

NOTES ON THE GENUS ASTRAGALUS IN IRAN I, CYTO-TAXONOMIC STUDIES ON SOME SPECIES

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Chromosome counts of 34 taxa belong to the genus *Astragalus* are recorded. More to a table which shows chromosome number and previous chromosomic counts of the taxa, karyotype morphology are briefly discussed. Figures of the karyotype of some taxa are given.

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مطالعاتی دربارهٔ جنس گون (*Astragalus*) در ایران (۱)، سینتوناگزونومی
تعدادی از گونه‌ها

از: علی اصغر رمک معصومی

شمارش کروموزومی ۳۴ واحد رده‌بندی از جنس گون (*Astragalus*) گزارش داده می‌شود. در یک جدول تعداد کروموزم‌های گونه‌های مطالعه شده و همچنین مراجع مربوط به مطالعات انجام شده در گذشته نشان داده می‌شود. شکل ظاهری کاریوتیپ بطور مختصر مورد بحث واقع شده و تصاویر کاریوتیپ تعدادی از گونه‌ها ارائه می‌گردد.

INTRODUCTION

In the course of a cytotaxonomic study of the genus *Astragalus*, 34 taxa belong to 19 sections from different regions of Iran were examined. In this study 25 chromosomic counts are recorded for the first time, they are marked by an Asterisk. Voucher specimens are deposited in the Herbarium of Research Institute of Forests and Rangelands (TARI).

MATERIALS AND METHODS

Chromosome counts were based on root tips grown by seeds which had been taken from the herbarium specimens and floret buds, collected in the different parts of Iran. Root tips were fixed in fixative (3:1 absolute ethanol/glacial acetic acid), hydrolized and stained by using Feulgen method; floret buds were fixed with the same fixative in the field, stored in refrigerator and stained in a mixture of simple aceto-carmin and ferric aceto-carmin.

Table 1. Karyologically studied *Astragalus* species, chromosome number and previous records (* new records).

Name	n, 2n=	Previous records
* <i>A. affghanus</i>	n=8	
<i>A. alopecias</i>	n=8	2n=16 (Ledingham et Rever 1963)
* <i>A. annularis</i>	2n=16	
* <i>A. camptoceras</i>	n=8	
<i>A. campylorrhynchus</i>	n=8	2n=16 (Ledingham et Fahselt 1964)
* <i>A. caragana</i>	n=8	
* <i>A. citrinus</i> ssp. <i>citrinus</i>	n=8	
* <i>A. fasciculifolius</i>	n=8	
<i>A. hamosus</i>	n=8	2n=32, 48 (Kreuter 1930)
* <i>A. lovensis</i>	n=16	
* <i>A. macrocephalus</i> ssp. <i>macrocephalus</i>	n=8	

Table 1. cont.

Name	n,2n=	Previous records
<i>A. mollis</i>	n=8	2n=16 (cf. Fedorov. 1969 p. 285)
* <i>A. nishapurensis</i>	n=8	
* <i>A. obtusifolius</i>	n=8	
* <i>A. onobrychis</i>	n=16	
* <i>A. ophiocarpus</i>	2n=16	
* <i>A. oxyglottis</i> var. <i>psyglottis</i>	n=8	
* <i>A. rawlinsianus</i>	n=8	
* <i>A. remotijugus</i>	n=8, 2n=16	
* <i>A. renzianus</i>	2n=16	
<i>A. retamocarpus</i>	n=8	2n=16 (Ledingham 1960)
* <i>A. schimperi</i> var. <i>schimperi</i>	2n=16	
* <i>A. schimperi</i> var. <i>subsessilis</i>	2n=16	
<i>A. sesamoides</i>	n=8, 2n=16	2n=16 (Ledingham et Rever 1963)
<i>A. sieversianus</i>	n=8	2n=16 (Ledingham 1960)
* <i>A. siliquosus</i> ssp. <i>siliquosus</i>	n=8	
* <i>A. stenocarpus</i>	n=16, 24	
<i>A. stalinskyi</i>	n=8	2n=16 (Podlech et Dieterle 1969)
* <i>A. submitis</i>	n=8	
* <i>A. subsecundus</i>	n=8	
<i>A. suluklensis</i>	n=24	2n=48 (Ledingham et Rever 1963)
* <i>A. tehranicus</i>	n=8	
* <i>A. tribuloides</i> var. <i>leiocarpus</i>	2n=16	
* <i>A. vicarius</i>	n=12	

DISCUSSION

ANNUALS

Sect. *Ankylotus* Bge.

Astragalus affghanus Boiss. (n=8, Fig.1)
—Gorgan: Golestan Park, Almeh, 1100 m, 8.5.1984, Maassoumi 47559.

At first anaphase two chromosomes in each pole are separated slower than the others, this type of chromosome disjunction with incomplete bridges showing various degree of chiasma terminalisation.

Astragalus stalinsky Sir. (n=8, Fig.2).—
Gorgan: Golestan park, Almeh, 1100 m, 8.5.1984, Maassoumi 47562.

In the Karyotype synchoron chromosomic disjunction can be recognized.

Sect. *Buceras* Bge.

Astragalus hamosus L. (n=8).— Gorgan: Golestan Park, between Sharlegh and Cheshme-Khan 1350 m, 7.5.1984, Maassoumi 47540.

A widespread species distributed in all over country. Previous counts $2n=32, 48$ (Kreuter 1930) indicate the polyploidisation tendency of this taxon.

Sect. *Fedtschenkoana* Sirj.

Astragalus campylorrhynchus F. et M. (n=8, Fig. 3).— Gorgan: Golestan park, between Shariegh and Cheshme-Khan, 1350 m 7.5.1984, Maassoumi 47551; Golestan Park, Almeh, 1100 m, 8.5.1984 Maassoumi 47561.

The species is known from a number of localities on the Iranian territory. In the karyotype the different size of chromosomes and heterochromatinisation can be recognized. Some chromosomes on the equator indicate the slow chromosomic terminalisation during the diakinesis. Same species was examined from a different ecological condition, showing the same character. Materials examined from Afghanistan (Podlech et Dieterl 1969) indicate two B chromosomes in the karyotype ($2n=16+2B$).

Sect. *Haematodes* Bge.

Astragalus annularis Forssk. ($2n=16$, Fig. 4).— Bushehr: 5 Km S. of Bandar-e Bushehr, 0–10 m, 2.3.1978, Runemark & Mozaffarian 26967.

Asymmetrical karyotype and heterochromatin chromosomes were noticeable.

Sect. *Ophiocarpus* Bge.

Astragalus ophiocarpus Benth. ($2n=16$,

Fig. 5).— Tehran: Kavir protected region, Siah-Kuh, 1100–1300 m, 23.5.1974, K. H. Rechinger 46216.

In mitosis metaphase, asymmetric and heterochromatin chromosomes are seen. Intense chromatinisation in the extremes of chromosomes was noticeable.

Sect. *Oxyglottis* Bge.

Astragalus oxyglottis Stev. var. *psyloglottis* (Stev. ex DC.) Bge. ($n=8$, Fig. 6) —Tehran: Botanical Garden, 1320 m, 30.4.1983, Maassoumi 47533.—Gorgan: Golestan Park, Sharlegh station. 1300 m, 8.5.1984, Maassoumi 47571.

Regular division in the different stages of meiosis was seen, but sometimes the mother cells in diakinesis show chromosomal agglutination. Disjunction of chromosomes at first anaphase is synchronous. Materials from the two localities showing the same character.

Astragalus schimperi Boiss. var. *schimperi* ($2n=16$, Fig. 7).— Hormozgan: Ca. 100 km SE. of Lar, near the village Sartang, 300 m, 19.4.1983, Assadi & Sardabi 41994.

In karyotype asymmetrical chromosomes and intense chromatinisation were seen.

Astragalus schimperi Boiss. var. *subsessi-*

lis Eig ($2n=16$).— Baluchestan: 71 km from Rask on the road to Chahbahar, 100 m, 8.3.1977, Runemark & al. 22462.

In the karyotype small, narrow and heterochromatin chromosomes were distinguishable. Regular division in the different stages of mitosis was seen. Two varieties examined are morphologically rather similar, but there are significant differences between them in their karyotypes.

Astragalus sesamoides Boiss. ($n=8$, $2n=16$).— Gorgan: Golestan Park, Almeh, 1100 m, 8.5.1984, Maassoumi 47557.

In the karyotype homochromatin chromosomes and regular division in all cells with synchronous disjunction were noticeable.

Astragalus tribuloides Delil. var. *leiocarpus* Boiss. ($2n=16$).— Semnan: 62 km E. of Shahrud, 1100 m, 17. May 1966, Pabot 28523.

Karyotype symmetric. During mitosis metaphase heterochromatin concentration in the extremities of chromosomes was distinguishable.

Sect. *Platyglottis* Bge.

Astragalus camptoceras Bge. ($n=8$, Fig. 8).— Gorgan: Golestan Park, between Sharlegh and Cheshme Khan, 1350 m,

7.5.1984, Maassoumi 47538.

Homochromatin karyotype, synchronous disjunction, and regular division were seen.

Sect. *Sewerzowia* Bge.

Astragalus vicarius Lipsky (n=12).— Gorgan: Golestan Park, Sharlegh station, 1300 m, 8.5.1984, Maassoumi 47570.

Homochromatin chromosomes and synchronous chromosomal disjunction in first anaphase can be recognized.

PERENNIALS

Sect. *Alopecuroidei* DC.

Astragalus alopecias Pall (n=8, Fig. 9).— Khorasan: near Darreh-Gaz (FG2), 1000 m, 29.5.1984, Assadi & Maassoumi 50860.

In diakinesis 8 heterochromatinic bivalents, and various degree of chiasma terminalisation can be recognized. In first anaphase synchronous chromosomal disjunction was noticeable.

Astragalus macrocephalus Willd subsp. *macrocephalus* (n=8, Fig. 10).— Khorasan: 31 km on the road of Gifan, from Bojnoord, 1400 m, 22.5.1984, Assadi & Maassoumi 50245.

In karyotype 8 small intense chromatinic chromosomes were seen. Synchronous disjunction in first anaphase was distinguishable.

Astragalus obtusifolius DC. (n=8, Fig. 11).— Bushehr: from Delvar to Hedkan, after Hedkan, sea level, 19.3.1985, Maassoumi & Abouhamzeh, 51963.

Variable chromatinization and various degree of chiasma terminalisation can be recognized. Concentration of heterochromatinic segment in the extremity of bivalents can be distinguished.

Sect. *Astragalus*

Astragalus caragana F. & M. (n=8, Fig. 12).— Karadj: Chalus road, before Adaran, Arangeh mts, 1900 m, Khatam-saz, Maassoumi & Abouhamzeh 52109.

This species is widespread in Iran. Variable chromatinisation and regular division in first anaphase with synchronous chromosomal disjunction were seen.

Astragalus retamocarpus Boiss. & Hohen. (n=8, Fig. 13).— Khorasan: between Ghoochan and Darreh-Gaz, Tandureh National Park, between Shekarab and Chehel Mehr, 1600–1900 m, 28.5.1984, Assadi & Maassoumi 50668.

Synchronous chromosomal disjunction and intense chromatinic chro-

mosomes were seen.

Astragalus sieversianus Pall. (n=8, Fig. 14).— Khorasan: between Ghoochan and Darreh-Gaz, Tandureh National Park, between Shekarab and Chehel-Mehr; 1600–1900 m, 28.5.1984, Assadi & Maassoumi 50669.

Symmetrical chromosomes in pollen mitosis are seen.

Sect. *Caprini* DC.

Astragalus citrinus Bge. subsp. *citrinus* (n=8, Fig. 15).— Gorgan: Golestan Park, Almeh, 1100 m, 8.5.1984, Maassoumi 47556 (det. Podlech).

In diakinesis homochromatinisation and slow chiasma terminalisation can be recognized. Synchronous chromosomic disjunction in Metaphase I was seen.

Astragalus remotijugus Boiss. (n=8; 2n=16).— Tehran: Karadj, Chalus road, before Adaran, Arangeh mts., 1900 m Khatamsaz, Maassoumi & Abouhamzeh 52108.

Two specimens examined, showing chromosomic agglutination in mitosis and meiosis division. It seems some pretreatments on root tips or floret buds are necessary before fixation.

Astragalus renzianus Podl. (2n=16).—

Khorasan: mountains N. of Neyshabour, 1450–1600 m, 16.6.1981, Assadi & Mozaffarian 35984.

This species was described recently from Khorasan, Neyshabour (Podlech 1986).

Careful karyological examination showing intense chromosomic agglutination in all mitosis stages. It seems some pretreatments are needed before fixation.

Sect. *Cystodes* Bge.

Astragalus stenocarpus Gontsch. s.l. (n=16, 24, Fig. 18).— Gorgan: Golestan Park, Almeh, 1100 m, 8.5.1984. Maassoumi, 47558 (n=24).— Khorasan: Ca. 45 km. N. of Shirvan, Golool-Sarani Protected Area (EG2), 1600–2300 m, 26.5.1984, Assadi & Maassoumi 50458 (n=16).

This species is widespread in N. of Khorasan. In diakinesis homochromatinisation and slow chiasma terminalisation of the bivalents can be recognized. In first anaphase synchronous chromosomic disjunction was seen.

Sect. *Laguropsis* Bge.

Astragalus subsecundus Boiss. & Hohen. (n=8, Fig. 17).— Tehran: Karadj, Chalus road, before Adaran, Arangeh mts. 1900

m, Khatamsaz, Maassoumi & Abouhamzeh 52110.

Chromosomic agglutination was seen and therefore it seems some pretreatments before fixation are needed.

Sect. *Malacothrix* Bge.

The species of this section show intense chromosomic agglutination.

Astragalus mollis M. B. (n=8).— Tehran: Botanical Garden, 1320 m, 3.4.1983, Maassoumi 47535.

Astragalus rawlinsianus Aitch. & Baker, (n=8).— Gorgan: 80 km to Bojnoord on the road from Gorgan, 1400 m, 20. 5. 1984. Assadi & Maassoumi, 50058.

Astragalus suluklensis Frey. & Sint. (n=24).—Khorasan: 68 km on the road to Gifan from Bojnoord, after Amirabad (EG1), 1200 m, 22.5.1984, Assadi & Maassoumi 50260.

Sect. *Megalocystis* Bge.

Astragalus nishapurensis Sirj. & Rech. f. (n=8, Fig. 16).— Khorasan: 12 km to Bojnoord on the road from Shirvan (EG2), 1100 m, 30.5.1984, Assadi & Maassoumi 50862.

In diakinesis heterochromatinisation and slow chiasma terminalisation of the

bivalents can be recognized. In first anaphase synchronous chromosomic disjunction was noticeable.

Astragalus submitis Boiss. et Hohen. (n=8).— Tehran: Karadj, Chalus road, before Adaran, Arangeh mts., 1900 m Khatamsaz, Maassoumi & Abouhamzeh 52111.

This species shows chromosomic agglutination.

Sect. *Onobrychium* Bge.

Astragalus onobrychis L. (n=8, Fig. 19).— Khorasan: Ca. 45 km. N. of Shirvan, Golool-Sarani Protected Area, 1600—2300 m, 26.5.1984, Assadi & Maassoumi 50457.

In diakinesis intense chromatinisation and various degree of chiasma terminalisation of bivalents can be recognized. In first anaphase synchronous chromosomic disjunction was noticeable.

Astragalus tehranicus Boiss. (n=8).— Tehran: Botanical Garden, 1320 m, 30.4.1983, Maassoumi 47536.

This species shows chromosomic agglutination and therefore it seems some pretreatments are needed.

Sect. *poterium* Bge.

Astragalus fasciculifolius Boiss. (n=8,

Fig. 20).— Fars: 100 km from Shiraz to Kazerun, after Dasht-e Arjan, Bolhayate, 1500 m, 17.3.1985, Maassoumi & Abouhamzeh 51830.

This species shows intense chromosomal agglutination in meiosis.

Sect. *proselius* Bge.

Astragalus lovensis Rech. f., (n=16).— Gorgan: Golestan Park, Sharlegh station, 1300 m, 8.5.1984, Maassoumi 47581.

Telophase II was observed and in this stage 16 small chromosomes were counted.

Sect. *Theiochrus* Bge.

Astragalus siliquosus Boiss. subsp. *siliquosus* (n=8, Fig. 21).— Tehran: between Damavand and Rudehen, 1300 m, 31.5.1984, Assadi & Maassoumi 50901. Homochromatin bivalents and slow chiasma terminalization in all examined cells are observable.

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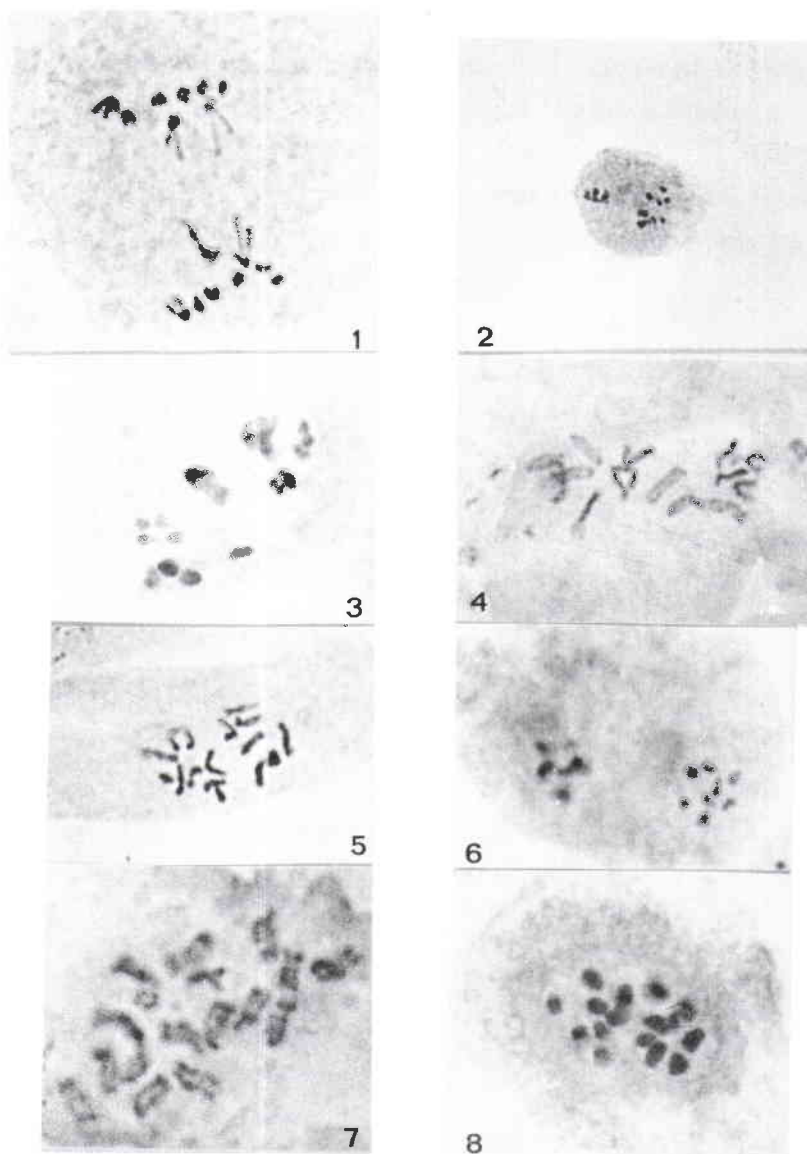


Fig. 1—8: —1. *Astragalus affghanus*, anaphase I (x 2400). —2. *A. stalinsky*, anaphase I (x 1600). —3. *A. campylorrhynchus*, anaphase I (x 2400). —4. *A. annularis*, mitosis metaphase (x 4000). —5. *A. ophiocarpus*, mitosis metaphase, (x 4000). —6. *A. oxyglottis* var. *psyloglottis*, anaphase I (x 4000). —7. *A. schimperi* var. *schimperi*, mitosis metaphase (x 6000). —8. *A. camptoceras*, anaphase I (x 4000).

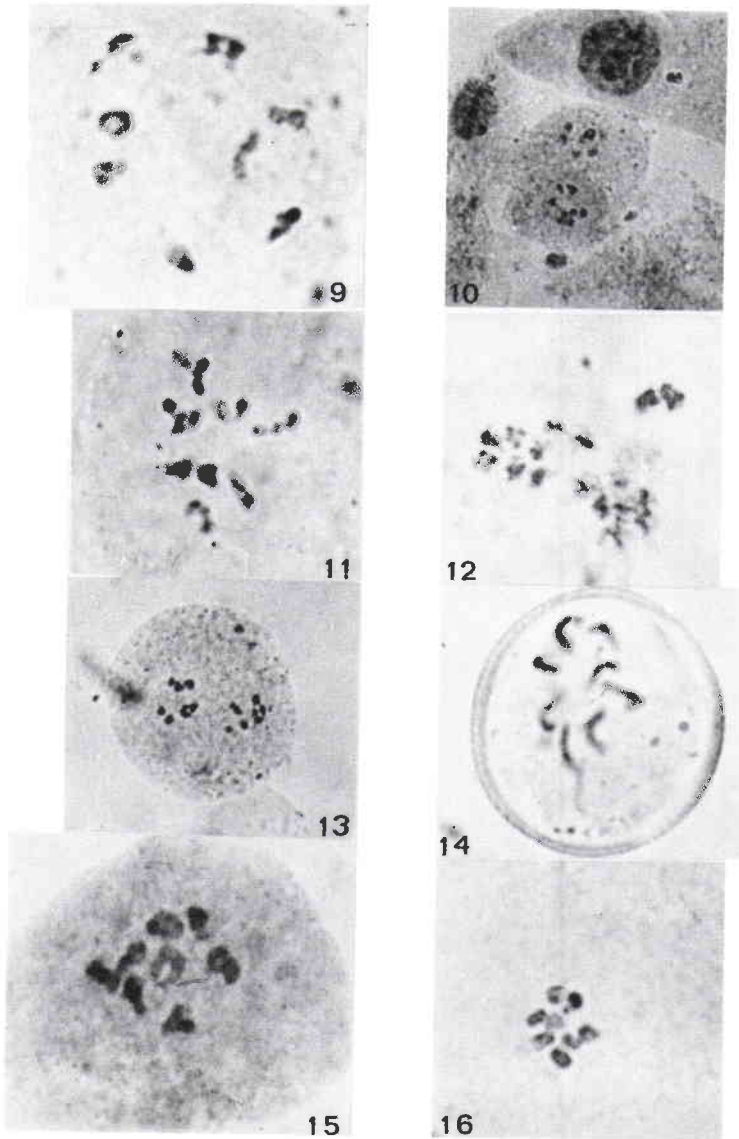


Fig. 9—16: —9. *Astragalus alopecias*, diakinesis (x 4000). —10. *A. macrocephalus* subsp. *macrocephalus*, anaphse I (x 1600). —11. *A. obtusifolius*, diakinesis (x 4000). —12. *A. caragana*, anaphase I (x 1600). —13. *A. retamocarpus*, Anaphase I (x 1600). —14. *A. sieversianus*, pollen mitosis (x 4000). —15. *A. citrinus* subsp. *citrinus*, diakinesis (x 4000). —16. *A. nishapurensis*, diakinesis (x 4000).

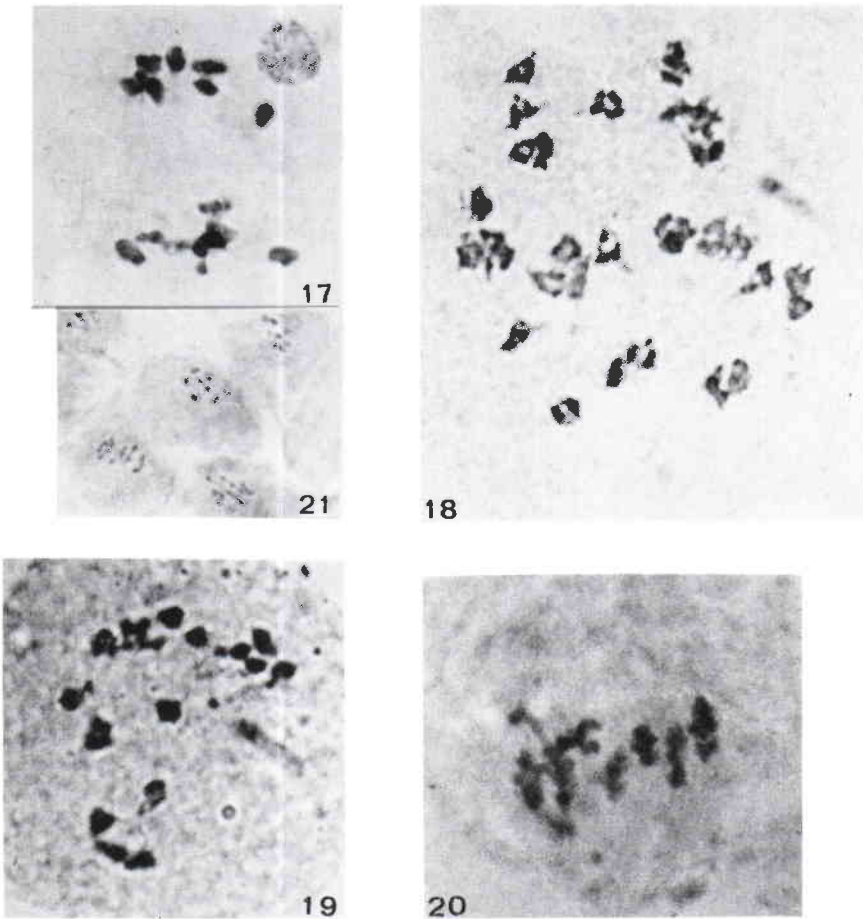


Fig. 17–21: --17. *A. subsecundus*, anaphase I (x 4000). --18. *A. stenocarpus*, diakinesis (x 4000). --19. *A. onobrychis*, anaphase I (x 4000). --20. *A. fasciculifolius*, metaphase I (x 4000). --21. *A. siliquosus* subsp. *siliquosus*, diakinesis (x 1600).