

Zeitschrift: Candollea : journal international de botanique systématique = international journal of systematic botany

Herausgeber: Conservatoire et Jardin botaniques de la Ville de Genève

Band: 40 (1985)

Heft: 2

Artikel: Seed studies in the Androsace L. (Primulaceae) species found in Pakistan

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DOI: <https://doi.org/10.5169/seals-879793>

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Seed studies in the *Androsace* L. (Primulaceae) species found in Pakistan

YASIN J. NASIR

ABSTRACT

NASIR, Y. J. (1985). Seed studies in the *Androsace* L. (Primulaceae) species found in Pakistan. *Candollea* 40: 403-408. In English, French abstract.

Eighteen species of *Androsace* L., have been studied for their seed morphology. The seed scanning and seed weight for the taxa have been attempted for the first time. In the genus there is a correlation between the seed number and the habit of the plant; however no definite correlation exists between the seed number and the seed size (i.e. seed weight). A seed key along with the seed number and seed weight is appended.

RÉSUMÉ

NASIR, Y. J. (1985). Etudes de graines dans les espèces du genre *Androsace* L. (Primulaceae) du Pakistan. *Candollea* 40: 403-408. En anglais, résumé français.

La morphologie des graines de dix-huit espèces du genre *Androsace* L. a été étudiée. L'examen au microscope électronique à balayage et le poids des graines ont été considéré pour la première fois. Dans ce genre on observe une corrélation entre nombre de graine et l'habitat de la plante. Il n'existe cependant pas de corrélation précise entre le nombre de graines et la taille (c'est-à-dire le poids) de la graine. Une table pour le nombre de graines et leur poids est jointe en appendice.

Introduction

The genus *Androsace* L. is represented by 24 species (in 4 sections) in Pakistan, confined to the mountainous regions of the N.W.F. Province, Baltistan, Gilgit and Kashmir.

A perusal of relevant literature indicates that very little work on the seed morphology of *Androsace* has been attempted. Brief account of the seed is to be found in various regional floras, such as by BOISSIER (1879), WENDELBO (1965), FERGUSON (1972) and LAMOND (1978).

The present paper is the result of a study undertaken while monographing the *Primulaceae* Vent., taxa occurring in Pakistan. In the course of this study several interesting features were observed. These findings are presented here, along with the morphology of the seed in *Androsace*.

Material and methods

Seeds for 18 species of *Androsace* were available. Seed material was obtained directly from the herbarium sheets or collected fresh from the field. Only those seeds which appeared healthy and of a full shape were taken into account. The identification of the species is largely based on herbarium specimens authenticated by various experts. The following characters were taken into account:

- Number per capsule: seeds from 4-10 individual plants per species, with an average of 3-5 capsules per plant were counted for their seed.
- Weight: 15-20 seeds per plant for each species were weighed by an electric balance.
- Length: the seed length was recorded by help of a mm scale.

Species	Seed number/capsule	Seed weight (mg)	Habitat	Elevation above sea level (m)
1. <i>A. umbellata</i>	12-50	0.11	Forest zone	600-1500
2. <i>A. rotundifolia</i>	8-27	0.15-0.85	Forest & alpine	800-4267
3. <i>A. septentrionalis</i>	14-20	1.1	Alpine	3000-5182
4. <i>A. thomsonii</i>	7-22	0.39	Alpine	2438-3962
5. <i>A. aizoon</i>	6-14	0.57-1.7	Upper forest & alpine	1981-3658
6. <i>A. himalaica</i>	4-8	1.41-1.43	Forest	1800-3200
7. <i>A. foliosa</i>	3-6	1.3	Forest	2200-3200
8. <i>A. lanuginosa</i>	3-5	1.0-1.4	Forest	1300-2900
9. <i>A. studiosorum</i>	2-3	0.9-1.9	Forest & alpine	2438-4267
10. <i>A. duthieana</i>	2-3	0.3-0.5	Forest & alpine	2438-3962
11. <i>A. harrissii</i>	2-3	0.7	Upper forest	2134-3300
12. <i>A. muscoidea</i>	2-3	0.80-0.83	Alpine	3200-5182
13. <i>A. mucronifolia</i>	2	0.70-0.80	Alpine	3300-4700
14. <i>A. sempervivoides</i>	1-2	1.3-1.4	Alpine	3200-4267
15. <i>A. robusta</i>	1-2	1.0-1.1	Alpine	2438-5182
16. <i>A. baltistanica</i>	1-2	0.65-0.69	Alpine	3000-4877
17. <i>A. villosissima</i>	1-2	1.05-2.7	Alpine	3500-4572

Table 1. — The seed number and weight in relation to the habitat in *Androsace*.

- Testa morphology: the study of the seed testa was by means of a Scanning Electron Microscope. The scanning was done mostly at the palynology Unit (Reading University, England) using a JEOL JSM 35 R Scanner and the palynology Unit (Royal Botanic Garden, Edinburgh, Scotland) using a JEOL JSM 2 at 15-35 Kv. All measurements are in millimetres or microns. The drawings are reproductions from photomicrographs obtained by the Scanning Electron Microscope.

Results and discussion

The seed in *Androsace* may be described as follows: Seeds 1-50 per capsule, small, from 0.8-3.0 mm long, ovoid to oblong or subglobose, often angular. Testa generally vesiculose, colour variable from brown to brownish-black. Hilum obscure. Weight 0.11-2.7 mg.

The seed shape and testa was found to be of some diagnostic value; however the seed number and weight was useful in differentiating between groups of species (key to species).

Seeds of all species studied had a vesiculose seed, except for *A. russellii* Y. Nasir, which had a subglabrous testa (i.e. minutely reticulate).

In *Androsace* there is a reductional trend in seed number which is correlated with the habit. The same has been demonstrated earlier for the genus *Dionysia* Fenzl by MELCHIOR (1943) and WENDELBO (1961). Species with a vigorous growth as *A. himalaica* Knuth, *A. foliosa* Duby, *A. lanuginosa* Wall., have a higher seed count (3-8) than species that are slender or assume a compact form (Table 1, species Nos. 12-17). The highest seed number is to be found in those species, namely, *A. umbellata* (Lour.) Merrill, *A. rotundifolia* Hardw., and *A. thomsonii* (Watt) Y. Nasir, in which the leaf is differentiated into a lamina and a petiole. *A. septentrionalis* L. is an exception as its leaves are not differentiated; the high seed count here (14-20) may possibly be due to the species annual habit. It is noteworthy that the species with a leaf differentiation have comparatively lighter seeds (0.11-0.85 mg) than most species with fewer seeds (i.e. 1-3 in number). HARPER & al. (1970) mention that the seed size can only be increased at the expense of seed number and vice versa. A perusal of the table indicates that this may not always be the case; few-seeded species as *A. duthieana* Knuth, *A. baltistanica* Y. Nasir and *A. mucronifolia* Duby, may have a similar seed weight to the many-seeded species. There is thus no definite correlation between seed number and weight in *Androsace*, at least in the species studied. Variation in seed size (in terms of seed weight) may depend upon various factors such as those of moisture and aeration in dry arid zones, ecological conditions for seed germination and establishment (HARPER & al., 1965; STEBBINS, 1974) and the density and stress encountered in plant populations of the same or different species (HARPER & al., 1970).

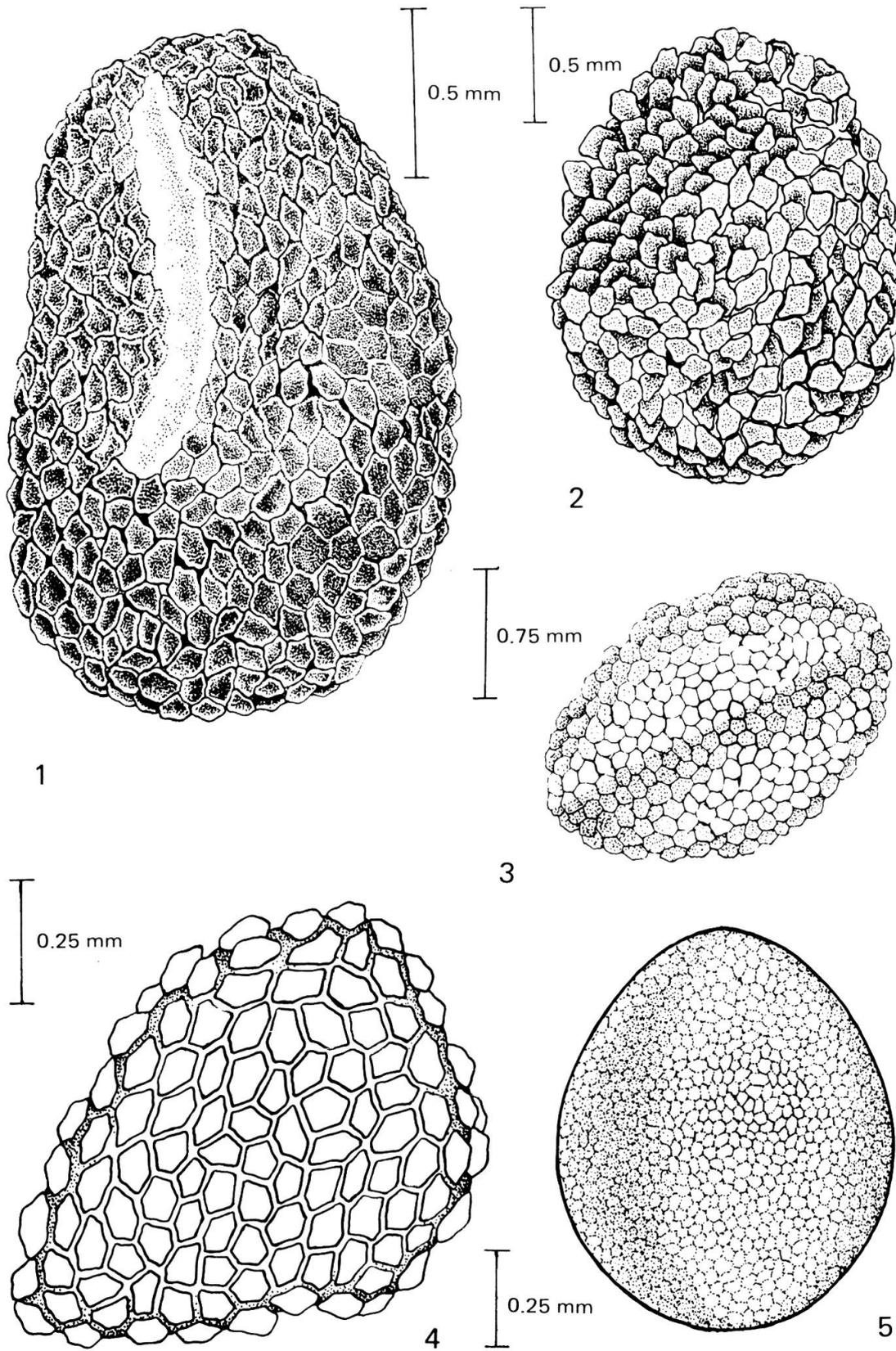


Fig. 1-5. — Seeds in *Androsace*.

1, *A. villosissima* (Aitchison 925), note prominent hilum scar; 2, *A. foliosa* (R. R. Stewart 3950); 3, *A. septentrionalis* (Duthie 13869); 4, *A. umbellata* (Stainton 5260); 5, *A. russellii* (R. S. Russell 1139), note testa minutely reticulate.

Key to the species of *Androsace* found in Pakistan

- 1. Number of seeds per capsule (6-)10-50 2
- 1a. Number of seeds per capsule 8 or fewer 4
- 2. Seeds 6-14 per capsule, (1.5-)2-3 mm long **A. aizoon**
- 2a. Seeds (7-)12-50 per capsule, 1-1.5 mm long 3
- 3. Average seed weight 1.1. mg **A. septentrionalis**
- 3a. Average seed weight 0.11-0.85 mg **A. rotundifolia**
- 4. Seeds 1-3 per capsule 5
- 4a. Seeds 3-8 per capsule **A. foliosa, A. lanuginosa, A. himalaica, A. hazarica**
- 5. Vesicles 16-20 µm long **A. sempervivoides**
- 5a. Vesicles 20-66.5 µm long 6
- 6. Seeds weight 0.9-2.7 mg **A. villosissima, A. robusta, A. studiosorum**
- 6a. Seed weight 0.5-0.83 mg **A. duthieana, A. baltistanica, A. muscoidea, A. mucronifolia, A. harrissii**

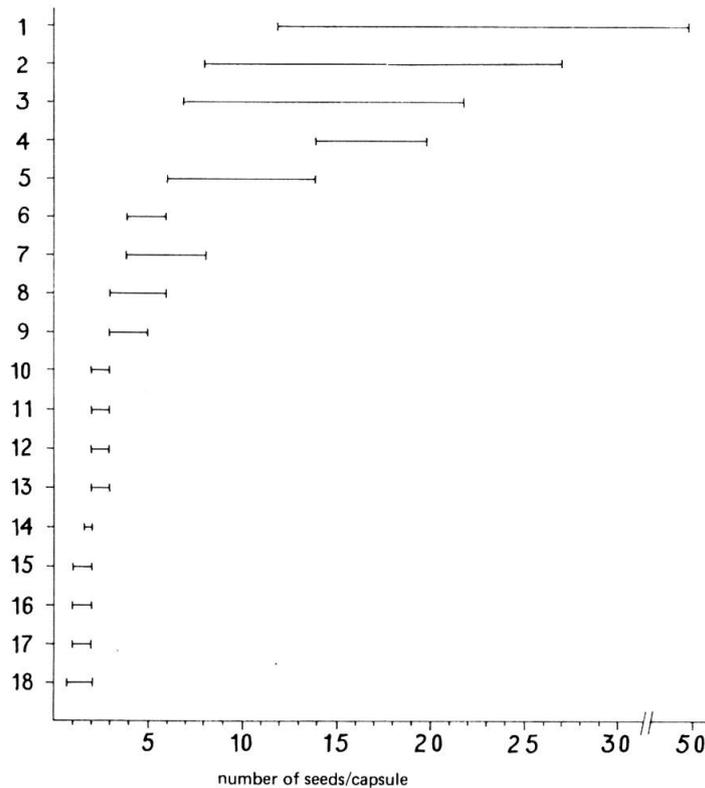


Fig. 6. — Seed number in *Androsace*.

Index to vertical numbers: 1, *A. umbellata*; 2, *A. rotundifolia*; 3, *A. thomsonii*; 4, *A. septentrionalis*; 5, *A. aizoon*; 6, *A. hazarica*; 7, *A. himalaica*; 8, *A. foliosa*; 9, *A. lanuginosa*; 10, *A. studiosorum*; 11, *A. duthieana*; 12, *A. harrissii*; 13, *A. muscoidea*; 14, *A. mucronifolia*; 15, *A. sempervivoides*; 16, *A. robusta*; 17, *A. villosissima*; 18, *A. russellii*.

Appendix 1. — Seed number in *Androsace*

Species	Voucher specimen	No. of seeds/capsule
1. <i>A. aizoon</i>	Tilel vy., R. R. & I. D. Stewart 18570 (GH) Brir, M. A. Siddiqi & A. Rahman s.n. (RAW) Rupal nala, Astor, Duthie s.n. (WU) Sonamarg, Kashmir, R. R. Stewart 6863 (S)	9, 10, 11 10, 14 6, 8, 12 10, 11, 14
2. <i>A. baltistanica</i>	Satpura pass, R. R. Stewart 20216A (RAW) Thalle La, R. R. Stewart 20637 (RAW)	2, 2 1, 2
3. <i>A. duthieana</i>	Satpura pass, R. R. & I. D. Stewart 18697 (RAW)	2, 3
4. <i>A. foliosa</i>	Changla Gali, R. R. & I. D. Stewart 3932 (RAW) Changla, Y. Nasir 7872 (RAW) Rd. to Sharan, Y. Nasir & W. Meijer 8836 (RAW)	4, 5, 6 3, 5, 6 4, 5
5. <i>A. harrissii</i>	Brir, Chitral, Bowes Lyon 693 (RAW)	2, 3
6. <i>A. hazarica</i>	Dunga Gali, R. R. Stewart 29139 (RAW)	4, 5, 6
7. <i>A. himalaica</i>	Above Chapri, Kurram, M. A. Siddiqi & Y. Nasir 6568 (RAW) Saryara, Khyber Agency, N. Khan s.n. (PPFI-B)	4, 5 4, 6, 8
8. <i>A. lanuginosa</i>	Mussoorie, C. Mohini s.n. (PAN) Kulu, Cooper 5602 (RAW)	4, 5 3, 4
9. <i>A. mucronifolia</i>	Sho nala, Swat, A. R. Beg 16 (RAW) Saiful Maluk, Kaghan, Ch. Shaukat Ali 98 (RAW)	2, 3 2, 3
10. <i>A. muscoidea</i>	Babusar, Kaghan, M. H. Khan 8969 (RAW)	2, 3
11. <i>A. robusta</i>	Mashoo nala, Ladak, Ludlow & Sherriff 8438 (RAW)	1, 2
12. <i>A. rotundifolia</i>	Shalozan, Kurram, M. A. Siddiqi & Y. Nasir 6599 (RAW) Kund, Hazara, Y. & I. Nasir 7724 (RAW) Makai village, M. A. Siddiqi & Y. Nasir 4356 (RAW) Miandam, Swat, Y. Nasir & E. J. Ecker 7511 (RAW) Patriata, Muree, Y. Nasir & Nazir 8478 W. Himalaya, Jaeschke 113 (WU) Chorwan-Kamri, Kashmir, R. R. & I. D. Stewart 21630 (RAW) Tendi, Lahul, Cooper 5374 (RAW) Zoji La, Kashmir, R. R. Stewart 21263 (RAW) Babusar, Kaghan, Sultanul Abedin 9043 (KUH)	18, 19 18, 19, 20 12, 13, 15 9, 10, 11, 12 17, 18, 19 16, 26 12, 17, 20 12, 14, 16 19, 20, 21, 27 11, 12, 13
13. <i>A. russellii</i>	Buri Harar, Gilgit, Scott Russell 1139 (BM)	1, 2
14. <i>A. sempervivoides</i>	Kasmir, Falconer s.n. (K)	1, 2
15. <i>A. septentrionalis</i>	Shigar nala, Baltistan, W. Koelz 9706 (GH) Chatpani nala, Duthie 13869 (E) Chantir Gah, Gilgit, F. Schmid 2123 (RAW)	14, 15 18, 20 16, 17, 18
15. <i>A. studiosorum</i>	Above Tragbal, R. R. Stewart 19484 (RAW) Cult., RBG., Edinb. Ascen. No. 693218 (E)	2, 3 2, 3
16. <i>A. thomsonii</i>	Skardu-Gol, E. Nasir & G. L. Webster 5861 (RAW) Sine loc., O. Polunin 6325 (BG) Skardu, R. R. Stewart 20448 (RAW)	7, 10, 13 18, 21, 22 11, 12, 13
17. <i>A. umbellata</i>	W. Nepal, Stainton 5260 (E) Upper Gangetic Plain, T. Thomson s.n. (K) Near Karot, Rawalpindi, M. A. Siddiqi & Y. Nasir 6678 (RAW) Jhewra Kahuta-Karor, Y. Nasir & Khan s.n. (RAW)	12, 14, 15 40, 43, 50 18, 22, 24 28, 30, 33, 37
18. <i>A. villosissima</i>	Kurram Valley, Aitchison 925 in 1879 (GH) Ascent to Mt. Sikaram, Aitchison 97 (K)	1, 2 1

Appendix 2. — Seed weight in *Androsace*

Species	Voucher specimen	Seed weight (mg)
1. <i>A. aizoon</i>	Rupal nala, Astor, Duthie s.n. (WU) Minimarg, Kashmir, R. R. & I. D. Stewart 19199 (RAW) Tilel valley, Kashmir, R. R. & I. D. Stewart 18570 (GH)	1.70 0.57 1.50
2. <i>A. baltistanica</i>	Satpura pass, Baltistan, R. R. Stewart 20216 (RAW) Babusar, Kaghan, M. A. Siddiqi & Y. Nasir 2745 (RAW)	0.65 0.69
3. <i>A. duthieana</i>	Kamri pass, Kashmir, R. R. & I. D. Stewart 18697 (RAW)	0.3-0.5

4. <i>A. foliosa</i>	Changla Gali, R. R. & I. D. Stewart 3932 (RAW)	1.32
5. <i>A. harrissii</i>	Brir, Chitral, Bowes Lyon 693 (RAW)	0.7
6. <i>A. hazarica</i>	Dunga Gali, Hazara, R. R. Stewart 29139 (RAW)	0.35
	Sudhan Gali-Ganga, Kashmir, Shazad & Maqsood 693 (ISL)	0.37
7. <i>A. himalaica</i>	Above Chapri, Kurram, M. A. Siddiqi & Y. Nasir 6568 (RAW)	1.43
	Sandapal, Tirah, Khyber Agency, N. Khan s.n. (PPFI-B)	1.41
8. <i>A. lanuginosa</i>	Mussoorie, C. Mohini s.n. (PAN)	1.40
	Kulu, Cooper 5602 (RAW)	1.0
9. <i>A. mucronifolia</i>	Sho nala, Swat, A. R. Beg 16 (RAW)	0.7
	Masjid Gali, Kashmir, R. R. & I. D. Stewart 18426 (RAW)	0.8
10. <i>A. muscoidea</i>	Babusar, Kaghan, M. H. Khan 8969 (RAW)	0.8
	Naran, Kaghan, Ch. Shaukat Ali s.n. (RAW)	0.83
11. <i>A. robusta</i>	Mashoo nala, Ladak, Ludlow & Sherriff 8438 (RAW)	1.0
	Mulbekh, Ladak, Hartmann 7780 (G)	1.1
12. <i>A. rotundifolia</i>	Above Miandam, Swat, Y. Nasir & E. J. Ecker 7511 (RAW)	0.85
	Patriata, Murree, Y. Nasir & Nazir 8478 (RAW)	0.20
	Dudnial, Kashmir, Ludlow & Sherriff 8262 (E)	0.23
	Above Makai, Kurram, M. A. Siddiqi & Y. Nasir 4356 (RAW)	0.41
subsp. <i>glandulosa</i>	Zoji La, Kashmir, R. R. Stewart 21263 (RAW)	0.25
	Chorwan, Kamri, Kashmir, R. R. & I. D. Stewart 21630 (RAW)	0.24
	Tendi, Lahul, Cooper 5374 (RAW)	0.15, 0.57
	W. Himalaya, Jaeschke 113 (WU)	0.53
13. <i>A. sempervivoides</i>	Kashmir, Falconer s.n. in 1838 (K)	1.30
	Gilgit, M. B. Zaman 159 (PPFI-M)	1.40
14. <i>A. septentrionalis</i>	Chatpani nala, Kashmir, Duthie 13869 (E)	1.1
15. <i>A. studiosorum</i>	Rajdhangan pass, Kashmir, R. R. Stewart 19484 (RAW)	0.9
	Cult., RBG., Edinburgh, Ascen. No. 693218 (E)	1.9
16. <i>A. thomsonii</i>	Skardu-Gol, Baltistan, E. Nasir & G. L. Webster 5861 (RAW)	0.39
17. <i>A. umbellata</i>	W. Nepal, Stainton 52600 (E)	0.11
18. <i>A. villosissima</i>	Ascent Mt. Sikaram, Aitchison 925 (K)	2.70
	Ascent Mt. Sikaram, Aitchison 925 (GH)	1.05, 1.3

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