

pressing demand, and at the present rate of taking up these lands by settlers, ten years will elapse before the irrigable lands already awaiting occupancy are completely occupied. The Reclamation Service has already expended about \$100,000,000 received from the sale of public lands; it has borrowed \$20,000,000 more, and may shortly be compelled to seek further Government aid to maintain and complete the projects already under way.

To many Americans, it appears that the Government entered upon its extensive irrigation enterprises too soon and on too costly a scale. Millions of acres of farm lands in the humid part of the United States are unused; millions more are producing but a fraction of their possibilities. There was no lack of good land that required no irrigation and would produce nearly as much as the irrigated land after great sums had been expended, merely to bring water to it. This irrigation experiment may cost the U.S. Treasury from a hundred million to two hundred million dollars, but it will not all be lost; a good deal of benefit will come from the undertakings. Besides, two hundred million dollars nowadays may scarcely seem worth worrying about!

ON THE POSSIBLE PROLONGATION OF THE HIMALAYAN AXIS BEYOND THE DIHANG

F. Kingdon Ward

THE marked resemblance between the Himalayan flora* and that of Western China might be due to a former direct geographical connection between the eastern Himalaya and the mountain system reaching out across China from the Tibetan plateau to the maritime plains (forming the watershed between the Yellow River and the Yangtze). It has therefore appeared to me worth while to investigate the following points:

- (1) Do any vestiges of such a connection still remain amongst the parallel ranges, trending north-west to south-east, which intervene between the eastern end of the Himalaya and the western end of the Tsin-ling?
- (2) Can any such direct connection be shown, by geographical and geological exploration alone, to have existed at some period?
- (3) In the event of no direct proof of former connection being forthcoming, can it be shown that no such direct connection could indeed ever have existed—that the parallel ranges of Yun-nan and Szechwan are all, in fact, features of original structure?

Since in the latter event it would be necessary to discard the theory of a Sino-Himalayan connecting range and start afresh, I will first of all briefly state the *indirect* evidence in its favour. Secondly, I will consider the general distribution of the flora over this region, as at present known,

* Throughout this paper "flora" means "alpine flora" unless otherwise stated.

and its relationships. Thirdly, I will point out what results might be expected to follow, in the flora, from the breaching of such a range as the Sino-Himalayan, with the subsequent gradual uplift of a series of parallel ranges separated by deep and narrow gorges passing through the breach. The line of investigation to be pursued will then become clearer; in a complicated task of this nature, full of perplexing side issues, it will be necessary to keep strictly in view exactly what we are seeking.

The alpine flora of Western China shows a remarkable relationship with that of the eastern Himalaya,* while the sub-alpine and forest flora of China, as was pointed out by Prof. Asa Gray, finds its affinity with the flora of the eastern United States! This is an extraordinary fact which requires explanation.

The similarity between this Himalayan flora and that of the parallel ranges of Yun-nan is even more striking, and we must recognize the fact that the similarity is most marked in the case of high alpine plants which, generally speaking, have the poorest means of seed-dispersal and the least opportunity of being widely dispersed. Yet these plants have either been distributed by natural means under present conditions, with the mountain ranges as they now stand, or there was at some previous time direct communication for the plants to follow.

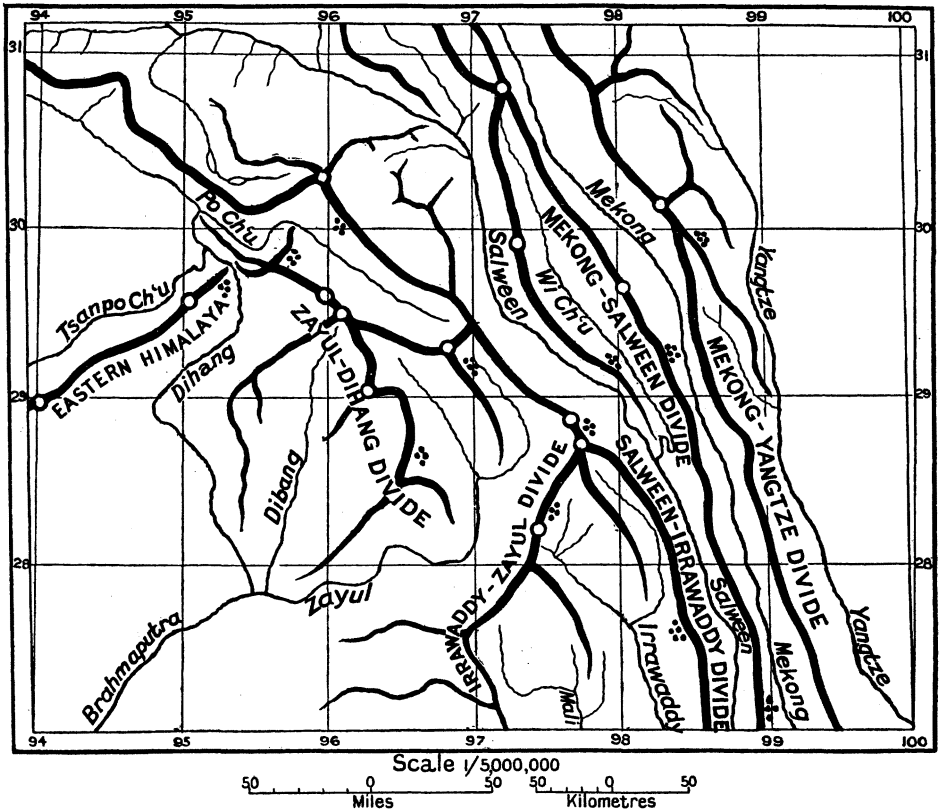
Now the flora of the eastern Himalaya could not cross the wide hot plains of Assam, the comparatively low mountain ranges to the east, and the hot valley of the Mali-kha, to reappear on the Salween-Irrawaddy divide. It must have travelled north-east, towards the knee bend of the Dihang, right round the head of the Assam valley, thence south-east, following the trend of the mountains separating the Zayul, Irrawaddy, and Salween rivers (see map). But it is as difficult to imagine an alpine flora crossing the gorges of the Dihang or upper Salween as it is to imagine it crossing the Assam plains.

Supposing, however, for the purposes of argument, that it had jumped the Dihang gorge, and achieved the great snowy range stretching down south-east between the Dihang and Zayul rivers; whence it might reach the mountainous divide between the Zayul and Salween rivers, from the southern ends of which rise the headwaters of the Irrawaddy. It is now stopped by the deep arid gorge of the Tibetan Salween, and beyond that again by the equally arid gorges of the Mekong and Yangtze rivers—it can indeed only have crossed these rivers much further north, that is, to the north-east of the Dihang bend. About this region we know little geographically, still less botanically; what we do know does not suggest a rich alpine flora; it would seem to be steppe country, though there are certainly forests.

If now we draw a line north-east from the Dihang bend, it will divide

* It was, I believe, Sir Joseph Hooker who first drew attention to the similarity between the alpine floras of the Himalaya and Western China.

this region into two climatic areas, more or less correctly. To the north-west lies plateau country, steppe, and desert; to the south-east forested mountains separated by deep arid gorges. The Himalayan flora could not have reached the trans-Himalayan ranges and the mountains of Yun-nan by crossing the Tsanpo, any more than it could have by crossing the Dihang. The northern slope of the Himalaya is much drier than the southern, and supports a somewhat different flora; there is the same difficulty about crossing the arid gorge; and north of the Tsan-po is the



The Eastern Himalaya and the Burma-Yunnan Ranges

dry Tibetan steppe-land. It would therefore appear that the only probable route by which the flora of the eastern Himalaya could reach western China would be, under present conditions, north-east of the Dihang bend, jumping the Dihang gorge.

It is profitless to speculate on the possibility of the flora having come down the Yun-nan ranges from the north-west and spread thence east and west to China and the Himalaya, for Tibet is now a desert, and we know nothing of what its flora may have been in the past. In order to escape

the same difficulty of crossing the river gorges, we should have to think of the whole of Tibet as far west as Ladak, and as far north as the Kuen Lun, supporting an alpine flora every trace of which has since disappeared.

Had the flora, on the other hand, travelled south-west from China to the Himalaya, we ought to find plants in the eastern Himalaya whose nearest relatives are Chinese, instead of plants on the Tsin-ling whose nearest relatives are Himalayan. The Tsin-ling flora, in fact, does not seem to have reached the Himalaya at all, and we are justified in assuming that the original home of this flora was the Himalaya. However we look at the matter, we see that to reach even as far east as the Szechwan mountains this flora has, under present conditions, to cross the Dihang, Salween, Mekong, and Yangtze gorges.

Yet this flora includes such genera as *Primula*, *Gentiana*, *Saxifraga*, *Isopyrum*, *Meconopsis*, *Arenaria*, *Diapensia*, *Lloydia*, *Aconitum*, *Cassiope*, *Corydalis*, *Cardamine*, *Polygonum*, *Androsace*, *Trollius*, *Pedicularis*, whose small seeds are simply shaken out of their capsules by the wind and scattered amongst the rocks. Moreover, many of them appear to retain their germinating power for only a short time, while for others the protection afforded by a snow blanket throughout the winter seems essential. One can conceive of no means by which such seeds could pass either directly from range to range, or gradually across the deep arid valleys intervening; though there is nothing to prevent them spreading many hundreds of miles along a mountain range. An alpine flora, in fact, marches slowly and compactly forward. The poverty of alpine floras on even the highest mountain ranges and peaks situated on islands proves that alpinists are not widely distributed fortuitously. Yet identical or almost identical species of the above genera are found at least as far apart as the eastern Himalaya and the Mekong-Yangtze divide, as the following table shows:

<i>Himalaya.</i>	<i>Mekong-Yangtze Divide.</i>
<i>Gentiana ornata</i>	<i>Gentiana sino-ornata</i>
<i>Primula sikkimensis</i>	<i>Primula pseudo-sikkimensis</i>
<i>Primula pusilla</i>	<i>Primula bella</i>
<i>Campanula colorata</i>	<i>Campanula colorata</i>
<i>Iris kumaonensis</i>	<i>Iris kumaonensis</i>
<i>Diapensia himalaica</i>	<i>Diapensia himalaica</i>
<i>Androsace chamaejasme</i>	<i>Androsace chamaejasme</i>
<i>Isopyrum grandiflorum</i>	<i>Isopyrum grandiflorum</i>
<i>Aconitum Hookeri</i>	<i>Aconitum Hookeri</i>
<i>Pinguicula alpina</i>	<i>Pinguicula alpina</i>
<i>Phlomis rotata</i>	<i>Phlomis rotata</i>
<i>Meconopsis racemosa</i>	<i>Meconopsis Wardii</i>

On the other hand, plants whose seeds are capable of being transported long distances by wind are not more widely distributed than the genera mentioned. Species of *Clematis*, *Cremanthodium*, *Lactuca*, *Lilium*, *Rhodo-*

dendron, *Crepis*, *Saussurea*, are, generally speaking, quite different in the Himalaya and in Yun-nan; they even differ on different ranges in Yun-nan.

We might also expect to find plants with edible berries, eaten by birds, widely distributed on these ranges; but such is not the case. Species of *Lonicera*, *Euonymus*, *Cotoneaster*, *Actinidia*, *Viburnum* generally differ even on ranges as close to each other as are the Mekong-Yangtze and Salween-Irrawaddy divides.

Yet the alpine flora, which under present conditions has the least chance of crossing from range to range, is more closely related than is the forest flora. Moreover, if seeds could reach the Mekong-Yangtze divide, say, direct from the Himalaya in the past, there is no valid reason why they should not do so now, and continue to do so. Hence the flora should become more and more Himalayan in character west of the Yangtze, till by the time the Zayul-Dihang divide was reached, an entirely Himalayan flora should prevail. On this point it is impossible to speak with certainty, but considering the striking differences of flora between ranges so close as the Mekong-Yangtze and Mekong-Salween divides, it would not appear very probable that the flora of the Zayul-Dihang divide is completely, or even preponderantly, Himalayan. It is possible, however, that the differences in the flora of the Mekong-Yangtze and Mekong-Salween divides may be due to, or emphasized by, other causes than mere failure in the transference of seeds from range to range: of which more anon. Finally, there is the significant fact that some of the plants found in the arid Mekong and Yangtze valleys are Himalayan: *Amphicome arguta* and the Himalayan asphodel, for example. Thus it would seem we are fully justified in rejecting the idea that the flora, alpine, forest, and arid, can have spread over all this country by natural means, under present conditions, and we are driven to inquire whether present conditions have always prevailed, or whether there might not at some period have been direct means of communication between the Indian and Chinese ranges.

Holding to our argument that the flora has probably travelled in a north-easterly direction from the Dihang bend, we find that a line drawn north-east from that bend passes across the Salween and Mekong rivers in the neighbourhood of their bends, which may be more abrupt than is shown on present maps, eventually reaching Kansu and the western end of the Tsin-ling Mountains. Major F. M. Bailey has discovered a peak just across the Dihang bend, which is on the main axis of the Himalaya; that is to say, the Dihang has cut through the main Himalayan axis, and it is not impossible that the Salween has done the same.*

Now both the Indus and the Dihang, as Sir Sidney Burrard points out, when crossing the main axis of the Himalaya, bend sharply. The Salween and the Mekong also change their direction, though more gradually, from east, or south-east, to south, so that they too may likewise

* I regret I have not had access to Prince Kropotkin's views on this region.

cross the axis of some great range. The direction of our supposed Sino-Himalayan range corresponds with the change of direction of these two rivers, and is parallel to the Ninchin-thang-la range of Tibet. It is to the south and east of the line that we find the Sino-Himalayan flora; to north and west the country passes rapidly into steppe and desert.

The inference then is that there was formerly some direct connecting range between the eastern end of the Himalaya and the western end of the Tsin-ling; and though there is lacking any direct evidence for the existence of this Sino-Himalayan range, what evidence there is points to this being the most profitable direction in which to seek it. Lastly, the Tsin-ling is the only east-and-west range extending across China which could carry Himalayan plants into the heart of China.

We come now to the question of distribution. It is not necessary at this stage of the inquiry to go into details, and I will confine myself to a broad review of the area.

First of all we have the general resemblance of the alpine flora from the eastern Himalaya to north-west China; no such resemblance is to be noted in the forest flora. Taking as a type some characteristic alpine genus such as *Primula*, we find that species increase as we go eastwards, the Himalayan groups of *Primula* attaining the greatest development in Yun-nan, as pointed out by Sir George Watt. This is equally true of other genera, such as *Rhododendron*, *Meconopsis* and *Pedicularis*. The same genera are well represented on the Tsin-ling, but the Himalayan relationship grows more distant as we go eastwards. On the Tsin-ling itself there are no Himalayan species.

Now turning to the mountain ranges of Yun-nan separating the Irrawaddy, Salween, Mekong and Yangtze rivers, we find that while their flora is very similar, it is richest in the south and west, that is, on the Salween-Irrawaddy divide, and each range possesses species not possessed by the others. North of lat. 28° the flora of the Mekong-Salween and Mekong-Yangtze divides is almost identical, but south of that there are striking differences. For example, *Primula Franchetii*, *Meconopsis Delavayi*, *Cassiope palebrata* and *Gaultheria sp.* found on the Mekong-Salween divide are absent from the Mekong-Yangtze divide. *Larix sp.* and *Meconopsis integrifolia* found on the Mekong-Yangtze divide are absent at least from the southern part of the Mekong-Salween divide, south of lat. 28°, and absent altogether from the Salween-Irrawaddy divide.

The Tsin-ling relationship of this flora is illustrated by the occurrence of species of the following *Primula* sections in both areas: *Mollis*, *Denticulata*, *Petiolaris*, *Candelabra*, *Omphalogramma*, *Soldanelloides* and *Malvacea*, though all of them, with the exception of the last named, have Himalayan representatives as well. As in the case of the Himalayan *Primulas*, these sections are all represented by more species in Yun-nan than they are on the Tsin-ling.

In the south the flora of these ranges is richer than in the north, as might be expected. Following them northwards, we find them presently turning north-west and diverging widely from each other, forest rapidly giving way to steppe and steppe to desert.

Taking the area between the eastern Himalaya and the Tsin-ling as a whole, we can recognize several distinct floral areas. For instance there is the Irrawaddy basin, whose flora is Indo-Malayan in the valleys, related to that of Assam, Arracan and Tenasserim; the alpine or Sino-Himalayan area; the south-eastern Tibetan area, with its arid flora, traversed by great mountain ranges carrying the Sino-Himalayan flora far to the south; and the Chinese area of central Szechwan and Yun-nan. The flora of the Irrawaddy basin from lat. 25° northwards is characterized by remarkable variety of *Impatiens*, *Rubus*, *Ficus*, *Begonia*, *Gesneriaceae* (*Aeschynanthus*, *Chirita*), *Acanthaceae* (*Thunbergia*, *Strobilanthes*), *Zingiberaceae* (*Hedy-chium*), *Aroideae* (*Arisaema*, *Amorphophallus*), together with species of *Pandanus*, *Musa*, *Pterospermum*, many palms (*Caryota*), bamboos, *Leguminosae* and *Dipterocarpaceae*. Even here, however, three peculiarly Chinese species occur, namely, *Wistaria chinensis*, *Rhododendron indicum* and *Rawolfia chinensis*, besides a number of plants known only from the eastern Himalaya, namely, *Hydrangea robusta*, var. *Griffithii*, *Aeschynanthus maculata*, *Thunbergia lutea*, *Calanthe brevicornu*, *Polygonatum nervulosum*, *Arisaema concinnum* ('Records of the Botanical Survey of India,' vol. 1, No. ii.).

The alpine area seems to be divisible into three sub-areas: (i.) the Eastern Himalayan, with no Tsin-ling species; (ii.) the Burma-Yun-nan, both Himalayan and Tsin-ling species; (iii.) the Tsin-ling, with no Himalayan species. The Burma-Yun-nan area, which includes also western Szechwan, is probably the richest of all. The Salween-Irrawaddy divide, even as far south as 26° lat., where the highest peaks rise little above 13,000 feet, is extraordinarily rich. Species of *Primula*, *Buddleia*, *Rhododendron*, *Viburnum*, *Rubus*, *Thalictrum*, *Codonopsis*, *Lonicera*, *Begonia*, *Impatiens*, *Magnolia*, *Clematis*, *Arisaema*, *Quercus*, *Cremanthodium*, *Polygonum*, abound; there are many *Zingiberaceae*, *Hamamelidaceae*, *Liliaceae*, *Orchidaceae*, *Aroideae*, *Lardizabalaceae*, *Araliaceae*, *Coniferae*; on the highest ranges are found *Meconopsis* sp., *Cassiope myosuroides*, *Ypsilandra yunnanensis*.

It will be sufficient to observe here that the Tsin-ling flora includes many species of *Primula*, *Meconopsis*, *Rhododendron*, *Gentiana*, *Saxifraga*, which fully establish its relationship to the Yun-nan, and through that to the Himalaya flora. Of seventeen sections of *Primula* found in north-western China, eight have representatives in both the Himalaya and Burma-Yun-nan areas; one (§ *Malvacea*) has representatives in Yun-nan but not in the Himalaya; one (§ *Farinosa*) has representatives in the Himalaya, but not in Yun-nan; while the remaining seven sections are peculiar to this region.

The arid gorges of south-eastern Tibet along the Yangtze, Mekong, Salween, and Wi-ch'ü support a special flora of their own about which little is known, at least as regards its relationships. It includes species of *Arisaema*, *Selaginella*, *Didissandra*, *Clematis*, *Berberis*, *Pertya*, *Stemona*, *Spiraea*, *Sophora viciifolia*, *Cheilanthes farinosa*, *Asphodelus*; but appears to vary in different valleys. Here again it is almost impossible that there should be transfer of species from valley to valley over the dividing ranges, except perhaps in the case of the Cryptogams.

To explain the presence of a flora showing Himalayan and north China affinities as far south as lat. 26° in Burma and 25° in Yun-nan, and the close relationship of the Himalayan and Tsin-ling flora, though these ranges are now separated by deep impassable river gorges; to explain also the similarity between the floras of the Salween-Irrawaddy, Mekong-Salween and Mekong-Yangtze divides, and their not less striking differences—these ranges being now separated from each other by deep river gorges—I have supposed an original connecting range between the Himalaya and the Tsin-ling, subsequently breached with the formation of a series of parallel north-and-south trending ranges which have cut right through this main axis, separating its broken ends. Further, that plants from both ends of the broken ranges were driven south through the breach down the new parallel divides by advancing ice during the glacial epoch.

The final result of such a sequence of changes might be somewhat as follows: To begin with, we have a single range, or rather series of close parallel ranges, stretching from Sikkim to China; it will carry an alpine flora, which will vary in different parts. After it has been breached, this alpine flora will be divided into three, a flora at each end of the broken range, and one in the middle, this latter being driven south by advancing ice. For the future these three areas are isolated from one another; but though their floras must differ, yet owing to their origin and the conditions under which they live, they will always bear the impress of a common relationship.*

The three areas may be represented diagrammatically as follows:

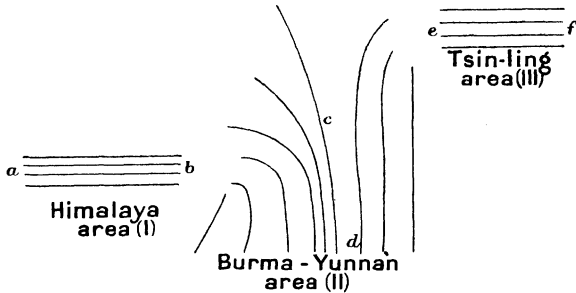


Diagram of Ranges, Sikkim to China

* I have given reasons, based on an analysis of *Primula* sections, for this division into three alpine plant areas (see *Transactions and Proceedings of the Botanical Society of Edinburgh*, vol. 27, Part I.).

It is clear that over an area so great and so complex as that with which we are dealing, the flora must differ in different parts of the same range—we know, in fact, that it does so. We may therefore note the following points: (*a*) The most westerly range of area (ii.) should show closer affinity with the Himalayan flora, the most easterly closer affinity with the Tsin-ling flora. (*b*) On any single range in area (ii.) the affinity of the flora with areas (i.) and (iii.) will be closer in the north, near the breach and in the line of the original connection, than it is in the south, where the floras have had time to become more mixed. Therefore also the floras of the parallel divides in area (ii.) should be more similar in the north, at *c*, than they are in the south, at *d*. (*c*) We should find a closer relationship in the flora occupying the internal lines, *b*, *c*, *e*, than we do in that occupying the external lines *a*, *d*, *f*. (*d*) If it was ice which drove the mixed flora through the breach, we ought to find some central China plants, with American affinities, as well as Tsin-ling plants, in area (ii.). The forests of these three regions would naturally not show the same affinities as the alpine flora, since they are subjected to more varying conditions. A mixture of Indo-Malayan forms will be found in many of the forests, especially in the more western valleys, while Chinese forms will be found especially in the east, from the Yangtze to the T'ung-ho.

We are now in a position to consider what line of investigation to take up, what to seek and where to seek it. The problem may be attacked in two ways: directly by geographical exploration, indirectly by botanical exploration. We might indeed look for some remnant of our Sino-Himalayan range in the direction indicated—that is, north-east of the Dihang bend. This implies an accurate survey of the country between the Dihang, where that river crosses the main Himalayan axis, and the Kansu-Szechwan frontier where the Tsin-ling emerges as a coherent range from the knotted mass of mountains fringing the Tibetan plateau; since it is only from large-scale maps that the lines of great peaks, indicating the probable main ranges, can be followed.

Such remnants, if they have survived the obliterating changes which must have overtaken this region, are more likely to be found at the Himalayan end of the breach than further north-east; and since many years must elapse before the whole of this area can be properly surveyed, it is there that I propose to seek them.

We may now consider the indirect method, botanical exploration the main line of investigation. Briefly, we require to seek whether the results already stated as likely to follow, if the sequence of changes suggested really took place, have in fact followed.

Taking these in order, we must first define the limits of our three areas, and compare their floras as fully as possible—a task to be undertaken in the herbarium. Next we must compare the flora of the western irruption ranges, say that of the Salween-Irrawaddy and Irrawaddy-Zayul divides,

with that of the Himalaya; and as we know nothing of the flora of the second, and very little of the first, there is scope for plenty of botanical exploration on these ranges. Similarly, we must compare the flora of the easternmost ranges, say those lying north and east of Batang and round Tatsienlu, with that of the Tsin-ling. Of the former area next to nothing is known botanically.

Taking now the best-known ranges of the Burma-Yun-nan area, say the Mekong-Yangtze and Mekong-Salween divides (though the latter is untouched in the south for a hundred miles), we must compare their floras in the north and in the south, say lat. 30° for the north and lat. 26° for the south. According to our theory, there should be a closer relationship brought out in the north than there is in the south. We know nothing about the flora of these divides north of lat. 29° , and practically nothing about them in the neighbourhood of 26° . Collections made on the Mekong-Salween divide in the neighbourhood of Menkong (lat. $28^{\circ} 30'$) would be invaluable; we know something about the flora of the Mekong-Yangtze divide in this latitude, from collections made at A-tun-tzu.

A corollary to the above is, that the flora on the northern part of the Mekong-Yangtze or Mekong-Salween divide will differ from the flora on the southern part—probably more than it does over the same length of Himalayan range. This difference might be less marked on the Salween-Irrawaddy divide than on the others, for reasons which will be stated presently.

Again, we can test our third deduction, namely, that the floras of the internal area *b*, *c*, *e* will show nearer relationship than those of the external areas *a*, *d*, *f*. Here indeed is scope for an immense amount of botanical exploration, for while the flora of Sikkim may be taken to represent *a*, that of the A-tun-tzu region as *c*, that of the Hpimaw and T'eng-yueh regions as *d*, and that of the Shensi-Kansu border as *f*, nothing whatever is known of *b* (the extreme eastern limit of the Himalaya), and practically nothing of *e*, where the Tsin-ling stretches far into Tibet. Moreover, area *c* is very imperfectly known, since it includes the almost unknown Salween-Irrawaddy divide and the quite unknown Irrawaddy-Zayul divide.

Finally, experience shows that the parallel divides in area (ii.) grow richer in species as we travel westwards, the Salween-Irrawaddy divide being apparently the richest of all—as it is the least known. We may well ask ourselves what happens on the great ranges which thrust down their snowy peaks between the Irrawaddy and Zayul rivers and between the Zayul and Dihang rivers. Is their flora even richer than that of the Salween-Irrawaddy divide, as appears not improbable? Has it still closer Himalayan affinities—is it, in fact, a direct link between the Eastern Himalayan flora of area (i.) and the Burma-Yun-nan flora of area (ii.)? Have any Chinese forms from area (iii.) and central China reached as far west as this? All these questions require answering.

It is clear that all we can do at present is to select certain spots and

make collections of plants from them for later comparison. And since many of the plants with which we are concerned are showy, and can be raised from seed in England, it is always an advantage to collect seed as well as herbarium material, and grow the plants themselves in England.

The ranges which specially call for exploration, then, are the Salween-Irrawaddy divide in the north, the Irrawaddy-Zayul and Zayul-Dihang divides, neither of which have been touched; the extreme eastern end of the Himalaya, the mountains north of Batang, and the Tsin-ling west of Tao-chow in Kansu. Much botanical exploration has been carried out in this region during the last twenty years by the French Catholic priests, by Mr. E. H. Wilson, Mr. G. Forrest, Mr. Purdom, and Mr. R. Farrer; but much more remains to be done, and the more one explores the country the more one finds to explore.

In a general way also we require to know where the alpine flora of the area (ii.) ceases and passes into the barren ranges of Tibet; where is the northern boundary of the Indo-Malayan flora which spreads up the valleys of the Brahmaputra tributary rivers, the Irrawaddy tributary rivers, and the Salween; how far east Indo-Malayan plants are found, and how far west Chinese plants.

When we come to area (ii.), where most of the exploration indicated has to be carried out, we find yet further matter for investigation. On the parallel ranges in the neighbourhood of A-tun-tzu there are indications of a very considerable retreat of the glaciers, which however seem to have retreated much further on the Mekong-Yangtze divide than they have on the Mekong-Salween divide; and it would appear that precipitation has been screened off the easternmost ranges one by one, by the gradual and consecutive uplift of ranges in the west.

How far, if at all, the ice has retreated on the Salween-Irrawaddy divide is matter for investigation. At present this range seems to divide the Indo-Malayan flora in the west from the Chinese flora in the east. The extensive retreat of the glaciers all over western China may date from the glacial epoch; it was during the advance of the ice at that time that the Atlantic American flora was driven far south into China, spreading, no doubt, from the Arctic circle, where it flourished in Tertiary times, down the Atlantic coast of America, on the one hand, and south-west into China, *viâ* the Aleutian Islands, on the other. For the reason that conditions seem more stable on the Salween-Irrawaddy divide than on either the Mekong-Salween or Mekong-Yangtze divides, it may be that the flora is more uniform along this range than along any other. But the desiccation of the Yun-nan ranges by the uplift of newer and higher ranges in the west, which capture the bulk of the rain coming over from Burma and Assam in the south-west, has certainly disturbed the alpine flora on the ranges in area (ii.).

Here I must end, with the task barely outlined. It is a pretty problem to be solved on this ground where Himalayan, Malayan and Chinese floras meet. Let us see what light the next assaults on it will throw.