A Revision of the Genus Diapensia, with Special Reference to the Sino-himalayan Species.

BY

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With Plate CCXXII and Three Figures in the Text.

The several species of *Diapensia* now fully known appear to fall into two distinct groups, characterised by peculiarities both of structure and of geographical distribution.

The genotype, *Diapensia lapponica*, Linn., stands alone in the first of these. The structural characters which distinguish it are two in number: the flowers are borne upon well developed peduncles which, prior to fertilisation, are generally from 1–1.5 cm. in length; while the androecium is represented solely by the five perfect stamens of its outer whorl, staminodes being altogether lacking. As regards its distribution, *D. lapponica* is remarkable in having an arctic-circumpolar range, extending from N. America through northern Europe to N. Asia and Japan. It is not known to occur in the Sino-himalayan area.

The second group includes the remaining species.* In all of these the flowers are practically sessile, the peduncles remaining suppressed unless fertilisation takes place, when they subsequently elongate during the maturation of the fruit; while, in addition to the outer whorl of perfect stamens, the androecium normally possesses an inner whorl of small, very simple staminodes, which are borne near the middle of the corolla-tube. In contradistinction to the remarkably wide distribution of *D. lapponica*, this group of species is confined to the Sino-himalayan alps—a comparatively compact and circumscribed area and one from which, as has already been mentioned, *D. lapponica* appears to be absent.

* Though the flowers of *Diapensia Wardii*, W. E. Ev. are as yet unknown, it seems certainly to belong to this group.

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On account of their structural and distributional peculiarities these two groups seem worthy of sectional rank within the genus *Diapensia* and may be defined and named as follows :—

SECTIO 1. *Lapponicae.* Flores sub anthesi normaliter pedunculis 1–1.5 cm. longis suffulti ; staminodia nulla. Species unica (*D. lapponica,* Linn.) Americae borealis, Europae borealis, Asiae borealis et Ins. Japoniae incola.

SECTIO 2. *Himalaicae.* Flores sub anthesi subsessiles, pedunculi tantum fructu maturescente elongantes ; staminodia normaliter 5 parva simplicia corollae tubum medium versus affixa, in speciminibus nonnullis numero reducta vel 0. Species tres, montibus sino-himalaicis circumscripti.

It is with this second Section that the present paper is principally concerned.

THE LEAF AND FLOWER ANATOMY OF THE HIMALAICAE.

The forms constituting the Section *Himalaicae* are, as might be expected, very closely related *inter se.* Hitherto rather scanty material has been available for study and the diagnoses of some of the proposed species have consequently been based on the examination of a limited number of specimens from a single locality. It has been the writer's privilege to work out the gatherings contained in the collections made by Messrs. George Forrest, Reginald Farrer and F. Kingdon Ward during their more recent botanical explorations, and now preserved in the Herbarium of the Royal Botanic Garden, Edinburgh, and elsewhere. In particular the long and numerous suites of specimens sent home by Mr. Forrest throw much additional light on the value of those characters previously regarded as specific. The chief object of this paper is to put on record some of the conclusions arrived at as a result of the examination of this most copious material, which has allowed of the dissection of some 250 flowers as well as of unstinted foliage, and to readjust the limits of the species here included in the *Himalaicae* in accordance with the results obtained.

The Section embraces five described species. In one of these, *D. Wardii,* W. E. Ev., the flowers are unknown, so that only four, namely *D. himalaica,* Hook. f. et Thoms., *D. purpurea,* Diels, *D. Bulleyana,* Forrest ex Diels and *D. acutifolia,* Hand.-Mzt. can here be discussed.

The shape of the leaf-apex, the presence or absence of stomata upon the upper surface of the leaf, the colour of the corolla and the length of its tube, the form of the filaments, the presence or absence of staminodia and the length of the style are all characters which have been used in separating the supposed species. It may, therefore, be best to review some of these points before considering the species themselves.

1. THE STOMATA OF THE LEAVES. In his description of *Diapensia purpurea** Dr. L. Diels seems first to have drawn attention to the specific value of the arrangement of the leaf-stomata in this genus. He there points out that, whereas in *D. himalaica*, Hook. f. et Thoms. both leaf-surfaces bear copious stomata, these are entirely confined to the under surface in *D. purpurea*.

While this is by no means the only case in which stomatal distribution has been regarded as specific in character† the writer was at first inclined to consider it of somewhat doubtful value in the present instance. To test the matter, therefore, a careful examination of several hundred leaves was made, the material being taken from 29 distinct gatherings and including all the described species of the Section. As a result it was found that the use of the character seems to be here quite sound, not a single leaf having been met with which showed an intermediate condition between the possession, on the one hand, of very numerous stomata on both leaf-surfaces and, on the other, their complete absence from the upper surface. Moreover the leaves of any given plant, and also of all plants in any given gathering, were invariably alike as regards the distribution of their stomata and it seems certain that *D. himalaica*, Hook. f. et Thoms, can always be separated from the very closely allied *D. purpurea*, Diels by this difference alone. In every example of the former plant which I have seen, including type specimens from Sikkim kindly lent from the Kew Herbarium and others from Tibet, Burma and Yunnan, the stomata of the upper leaf-surface were readily observable, even with a pocket lens, and were always numerous; in the latter species they were constantly and entirely absent. Unfortunately, as will be shown later, what was taken by Dr. Diels to be a second and perhaps better distinguishing feature of *D. himalaica*, namely its supposed lack of staminodia, will have to be discarded, so that the only clearly defined and concrete character which can now be pointed to as differentiating it from *D. purpurea* lies in the distribution of the leaf-stomata. There are, however, other less easily expressed and less definite characteristics of *D. himalaica* which almost invariably enable one to recognise it quite apart from the stomata such, for example, as its usually more slender stems with somewhat smaller leaves of rather less coriaceous texture which, almost without exception, have the upper surface of the lamina smooth and glossy, not dull and very finely papillose as is the case in *D. purpurea*.

It is of interest to note that, so far as there is any available information on the matter, *D. himalaica* seems to prefer a more moist environment than does *D. purpurea*. Of its Sikkim habitats Sir

* Fedde, Repert., x (April 1912), p. 419.

† In the genus *Soldanella*, for instance, a quite similar arrangement of the leaf stomata has been found to be specific. In *S. minima*, Hoppe the stomata are confined to the under surface of the leaf, while in *S. austriaca*, Vierh. they are developed upon both surfaces.

J. D. Hooker writes* :—" it is seen on wet rocks and banks in the humid subalpine valleys, at elevations of 10–14,000 feet ; it does not however inhabit either the outer ranges or the drier interior valleys ". Again, Mr. Reginald Farrer, in referring to material collected by him in Upper Burma, draws attention to the same peculiarity.† " It likes ", he states, " the wetter ledges of the bluff, while the Diapensia [purpurea] is everywhere on it." While it thus appears possible that the presence or absence of stomata upon the upper surface of the leaf bears some relation to the environment best suited to the species concerned and may, indeed, have arisen through environmental factors, what it is here desired to emphasize is the fact that this difference in stomatal distribution has clearly become a fixed character backed by certain other less pronounced peculiarities and may, therefore, be confidently regarded as of specific value, fixity being undoubtedly the prime argument in favour of any feature in this respect.

As for the two remaining forms, *D. Bulleyana*, Forrest ex Diels and *D. acutifolia*, Hand.-Mzt., the leaves in the former so exactly correspond to those of *D. purpurea* in every respect that it can only, in the absence of any distinguishing feature other than the colour of the corolla, be regarded as a yellow-flowered form of that species. In *D. acutifolia* the stomatal distribution is quite similar to that of *D. himalaica* and the leaves have, in addition, the same smooth and glossy surface, differing only in their more apiculate tips ; as will be shown later, the structure of the flowers is identical in the two forms so that *D. acutifolia* seems to be but a variety of *D. himalaica* with exceptionally strongly apiculate leaves.

2. THE COLOUR OF THE COROLLA AND THE LENGTH OF ITS TUBE. In the published descriptions of *Diapensia himalaica*, Hook. f. et Thoms. and *D. purpurea*, Diels the flowers are called purple. On the other hand, those of the Yunnan plant forming the type of *D. Bulleyana*, Forrest ex Diels are referred to as " canary-yellow ", while the corollas in the specimens upon which *D. acutifolia*, Hand.-Mzt. is based appear to have been, in some cases at least, white.‡

The flowers examined during the preparation of this paper numbered about 250 and were taken from 38 separate gatherings. In about half of these gatherings, in 20 to be exact, the corollas had been distinctly rose or rose-purple ; in 10 cases they had been white or very pale yellow, and in the remaining 8 cases primrose or even canary-yellow. It seems probable, however, that plants with white or yellow blooms are actually less frequently met with than would appear from these

* Hook. Kew Journ., ix (1857), p. 372.

† On the ticket accompanying the specimens in question, Farrer no. 1553, in Herb. Edin.

‡ Anzeig. Akad. Wiss. Wien, Sonderabd. No. 19 (1923), p. 3.

figures since collectors, once the commoner forms have been obtained, naturally tend to select those that are rarer, rather than indulge in mere repetition.

Considering first the plants having stomata only on the under surface of the leaves, it would seem that the colour of the flowers in undisputed examples of *D. purpurea*, Diels is more accurately described as rose rather than purple and that the corolla-tube, the length of which in the type specimens was from 4 to 5 mm.,* is subject to very great variation in this respect. These points are made apparent by a consideration, for example, of the fine series of specimens of the species obtained by Mr. Forrest, along with his careful field notes in which he has always taken pains to record accurately the tint of the blooms. The data respecting six of his numbers are as follows:—

Forrest no.	Colour of corolla.	Average length of corolla-tube in mm.	Flowers dissected.
14,010	Rose-pink	11.0	10
14,220	Bright rose-pink	10.6	10
12,538	Deep rose-purple	8.8	10
19,115	Rose-red	5.8	10
14,073	Rose-pink	4.9	10
16,494	Rose	3.7	10

It may be added that, striking as is the long range of variability shown to occur in the corolla-tube by the above averages, an almost better idea of the instability of this supposed character may be had from the fact that the writer has dissected a fully developed corolla the tube of which was only 3 mm. long whereas, in another, it was no less than 13.5 mm. in length.

An attempt was made to separate the white and yellow-flowered forms showing a stomatal distribution similar to that of *D. purpurea* in order to ascertain whether any permanent structural peculiarities could be found to accompany the difference in colour of the flowers. No clear line of demarcation could, however, be drawn between white and yellow which, as can be seen from the collectors' notes tabulated below, are completely linked by intermediate shades. It will also be observed that the corolla-tube in the forms in question shows the same great variation in length as occurs in typical *D. purpurea*, and further that this variation bears no relation to the colour of the flowers.

* Fedde, Repert., x (1912), p. 419.

Collector and no.	Colour of corolla.	Average length of corolla-tube in mm.	Flowers dissected.
Forrest 17,983	V. pale primrose	9.3	3
,, 6,758	Primrose-yellow	8.1	5
,, 1,853	Canary-yellow	7.8	3
Ward 3,187	White	6.0	10
Farrer 932	White	5.5	5
,, 1,584	Primrose-yellow	4.0	10
Forrest 14,017	White	4.0	10
,, 12,756	Very pale yellow	3.6	8
,, 19,130	Creamy yellow	3.5	10
Ward 429	White	3.4	10

As regards the type specimens of *D. Bulleyana*, Forrest ex Diels (Forrest 1,853), only three corollas could be spared for dissection. The measurements of the tubes of these were, respectively, 7.5 mm., 7.75 mm. and 8.0 mm. From this it seems reasonable to infer that the average length would be somewhat under 8 mm., or practically the same as that now ascertained in the case of *D. purpurea*, Diels, in which the average for 69 flowers taken from 7 gatherings was found to be 7.6 mm. The view already expressed, that *D. Bulleyana* can only be regarded as a form of *D. purpurea* is thus confirmed; indeed it appears clear that all these plants with white, yellowish or yellow blooms and leaves in which the stomata are restricted to the under side should be included in that species.

Of those plants having stomata upon both surfaces of the leaves a much less extensive series of specimens was available for study. Sufficient data can, however, be tabulated in the case of undoubted examples of *D. himalaica*, Hook. f. et Thoms. to make a fair comparison with *D. purpurea*, Diels possible. It will be seen that the length of the corolla-tube is again subject to much variation, proving conclusively that such measurements are, in *Diapensia*, of no specific significance.

Collector and no.	Colour of corolla.	Average length of corolla-tube in mm.	Flowers dissected.
Cave 2,390	Purple	7.4	10
Ward 5,840	Salmony pink	7.0	3
,, 580	Rose-purple	6.0	3
W. W. Smith 3,442	Rose-purple	5.0	8
Farrer 1,553	Lively lilac	4.0	2
Ward 5,769	Deep rose	3.6	5

A further point of interest is that, amongst the material having, as regards its stomatal distribution, the leaf-character of *D. himalaica*, there occurred plants in which the corolla was white (Hand.-Mzt. 8,935) or " sulphur-yellow " (Ward 5,841). It would therefore seem that colour forms are found in this species also, corresponding to those which exist in *D. purpurea*.

From the facts brought to light, then, it appears certain that neither the colour of the corolla nor the length of its tube is specific in the *Himalaicae*.

3. THE STAMENS AND STAMINODES. As has been shown by Dr. L. Diels,* the androecium in the Family *Diapensiaceae* may in every case be regarded as a modified diplostemonous one. Its outer whorl consists of five functional stamens, while usually an equal number of staminodes represent the inner; sometimes these staminodes are reduced to very simple, almost rudimentary structures and in a few cases they are completely lost.

The stamens in *Diapensia* are inserted around the margin of the corolla-tube, alternating with its lobes. Their filaments, in the forms comprising the Section *Himalaicae*, vary considerably in length and are not infrequently almost suppressed while, at their point of insertion upon the tube of the corolla, they may be more or less distinctly dilated or auriculate. It has been suggested that the presence or absence of this basal wing is of diagnostic value.†

Below is given a tabulated digest of the results obtained from an examination of the filaments of 158 flowers. For purposes of comparison the same grouping is again adopted as was used when discussing the corolla.

A. Undoubted examples of *D. purpurea*, Diels:—

Forrest no.	Average length of corolla-tube in mm.	Average length of filaments in mm.	Auriculate base.	No. of flowers examined.
14,010	11.0	.74	Present or not	10
14,220	10.6	1.07	Slight	10
12,538	8.8	1.07	Slight	10
19,115	5.8	1.64	Very slight	10
14,073	4.9	.86	Present or not	10
16,494	3.7	.70	Slight	10

* Diapensiaceen-Studien, Engl. Bot. Jahrb., l, Suppl-Bd. (1914), p. 313.

† Of *D. purpurea* it is stated in the diagnosis: " differt . . . a *D. Bulleyana* . . . filamentis insertione vix auriculato-dilatatis ". Fedde, Repert., x (1912), p. 419.

B. White and yellow-flowered forms of *D. purpurea*, Diels :—

Collector and no.	Average length of corolla-tube in mm.	Average length of filaments in mm.	Auriculate base.	No. of flowers examined.
Forrest 15,498	10.3	1.97	Present	12
Ward 3,187	6.0	.98	Wanting	10
Forrest 14,072	4.2	.54	Present	15
Farrer 1,584	4.0	.48	Present	10
Forrest 19,130	3.5	.35	Very marked	10
Ward 429	3.4	.50	Present	10

C. Undoubted examples of *D. himalaica*, Hook.f. et Thoms. :—

Collector and no.	Average length of corolla-tube in mm.	Average length of filaments in mm.	Auriculate base.	No. of flowers examined.
Cave 2,390	7.4	2.10	Slight	10
Ward 5,840	7.0	1.75	Slight	3
Ward 580	6.0	1.50	Very slight	3
W. W. Sm. 3,442	5.0	.18	Present	8
Farrer 1,553	4.0	.50	Very marked	2
Ward 5,769	3.6	1.05	Slight	5

Despite occasional exceptions the above data show that in general the length of the filaments and the extent to which they appear dilated at the base bear a distinct though rather inconstant relationship to the length of the tube of the corolla. As might almost be expected, flowers possessing a long corolla-tube generally have stamens with well-developed filaments the bases of which, owing to their width, are not markedly auriculate ; while in any gathering, or even in any individual flower showing a shortening of the tube the filaments in

most cases exhibit a somewhat corresponding reduction, usually accompanied by an apparent increase in size of the basal wing. The latter feature is, however, more apparent than real and results rather from the narrowing of the base of the filament proper than from any actual increase in size of its expanded attachment to the corolla (fig. 1). It will be seen, moreover, that these relationships are brought out more or less clearly in all three groups tabulated and that the measurements and development of the filaments in each of these groups are of much the same kind and extent. Any hope of finding in these organs a means of separating the species is thus disposed of.

There remains, however, one peculiarity of the stamens not yet touched upon which at first sight appears significant. The anthers, as shown in fig. 1, are differently placed in relation to one another in long as compared with short stamens. In the former they diverge markedly in their lower part, whereas in the latter they tend to lie practically parallel throughout their entire length. The drawings given were made from extreme cases, however, and when the complete

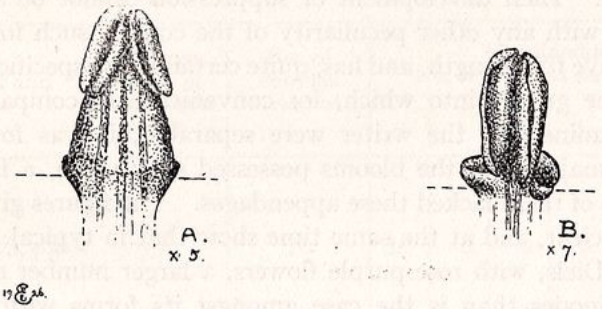

Fig. 1. Stamens of *Diapensia purpurea*, Diels.

A. A stamen with well developed filament, × 5. The anthers are markedly divergent and the filament merges gradually in and obscures the expanded base. Forrest 15498.

B. A stamen with greatly reduced filament, × 7. The anthers lie parallel and the expanded base is conspicuous. Forrest 14017.

series of specimens examined is taken into consideration it appears certain that this difference makes its appearance exactly in proportion to the degree of development or suppression of the filament. Where that organ is long and broad the basi-fixed anthers become in consequence divergent in their lower part; where the filament is suppressed their point of attachment is narrower and their bases lie more closely together. There would not seem then, to be any character of specific value discoverable in the stamens.

Staminodes appear to be normally present in all those forms now under discussion. They are here exceedingly simple structures, of small size and borne upon the tube of the corolla only slightly above its middle. In consequence of this they are, when present, very liable to be overlooked, as they undoubtedly have been in the case of *Diapensia himalaica*, Hook. f. et Thoms. They may be described

as somewhat spur-like projections, more or less conical in outline and with a tendency at the base to be a little prolonged downwards upon the corolla-tube at their point of insertion.*

That these staminodia are truly homologous with an inner whorl of the androecium is occasionally demonstrated by their reversion to normal, functional stamens. Flowers showing this peculiarity have been observed in *Diapensia purpurea*, Diels, in the white and yellow flowered forms of that species, and in *D. himalaica*, Hook.f. et Thoms.; but in no case was more than one of the five staminodes so altered, the others remaining quite normal in structure. In every example seen the reverted staminode arose at a higher level than that occupied by those that were unaltered being, in fact, in line with the stamens of the outer whorl, from which it differed only in its position opposite a lobe of the corolla.

Throughout the *Himalaicae*, as has just been indicated, staminodes are normally present; not infrequently, however, flowers are met with in which they are either entirely wanting or, much more rarely, reduced in number. Their development or suppression cannot be constantly correlated with any other peculiarity of the corolla, such for instance as its relative tube-length, and has, quite certainly, no specific meaning. In all three groups into which, for convenience of comparison, the plants examined by the writer were separated, it was found that, while the majority of the blooms possessed staminodia, a fairly high percentage of them lacked these appendages. The figures given below make this clear, and at the same time show that in typical *Diapensia purpurea*, Diels, with rose-purple flowers, a larger number of corollas bear staminodes than is the case amongst its forms with white or yellow blooms.

A. Undoubted examples of *D. purpurea*, Diels:—

Forrest no.	Average length of corolla-tube in mm.	No. of corollas dissected.	Staminodia. No. of corollas having:—					
			0	1	2	3	4	5
14,010	11.0	10	5	0	1	1	0	3
14,220	10.6	10	0	0	1	0	1	8
25,722	7.4	10	0	0	0	0	0	10
14,015	6.3	10	0	0	0	0	0	10
14,073	4.9	10	0	0	0	0	0	10
16,494	3.7	10	0	0	0	0	0	10
Approximate percentage			8.5	0	3.5	1.5	1.5	85

* A staminode of *D. purpurea*, Diels is well figured in Engl. Bot. Jahrb., I, Suppl.-Bd. (1914), p. 315, fig. 7F.

B. White and yellow-flowered forms of *D. purpurea*, Diels:—

Forrest no.	Average length of corolla-tube in mm.	No. of corollas dissected.	Staminodia. No. of corollas having:—					
			0	1	2	3	4	5
15,498	10.3	10	0	0	0	0	0	10
6,758	8.1	5	0	0	0	0	0	5
15,677	5.0	5	0	0	0	0	0	5
14,017	4.0	10	9	1	0	0	0	0
12,756	3.6	8	4	1	1	0	1	1
19,130	3.5	10	0	0	0	0	0	10
Approximate percentage			27.5	4	2	0	2	64.5

C. Undoubted examples of *D. himalaica*, Hook.f. et Thoms.:—

Collector and no.	Average length of corolla-tube in mm.	No. of corollas dissected.	Staminodia. No. of corollas having:—					
			0	1	2	3	4	5
Cave 2,390	7.4	10	10	0	0	0	0	0
Ward 5,840	7.0	2	0	0	0	0	0	2
J. D. Hooker s. no.	6.0	3	0	0	0	0	0	3
W. W. Smith 3,442	5.0	10	0	0	0	0	0	10
Farrer 1,553	4.0	2	2	0	0	0	0	0
Ward 5,769	3.6	4	0	0	0	0	0	4
Approximate percentage			38.5	0	0	0	0	61.5

As regards the plant described under the name *Diapensia acutifolia*, Hand.-Mzt.* and supposed to differ from *D. himalaica*, Hook.f. et Thoms. in possessing staminodia, it is now clear that no such difference does in fact exist. Dissection of flowers from a cotype and from specimens with identical leaf-characters collected in the same area by

* Anzeig, Akad. Wiss. Wien, Sonderabd. No. 19 (1923), p. 3.

Kingdon Ward (Ward 580), show them to be in every way similar to those of *D. himalaica* of which, therefore, as has already been pointed out, *D. acutifolia* would appear to be a variety with mucronate foliage.

4. THE STYLE. The general appearance of the gynaeceum which, with the exception of the small, papillose stigmatic surface, is entirely glabrous, is illustrated in fig. 2. As can be seen, the cylindrical style shows great variation in length ; in *Diapensia himalaica*, Hook. f. et Thoms. it has been found to range from 4 mm. to 11 mm., while in the typical form of *D. purpurea*, Diels it may be only 2 mm. in length or as much as 15.5 mm. No specific distinction can be found,

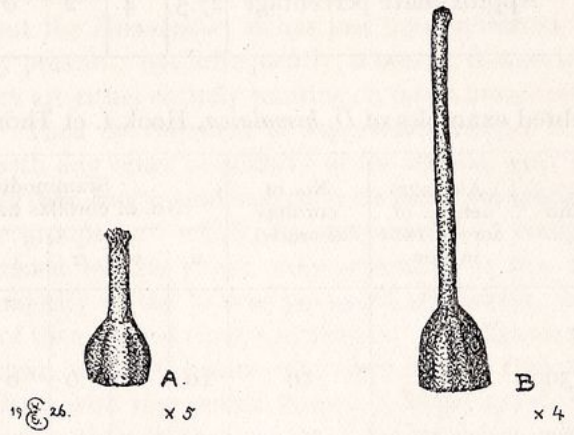

Fig. 2. Carpels of *Diapensia purpurea*, Diels.

A. A carpel with short style, × 5. Forrest 14,017.
B. A carpel with long style, × 4. Forrest 15,498.

therefore, in the length of the style, nor has any other characteristic feature been brought to light by the examination of the extensive material now available.

There would appear to be, in the case of *Diapensia purpurea*, Diels and its colour forms at least, an approach to heterostyly. The figures tabulated below bring out the fact that, on an average, flowers having a corolla-tube exceeding about 4 mm. in length possess also an exserted style, whereas in those with a shorter tube the style is included. The gradation from the longest to the shortest styles seen is quite continuous, however, and occasional flowers are to be met with in which the general rule does not hold. It is possible that the state of affairs found here may be regarded as a first step in the development of a more definite heterostyly in the genus *Diapensia ;* but even if that be not the case, there can be little doubt that cross-pollination is favoured by the arrangement at present in existence.

A. Undoubted examples of *D. purpurea*, Diels :—

Forrest no.	Average length of corolla-tube in mm.	Average length of style in mm.	Number of flowers examined.
14,010	11.0	13.4	10
12,538	8.8	9.7	10
19,115	5.8	7.6	10
14,073	4.9	6.4	10
16,494	3.7	3.7	10
25,723	3.4	2.3	2

B. White and yellow-flowered forms of *D. purpurea*, Diels :—

Collector and no.	Average length of corolla-tube in mm.	Average length of style in mm.	Number of flowers examined.
Forrest 17,983	9.3	10.8	3
,, 1,853	7.8	10.8	3
Ward 3,187	6.0	8.2	10
Farrer 932	5.5	6.2	5
,, 1,584	4.0	2.0	10
Forrest 12,756	3.6	2.0	8
,, 19,130	3.5	1.9	10
Ward 429	3.4	1.8	10

C. Undoubted examples of *D. himalaica*, Hook. f. et Thoms :—

Collector and no.	Average length of corolla-tube in mm.	Average length of style in mm.	Number of flowers examined.
Cave 2,390	7.4	9.4	10
Ward 5,840	7.0	5.0	3
,, 580	6.0	8.9	3
W. W. Smith 3,442	5.0	5.2	8
Farrer 1,553	4.0	4.6	2
Ward 5,769	3.6	4.8	5

5. ABNORMAL FLOWERS. Apart from those blooms showing reduction in the number of staminodia or their total suppression and those in which, as already described, one staminode is replaced by a functional stamen, a few other kinds of abnormality were met with and may be briefly referred to.

In *Diapensia purpurea*, Diels, of which 209 flowers were dissected, two were seen which, while otherwise normal, had a four-lobed corolla bearing four stamens and an equal number of staminodes; while four had the lobes, stamens and staminodes in whorls of six. The staminodia in one corolla were all exceptionally enlarged and bilobed; in a second they arose close to the mouth of the corolla-tube almost level with the stamens.

Only three abnormal blooms were observed in the case of *D. himalaica*, Hook. f. et Thoms. One of these had both the corolla-lobes and the stamens six in number and possessed no less than seven staminodes; while in another the stamens were replaced by five quite large, sterile, petaloid structures, the usual staminodia were wanting and the corolla-tube, which was five-cleft in its upper part, bore near its base a small but complete additional gynaeceum of which the style measured six mm. in length.

SUMMARY.

The outcome of the investigation of copious material from the systematic standpoint may be summarised as follows:—

1. Those species of the genus *Diapensia* inhabiting the Sino-himalayan alps are peculiar in possessing flowers which are practically sessile during anthesis and which are normally furnished with very simple staminodia representing the inner whorl of the androecium.

2. For these reasons it would seem that the species from that area represent a distinct Section within the genus, for which the name *Himalaicae* is proposed.

3. The leaves of the *Himalaicae* show two distinct types of stomatal distribution. The first is characteristic of *D. himalaica*, Hook. f. et Thoms., in which copious stomata are present upon the upper as well as upon the under surface of the leaf; in the second, found in *D. purpurea*, Diels, the stomata are confined entirely to the under surface.

4. Certain less definite peculiarities accompany this difference in stomatal distribution which may, in consequence, be regarded as of considerable importance in separating the species.

5. The flowers, contrary to what has been assumed, do not provide any specific characters. Neither in the corolla itself nor in the androecium and gynaeceum is there any constant difference which can be used in this connection.

6. *Diapensia himalaica* and *D. purpurea* do not differ, as has been thought, in the absence from the former of staminodia. These organs are of equally frequent occurrence in both species.

7. In the gynaeceum of *D. purpurea* a condition approaching heterostyly is observable. The style is generally long and the stigma consequently exserted in flowers having a corolla-tube of about four mm. in length or upwards ; where the corolla-tube is less than four mm. the style is usually quite short and the stigma included.

8. *Diapensia Bulleyana*, Forrest ex Diels differs from *D. purpurea* only in its yellow or yellowish corolla. In all other respects, including its stomatal distribution, it agrees entirely with that species, of which it can in consequence be considered only a yellow-flowered form.

9. *Diapensia acutifolia*, Hand.-Mzt. has the stomatal distribution and all other characters of *D. himalaica* which, as is now known, is furnished with staminodia. Only in its leaf-apex does *D. acutifolia* differ from typical *D. himalaica* of which it is apparently a variety.

The following key to the species can, in consequence, be given with confidence.

KEY TO THE SPECIES.

A. Leaves small, the lamina only very exceptionally so much as 6 mm. long by 3 mm. broad, length about twice the breadth :—

1. Peduncle elongated at the time of flowering, staminodes never present. A plant of wide arctic and alpine sub-arctic distribution . . . . . 1. *D. lapponica* (p. 224).

2. Flowers sub-sessile, the peduncle only elongating as the fruit ripens, staminodes normally present. Species confined to the Sino-himalayan alps :—

a. Stomata copiously developed upon the upper, generally smooth and shining, surface of the leaves. . . . . 2. *D. himalaica* (p. 224).

b. Stomata entirely wanting on the upper, generally dull and very finely papillose, surface of the leaves . . . . . 3. *D. purpurea* (p. 229).

B. Leaves distinctly larger and broader, the lamina, in all but a few of the uppermost leaves, from 7–10 mm. long by 4–7 mm. broad . . . . . 4. *D. Wardii* (p. 233).

ENUMERATION OF THE SPECIES.

1. **Diapensia lapponica,** Linn. Sp. Pl. (1753), p. 141.
Diapensia japonica, J. F. Gmel. Syst. (1788–93), 1539, sphalm.
Diapensia obtusifolia, Salisb. Parad. Lond. (1806–7), t. 104.

ARCTIC AND ALPINE SUB-ARCTIC REGIONS. Extensions southwards occur in N. America (White Mountains, New Hampshire) and in Japan.

Within the genus *Diapensia* the present species is peculiar in its distinctly stalked flowers, never provided with staminodia, and in its wide arctic-circumpolar distribution.*

Two varieties have been recognised, occupying separate areas, and distinguishable as follows:—

a. Leaves linear-oblong, 9–17 mm. in length, 1–1½ mm. broad; midrib alone distinct, lateral veins generally obsolete. Native of N. America including Greenland, N. Europe (Iceland, Norway, Sweden, Lapland, Russia) and N.W. Asia (N.W. Siberia west of the Yenesei) . . . . . var. *α genuina,* E. Busch†

b. Leaves obovate or obovate-oblong, 5–9 mm. in length, 1½–3 mm. broad; a few lateral veins generally distinct as well as the midrib; bracts somewhat broader than in var. α. Native of N. Asia (N. and N.E. Siberia, Kamchatka) and Japan . . . . . var. *β obovata,* F. Schm.‡

The above varieties, though not always easily separable, especially in the case of herbarium specimens, seem to be genuinely distinct. In dried material the foliage of var. α has almost always a more yellow-green colour than has that of var. β.

It has been found in the Royal Botanic Garden, Edinburgh, that Japanese plants of var. β grow much more vigorously than do European examples of var. α being, in consequence, better than the latter for cultivation. Whether this difference is always characteristic of the varieties cannot, however, be stated.

2. **Diapensia himalaica,** Hook. f. et Thoms. ex Hook. f. in Hook. Kew Journ., ix (1857), 373; tab. XII.
Diapensia acutifolia, Hand.-Mzt. in Anzeig. Akad. Wiss. Wien, Sonderabd. No. 19 (1923), p. 3.

E. HIMALAYA, UPPER BURMA AND S.W. CHINA. *Sikkim.* Lachen, alt. 10–14,000 ft. In flower and fruit, June 3rd–25th 1849. J. D.

* A map showing this distribution is given by Dr. L. Diels in Engl. Bot. Jahrb., l, Suppl. Bd. (1914), Taf. VII.

† Fl. Siberiae et Or. Extremi a Mus. Bot. Acad. Leningrad ed., Pars 4, 64 Diapensiaceae (1926), p. 3. A map showing the distribution of both the varieties is given at p. 5.

‡ Reisen im Amurlande und auf der Inseln Sachalin, Bot. Teil, in Mém. Acad. Imp. Sci. Pétersb., VII Sér., Tome xii, No. 2, p. 161.

Hooker sine no. ! Laghep, alt. 11,000 ft. " Corolla purpurascent " ; in flower, May 1876. C. B. Clark 27786 ! and 27792 ! Lower Sikkim, without precise locality. In flower, May 1885. Pantling in Herb. C. B. Clark 46561 ! Kapoop, alt. 13,500 ft. In flower, July 1910. W. W. Smith 3442 ! Ghora La, alt. 16,000 ft. Flowers almost over, September 1911. Ribu et Rhomoo 5194 ! Tibet side of Dzalep La, alt. 14,000 ft. " Pink flowers carpeting rocks." In flower, July 1913. R. E. Cooper 150 ! Linghu, alt. 13,000 ft. " Creeping, flowers purple, carpeting rocks." In flower, May 1925. G. H. Cave 2390 !

Upper Burma. " In deep moss, on cold, damp, non-calcareous cliffs of the high alpine zone, Chawji pass, alt. 11,000 ft. Flowers of a lively lilac, lighter than in *Petrocallis pyrenaica*, but very like. It likes the wetter ledges of the bluff, while the Diapensia [*D. purpurea*, Farrer 1554] is everywhere on it." In flower, May 1920. R. Farrer 1553 !

S.E. Tibet. Temo La, 10 miles S.W. of Tumbatse (which is in lat. 29° 40′ N., long. 95° 45′ E.), Rong-chu basin, alt. 14–15,000 ft. " Flowers deep rose. Forms extensive mats in the alpine pastures, between clumps of dwarf Rhododendron." In flower, June 1924. Kingdon Ward 5769 !

Doshong La, lat. 29° 30′ N., long. 95° E., alt. 12–13,000 ft. " Flowers salmony pink, with yellow corona. On rocks and steep slopes, amongst dwarf Rhododendron. Forms large mats." In flower, June 1924. Kingdon Ward 5840 ! Same locality. " Flowers sulphur yellow. On rocks and steep alpine slopes, where it forms large mats. This species and no. 5840 are found growing side by side. Probably varieties of one species, *D. himalaica*." In flower, June 1924. Kingdon Ward 5841 !

N.W. Yunnan. Doker La, lat. 28° 17′ N., long. 98° 40′ E. In flower, June 1913. Kingdon Ward 580 !

" In regione alpina jugi Si-la inter fluvios Landsang-djiang (Mekong) et Lu-djiang (Salween), 28°, in lapidosis in reg. frigide temperatam usque. Substr. micoschistaceo ; alt. s.m. ca. 3900–4375 m." In flower, June 1916. H. F. v. Handel-Mazzetti 8935 ! Type of *D. acutifolia*, Hand.-Mzt.

The Szechuan plant (Pratt 859 in Herb. Kew.), recorded as this species,* now forms the type of *D. purpurea*, Diels.

Diapensia himalaica, Hook.f. et Thoms. was described from plants collected by Sir J. D. Hooker at Lachen in Sikkim during 1849. The original tickets, attached to the type sheet in the Kew Herbarium, show that these specimens were not all of one gathering and were, in fact, collected on four distinct dates in June of that summer, namely the 3rd, 9th, 20th and 25th of the month. The majority of the plants on the sheet are in flower but a few are in fruit, perhaps collected on one of the later dates, though that is now uncertain. It is of

* Journ. Linn. Soc. (Bot.), xxxix (1909), p. 442.

importance to emphasize that these type specimens were not collected at one time and are almost certainly not all from the one habitat in view of what will be brought out later as regards the varieties of the species.

As was shown by Dr. L. Diels in 1912, when describing his *Diapensia purpurea*,* the distribution of the stomata on the leaves serves as a means of separating that species from *D. himalaica*. In the former the stomata are entirely confined to the under side of the lamina while in the latter they occur abundantly upon both its upper and under surfaces. This peculiarity has already been fully discussed (ante p. 211) and need not be entered into again here. Apart from the arrangement of the stomata, however, the two species can almost always be distinguished at a glance by the fact that the leaves in *D. himalaica* have a smooth and glossy upper surface whereas those of *D. purpurea* are quite dull and, under a powerful lens, are seen to be minutely papillose, not smooth.

In 1923 Dr. Handel-Mazzetti described, under the name *Diapensia acutifolia*,† a form with the foliage-characters of *D. himalaica* except that the apex of the leaf was more acute and distinctly acuminate. It having been found, as will be shown later, that other supposed points of difference between this form and the present species did not hold good, the writer was led to examine the leaves critically in all available material. This examination resulted in the discovery that, amongst plants having in every other respect the features of *D. himalaica*, there occur three distinct varieties which, in those seen, are always easily recognisable by the form of the leaf-apex and show no tendency to intergradation. The flowering specimens forming the greater part of the type in the Kew Herbarium have subacute foliage as stated in the original diagnosis and as shown in the figure accompanying it.‡ This may be regarded, then, as the typical condition and may consequently be called var. *typica*. In the fruiting material forming the remainder of the type the leaves are markedly retuse and, since several gatherings of later date have been received in which the apex is exactly similar, the name var. *retusa* is proposed for these. It may be added that, in dried specimens, the foliage of this variety is generally of a distinctly yellower tint than is the case in the others, showing an interesting parallel to what has already been noted in *D. lapponica*, Linn. (ante p. 224). Finally, there is *D. acutifolia*, Hand.-Mzt. which, in the light of the whole series examined, can only be regarded as a third variety of *D. himalaica* with mucronate-apiculate leaves. Drawings illustrating the appearance of the leaf-apex in these varieties are given in fig. 3, and the following diagnoses may here be added:—

* Fedde, Repert., x (1912), p. 419.
† Anzeig. Akad. Wiss. Wien, Sonderabd. No. 19 (1923), p. 3.
‡ Hook. Kew Journ., ix (1857), tab. XII.

Var. α **typica,** W. E. Ev., var. nov., foliorum subacutorum apicibus haud mucronato-apiculatis distinguenda.

Var. β **retusa,** W. E. Ev., var. nov., foliorum in sicco saepius galbinorum apicibus obtusissimis atque valde retusis facile recognita. (Plate CCXXII, b.)

Var. γ **acutifolia,** W. E. Ev., comb. nov., foliorum apicibus acutissimis atque distincte mucronato-apiculatis a var. *typica* differt.

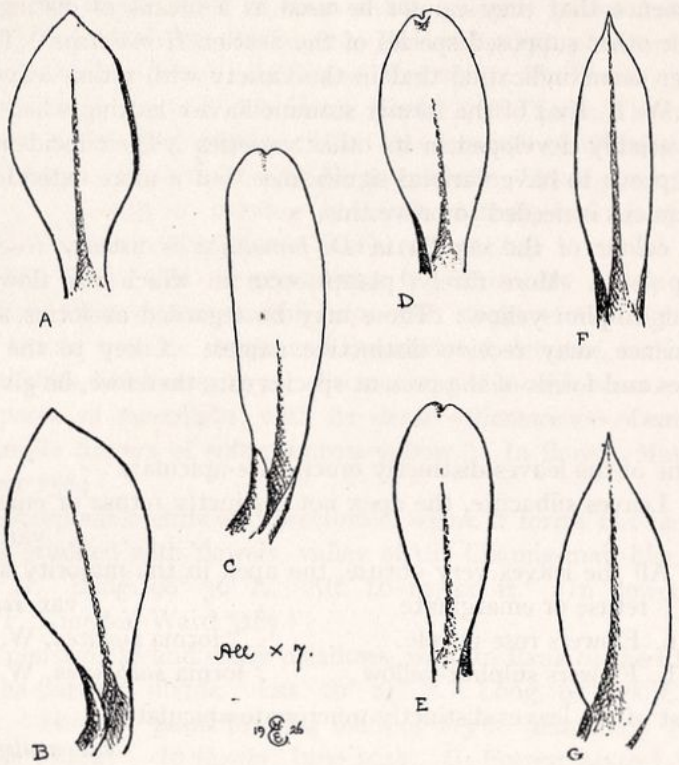

Fig. 3. Leaves of *Diapensia himalaica*, Hook.f. et Thoms.

A, B. Lamina of var. *typica*, W. E. Ev., × 7. Cooper 150.
C. Lamina of var. *retusa*, W. E. Ev., × 7. Ward 5841.
D, E. Lamina of var. *retusa*, W. E. Ev., × 7. Cave 2390.
F. Lamina of var. *acutifolia*, W. E. Ev., × 7. Hand.-Mzt. 8935.
G. Lamina of var. *acutifolia*, W. E. Ev., × 7. Ward 580.

The most surprising fact which a careful examination of the type and other material has conclusively proved is that the flowers in *D. himalaica*, Hook. f. et Thoms., which have till now been assumed to be destitute of staminodia, are in reality usually provided with these organs. Although staminodes are not mentioned in the diagnosis of the species and although the otherwise excellent figure accompanying it shows a perfectly naked corolla-tube, they are undoubtedly present in the type plants, at any rate in the flowers dissected by the writer. A capsule attached to the sheet contained three loose corollas, from

their appearance apparently those used in the preparation of the description and plate; in these also careful maceration revealed the presence of staminodia. The only conclusion to which one can come is that their small size and position within the tube of the corolla, only a little above its middle, led to their being overlooked.

It follows, therefore, as has already been fully indicated (ante p. 217), that staminodes may be either present or wanting in both *Diapensia himalaica*, Hook. f. et Thoms. and *D. purpurea*, Diels with the consequence that they cannot be used as a means of distinguishing these or other supposed species of the Section *Himalaicae*. There is, however, some indication that in the variety with retuse leaves (var. *retusa*, W. E. Ev.) of the former staminodia are lacking whereas they are invariably developed in its other varieties. Their incidence may indeed prove to have varietal significance, but a more extended suite of specimens is needed to prove this.

The colour of the corolla in *D. himalaica* is usually rose-purple (ante p. 212). More rarely, plants occur in which the flowers are white or sulphur-yellow. These may be regarded as forms and, for convenience, may receive distinctive names. A key to the known varieties and forms of the present species can, therefore, be given here as follows:—

A. None of the leaves distinctly mucronate-apiculate:—
   1. Leaves subacute, the apex not distinctly retuse or emarginate . . . . . var. *typica*.
   2. All the leaves very obtuse, the apex in the majority strongly retuse or emarginate . . . . var. *retusa*:—
      a. Flowers rose-purple. . . forma *violacea*, W. E. Ev.
      b. Flowers sulphur-yellow . . forma *sulphurea*, W. E. Ev.

B. Most of the leaves distinctly mucronate-apiculate . . . . . var. *acutifolia*:—
   a. Flowers white . . . forma *candida*, W. E. Ev.
   b. Flowers rose-purple . . forma *rubella*, W. E. Ev.

The material examined during the preparation of this paper represents the above varieties and forms as shown below:—

Var. *α. typica*:—R. E. Cooper 150; J. D. Hooker sine no., June 1849 (quoad speciminibus florentibus); Ribu et Rhomoo 5194; W. W. Smith 3442; F. Kingdon Ward 5769, 5840.

Var. *β. retusa*:—

Forma *violacea*:—G. H. Cave 2390; C. B. Clarke 27786, 27792; R. Farrer 1553; Pantling in Herb. C. B. Clarke 46561.

Forma *sulphurea*:—F. Kingdon Ward 5841.

Var. *γ. acutifolia*:—

Forma *candida*:—H. F. v. Handel-Mazzetti 8935.

Forma *rubella*:—F. Kingdon Ward 580.

3. **Diapensia purpurea,** Diels in Fedde, Repert., x (April 1912), p. 419.

Diapensia Bulleyana, G. Forrest ex Diels in Notes, Roy. Bot. Gard. Edin., v (June 1912), p. 207.

Diapensia himalaica, Dunn in Journ. Linn. Soc. (Bot.), xxxix (1909), p. 442 ; non Hook. f. et Thoms.

UPPER BURMA AND S.W. CHINA. *Upper Burma ;* " forming wide masses, beautifully covered with little white trumpets, among deep moss on the shady cliffs of deep shady granitic gullies below the Chimili Pass, etc. Alt. 11,000 ft. No scent, but observed to be greatly affected by bees." In flower, May 1919. R. Farrer 932 !

" With Farrer 1553 [*D. himalaica*, Hook. f. et Thoms.], in moss on cold and damp high-alpine cliffs, non-calcareous, Chaw-ji Pass. Alt. 11,000 ft. Flowers of a bright purple-rose, like a good form of *Saxifraga oppositifolia*, varying in depth of tone, but always very pretty." In flower, May 1920. R. Farrer 1554 !

" Mokuji Pass. Alt. 11,500–12,000 ft. This very lovely species forms wide tight masses on the bare open slopes of the high-alpine region, among granitic stones and consolidated detritus, rather than in actual cliffs, like Farrer 1554. From a long way off it is conspicuous, like a patch of moonlight, with its dense efflorescence of rounded-lobed ample flowers of soft primrose-yellow." In flower, May 1920. R. Farrer 1584 !

" On steep shale cliffs and precipices, where it forms flat moss-like cushions studded with flowers, valley of the Chaung-maw-hka. Lat. 26° 10′ N. Long. 98° 30′ E. Alt. 10–12,000 ft." In flower, June 1919. F. Kingdon Ward 3187 !

" On moist rocks and stony meadows, western flank of the Chimi-li, N'Maikha-Salween divide. Lat. 26° 21′ N. Long. 98° 48′ E. Alt. 9,000 ft. Shrubby plant forming mats of 2–3 ft. diameter. Flowers very pale yellow." In flower, June 1924. G. Forrest 24591 !

S.E. Tibet. " On moist banks of streams and boggy meadows, Salween-Kiu-chiang divide, Tsarong. Lat. 28° 40′ N. Long. 98° 15′ E. Cushion plant of 4–8 inches diameter. Flowers rose-red." In flower, August 1919. G. Forrest 19115 !

" On open peaty pasture, Salween-Kiu-chiang divide, Tsarong. Lat. 28° 40′ N. Long. 98° 15′ E. Cushion plant of 6–8 inches diameter. Flowers creamy-yellow." In flower, August 1919. G. Forrest 19130 !

" Moist situations on rocks by streams, Ka-gwr-pu, Mekong-Salween divide, Tsarong. Lat. 28° 25′ N. Alt. 12,000 ft. Mat shrub of 6–18 inches diameter. Flowers bright rose-pink." In flower, July 1917. G. Forrest 14220 !

Szechuan. " West Szechuen and Tibetan frontier : chiefly near Tachienlu, at 9,000–13,500 ft." Without exact data. A. E. Pratt 859 !

" Tatsienlu : Monymien, Yakiaken, in summis montibus, floribus rubro-violaceis."* Soulié 681 and 739 in Herb. Paris.

" Forms flat cushions on the sheltered slopes under rocks, Litang River divide. Alt. 14–15,000 ft. Flowers deep rose pink." In flower, June 1921. F. Kingdon Ward 4095 !

" On rocks and marshy pasture by streams, Mu-li mountains. Lat. 28° 12′ N. Alt. 13–14,000 ft. Cushion plant, one inch in height, 12–24 inches in diameter. Flowers rose." In flower, June 1918. G. Forrest 16494 !

" Mount Wu, 10,000 ft. ; flowers brownish-red, moist rocks." In immature fruit. July 1903. E. H. Wilson 3926 ! Also, probably from the same area, but without precise locality, the following material in flower was obtained : " flowers rosy purple, rocks 13–16,000 ft., May 1904 " (E. H. Wilson 3581 !) and " rocks, 13–15,000 ft., July 1904 " (E. H. Wilson 3253 !).

W. Yunnan. " Tuft plant, alpine rocks, 14–15,000 ft., A-tun-tsi. In flower, July 1911." F. Kingdon Ward 79 !

" On open moist alpine moorland, mountains east of Atuntze. Lat. 28° 36′ N. Long. 99° E. Alt. 15,000 ft. Cushion plant several inches in diameter." In fruit, October 1922. G. Forrest 22780 !

" Moist stony pasture, mountains north of Atuntze. Lat. 28° 35′ N. Alt. 14,000 ft. Cushion plant of 6–18 inches diameter. Flowers rose-pink." In flower, June 1917. G. Forrest 14015 !

" Open situations on boulders and ledges of cliffs, Bei Ma Shan, Mekong-Yangtze divide. Lat. 28° 20′ N. Alt. 14,000 ft. Shrubby cushion plant of 1–2 inches." In fruit, August 1914. G. Forrest 13286 !

" On rocks, precipices, etc., forming big cushions ; Mekong-Yangtse and Mekong-Salween divides. Alt. over 14,000 ft." In flower, 1913. F. Kingdon Ward 429 !

" Open boggy situations by streams, Mekong-Salween divide. Lat. 28° 20′ N. Alt. 12,000 ft. Cushion plant of 12 inches diameter." In flower, June 1917. G. Forrest 14072 ! (flowers " white ") and 14073 ! (flowers " rose-pink ").

" Open moist pasture, Mekong-Salween divide. Lat. 28° 12′ N. Alt. 13,000 ft. Tufted shrub of 1 inch." In fruit, July 1917. G. Forrest 14288 !

" Moist gravelly peaty meadows and by streams, Londre pass, Mekong-Salween divide. Lat. 28° 12′ N. Long. 98° 40′ E. Alt. 14–15,000 ft. Cushion plant of 6–18 inches diameter. Flowers deep clear rose-crimson." In flower, July 1921. G. Forrest 19577 !

" Open, moist, stony pasture on the Bei-ma Shan. Lat. 28° 12′ N. Alt. 14,000 ft. Cushion plant of 1 inch, 9–20 inches diameter." In flower, June 1917. G. Forrest 14010 ! (flowers " rose-pink ") and 14017 ! (flowers " white ").

* Teste Diels in Fedde, Repert., x (1912), p. 419.

" On ledges of cliffs and humus-covered boulders, mountains of the Chungtien plateau. Lat. 27° 55′ N. Alt. 11,000 ft. Cushion shrub of 6–8 inches." In fruit, July 1913. G. Forrest 10670 !

" On rocks and stony pasture, Mountains of the Chungtien plateau. Lat. 27° 30′ N. Alt. 12,000 ft. Cushion shrub of 2 inches." In flower, June 1914. G. Forrest 12538 ! (flowers " deep rose-purple ") and 12756 ! (flowers " very pale yellow ").

" Locis lapidosis humosis ventis aversis regionis alpinae summi tergi inter vicos Haba et Dugwantsun ad austro-orient. pagi Dschungdien, alt. 4350–4450 m., fl. purpurei." In flower, June 1915. H. F. v. Handel-Mazzetti 6922 !

" On moist stony meadows, Mekong-Salween divide. Lat. 27° 54′ N. Long. 98° 50′ E. Alt. 14,000 ft. Mat plant of many inches diameter, 6–12 or more. Flowers white." In flower, June 1921. G. Forrest 19493 !

" On wet rocks and peaty pasture, Chao-ii Shan, Mekong-Yangtze divide. Lat. 27° 5′ N. Long. 99° 35′ E. Alt. 14,000 ft. Mat plant of a foot or more in diameter. Flowers very deep rose." In flower, July 1924 (G. Forrest 25722 ! and 25723 !) and in fruit, October 1924 (G. Forrest 25986 ! and 25884 !).

" On moist rocks and boggy peaty pasture, Chienchuan-Mekong divide. Lat. 26° 30′ N. Long. 99° 40′ E. Alt. 13,000 ft. Prostrate trailing shrub of many inches. Flowers bright rose." In flower, August 1922. G. Forrest 23258 ! Also, foliage only, September 1922. G. Forrest 22310 !

" On open moist stony pasture and screes, N'Maikha-Salween divide. Lat. 26° 20′ N. Alt. 11,000 ft. Cushion plant of 6–12 inches diameter. Flowers very pale primrose-yellow." In flower, June 1919. G. Forrest 17983 !

" Exposed situations on ledges of cliffs and humus-covered boulders on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 11–12,000 ft. Dwarf shrub of 2–4 inches. Flowers canary yellow." In flower, September 1906. G. Forrest 1853 !

" Stony open pasture, eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 13,000 ft. Dwarf shrub of 2–6 inches. Flowers primrose-yellow." In flower, June 1910 (G. Forrest 6758 !) ; August 1913 (G. Forrest 11614 !) ; August 1917 (G. Forrest 15498 !).

" Shweli-Salween divide. Lat. 25° 30′ N. Alt. 10–11,000 ft." In flower, flowers yellow, June 1917. G. Forrest 15677 !

" On screes and ledges of cliffs, Jang-tzow Shan, Shweli-Salween divide. Lat. 25° 10′ N. Alt. 11,000 ft." In flower, flowers yellow, May 1919. G. Forrest 17956 !

Diapensia purpurea, Diels was described in 1912 and was based upon Pratt's Szechuan specimens, which had previously been recorded as *D. himalaica*, Hook. f. et Thoms.* From the latter the present

* Journ. Linn. Soc. (Bot.), xxxix (1909), p. 442.

species can generally be distinguished by its rather more robust appearance and somewhat larger leaves (Plate CCXXII, b. c.); but there is considerable overlapping in these respects, and a close examination of the foliage is the only really reliable means of separating the two. The upper surface of the lamina in *D. purpurea* is entirely destitute of stomata and is, in addition, dull and devoid of gloss owing to its being covered with very minute papillae. In *D. himalaica*, on the other hand, numerous stomata are always present upon the smooth and glossy upper surface of the leaf. That this is a perfectly constant and satisfactory specific distinction has been fully proved by the examination of a very large number of leaves, as already stated (ante p. 211).

The supposed constant lack of staminodia in the flowers of *D. himalaica*, Hook. f. et Thoms., as opposed to their occurrence in the present plant, has proved to be a misconception and to have arisen through their being overlooked in the former case (ante p. 227). It follows, therefore, that the characteristic distribution of their leaf-stomata, just mentioned, supplies the only concrete point of difference to which recourse may invariably be had with certainty in diagnosing these species which, though this character requires the use of a somewhat powerful lens to fully reveal it, are quite certainly genuinely distinct. After a little practice their general facies and the appearance of their foliage, seen in the mass, can be relied on without hesitation as a means of separating them.

The normal colour of the corolla in *D. purpurea*, Diels is rose or rose-purple but plants with white or yellow flowers occur not infrequently. For convenience these may be regarded as colour-forms of the species and may be grouped and named as follows :—

Forma *rosea*, W. E. Ev. corolla plus minusve distincte rosea vel purpureo-rosea.

Forma *albida*, W. E. Ev. corolla alba vel albida.

Forma *Bulleyana*, W. E. Ev. comb. nov. corolla distincte lutea.

Though no sharp line can be drawn between those with white as opposed to those having yellow blooms (ante p. 213), the specimens examined during the preparation of this paper seem to be best arranged thus :—

Forma *rosea* :—R. Farrer 1554; G. Forrest 12538, 14010, 14015, 14073, 14220, 16494, 19115, 19577, 23258, 25722, 25723, 25884, 25986; A. E. Pratt 859; F. Kingdon Ward 79, 4095; E. H. Wilson 3581.

Forma *albida* :—R. Farrer 932; G. Forrest 12756, 14017, 14072, 17983, 19130, 19493, 24591; F. Kingdon Ward 3187.

Forma *Bulleyana* :—R. Farrer 1584; G. Forrest 1853, 6758, 11614, 15498, 15677, 17956.

It should be here explained that the name *D. Bulleyana*, Forrest ex Diels* was applied to the most pronouncedly yellow of the above

* Notes, Roy. Bot. Gard. Edin., v (June 1912), p. 207.

colour-forms. There is, however, no structural difference whatever between these and normal *D. purpurea*, Diels while, moreover, many intermediate shades, bridging the gap which might have separated yellow from white, are actually met with. Under those circumstances there can be no doubt that the plants in question should be regarded as a form of the present species (ante pp. 212, 214), and this view is still further supported by the interesting fact that, as already shown, a quite similar set of colour-forms seems to exist in *D. himalaica*, Hook. f. et Thoms.

A somewhat important point which has been brought to light by the dissection of the numerous flowers available for that purpose is the presence in this species of a kind of heterostyly. Full reference has previously been made to this peculiarity (ante p. 220), but briefly it may be repeated that, almost without exception, blooms having a corolla-tube of 4 mm. in length or longer possess also an exserted style, whereas in those with a shorter tube the style is included. It is only when the relationship existing between the tube of the corolla and the style is taken note of that the presence of this aid to cross-pollination is clearly seen. The great range in length of the style, varying in the specimens examined by the writer from 2 mm. to as much as 15.5 mm. and showing a complete sequence of measurements from the one extreme to the other, does not of itself suggest that a condition amounting to heterostyly actually is present.

Great elongation of the peduncle after fertilisation, characteristic as it is of the *Himalaicae* as a whole, is particularly well shown in some of Mr. Forrest's gatherings of *D. purpurea*, Diels. In these the capsule is borne upon a scarlet stalk, which may reach as much as 5.5 cm. in length, and Mr. Forrest states that the appearance of the species is particularly attractive when its fruits are nearing maturity and are of the same striking colouration.

The geographical distribution of *D. purpurea*, Diels is not identical with that of *D. himalaica*, Hook. f. et Thoms., though both plants occur together in N.E. Upper Burma and that part of N.W. Yunnan bordering on it. From this area the two species spread in opposite directions, *D. himalaica* to the west and *D. purpurea* to the east as far as the extreme eastern boundary of Szechuan.

4. **Diapensia Wardii,** W. E. Evans, sp. nov. Plate CCXXII, a.

Fruticulus nanus prostratus glaberrimus. Rami angulosi ad 15 cm. vel ultra elongati 1–1.5 mm. diametro parte superiore ramosa atque foliata excepta nudi, ramulis foliatis. Folia ovata vel late elliptica petiolata ; lamina coriacea 4–10 mm. longa 2.5–7 mm. lata in petiolum distinctum ad 4 mm. attingentem angustata, supra (in sicco) plus minusve reticulata venis impressis, subtus pallidior venis obscuris. Flores ignoti. Pedunculi fructiferi rubidi e ramulorum apicibus

singulariter orti graciles mox ad 5–7 cm. elongati apicem versus bracteam foliaceam gerentes, capsulis solitariis terminalibus atrorubentibus circ. 3 mm. altis maturitate longitudinaliter tripartitis inter calycis persistentis segmenta foliacea circ. 6 mm. longa sessilibus.

S.E. TIBET. "Doshong La. Alt. 10–11,000 ft. Not seen in flower. Prostrate creeping plant forming flat mats on the mossy and shrub clad gneiss cliffs which face north. Growing with Cassiope, etc. The capsule resembles that of *Diapensia himalaica*, but is borne erect on a red pedicel 2–3 inches high. Capsule turns from red to black as it ripens." In fruit, October 1924. F. Kingdon Ward 6226 !

Diapensia Wardii, W. E. Ev. is known only from the rather fragmentary fruiting specimens cited above, but seems to be distinguishable from all other species by its remarkably large and broad leaves.

Though the flowers are at present unknown, it may be predicted with confidence that, when found, they will prove to be practically sessile and to possess, normally, simple staminodes, as is the case in *D. himalaica*, Hook. f. et Thoms. and *D. purpurea*, Diels, the only other members of the genus inhabiting the same geographical area. The peduncles, it may safely be assumed, do not elongate until after fertilisation of the flowers has taken place. They do not seem to differ, either in this respect or in their colour, from what is usual throughout the Section *Himalaicae*. The writer has seen plants of *D. purpurea* in which the fruits were borne upon stalks 5.5 cm. in length and Mr. Forrest has told him that, in the same species, the dark crimson capsules, when in profusion, have a very arresting appearance.

As in *Diapensia himalaica*, Hook. f. et Thoms., the stomata of the leaves are found upon both their surfaces; these structures are, however, more difficult to detect than in that species, the dried material requiring to be macerated and examined under a fairly high power with a good microscope.

NUMERICAL LIST OF HERBARIUM MATERIAL REFERRED TO IN THIS PAPER.

Cave, G. H.
2390 D. himalaica var. retusa.

Clarke, C. B.
27786, 27792 D. himalaica var. retusa.

Cooper, R. E.
150 D. himalaica var. typica.

Farrer, R.
932 D. purpurea,
1553 D. himalaica var. retusa.
1554 D. purpurea.
1584 D. purpurea.

Forrest, G.
1853 D. purpurea.
6758 ,,
10670 ,,
11614 ,,
12538 ,,
12756 ,,
13286 ,,
14010 ,,
14015 ,,
14017 ,,
14072 ,,
14073 ,,
14220 ,,
14288 ,,
15498 ,,
15677 ,,
16494 ,,
17956 ,,
17983 ,,
19115 ,,
19130 ,,
19493 ,,
19577 ,,
22310 ,,
22780 ,,
23258 ,,
24591 ,,
25722 ,,
25723 ,,
25884 ,,
25986 ,,

Handel-Mazzetti, H. F. v.
6922 D. purpurea.
8935 D. himalaica var. acutifolia.

Hooker, J. D.
Lachen, 1849 sine no. D. himalaica var. typica et var. retusa.

Pantling in Herb. Clarke
46561 D. himalaica var. retusa.

Pratt, A. E.
859 D. purpurea.

Ribu et Rhomoo
5194 D. himalaica var. typica.

Smith, W. W.
3442 D. himalaica var. typica.

Soulié, J. A.
681, 739 D. purpurea.

Ward, F. Kingdon
79, 429 D. purpurea.
580 D. himalaica var. acutifolia.
3187 D. purpurea.
4095 D. purpurea.
5769, 5840 D. himalaica var. typica.
5841 D. himalaica var. retusa.
6226 D. Wardii.

Wilson, E. H.
3253, 3581, 3926 D. purpurea.

EXPLANATION OF PLATE CCXXII.

Illustrating Mr. Evans' Paper on the Genus Diapensia.

a. *Diapensia Wardii*, W. E. Ev. Part of type, Ward 6226, showing foliage; natural size.

b. *D. himalaica*, Hook. f. et Thoms. var. *retusa*, W. E. Ev. Part of Cave 2390; natural size.

c. *D. purpurea*, Diels. Part of Forrest 10670, showing foliage; natural size.

a. Diapensia Wardii, W. E. Ev.
b. D. himalaica, Hook. f. et Thoms.
c. D. purpurea, Diels.

R. M. Adam, photo.]