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CHROMOSOME NUMBER AND KARYOTYPIC STUDIES IN *GLYCYRRHIZA*

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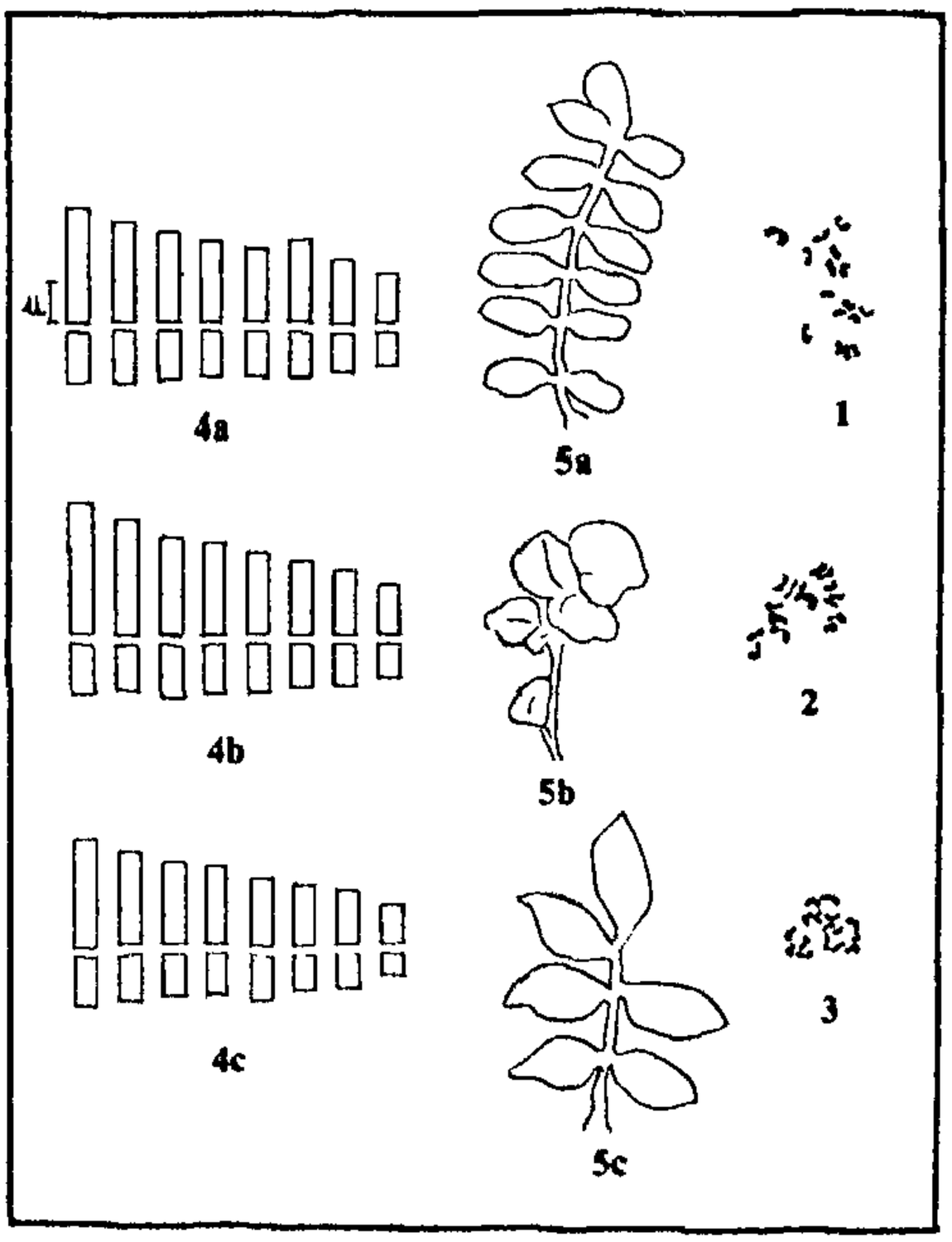
GLYCYRRHIZA is a genus of perennial herbs and undershrubs distributed in the subtropical and warm temperate regions of the world. This genus is of great medicinal importance as glycyrrhizic acid and various alkaloids extracted from different species are used in different types of medicinal preparations mainly in cough syrups. This genus is commonly known as liquorice as it yields the product of commercial importance. So far, no species of *Glycyrrhiza* has been reported from India but cultivation of *G. glabra* and some other species has been undertaken at several places in India. Though the genus is of great medicinal value, previous reports indicate that very little cytogenetic work has been done. All the available papers deal only with chromosome numbers[1-5].

The present work is the account of chromosome number and karyotypic studies in three species *viz. Glycyrrhiza glabra, G. macdonica* and *G. uralensis*. The chromosome number and karyotype of *G. macdonica* are reported for the first time.

The seeds and rhizome cuttings of *G. glabra, G. macdonica* and *G. uralensis* were obtained from Indian Council of Agricultural Research Co-ordinated Project on Medicinal and Aromatic Plants, New Delhi. The chromosome study was made from healthy root tips using 8-hydroxyquinoline for pre-treatment and haematoxylin as stain. For studying the details of morphological characters of chromosomes, forty metaphase plates were selected, and for centromeric position, the standardized method of Levan *et al*[6] was followed.

The basic number in all the three species is $2n = 16$ (figures 1–3). The measurements and other details of the somatic chromosome in *G. glabra, G. uralensis* and *G. macdonica* are presented in table 1. The chromosomes in these three species are idiogrammed in figure



Figures 1–5. Chromosome number and karyotypic studies of *Glycyrrhiza glabra, G. macdonica* and *G. uralensis*. **1–3.** Basic numbers, **4a–c.** Idiograms of chromosomes, **5a–c.** Line diagrams of leaf morphology.

Table 1 *Morphological details of chromosomes of 3 species of Glycyrrhiza.*

Name of species	Chromosomes pair	Length of chromosome in μ Long arm	Short arm	Total length	Relative length*	Ratio $r = \frac{l}{s}$	d value = $10(r-1)/(r+1)$	Index $i = 100 \times S/C$	Centromeric position	Group
Glycyrrhiza glabra Linn	I	2 6	1.1	3 7	16	2.4	4 1	30	Sm	A
	II	2 3	1.1	3.4	15	2.0	5 0	32	Sm	A
	III	2.1	1.1	3.2	14	1 9	3.1	34	Sm	A
	IV	1.9	1 0	2 9	13	1.9	3.1	34	Sm	A
	V	1.7	1.0	2.7	12	1 7	2 6	37	Sm	A
	VI	1.5	1 0	2.5	11	1.5	2 0	40	m	B
	VII	1.4	0 9	2 3	10	1.5	2.0	39	m	B
	VIII	1.1	0.8	1 9	8	1 4	1.7	42	m	B
Glycyrrhiza macdonica	I	3 0	1.1	4 1	17	2.7	4 8	26 8	Sm	A
	II	2 6	1 0	3 6	15	2 6	4.4	27.7	Sm	A
	III	2.2	1.2	3.4	14	1 8	2 8	35 3	Sm	A
	IV	2.1	1.1	3 2	13	1.9	3.1	34 4	Sm	A
	V	1.9	1 1	3.0	12	1 7	2.6	36 6	Sm	A
	VI	1 7	1.0	2.7	11	1.7	2 6	37.0	Sm	A
	VII	1.5	1.0	2 5	10	1.5	2.0	40 0	m	B
	VIII	1.1	0 8	1.9	8	1 4	1 6	42 0	m	B
Glycyrrhiza uralensis	I	2.4	1.1	3.5	17	2.2	3 7	31 4	Sm	A
	II	2.1	1 0	3.1	15	2.1	3 5	32 2	Sm	A
	III	1 9	0 9	2.8	14	2 1	3.5	32 1	Sm	A
	IV	1 8	0.9	2.7	13	2 0	3 3	33.3	Sm	A
	V	1 5	1.0	2.5	12	1.5	2 0	40 0	m	B
	VI	1.4	0 8	2.2	11	1 7	2 6	36 4	Sm	A
	VII	1 2	0 8	2 0	10	1.5	2.0	40 0	m	B
	VIII	0 9	0 5	1.4	7	1 8	2.1	35 7	Sm	A

*Relative length = Percentage length in haploid complement
No. of cells scored = 40
Total length of haploid complement *G. glabra* –22.6 μ
Total length of haploid complement *G. macdonica* –24.4 μ
Total length of haploid complement *G. uralensis* –20 2 μ

4a–c. The line diagrams of leaf morphology of these three species are given in figure 5a–c.

The total length of haploid chromosome complement is 24.4 μ, 22.6 μ and 20.2 μ in *G. macdonica*, *G. glabra* and *G. uralensis* respectively. The chromosome length varies from 4.1 μ to 1.9 μ in *G. macdonica*, 3.7 μ to 1.9 μ in *G. glabra* and 3.5 μ to 1.4μ in *G. uralensis*. All the three species show chromosome either with submedian centromere or with median centromere. Out of eight pairs of chromosomes in *G. macdonica* and *G. uralensis*, six pairs are with submedian centromere and two with median centromere while in *G. glabra* five pairs with submedian centromeres and three pairs of median centromeres.

It is clear from table 1 that the relative length of first seven pairs of chromosomes in *G. uralensis*, *G. macdonica* and *G. glabra* is quite similar while the last pair of *G. uralensis* having relatively less length is shorter than in the other two species. The longest pair of *G. glabra* chromosomes is relatively shorter than that of the longest pairs in the other two species.

The chromosomes in all the three species can be classified into two types 'A' with submedian centromere and 'B' with median centromere. So karyotype formula for *G. macdonica* and *G. uralensis* is $K:2n = 16 = 6A^{Sm} + 2B^{m}$ and for *G. glabra* is $K:2n = 16 = 5A^{Sm} + 3B^{m}$.

The basic chromosome number $2n = 16$ for

Glycyrrhiza uralensis and *G. glabra* is in confirmity with the previous record[1,2], while it is reported for the first time for *G. macdonica*. $n = 8$ has been suggested as the basic number for different species of *Glycyrrhiza*[1-5].

The great majority of vascular plants possess karyotypes that are relatively symmetrical, that is, they have chromosomes of similar sizes within the same karyotype and chiefly median or submedian centromere[7]. The present study also shows that in *Glycyrrhiza glabra, G. macdonica* and *G. uralensis*, the karyotype is of symmetrical nature, since all these species have chromosomes with median and submedian centromeres.

Karyotype of the different species of a genus may either be much alike or vary greatly. Among seed plants in some genera, the karyotype in all the species of the genus remained constant from symmetry point of view *e.g., Solanum, Hordeum, Bromus, Oenothera, Agave, Yucca* and *Furcraea* etc. In these plants since the inversions are paracentric and the translocations involve either relatively small or approximately equal chromosome segments, the basic features of the karyotypes remain constant or unaltered in all the species of the same genus[8]. The constant basic number ($2n = 16$) and relatively same size chromosomes with median or submedian centromere suggests that in the three species of *Glycyrrhiza glabra, G. macdonica* and *G. uralensis*, the basic features of karyotypes are unaltered, indicating relatively small number of chromosomes involved in the translocations during the course of evolution.

The symmetrical karyotype and the similarlity of the karyotype amongst the three species indicates that phylogenetically these species are primitive and are inter-related.

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DISTRIBUTION OF ADRENALINE AND NORADRENALINE CHROMAFFIN CELLS IN THE ADRENAL GLAND OF A FRESHWATER TURTLE, *LISSEMYS PUNCTATA GRANOSA*

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ALTHOUGH the adrenal gland of reptiles have adrenaline (A) and noradrenaline (NA) chromaffin cells but there are numerous species belonging to this class which exhibit great variations in their arrangement and distribution. In most of the Squamates, the chromaffin cells lie mainly in a compact dorsal layer and send extensions into the parenchyma. A few islets of chromaffin cells also occur intermixed with the cortical strands. The dorsal layer and its digitations contain mainly NA cells, whereas the islets are constituted of only A cells[1-3]. In *Alligator mississippiensis* and *Caiman crocodilus*, belonging to order Crocodilia, a similar zonation of the two cell types has been observed as in Squamata[4]. However, in *Crocodylus niloticus*[5,6] all the clusters of chromaffin tissue contain A as well as NA cells. In the Chelonia, the clusters of chromaffin tissue may contain only one kind of cell or a mixture of both the types. As there is no separate dorsal concentration of chromaffin tissue in these animals, all the types of islets can be found in any zone of the gland[7,8]. This short communication reports on the distribution of two chromaffin cell types in the adrenal gland of *Lissemys punctata granosa* for the first time.

Specimens (15) used in this investigation were bought from local supplier and acclimated to the laboratory conditions for a week. Their adrenal glands were removed under anesthesia with ether and fixed in 3 different fixatives as required by 3 different techniques (Dichromate and iodate tests of Hillarp and Hökfelt[9]; and Glutaraldehyde silver technique of Tramezzani *et al*[10]) adopted for the identification of A and NA storing cells. The tissues were embedded in paraffin and 5 to 7 micra thick sections were obtained. The sections were deparaffinized in xylene and were observed in light microscope.

In the turtle, *L. p. granosa*, the clusters of chromaffin