

amounts of pyridine so as to give 0.0316 M, 0.0633 M or 0.126 M solutions. The antiserum was added last and incubated at 37° C for 10 minutes. The mixture was then filtered on MDI filters, washed with TBS, dried and radioactivity monitored. Reciprocal plots of the varying concentrations of total (T), (³H)-iA^{ox-red} used and antiserum bound (B), (³H)-iA^{ox-red} for fixed concentrations of pyridine are given in the figure. The inset gives replots of slope and intercept values versus varying pyridine concentration.

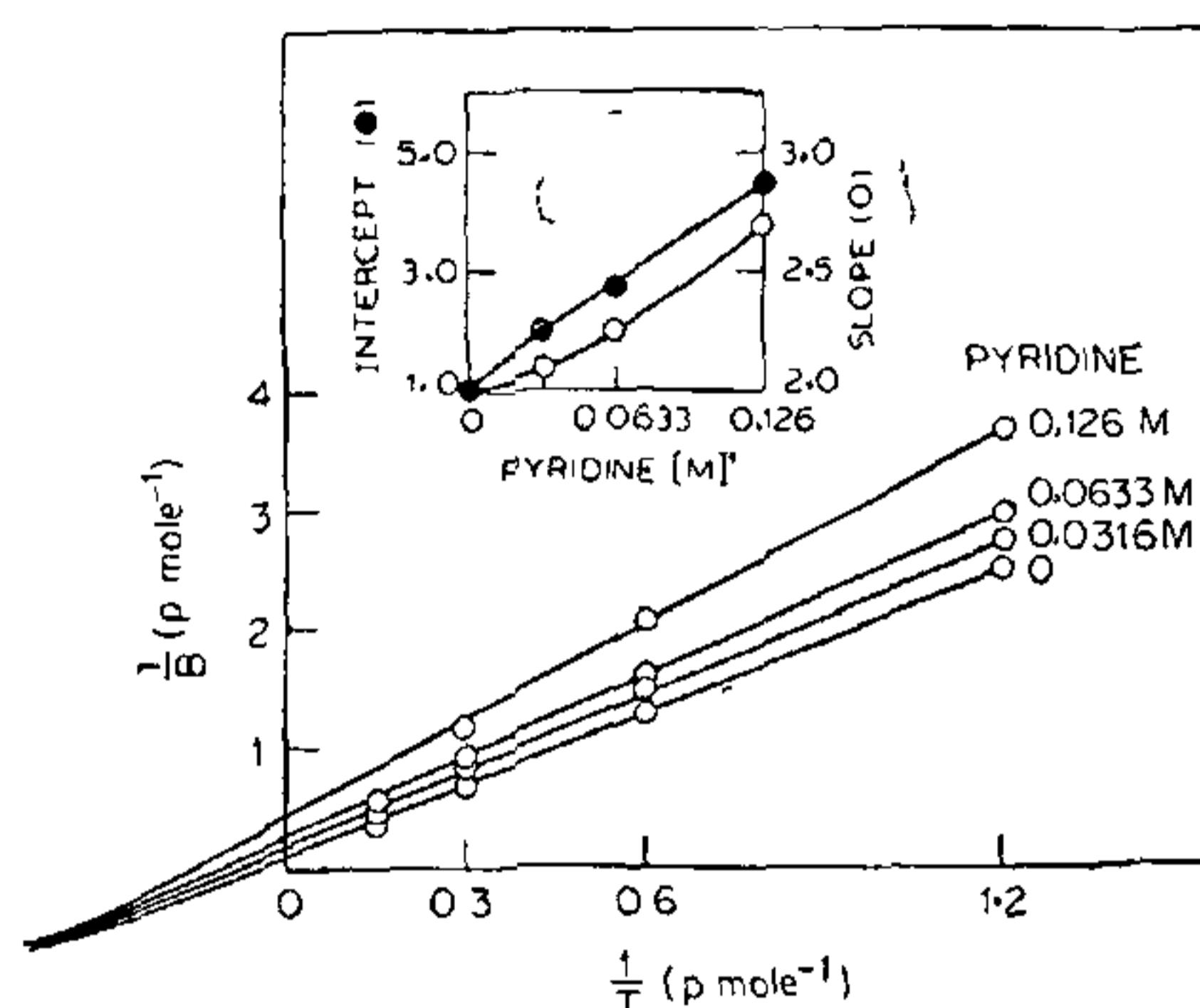


FIG. 2. Kinetics of pyridine inhibition of iA binding to Fab-fragments of anti-iA.

The experiment was done as described under Fig. 1 except that anti-iA Fab-fragments (3 µg) was used instead of anti-iA serum.

Since there are some structural features common to pyridine and iA, a competitive type of inhibition could not be ruled out before this study. It is unlikely that

pyridine serves as a hydrogen bond breaker at the concentration employed in this study because reagents such as urea which are known to be good hydrogen bond breakers⁸ do not dissociate antigen antibody complexes as efficiently as pyridine at similar concentrations. The inhibition may be due to the protein conformational changes that accompany the shift from aqueous to pyridine environment. This necessitates the binding of more than one inhibitor molecule per molecule of antibody. The above mechanism is in conformity with the parabolic non-competitive type inhibition observed.

A consequence of the mechanism postulated is that pyridine inhibition of antigen-antibody interaction can be expected to be of general applicability. It is also to be expected that eventhough pyridine may inhibit the formation of precipitate, it may not be able to dissociate the antigen-antibody precipitate after its formation.

1. Humayun, M. Z. and Jacob, T. M., *Biochim. Biophys. Acta*, 1974, **349**, 85.
2. Senapathy, P., *Indian J. Biochem. Biophys. Supplement*, 1978, **15**, 32.
3. —, *Ph.D. Thesis*, Indian Institute of Science, Bangalore, 1978.
4. Milstone, D. S., Vold, B. S., Glitz, D. G. and Shutt, N., *Nucleic Acid Research*, 1978, **5**, 3439.
5. Randerath, K. and Randerath, E., *Anal. Biochem.* 1969, **28**, 110.
6. Humayun, M. Z. and Jacob, T. M., *Biochim. Biophys. Acta*, 1973, **331**, 41.
7. Cleland, W. W., *Ibid.*, 1963, **67**, 173.
8. Nezlin, R. S., *Biochemistry of Antibodies*, Plenum Press, New York, 1970, p. 27.

KARYOLOGICAL STUDIES ON FOUR SPECIES OF LIZARDS FROM PENINSULAR INDIA

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ABSTRACT

The karyotypes of four species of lizards, viz., *Mabuya trivittata* (Hardwicke and Gray) and *M. carinata* (Schneider) (Family: Scincidae); *Psammophilus dorsalis* (Gray) and *Calotes versicolor* (Daudin) (Family: Agamidae) are described. The morphometric data on the chromosomes are presented. Geographic variation in the karyotype of *M. carinata* is described. The karyotypes of these species are compared with those of the other karyologically analysed lizards.

KARYOLOGICAL data are sparse for lizards of the families Scincidae and Agamidae and many more species are to be worked out. So far, only seven genera of the family Scincidae and seven genera of the family Agamidae have been analysed¹. In the present communication detailed karyological

data on *Mabuya trivittata* (Hardwicke and Gray) and *M. carinata* (Schneider) of the family Scincidae; *Psammophilus dorsalis* (Gray) and *Calotes versicolor* (Daudin) of the family Agamidae are presented. Among these four species, the chromosomes of *M. trivittata* and *P. dorsalis* have not been reported

so far. The chromosomes of *M. carinata* and *C. versicolor* have been studied by Singh^{7, 8} from Varanasi and in this report their chromosome complements from peninsular India are presented.

MATERIALS AND METHODS

The lizards (Table I) were collected from various localities of peninsular India. The animals were injected with 0.1 ml of 0.05% colchicine and sacrificed after two hours. Bone-marrow, spleen and the testes were utilized for chromosome preparations by air-dry technique. At least 100 metaphases were analysed for each animal to confirm the diploid number. Five karyotypes with well stretched chromosomes were measured for each animal for morphometric data and the average relative lengths and centromeric indices were calculated. Microchromosomes were also included in calculating the relative lengths of the chromosomes. The chromosomes were arranged according to the system of Levan *et al.*⁹. The fundamental number (NF) was calculated according to Matthey⁵. The specimens were identified by the British Museum (Natural History), London.

TABLE I

Showing the family, species, number, sex and localities of collection of lizards utilized

Family	Species	Sex		Locality
		Male	Female	
Scincidae	<i>M. trivittata</i>	6	5	Gundlupet (Karnataka)
Scincidae	<i>M. carinata</i>	5	5	University Campus (Manasa Gangotri, Mysore)
		2	2	Sagar (Karnataka)
		1	1	Trichur (Kerala)
Agamidae	<i>P. dorsalis</i>	6	6	Chamarajanagar (Karnataka)
Agamidae	<i>C. versicolor</i>	5	5	University Campus
		3	3	Sagar
		4	3	Trichur

RESULTS

Mabuya trivittata :

The diploid chromosome number is 32 with 18 macro- and 14 microchromosomes (NF = 50). The karyo-

type (Fig. 1) consists of 16 metacentric (Fig. 1, pairs 1-8), two submetacentric (pair 9) and 14 microchromosomes. Three pairs of microchromosomes are metacentric and the remaining appear to be telocentric. The morphometric data have been presented in Table II. The sex chromosomes could not be identified either in male or female individuals. In diakinesis 16 bivalents are seen and the sex bivalent could not be identified.

TABLE II

Composite table for the morphometric data on the chromosomes of *Mabuya trivittata* and *Mabuya carinata*

Chromosome number	<i>Mabuya trivittata</i>		<i>Mabuya carinata</i>	
	L ^B %/I ^C	Chrom. type	L ^B %/I ^C	Chrom. type
1.	20.0/39.3	m	17.7/38.1	m
2.	17.1/41.6	m	15.3/42.4	m
3.	13.8/44.2	m	13.0/43.7	m
4.	12.6/40.3	m	12.4/44.5	m
5.	7.1/41.7	m	7.1/46.6	m
6.	4.7/40.3	m	5.1/45.8	m
7.	4.5/42.1	m	5.0/46.8	m
8.	3.9/42.5	m	4.6/45.7	m
9.	3.2/36.0	sm	3.5/31.1	sm
Microchromosomes	13.1		16.3	

Mabuya carinata :

The somatic metaphases show 32 chromosomes with 18 macro- and 14 microchromosomes (NF = 50). The karyotype (Fig. 2) consists of 16 metacentric (Fig. 2, pairs 1-8), 2 submetacentric (pair 9) and 14 microchromosomes. All the microchromosomes appear to be telocentric. The identification of the sex chromosomes is not possible in either sexes. The morphometric measurements are presented in Table II. Sixteen bivalents are clearly observed in meiotic figures.

Psammophilus dorsalis :

The diploid chromosome number is 32 with 12 macro- and 20 microchromosomes (NF = 44). The karyotype (Fig. 3) consists of 10 metacentric (Fig. 3, pairs 1-5), 2 submetacentric (pair 6) macrochromosomes and 20 microchromosomes. All the microchromosomes appear to be telocentric. The morphometric data have been presented in Table III. In diplotene and diakinesis 16 bivalents are seen. Here also the sex chromosomes could not be identified.

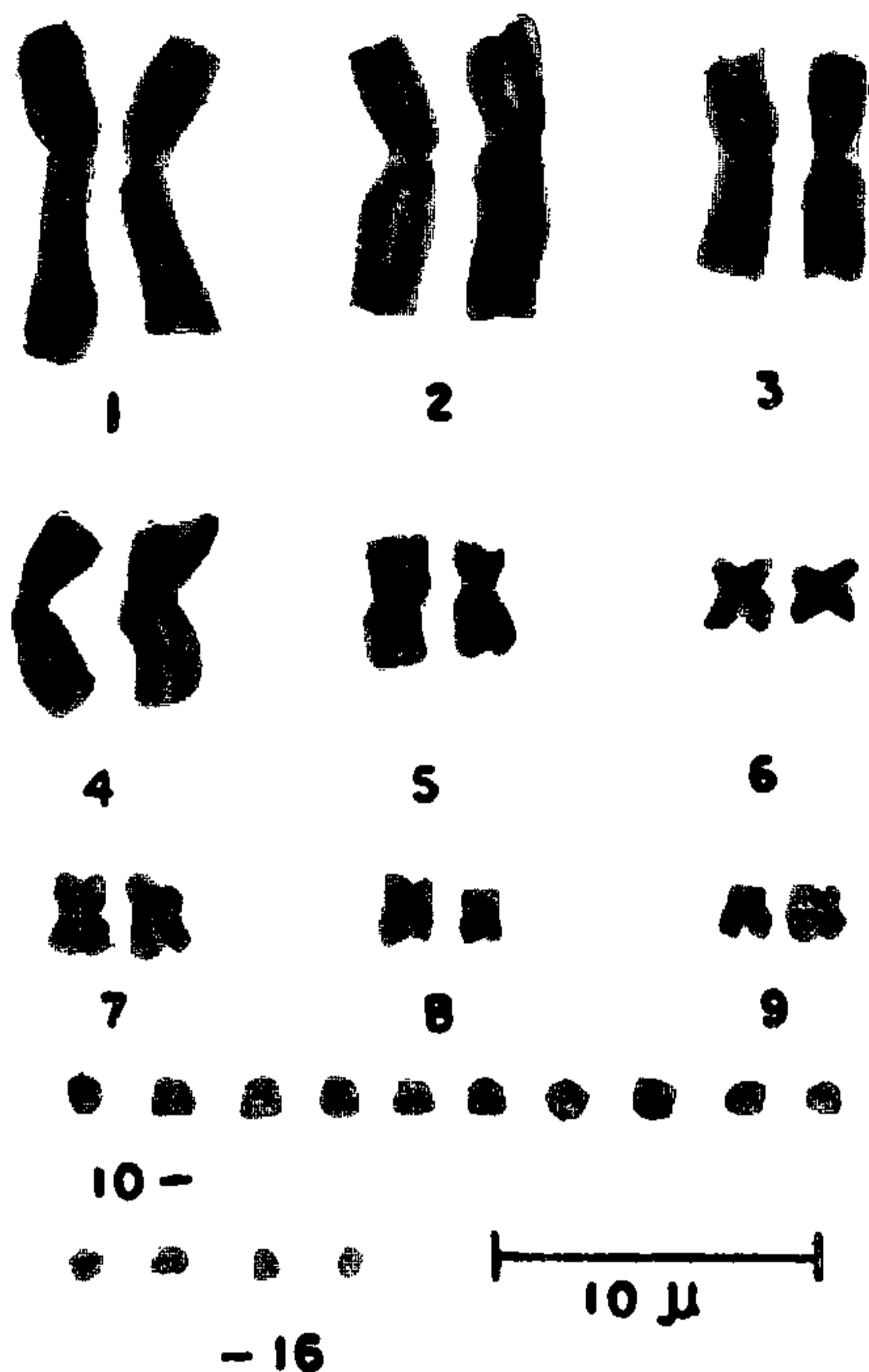


FIG. 1. Karyotype of *Mabuya trivittata*, Female.

Calotes versicolor :

The diploid number is 34 with 12 macro- and 22 microchromosomes (NF = 46). The karyotype (Fig. 4) has 10 metacentric (Fig. 4, pairs 1-5), 2 sub-metacentric (pair 6) and 22 microchromosomes. Many of the microchromosomes are banded in nature. The karyotypes of both male and female look alike. The meiotic figures reveal 17 bivalents. The morphometric measurements of the chromosomes are presented in Table III.

DISCUSSION

Scincidae :

Among the other karyologically analysed genera of this family, viz., *Chalcides*, *Cryptobrephalus*, *Eumeces*, *Riopa*, *Scincus* and *Sphenomorphus*⁵ the karyotype of *E. schneideri*⁵ has some resemblance with the karyotypes of *Mabuya trivittata* and *M. carinata* in chromosome number and morphology of some chromosomes. In turn, the karyotype of *E. schneideri* is quite different from those of the other *Eumeces* species. In the genus *Mabuya*, chromosomes of 5 species have been reported so far^{1, 4, 5, 7, 8, 2, 3}, viz., *M. macularia*, *M. striata*, *M. m. mobouya*, *M. carinata* and *M. aurata septemtaeniata*.

TABLE III

Composite table for the morphometric data on the chromosomes of *Psammophilus dorsalis* and *Calotes versicolor*

Chromosome number	<i>Psammophilus dorsalis</i>		<i>Calotes versicolor</i>	
	L ^R %/I ^C	Chrom. type	L ^R %/I ^C	Chrom. type
1.	19.9/46.4	m	18.9/44.3	m
2.	13.4/46.2	m	13.4/49.1	m
3.	12.8/47.8	m	12.7/48.1	m
4.	10.6/46.1	m	10.6/46.9	m
5.	6.9/44.3	m	6.9/47.5	m
6.	17.0/36.0	sm	17.9/36.0	sm
Microchromosome	19.4		19.6	

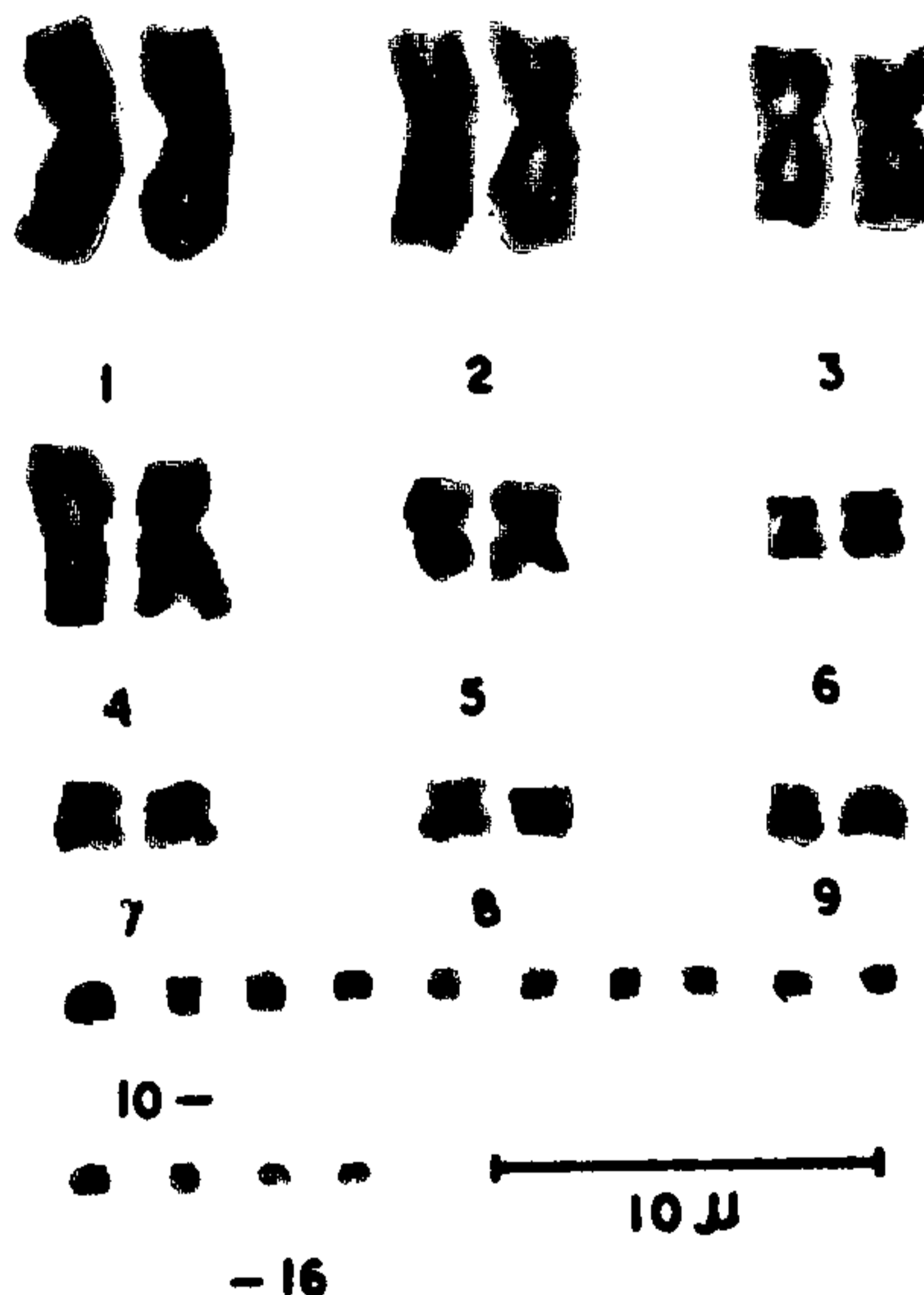


FIG. 2. Karyotype of *Mabuya carinata*, Male.

The diploid chromosome number of *M. macularia* is 26 and the karyotype consists of 10 V, 6 I and 10 m chromosomes¹. The karyotypes of *M. trivittata* and *M. carinata* do not show any resemblance with that of *M. macularia* either in chromosome number or karyotypic structure. In the case of *M. striata*, Dallai and Talluri⁴ reported a diploid number of 28, all with

biarmed chromosomes. Singh⁷ has critically examined their karyotype and concluded that some of the chromosomes are telocentric. He also measured the chromosomes of *M. striata* and *M. carinata* and concluded that morphometric data on the karyotypes are very much similar. The morphometric data on the chromosomes of *M. trivittata* and *M. carinata* from this area are also similar to that on *M. striata*.

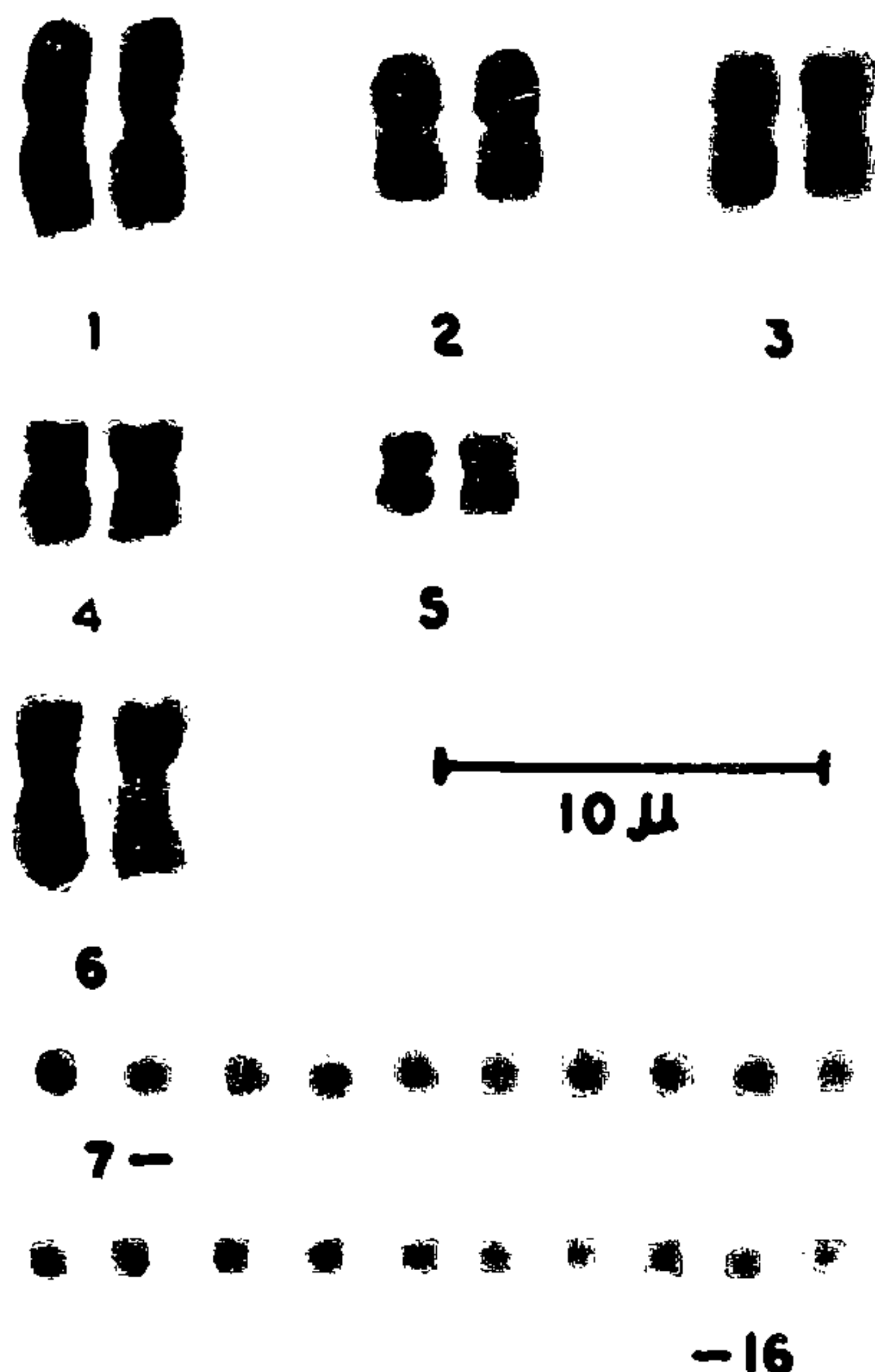


FIG. 3. Karyotype of *Psammophilus dorsalis*, Female.

The diploid number of *M. m. mobouya* is 30 with 16 macro- and 14 microchromosomes². The pair number 9 in their karyotype is distinctly larger than the microchromosomes and so if this pair is regarded as macrochromosome, the macrochromosomes in the karyotypes of all the three species, viz., *M. m. mobouya*, *M. trivittata* and *M. carinata* show a close resemblance with each other. However, there are two microchromosomes less in the karyotype of *M. m. mobouya*. The chromosome number of *M. aurata septemtaeniata* has been reported by Bhatnagar and Yoniss³ to be 32. The karyotype has 10 macro- and 22 microchromosomes. The karyotypes in the present study do not show any resemblances with that of *M. aurata septemtaeniata*.

The karyotypes of *M. carinata* analysed by Singh^{7, 8} from Varanasi, N. India, is similar to our *M. carinata* except that the last pair of macrochromosomes (pair 9)

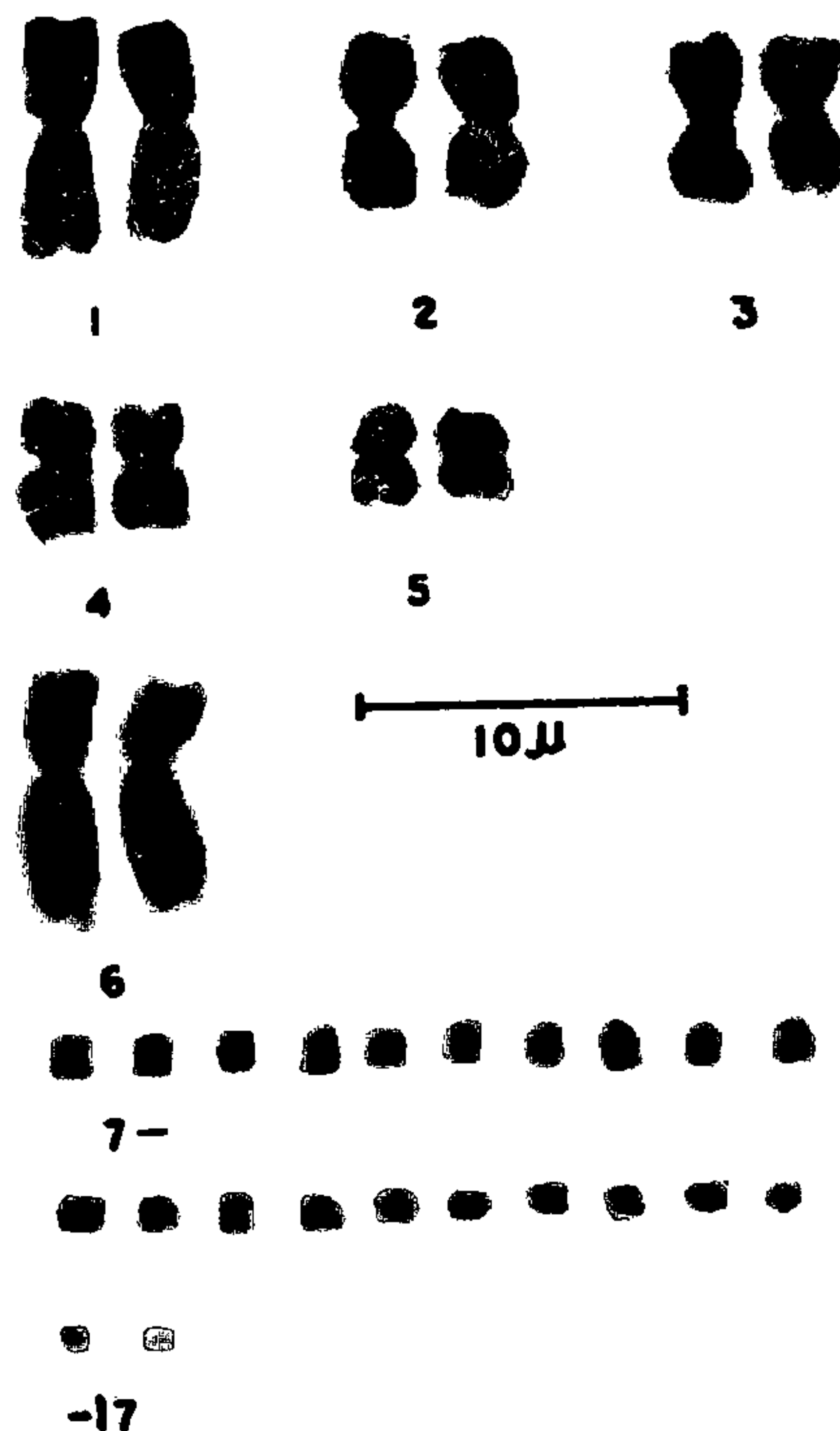


FIG. 4. Karyotype of *Calotes versicolor*, Male.

is telocentric in their karyotype. But this pair is slightly larger in size and submetacentric in *M. carinata* in all the three localities studied from South India. This may be due to the addition of heterochromatin which should be confirmed by C-banding studies. This shows that there is geographical variation in the structure of the karyotype in *M. carinata* from different localities.

The karyotypes of *M. trivittata* and *M. carinata* reveal a close resemblance with each other in the diploid number, chromosome morphology and fundamental number. The relative lengths of most of the chromosomes are almost similar. Further, the first three pairs of microchromosomes in *M. trivittata* are metacentric whereas they are telocentric in *M. carinata* which can be attributed to pericentric inversion without altering the size of the chromosomes.

Agamidae :

In this family chromosomal data are available for 7 genera. Among these, the karyotypes of *Agama caucasica*, *A. tuberculata* and *Leiolepis belliana* show resemblances with the karyotypes of *P. dorsalis* and

C. versicolor except that *P. dorsalis* has two microchromosomes less. Our study of the chromosomes of *C. versicolor* from 3 different localities of peninsular India confirms the diploid number of 34 with 12 macro- and 22 microchromosomes as reported by Singh⁷. The karyotypes of *P. dorsalis* and *C. versicolor* also show a closer resemblance with that of *Uromastix hardwicki* which has a diploid number of 36 with 12 macro- and 24 microchromosomes^{5,7}. The number and size of the macrochromosomes are similar in all the three karyotypes.

When the karyotypes of *P. dorsalis* and *C. versicolor* are compared there is a striking similarity in the chromosome morphology, relative lengths and centromeric indices. However, there are two microchromosomes less in *P. dorsalis*. The karyotype of *P. dorsalis* can be derived from that of *C. versicolor* by translocation of a pair of microchromosomes to the macrochromosomes. Analysis of G-banding pattern may help to detect this translocation.

A perusal of the karyotypes of different species of Scincidae and Agamidae suggests the role of various chromosome rearrangements and addition/deletion of heterochromatin in the karyotypic evolution of these lizards. It is interesting to note the karyotypic similarities between *E. schneideri* and *M. trivittata* and *M. carinata*. Similarly the karyotypes of a few species of *Agama*, *Leiolepis* and *Uromastix* are also similar to those of *P. dorsalis* and *C. versicolor*. These may help to understand the evolution of the karyotypes of different genera in these families. A comparison of the karyotypes of the different members of Scincidae

with those of Agamidae suggests no karyological relationships between the two. They might have diverged very early in the course of evolution. A detailed karyological analysis including banding studies of the various species of lizards is felt highly essential to throw more light on their cytotaxonomic relationships.

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1. Asana, J. J. and Mahabale, T. S., *Curr. Sci.*, 1941, **11**, 494.
2. Beçak, M. L., Beçak, W. and Denaro, L., *Caryologia*, 1972, **25**, 313.
3. Bhatnagar, A. N. and Yoniss, Y. Th., *Ibid.*, 1977, **30**, 399.
4. Dallai, R. and Talluri, M. V., *Chromosoma (Berl.)*, 1969, **27**, 86.
5. Gorman, G. C., In: *Cytotaxonomy and Vertebrate Evolution* (A. B. Chiareli and E. Capanna, eds.), Academic Press, London, New York, 1973, p. 349.
6. Levan, A., Fredga, K. and Sandberg, A. A., *Hereditas*, 1964, **52**, 201.
7. Singh, L., *Proc. Zool. Soc., Calcutta*, 1974, **27**, 57.
8. —, Sharma, T. and Ray-Chaudhury, S. P., *Mamm. Chrom. Newsl.*, 1970, **11**, 91.

INDIAN LEAD ZINC INFORMATION CENTRE

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SEMINARS AND PRIZE AWARDS

- (A) Two seminars on Gating of Diecasting Dies and Diecasting Technology will be held at two centres : (1) Madras at Taj Coromandel on 16th and 17th August 1979 and (2) Bombay at Hotel President on 22nd and 23rd August 1979.
- (B) Two-day Solder Seminar will be held at Bangalore in October 1979. Two keynote papers are being invited from the International Tin Research Institute and Lead Development Association, U.K.
- (C) 1980 Wilhelm Hofmann Memorial Prize Awards for Research on Lead, given to authors of papers

describing original work which, in the opinion of an International Consortium of experts in metallurgy and lead technology, adds significantly to the existing knowledge of lead. There are two groups for entries, each with an Award of £ 1,000 sterling, as follows : Group A—Extractive Metallurgy of Lead and Group B—Physical and Mechanical Metallurgy of Lead. Papers published, since the last awards were made in 1977 are eligible.

Further details can be had from the General Manager whose address is given above,