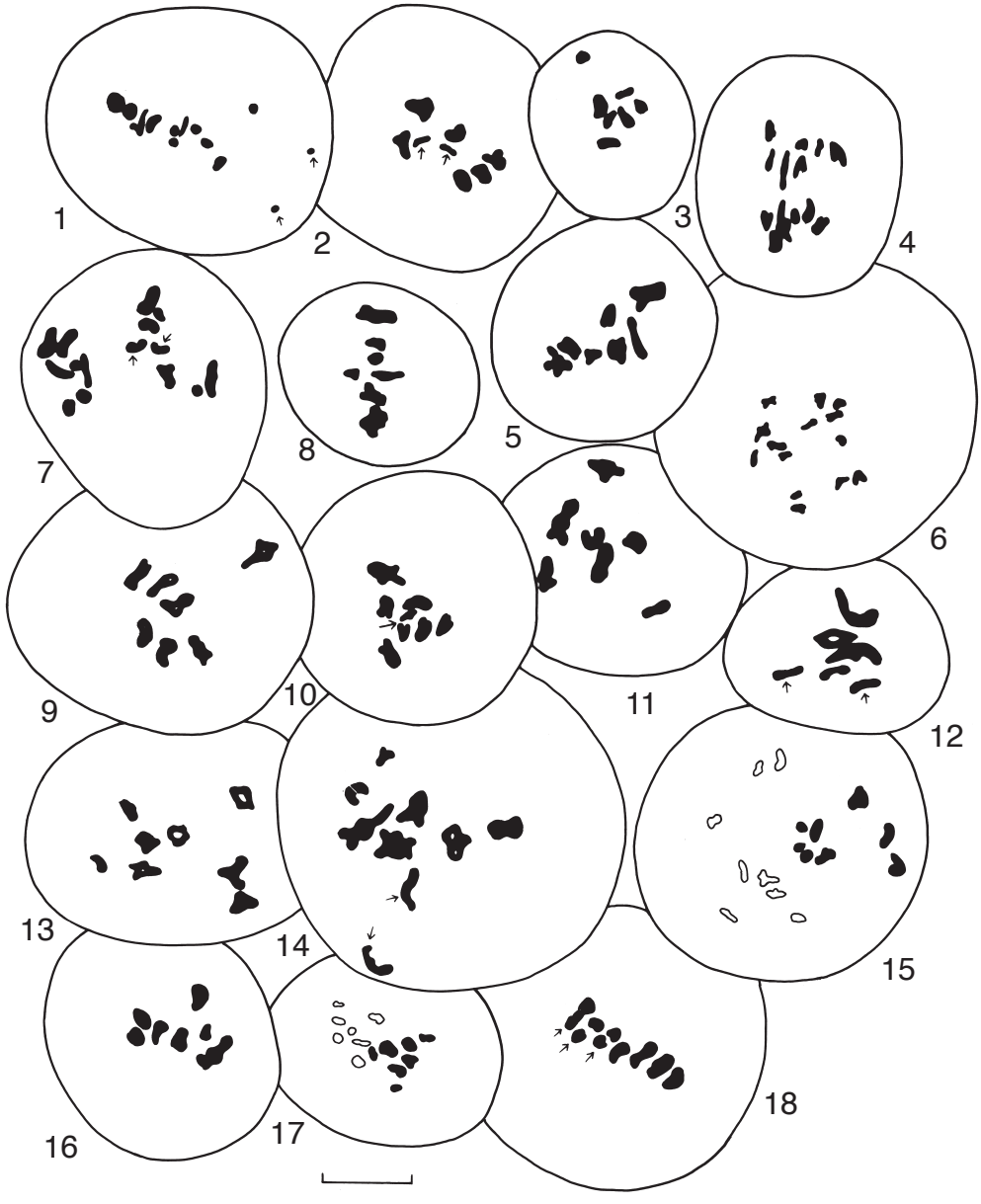
The chromosome number n = 7 was obtained here for the first time for three populations in New Zealand (30/87, 25/87, 83/82, Figs 7 & 8) (Table 1). The same chromosome number, n = 7, was also recorded for the first time for two populations from separate locations in Papua New Guinea (18/82, 66/82, Figs. 2–5) (Table 1). This agrees with the previously recorded chromosome number of n = 7 for Australian populations (Ramsay 1974, 1985; confirmed also by a further two populations from New South Wales, 6/72, 7/82).

Figures 1–18. Various stages of meiosis in *Dicranoloma* species.

1. *D. billarderii* n = 12 (NZ 21/87), MI meiosis note bivalents of various sizes present, one is separating early (arrows);

2–8. *D. dicarpum* n = 7, 2.(PNG 18/82) MI showing early separation of one bivalent (arrows), 3. (PNG 66/82) MI note seven bivalents of various sizes, 4. (PNG 18/82) AI note the 7 chromosome pairs moving to opposite poles, 5. (PNG 18/82) MI note seven bivalents present, 6. (Aust. 7/82) AI note the 7 half bivalents moving to opposite poles, 7. (NZ 83/82) AI note the 7 half bivalents moving to opposite poles, 8. (NZ 25/87) seven bivalents of various sizes present;

9 & 10. *D. menziesii* n = 7 (14/83 NZ), 9. MI note seven bivalents present, no m-bivalent detected in the NZ populations studied, 10. MI note one bivalent disjoining early;



11 & 12. *D. platycaulon* n = 7, 11. (NZ 39/87) MI note the seven bivalents of various sizes, 12. (NZ 68/84) MI showing the two half bivalents of one bivalent are separating;

13–15. *D. plurisetum* n = 8, 13. (NZ 71/84) MI, 14. (NZ 87/84) MI one bivalent has separated early, 15. (NZ 87/84) MII showing the eight half bivalents of each plate;

16–18. *D. robustum* n = 7, 16. (NZ 19/87) MI note seven bivalents, one larger than the others, 17. (NZ 22/87) AI note the 14 half-bivalents moving apart, 18. (NZ 58/84) note the 7 bivalents on the metaphase plate, 3 beginning to separate.

Table 1. Chromosome numbers in *Dicranoloma* species in Australia (Aust), New Zealand (NZ) and Papua New Guinea (PNG) reported in these studies. Unless otherwise stated collections were made by the author. Other abbreviations; HS = Heinar Streimann, NI = North Island, NSW = New South Wales, SI = South Island

Species	Chromosome number (n =)	Country	Voucher details
D. billarderii	12	Aust	*12/80*, NSW, Megalong Valley
D. billarderii	12	NZ	*21/87*, SI, Red Hills
D. dicarpum	7	NZ	*30/87*, SI, Lake Rotoroa track; *25/87*, *A. Fife*, SI, Red Hills; *83/82*, *A. Fife*, SI, Cora Lynn Station
D. dicarpum	7	Aust	*6/72*, NSW, Royal National Park; *7/82*, NSW, Wattagan State Forest
D. dicarpum	7	PNG	*18/82*, *HS 22528*, Upper Nawata Banda *66/82*, *HS 25833*, Bulolo-Watut Divide
D. menziesii	7	NZ	*14/83*, SI, Mt Cargill; *15/83*, ibid.
D. menziesii	8 (7 + m)	Aust	*33/84*, NSW, Mt Wilson
D. platycaulon	7	NZ	*28/87*. SI, Lake Rotoroa track; *39/87*, ibid. *68/84*, NI, Akatarawas
D. plurisetum	8	NZ	*71/84*, NI, Akatarawas; *94/84*, NI, ibid. *87/84*, NI, Mt Ruapehu; *26/87*, SI, Red Hills; 38/87, ibid.
D. robustum	7	NZ	*57/84*, NI, Mt Ruapehu; *58/84*, ibid.; *81/84*, ibid.; *19/87*, SI, Lake Rotoroa; *27/87*, SI, ibid.; *22/87*, SI, Red Hills; *23/87*,ibid.; *24/87*, ibid.

3. *Dicranoloma menziesii* (Taylor) Renauld, n = 7, Figs 9 & 10

Counts for two populations from New Zealand (14/83,15/83) had the chromosome number n = 7 (Figs 9 & 10). The chromosome complement lacked the *m*-chromosome found in the Australian populations (n = 8 (7 + m); Ramsay 1974, 1985, figs 1–4), a count reconfirmed here by one additional Australian population (33/84; Table 1).

4. *Dicranoloma platycaulon* Dixon, n = 7, Figs 11 & 12

The chromosome number, n = 7, was obtained from studies of three populations in New Zealand, (28/87; 39/87, Fig. 11; 68/84, Fig. 12). The bivalents were large and of various sizes with one, medium in size, that disjoined first at early anaphase I (Fig. 12; Table 1).

5. *Dicranoloma plurisetum* Dixon, n = 8, Figs 13–15.

Five populations examined for the first time had the chromosome number n = 8 (87/84, 94/84, 71/84, 26/87, 38/87, Fig. 13). The bivalents varied in size, most being relatively large with several often separating early at anaphase I (Fig. 14) but no *m*-bivalent was seen. The number was confirmed at anaphase I (Fig. 15; Table 1).

6. *Dicranoloma robustum* (Hook.f. & Wilson) Paris, n = 7, Figs 16–18.

The chromosome number was determined as n = 7 (Figs 16–18) from eight separate New Zealand collections (23/87, 19/87, 22/87, 24/87, 81/84, 57/84, 58/84, 27/87). Of these several (19/87, 22/87, 23/87, 24/87) originally identified as *D. cylindrothecium* but now in synonymy with *D. robustum* had bivalents comparable with the latter. These counts are consistent with those found for Australian populations (Ramsay 1974, 1985).

Chromosome numbers reported for the related genus *Dicranum* include n = 11, 12, 13, 14 to 24 with the number n = 12 being most frequent. The number n = 7, found in a number of species of *Dicranoloma*, is rarely recorded for *Dicranum* (Fritsch 1991) and only from Russia. Ramsay (1985) noted that the chromosomes in *Dicranoloma* species with n = 7or 10, are relatively larger than those of *D. billarderii* with n = 12. Alignment of chromosomes for Australian species suggests that *D. billarderii* is likely to be polyploid in origin (Ramsay 1985). It has been suggested that the basic number for the genus is x = 7 (Ramsay 1974).

Acknowledgments

I am deeply grateful to Jessica Beever for accompanying and guiding me on several collecting excursions in New Zealand. Neils Klazenga helped by determining the identity of each collection. Several reviewers provided useful suggestions for improving the manuscript.

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Manuscript received 21 October 2005, accepted 15 August 2006