Pachytene Chromosomes of Annual *Medicago* Species

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Preface: This report is based on a Poster Abstract presented at the 24th Meeting of the Genetics Society of Australia, Murdoch University, 26-27 Aug. 1977. The report extends the coverage of pachytene chromosomes summarised by Lesins and Gillies (1973) In: Alfalfa Science and Technology, Amer. Soc. Agron., to include the pachytene chromosomes of *M. arabica, M. intertexta*, *M. truncatula, M. littoralis, and M. tornata. M. truncatula* has become an important model species for legumes since the 1973 publication.

Abstract: There are approximately 34 annual species of *Medicago*, and over a dozen of these "Medics" occur as naturalized self-sown legumes in pastures of Southern and South-Western Australia. Studies of mitotic metaphase chromosomes have revealed that all but five species have 2n=16 chromosomes. The somatic chromosomes are relatively short, ranging from 1.8 to 5.0 μm in length, with most being metacentrics or submetacentrics shorter than 2.5 μm. Four species, *M. constricta, M. polymorpha, M. praecox, and M*. *rigidula*, have 2n=14 (Gillies, 1971), and one species, *M. murex* has both 2n=14 and 2n=16 strains (Lesins, Lesins and Gillies, 1970). The uniformity of the short somatic karyotypes has generally precluded their use in determining species relationships and evolution.

The pachytene chromosomes (bivalents) of annual medics are up to 10 times longer than somatic metaphase chromosomes, and exhibit characteristic knobs and chromomeres. Pachytene chromosomes range from 20 to 60 μm in length, with the main chromatic knobs arranged around the centromeres. Nucleolus organizers are usually located near the centromeres. The more distinctive pachytene karyotypes which can be compiled have allowed study of cytological relationships of species. For example, it has been suggested that the 2n=14 *M. murex* is derived from the 2n=16 *M. murex* (Lesins, Lesins and Gillies, 1970).

The three species *M. littorallis, M. tornata, and M. truncatula* are considered closely related, and some intercrossing occurs. Their pachytene karyotypes show many similarities, such as the NOR chromosome being third longest and metacentric, the longest chromosome being also metacentric, and the second chromosome being a submetrcentric. Differences in absolute length occur, but proportional lengths of chromosomes are similar. *M. littoralis and M. truncatula* differ by one acrocentric, and possibly in the NOR position. This could be the result of pericentric inversions, or a reciprocal translocation. The pachytene karyotype data reported conforms in most cases with the taxonomic classifications.

Cytotaxonomic Notes

1. The base chromosome number for the genus is x=8 (approximately 55 of 60 species).

2. 2n=14 and 2n=16 *M. murex* do not interbreed. 2n=16 *M. murex* crossed with *M. turbinata* gave hybrids which died as seedlings (Lesins, Lesins and Gillies, 1970)

3. 2n=14 species *M. rigidula, M. praecox* and *M. polymorpha* each have one exceptionally long bivalent and hence may have been derived in the same manner as suggested for 2n=14 *M. murex.* (Gillies 1971)

4. *M. polymorpha* and 2n=14 *M. murex* have almost identical pachytene ideograms, yet are in different taxonomic subsections.

5. *M. praecox* and *M. polymorpha* (both in subsection *Leptospirae*) may differ by a minimum of two pericentric inversions or translocations.

6. *M. constricta* and *M. rigidula* (both in subsection *Pachyspirae*) may differ by only two pericentric inversions.

7. *M. littoralis, M. tornata, and M. truncatula* are closely related and interbreed to some extent. *M. littoralis and M. truncatua* differ by one acrocentric and possibly a NOR pericentric inversion. *M. truncatula* and *M. tornata* have similar basic ideograms which differ in absolute length and much less in arm ratios. These could be contraction differences. NORs may differ by a pericentric inversion.

8. *M. arabica* has very long chromosomes (total pachytene bivalent length 453 μm) and similarities in arm ratios with 2n=16 *M. murex.* These species have some morphological similarities but *M. arabica* is in the same subsection as *M. polymorpha.*

9. *M. intertexta* has distinctly different chromosomes from the rest of the annuals so far studied. It is in a different subsection (*Intertextae*) and is morphologically closer to perennials. Pachytene chromosomes are more chromatic around centromeres than other annuals and have a total length of 356μm.

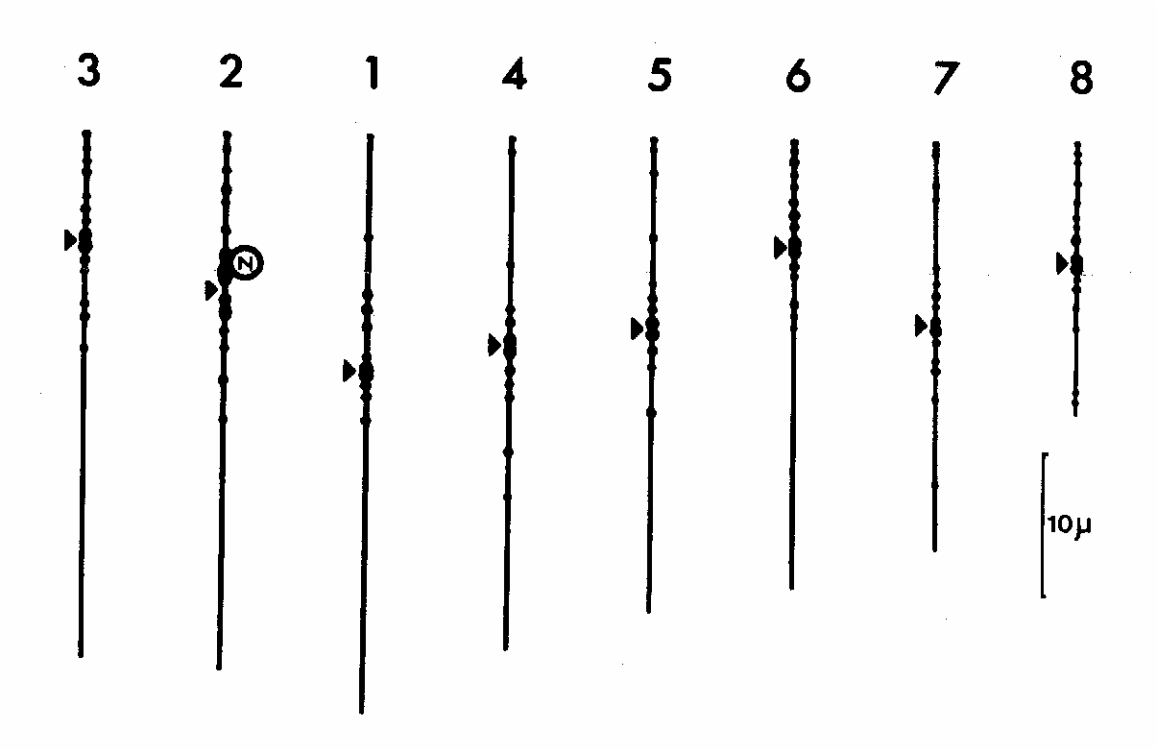
10. The majority of these pachytene ideograms are based on data from single accessions (Table); the exceptions are *M. murex and M. polymorpha.* Further work is needed to encompass more accessions to detect any karyotype changes which might be associated with morphological v*ariation.*

TABLE: Accessions of *Medicago* species used in pachytene karyotype construction

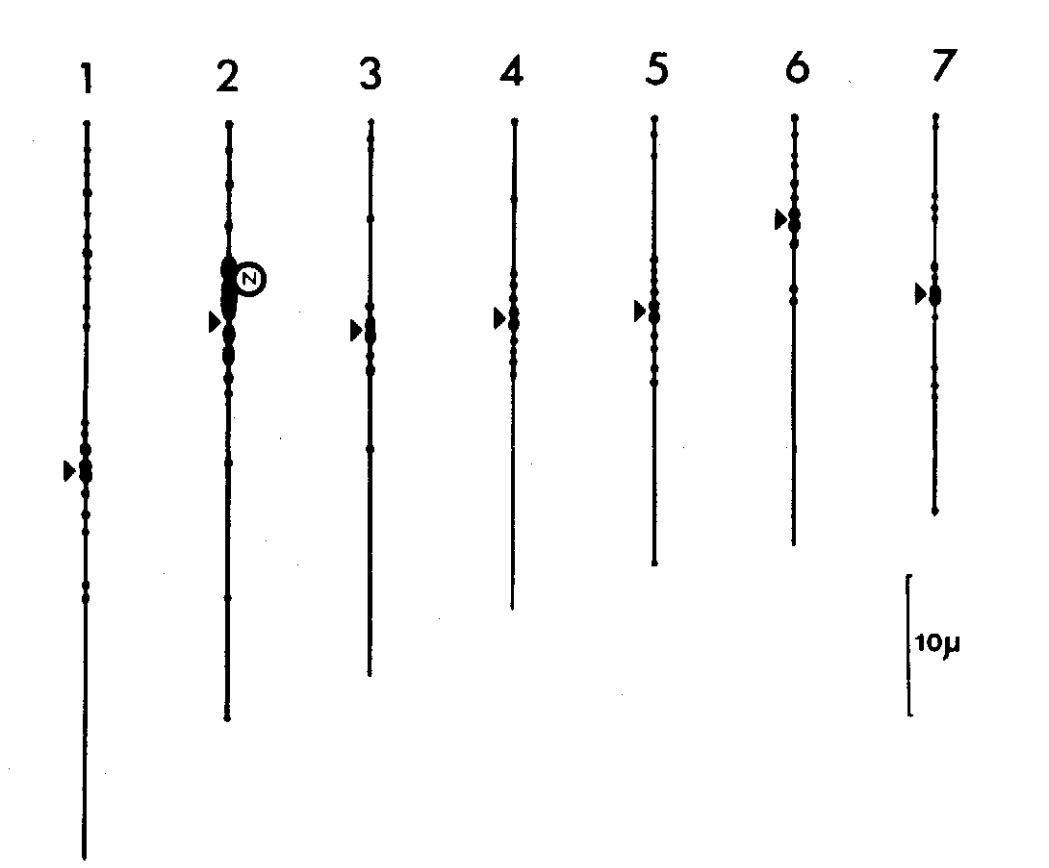
Species	Supplier	Supplier's Accession No.	Details of origin, variety, collector
arabica	CBG	0201	collected roadside Concord, Sydney, Australia
constricta	U of A	1447	Thessaloniki. Greece
intertexta	U of A	239	variety intertexta
littoralis	UWA	5647	striata type
murex (2n=16)	U of A	353	Inst Sci Cherifien, Morocco
	U of A	1075	Sardinia (Lesins)
	U of A	1982	Sicily or Sardinia (via UWA)
	U of A	1983	Isrrael (via UWA)
murex (2n=14)	U of A	1521	Cannes, France
	U of A	1980	Portugal (via UWA)
	U of A	1981	Portugal (via UWA)
	U of A	2065	Pantellaria, Italy (Lesins)
	U of A	2143	Pantellaria, Italy (Lesins)
polymorpha	U of A	401	Al`Azair, Iraq
	U of A	409	Botanical Garden, Czechoslovakia
	U of A	427	Botanical Garden, Czechoslovakia
	U of A	3176	Kefar Nashum, Israel (JP Simon)
praecox	U of A	461	Botanical Garden, Poland
rigidula	U of A	479	Botanical Garden, Polannd
	U of A	1325	Sofar, Lebanon
tornata	UWA	3170	Seashore Israel, var. aculeata (Heyn)
truncatula	UWA	3310	via SA Ag, acc396 pod coil direction

U of A: Collection of K Lesins, Dept of Genetiics, Univ of Alberta, Edmonton
UWA: J McComb, Univ of Western Australia, Nedlands

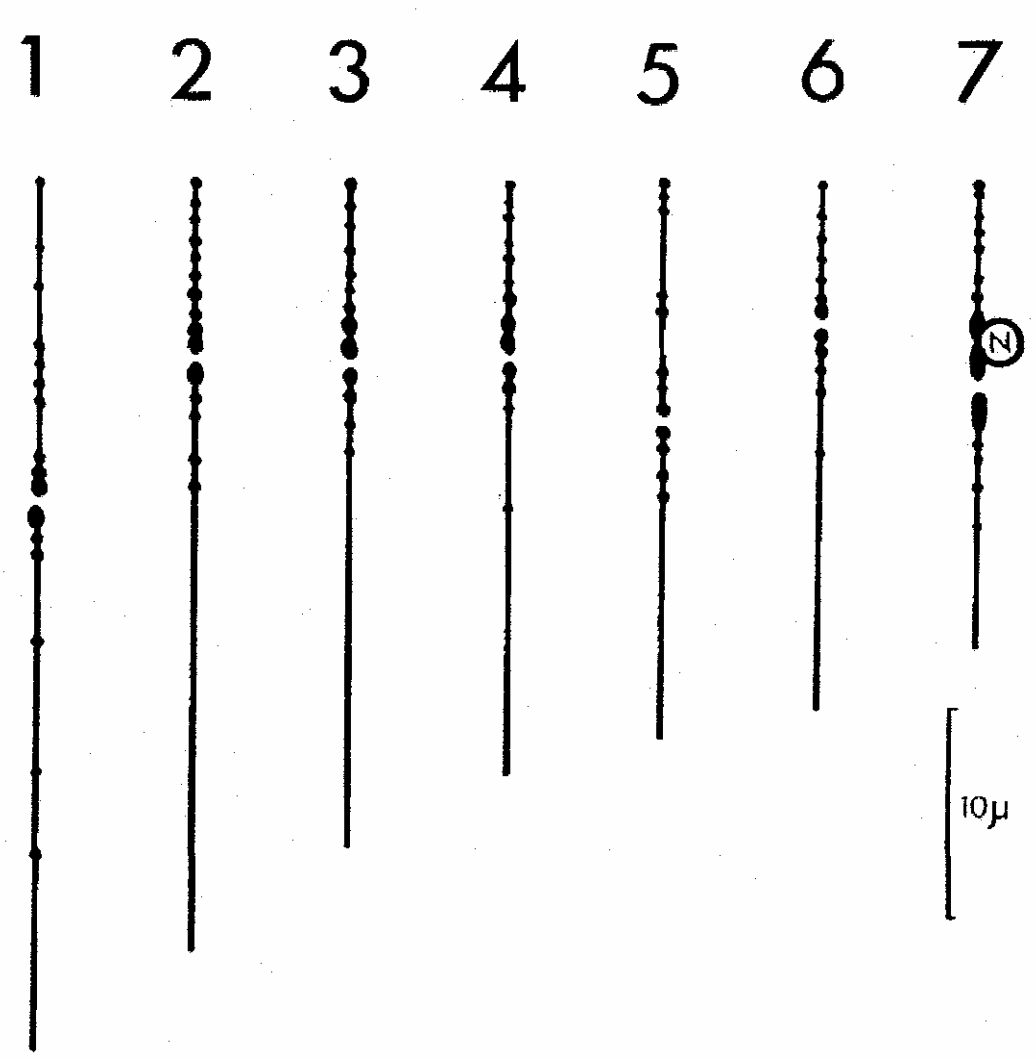
M. murex (2n=16)



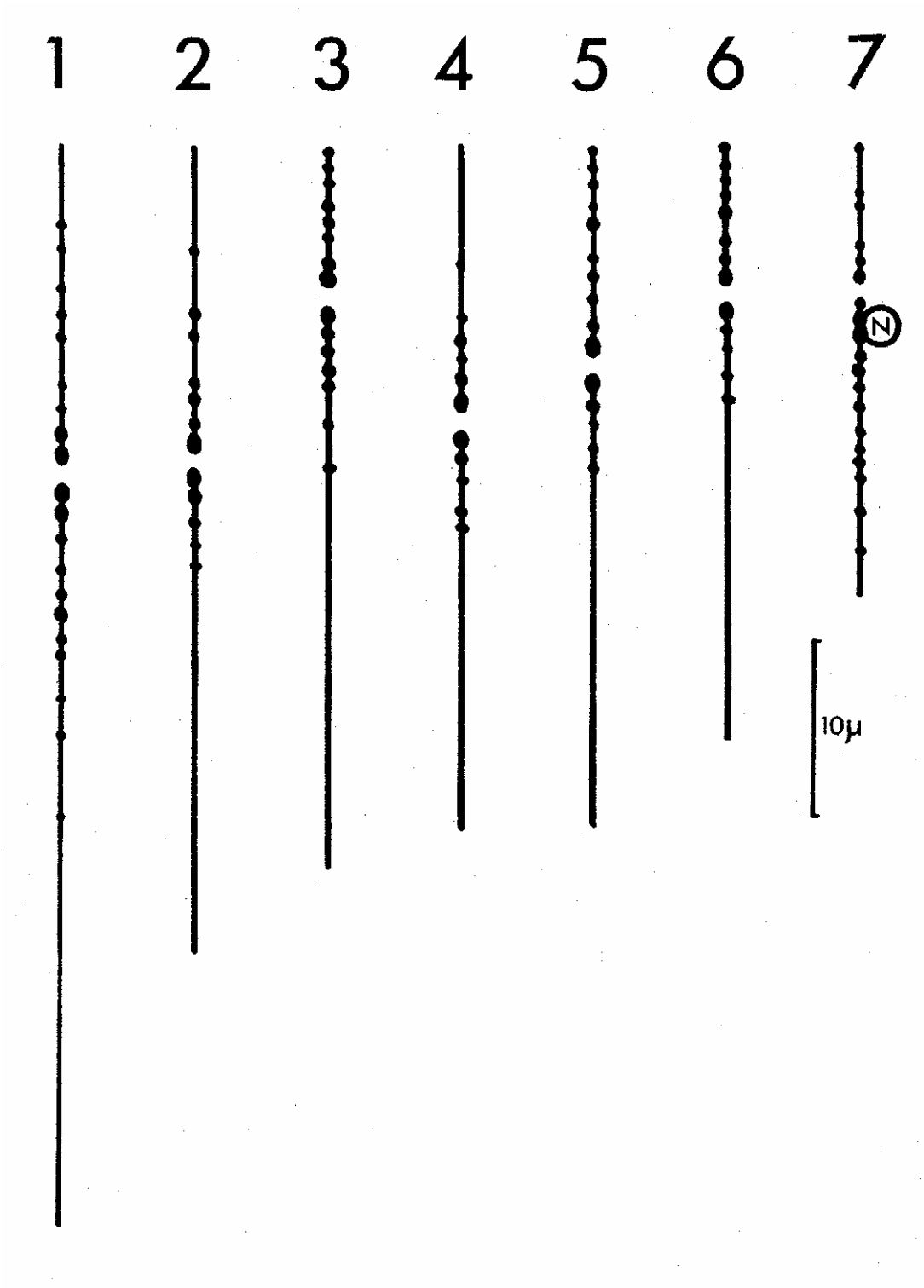
M. murex (2n=14)



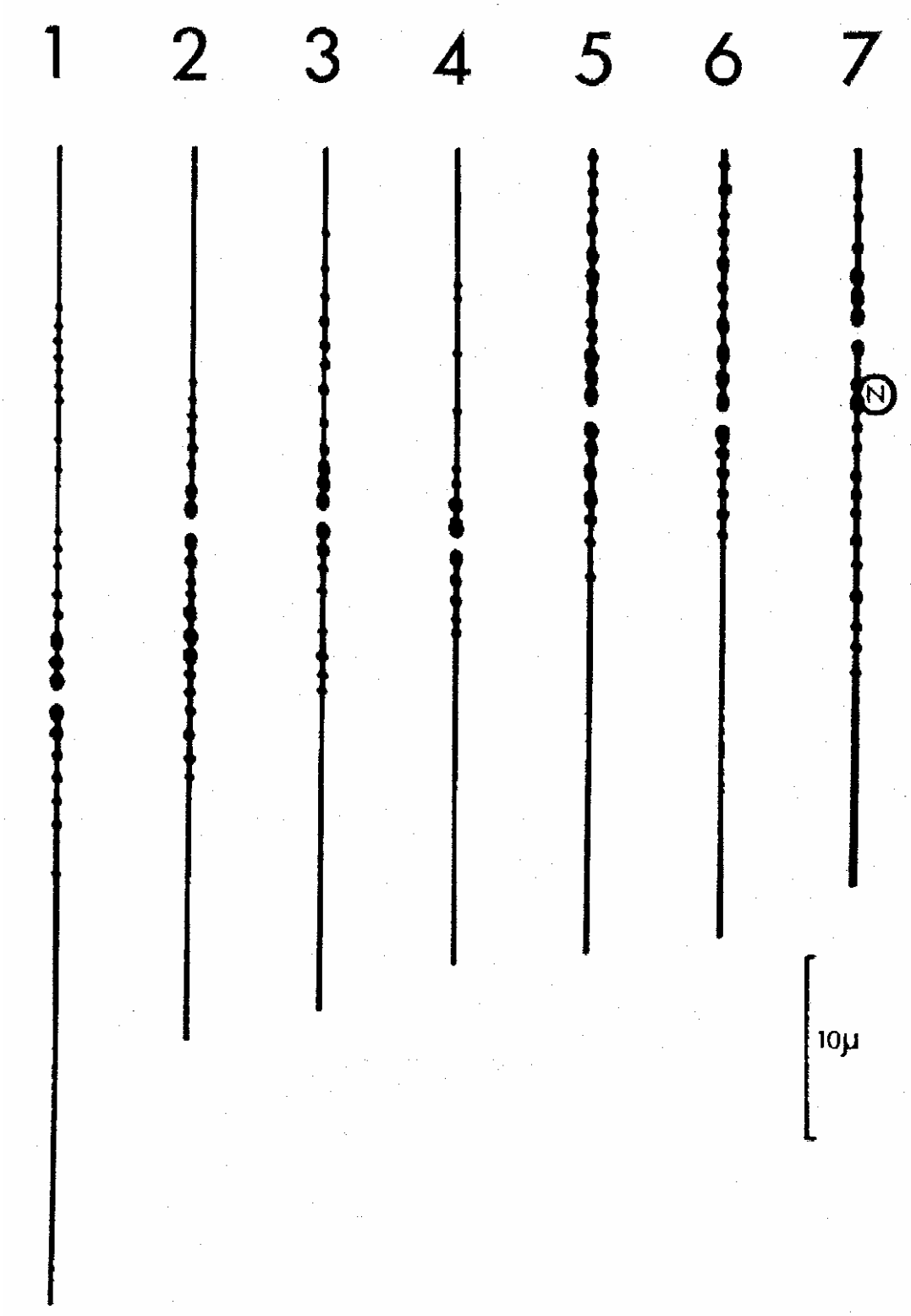
M. constricta (2n=14)



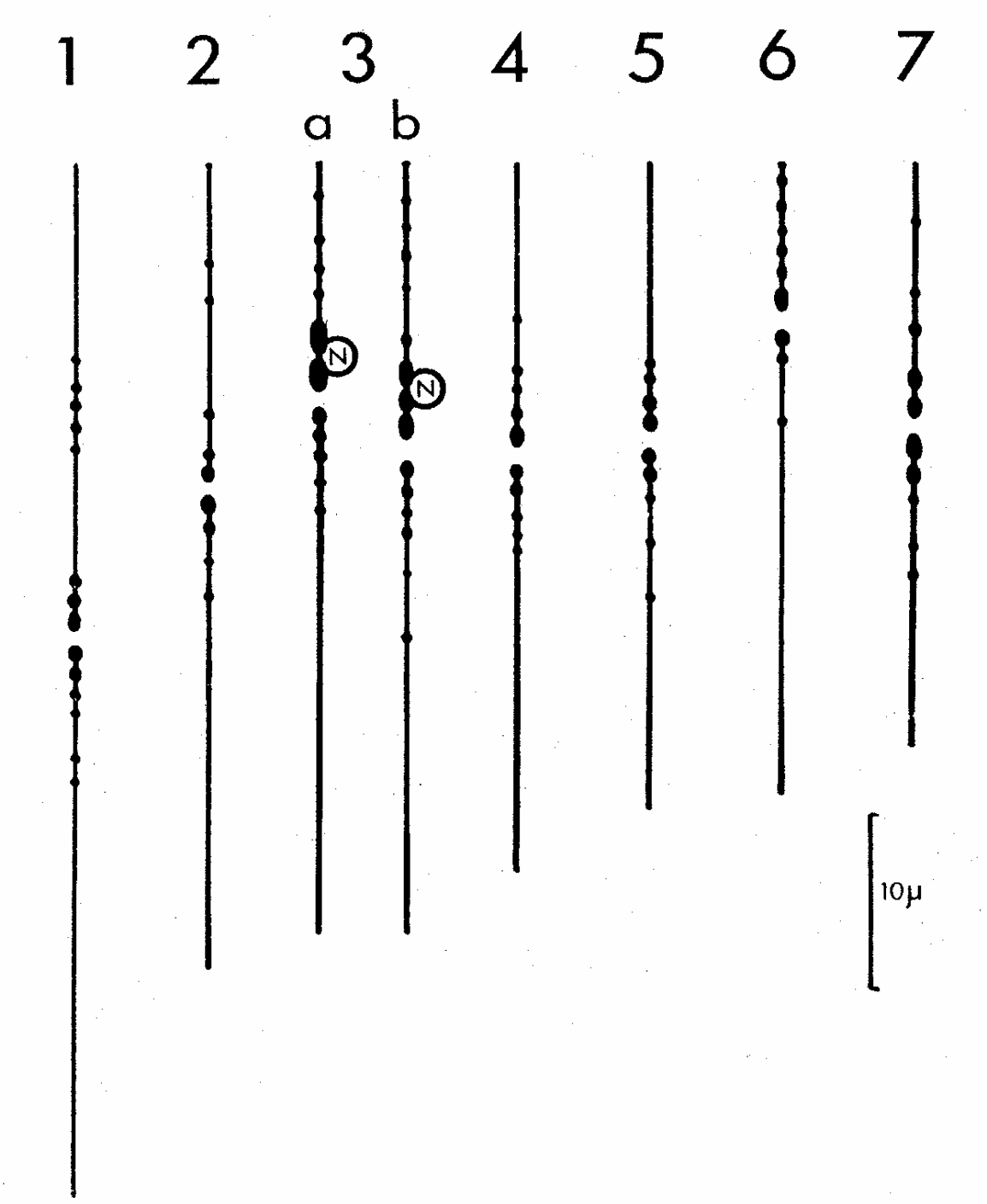
M. rigidula (2n=14)



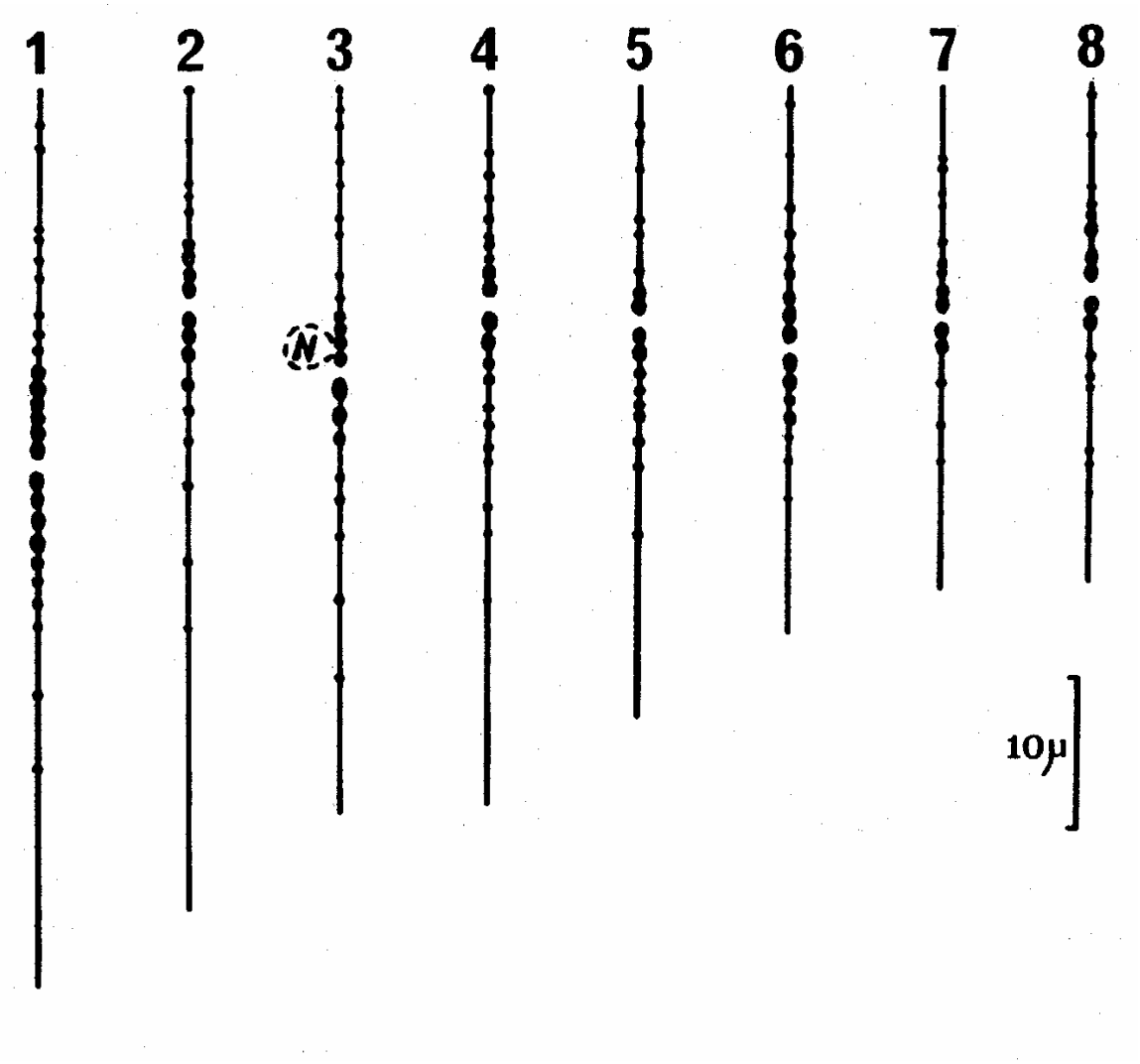
M. praecox (2n=14)



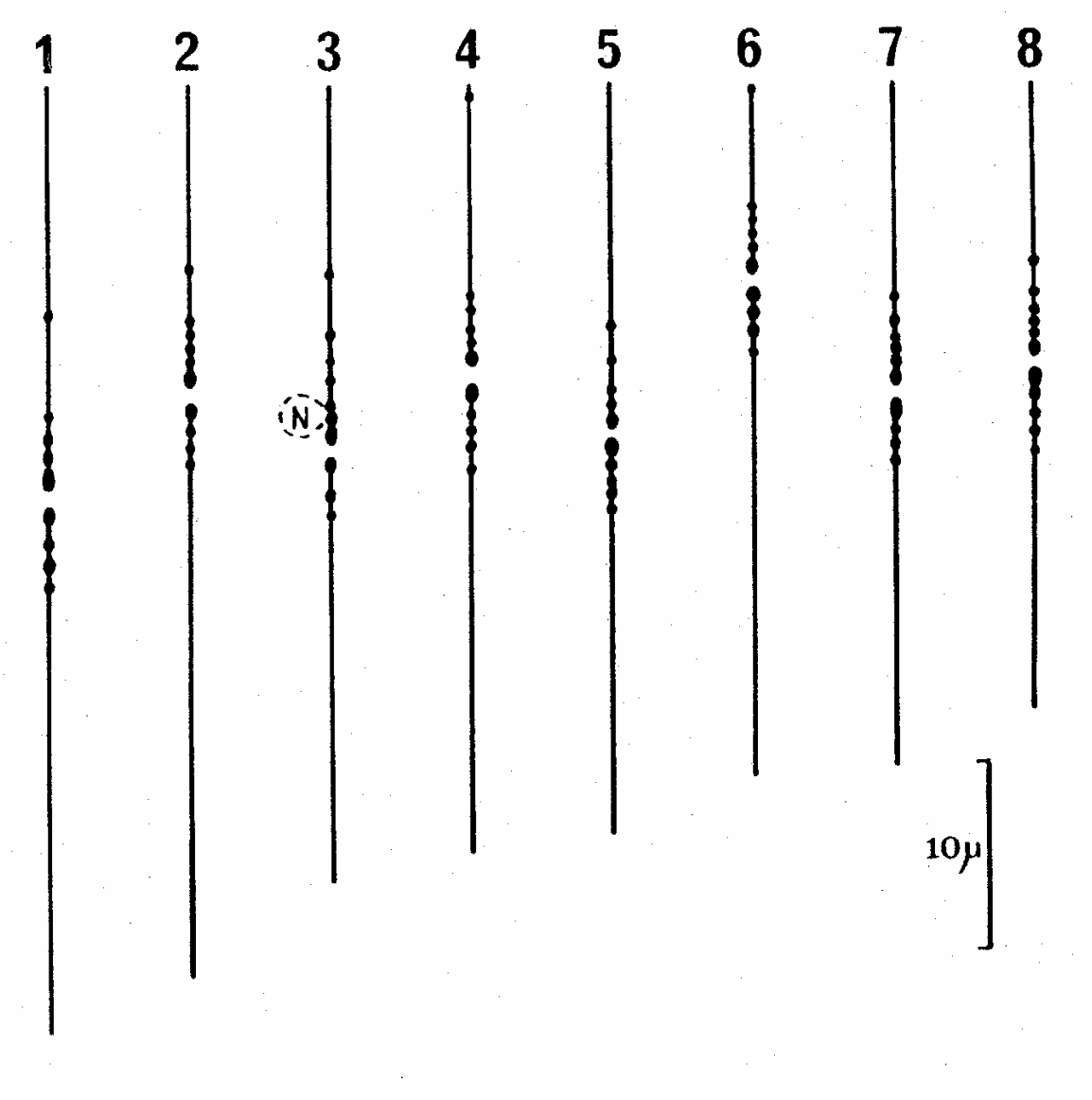
M. polymorpha (2n=14)



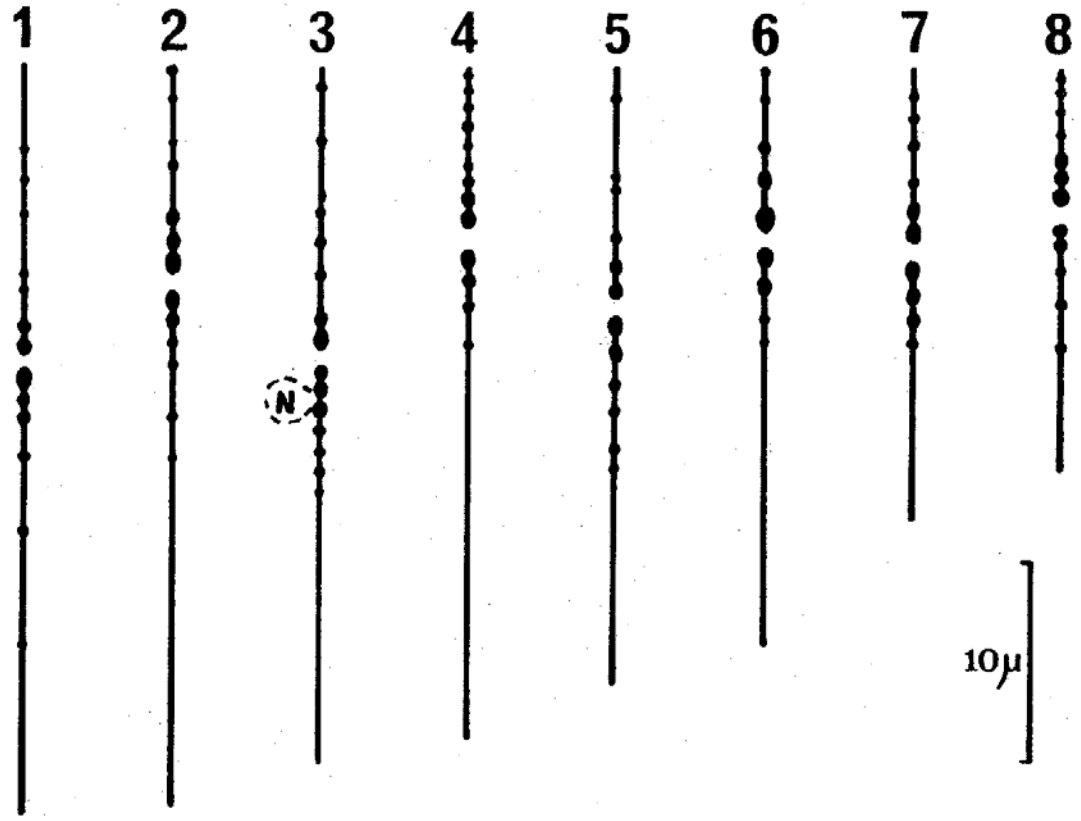
M. intertexta (2n=16)



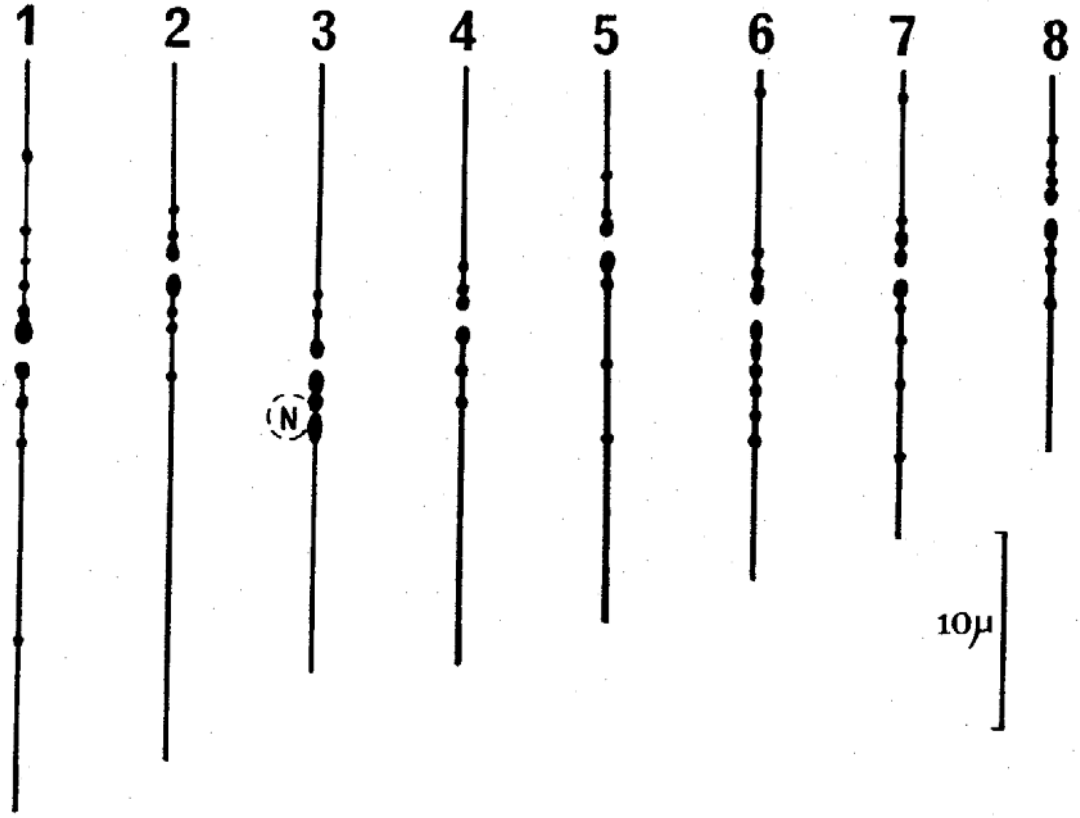
M. tornata (2n=16)



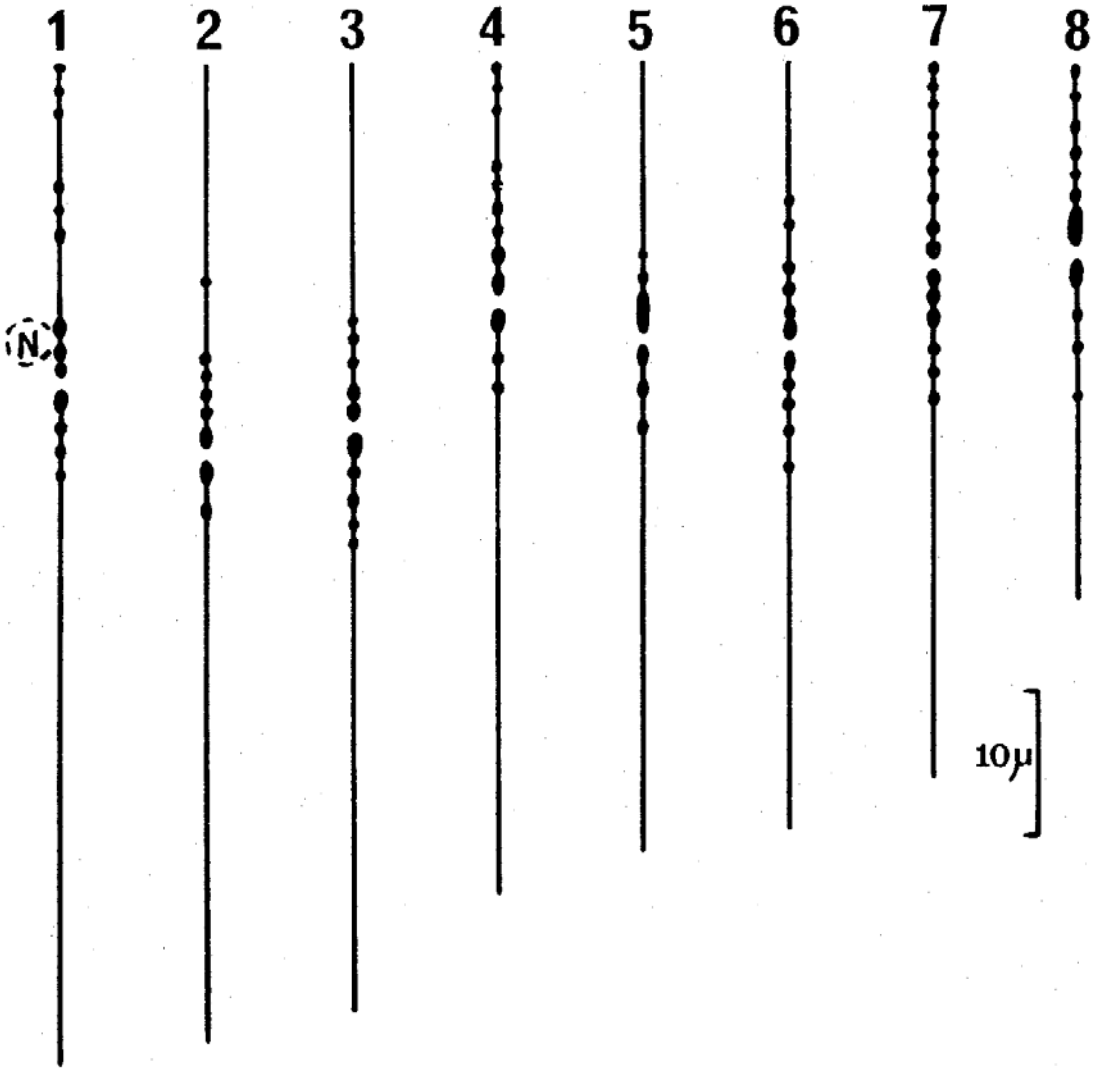
M. littoralis (2n=16)



M. truncatula (2n=16)



M. arabica (2n=16)



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